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Water Resources Management in Zambia and Zimbabwe

Report from study trip 1992

NIVA - REPORT

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Abstract:

Two researchers, Mr. Hans Olav Ibrek and Mr. Jan Sørensen from the Norwegian Institute for Water Research (NIVA), visited Zambia and Zimbabwe for two weeks in April/May 1992 to undertake a comparative study on water resources management. The study was financed by the Norwegian Ministry of Foreign Affairs and the Norwegian Institute for Water Research as part of a program to improve Norwegian environmental scientist's competence with regard to development aid co-operation. The report is divided in three main , 2) Zambia and 3) Zimbabwe. Part two, on Zambia also contains a list of concrete project ideas/proposals for planned R & D co-operation between the Zambian National Council for Scientific Research (NCSR) and the Norwegian Institute for Water Research (NIVA)/State Pollution Control Authority (SPCA).

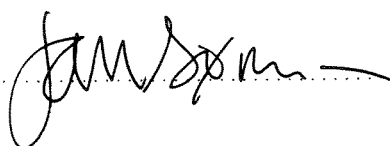
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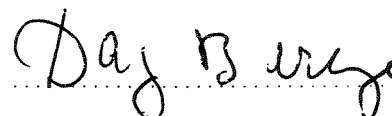
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Norwegian Institute for Water Research

**Jan Sørensen
Hans Olav Ibrekk**

PREFACE

Two researchers, Mr. Hans Olav Ibrekk and Mr. Jan Sørensen from the Norwegian Institute for Water Research (NIVA), visited Zambia and Zimbabwe for two weeks in April/May 1992 to undertake a comparative study on water resources management. The study was financed by the Norwegian Ministry of Foreign Affairs and the Norwegian Institute for Water Research as part of a program to improve Norwegian environmental scientist's competence with regard to development aid co-operation.

We want to give special thanks to the different authorities and organisations in Zambia and Zimbabwe who kindly supported us during our stay. A list of contact persons is given in the Appendix.

We would also like to thank NORAD's offices in Lusaka and Harare for the time they took to inform us about their activities and their future plans within the water sector.

For practical reasons the report is divided in three main parts; the first part giving a short comprehensive summary and conclusions and part two and three covering Zambia and Zimbabwe respectively. Part two, on Zambia also contains a list of concrete project ideas/proposals for planned R & D co-operation between the Zambian National Council for Scientific Research (NCSR) and the Norwegian Institute for Water Research (NIVA)/State Pollution Control Authority (SPCA).

Due to a tight schedule, the report has been written in a very short time and without any possibility to check on the reliability of the information. We want to apologise for any incorrect statements and misinterpretations that may occur.

*Norwegian Institute for Water Research
Oslo 15.06 1992*

*Jan Sørensen
Hans Olav Ibrekk*

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PART I. SUMMARY AND CONCLUSIONS

I.1 GENERAL ASPECTS

Zambia is one of the most indebted countries in Africa while Zimbabwe's economy is considerably sounder. Socio-economic indicators show that the standard of living is relatively higher in Zimbabwe than in Zambia. Both Zambia and Zimbabwe are two of Norway's main co-operation countries with regard to development aid, while the contribution to Zimbabwe is comparatively lower.

The growth in Gross Domestic Product (GDP) in Zimbabwe has been between 4 to 6,5 per cent the last few years. Due to the severe drought problems the growth is expected to be negative in 1992. At a donor's conference this year a Zimbabwean government official indicated that the cost to the Zimbabwean economy of the present drought will be in the region of US\$ 430 million. In Zambia the growth in GDP has been minimal the last few years, the inflation is high and most macroeconomic indicators show a decline.

Both Zambia and Zimbabwe are now undergoing a Structural Adjustment Programme initiated by the International Monetary Fund (IMF) and the World Bank. This programme calls for increased privatisation, removal of subsidies, reduction in civil services and several other measures. The main objectives of the programme are to reduce the level of debt and to increase economic growth.

I.2 LEGAL FRAMEWORK

The Environmental Protection and Pollution Control Act which was enacted in 1990 in Zambia seems to be an important step towards a more comprehensive and holistic environmental legislation. The Environmental Act covers a broad spectrum of environmental issues, but focuses upon pollution control and abatement. The act prescribes goals for improved handling of environmental problems and guidelines for the administrative processes. The act in its present form does not, however, constitute any legal framework for long-term environmental policy making and planning. Consequently, there still seems to be a need to strengthen the legislation to give jurisdiction to more preventative issues/measures/actions.

There are still problems related to enforcement of the Environmental Act. Enforcement calls for establishment of a National Environmental Council (NEC), which will be constituted of representatives from 25 ministries, organisations, industries etc. on a cross-sectoral basis. The Environmental Council is not fully operational yet. The act, amongst others, calls for setting of national environmental standards, which are lacking at the moment. The crucial point is how the board will make its decisions. With so many and different interests represented there will obviously be disagreement on a lot of topics concerning i.e. choice of actions, resource allocation and economic cost recovering.

The legal framework for environmental management in Zimbabwe seems at present inadequate and less comprehensive compared to Zambia. Due to lack of an appropriate legal framework the governmental agencies have few means to stop activities which degrade the environment. Changing the legal framework is a lengthy project but there is a need to overhaul the legal framework for environmental management. There is work under way but it is necessary to speed up the process. As a first step the existing legal framework should be assessed. The Henley-report has probably covered most of this, however, the experience from countries in a similar situation, i.e. Zambia, could be used to facilitate the process of revision of the legal framework. Provisions requiring EIA of major projects should be enacted. This will facilitate environmental impact assessment of different plan alternatives and will also improve public participation in the decision making process.

The need for revising the legislation is acknowledged, however, lack of trained manpower and especially the brain drain Zimbabwe has suffered after independence has made it difficult for the authorities to revise the environmental laws. This factor must be taken into consideration when discussing the need for revising the legal framework.

I.3 ADMINISTRATIVE STRUCTURE

It is difficult to assess the capabilities of the administrative institutional system in the two countries without an in-depth knowledge of the systems. The overall resource situation/infrastructure must i.e. be taken into account. Generally, the resource situation seems better in Zimbabwe than in Zambia. Access to modern technology like computers and telecommunication is more widespread in Zimbabwe than in Zambia. This has probably a significant effect on the functioning of the administrative system.

The administrative structures in Zambia and Zimbabwe are both relatively fragmented with high division of responsibilities between several ministries and departments and agencies in the environmental/water sector. This situation stresses the need for effective routines to facilitate close co-operation between the different administrative units. Unfortunately, geographical (distance) constraints, lack of effective means of communication, poor incentives etc. only seem to widen the sectoral gaps.

In Zambia, the Environmental Act (1990) and the constitution of the National Environmental Council (NEC) for enforcement of the law, should prove to be radical steps towards developing a more integrated environmental/water administrative system that can reduce the sectoral constraints.

In Zimbabwe a National Co-ordination Unit (NCU) has been established. NCU's main objective is to improve co-ordination within the water supply and sanitation sector.

In both countries the lack of both financial and human resources is, however, a major problem for effective environmental management. The Government in both countries are facing brain-drain, either to other countries or to private consulting firms. This seriously affects the ability of the Government to tackle serious environmental problems. Human resources development must be an important factor and at the same time there seems to be a need to adjust the incentive system i.e. improving working conditions in general, upgrading of salaries etc.

In Zambia there is an on-going transfer in delegation of responsibilities and power from the central State administrative level to the local councils. Decentralisation of environmental management can be looked upon as a positive trend, but will only have an effect if the necessary means and resources accordingly are allocated to the local authorities. As mentioned earlier, both Zambia and Zimbabwe are now undergoing a Structural Adjustment Programme which amongst others call for reduction in civil services and several other measures. It is, however, not clear how this will affect the local autonomy.

Many projects within the environmental/water field are initiated by the donors. Lack of co-ordination between the donors is believed to result in too many overlapping activities and poor efficiency. Steps towards better communication, i.e. joint donor meetings have now been considered for improvement of the situation.

I.4 WATER PROBLEMS AND ISSUES

Zambia and Zimbabwe, as well as the other Sub-Saharan countries, are at present (May, 1992) struggling with severe drought problems. The effects of the drought especially strike the agriculture because of too little precipitation in the growing season. This has more or less completely destroyed the maize harvest and since maize is the basic food for a large part of the population, the food supply situation is critical.

Drought problems will inevitably occur at certain intervals which will call for emergency solutions. This situation expresses the need to plan ahead for future similar crisis, i.e. design of drought preparedness and management plans.

Both Zambia and Zimbabwe is likely to face a more permanent water shortage problem in the future since it is expected that irrigation/water abstraction will increase as a result of developing the agricultural sector. Securing a sustainable food supply will require access to safe water. It is therefore important to prepare comprehensive plans and strategies for how to use and manage the water resources. Identification of the sources, i.e.. distribution of water supply and expected demand are crucial elements in such plans. Protection of water sources against pollution through integrated land use/water planning will

become more important by agricultural and industrial development. The need for drought preparedness and management plans for all water resources to handle extreme situations/emergency situations has been further stressed by the current drought situation.

Kafue River

The Kafue river is the economically most important water resource in Zambia with a variety of different user-interests and subsequently the environmental problems are among the most severe in this area:

- Erosion/sedimentation as result of deforestation and agriculture
- Salination caused by excessive water abstraction
- Ecological impacts due to damming (changes in water regime)
- Pollution from discharges from industry, population etc.

Intensified demand for water from industry, agriculture and domestic use in the Kafue, will probably result in more competition and conflicts between user-interests and higher risks of exceeding the level of sustainability.

Save River

In Save river in Zimbabwe, similar problems as in Kafue have been identified. The following problems related to watershed management are found in communal lands:

- High human and livestock population
- Major erosion problems in grazing lands
- Arable land being cultivated without adequate erosion control measures
- Problems of deforestation leading to accelerated erosion
- High prevalence of streambank cultivation
- Land husbandry techniques practised by the majority of the communal farmers are inadequate
- Siltation of streams and rivers
- Many human settlements are poorly planned
- Lack of an integrated resource planning concept.

Potential water conflicts between user-interests in the further development of the Save river are:

- Effects on environmental degradation on food and health need satisfaction.
- Allocation of irrigation waters to communal land areas or to commercial farming areas.
- Water pollution caused by the proposed pulp and paper mill.
- Siltation of dams caused by land degradation.
- Allocation of water to Mozambique.

I.5 NEED FOR WATER RESOURCES MANAGEMENT

The growing problems experienced in Zambia and Zimbabwe, i.e. in Kafue river and Save river are of complex character and need multi-sectoral efforts to be solved. There is need for a *water management policy* which can direct the focus more towards *preventative* matters than curative and point out the main issues and objectives for water management and planning.

There is further need for designing a *strategy* on how to encounter the problems on short, medium and long-term basis. And there is obviously a need for developing systems for *integrated water resources management and planning*. Integrated management and planning are especially urgent in the Kafue and Save rivers because of the arising problems and conflicts.

Water resources management plans are already under preparation. The Save River Catchment Rehabilitation Committee is charged with the task of preparing and implementing the Save River Rehabilitation Action Plan. This plan will address the following areas:

- Conservation and management of the soil and water resources
- Improved production of crops both for food and marketing
- Improved animal husbandry over the catchment.

In Zambia, the National Council of Scientific Research (NCSR) is preparing a water management plan covering the lower parts of Kafue river, focusing on water demand and availability.

These efforts, hopefully, mark the start of a continuous integrated water management process that will be an important tool for securing a more sustainable water use.

It is, however, necessary to take a closer look at the *basis for integrated water management planning* within the existing management system, with regard to legislation and institutional framework.

Other issues of importance will be to develop locally adapted *environmental standards* and *water quality criteria* that can serve as a basis for enforcing the environmental laws, directives and guidelines. Likewise, an *environmental impact assessment system (EIA)* should be developed and implemented for evaluation of development projects that may have environmental impacts.

I.6 DEVELOPMENT CO-OPERATION

At present, development aid co-operation between Norway and Zambia and Norway and Zimbabwe is mainly directed towards rural water supply and sanitation.

Facing increasing environmental problems due to prolonged mismanagement of water resources, it could be relevant to consider the environmental/water sector in a broader perspective, including the administrative and institutional aspects, water management and planning and further develop locally adapted systems and tools for sustainable water management. Norway has a valuable tradition in water resources management and the expertise needed to supervise or carry out such projects.

In Zambia, the National Council for Scientific Research (NCSR) and the Norwegian Institute for Water Research (NIVA) and the State Pollution Control Authority (SPCA) have been trying to develop a co-operation agreement. Based on the information gathered from meetings with NCSR and Zambian authorities, NIVA has proposed some project ideas that may serve as an initial starting point for development co-operation within a broader spectrum of environmental/water problems. These ideas are presented in chapter II.6.2 and II.6.3. Further development and realization of the project ideas will, however, depend upon Norwegian funding and donor support.

PART II. ZAMBIA

II.1 GEOGRAPHY AND POPULATION

The total area of Zambia is 715,000 km². Zambia is bordering Angola, Zaire, Tanzania, Malawi, Mozambique and Zimbabwe. Zambia is a member of the Southern African Development Co-operation Conference (SADCC).

Zambia is divided into nine provinces, with a 1990 population close to 8 millions. The annual population growth averaged 3,7% between 1980 and 1990. The crude birth rate has remained almost static since 1960 at around 50 per 1000. Some 73 different ethnic groups have been identified among Zambia's indigenous population. The largest single group is the Bemba which comprises approximately 18% of the population.

Zambia is the most urbanised country in Sub Saharan Africa with an estimated urban population of about 54 % in 1990.

II.2 ECONOMIC AND SOCIAL DEVELOPMENT

Until 1975 Zambia was one of the most prosperous countries of Sub-Saharan Africa. This wealth, and the development of the infrastructure and public services which went with it, was founded mainly on the export of copper. Still today copper stands for 85% of exports revenues. However, since the world copper prices plummeted in 1975, there has been a continuous economic decline.

As of 31 December 1989, Zambia's total external debt stood at USD 6,900 millions. Arrears on principle and interest payments amounted to USD 3,400 millions, of which about 40% was owed to the IMF and World Bank. These figures make Zambia one of the world's most indebted countries, with a burden per head of about USD 890, more in line with middle income Latin America debtors than other African states.

The prolonged economic crisis has had serious social impacts; high unemployment in urban areas, declining standards of living, reduced social services etc.

Zambia is highly dependent on support from the international community and the pledging for donor assistance in 1991 amounted to USD 556 mill. The economic outlook remains extremely difficult due to the large debt overhang and import dependence, and Zambia still will have to rely upon substantial donor support for a long time.

The government has launched an Economic Recovery Programme. This includes, amongst others, a public service reform, more emphasis on market pricing, more flexibility in resource mobility and encouraging greater involvement of the private sector to promote those activities in which Zambia can compete effectively in international and domestic markets.

To address short term negative effects of the economic recovery programme and to alleviate poverty and hardship the Government has launched a Social Action Programme. This programme focuses on health, food security and nutrition, education and training, water and sanitation, roads, marketplaces and public transport, household energy, and so forth.

II.3 DEVELOPMENT AID CO-OPERATION

Zambia is one of Norway's main co-operation countries within development aid. The total donor support in 1990 was approx. 346 mill. NOK (equiv. USD 55 mill.). The main goals for Norwegian development aid in Zambia are:

- Restructuring of the economy
- Maintenance of basic social services
- Sustainable management of the natural resources.

In the water sector, direct actions to secure public health, i.e. water supply, have been given high priority. Norway has contributed to the improvement of the rural water supply network and especially water supply to smaller cities in the western province. Water resources management and strategy planning in general to secure suitability for overall use and for securing the sustainability of the water resources on a long term basis, have so far not been prioritised.

A land strategy analysis will be submitted in September this year. The analysis will identify needs for new programmes and re-allocation of resources. Until then, on-going programmes and projects will continue as before.

In the near future, NORAD will probably take a more active part in strengthening the institutional and administrative framework, i.e. support the constitution of the National Environmental Council (NEC). At present, NORAD is giving support to the National Data Bank (NDB) which is now located at the University, but under administration by IUCN which has a further administrative link to the Ministry of Environment. The responsibility for NDB will later be transmitted to NEC.

II.4 WATER RESOURCES – ENVIRONMENTAL PROBLEMS

II.4.1 Water Resources in Zambia

By African standards, Zambia is considered to have an abundance of water resources with several major rivers and swamps. Generally, Zambia also has better groundwater conditions than most of the surrounding countries. It is estimated that Zambia has almost 45% of the water resources of Southern Africa and is considered to be the "water tower" in this part of the continent.

Surplus water, i.e. the amount of precipitation that runs into the stream flow and deep percolation, shows variations from 633 mm in the North of the country to zero surplus in the South. Most of the discharge of the main rivers is therefore from the more humid, Northern parts of the country, only little being added by tributary drainage in the dryer South.

About 20% of the land area is cultivated, but at present only 1% of potential cultural land is irrigated. With growing water demands for agricultural, industrial and domestic use, Zambia could experience a severe water shortage in the dry southern regions by the year 2050. Current trends also suggests that this shortage might be exacerbated by industrial pollution contaminating the diminishing resources.

Table II.4.1 The most important river basins.

River/basin	Drainage area 1,000 km ²	Runoff mm	Water yield l/min/km ²	Mean annual m ³ /s
Zambesi	261	135	84	762
Kafue	152	70	162	348
Luangwa	165	95	174	584
Chambeshi	34	210	462	337
Luapula	124	175	312	754

The surface waters which cover 5,3% of the total area of Zambia, are important not only as potential sources of water for agriculture, industry, domestic use and hydroelectric power generation, but also as biologically productive systems. Fishery yields approximately 70,000 tonnes pr. year and employs some 250,000 people. Fish provides 55% of the animal protein consumed in the country.

Zambia, as well as in the other Sub-Saharan countries, are at present (May, 1992) struggling with severe drought problems. The effects of the drought especially strike the agriculture because of too little precipitation in the growing season. This has more or less completely destroyed the maize harvest and since maize is the basic food for a large part of the population the food supply situation is critical.

The water flow in most rivers is at present very low even shortly after the rainy season which normally lasts from September/October to March/April. Scarcity of surface water leads to increased water abstraction from groundwater aquifers and the groundwater table is descending. Prolonged pressure on and overuse of groundwater may cause long-term negative effects.

Low water flow in the rivers results in overfishing as the fish is easier to catch in shallow water. The overfishing will have negative impacts on the fish stock for the next years to come due to reduced reproduction. So far, the Ministry of Agriculture, Food and Fisheries has not taken any concrete steps to address the problem.

Drought problems will inevitably occur at certain intervals which will call for emergency solutions. This situation expresses the need to plan ahead for future similar crisis, i.e. design of drought preparedness and management plans.

As mentioned earlier, Zambia is likely to face a more permanent water shortage problem in the future since it is expected that irrigation/water extraction will increase as a result of development of the agricultural sector. Securing a sustainable food supply will require access to safe water. It is therefore important to prepare comprehensive plans and strategies for how to use and manage the water resources. Identification of the sources, i.e.. distribution of water supply and expected demand are crucial elements in such plans. Protection of water sources against pollution through integrated land use/water planning will become more important by agricultural and industrial development. The need for drought preparedness and management plans for all water resources to handle extreme situations/emergency situations has been further stressed by the current draught situation.

In general, environmental problems in urban and rural areas are exacerbated by lack of basic water supply and sanitation services. Only 40% of Zambia's rural population has access to clean water. Deficiencies in water and sanitation are a significant problem, substantially lowering the quality of life for many people and causing dangerous health hazards. High morbidity and mortality from diarrhoeal disease and parasites infections are particularly critical in densely populated squatter compounds where over one million people reside. The consequences can be serious, as illustrated by the recent outbreaks of contagious cholera in some major urban areas.

II.4.2 The Kafue River

The Kafue river basin is the most economically important and industrialised river basin in Zambia and subsequently the environmental problems are among the most severe in this area. NIVA's mission to the Kafue basin in 1991 collected information about some of the environmental problems this region are experiencing (Sørensen og Gulbrandsen 1991):

- Erosion/sedimentation as result of deforestation and agriculture
- Salination caused by excessive water abstraction
- Ecological impacts due to damming (changes in water regime)
- Pollution from discharges from industry, population etc.

Agricultural development in the Kafue watershed will increase erosion, sedimentation and salination problems. Siltation can have serious impacts on fish breeding grounds and can cause reduction of the fish stock.

Expanding agricultural activity i.e. in the upper parts of the Kafue watershed will accordingly increase the use of pesticides and fertilisers which inevitably use. Extraction of larger water quantities for i.e. irrigation means less water for dissolution of effluents and thereby higher concentration of pollution.

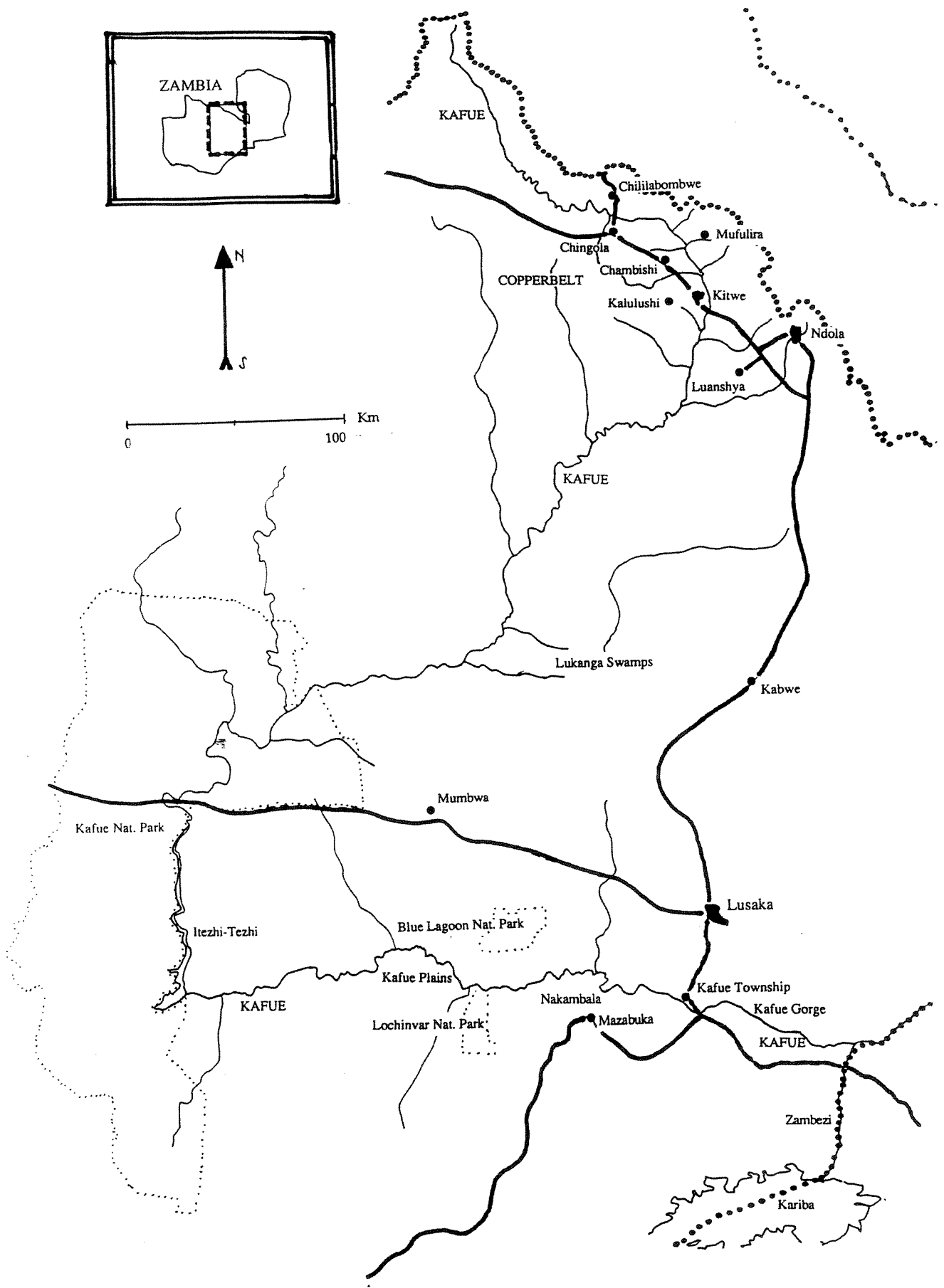


Fig. II.4.1 The Kafue river catchment area.

will affect the water quality as long as there exist no regulations and control on

Several industries, located i.e. in the Copperbelt and west of Kafue Township, discharge effluents into the environment without little or no treatment and the industrial processes are in many cases based on out-dated technology. Some of the larger industries monitor the water quality regularly in areas where discharges are likely to have an effect on the water quality. There are, however, no regular monitoring programmes or baseline studies run by the water authorities.

During NIVA's study trip to Zambia in 1991, water samples were collected at different sites in the Kafue river and analysed at NIVA's laboratory in Norway. The spot-tests give only an indication of some of the pollution problems.

Table II.4.2 Results of water quality samples collected from sampling sites in the Kafue river in 1991.

Water quality parameters								
Location	Cu µg/l	Zn µg/l	Cd µg/l	Co µg/l	Mn µg/l	SO ₄ mg/l	Ca mg/l	pH
Raglans farm	1,5	<10	<0,1	<5	7,8	1,4	12,1	7,67
Hippo Pool	1580	<10	<0,1	53	140	11,5	17,4	7,79
Wusakile Bridge	920	<10	<0,1	38	240	53,5	28,6	7,80
Kafue Waterworks	3,1	50	<0,1	<5	16,2	-	-	-

Raglans farm is situated high up in the watershed and is little affected by pollution. The water analysis from Raglans farm represent the natural background values for the different parameters (although the situation will vary regionally).

Both Hippo Pool and Wusakile Bridge downstream the copper mining areas show extreme values in copper concentration. Natural background concentration found in Norwegian rivers is between 1-2 µg/l which is comparable to the values (at the non-polluted river) at Raglans farm. Values exceeding 60 µg/l are considered to be very high and will have substantial negative effects on biotic life. High copper content, however, does not consist any direct risk for human health.

Intensified demand for water from industry, agriculture and domestic use in the Kafue, will probably result in more competition and conflicts between user-interests and higher risks of exceeding the level of sustainability. It is therefore important to identify the different existing and potential users, their demand for water, pollution effects and thereby design a strategy plan for sustainable water management, allocation of water resources and actions to be held in preparedness in case of i.e. accidental pollution, water shortage/drought etc.

II.5 WATER MANAGEMENT SYSTEM

II.5.1 Administrative Structure

After the recent political changes in Zambia, the Government has reorganised the administration to rationalise and improve efficiency. Control of utilisation of water and water supply is now under the new Ministry of Environment and Natural Resources, Department of Natural Resources and Department of Water Affairs. Department of Water and Sewerage and Department of Public Health under the Ministry of Local Government and Housing, are mainly responsible for urban water supply and distribution, sewerage treatment and water quality control. The Ministry of Agriculture, Food and Fisheries is responsible for i.e. management of fish resources, stock assessment and regulations. (Unfortunately, no comprehensive survey or chart showing the new administrative structure and links between the different units and their responsibilities was available).

The responsible authorities seem to be well aware of the problems related to lack of co-ordination within the environmental/water sector. Indistinction in responsibilities and sectoral barriers are regarded as constraints for effective environmental management and resource allocation. Co-ordination and contact between the authorities at different administrative levels, i.e. between the State level and the local Councils, seems inadequate. Some decisions i.e. on drinking water supply are, however, delegated to the Councils. Lack of co-ordination between donor support also pulls in the same direction causing problems of project overlap and ineffective use of economical resources.

However, the recent political changes with administrative restructuring, the Environmental Act (1990) and the constitution of the National Environmental Council (NEC) for enforcement of the law, should prove to be radical steps towards developing a more holistic and integrated environmental management system. The need for a more stringent water policy and strategy, i.e. for water resources management should be highly stressed.

With regard to improving co-ordination between donor financed projects, the donors have now agreed to set up joint donor meetings regularly to secure more effective use of resources and reduce overlap between projects.

II.5.2 Authorities, Organisations and Users

During NIVA's study trips in 1991 and 1992 the team visited different authorities, organisations and users with responsibilities or activities related to environment/water. The following descriptions is based on short meetings and interviews.

Department of Water Affairs

The responsibility of the Department of Water Affairs covers management and control of water supply, development/use, water resource allocation, water research and planning. The Water Supplies Division covers water supply to all small urban townships and rural areas, while the Water Resources Division covers allocation of surface water resources, control of uses, etc. The control function is conducted by an Inspectorate, but inadequate staffing, transport facilities etc. results in no or little control of the use of surface water. There is neither any control of the use and abstraction of groundwater.

The Department of Water Affairs has considered to prepare a master plan for the water resources in Zambia in co-operation with the Department of Natural Resources and other authorities, but so far the project has not been initiated.

Decisions concerning discharge permits and allocation of water resources are settled by the Water Board, which constitutes of members from different sectors. The Board only meets sporadic. The Board has an Inspectorate to its disposal, but at the moment the staffing is far from adequate (only one person).

Department of Natural Resources

As a result of the Conservation of Natural Resources Act from 1982, the Natural Resources Advisory Board was established as an advisory body to the Ministry. The Board's Secretariat got extended responsibilities and was later transferred to Department of Natural Resources.

The Department of Natural Resources is responsible for protection of natural resources, hereby water resources which includes monitoring of water quality etc. The Department is also responsible for carrying out Environmental Impact Assessments (EIA) which have been done i.e. in relation to abandoned coal mines and dam construction. There exists, however, no legal framework or comprehensive administrative guidelines as a basis for EIA.

In relation to water uses, the Department of Natural Resources has few responsibilities, but co-operates with the Department of Water Affairs in this field. The Department follows up the National Conservation Strategy from 1985 and wishes to initiate pilot projects in different parts of the country.

The Department points out the following problems:

- Deforestation causing erosion
- Water pollution.

Lack of reliable data makes it, however, difficult to support reliable documentation about the state of the environment and the level of pollution.

The Department of Natural Resources is trying to identify pollution from industrial activities from the Copperbelt to Kafue Township. An important part of the project is public awareness campaign seminars with the objective to

bring the industries together to highlight, inform about and discuss the problems.

Lack of economic resources, equipment and man-power constitute a serious restriction for efficiency. Only one person covers the whole Kafue river basin and the Department has no access to transport facilities.

Department of Agriculture

The Department of Agriculture is divided in three divisions: i) Agriculture and Engineering, ii) Research, iii) Land Use, Irrigation and Husbandry.

Department of Agriculture is represented both on provincial and district level.

There is an on-going process to decentralise some of the authority to the provincial level. A problem is, however, lack of financial resources which has negative effects upon staffing and level of competence.

Ndola City Council

Ndola is the largest industrial city in Zambia. The City Council is the local authority. The Council has altogether eight different Departments, the Department of Water and Sewerage being responsible for water supply and distribution, quality control and sewerage treatment/pollution control.

The Council has no direct relationship or contact with the Department of Water Affairs in Lusaka.

The Council has prepared pollution and sewerage treatment plans, i.e. each industry should have pre-treatment facilities. However, the Council has not the legal tools to enforce the plan or to implement any environmental standards.

Effluents from both the industrial activity and from households end up in the Kafue water stream. Pollution also ends up in the ponds used for drinking water. In the present situation with low water flow, the pollution level is probably high because of little water in the receiving waters.

Water weed (*Salvinia*) has been a problem in some of the ponds used for drinking water in the Ndola council, blocking the intake of water and the pipelines. The weed growth is probably a result of eutrophication. The weed spreads very fast and can cover the entire surface in short time, comparable to *Vasspest* in Norway. Formerly, the weed was removed by mechanical dredging, which had to be repeated at short intervals. To solve the problem permanently, a special insect specimen has been imported and introduced in the dams. The insect feeds on the plant root system and reduces the weed growth substantially. The eventual side-effects of this kind of bio-manipulation seems, however, not to be investigated in detail.

Kitwe City Council

Water supply is high on the political agenda, but lack of funding constitutes a serious problem. It can take as much as 10 years to raise funding for a project. Cost recovery/water fees is an accepted principle, but the fees does not cover the true costs and water supply is subsidised. Because of lack of resources it is not possible to maintain an adequate water quality. Water supply is therefore running towards privatisation and company status, copying the Lusaka model.

Kitwe is dependent on water from Kafue. There is no water shortage. In Konkola the mining industry discharges a lot of water, part of it is groundwater. The discharge is necessary to secure sufficient water amount further downstream. Pollution is increasingly a problem. ZCCM is the main polluter, some of the effluent is goes directly into the river without treatment. The load from the different industries is, however, not measured.

Corrosion of water pipes from plant to distribution point and further to the households is also considered a problem. This results in contamination of the water. There have been outbreaks of Cholera, but the spread is not caused by contaminated water.

The sewerage system is on the verge of collapse. The pipe network is undersized. The sewerage systems will probably not be improved because drinking water/water supply will be given priority.

The air pollution in the area is severe. Deposits from air pollution also contributes to the level of water pollution.

The industry produces a lot of solid toxic waste. The waste is disposed in dumpsites and old quarries. There is no special treatment of toxic waste or any control i.e. of the impacts on groundwater.

National Council for Scientific Research (NCSR)

NCSR covers a broad spectrum of different environmental topics, i.e. epidentomology, forestry and agriculture, water etc. The research council has it's own Water Resources Research Unit (WRRU). NCSR has close contact with the authorities both at the ministerial and departmental levels.

WRRU has carried out water research in the Luano catchment in the Chingola area and in Luangwa, but also in parts of the Kafue river basin. The research activities have resulted in substantial amount of environmental data from the Copperbelt and around Kafue Township which are the most polluted areas in the Kafue watershed. The information is, however, relatively old and to some extent outdated. WRRU has little information on the pollution sources and the relative contribution from each source. Collection of data on industries tend to be problematic since much of the information is restricted.

Water resources management and planning has not been given high priority, but is apparently becoming more relevant as the complexity of the problems increases. NCSR/WRRU has initiated a planning project in the lower Kafue river, which has been on-going since 1991. Zambia and NCSR/WRRU has until now not been very active in the Zambezi Action Plan (ZACPLAN).

The scarce economical resources create a lot of problems. There is lack of basic equipment and the staffing is inadequate and unstable. A general upgrading of NCSR/WRRU is needed.

University of Zambia, School of Natural Sciences

School of Natural Sciences was created in 1966 and has now five divisions; physics, chemistry, biology, mathematics and geography. The capacity today is 430 students.

Between 1977 and 1985/86 there existed a Kafue basin Research Committee at the University. The committee was interdisciplinary and studied water-related development projects, especially hydropower development projects. The committee identified problems and proposed solutions. The committee carried out research on impacts of damming and allocation of water resources between different users.

After this period, very little work has been done related to water resources management.

The School of Natural Sciences is offering an undergraduate study within geography that is of relevance to water management; geographical hydrology and in addition more general studies on natural resources management.

Department of Fisheries, Research Division

The main role of the Fisheries Department Research Division is to supply research information as a basis for drawing up plans for the development of fisheries. The Research Division has different units covering the biggest lakes; Lake Tanganyika, Lake Mweru Luapula, Lake Bangweulu, Lake Itzezi-Thezi etc.

The yield of the fisheries is estimated to 70,000 metric tonnes pr. year mostly breams and sardines. Overfishing is a general problem.

The Research Division runs several donor-supported projects, i.e. a SADCC-project, a project in Lake Tanganyika (bio-mass and stock assessment), a project on pollution control in Lake Tanganyika, a project on overfishing and on effects of deforestation leading to erosion. Other research projects are related to studying effects of fishing on specific pelagic species in three small lakes, reasons for stock reduction in Lake Mweru Wantipa, experiments with different net-sizes, assessments of fisheries potential in Lukanga Swamp Lakes and Upper Zambezi etc.

In 1965 the Department of Fisheries carried out studies (UNDP-financed) of the whole ecology of the Kafue Flats before the Itezi-Thezi dam was constructed. No similar studies have been undertaken after the damming. Consequently, there exists little knowledge of the fish stock, recruitment and the sustainability of use/fishing.

Increased agriculture activity in the Kafue catchment has led to erosion and problems of sedimentation which is likely to affect the primary production. Another problem is connected to use of pesticides against the Tse-Tse fly on the Kafue Plains which has led to high concentrations of pesticides in fish tissue and fish mortality.

In Kafue, heavy metals are considered a problem in certain areas. Especially the copper content is high, which is critical for fish recruitment. There is no knowledge of heavy metal content in fish tissue and the possible effects on human health.

There exists a Fisheries Act which, however, has not been enforced. The act states that the rainy season is closed for fishing (from 1. December to end of February). The act also regulates type of gear to be used and the net size etc. Fishing is very difficult to regulate, since fish resources are considered a "God-given gift" , free for everybody.

Fishfarming occurs mostly in the Copperbelt, Northwestern, Eastern and Southern regions. Production is relatively low and is not exceeding 1000 metric tonnes pr. year.

With the present problems of small water bodies due to the drought, the fish is now easy to catch and huge overfishing is expected which will probably create a serious problem in the future years. The Ministry of Agriculture, Foods and Fisheries is informed, but has so far not responded or decided upon any preventive actions.

The Research Division runs a data bank. Data are stored on a mainframe computer. There is also a laboratory which is badly equipped, basic equipment is lacking.

Lusaka Water & Sewerage Company

Lusaka Water & Sewerage Company is technically a private firm, but Lusaka City Council is the major stockholder. The company's economy is based on non-profit cost recovery and is not dependent on donor grants.

The water fees tariffs varies according to different users/areas in Lusaka. The level of coverage in Lusaka is about 60-70%.

The most important water source is Kafue river, groundwater is limited. Lusaka Water & Sewerage Company will use a computer model based on

digitalized data to analyze the whole network system in Lusaka. The system does not, however, cover the unplanned parts of Lusaka.

Industrial pollution represents a future threat to drinking water. Today there is little or no pre-treatment i.e. on discharges from tanneries etc. The groundwater aquifers are also threatened by building activity that can cause contamination. Today, no-one knows the possible impacts and no steps are taken to avoid pollution of groundwater.

The sewerage system needs rehabilitation. Sewerage has not been a field of priority. A possible solution for pre-treatment of effluents which mainly come from households is to use biological methods i.e. lagoons/wetlands. A program for re-use of effluents should be initiated, including compounding, recycling for later use as fertilisers, surveying the possibilities of fishfarming etc.

Today, there is a lot of mechanical equipment that does not work because of lack of maintenance, spare parts etc. The main point is therefore to avoid sophisticated engineering that will not work in the long run, a more "soft scientific approach" is needed.

Lusaka Waterworks

Lusaka Waterworks was built by the British in the 1970's and rehabilitated by the Japanese in 1989. The waterworks is modern and well functioning.

Lusaka Waterworks deliver 60% of the total water supply to Lusaka through a 45km long pipeline. Leakages are a problem in Lusaka – about 40% of the water is lost due to leakages from the network.

The water quality is monitored two times pr. week, but the responsible operator at the waterworks has no knowledge of the results since the data are stored centrally in Lusaka.

Kafue Waterworks

Kafue Waterworks' intake is located downstream the industrial areas and the sewerage discharge point from Kafue Township.

In addition, the waterworks has not been properly maintained and is therefore more or less out of function. Spare parts for maintenance and even chlorine for disinfection are lacking.

Zambia Consolidated Copper Mines (ZCCM)

ZCCM is the largest industrial firm in the country and employs about 55,000 people. ZCCM has an Environmental Unit of three persons that mainly functions as an "ad hoc" unit, not fully integrated in the main structure of the company.

ZCCM has five mines in operation. All five mines have tailings impoundment's. The mass control is said to be satisfactory.

Drainage from the deponies goes to Kafue river. Kafue functions as a sink for the whole Copperbelt.

In the dry season, the Konkola Division extracts groundwater amounting to 13 times the natural water flow in Kafue river. In the dry season sometimes water scarcity for other users occurs. Plans (dating back to 1961) have been made for construction of a dam in Kafironda (between Kitwe and Mufulira) that will secure a more even water supply throughout the year.

ZCCM admits to have problems with discharge of sulphates, especially in the dry season. There is a need to develop low-cost technology solutions to reduce sulphate content in large quantity discharges. In the rainy season, there are problems with particles and heavy metals. ZCCM informs that their existing waste water treatment is adequate to secure the water quality and that the Kafue meets the drinking water quality standards set by WHO.

The agriculture activities cause increasing competition for water from Kafue. All the farms in the area have their own water reservoirs.

ZCCM monitor and analyses water quality at selected locations, but does not report back to the authorities i.e. the Ministry or the City Council.

Nitrogen Chemicals of Zambia (NCZ)

NCZ is Zambia's largest producer of chemicals. NCZ claims to have an permission from Kafue Council to legally discharge into the council's sewerage network, but since all the five sewerage plants are out of function, the effluents are in reality discharged without treatment directly into the river.

NCZ has their own laboratory for analysis of effluents. The results are regularly submitted to NCSR. The content of different pollutants were said to meet international standards in most cases.

Nakambala Sugarestate

Nakambala is situated nearby Mazabuka south of the Kafue Flats. Nakambala Sugar Estate has a 10,000 ha area planted with sugar cane and a sugar refinery

and is the largest commercial farm in the Kafue catchment area. The production started in 1967 and is now more than 130,000 tonnes pr. year.

The sugar estate's water extraction from Kafue amounts from 3m³/s to 11-12m³/s. The water demand is high in September-November and less in May-June. In the rainy season, December -April, the water demand is marginal.

90% of the water is used for irrigation, the rest is used as process-water in the sugar refining and for drinking water. Irrigation is operated through a canal system. Approximately 95% of the water is used without any treatment.

Wastewater, approximately 500m³/h, and filter material from the refinery, is discharged directly without treatment into canals that lead to the Kafue river. The sugar estate plans, however, to improve the monitoring of discharges and actions for environmental upgrading.

The use of herbicides is not regulated or controlled, neither is the spraying of chemicals for speeding up the maturing process. Large quantities of different fertilisers are also used.

Commercial Farmers Bureau (CFB)

One important task for CFB is to ensure that the Water Board (which allocate water rights) allocate sufficient, but not too much water to the farmers. CFB wishes better control from the water authorities on extraction of water to reduce water shortage in the dry season.

The agriculture in Zambia has abundant water supply compared to other countries in Southern Africa.

A special committee within CFB, the Agriculture Conservation Association of Zambia, has been created to combat pollution and erosion problems, mainly through information and awareness campaigns.

The only present important area for farming in Kafue is Mazabuka. In the Copperbelt there are only a small number of farms. The potential for further development in the Copperbelt lies mainly in cattle farming.

Recently, the import of herbicides has been regulated, but the regulations are probably not effective. Pesticides may constitute a more serious problem.

II.5.3 The Environmental Act 1990

The Environmental Act covers several environmental topics, but is mainly focused on pollution control and abatement. The act prescribes mainly the goals for improved handling of environmental problems and the

administrative processes. The act in its present form does not, however, constitute any legal framework for sustainable environmental management and strategic planning. Consequently, there still seems to be a need to broaden and strengthen the legal framework to give jurisdiction to "preventative issues" like cross-sectoral environmental planning.

Part IV in the act covers water issues and is divided into the following main sections (22-34):

- *Interpretation*
- *Responsibility of the Council*
- *Prohibition of water pollution*
- *Duty to supply information to Inspectorate*
- *Permission to discharge effluent into sewerage system*
- *Conditions for acceptance of effluent*
- *Treatment of effluent*
- *Licence to discharge effluent*
- *Application for licence for new undertaking etc. likely to discharge effluent*
- *Circumstances under which extension deemed new*
- *Grant and refusal of licences*
- *Contents of application and conditions of licence to be prescribed by regulation.*

One important issue is the call for development of water quality and pollution control standards which will be of utmost importance as a basis for i.e. determining conditions for industries and other sources of pollution, inspection and control. Such standards are at present more or less non-existent in Zambia. The Local Administration Act defines different effluent standards for i.e. industrial discharge into Councils' sewerage system or directly to the recipient. The problem is that the sewerage treatment plants often are out of order and not functioning properly.

New environmental standards have to be based on the local natural conditions in the country and as such international standards can only be used as guidelines and tools for developing specific national standards. Zambia will need external support to develop such standards.

Enforcement of compliance with the standards requires adequate resources both financial and expertise. Enforcement of water quality standards and discharge standards should be based on monitoring, both monitoring of the ambient water quality and monitoring of discharges from each major source of pollution. Few monitoring programmes, if none, is currently operating in Zambia. A cost-efficient monitoring program for the most important water resources should be developed.

Most cities in the Kafue River basin use the river as the source of drinking water. The quality of the supplied drinking water does not meet international water quality and health standards. In addition the existing water treatment plants are in desperate need of rehabilitation and expansion. Since over 50% of Zambians live in urban areas and since this number will increase considerably

in the future, safe water supply must be assured. This can only be obtained by constructing efficient treatment plants and to avoid, reduce or relocate the upstream input of pollution to the most important water supply sources.

II.5.4 National Environment Council (NEC)

The act calls for establishment of a National Environment Council (NEC) with representatives from the government, industry, NGOs, scientific community, etc. The director for the council has been appointed, but staff allocation has not yet been initiated.

NEC will establish inspectorates to deal with specific environmental problems, e.g. water, air, waste, nature conservation. The number of inspectorates is not yet decided. However, FINNIDA and CIDA in co-operation with IUCN have done a feasibility study of NEC. This study recommends the establishment of two directorates, one for pollution control and one for natural resources management. The establishment of NEC is dependent upon considerable donor support.

The implementation of the Environmental Act and the success of the Environmental Council is to a large extent dependent on access to reliable environmental data. The council will implement needed abatement measures. The decision of the court system has to be based on environmental data of high quality. The burden of proof rests with the authorities and the enterprises violating the standards will most likely try to object to implementing abatement measures if such proofs are not available.

The Environmental Research Laboratory at the NCSR's Water Resources Research Unit (WRRU) may be strengthened to support NEC. The Environmental Research Laboratory has at present a limited capacity in water quality assessment. The activity is low due to lack of personnel and equipment. The laboratory has a lot of experience in this field. The Department of Water Affairs may be given the mandate to do routine water monitoring activities in the meantime before the NEC is fully fledged.

NEC will be constituted as a board with members drawn from various institutions and individuals of high standing in issues of environmental concern. NEC's secretariat will have 4 sections covering: Pollution Control, Natural Resource Conservation, Information and Management and Environmental Planning etc.

NEC will operate through an Inspectorate. The Council will appoint the number of inspectors considered necessary. Apparently, there will be one inspector for each different environmental topic: Water, air, solid waste, pesticides and toxic substances, noise, ionising radiation and natural resources conservation. The Council may delegate all or any of the duties of the Inspectorate to a local authority in such area it may designate.

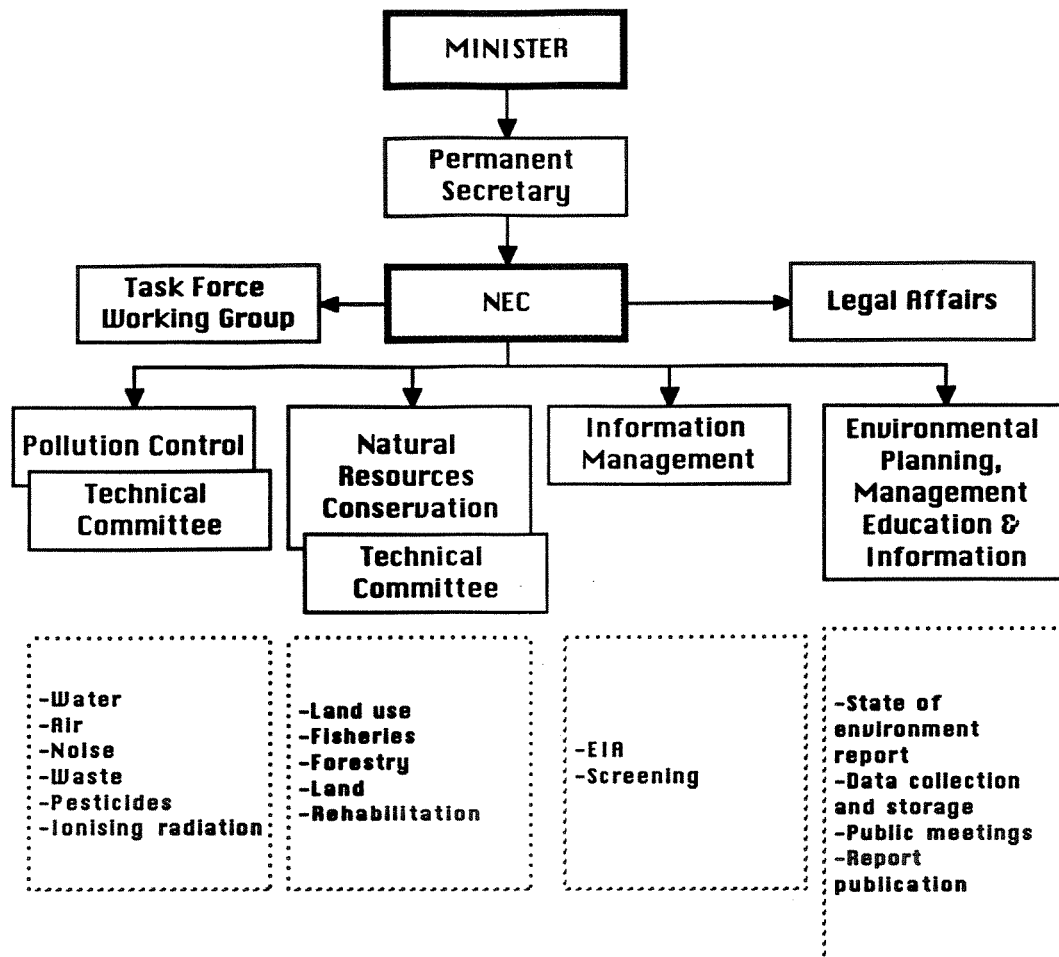


Fig. II.5.1 Proposed structure of the National Environmental Council.

The board will consist of members from altogether 25 Ministries and organisations (E.A, Part IV, Section 4, § 1b). Gathering together different interests and sectors to constitute a cross-sectoral and interdisciplinary board should, idealistically, improve communication and reduce fragmentation in the approach to environmental problems. Allocation of responsibilities to "the polluters" (industry, agriculture etc.) and participation in decision making processes should principally improve possibilities of implementation and secure financial support of actions, i.e. by use of the "polluter pays principle".

The crucial point is how the board will make its decisions. With so many and different interests represented there will obviously be disagreement on a lot of topics concerning i.e. choice of actions, resource allocation and economic cost recovery. Part II, Section 7, § 6 states:

"A decision of the Council and any question shall be by a majority of the members present and voting at the meeting and, in the event of an equality of votes, the person presiding at the meeting shall have a casting vote in addition to his liberate voice."

The composition of the board is therefore particularly important. Authorities and interests involved directly in environmental management and protection do not constitute any majority within the board. Accordingly, there is no guarantee that the decisions always will be made in favour of environmental sustainability. This emphasises the urgent need for environmental standards, guidelines and directives to specify the content of the act.

According to the Environmental Act, NEC will mainly focus on "curative" matters and "repair" of existing damages to the environment, while the Ministries still will be responsible for "preventative" matters, i.e. policy making, strategies and planning.

Enforcement of compliance with the standards and monitoring require thruthworthy monitoring results. The existing environmental laboratories in Zambia lack equipment, trained staff, analytical instruments, etc. To utilise the available resources most efficiently one or two environmental laboratories of high standard should be developed. The National Council for Scientific Research (NCSR) has a laboratory that can be upgraded and modernised to meet these requirements. There is also need for staffing and training of personnel. This upgrading will have to rely upon substantial donor support, both investments, supply of expertise for training of personnel and for coverage of running costs and maintenance.

Development of water projects should be linked to an overall development planning system and water resources planning and land use planning should be undertaken in an integrated manner. To our knowledge there exists no legal and institutional framework for cross-sectoral planning. Environmental planning is, however, incorporated in the NEC's proposed structure. The multi-sectoral and inter-disciplinary composition of the board should prove to be suitable for integrated environmental planning and water resources planning.

II.6 RESEARCH AND DEVELOPMENT CO-OPERATION

II.6.1 Planned Co-operation between NCSR and NIVA/SPCA

The National Council for Scientific Research (NCSR) and the Norwegian Institute for Water Research (NIVA)/State Pollution Control Authority (SPCA) have for some time tried to establish an agreement of co-operation within the water sector. Representatives from NIVA/SPCA have visited NCSR on several occasions to identify the most needed research fields and possible co-operation projects. Due to the former unstable political situation in Zambia and different practical problems, the co-operation has not yet materialised.

The parties have agreed that the projects should be defined according to solve actual problems and be action-oriented and that the research/study component should be tuned down respectively. Long term water management and planning and design of a more stringent water policy and strategy should, however, constitute a framework for deciding upon further priorities of concrete actions. Necessary infrastructure facilities (upgrading of laboratory facilities, staffing, training etc.) should be provided according to the actual needs.

Major on-going and planned NCSR activities and expenditures in the water sector in 1992 are as follow (NCSR - Project workplan for 1992):

1. Unit Centralised Expenditure 1992. (Grand total costs: 185,080 Kwa. GRZ grant).
2. Control of eutrophication using aquatic macrophytes. On-going from 1991. (Grand total costs: 40,000 Kwa. GRZ grant - yet to be allocated).
3. Evaluation of the current and future water demand/availability in the Kafue river basin above Kafue road bridge. On-going from 1991-95. Expected output: A water management plan for the region: Water balance, demand-availability, effects of land use changes/development on water resources. (GRZ grants: 90,000 Kwa).
4. Hydrological studies of drought prone areas of the south Kafue basin. On-going from September 1991 and for 2 years.

Water resources management and planning (water demand and availability in south Kafue basin) is incorporated in NCSR's workplan for 1992 (1991-1995). A possible co-operation project could aim towards expanding this management plan to other parts in Kafue watershed and to cover also water quality issues.

Other projects of relevance to water resources management and planning in the Kafue basin:

The Department of Natural Resources is trying to identify pollution from industrial activities from the Copperbelt to Kafue Township. An important part of the project is a public awareness campaign with the objective to bring the industries together to inform about and discuss the problems.

The Commonwealth Consultative Group on Technology Management (CGTM) is running a project on Institutional Development for Environmental Action (IDEA). The IDEA project intends to take into account the complexity of the environmental problems by use of a task oriented network to enhance environmental management capability for development.

IDEA watershed projects in Zambia and Zimbabwe:

Zambia: Improved management of the lower reaches of the Kafue river.

Zimbabwe: Improved institutional co-ordination to reduce pollution in the Harare watershed.

II.6.2 Project proposals

Based on the findings from NIVA's study trips and contacts with NCSR and different authorities and institutions in Zambia, the following selection of projects have been identified for possible co-operation between NCSR, NIVA/SPCA. Some of the projects demand co-operation with other research institutes to cover a broader spectrum of environmental competence areas.

The project ideas/project proposals will be presented to NORAD for further discussion. The ideas are at this stage only discussed in general and will need further elaboration before more concrete projects can be presented. However, based on the findings from our trip to Zambia, these ideas can serve as a basis for expanding the co-operation between Zambia and Norway in the environmental field.

Matrix for project proposals – see fig. II.6.1 on page 34.

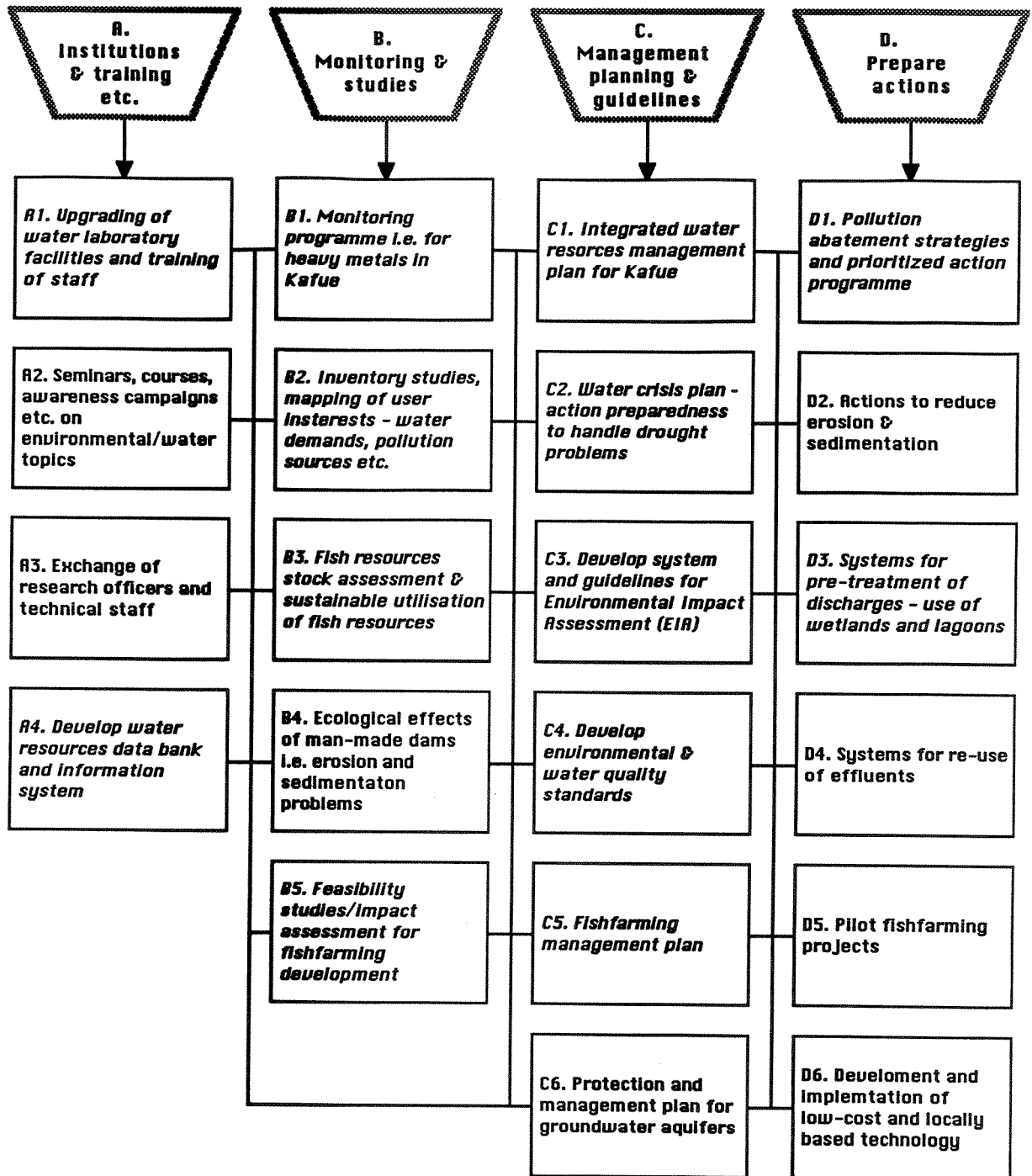


Fig. II.6.1 Project proposals for possible co-operation between NCSR and NIVA/SPCA. Prioritised co-operation projects are written in *Italic*.

II.6.3 Initial Project Summary

In the following the projects/project ideas are given a short description and rationale as a basis for further project prioritisation and development of project content. The projects should be co-ordinated/integrated with on-going projects within the water field. The initial codes set for each of the projects refers to the chart (fig. II.6.1).

A1. Upgrading of water laboratory facilities and training of staff.

Project description

The laboratory facilities at NCSR should be upgraded to meet the needs and requirements of the National Environmental Council. An upgrading should cover both supply of necessary equipment, staffing and training of staff.

NCSR/NIVA/SPCA will co-operate in the design of the laboratory, and training programmes for the staff (i.e. routines and quality control) .

Rationale

Water resources management and control and enforcement of the measures set in the Environmental Act of 1990. is highly dependent on modern laboratory facilities which can deliver reliable data and documentation.

NIVA is running the largest water quality laboratory in Norway and should be highly competent for the task.

A2. Seminars, courses, awareness campaign etc. on environmental/water topics.

Project description

NCSR/NIVA/SPCA will develop specific material and documentation for and arrange seminars, courses and awareness campaigns for the different authorities/administrative units both at state level and the local levels. The local levels are especially important because of the on-going trend of transfer of decision making from state to local level. Courses/seminars can also be arranged for the industry, agricultural organisations and other relevant user groups.

Rationale

Competence building and creating awareness on a broad scale, involving the authorities participating in water management and the different users, are crucial for developing a more sustainable water utilisation. NIVA has i.e. developed course modules for training of municipal environmental executive officers in Norway. Some of the modules can probably be adjusted to fit the Zambian needs. NIVA has also participated in developing guidelines for environmental impact assessments in developing countries.

A3. Exchange of research officers and technical staff

Project description

Part of the competence building/training programme should be exchange of research officers and technical staff. Staff from NCSR and/or from other water related research institutes will visit NIVA for work on specific Zambian projects.

Rationale

Exchange of staff between the participating institutions is necessary to reduce the scientific isolation experienced by the staff at NCSR and to transfer the experience of applied research and water management from NIVA to NCSR.

To make the most efficient use of the exchange programme, participating scientists should be attached to specific research projects in Zambia. The extent of the exchange of personnel should be approx. one man-year pr. year, apportioned among 4-6 scientists and technicians.

A4. Develop water resources data bank and information system

Project description

Existing information and data from the water monitoring programmes/inventory studies should be stored in such a way to make the data easy accessible for different users, i.e. the water authorities, organisations etc. It is therefore necessary to develop a water resources data bank and an information system that will function within the institutional framework. The data bank/information system should be made an integrated part or be linked up with the existing National Data Bank (NDB).

Rationale

Gathering information is in itself less useful if the data is not made easy available for different users. A data bank and information system is considered a necessity for effective distribution of information to and between the users. NIVA/NCSR should design a system for storage, distribution and exchange of water resources information.

B1. Monitoring programme for heavy metals in Kafue

Project description

A programme for monitoring of pollution has been initiated by WRRU, but the activity is too limited in relation to the large-scale industrial activities in parts of the Kafue river catchment. The studies carried out so far by WRRU indicate that industrial pollution in the Copperbelt is severe (particularly heavy metals). A better knowledge of the extent and effects of the pollution is needed as a basis for further actions to combat the pollution. NCSR/NIVA/SPCA will

design and implement a monitoring program for Kafue, focusing on the most polluted parts.

Rationale

Reliable monitoring data is necessary to support documentation on the environmental status and as basis for water resources management and planning and priority of abatement strategies and concrete actions. The monitoring programme should, however, be carried out step by step, at first focusing on the most polluted areas of Kafue.

B2. Inventory studies, mapping of user interests – water demands, pollution sources etc.

Project description

The project aims at improving the knowledge and documentation on resource location and the distribution of different users and their water etc. demands.

The first stage of the project should concentrate on collection and systematisation of existing data obtained from different information sources that are not integrated.

The next stage will be to supply the existing information through field inventory studies when necessary.

The studies should be dimensioned according to the needs of the National Environmental Council and the water resources management planning.

Rationale

A minimum knowledge and information about resources and users are necessary for making rational decisions and for carrying out integrated water resources management and planning and for further selection of the most cost-efficient actions. The inventory studies should, however, be carried out in accordance to specific management and planning needs and not on a general basis.

NIVA/SPCA has carried out several similar inventory projects in Norway in connection with water resources planning and have the experience needed to decide upon the level of ambition and detail.

B3. Fish resources stock assessment – sustainable utilisation of fish resources

Project description

The fish resources in Kafue will be assessed and a strategy for sustainable resource management will be designed on basis of this information. Today, overfishing is a problem and the drought are adding to this negative trend. The

project will advise regulations for the taxation of fish resources based on sustainable measures.

Rationale

The effects of continuous overfishing can have serious impacts on the fish stock and fish reproduction. A fish resources assessment is necessary basis for designing a strategy for taxation of the resources in accordance with the carrying capacity. This strategy should be linked to stronger enforcement of the regulations set by the Fisheries Act.

B4. Ecological effects of man-made dams, i.e. erosion and sedimentation problems

Project description

After the building of the dams in the Kafue, little has been done to assess the ecological effects and the problems related to changes in sediment transport etc. The project will aim towards identifying the different problems caused by the damming and use the information to design more specified in-depth studies and for drawing up guidelines for more flexible dam operation to reduce the environmental impacts.

Rationale

The damming projects may have serious long term ecological effects due to radical changes in the water regime that can have negative impacts on animal life, fishery, agricultural activities etc. This may again have substantial economical consequences. To select and prioritise cost-efficient actions to prevent irreversible damages, it is necessary to improve the knowledge about the ecological processes in the area and the impacts of the damming projects.

B5. Feasibility studies/impact assessment for fishfarming development

Project description

Fishfarming in Zambia is in it's infancy and the production is only about one metric tonnes pr. year. There is probably a potential for substantial development on a more commercial basis in Kafue. The development should, however, take place in a controlled manner to reduce the impacts on the environment. The project will carry out feasibility studies to identify the most suitable locations and develop locally adapted fish farming technologies.

Rationale

Fishfarming can become a commercial trade that can give revenues to the country and secure food supply. Feasibility studies/impact assessments are necessary to identify and secure the most suitable locations and as basis for reducing environmental impacts, i.e. pollution from discharges, that eventually can give negative feedback on the fishfarming itself and cause economic losses.

NIVA has expertise on fishfarming both from Norway and from projects in sub-tropical countries like Zambia.

C1. Integrated water resources management plan for Kafue

Project description

Kafue river is the economically most important river in Zambia with a lot of different user-interests. The development pressure results both in environmental impacts and user-conflicts. Extraction of large water quantities i.e. for the mining industry and discharges from industrial activities and population result in water shortage and water pollution in some areas. The problems seems to be most severe in the Copperbelt and in the lower parts of Kafue. Planned agricultural development and need for irrigation systems will probably increase the problems in the near future. The problems are mostly encountered separately on an ad hoc basis.

The project aims towards designing an integrated water resources management plan for the Kafue catchment area, taking into account all the user-interests, their existing and future demand for water and their environmental impacts. The plan should draw up preventative strategies as well as action proposals to repair already existing damages and propose guidelines for future sustainable water resources management.

All relevant authorities should participate in the planning process together with different user-organisations on a cross-sectoral, inter-disciplinary basis. The NEC probably constitutes a suitable central body for this type of integrated planning. The project should be linked and co-ordinated with the on-going planning project for the lower Kafue watershed run by NCSR.

Rationale

Increasing environmental problems will reduce suitability for uses and cause costly competition between user-interests with conflicting water demands and needs. An integrated plan for co-ordinating the activities is necessary to reduce the present un-controlled utilisation and the increasing user-conflicts. To maximise the revenues from commercial use of Kafue resources it is necessary to optimize water management and secure future sustainability.

C2. Water crisis plan – action preparedness to handle drought problems

Project description

The water shortage crises experienced by Zambia and other Southern African countries this year stresses the need for planning ahead to meet similar crisis in the future. Drought problems have and will most probably continue to occur at certain intervals in the future. Climatic changes may increase the chances of drought and water crisis. The project will design a strategy plan and propose actions to be held in preparedness for future crisis. A system for fast

mobilisation of authorities/resources and organisation of action projects, aid etc. will have to be addressed thoroughly in the plan.

Rationale

When drought crisis occur, it is of utmost importance to have a system to, first of all prevent, but also handle all the problems that arises. A well prepared organisatory body with clear responsibilities should be capable of reducing the negative effects and economic consequences substantially in case of a water shortage crisis.

C3. Develop system and guidelines for environmental impact assessment (EIA)

Project description

At present, there exist no system or guidelines in Zambia for when and how to carry out EIA. Large-scale constructions and building activities are not given a proper impact assessment and the possible environmental and social consequences are therefore not known. The Environmental Act of 1990 states the necessity of developing a locally adapted EIA system.

Rationale

All larger development projects should be evaluated through an EIA. The EIA should make it possible to point out the most optimal solutions from a combined economic and environmental point of view. NIVA has long experience in carrying out EIAs and has recently participated in a project for drawing up general guidelines for EIA in developing countries.

C4. Develop environmental and water quality standards

Project description

One important issue in the Environmental Act of 1990 is the call for development of water quality and pollution control standards. Such standards are at present more or less non-existent in Zambia. The project will develop locally adapted environmental standards. A survey of use of environmental standards in other, neighbouring countries will be carried out as a part of the project. The experiences from these countries should function as a basis for deciding upon specific Zambian standards.

Rationale

Development of water quality and pollution control standards will be of utmost importance as a basis for i.e. determining conditions for industries and other sources of pollution, inspection and control.

C5. Fishfarming management plan

Project description

The feasibility studies/impact assessment studies should end up in a strategy plan for fishfarming. The plan should cover issues like siting of fish farms, technological solutions, environmentally sound management, infrastructure, economic aspects etc.

Rationale

Experiences from Norway and other countries with traditions within aquaculture show the importance of choosing an integrated approach in developing the activity that can secure a sustainable development and prevent negative effects that inevitably will strike back on the trade itself.

C6 Protection and management plan for groundwater aquifers

Project description

The groundwater aquifers are threatened by building activity that can cause contamination. Today, no-one knows the possible impacts and no steps are taken to avoid pollution of groundwater. The project will aim towards identifying and securing the groundwater resources against risk of contamination.

Rationale

Groundwater is important as supplement to surface water from Kafue. In Lusaka, 40% of the water supply comes from local groundwater aquifers. Contamination of the groundwater may have serious consequences for the consumers and even minor accidental spills from industrial activity etc. can give serious economic consequences.

D1. Pollution abatement strategies and prioritised action programme

Project description

The main purpose of the action programme should be to rank selected actions according to cost-benefit analysis and to design a strategy for implementation, including an investment plan. The programme should be designed in agreement with the donors at joint donors meetings.

Rationale

The action programme and investment plan should rationalise pledging for donor support and reduce the problems with project overlap.

D2. Actions to reduce erosion and sedimentation

Project description

The project should design actions to reduce the problems with erosion and sedimentation. The actions should be both preventative, i.e. restrict development/building activity that can increase erosion and reduce existing problems by stabilising and re-vegetating the riverbank etc.

Rationale

Erosion and sedimentation lead to loss of fertile/productive land in some areas and siltation of fishing grounds reducing biological/fish production etc. in other areas. Actions should be directed towards the most severely affected areas with regard to ecological and socio-economic impacts.

D3. Systems for pre-treatment of discharges – use of wetlands and lagoons

Project description

At present, most of the domestic and industrial discharges are discharged directly into the river without any treatment. The project should therefore aim towards finding systems for pre-treatment of discharges, preferably using simple biological methods. Use of natural areas like wetlands and lagoons as biological filters for treatment of organic matters have been proposed as one possible solution. A concrete pilot project should be carried out in one selected area to study the effects and impacts.

Rationale

Finding simple, but functional methods for pre-treatment of discharges should prove to be a more cost-effective way of reducing the pollution input into the Kafue river, rather than the construction of expensive, sophisticated mechanical plants that need special skilled staff for operation and maintenance.

D4. Systems for re-use of effluents

Project description

The project should investigate the possibilities of composting, and re-using the effluents, i.e. for agricultural purposes.

Rationale

Non-toxic effluents from households can be looked upon as a resource, rather than a problem and thereby a source of creating revenues.

D5. Pilot fishfarming project**Project description**

The project should initiate pilot fishfarming projects on a commercial basis as a follow up of the fishfarming management plan.

D6. Development and implementation of low-cost and locally based technology**Project description**

Experiences with import of sophisticated technical equipment i.e. treatment plants for waste water, have proved to be less successful because of high running costs, problems with supply of spare parts and maintenance. The project should therefore investigate the possibility of developing low-cost technologies that can be produced by local firms.

Rationale

Production of equipment locally should reduce the need for investments and support the locally based industry.

PART III. ZIMBABWE

III.1 GEOGRAPHY AND POPULATION

Zimbabwe sits on a high plateau between the Limpopo and Zambezi rivers, and has a range of mountains in the east along the border with Mozambique. The population is about 10 million of which 75% belong to the ethnic group Shona. Zimbabwe borders Zambia, Botswana, Mocambique and the Republic of South Africa. Zimbabwe is member of SADCC.

III.2 DEVELOPMENT AID CO-OPERATION

Norway gives bilateral assistance to Zimbabwe. The main channel for bilateral assistance is the co-operation projects and programmes entered on a government level, administered within the framework of a multyear Country Programme. Zimbabwe has become one of the priority partners for Norway's co-operation within Southern Africa. This is particularly due to its strategic political, economical and geographical position in the sub-region. The annual Norwegian support to Zimbabwe is approximately NOK 140-150 million.

The main areas of co-operation can be classified under the following headings:

- Rural water supply and sanitation (NOK 180 mill. over four years)
- Commodity import programme
- Primary health care
- Family planning
- Agricultural development
- The role of women

Within the environmental sector no programme as such is running besides the Rural Water Supply and Sanitation Programme. However, most projects have an environmental component and aims to improve the sustainability of the region. Specifically Norway is supporting a SADCC fisheries project in Lake Kariba.

Norwegian development assistance is in principle unconditional and the support to Zimbabwe is allocated with few strings attached. Norwegian industry and consultants are not involved in many NORAD funded projects.

III.3 WATER MANAGEMENT SYSTEM

III.3.1 Legal Framework

No comprehensive environmental legislation has been enacted in Zimbabwe so far. The legal framework for environmental actions is scattered among several acts. The Henley-report identified several import gaps in the relevant legislation pertaining to environmental matters. Several proposed amendments

to different acts have been submitted to the Parliament. The lack of efficient environmental legislation is hampering the government's possibilities to deal with environmental management.

There is no legal framework covering environmental impact assessment of major projects. However, all major projects are screened by the Department of Natural Resources (DNR) belonging to the Ministry of Environment and Tourism (MET). The Department assesses the environmental impacts of each project and proposes mitigation measures. The Department can also require the proponent of a project to undertake environmental studies to determine baseline data for a project and to assess the impacts. A comprehensive legal framework for Environmental Impact Assessment should be developed in Zimbabwe.

The Natural Resources Act of 1986 forms the foundation for management of natural resources in Zimbabwe. The act is used to ensure wise and appropriate use of natural resources to ensure sustainability. The DNR is empowered by the Natural Resources Act to stop all operations where the use of natural resources is not consistent with appropriate and sustainable use. The initiative to actions is taken by local Natural Resource Committees.

The Water Act is based on a combination of the "appropriation" doctrine whereby water rights are allocated on a "first come first served" basis and the "riparian" doctrine, in which riparian owner can enjoy an inherent right to use water for primary purposes, i.e. domestic and stock watering. These inherent rights take preference over other rights except in certain special circumstances such as water requirement for townships, railways and schemes of national importance. For any use other than the primary purposes, special authority must be obtained from the Water Court.

The Water Act provides that plans should be prepared for development and utilisation of the Zimbabwe's surface water and that there should be public involvement in the planning process. Provisions are also made for the Minister of Energy and Water Resources and Development (MEWRD) to reserve water for future potential use, when for example the water is approaching the limit of the potential of its catchment area.

Generally the Government has the ownership to water. The MEWRD is charged with the responsibility of allocating water rights. Abstraction of water requires an abstraction license. The Regional Water Authority (RWA) which is a parastatal under the MEWRD is charged with the responsibility of managing the allocation of water rights in areas where it has jurisdiction. RWA determines the allocation of water based on storage level in dams and reservoirs at the beginning of the water year (September to August normally). The farmers orders the water from the RWA which releases the allocated amount of water into irrigation canals. RWA is required to provide storage for at least two years of supply of domestic water supply (primary water supply). RWA operates on a cost recovery basis.

Pollution of water is prohibited according to the Water Act. Effluent waste water may not be discharged into any public stream or underground water unless it complies with prescribed quality standards or an exemption permit issued by the MEWRD. The Act has options for imposing severe penalties on offenders who do not comply with the standards. An effluent charge system has not been introduced in Zimbabwe and is not mentioned as a pollution abatement alternative in the Water Act.

No separate legislation with Environmental Impact Assessment of major development projects exists. There is a need to develop such legislation.

The Land Acquisition Bill of 1992 which calls for property expropriation of commercial farming land will if enacted most likely lead to changes in the land-use. The environmental effects of this up-splitting of farms are unclear. In addition the agricultural production will most likely be disrupted and further exacerbate the food production and distribution problems. The economic viability of the farms will be affected, which might lead to reduced use of external input factors, i.e. mineral fertilisers and pesticides. This will reduce the polluted runoff from agricultural land. However, the environmental problems related to agriculture can increase. The concept of sustainable agriculture should form the basis of the proposed changes in the agriculture in Zimbabwe.

III.3.2 Evaluation

The legal framework for environmental management seems at present inadequate. Due to lack of appropriate legal framework the governmental agencies have few means to stop activities which degrade the environment. Changing the legal framework is a lengthy project but there is a need to overhaul the legal framework for environmental management. There is work under way but it is necessary to speed up the process. Zambia enacted a new comprehensive Environmental Act in 1990. Even though the legal system might be different it could be worthwhile to study this act. As a first step the existing legal framework should be assessed. The Henley-report has probably covered most of this, however, the experience from countries in a similar situation could be used to facilitate the process of revision of the legal framework. Provisions requiring EIA of major projects should be enacted. This will facilitate environmental impact assessment of different plan alternatives and will also improve public participation in the decision making process.

The need for revising the legal framework is acknowledged, however, lack of trained manpower and especially the brain drain Zimbabwe has suffered after independence has made it difficult for the authorities to revise the environmental laws. This factor should be taken into consideration when discussing the need for revising the framework.

III.3.3 Administrative Structure

In Zimbabwe as well as in most other countries several ministries and departments are involved in water management. The division of responsibility is mainly based on historical events and expresses the establishment of different administrative units to deal with specific problems. During our trip we did not have time to meet with all agencies responsible for water management but we managed to cover the most important ones. In addition we have used information from Wangen 1991: "Case study on water management in the Save River basin. Zimbabwe. Prepared for the Copenhagen Informal Consultation".

Due to the short time in Zimbabwe and the difficulties of assessing a complex administrative setting in such a short time the description below is not comprehensive and we apologise for any mistakes.

The Ministry of Energy and Water Resources and Development (MEWRD)

MEWRD is responsible for the overall planning, management and development of the water resources. The ministry administers the government's policy on the development of water resources. This ministry is also responsible for surveys, data collection and drilling of boreholes. Collection of water quantity data seems to be well organised, but a comprehensive monitoring system for water quality is missing. The same applies to data on erosion. In Zimbabwe there are 60 or so stations monitoring water quality. No national water quality laboratory is in operation. The results from the monitoring programme is questionable. According to officials Zimbabwe has few water quality problems while others stressed that the water quality problems are severe. The main reason for this difference in opinion is probably related to the question if siltation of water courses is a water quality problem or not. We would argue that this is a major water quality problem which should be addressed in a comprehensive way.

MEWRD is decentralised to 5 provincial offices, but has no representation at the district level. The authority of the MEWRD is outlined in the Water Act which specifies procedures to follow for obtaining water rights and effluent discharge permits.

The ministry is charged with the responsibility of developing water legislation. The Water Act of 1976 forms the basis of the Ministry's work. There is a need to revise the act, however, the ministry has lost 120 engineers and 400 technicians since independence and this shortfall of manpower has turned the attention away from development of new activities.

The Ministry has three divisions; Design, Operation and Planning. Under the Planning Division there is a Hydrological Branch while the Pollution Control Branch is under the Operation Division.

MEWRD seems to be a very technical ministry. Although the main responsibility seems to be development and implementation of water development policy a considerable task for the ministry is operation of drilling rigs. It can be questioned if a ministry should be responsible for the actual operation of rigs. In most countries such activities are normally delegated to sub-ordinate agencies.

The Regional Water Authority (RWA)

RWA is a parastatal (government/private agency) under MEWRD with the function to exploit and conserve the water resources of the area with the objective of:

1. Securing their proper use and effective development.
2. Providing, in both short and long term, adequate water supplies on the most economic basis.
3. Ensuring efficient distribution of water supplies in order that the economic development of the area may be promoted, facilitated and expedited in the national interest.

The RWA operates and maintains the dams in their area, three catchment areas/river basins, and sell water to whoever requires it. The RWA is responsible for operation and maintenance of several dams in the catchment areas under its jurisdiction. In close co-operation with the MEWRD the RWA is involved with the release of water from several other dams. The RWA has built canals connecting several river basins with each other.

The RWA manages the water rights on behalf of the MEWRD and allocates the water on a cost recovery basis. The RWA is a non-profit agency with head office in Harare and several branch offices. The RWA provides bulk water to any consumer. Supplies to farmers for irrigation are the most important source of revenue. Revenues from selling water to local councils for domestic water supply are very small. The RWA is headed by a Board of Directors which reports to the MEWRD, but the RWA operates independently of the MEWRD to a large extent.

The RWA is facing severe problems with siltation of dams which reduces available storage volume and destroys the pumps. In the present drought the RWA is drilling boreholes for irrigation, however, the price of the water exceeds the farmers' willingness-to-pay. This year there is no available water for irrigation in most dams and as such the operating revenues of the RWA is very small. The RWA tries to release sufficient water to keep the rivers wet but this year no water has been available for this purpose.

River Boards (RB)

The MEWRD can according to the Water Act delegate responsibilities to control water rights and monitor instream flows for a specific area to River Boards.

These boards get a small grant from the government and raises levies from water right holders to finance their activities. The River Boards report to the Secretary of the MEWRD.

In the Save River Basin there are 5 River Boards, all established in commercial farming areas.

The Ministry of Local Government, Rural and Urban Development (MLGRUD)

MLGRUD is charged with the task of co-ordination of planning and implementation of projects which require input from various ministries and agencies. MLGRUD is playing this role in the provision of domestic water supply and sanitation in communal lands area and resettlement areas. As chairperson of the National Action Committee for Rural Water Supply and Sanitation (NAC) MLGRUD is co-ordinating inputs from 6 various agencies in implementing Integrated Rural Water Supply and Sanitation Projects throughout the country.

MLGRUD is responsible for rural development, infrastructure especially roads, primary water supply, small dams and small scale irrigation. The ministry is also trustee of the District Development Fund (DDF).

National Co-ordination Unit (NCU)

NCU was established in 1987 to act as a co-ordinating unit and to act as a secretariat for the NAC. The establishment was a result of the National Master Plan for Water Supply and Sanitation which NORAD funded. NCU was set up to co-ordinate all sectoral activities and to streamline and rationalise the distribution and use of resources. NORAD has been the main source of funding of NCU. NCU main task is to co-ordinate all the actors and also to undertake all the "unofficial" co-ordination of donors. The Ministry of Finance officially co-ordinates all the donors.

NCU is the focal point of the Government's Emergency Water Plan for drought situation in Zimbabwe. The NAC is charged with the responsibilities of developing actions and NCU has to implement them.

District Development Fund (DDF)

The DDF is part of the MLGRUD and is together with MEWRD responsible for provision of primary water supplies to communal land areas and resettlement areas through its wellsinking and drilling projects implemented under the National Rural Water Supply and Sanitation Programme.

DDF has 7 drilling rigs partly of fully funded by NORAD as part of the implementation of the Master Plan. The Master Plan has so far only been a

working tool since the Parliament has not adopted the plan. One reason, according to some rumours the only one, is that these drilling rigs are the principal reason for not adopting the plan since this cause a division of responsibility. Previously MEWRD was responsible for drilling of boreholes and is currently operating 47 rigs. There seems to be an internal fight between DDF and MEWRD. DDF only accomplish 40% of the projected work in one year due to outside pressure to change the drilling schedule.

Ministry of Environment and Tourism (MET)

MET has a Department of Natural Resources, Department of National Parks and Wildlife Management, Forest Commission and Department of Tourism. The two latter are parastatals.

The Natural Resources Act of 1986 forms the legal basis of the work of the Department of Natural Resources. The department is empowered by the Act to stop all operations where the use of natural resources is not consistent with appropriate and sustainable use. The department operates under the Natural Resource Board, which consists of representatives from all walks of life (government, industry, interest groups, etc.). This board decides on environmental problems caused by poor use of natural resources and asks responsible department to rectify the problem. The board also proposes rehabilitation of degraded areas.

The Natural Resource Board operates through local Natural Resource Committees. These play a watch dog role and report mismanagement to the Board which takes decisions. The Board calls upon relevant ministries and departments to provide information and in most cases an agreement is reached to rectify the problem.

The Ministry has at the national level established the Save Catchment Rehabilitation Committee with the mandate to prepare and implement the Save River Rehabilitation Action Plan. The European Economic Community is preparing a project titled the Save Catchment Rehabilitation and Monitoring Programme. The project will encompass the whole catchment area and it will include inventory of natural resources, socio-economic factors, land-use, soil assessment, quantitative land degradation assessment, development in communal areas, and water resources. As part of the project a natural resources data base will be developed and pilot areas for environmental rehabilitation will be identified. The next step will to prepare master plans for these areas and implement needed actions to rehabilitate the areas.

All proposed projects are screened by the Department of Natural Resources which can require the proponent of the project to undertake environmental studies. No formal legal framework for EIA exists in Zimbabwe. In general it was expressed that effective environmental protection and management is hampered by lack of efficient and up-to-date legislation.

A comment could be made to the decision-making structure of the Natural Resource Board. According to information the board acts through unanimously decisions and the representatives are representing themselves and not necessarily their organisation. The efficiency of the Natural Resource Board and its ability to counteract some of the environmental problems caused by mismanagement of natural resources could be a topic of further studies.

Ministry of Health (MOH)

MOH is responsible for wellsinking activities (small wells and dugged wells) and for health and hygiene education as part of the provision of domestic water supply for CLA and RA. The Ministry also is responsible for the monitoring of health related water quality parameters.

Other Ministries etc.

In addition to the organisations mentioned above several others are involved with water resources management at large. Among these are Ministry of Land Agriculture and Rural Resettlement (landuse planning, irrigation), Ministry of Community and Co-operative Development (community mobilisation) and Ministry of Political Affairs (community mobilisation).

III.3.4 Assessment of the Administrative Structure

Based on the short visit and the collected material it is impossible to undertake an assessment of the environmental management structure in Zimbabwe. However, a few comments can be made.

Generally the management system in Zimbabwe is based on a sectoral division of responsibility. Each ministry is responsible for primarily one sector while cross-sectoral issues tend not to be prioritised. To combat the problem with lack of co-ordination within the water supply and sanitation sector the National Co-ordination Unit (NCU) was established.

The review shows that the responsibility for many water resources management activities are shared between various agencies. In the planning and implementation of water projects the situation is as follows:

- Responsibility of design and construction of dams is shared between DDF and MEWRD depending on the height of the dam. In addition several other organisations particularly the commercial farming sector are responsible for the construction of many dams. There are 12000 dams of varying size in Zimbabwe.

- Three agencies (MEWRD, DDF and MOH) are sharing the responsibility for provision of primary water supply in communal and resettlement areas.
- Two agencies are responsible for borehole drilling (MEWRD and DDF).
- Several agencies are involved with providing water to irrigation.
- Two agencies are sharing the responsibility for community mobilisation (MCCD and MPA).
- The National Co-ordination Unit serves an important function as co-ordinator of all activities within the rural water supply and sanitation programme.

As far as monitoring of water quality and quantity and operation of water facilities are concerned the situation is primarily as follows:

- Responsibility for monitoring of water quantity and quality rests with MEWRD. Most emphasis is on water quantity which seems natural considering the present situation. It is more important to reach full water supply and sanitation coverage of adequate quality than to spend resources on monitoring water quality in reservoirs and rivers. Besides most drinking water supplies are based on groundwater which generally is better protected against pollution. However, there is a need to upgrade the existing system for water quality monitoring. This will include establishment of a national water quality laboratory. UK has pledged support to such a laboratory.
- Control of water rights and monitoring is the responsibility of MEWRD. The Regional Water Authority manages these rights on behalf of the ministry. Allocation of bulk water is based on a cost recovery system. The system for allocation of water in emergency situations, i.e. droughts, should be studied further and clarified.
- Responsibility of operation on irrigation schemes is divided between several agencies.
- Operation and maintenance of piped schemes are the responsibility of three agencies (MEWRD, DDF and Local Authorities).

Compared to other developing countries in the Southern Africa region the administrative apparatus seem to function fairly well. According to information obtained most elements of the government operates reasonably well. However, the bureaucracy is definitely present, the system seems to suffer from brain drain and change of leaders and so forth. There is a need to overhaul the whole system, however, most other countries are struggling with the same problems and it is maybe more effective to work with and within the existing system instead of establishing new ad-hoc units. It is quite a task to

reorganise ministries and department and it requires a fair amount of resources. Maybe these resources can be spent more efficiently in other areas.

Several ministries are responsible for water management. There seems to be a need to clarify the responsibility of the different actors. Many ministries are responsible for providing water supply. The National Co-ordination Unit is set up to co-ordinate all the players. Maybe NCU also should consider the feasibility of merging the organisations responsible for drilling of boreholes. It can be questioned if it is really necessary to have two government organisations responsible for drilling of boreholes.

Ideally, one ministry should be responsible for water resources assessment and the overall planning and development of water resources. This ministry should develop needed legislation and be in control of legislation which covers water rights as well as pollution control measures. MEWRD has this responsibility today but there seem to have been taken actions which undermines this responsibility. MEWRD needs to be strengthened both in terms of manpower and financial resources, however, manpower seems to be the most critical constraint.

Development of water project should be linked to the overall development planning in rural and urban areas. Water resources planning and land use planning should be undertaken in an integrated manner. To integrate water and land use planning a strong linkage between the lead agency on water resources planning and the agency in charge of development planning should be established. This implies that the linkage between MLGRUD and MEWRD should be strengthened in the planning of water projects. The conflict between DDF and MEWRD regarding drilling of boreholes might be an obstacle to improved linkage.

To increase the efficiency in water resources planning and development a clear distinction should be made between the responsibility of the Government, the Local Authorities and the private sector. There seems to be a need to review the role of these players in water resources development in Zimbabwe.

III.4 WATER RESOURCES PLANNING

III.4.1 General

Some river basin plans were prepared in the 1970s. Due to staffing problems within MEWRD no comprehensive water resources planning has been undertaken. The need for such planning was acknowledged, however, lack of staff and financial resources made it impossible to embark upon such a task.

The current drought situation expressed the need for integrated comprehensive water resources planning. In such a situation the supply and demand for water should be clearly identified. An integrated approach to water resources

planning and development requires participation from all affected parties and a commitment to implement the needed actions. Water resources plans incorporated in land use plans can be used to steer the future development towards sustainability.

III.4.2 Emergency Water Plan for Drought Situation in Zimbabwe

The Nature of the Problem

Zimbabwe is in the middle of a drought of disastrous proportions. Rains have been well below average. Water in reservoirs is way below capacity from as low as 1.7% in Masvingo to only 50% in normally high rainfall areas of the highveld, i.e.. including most of the Mashonaland Provinces. Most shallow wells in the worst affected areas have dried up. As of mid April 44% of the deep wells have dried up as well as 20% of the boreholes. Approximately 28% of the primary water supplies have dried up so far.

This situation has caused considerable crop devastation. Maize deliveries to the state-owned grain marketing board will fall by 90% to 60,000 tonnes, from more than 600,000 tonnes last year. Cotton deliveries are forecast at less than 90,000 tonnes (205,000 tonnes in 1991), soybeans at 30,000 tonnes (133,000 tonnes), while winter wheat production is expected to fall to less than a third of normal levels. Sugar production has come to an halt. The impact of the economy will be considerable in addition to the human sufferings. Agriculture accounted for almost 20% of gross domestic product last year, though in real terms it was down from previous years.

Objectives/Actions

The Government has tasked the National Action Committee (NAC) to co-ordinate strategies for meeting the disaster in water shortage. NAC has prepared an Emergency water plan which calls for several actions to be taken. The objectives these actions are aimed at are:

1. To install 700 hand pumps to provide potable drinking water to 175,000 people in the communal and resettlement areas by 31 July 1992.
2. To rehabilitate 1,900 deepwells with hand pumps providing water to 285,000 people in the communal and resettlement areas by 30 November 1992.
3. To rehabilitate 1,500 boreholes with hand pumps.
4. To rehabilitate 190 existing rural piped schemes.
5. To hydrofracture 450 existing dry boreholes.

6. To drill 1,100 new boreholes with hand pumps with existing Government drilling equipment providing water to 125,000 people in communal and resettlement areas.
7. To drill a total of 2,000 new boreholes with private drilling equipment providing water to 1,400 commercial farmers and 100,000 people.
8. To drill a total of 2,600 new boreholes with new Government drilling equipment (Note: There are a total of 12,939 existing boreholes in Zimbabwe).
9. To reduce water consumption and loss in the most affected municipalities.

The Emergency Water Plan is constantly being updated. As can be seen from the number of actions mentioned above, the task is considerable. To alleviate the situation requires new and additional resources. Several donors have increased or reallocated the aid. This situation will put the administrative structure under a considerable pressure. It will require great efforts from all parties. There is no time for power struggle in such a situation.

The drought causes stop or reduction in water supplies to people and to irrigation. The National Water Authority (NWA) is a parastatal body which gets most of its revenues from selling water for irrigation. Due to the drought very little water is available for sale and as a consequence NWA is facing financial problems. In such a setting there is an incitement to sell water to the users who are willing to pay most. Without having detailed knowledge about allocation of water to different users in Zimbabwe there is reason to question the existing system for allocation of water. However, not enough information is available to assess the system in detail.

III.5 SAVE RIVER

(This description is excerpted from a paper written by Dr. G. Wangen at the request of NORAD: "Case study on water management in the Save River basin, Zimbabwe").

III.5.1 Geographical Setting

The Save River Basin is located in Eastern and South Eastern part of Zimbabwe. The basin consists of the Save River catchment which covers a total area of 43,500 km² and the Runde River catchment with a total area of 41,000 km². The river system ends in the Mocambique Channel south of Beira. Save River is an transboundary river.

The total population in the basin is estimated at 2.6 million. The basin accounts for 21% of all cultivated land in the commercial farming areas in Zimbabwe.

The rainfall pattern in the basin is well documented. The mean annual rainfall is 648 mm for the Save River and 699 mm for the Runde River. The annual rainfall varies from more than 1200 mm in the North to less than 500 mm in the South.

Only about 10% of the rainfall appears as flow in the river system. The mean annual runoff (MAR) is 5954 mill. m³. The potential yield has been calculated at 3451 mill. m³ and the present use to 1248 mill. m³.

III.5.2 Use and Demand for Water

The present use of water amounts to 36% of the potential yield. There is a potential for construction of new reservoirs in the basin. The Save River Development Plan proposes to utilise the water yield in the following way:

1. Existing water rights	23 %
2. Increase in primary use	2 %
3. Reservation 10% of MAR	9 %
4. National urban, industrial and mining	6 %
5. National agriculture	59 %

There are several dams in the basin. The Regional Water Authority operates five dams with a total supply capacity of 1,890 mill m³.

Total irrigated land is due to lack of data estimated at 170,000 ha (total cultivated land area is 1.1 mill. ha).

Domestic water supply in rural areas is mainly provided from ground water resources using standard technology of boreholes, blasted wells and shallow wells. Rather few piped water supply schemes are located in the basin. The level of coverage ranges from 10 to 100% while the sanitation coverage ranges from 5-75%. The ongoing National Rural Water Supply and Sanitation Programme aims at providing people in communal and resettlement areas with safe water from a primary water supply by year 2000. The target is 100% coverage for water supply and 50% coverage of adequate sanitation services.

The following problems related to watershed management in communal land areas are the most important:

- High human and livestock population
- Major erosion problems in grazing lands
- Arable land being cultivated without adequate erosion control measures
- Problems of deforestation leading to accelerated erosion
- High prevalence of streambank cultivation
- Land husbandry techniques practised by the majority of the communal farmers are inadequate
- Siltation of streams and rivers

- Many human settlements are poorly planned
- Lack of an integrated resource planning concept.

The proposed EEC study will address most of these problems. The only question is if the EEC will fund the study. The need for developing an integrated rehabilitation and management plan for the area is evident, especially in the current drought situation.

During our visit we got a chance to see most of the problems mentioned above.

III.5.3 Conflicts between Water Uses

Wangen (1991) summarised the potential water conflicts between water use in the further development of the area as follows:

1. Effects on environmental degradation on food and health need satisfaction.
2. Allocation of irrigation waters to communal land areas or to commercial farming areas.
3. Water pollution caused by the proposed pulp and paper mill.
4. Siltation of dams caused by land degradation.
5. Allocation of water to Mozambique.

III.5.4 Water Resources Planning

To our knowledge no comprehensive water resources plan exists for the Save River. The Save River Catchment Rehabilitation Committee is charged with the task of preparing and implementing the Save River Rehabilitation Action Plan. This plan will address the following areas:

- Conservation and management of the soil and water resources
- Improved production of crops both for food and marketing
- Improved animal husbandry over the catchment

This plan will when developed hopefully serve as a basis for an integrated water resources development of the Save River.

III.5.5 Evaluation

The environmental problems in the Save River is caused by mismanagement of natural resources and poor landuse practices. The catchment area is severely affected by over-grazing and deforestation. The need for rehabilitation is evident. The situation in 1992 is extremely critical due to the drought. The environmental problems are exacerbated by the drought. Since crops have failed, water is scarce, the destruction of the natural resources will be intensified in this situation. Without a considerable effort from the Government and international donors the drought situation might cause irreparable damages to the environment.

Save River is an international river. No agreement regarding the use of the river exists between Zimbabwe and Mozambique. The availability of water on a perennial basis is of great interest to Mozambique. Continued construction of reservoirs in Zimbabwe for irrigation water will have an impact on the availability of water from year to year. This will make it difficult to guarantee a minimum instream flow on the border to Mozambique. A Water Commission between Zimbabwe and Mozambique should be set up to address issues of mutual interest in management of the available water resources.

APPENDIX

LIST OF PERSONS CONTACTED IN ZAMBIA AND ZIMBABWE

ZAMBIA 1991

Hallaråker, M., Mr.	NORAD
Lønning, A., Mr.	NORAD
Solgaard, M., Mr.	Interconsult
Siamwisa, Mr.	National Council for Scientific Research
Mwassile, M., Mr.	National Council for Scientific Research
Mucheleng'anga, C. G., Mr.	National Council for Scientific Research
Kasonde, J., Mr.	National Council for Scientific Research
Mwansa, B., Mr.	National Council for Scientific Research
Liayo, I. M., Mr.	Nitrogen Chemicals of Zambia
Kasonde, Mr.	Kafue Council/Kafue Waterworks
Sangulube, G. O., Mr.	Department of Water Affairs
Mwale, Mr.	Department of Agriculture
Banda, Mr.	Department of Natural Resources
Aongola, Mr.	Department of Natural Resources
Chanda, R., Mr.	University of Zambia
Hudson, Mr.	Commercial Farmers Bureau
John, Mr.	Zambian Consolidated Copper Mines
Charman, J., Mr.	Zambian Consolidated Copper Mines
Trebes, P., Mr.	Zambian Consolidated Copper Mines
Mbinji, Mr.	Zambian Consolidated Copper Mines

ZAMBIA 1992

Banda, Mr.	Department of Natural Resources
Mwansa, Mr.	Department of Natural Resources
Njoiu, Mr.	Department of Natural Resources
Kalunga, Mr.	Department of Natural Resources
Hendrich, J., Mr.	Lusaka Water & Sewerage Co.
Mubamba, R., Mr.	Fisheries Department Research
Mwansa, Mr.	Ndola City Council

Kabimba, W., Mr.
Lungu, W., Mr.

Kitwe City Council
Kitwe City Council

Luyele, J., Mr.
Charman, J., Mr.

Zambian Consolidated Copper Mines (ZCCM)
Zambian Consolidated Copper Mines (ZCCM)

Siamwisa, Mr.
Banda, S. C., Mr.
Mucheleng'anga, C. G., Mr.
Kasonde, J., Mr.

National Council for Scientific Research
National Council for Scientific Research
National Council for Scientific Research
National Council for Scientific Research

Hagen, S., Mr.
Lønning, A., Mr.

NORAD
NORAD

ZIMBABWE 1992

Engstrøm, J.E., Mr.
Eschweiler, J.A., Mr.
Hungwe, B.B., Mr.
Khatso, J.L.T, Mr.
Kristiansen, V., Mr.
Landing, K., Mr.
Mbetu, R.M., Mr.
Melsom, S., Mr.
Munemo, D., Mr.

National Coordination Unit
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