



WORLD METEOROLOGICAL ORGANIZATION



Global Water Partnership

THE ASSOCIATED PROGRAMME ON FLOOD MANAGEMENT



INTEGRATED FLOOD MANAGEMENT

CASE STUDY

ZIMBABWE: *FLOOD MANAGEMENT PRACTICES – SELECTED FLOOD PRONE AREAS ZAMBEZI BASIN*

January 2004

Edited by

TECHNICAL SUPPORT UNIT

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ZIMBABWE: FLOOD MANAGEMENT PRACTICES - SELECTED FLOOD PRONE AREAS ZAMBEZI BASIN

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Abstract: *This is a case study of two places in Zimbabwe prone to flooding. The paper examines causes of flooding, flood management practices, legal instruments and institutions in place to manage flood events. Finally the way forward is drawn from recent flood events lessons taking into account the new concept of integrated flood management practices*

1. Location

The term Mzarabani in the local language means flood plain or an area that is frequently flooded. The Mzarabani and Guruve districts are some of the most vulnerable areas to flooding in Zimbabwe. The two districts are located in the Northern part of Zimbabwe, in the Zambezi basin (see map1). Mzarabani is located 30° 45"E to 31° 20"E and 16° 00"S to 16°30"S. Lower Guruve is located 30° 25" E to 30° 45" and 16°S to 16° 30"S .The Zambezi basin is the fourth largest international basin in Africa, shared by eight countries namely, Zambia, Namibia, Botswana, Angola, Zimbabwe, Malawi, Tanzania and Mozambique. The Zambezi River itself starts from the Kalene Hills in Zambia and flows 2800km in an easterly direction into the Indian Ocean.

Topography

The greater part of the Zambezi basin comprises of a plateau that lies at an altitude of between 1000 and 1500m above sea level. The topography of the basin varies in altitude from sea level at its delta on the Indian Ocean to over 1500m on the plateau with mountain areas lying beyond 2500m. The plateau is deeply divided and dissected by river valleys that form the tributaries of the Zambezi, Mzarabani and Guruve are located in the valleys of the lower Zambezi about 400m above sea level.

The Zambezi consists of such tributaries as Lungo Bungo Cuando, Luina Kabonde(Angola) Kafue Luangwa(Zambia), Msengezi Manyame(Zimbabwe) Shire(Malawi). Mzarabani and Gururve are located at the confluence of Zambezi and Manyame, Zambezi and Msengezi respectively. Besides the river systems the Basin also consists of a large number of wetlands shown on the map.

Climate

The Zambezi basin's climate is to a large extent influenced by the Congo air masses, north easterlies and the inter-tropical convergence zone (ITCZ). The tropical cyclones from the Indian Ocean also affects the Zambezi basin by bringing large storms of rain which of late has caused destruction of property and loss of lives through flooding. The climate of the basin is also affected by the presence of large water bodies such as Lakes Kariba, Malawi/Nyasa, Cabora Basa and others (SADC 2000 *et al*).

The rainy season is largely dependent on low-pressure system, the ITCZ which moves to the southern part of Zambia in November and reaches its peak in January or February. The peak period also coincides with the period when rivers are at their peak and flooding is quite common during this time of the year. Because of high temperatures during this period convectional rainfall is also common. On average the Mzarabani and Guruve areas receives about 650mm of rainfall per year. However the basin is characterized by extreme variations in rainfall both spatially and temporarily. Year to year droughts have been experienced especially in the last decade. This decade has seen floods of unprecedented magnitudes experienced in years 2000

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and 2003 caused by tropical cyclones. However there is still no explanation as to why cyclones have become so frequent in these few years.

Hydrology

The hydrology of the Zambezi is to a large extent dependent on the rainfall pattern. The main Zambezi River is perennial due to the presence of large bodies of wetlands at the source of the river. The River Zambezi Reaches its peak flows around May and is at it's lowest in October. The flows are largely modified by the existence of the Kariba Dam. However some of the tributaries are perennial while others are not. On the Zimbabwean side i.e. Manyame and Msengezi reach their peak in January/February. Lowest flows ranging from are recorded around September and October. Flows on the two tributaries range from 0 m³/s to 200m³/s. Flows as higher than 450m³/s were recorded in February 2000. On the Zambezi River flows range from 300m³/s to 4000m³/s. During the same period discharges of over 4000m³/s were recorded during the same period. Figures 2 and 3 show the typical flow patterns in the area of study.

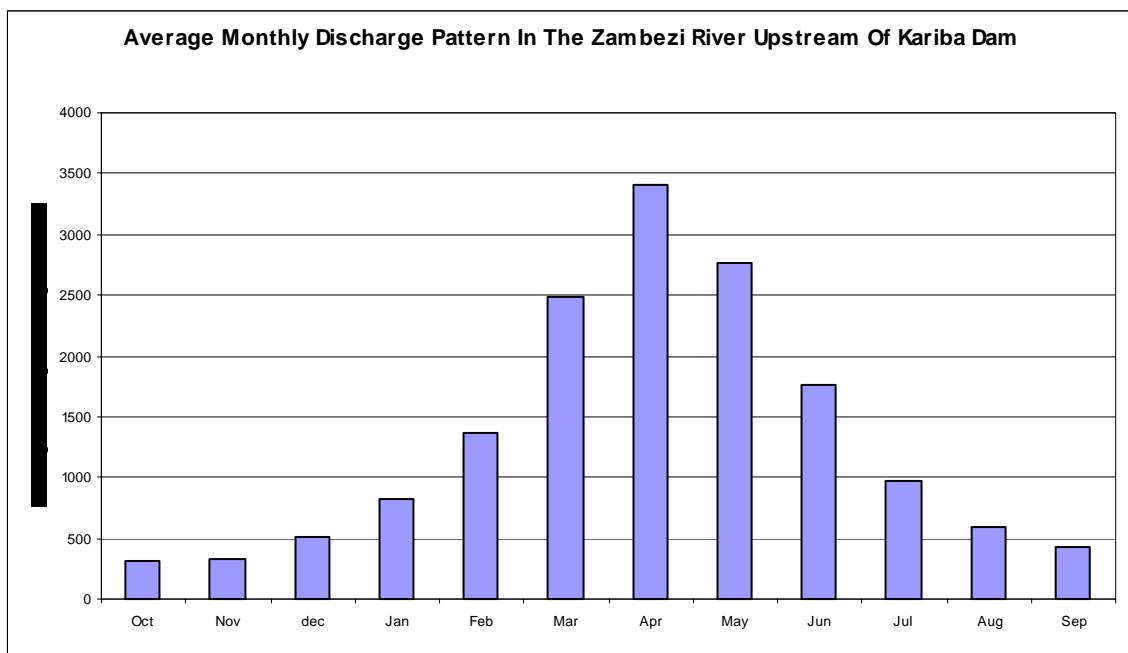


Fig 1 Typical Monthly average discharge pattern in the Zambezi River

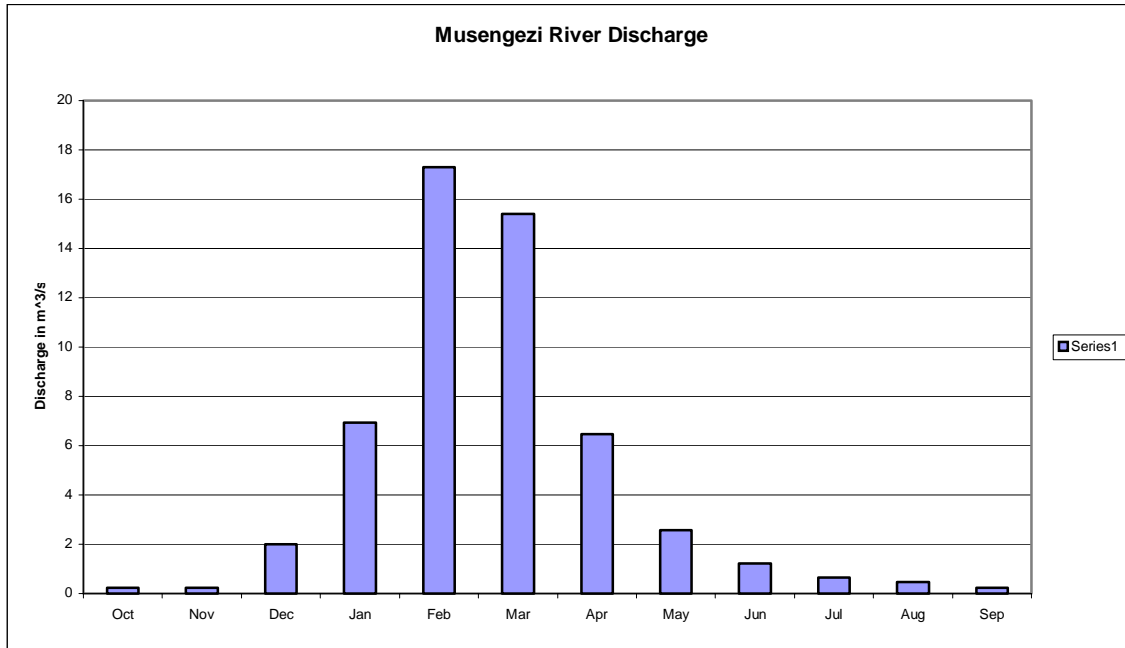


Fig 2 showing a typical monthly average discharge pattern of the Msengezi River in Mzarabani

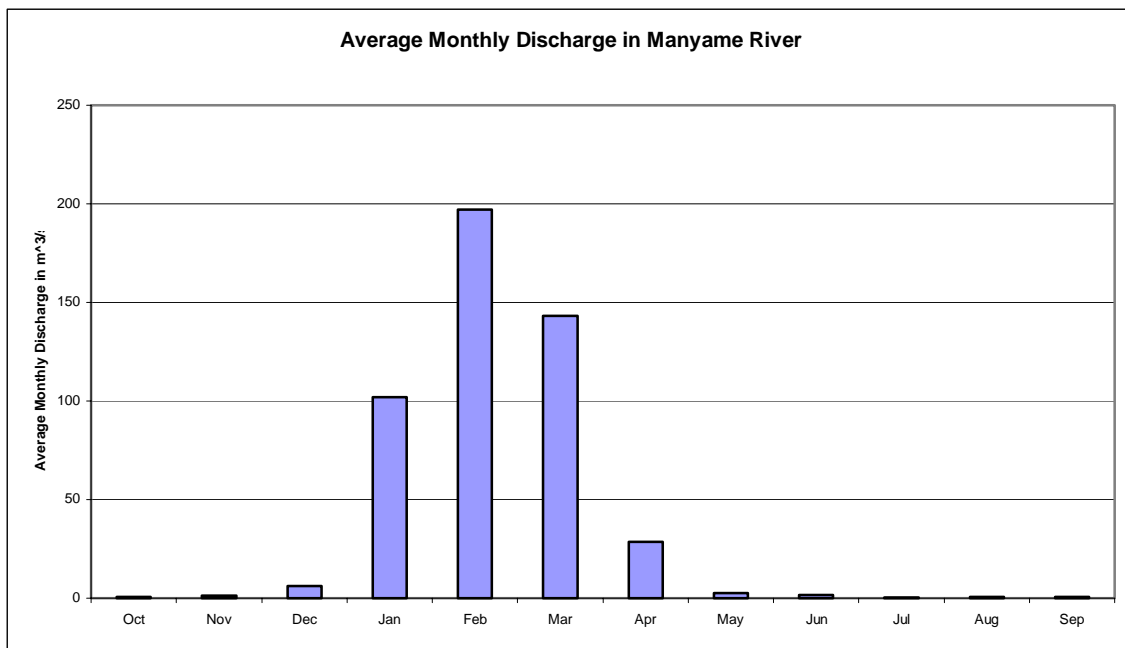


Fig 3 showing a typical monthly average discharge pattern of the Manyame River in Gururve (Data source ZINWA)

Soil types

The main soil types in basin are the acid, leached out tropical soils of low fertility, commonly know as red soils. However cotton black soils, which are of high fertility, are also found in the basin in the area of study. With good rains excellent crops may be harvested.

2. Land Use and Water Resources Use Pattern



The area under study is about 8 000km² and the population is estimated at 300 000 of which about 160 000 are women. For a long time there was no activity in the Mzarabani and Guruve areas due to adverse environmental conditions such as high temperatures, prevalence of malaria, which made human habitation difficult. It is only in the past thirty or so years that the government started opening up the land after realizing that it had very high agricultural potential due to fertile land. Today there is both commercial and subsistence agriculture as well as wildlife management as the main economic activities. Cotton is the key crop in this area grown on commercial scale as well as by the local villagers. The area has been opened up for large-scale irrigation of maize and beans. Large Banana plantations also exist and there are plans to put up a huge sugar plantation. Livestock rearing i.e. mainly goats, sheep and cattle is done at subsistence level. In terms of water usage commercial farming (irrigation) and water supply for domestic purposes are the dominant users. However most of the rural farmers in the area depend to a large extent on rain-fed agriculture.

The area under study has lots of natural vegetation, which consists of thick forests consisting of indigenous hardwood trees and tall grass. The vegetation seems to do well as a result of the seasonal floods, which deposits soil fertility and leaves the ground saturated as well as recharging the ground water aquifers. Large tracts of forests have therefore been set aside for wildlife management. The forests are habitat to wildlife species such as elephants, lions, leopards etc. A community-based project called Campfire has been initiated to manage the natural resources in the area. The campfire project involves sustainable management of wildlife in the area by the locals. In turn the locals tend to benefit from the funds generated through tourism and hunting. The funds so generated are used for projects chosen by the community, such as construction of schools, clinics and bridges.

3. Description of floods

Two types of floods affect the area under study. The first and most frequent type of floods is the seasonal flood. This occurs in most years normally in January or February. This is at the peak of the rainfall season. The second and not so frequent one is the cyclone-induced flood. This has become more frequent than before. In February 2000 cyclone Eline hit the basin bringing with it intense storms. In March 2003 the basin was again hit by cyclone Japhet which also caused flooding in the area. Guruve and Mzarabani are affected by floods because of their location. The two are located downstream of Kariba dam but upstream of Cabora Basa and at the confluence of Manyame and Msengezi. When the Kariba dam rises to a certain level, water is released from the dams to avoid dam failure. Most releases are done between December and February. This causes the discharge in the Zambezi to increase substantially. Manyame and Msengezi rivers will thus not be able to discharge in the Zambezi as a result water begins to accumulate at the confluence of Manyame and Zambezi leading to flooding in the Guruve area. Further downstream Cabora Basa dam levels continue to rise as releases from the dam are exceeded by inflows due to releases from Kariba and Zambezi tributaries. The swelling of the Cabora Basa dam leads to flooding in the area under study. This has led to loss of livestock and human life, crops and infrastructure have been destroyed leaving the rural folk in general poorer. The actual costs of the flood damages are not available as most of the assessments done so far are of a qualitative nature. Women are the most affected since they are responsible for the day-to-day management of the families such as looking after the health of the child and securing food for the family. Diseases outbreaks such as malaria and cholera have been quite common during this period

4. Flood Management Measures

There are two types of flood mitigation measures in place in Zimbabwe, structural and non structural. The structural measures consist of dams and weirs in place which store runoff.



Though these structures were put in place to improve water security they also serve as flood mitigation structures by reducing the amount of runoff/discharge in a river if storage is available. The impact of dams in flood control is limited to the amount of storage available and the way these dams are operated prior to and during the rainy season. Zimbabwe is also in a semi-arid region it is therefore difficult for the water managers to release water in anticipation of floods because of very high uncertainties in the occurrence and magnitude of runoff during the coming season. The major dams that play part in flood mitigation in area under study are listed in the table below

Dam Name	Purpose	Capacity x10 ⁶ m ³
Seke	Water supply	3.38
Bhiri-Manyame	Irrigation	172.4
Harava	Water supply and Irrigation	9.0
Bumururu	Water supply and Irrigation	2
Karoi	Water supply	1.35
Eastworlds	Irrigation	24
Manyame	Water supply and Irrigation	480.2
Chivero	Water supply and Irrigation	247.2
Blockley	Water supply and Irrigation	4.9
Pembi	Water supply and Irrigation	2.3
Mazvikadei	Water supply and Irrigation	343.8
Kariba	Hydroelectric power generation and Water Supply	64800
Total Capacity		66 090.33

Table 1 Showing dam capacities in the study area

The total storage of the major dams is therefore 66 090.33 x 10⁶m³. Most of these dams however have the disadvantage that they are located further upstream of the study area. In between the study area and these dams substantially amount of runoff is generated to the extent that the contributions from intermediate catchments can cause flooding. By virtue of their location, the dams offer limited mitigation potential. The Kariba dam also located upstream of the study area reduces the impact of floods as it has a huge capacity. However once the water level reaches potentially dangerous levels (i.e. the level which may cause dam failure) releases are done and this may lead to flooding in the Mzarabani/Guruve area

The other type of flood mitigation measures is the non- structural type. This ranges from flood forecasting to rescuing operations as well as defining areas to settle. The meteorological office issues forecasts throughout the year. During the wet season the met office observe the state of the atmosphere and predict the amount of rainfall that is likely to fall in the next few days. This information is used in predicting the river flows and thus be in a position to tell whether there will be floods or not. Based on this information the appropriate authorities take the necessary steps to ensure the information is disseminated and the potential victims evacuated before or during the floods events. Two problems are have been noted in flood management. The first one is the lead-time between the flood forecast and the flood event. At the moment the models being used for meteorological forecasts can only provide very short forecasts accurately. This may not allow enough time to reduce the impact of the magnitude. The second one is accuracy of the forecasts. Due to previous false alarms from the met office, people were no longer taking forecasts seriously as demonstrated during the Eline cyclone. An accurate forecast was issued by the meteorological office but was not taken seriously until reports of people dying as a result of floods in Mzarabani and Guruve were received.



The non-structural type of flooding is still the most important type of flood measures in place. This is because Zimbabwe and Southern Africa as a whole often receives erratic rainfall and droughts are so frequent. It is therefore not possible to release water from the dams (which are the only structural measures in place) when there is no guarantee that the following year would be wet.

Information exchange has significantly improved. Data collection of rainfall, discharge in rivers is done by the national agencies, which are Meteorological office and Hydrological Branch (ZINWA). Others sources of information are satellite/radar observations, forecasts from other institutions, information from the local communities and local authorities. Dissemination of information is normally through the newspapers, radios, televisions, telephones, Internet, and awareness programs by government and non-governmental organizations. The flow of information can best be summarized by the flow chart below

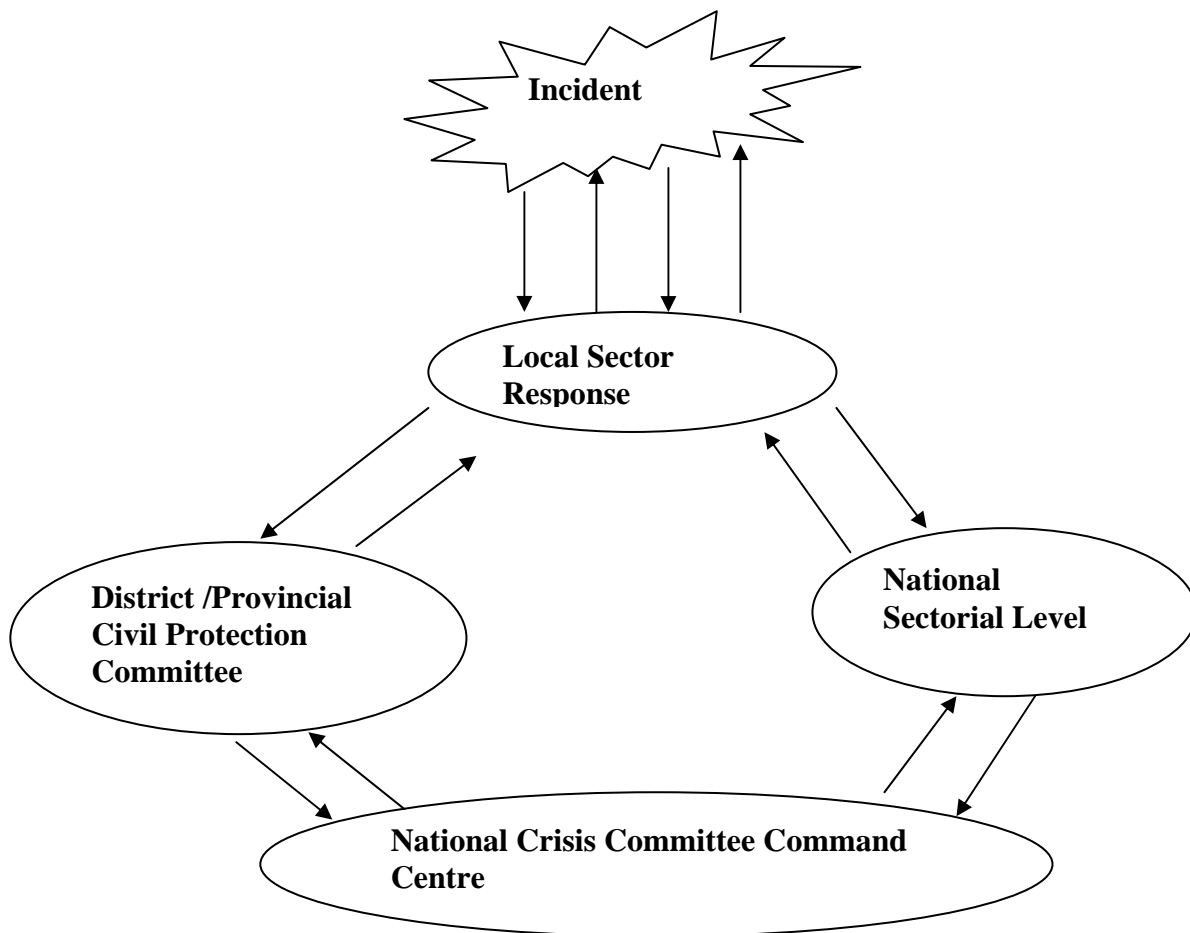


Chart showing the flow of information (adapted from *Operational Manual Management of Flood Emergencies in Zimbabwe*)

Nature of Information

Nature information that is important in flood management in Zimbabwe is the magnitude of flood event, its impact in terms of space and time, assistance required, number of victims as well as the potential victims

There has been a marked improvement in co-operation following extreme events at both local and national level. Multi-sect oral meeting on flood management which are coordinated by the Civil protection agencies are well attended and a lot of positive contributions are made, the meteorological forecasts are now taken more seriously than before. Awareness campaigns held



recently by Save the Children Fund UK and the Department of Civil Protection in flood prone areas have shown that people are now willing to participate in flood management than ever before. Topics which are normally covered during these campaigns include informing people about what floods are, where they normally occur, that people, should be aware of the normal behaviour of their rivers, areas to relocate in the event of floods, the need to work as a community when floods occur, survival tactics, what to do after the floods. They are also advised on the long term planning of type of house to construct, materials to use in order to reduce the impact of floods on shelter, and where to locate their houses. Details of some of the campaigns are the booklet attached.

5. Flood and Water Management Instruments

Civil Protection Act [Chapter20:06] spells out the legal instruments for disaster management and the powers vested in individuals as well as organizations in the case of disasters such as floods. The responsibility of disaster preparedness and response rests with the Civil Protection department. However the Civil Protection department can call on any government department or private sector to assist wherever such assistance may be required as will be explained in the next section. This Act is undergoing revision and is soon to be renamed *Emergency Preparedness and Disaster Management Act* The main thrust is to address structural and organizational gaps, to ensure a multi sectorial representation. The revisions will place emphasis on localized decision making with the local authority being expected to take a leading role in preparedness and response with the support of the provincial national level thus strengthening the decentralization policy. The Act also seeks to decentralize critical services with the local authorities being provided with the relevant equipment and training to make sure that most of the search and rescue activities are done locally as opposed to the current centralized systems. A comprehensive system of emergency services countrywide is being proposed. This is meant to ensure competence through training curriculum and standardized services provision throughout the country. A training institute is to be setup to ensure continuous training is carried out. (Extracted from memorandum of principles: revised Civil Protection Act 21/10/02)

Meteorological Services Bill (2003), which will soon be an act of parliament, states as one of Meteorological Services Department's functions issue weather and climate forecasts, and advance warnings on weather conditions likely to endanger life and property.

Water Act (1998) This law promotes Integrated Water Resources Management, which has since been adopted as a basis for water resources management in Zimbabwe. The country has been subdivided into seven Catchment. Each catchment is managed by a catchment council. The catchment council consists of elected representatives from the different water users. These include local authorities, commercial as well as subsistence farmers, miners, environmental group etc. These stakeholders actually manage the water resources in their catchment and have the powers to allocate water. The Catchment council is in itself a legal body that can sue or can be sued. Gender balance is encouraged in the representation on the catchment council. Women have therefore a good chance to participate in the decision making process. Though the catchment's mandate is to manage the water resources in an integrated way, in their terms of reference, there is no specific reference to how they should floods.

SADC Protocol on Shared Water Course Systems spells out how international rivers within the SADC community shall be managed. It also stresses the importance of information dissemination during floods and droughts to neighbouring countries in order to reduce flood impact.



ZACPRO (Zambezi Action Program) this is an initiative by the Zambezi basin states which has been designed to bring countries which share the Zambezi basin to manage the basin as one and in an integrated way. At the moment member countries have different policies on management of their portion of the Zambezi. However this project will see the Zambezi Basin Management System put in place mechanisms for sharing water, management of floods and droughts and this will probably reduce the impact of floods in the study area.

Resources for flood management are very little. Very little amounts are allocated annually by the government for disaster management in general. If the disaster is such that large resources are required, the government will cheap in what ever is available. The international community and private sector are also approached for assistance, and very often they have, positively responded.

The legal instrument on land use is that no house or agricultural activity shall be constructed 50 meters from the riverbank. However this has not been found to be useful especially during the last few years where river flow levels have easily surpassed those levels. In any case there does not seem to be any scientific basis for arriving at this distance. This law has also not been enforced as evidenced by stream bank and settlements in the area understudy.

6. Institutional Responsibilities for flood management

The Civil Protection Organization of Zimbabwe is overallly responsible for management of flood emergencies. However there are structures in place to manage the emergency situations such as floods. There is a working party comprising of the flowing government departments: health, foreign affairs, water, mining, state security and information. Other organizations related to floods may be co-opted as and when required. The working party is subdivided into three sub-committees. These are

Emergency Services
Food and Water Crisis
Epidemics and zoonotics

Emergency Services Sub-committee Roles and Responsibilities (Chaired by Director Civil Protection, Vice Chair Zimbabwe Republic Police)

Zimbabwe National Water Authority (ZINWA) and The Meteorological Department form the early warning unit. This is responsible for the weather and flood forecasts and will continue to update the public as events unfold

Zimbabwe Defense Force (ZDF) and Zimbabwe Republic Police (ZRP), Civil Aviation and Ambulance services, are there to search rescue and relocate victims of floods as well as provide security during flood crisis.

Health Services is there to attend to the injured

Social Welfare looks at the needs of flood victims as well as provides social/ psychological support to the victims during and after the crisis. They also provide assistance in the form of food, shelter. Where resources are inadequate they appeal for assistance internally and externally.

Local government will coordinate the activities by these different sectors in their areas of jurisdiction



Food and Water Crisis Sub-committee Roles and Responsibilities (Chaired by Director Civil Protection, Agricultural and Extension Services (AREX))

The sub-committee is set up to look at the food and water requirements in areas where a disaster would have occurred.

AREX and Veterinary Services will establish the extent of crops and animals losses during floods and draw up plans to immediately rescue the situation and also look at the long term plans to restore the situation and to back to normal.

The Grain Marketing Board's (GMB) role is to provide or procure on behalf of the state, food requirements to alleviate hunger during the crisis.

District Development Fund and ZINWA's role is to establish the current water situation in terms of its quantity and quality to meet human needs. They also look at the water infrastructure and if need be carry out the necessary repairs to make sure that water is made available. If need be boreholes are drilled to meet the demand.

Department of Transport/ZRP/GMB/ZDF provides the logistics for distribution provisions such as food medicine and Water.

Zimbabwe Revenue Authority will assist in importation of food staffs and other requirements

Epidemics and Zoonotics subcommittee (Chaired by Director Civil Protection Vice Chair; Health Department)

The committee looks at disease outbreaks that may occur during flood events to both animals and human beings. It draws up plans on how to control as well as eradicating the diseases. The plans will also include personnel and medicine requirements.

The ZDF and ZRP also provide health personnel, which will augment the staff from the health and veterinary departments. The Department of immigration plays in controlling the movement of people where there are disease outbreaks.

In all these sub committees there will be personnel from information department who will assist in disseminating information to the public.

Though these committees are based at the head office. Similar structures are there in the provinces and districts, which work closely with the local authority.

7. Policy

The National policy for disaster management is that every citizen of this country should assist wherever possible to avert or limit the effects of disaster. Central government initiates hazard reduction measures through sector ministries with local administration taking the responsibility for implementing and maintaining its effectiveness.

The system uses existing government, private and non-governmental organizations whose regular activities contain elements of prevention and community development. The organizations are adopted structurally, materially and technically so that they can speedily shifted from their regular activities to undertaking protective, relief and rehabilitation measures in times of disasters in terms of intensity only without drifting from their operational principles. (*An extract from disaster management Policy by the Civil Protection Department*)

The Civil protection Department has a client's charter with a mission statement as follows:



To provide for and ensure optimal emergency preparedness and disaster prevention at the individual, community, sectorial, local authority and national level through regulatory mechanisms and co-coordinated strategic planning for emergencies. *(an extract for Civil Protection Client Charter)*

From the above policy it is clear that stakeholders participate in the management at local level. This policy was written soon after the Eline Cyclone induced floods to try and address the weaknesses identified in the management of flood events. Some of the weaknesses included the fragmented approach to flood management. Highly centralized decisions in flood management, the lack of stakeholder involvement. Some of the victims of Eline cyclone refused to be evacuated due suspicion and lack of knowledge of the effect of flooding. The rescue teams at times had little knowledge of the area and often ran into danger during the rescue operation. The change in policy reflects a major shift towards integrated floodwater management approach

8. Lessons Learned

- ✓ There is need to improve the existing capacity to do forecasts so that stakeholders will have more faith in the forecasts. The forecasts need to be made simple so that the ordinary man understands the likely impact of such forecasts.
- ✓ There is need to be proactive, once a warning has been issued so as to minimise the impact of floods. In the case of Eline Cyclone induced floods people only took the forecasts seriously when floods had already started causing havoc to the locals.
- ✓ Zimbabwe has a considerable number of dams. Water is therefore stored as security for the dry years or seasons. There is therefore reluctance to release water from the dams in order to accommodate floods. The non-structural approach, which includes flood forecasts, is therefore used as an alternative strategy for flood management. If forecasts were accurate and the lead time reasonable, water resources managers would be in a better position to make decisions on whether to release water or not. Thus both structural and non-structural approach to flood management could be used to reduce the impact of floods and drought.
- ✓ The involvement of a broad spectrum of the population in management of floods, with particular emphasis on management at local level has made the management of floods a lot easier this year than the traditional centralized approach.
- ✓ There is need to harmonize the water law, land use, development planning and disaster response laws as a way of encouraging IFM. At the moment the laws seem to be independent of each other.
- ✓ Communication needs to be improved so that the potential victims can be reached. There is also need to create awareness on the impact of floods and how people should respond to such events at local level.
- ✓ The basin must be managed as one unit. At the moment each country has its own way of managing floods. There need have a coordinated approach to flood management, which will involve all eight countries sharing the Zambezi. At SADC level member countries are forming international river basins commissions. There is therefore hope that once these are fully functional then there will be coordination on flood management among member countries since SADC protocol on shared water course systems promotes integrated water resources management



- ✓ Vulnerable areas should be demarcated and use of such areas should be well planned to avoid disasters.

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