

## **4 DOWNSTREAM ENVIRONMENTAL ASSESSMENT**

### **4.1 OVERVIEW**

This section of the workshop dealt with the likely impacts of the proposed Mutonga and Lower Grand Falls Dams on the downstream human communities and natural ecosystems. The great majority, if not all of the existing ecological, social and economic production systems along the Tana River below the proposed reservoirs are totally dependant on the normal flooding regime of the river for their continued maintenance. Artificial release of floods and sediment was recommended by the Environmental Assessment report as the only practical mechanism for mitigation of expected environmental, social and economic impacts resulting from the construction of the proposed reservoirs. Workshop participants, who also considered that further studies were required to provide an improved understanding of the reliance of downstream systems on flooding, endorsed these findings. Workshop participants also considered that there was a need to further sensitise downstream communities about the project, likely impacts and potential benefits resulting from artificial flooding. The probable length of the infilling period and resulting likelihood of artificially induced severe drought conditions during infilling was of particular concern to representatives of downstream communities who considered that insufficient attention had been given to the need for compensation.

### **4.2 PRESENTATION: DOWNSTREAM ENVIRONMENT & POPULATIONS.**

#### **4.2.1 Video**

A 20-minute video was presented. This described natural, agricultural, pastoral and fisheries systems of the Tana River along with the opinions of inhabitants of the floodplain, Tana Delta and of the proposed reservoir area itself. The video presented a background to the remainder of the workshop presentations and discussions.

#### **4.2.2 Downstream Environment**

The downstream environment was described as a system largely dependent on the flooding of the Tana River.

- Floods provide a natural irrigation system in an otherwise arid environment
- The "Natural" environment has evolved within a regular flooding environment, and as a result, the Flood Plain, Delta and Mangroves depend on regular flooding
- Livestock production depends on flooding
- Downstream Populations have developed Arable, Pastoral and Fisheries systems that depend on the maintenance of this natural flooding environment

Referring to a map of basin systems, the range of habitats and productive systems found within the Tana River floodplain were briefly covered and described, along with their dependence on the flooding of the Tana River.

### **Floodplain Grasslands**

- Occupy the Largest Area of all floodplain habitats
- Vital function as Dry Season Grazing
- Forms the basis for more or less all agricultural areas
- Floodplain grass species are more nutritious than non-floodplain grass species
- Depend on regular flooding for their maintenance

### **Floodplain Forests**

- Exceptionally high conservation importance
- Importance for Local Communities
- Maintenance & Regeneration closely tied to flooding

### **Tana Delta**

- Grassland, Forests and Oxbow lakes
- Dry Season Grazing conserved by flooding patterns
- Also has important agricultural areas
- Depends on regular flooding

### **Mangroves**

- Major timber resource, wildlife habitat.
- Breeding/feeding area for artisanal and commercial marine fisheries - esp. prawns.
- Composition and extent dependent on fresh water flushing

### **4.2.3 Downstream Population**

Downstream populations were described. Referring to information presented in the Executive Summary, estimated numbers of the rural and urban population were given as projections up to the year 2005. The year 2005 estimated population dependant on the Tana River was given as 555,500.

### **Agricultural Systems**

- Traditional Pokomo flood-recession farming (especially rice, maize) predominant
- Few livestock
- Dependant on floods to irrigate crops
- Year 2005 projection: 250,000 people dependant on system
- Pastoral Systems
- Largest land use within the area: Boran, Somali, Orma & Wardei
- Large Populations of Livestock: Camels, Cattle, Goats, Sheep, Donkeys
- Dependant on Tana River Floodplain for dry season grazing
- Delta supports up to 400,000 cattle

- Year 2005 projection: 200,000 people dependant on system

#### **Small-scale Irrigated Systems**

- Pumped systems extending from Mbalambala through Garissa to Bura and Tana
- Generally initiated as an alternative livelihood for destitute pastoralists/farmers
- Typically 0.25ha per family
- Out of 76 schemes 13 have failed, but a further 83 are proposed

#### **Large-scale Irrigated Systems**

Existing irrigation schemes were referred to along with the currently planned expansion of large scale irrigation, with implications for increased water demand both upstream and downstream:

- Mwea, projected to increase to 20,000 ha by the year 2020
- Bura, to be rehabilitated and increased to 8,000 ha
- Hola, to be rehabilitated to the original 900 ha
- Tana Delta Irrigation Project Phase 1 under construction, planned increase to 8,250 ha.

#### **Irrigation Demand**

- Upstream expansion of irrigation will compete with hydropower
- Downstream expansion increases minimum acceptable discharge levels
- Note: The Environmental Assessment carried out on the rehabilitation of Bura-Hola has not allowed for upstream dam construction in further development of these schemes.

#### **Floodplain & Delta Fisheries**

- Fish productivity and breeding cycles are dependant on regular flooding
- Creation and maintenance of habitats by flooding
- Subsistence fishing, involving 1/3 of non-pastoralist households
- Commercial Delta fisheries, especially in oxbow lakes

#### **4.2.4 Flood and Sediment Release**

The requirements for flood and sediment release to be built as an integral component of the dams / reservoirs was related to the requirements of all downstream natural and production systems.

- The conclusions of this study are that the dams will need to be constructed to allow controlled release of an artificial flood.
- These floods will replicate a "Normal Flood"
- The potential capacity to release sediment has yet to be established and requires further studies during the design stage

## **The "NORMAL" Flood**

Was defined as:

- The median flood which results in over-bank flooding at Garissa, inundating the floodplain upstream and downstream for a period sufficient to maintain the environment and level of economic activity currently supported by the river regime.
- This takes place if there is a flow of over 500 cumecs at Garissa for more than one day

## **The "NORMAL" Flood: Characteristics of Floods >500 cumecs at Garissa**

Characteristics of normal floods experienced in the Tana were explained with reference to the flood volume, flow and duration of flow at Garissa. The normal flood was defined as a flood having a peak flow of 784.8 cumecs, a total volume of 394.2 million cubic metres and a duration of 6.5 days. A chart was exhibited relating the duration and volume of floods experienced in the past and dividing these into large, medium and small floods. It was explained that the "normal" floods are equated with these smaller floods.

### **Release of a "NORMAL" Flood:**

- Different rainfall patterns will require different releases from Grand Falls to produce a "Normal" Flood in downstream reaches of the Tana:
- Rainfall in upper catchment only results in a flood that decreases below Grand Falls
- Some rainfall below Grand Falls results in a flood that exhibits little change in flood volume between Grand Falls and Garissa
- Heavy rainfall in catchment between Grand Falls and Garissa results in a flood that increases below Grand Falls.

The characteristics of each of these flood types were explained with reference to a table and graph comparing total required volume and peak flow for each of these flood types. The potential saving in terms of stored water and therefore increased power production potential was described.

### **Impact of Reduced Sediment Load**

Due to the trapping of sediment, particularly coarse sediment, in the proposed reservoirs downstream changes were predicted:

- Sediment load reduced in the stretch immediately below the dam, particularly the medium to coarse sediments carried during the flood season
- Bed erosion downstream of the dam site, leading to a drop in river bed level of up to 11 metres within 34 years, and to a consequent drop in groundwater of similar amount near the river in these areas.
- Loss of primary, upper catchment sediments leads to a decreased nutrient load, and hence to a decreased productivity of downstream systems

## Impacts of River Bed Degradation

Impacts of the proposed reservoirs on downstream reaches of the Tana in terms of Predicted changes in river bed levels were briefly explained:

- Flooding will occur less frequently and the depth of flooding will be less. ⇨ Significant impact on those aspects of the environment that rely on flooding of the floodplain.
- The surrounding groundwater levels will also reduce. ⇨ Significant impact on those aspects of the environment that rely on groundwater.
- Destabilised river banks ⇨ Impacts on infrastructure
- Change in equilibrium conditions affecting plan form of the river ⇨ Braided sections will tend to become meandering  
⇨ In meandering sections, the sinuosity of the river will reduced  
⇨ Impacts on infrastructure

### Change in water level as a function of chainage

With reference to simulation studies carried out on a 34-year daily flow series, expected changes in riverbed levels (after 34 years) were displayed as a chart from the Supporting Document (2). This showed that although the bed levels immediately below Kora Rapids were expected to be reduced by 11 metres, these eroded materials would be deposited further downstream. The effect after 34 years would be an increase in bed levels at Garissa by about 2 metres.

### 4.2.5 Infilling Periods

Simulation studies on infilling periods were described and the results given for different scenarios involving different operating rules during the infilling period. With environmental flows of 50 cumecs plus an additional, variable flow equal to 25% of the remaining inflow (rule 4 in the EA report) the 70% probability of infilling for Mutonga was less than one month. For Low Grand Falls the 70% probability of infilling was 8.2 months and for High Grand Falls 32.8 months. Since these downstream flows were similar to the minimum flows recorded for each month in the 34 year flow series, downstream flows of this volume were expected to result in economic and environmental problems in the Tana River floodplain.

### 4.2.6 Conclusions

**Floods** Artificial Floods can be released, but must be based on monitoring stream flow and predicting rainfall and must be guided by the needs of downstream communities. Therefore downstream communities must be incorporated in management mechanisms. Further studies during the additional environmental assessment and design phase are required to define downstream water requirements in more detail

**Sediments** Natural sediment release patterns will be disrupted. There will be negative impacts on downstream systems, but further studies during the additional environmental assessment and design phase are required and these will need to focus on sediment release mechanisms

## **4.3 DISCUSSIONS**

### **4.3.1 Discussions During General Assembly**

Following the presentations a number of questions, as well as comments and points of clarification, were raised by participants.

**Comment:** Referring to the video presentation, clarification was received from the floor that Tana Delta Irrigation Project (TDIP) had not had an adverse impact on forests in the delta area. Reforestation programs were already in place with a view to enhancing reforestation and environmental protection. It was further indicated that rice produced in the project is purely for local consumption and not for export.

**Q.** Did the study establish that there is current intrusion of sea-water into the Tana Delta and causing dying of riverine forest?

**A.** Specific studies were not undertaken during the EA. However, saline intrusion is caused by reduced flood intensity and by reduced dry season flows. The proposed artificial flood release system and the increased low flows resulting from hydropower production can be expected to help reduce the problem of saline intrusion.

**Q.** There is need to enhance studies downstream so that the flood releases will be adequate to meet all the demands.

**A.** All downstream systems are adapted to the average, or "normal" flooding pattern and are therefore dependent on these conditions. Due to the complexity of downstream natural, social and economic systems and the short time available during this study, the course of action chosen was to define these flooding conditions and recommend that engineering solutions be found to replicate the "normal" floods. If normal floods are replicated then downstream systems can be maintained or possibly enhanced.

**Q.** There has been an increase in erosion at the mouth near Kipini at Chemasia and Tenai and thus affecting the nesting of turtles.

**A.** The bulk of sediments are released during flood periods. If floods are released more frequently, e.g. twice a year as opposed to the current average of about 1.2 per year, then we will increase the sediments reaching the river mouth. Similarly, higher dry season flow volume resulting from hydropower generation can be expected to carry an increased sediment load. However, beach erosion is a common phenomenon along the East African coastline and currently occurs in many areas where there are no rivers. Erosion of beaches near the Tana Delta may also be related to practices such as clear-felling of mangroves and the construction of prawn farms.

Q. Due to land use changes taking place in lower Tana river and Lamu, if the amount of water going down is reduced, this means that ground water will reduce too and thus the borehole water which is critical to the local communities is likely to be affected. What measures has the project taken in this regard?

A. Artificial floods should also assist in replenishing ground water resources in those areas where they are flood dependent.

Q. How was the community prepared to contribute towards the video?

A. The purpose of the video was to gather views of the downstream people to enlighten workshop participants. Participatory Rapid Assessment (PRA) was carried out to gather perceptions of downstream communities and mobilisation must be done if the project is to go ahead. PRA has alerted downstream communities regarding the dam.

Clarification: The Flood plain does not serve as just a dry season grazing area, but as both dry and wet seasons grazing area. Pastoralists have adopted the system of leaving the milk herd at home and these use the flood plain throughout the year.

A. This division of herds into groups, including those using the flood plain throughout the year is reflected in the main report. However, it is still true that the majority of livestock move into the hinterland during the wet seasons.

Q. How much has this study involved the real local community in the delta region? The pastoralists at the delta are not aware of the impending dam construction.

A. In addition to the video there were groups working on socio-economic studies in the whole area and this information has been incorporated in the main report. The video crew was constrained by access due to flooding.

Comment: It was observed that this country is characterised by high project failure rate due to lack of technological know how and managerial skills transfer. It is in this light that artificial flooding appears to be a scientific issue and may not be properly implemented to produce the desired results.

A. There are very few places where artificial flooding is carried out as projects have in the past tend to ignore downstream users. This has resulted in significant economic hardships. However, we can learn from experiences from those already using artificial flooding, e.g. South Africa, USA and parts of West Africa as it is not a difficult concept to adopt. The most important requirements are likely to be implementation of policies and communication of information amongst all stakeholders.

Q. Is there provision for involvement of small scale irrigation schemes e.g. Mwea in project costing for the next environment impact assessment?

A. Irrigation has been considered by the current project as a means of impact mitigation, but as one component of a wider rural development programme that will be required for the resettlement area. This workshop will assist in determining the main

requirements for additional work required in the next environmental impact assessment and during the design phase.

Comment: It was observed that further construction of Hydro Projects requires wide consultation with a view to involving interested parties. Existing projects have had negative impacts on the downstream areas without appropriate mitigation measures being put in place. It was also observed that the flood plain grazing area is used by pastoralist from areas outside the Tana River basin, e.g. Wajir, Southern Somalia and Ethiopia and that the flood plain is used during both wet and dry seasons.

Q. What are the negative impacts of flooding?

A. Negative impacts of flooding are limited to the larger floods, which tend to be destructive rather than beneficial. Small floods have a beneficial effect on floodplain systems. The reservoirs will effect the small floods but they are incapable of affecting medium and large size floods. In addition, the very fact that annual flooding occurs creates a risk management strategy amongst floodplain inhabitants. Small floods on a regular basis reinforce these risk management strategies. However, if these small floods are reduced in frequency - as is the expected result if the dams are implemented without artificial flooding, risk management strategies will tend to be lost. When the inevitable large floods arrive, disasters will occur and these will be more severe than would normally be the case. Social consequences of lack of flooding may therefore be high.

#### **4.3.2 Group Discussion: Downstream Environment**

The down-stream group was charged with the responsibility of discussing likely impacts of the proposed Mutonga and Low Grand Falls Dams on downstream human communities, and natural ecosystems. A brief review of the EA was presented covering major discussion issues. In addition, a presentation was made of several issues thought to be relevant to the downstream environment but not presented at the general assembly due to lack of time.

The group noted that the present Environmental Impact Assessment report had made major contribution on most issues pertinent to the project objectives. However, it was realised that the conceptualization of the Environmental Impact Assessment study did not adequately incorporate all stakeholders. In this regard, the participation of the local communities was limited. Further, it was noted that it would have been more rewarding if a thorough evaluation of the Environmental Impact Assessment reports for each of the existing dams were undertaken. Such action would have provided sound foundation on which the current Environmental Impact Assessment study is based.

#### **Land Issues**

Land continues to be a volatile issue among the down-stream communities. Historically the local communities have developed indigenous land tenure system, which if disrupted would lead to untold difficulties. It is important to note that the situation could be aggravated by



unplanned changes in water use rights that could result in increased pressure on available land and associated resources. Given that one possible impact of the dams could be the reduction in water volume released down-stream thus leading to major stress being placed on the flood-plain grasslands, it is imperative that the resulting dynamics are understood by the local communities.

It was considered that the study should come up with models simulating the existing conditions and other models simulating the four options studied that would prevail in the downstream area because they would have an impact on the land use practices and the land pressure that will be created by population increase.

Concern was raised regarding possibility of land adjudication in the Tana River District and therefore water rights becoming an important issue. Therefore, during the additional Environmental Assessment, downstream water demands and use patterns should be considered within the current and future land tenure systems.

### **Population Issues**

Realizing that the rapid growth in human population is a natural phenomenon and that the resulting population density has to be catered for, careful management of natural resources become even more important. We note that while the human population is determined to rise, the natural resource base may not necessarily increase commensurately. As a result, human population pressure may lead to conflicts in resources use.

**Q.** How will the project impact on the population patterns and numbers?

**Comment:** Why should the dams have any effect on the downstream population?

- A.** Rather than looking at the population numbers per se we should look at the impact of the proposed dams on downstream water resources and how changes to the seasonal and annual availability of water resources affect the population, in terms of morbidity, health, livestock and crop production etc.
- A.** According to the study there is no evidence of negative effects, assuming that artificial flood release does occur. If the project improves the flooding pattern there may then be an increase in population density on the land.

### **Local Community Involvement**

It was noted that at this stage there was no involvement of the community at the grassroots level. It was also noted that even within the Government departments, co-ordination was lacking. In future, the implementing body should write to relevant DDCs in the area to allow free discussion and consultation regarding the project.

**Comment:** It was said that there was need to identify all stakeholders and invite them to the workshop. However, it was also mentioned that had extensive consultations been undertaken before the beginning of the study, there was a distinct possibility of the project not taking off because of the widely divergent views of the peoples affected.

It was said that local NGOs should be allowed to sensitise the people about the project and the project should consider funding the NGOs in their work.

### **Infilling Period**

Given the results of simulation of the in-fill period for the proposed dam, concern is raised on the possible stress that is likely to be experienced by the downstream human communities and the natural environment in the event of the worst scenario.

The JICA team member recapped on the estimated in filling periods and how the figures were arrived at. Using a 70% probability of infilling with minimum downstream environmental flow of 50 cumecs plus 25% of remaining inflow, expected periods were given as follows:

- i) Low Grand Falls -- 8.2 Months (i.e. less than one year)
- ii) Mutonga -- 25 days (i.e. less than one month)
- iii) High Grand Falls -- 32.8 Months (i.e. almost three years)

It was also stressed that the simulation studies indicated that there was a 30% probability of the above infilling periods being exceeded.

**Q.** During the infilling period, will the project be generating electricity?

**A.** No power production can begin until after the minimum operation level is reached. The figures presented were for full infilling of the reservoirs. The figures were based on a 70% probability, meaning that there was a 30% chance of the filling not being achieved within the estimated period. However, the issue that we need to consider is the estimated filling period with regard to the volumes of flow of water downstream and how much is required to support the downstream environment and communities.

**Q.** What happens to the downstream communities during the infilling period?

**A.** Downstream flows during infilling will be similar to low dry season flows. Longer infilling periods, with higher environmental flows, may need to be examined by the additional environmental assessment in order to allow passage of adequate flows for downstream communities and for the maintenance of ecological systems. It was also suggested that the project look into the possibility of timing the beginning of the infilling to just after the first flood flow.

**Q.** How and who will be responsible for the management of reservoir infilling.

**Comment:** A management board should be set up to manage the infilling process. It was noted that, in case of a bad year, the infilling could be postponed until the following year. This same committee should continue to manage the flood release because of the experience gained. It was proposed that the composition of the board includes project owners, operators and downstream communities to avoid a situation of releasing a detrimental flood or not releasing a flood when required.

Q. According to the Executive Summary Report page SE-18, relief food will be supplied to downstream communities as compensation for diminished flows during in-filling period. Is food relief the best option?

Comment: Provision of food aid will create a dependency syndrome and proposed monetary compensation for lost income.

Q. Who will meet these costs as they are not budgeted in the project costing?

A. The project should meet the above-mentioned cost.

### **Artificial Flood Release**

It has been reported that the proposed dam will incorporate flood as well as sediment release facilities. While this is encouraging, the group noted with concern and proposes a painstaking effort in the design actions so as to ensure that they function properly.

It was recommended that the flood release facilities be build during the project implementation irrespective of the cost involved and the downstream communities be involved in the management of flood releases.

It was also proposed that an additional study be carried out to evaluate the viability and economics of fish ladders.

Fish habitat and production depends on the flooding of the ox-bow lakes and the group was urged consider it.

It was noted that the study should examine findings from other comparable rivers (Pangani, Rufiji and Ruvuma) with a view to answering questions related to fisheries, salt water intrusion and flushing.

Concern was expressed that due to lack of frequent flooding salt water intrusion was affecting the availability of fresh water at Kipini and in the delta region.

Q. Was sea water intrusion studied?

A. This aspect was not studied but could be studied during the Additional Environmental Assessment.

### **Floodplain Grasslands, Riverine Forests and Protected Areas**

It is noted that the most important ecosystems in the downstream environment include flood plain Grasslands, riverine Forests (including Mangroves) and protected areas. In order to sustain ecological balance of the area, it is imperative that river flow is maintained at suitable levels, an action that would ensure maintenance of ecological health and functions starting at the present levels of human interventions and proceeding to projected demands as the human population increases. Certainly, exerting any artificial pressure on the ecosystems is potentially disastrous.

## **Biodiversity**

It was suggested that a monitoring system be set up to monitor the ecosystem, e.g. groundwater levels, vegetation samples, river level etc. The monitoring will to be carried out by an institutional body created for this purpose. The Kafue project in Zambia was referred to as one that could serve as a relevant source of information.

Q. Given that riverine forests depend on ground water recharge level, has this been considered in the design of the artificial flood release and is the volume and duration of flooding long enough to mimic natural conditions?

Comment: Looking at the flood dynamics, the recommended six-day duration flood at Garissa should be adequate to recharge the ground water level sufficiently to support the riverine forests.

Q. Will the proposed sediment release include clay soils or only sand?

Comment: Both sand and clay are required downstream to prevent erosion of the channel.

Comment: The release of adequate sediments downstream was said to be an engineering issue and should be thoroughly investigated in order to maximise the passage of sediments during the artificial flood release.

Comment: Projects should incorporate communities in project packages and since the Mutonga / Low Grand Falls is a revenue-generating project, downstream communities should be assisted in the development of their areas.

The project should ensure that the primates are preserved and the communities are included in project packages to share in their benefits.

Q. Are there negative effects on fish migration habits, breeding patterns etc.

A. Fish species in the Tana River indicate that the population is adapted to the delta, the length between the delta and the Kora rapids. Only about three eel species are expected to be severely affected, but these are already impacted by the existing dams. The proportion of the lower Tana fish populations affected will depend on the presence or absence of regular flooding patterns.

## **Downstream Production Systems**

The downstream environments constitute multi-faceted and fragile production systems. Some human communities depend on crop production and others on livestock husbandry. Both systems rely on rain as well as river flow. It was recognized that it is important to ensure that these systems are maintained or enhanced while at the same time insisting on minimization of the exigencies associated with human migration under stress due to lack of water.

Q. During the infilling of the dams, will the irrigation systems downstream be able to draw enough water to continue with their operations?

- A. Downstream water flow during the infilling period will need to be set at a level that will cater for all downstream users with some water flowing into the ocean. We need to look at the integral water demand requirements by all the production systems and not only the irrigation requirements.
- Q. Is it possible to release 490 mcm out of 955 mcm and still retain enough volume for power production or is it an academic exercise?
- A. The value was determined by simulation of 34 years of hydrological data and this was found to be the maximum flood required at Grand Falls to mimic the naturally occurring floods on the floodplain. The engineering designs must have the capacity to release these volumes. During the operational phase, it is considered highly likely that this maximum volume will not be required during a majority of years. However, these values will be looked into and refined during the additional Environmental Impact Assessment study and detailed design.
- Q. Given that the existing Masinga dam operational rules are not adhered to, how do we expect the proposed flood release operations to succeed? What systems do we foresee in place to manage the flood release as stakeholders have conflicting water use interests?
- A. Existing situations world-wide should be examined, possibly even visited to learn from their mistakes, and their experiences adapted to the Kenyan situation. Operation rules should be carefully worded to avoid possible problems.

Comment: Looking at the existing situation, even where few stakeholders are involved, the proposed operating rules might be flouted.

Comment: The proposed environmental legislation touches on water rights and this could provide important pointers towards the operating rules. On the other hand, the maximum economic benefit scenario, including all downstream economic systems as well as upstream systems, can be used to guide the operation of the dam, especially of the artificial flood release.

Comment: The project study and viability is currently based on power benefit alone and no other multi-purpose benefit is considered by the economic evaluation. Hence the project is already biased on power and the flood release proposed may not work because the multi-purpose benefits of the project have not been thoroughly studied and quantified in monetary terms.

- A. Downstream artificial flood release represents a very considerable economic and environmental benefit. With the flood release in operation the reservoirs should be considered as having a multi-purpose objective. The proposed additional environmental assessment may be able to determine the economic values of these benefits.

### **Economic Value of Downstream Production Systems**

Indigenous and adaptive economic activities in the downstream environment continue to be promoted. In this regard, while maintaining the interaction between pastoralist, fishing and farming communities, efforts have been made to introduce irrigated agriculture, prawn farming, wildlife management, nature reserves, and infrastructure development.

These activities require careful maintenance of supporting ecosystems, hence the need for proper management of the river channel dynamics. If the above scenario is not sustained the result would be the degradation of biodiversity upon which the peoples economies are dependent.

- Q. Have the economic values of the downstream production systems been evaluated in the report?
- A. Efforts have been made during phase 2 of the current study but this needs to be expanded to include a more detailed examination of economic and social values (livestock, vegetation, protected areas, fisheries etc.) during the proposed Additional Environmental Assessment, so that the mechanisms and value of the flood release could be more easily quantified.

### **Institutional Framework**

The role of institutions in the management of projects such as the proposed Mutonga and Low Grand Falls often experience conflict of interests. The situation may be exacerbated by the lack of legal instruments designed to separate operational frameworks. As a result, a project could shift management from one agency to another. When this occurs, the likelihood of biodiversity suffering is eminent. In addition the management of artificial flood release may be adversely affected due to lack of continuity. Further, it may become even more difficult to maintain contact between downstream communities and the management of such projects when dealing with decision- making pertaining to critical release of artificial floods, sediments and nutrients.

An institutional framework is required to ensure that the status quo is maintained or enhanced for the well being of the people. Within the current institutional set-up, there is no provision for redress of an aggrieved party. It was also noted that within the proposed National Environmental Act, there is National Environmental Management Authority (NEMA) that would by law enforce flood releases and settle conflicts. Therefore there is need to enact the environmental bill into law before going forward with the project.

### **Capacity Development**

Considering the recommendation made in this chapter with respect to the development on an environmental monitoring system and noting the underlining implications, it would be necessary to encourage the development of both scientific and technical expertise for the task at hand. While we recognize the presence of some of these experts in Government Ministries, parastatals and the private sector, it is noted that the intricacies associated with scientific management of such proposed environmental monitoring system may be best

handled within the framework of an academic environment that could best be provided through a University.

Training of staff to manage the flood release and carry out environmental monitoring is a key issue to the success of the project.

It was proposed that a neutral institution like a University be involved, which has capacity to carry out the required monitoring and process the data. However concern was raised as to who would fund the monitoring.

Comment: Since the project would generate revenue through electricity sales, some money should be allocated for monitoring purposes.

Q. How would the monitoring results be communicated to the communities?

Comment: KPC has formed a committee in Naivasha involving the local community where they discuss the results of the geothermal project environmental monitoring and this has born fruits. Similar mechanisms may be feasible.

### **The Proposed Environmental Impact Assessment**

Considering that this is the first time that the concept of artificial flood release is being incorporated in the design of a dam on Tana River and realizing that little experience is available internationally in this regard, it is imperative that careful consideration of environmental issues be put into perspective.

It was suggested that:

- not only should the provincial administration be involved, but also local NGOs e.g. Rescue the Nomad, national NGOs like the Kenya Pastoralist Forum, community development officers, YWCA in Tana River district and other interested parties.
- Direct interviews with the local people should be conducted.
- Use of government officers in the field through the DDCs be incorporated.
- Before the study starts, there needs to be consultation and discussions with all stakeholders to ensure that their interests are taken into account.

### **Design Stage**

It was suggested that:

- Dam design should at least sustain downstream communities and even enhance livelihoods.
- A balance between hydroelectric power and downstream water demands should be sought.
- Provision of fish ladders should be explored
- A facility for artificial flood release must be incorporated in the project.

## **Final Comments**

The JICA study team member briefed the group on a World Bank / IUCN workshop, held during 1997, that was aimed at developing a framework to consider issues critical for the future development of large dams. This resulted in the establishment (in November 1997) of a World Commission on Dams. Since these activities are expected to result in new/modified World Bank guidelines, there is also the possibility that unless in the future, where relevant, large dams are designed with flood release facilities to cater for the needs of downstream users, the funding of such schemes will be particularly difficult.

## **WORLD COMMISSION ON DAMS**

Terms of reference for the World Commission on Dams were presented as follows:

- Assess experience so as to improve practices, social & environmental conditions
- Develop criteria for assessment of alternatives for energy & water resources development
- Evaluate effectiveness of large dams
- Promote internationally accepted standards for planning, assessment, design, construction, operation and monitoring of large dam projects, and ensure affected people are better off
- Identify implications for institutional, policy & financial arrangements so that benefits, costs and risks are equitably shared at global, national & local levels
- Recommend interim modifications, as required, of existing policies & guidelines, and to promote best practices.
- In addition, critical gaps in knowledge and practice were identified for further research, including the technical flexibility to release sediment and/or artificial flood releases when needed
- Such guidelines, when complete, are likely to become the recommended standard practice

## **Conclusion**

The present Environmental Assessment has made important contributions to seeking mitigation measures against possible effects of the proposed dams on the downstream environment. However, given that the concept of artificial flood release is new, and therefore untried in the region, it is imperative that an additional Environmental Assessment be commissioned so as to incorporate the recommendations of this report.



## **5 WORKSHOP FINDINGS AND RECOMMENDATIONS**

### **5.1 ENGINEERING STUDY**

#### **5.1.1 Recommendations for Future Studies and Detailed Design**

The group recommends the following

##### ***Additional Environmental Assessment Study***

- Review and identify the use of water in the lower and upper catchment zones.
- Carry out further analysis and quantify multiple use of water benefits.
- Identify and formulate institutional mechanisms for proper flood releases for the benefit of all stakeholders.
- Assess the need for fish ladders to facilitate movement of fish up/down the reservoir.

##### ***Detailed Design***

- Carry out detailed geological mapping of the project area
- Optimize the dead storage level
- Consider provision for installation of a third unit of generating unit.
- Consider the use of diversion tunnel after project construction.
- Consider choice of weir instead of gated type spillway.
- Consider the proximity of the sand flushing and power intake facilities.

##### ***Final Feasibility Report (Engineering & EIA)***

The format of presenting the final report should be changed to the following format for easy reading:

- Executive Summary
- Main Report
- Detailed Appendices

##### ***Other aspects***

- Workshops should continue to be held even during later stages of the project.
- The involvement of local universities, specialists and counterpart personnel should be part of the implementation of this project.

### **5.2 UPSTREAM ENVIRONMENT IMPACT ASSESSMENT**

In the past, when resettlement was done to pave the way for the construction of the older upstream dams, people were haphazardly settled. To avoid the same mistakes the group is recommending the following:-

- The resettlement should be orderly and adequate.
- There should be a responsible institution, preferably a task force, made up of knowledgeable people from the implementing agency, the community and the Government.
- This task force will identify the land to be settled on and let the land owners decide which deal they would prefer, but with the guidance of the task force; e.g., those who own land elsewhere can be paid in cash, while the rest can take both cash and land as approved, appropriately considering the need of each household.
- That the two hectares being floated by the JICA team is not enough for dry arid environment of the resettlement area. More land should be sought further away from the current estimated area of the special management area to give people adequate settlement land.
- That the money to be paid per acre should be determined by all the stake holders on the date of acquisition.
- That where appropriate water for domestic use and irrigation should be supplied by the project at the special management zone.
- Proper and careful conservation of Mt. Kenya and Nyambene forests. Water catchment management by all concerned i.e Ministries, NGO's ect in the entire upstream catchment area. This will require intervention measures i.e soil conservation, dam management awareness creation and concerted effort by all in the upstream catchment
- Further studies should be carried out to ascertain the current and future pollution levels from farming, sanitation and industrial sources, in the upstream environment e.g; use of poisonous pesticides and weed killers should be analysed.
- The integrated approach should be used to make sure all the laws and relevant authorities are in place to effect safety measures to check pollution.
- That an Environmental audit be initiated for purposes of monitoring issues affecting the upstream corridor.
- That the infrastructure and social facilities that will be lost in the establishment of the reservoir should be costed/quantified and internalised in the final project document.
- Calculations on the compensation requirements given in the report are merely indicative. The same should be reviewed appropriately at the prevailing market rates in the final project document/costings.
- There is need for community education/sensitisation on the benefits of resettlement compensation to minimise cases where some family members, especially women and children are left to suffer when male heads of households decide to misuse or misappropriate the cash accruing from compensation.

- As much as possible, compensation benefits could also consider cash in kind, e.g. provision and delivery of building materials to affected households.
- Institution/task force mandated to handle the resettlement issue should have a significant women representation/gender balance. The DDC's or the task force should set the displacement time table.
- There is need for further consultations by either the study team or the task force on resettlement on the issue of settling people as a block as this might not be acceptable to all.
- The issue of what happens to the livestock when the owners have been relocated/resettled in relatively reduced farm sizes should be addressed e.g. improved range management and quality stocking.
- The local people should be encouraged and assisted to practice intensive livestock farming such as zero grazing, modern bee keeping techniques and poultry. The role of irrigation should be emphasised to maximise the benefits of the displaced community.
- The next environmental study should incorporate surveillance and control programs on livestock related diseases such as Nagana, Rift Valley fever, e.t.c. The same approach should be observed in human health and disease control.
- International standardised methods applied when handling cultural artifacts should be applied when dealing with plants with significant cultural values/implications.
- Nurseries/seed banks should be established as a measure of restoration and replacement of lost bio-diversity along dam sides.
- Artificial wetlands be established along the Buffer zones to trap any pollutants directed at the reservoir.
- The Additional Environment Assessment should revisit and review the model presented on water quality - nutrients and particulate matter.
- With the increasing population and land use there is, within the reservoir and upper catchment, a need for periodical studies on the use of pollutants caused by chemicals, herbicides and pesticides which should also include heavy metals e.g. mercury.
- In order to exploit fully the fisheries development potential once the dams are established, the local people should be encouraged and assisted to venture into the fishing industry. Further studies on reservoir conditions should be done to ascertain suitable fish species. The population should also be sensitised on the need to use modern methods of fish production and marketing as well as its nutritional and economic value.
- Detailed topographical and soil surveys should be carried out to decide proper identification of site, after which an irrigation impact study should be carried out to find out suitable cash crops and subsistence crops.

- TARDA and all the relevant stakeholders should be fully involved in future project activities, to enhance consultation and effective implementation, as it is charged with the responsibility of managing the Tana River Basin.
- Fair distribution of infrastructure and attendant facilities on project site - e.g. camp sites and access roads - should be given due consideration, and not be seen to be favouring one side (district) along with the project area. (Refer General Assembly to Fig S14) Mwingi and Mbeere favoured against Tharaka-Nithi.
- The project preparation should be subjected to a Logical Framework (Log-Frame) Analysis where aspects such as overall goals, objective(s); activities, specific roles assigned to implementers and objectively verifiable indicators (OVI's) are clearly outlined and measurable to ease project monitoring and evaluation. New agreement between JICA and the GK should include the task force.
- Grand Falls Dam should be renamed Kibuka Hydropower Dam to retain its original historical and cultural name.
- It was noted that displaced communities have in the past been haphazardly settled therefore interfering with their lifestyles. It was recommended that the affected community be physiologically prepared to move out of the reservoir area within a specified time frame by setting out a displacement timetable.
- It was also felt that funds be set aside to cater for socio-cultural losses such as shrines, artifacts etc. as well the restoration and replacement of lost biodiversity local.
- There is need to hasten land adjudication and registration activities so as to transfer land ownership to individual to ease compensation.
- Emanating from recent experience, there is possibility of the water hyacinth being transported to the reservoirs through fishing gears, and a mechanism should be established to regulate and control the spread of the hyacinth.
- Need for deeper research and monitoring of the breeding patterns of fish in the river.

### **5.3 DOWNSTREAM ENVIRONMENTAL ASSESSMENT**

- A study be commissioned to consider a model that precipitated current conditions resulting from the impact of the existing dams. In addition efforts be made to develop models associated with scenarios of each of the proposed dams and options or combination thereof, with a view to designing a sustainable human settlement programme that would have little or zero effect on the down-stream communities.
- Land tenure systems should be adequately considered prior to the design and implementation stages.

- There is need for a Participatory Rapid Assessment Study (PRA) on land issues.
- There is need to encourage the design and implementation of population programmes, to ensure an economically viable population structure that permits efficient nutrition and health programme.
- The time length between infilling of the reservoir and the maintenance of the critical water volume in the river channel should be carefully worked out in collaboration with downstream communities.
- Modalities be worked out to address the issue of loss of income among the downstream communities which is likely to emerge during the in-filling period.
- Capacity of flood release be built in the dams and the necessary management system worked out at whatever cost.
- Flood release dynamics be designed so as to sustain downstream ox-bow lakes, while at the same time ensuring the promotion of the requirements of the fishing communities in the delta. Experience of the Rufiji, Ruvuma and Pangani rivers in Tanzania be drawn upon, especially in connection with fish reproduction systems associated with the interface of fresh water and sea water (mixing).
- An ecological monitoring system covering the entire Tana River Basin be put in place.
- Management modalities be worked out so as to ensure that riparian forests and flood-plain grasslands are not stressed by artificial withholding of water in the proposed dams as a result of design omissions. In this regard guarantees should be put in place to ensure the twice-yearly flood regime.
- A detailed study be undertaken on the dynamics of the riparian and flood plain flora and fauna communities, to ensure a sound foundation for the recommended monitoring system.
- In order to maintain sediment and nutrients balance within the downstream ecosystem, the execution of the proposed artificial flood release should ensure maximum passage of these elements.
- While ensuring maximum release of nutrients and sediments that may be trapped in the proposed dams, it is imperative that sustainable development of downstream production systems be articulated on integrated management of existing and proposed dams in the Tana basin.
- There is need to cost the value of bio-diversity in the downstream environment and incorporate the findings in the design of the proposed dams with a view to, not only ensuring power generation, but also enhancing downstream production systems.
- A comprehensive socio-economic survey be undertaken as a component of the proposed E.I.A. with a view to developing new IRRs based on valuation of environmental variables.

- The enactment of the Environmental Bill 1995 should be expedited in order to permit the creation of the National Environmental Management Authority (NEMA), which will be in a position to establish regional frameworks that would respond to interests of communities residing in the Tana Basin, while ensuring sustainable regulations of river flow based on integrated watershed management.
- In the event that the above recommendation is not feasible, it would be necessary to review the TARDA Act so as to enhance its functions in the context of the recommendations made in this report.
- Modalities be worked out in order to mandate a University to undertake the task of developing the proposed Tana River environmental monitoring system.
- Necessary steps be undertaken to build the budget for the monitoring task in the project funding with a view to sustaining it on an annual basis through the involvement of Kenya Power Company (KPC) and other relevant agencies.
- As part of creating awareness among the stakeholders in the Tana Basin and with a bid to ensuring efficient and effective utilisation of reports generated by the mandated University Agency operating the environmental monitoring system, there is need to develop appropriate training packages.
- Steps be undertaken to conduct an evaluation/auditing of the E.I.A reports for each of the existing dams, so as to provide a sound foundation for the design of the proposed additional environmental assessment.
- Efforts be made to incorporate recommendations made in this report in the design of the proposed additional environmental assessment while at the same time involving Community Based Organisations (CBOs), NGO's, individual community members, leaders, Government Agencies eg: the DDCs), etc.
- The dams be designed with the priority objective of sustaining the downstream ecosystems while gradually improving the livelihood of human population through enhancement of existing production systems.
- The downstream communities be considered when designing the transmission of the power grid.
- A fish ladder be provided for.

#### **5.4 GENERAL RECOMMENDATIONS**

- For future workshops, the secretariat should draw guidelines on issues to be tackled without limiting or compromising peoples' thinking.
- Study reports should be sent out in good time to enable participants to read them and attend workshops fully prepared.
- Modalities be worked out to widely circulate the Terms of Reference (TOR) for the proposed Environmental Impact Assessment so as to encourage stakeholders co-operation.

## **CLOSING SPEECH**

### **SPEECH BY MR. C.N. MUTITU, EBS, PERMANENT SECRETARY, MINISTRY OF ENERGY DURING THE OFFICIAL CLOSING OF THE MUTONGA/GRAND FALLS WORKSHOP**

**THE MANAGING DIRECTOR, TARDA, MR. MARTIN MIYESA, THE, HEAD OF JICA OFFICE, NAIROBI, MR. TAGAMI, PROJECT CONSULTANTS, DISTINGUISHED GUESTS, LADIES AND GENTLEMEN,**

It gives me great pleasure to be here to officiate at this closing ceremony of the third workshop for the proposed Mutonga/Grand Falls hydropower project.

At the outset, I wish to express sincere gratitude to the government of Japan through the Japan international co-operation agency (JICA) for the technical assistance they have extended to facilitate the carrying out of the Mutonga/ Grand Falls hydro-power project studies.

Let me also express my ministry's appreciation to you all for your positive response to the invitation to this workshop. Your participation is a clear indication of your concern for the efficient utilisation of this country's water resources.

As implementation of this project will impact on various users of the water both upstream and downstream, in addition to influencing the ecosystem of the river basin, my ministry thought it prudent to share the results of the study with you through this forum.

I believe that over the last four days you have critically reviewed the report of this study, including its conclusions and recommendations, and hopefully through discussions made valuable contributions.

I have been made to understand by the rapporteurs that your proposals include the following:

- (i) preservation of the riverine basin to ensure continued economic activities which obtain hitherto, through artificial flood release, amongst other measures;
- (ii) undertaking of a participatory rapid assessment study on land and other related issues on the project's development; and
- (iii) creation of an appropriate institutional framework to ensure that any recommendations made and agreed on environmental impact mitigation strategies are implemented expeditiously.

I am sure that JICA will take into consideration your observations and recommendations while undertaking a further study in finalising their report.

It is the intention of the government to ensure the preservation of the existing socio-economic status as well as the ecosystem in the Tana basin, as it is committed to improving the life of its citizens. In this respect, adequate supply of water for irrigation and human and animal use will be ensured, both upstream and downstream of the

proposed hydropower project. Careful consideration for adequate compensation will be given when resettling those who may be displaced by the project.

Let me point that a project of this size will cost a colossal sum of money. Such funding will have to be secured before deciding on the modalities for implementation, furthermore, the project's economic viability would have to be compared with other available options such as thermal, geothermal and other hydro-power projects appropriately ranked so as to determine the timing for its implementation. For these reasons, the government has not yet committed itself to implementing the proposed Mutonga/ Grand Falls project.

At this juncture, I would like to take this opportunity to highlight the progress made in the energy sector reforms with a view to improving the supply of energy and to enhancing the economic efficiency of the resources dedicated to supply and delivery of energy.

Principal reforms made include:

- (i) the re-organisation of the power sub-sector companies into two companies, the Kenya power company to be exclusively in charge of generation of electricity and the Kenya power and lighting company for transmission and distribution of electricity. Since September 1997 these two companies have been operating with separate management and staff. Consistent with this restructuring policy power assets and liabilities of the power parastatals will be appropriately apportioned to these two companies by the third quarter of this year.
- (ii) Liberalisation of the generation segment of the power sub-sector, already two private sector companies, which in power industry circles are known as independent power producers (IPPs), have each built a power plant. Electricity from these power plants, which have been operational since August 1997, is being sold to KPLC on the basis of long-term power purchase agreements.
- (iii) Creation of a regulatory body through the electric power act, 1997 which came into force on 9th January, 1998, to protect the interests of both the consumers and economic operators in generation and transmission and distribution of electricity.

As part of this reform programme, six projects are being implemented, four by the public sector and two by IPPs. Negotiations for implementation of the two projects by IPPs are virtually complete and power purchase agreements (PPA) are expected to be signed within three weeks, specific details on the six projects were contained in my minister's opening speech on Monday.

Due to delays in the implementation of planned projects and also taking into account the projected growth in demand for energy and power of about 6% p.a. over the next five years. A need for an additional capacity of 110 mw has been identified. As part of the 20 year least-cost power development plan. In absolute terms, the demand for power is expected to rise from 772 mw currently to 1018 mw by year 2002/3.

To ensure availability of power to match the projected demand, the government has decided to invite tenders from IPPs for development of two power projects, each with a



capacity of about 55 mw. on a fast track basis. These two projects are expected in service during the second half of 1999.

Three out of the four public sector projects, namely Kipevu I, 75mw, Sondiu Miriu, 60 mw and Gitaru third unit, 72.5 Mw are currently being implemented, while implementation of the fourth, Olkaria II, 64 mw will commence soon, with the effectiveness of the world bank credit of us \$125 million (CR 2966-KE) within the next two months.

Consistent with its policy of providing electricity to the rural population as a basic economic infrastructure, the government has continued to seek donor support to augment its resources for rural electrification. In this regard, the European union (EU) has provided shs.360 Million for phase I of the coffee factories rural electrification programme, covering 168 factories in different parts of the country. EU has also pledged financial support for Phases II and III of this programme, which is expected to benefit another 600 coffee factories as well as surrounding populations. Phase I of this programme commenced in March 1997 and is expected to be completed by June 1998. Negotiations are also in progress for a soft bilateral loan from Spain. The terms of this loan are very similar to those of IDA.

In recognition of its fiscal resources constraints Parliament under the electric power act 1997 provided for a levy of up to 5% to be imposed on electricity sales to go into a rural electrification fund. Modalities for setting up the fund are currently in progress.

Ladies and gentlemen,

Before concluding my remarks, I would like to register my gratitude to the Kenya government institutions, NGOs. Other organisations and individuals who were participating in this workshop for their co-operation and valuable contributions which have made this workshop a success.

I would also like to thank KPLC, KPC and TARDA for their full support in making this workshop a success. My thanks also go to the principal and staff of the Kenya College of Communications Technology for providing these excellent facilities.

Last but not least, I should not forget to thank JICA once more for technical and financial contribution towards the hosting of this wonderful workshop.

Finally, I wish all the participants a safe journey home.

With these remarks, it is now my pleasure to declare this workshop officially closed.

THANK YOU.

C.N. MUTITU, EBS  
PERMANENT SECRETARY, MINISTRY OF ENERGY

## ANNEX 1

### LIST OF PARTICIPANTS

	<b>IN ATTENDANCE</b>	<b>ADDRESS</b>
1.	Hon. C. Okemo	Minister for Energy
2.	Hon. Kalonzo Musyoka	Minister for Education and Human Resources Development
3.	Hon. S. M. Manga	Asst. Minister, Ministry of Energy
4.	Hon. Col. (Rtd) R.J. Kiluta	Asst. Minister, Ministry of Energy
5.	Hon. E.B. Shill	MP (Fafi - Garissa District)
6.	Hon. Mohamed A. Galgalo	MP (Galole - Tana River District)
7.	C. N. Mutitu	Permanent Secretary, Ministry of Energy

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20.	Prof. D.A. Obara	JICA Study team
21.	K. Sumikawa	JICA Study team
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95.	Clr. Ruanga Njera	
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3	P.N. Wamburu	Workshop coordinator
4	Nginyah. Ngaruma	Programme coordinator
5	John M.W. Gikuri	Secretary

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1	Susan Kamau	MOE
2	Mary Iswekha	MOE
3	Nancy Mwangi	MOE
4	Christabel Otenda	MOE
5	Zipporah Kariuki	MOE
6	Susan Obera	TARDA
7	Jane Waweru	TARDA
8	Nina Wanjiru	Acropolis Kenya Ltd.

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**LOGISTIC SUPPORT**

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1	John M.L.Fedha	MOE
2	Josephine Abatsa	MOE
3	Jane Wanjere	MOE
4	Francis Kariuki	MOE
5	John Muindi	MOE
6	George Ng'ang'a	MOE
7	Joseph Njoroge	KPLC
8	John Chege	TARDA

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## ANNEX 2 MEMBERS OF GROUP DISCUSSIONS

### GROUP I: ENGINEERING STUDY

	Name	Organisation
1.	P. N. Njurumba	MOWR, Nrb.
2.	P. N. Murai	M/S Electro Agency, Box 1465, Thika
3.	L. A. Soboi	Kenyatta University, Nrb.
4.	H. M. Kisitu	MOWR, Box 467, Meru
5.	P. K. Ikigu	Kamconsult Ltd., Nairobi
6.	P. J. Friend	Knight Piesold, Box 50569, Nrb.
7.	W. W. Wakaranja	MOWR, Box 30521, Nrb.
8.	A. M. Njagi	KPLC
9.	M. K. Mangoli	University of Nairobi.
10.	Fluer Ng'weno	KFWG, Box 20110, Nrb.
11.	T. N. Ikiugu	TARDA
12.	C. L. Lango	Box 66247, Nrb.
13.	F. Kimani	KVDA
14.	J. Murunga	Private Industry, Box 168, Isiolo.
15.	Philip G. Gichuki	Ewaso Ngiro North Dev. Authority
16.	S. F. Mbogo	KPC
17.	J. K. Wahogo	KPC
18.	C. S. Muli	MOWR, Chuka
19.	O. K. Bobotti	TARDA
20.	P. N. Mbuti	MOE
21.	E. M. Mnyamwezi	MOWR, Box 30521, Nrb.
22.	D. R. O. Riaroh	MOE
23.	J. M. Malebe	Geo Consult, Boc 73413, Nrb.
24.	A. M. M'arimi	TARDA
25.	Prof. A.J. Akello	Univ. Nairobi/Reengineering Consortium

### GROUP 2: UPSTREAM ENVIRONMENTAL ASSESSMENT

1.	G.Njeru Kanyi	Chairman/TCB
2.	A.K. Mainda	-
3.	P.W. Kollokho	KPC
4.	Samuel Munene	-
5.	Addy Kaaria	OOP
6.	Dan Kiara	Physical Planning - Chuka
7.	Anne Kinyua	Reeds
8.	F.M. Muthuri	Otieno Odongo
9.	Rolin W. Mwiva	LBDA
10.	Florah Mwamghanga	KPC
11.	Daniel Thuko	District Water Office
12.	Ruanga Njera	Clr. Tharaka Nithi
13.	P.G. Macharia	KPC
14.	A. Ndungu	Kenyatta University
15.	Samson M. Masika	Chuka



16.	Karuri	Kenyatta University
17.	G.N. Guandaru	Chuka
18.	Daniel Lago	Mdoni Network
19.	I.M. Kilonzo	MOWR
20.	E. Mwenda	PPCSCA
21.	D. Kilele	Ministry of Energy
22.	Beatrice Kathani	Chuka
23.	Germano Mundi	Tharaka/Nithi
24.	B.C. Muhangi	Tharaka
25.	S.N. Mbae	MOWR - Isiolo
26.	Dr. Samwel O. Wagah	Nakuru
27.	J. Ngure	Chuka
28.	P. Ngicuru	Chuka
29.	Daniel Nyamu Kagembe	Chuka
30.	Zachary M.Kithure	Chiakariga
31.	Keffa Musambi Mwiandi	Chogoria
32.	Simon K. Mugeru	NES
33.	Jacob Gacanja	D.E.O. Mwingi
34.	Arnold M. Nthigah	Forest Dept.
35.	Henry Kinuthia	NES
36.	Jane Nyandika	NES
37.	P.C. Kamau	TARDA
38.	J.K. Wang'ombe	MCS
39.	T.R. Munyua	TRS
40.	W.O. Were	NES
41.	Z.K. Gitonga	Tharaka/Nithi
42.	Joy Murithi	Meru Central
43.	N. Odd	Wallingford water
44.	Samwel Kimani	Thiru Kimani & Associates
45.	Angelline Mbugi	Tharaka Nithi District
46.	Mary kanana	Tharaka Nithi District
47.	Japhet M. Nyagah	Tharaka Nithi District
48.	J.M. Murungu	Isiolo District
49.	Henry Kowero Ogoye	KPC
50.	Haron Njuguna	Tharaka Nithi District
51.	Paul Goldsmith	Meru/Isiolo
52.	Evans Mwangi	KWS
53.	James N. Karekia	ENNDA
54.	Michael I	-
55.	Z.G. Ogendi	Ministry of Energy
56.	Otwelo J.A.O.	Ministry of Agriculture
57.	M.K. Murgor	TARDA
58.	F.N. Machira	Chiakariga
59.	J.M.W. Gikuru	Ministry of Energy
60.	Prof.Obara	JICA Study Team
61.	G.O. Okinda	Secretary/Mbeere District

### GROUP 3: DOWNSTREAM ENVIRONMENTAL ASSESSMENT

- |     |                          |                                       |
|-----|--------------------------|---------------------------------------|
| 1.  | Dr. J.I Mwanje           | Chairman - KU                         |
| 2.  | Dr. E.J. Mrabu           | Secretary- JKUAT                      |
| 3.  | Ndungu J.M.              | MOALD & M - Mwingi                    |
| 4.  | Mursal Sheikh A. Galgalo | MOALD & M, KPF Member                 |
| 5.  | Said Omar Aflow          | Rescue the Nomads                     |
| 6.  | Martin F. Miyesa         | TARDA                                 |
| 7.  | Elizabeth Obel Lawson    | WWF                                   |
| 8.  | Michael K. Gachanja      | KFWG                                  |
| 9.  | Susan Matindi            | IUCN                                  |
| 10. | Dr. Geoffrey Howard      | IUCN                                  |
| 11. | George Wamukoya          | KCC & DP                              |
| 12. | F.M. ole Nkako           | KWS                                   |
| 13. | E.M. Mnyamwezi           | Ministry of Water Resources           |
| 14. | G.A. Owuor               | Ministry of Energy                    |
| 15. | Dr. K.V.O. Rabah         | Green Africa Network                  |
| 16. | Dr. Githira Peter        | JKUAT                                 |
| 17. | Mwange Collins           | UON                                   |
| 18. | Anne Kinyua              | REEDS                                 |
| 19. | Lucy Kainyu              | Social Worker                         |
| 20. | J.N. Ongegu              | TARDA                                 |
| 21. | Hadley Becha             | East African wildlife society         |
| 22. | S. Kambe                 | MFS (NGO)                             |
| 23. | Rika Hiraji              | Mikono International                  |
| 24. | Jane Kibwage             | Fisheries Society                     |
| 25. | Dr. Wanjiru Mwatha       | Kenyatta University                   |
| 26. | Musyoka M.M.             | Coast Development Authority           |
| 27. | Richard Mwarema          | District Development Office - Malindi |
| 28. | Julius Ithagu Ben        | NES                                   |
| 29. | Peter A. Otinda          | Agricultural society of Kenya         |
| 30. | Junko Tamura             |                                       |
| 31. | Charles K. Omukeya       | Municipal Council (Mumias)            |
| 32. | E.J. Akinyi              | Ministry of Energy                    |
| 33. | Miyagawa Masaaki         | JICA Headquarters                     |
| 34. | Jacob K. Kibwage         | Maseno University College             |
| 35. | H.B. Shill               | Tana Catchment Board                  |
| 36. | Benjamin Kubo            | KPC - Olkaria                         |
| 37. | Ken Campbell             | JICA Study Team                       |

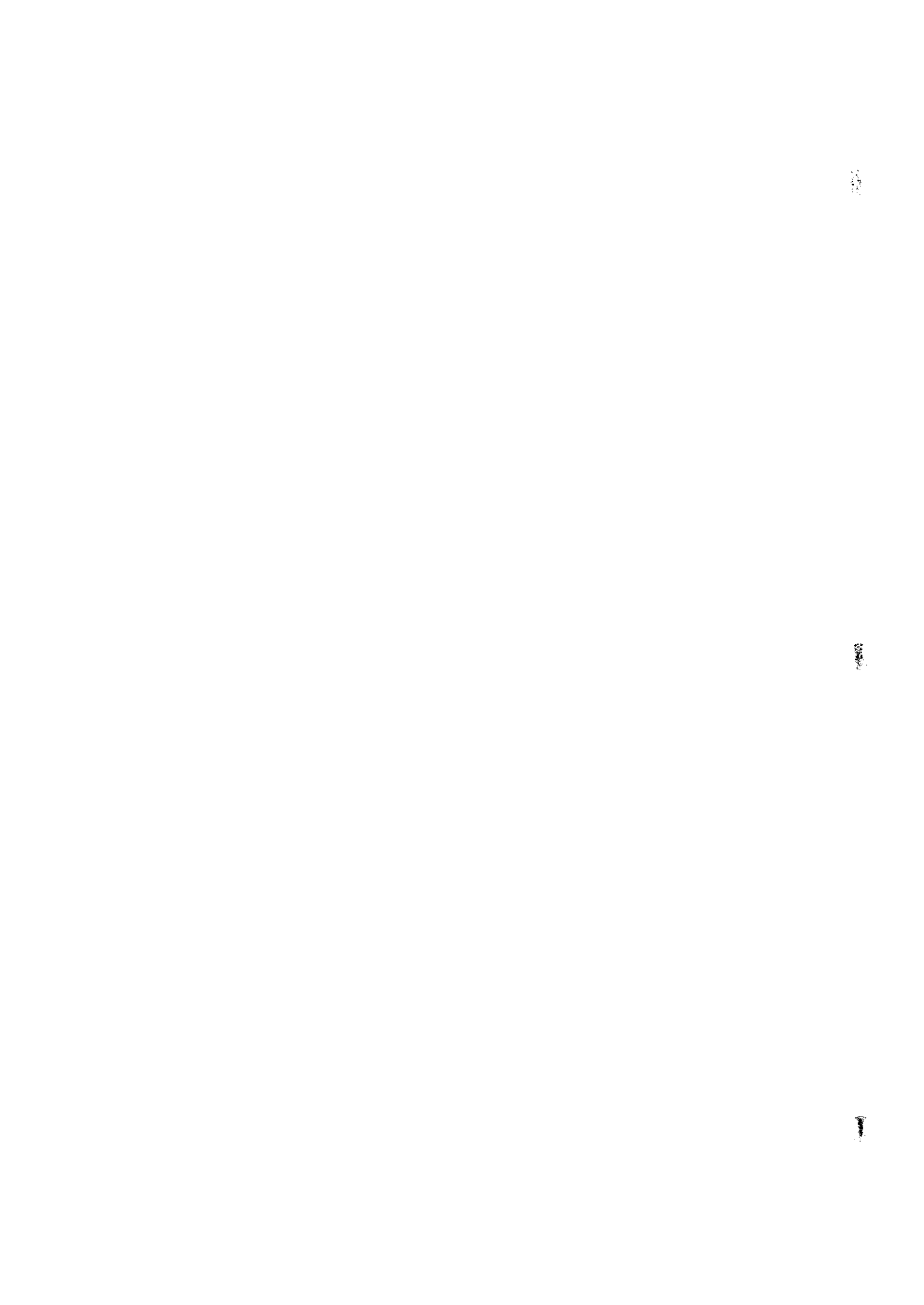
## ANNEX 3

### PROGRAM FOR THIRD WORKSHOP IN JANUARY 1998.

	26th January, Monday	27th January, Tuesday	28th January, Wednesday	29th January, Thursday
8:30	Registration and Reception			
9:00		Upstream Environmental Assessment	General Assembly to report Group Discussions	Summary of Group Discussions
9:20	Opening Speeches by JICA and Ministry of Energy			
9:50		Comments/ Clarification		
10:00	Tea Break	Tea Break	Tea Break	Tea Break
10:30	- Project Introduction - Preferred Option for Water Resources Development	Downstream Environmental Assessment	Group Discussions	Summary of Group Discussions
10:50	Comments/ Clarification			
11:00	Results of Feasibility Study on Selected Option			
11:50	Comments/ Clarification	Comments/ Clarification		
12:30	Lunch	Lunch	Lunch	Lunch
14:30	Explanation of Modalities for Discussion Groups	Group Discussions	Group Discussions	Workshop Findings  Closing Speech
14:40	Summary of Engineering Study			
16:00	Tea Break	Tea Break	Tea Break	
16:30 17:00	Comments/ Clarification	Group Discussions	Group Discussions	

### SUBJECT OF GROUP DISCUSSIONS

Group	Topics
1	Engineering Study
2	Upstream Natural/Social Environment of Mutonga/Grand Falls Dam Sites
3	Downstream Natural / Social Environment of Mutonga/Grand Falls Dam Sites



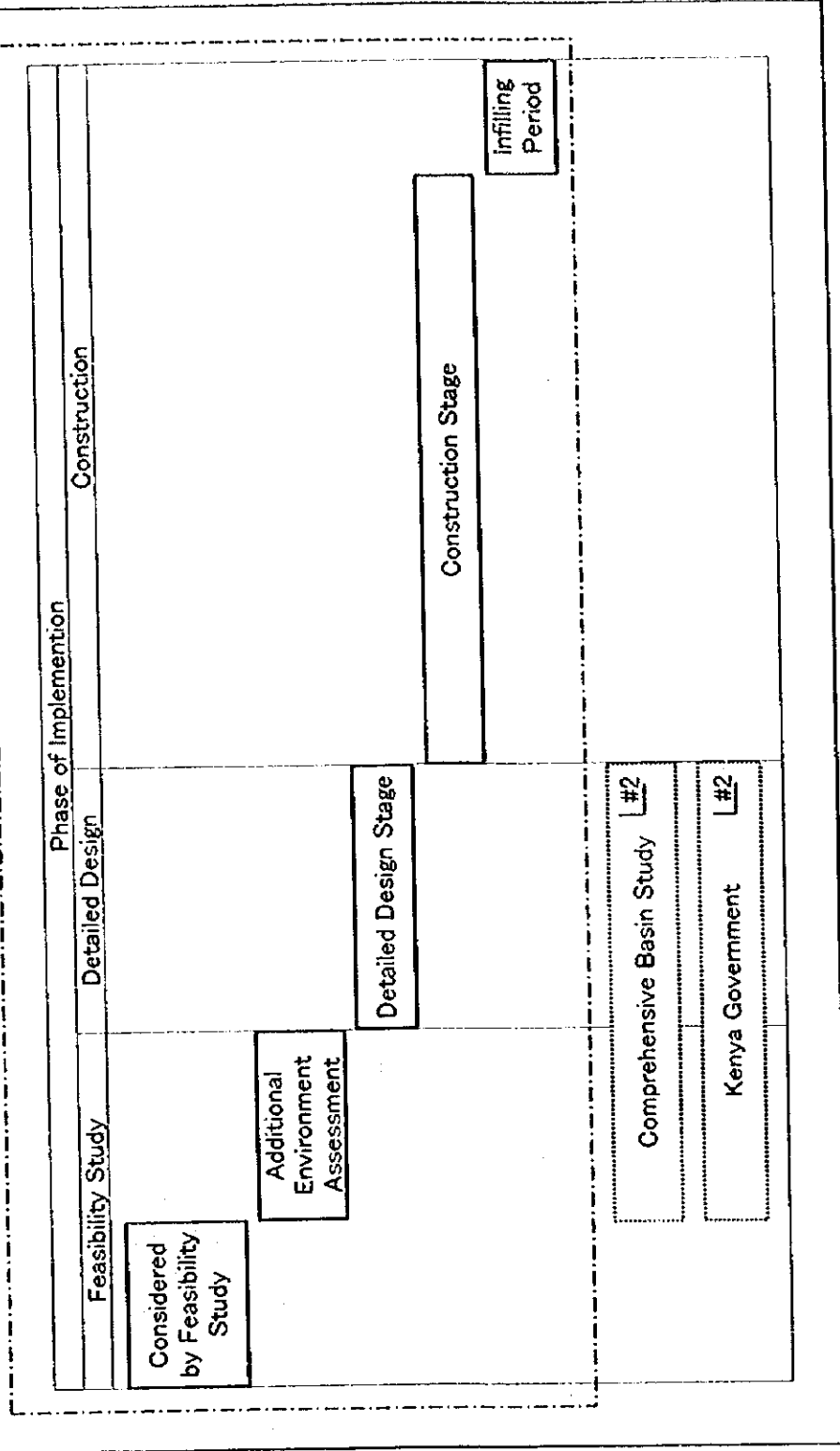
***ANNEX - D***

***IMPLEMENTATION OF  
WORKSHOP NO.3  
RECOMMENDATIONS  
BY PROJECT STAGE***

# IMPLEMENTATION OF WORKSHOP RECOMMENDATIONS BY PROJECT STAGE

<b>1</b>	<b>ORGANISED BY WORKSHOP GROUP DISCUSSION (AS IN THE PROCEEDINGS OF WORKSHOP 3)</b> .....	<b>2</b>
1.1	ENGINEERING ISSUES.....	2
1.2	UPSTREAM ISSUES.....	3
1.3	DOWNSTREAM ISSUES.....	6
1.4	GENERAL ISSUES.....	8
<b>2</b>	<b>ORGANISED BY MAJOR TOPIC</b> .....	<b>9</b>
2.1	BIODIVERSITY.....	9
2.2	CATCHMENT MANAGEMENT.....	9
2.3	COMMUNITY PARTICIPATION.....	10
2.4	ENGINEERING.....	10
2.5	FISHERIES.....	11
2.6	FLOOD RELEASE.....	11
2.7	GENERAL.....	12
2.8	INFILLING PERIOD.....	13
2.9	INSTITUTIONAL.....	13
2.10	IRRIGATION.....	14
2.11	MONITORING.....	14
2.12	RESETTLEMENT.....	15
2.13	RESETTLEMENT: COMPENSATION.....	16
2.14	SOCIAL AND ENVIRONMENTAL LEAST COST RANKING.....	16
2.15	WATER QUALITY.....	17
2.16	WATER USE.....	17

# Implementation by the Project #1



#1: To be taken into consideration in the sequence of the Project implementation  
 #2: To be taken into consideration in parallel with the Project implementation

JAPAN INTERNATIONAL COOPERATION AGENCY REPUBLIC OF KENYA MUTONGA/GRAND FALLS HYDROPOWER PROJECT	Stage of Implementation D-1
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**IMPLEMENTATION OF  
WORKSHOP RECOMMENDATIONS  
BY PROJECT STAGE**

**1 ORGANISED BY WORKSHOP GROUP DISCUSSION  
(AS IN THE PROCEEDINGS OF WORKSHOP 3)**

**1.1 ENGINEERING ISSUES**

RECOMMENDATION	PROJECT STAGE						
	Considered by Feasibility Study	Additional Environment Assessment	Detailed Design Stage	Construction Stage	Infilling Period	Comprehensive Basin Study	Kenya Government
Review and identify the use of water in the lower and upper catchment zones.		✓				✓	
Carry out further analysis and quantify multiple use of water benefits.		✓				✓	
Identify and formulate institutional mechanisms for proper flood releases for the benefit of all stakeholders.		✓					✓
Assess the need for fish ladders to facilitate movement of fish up/down the reservoir.		✓	✓				
Carry out detailed geological mapping of the project area			✓				
Optimise the dead storage level			✓				
Consider provision for installation of a third generating unit.			✓				
Consider the use of diversion tunnel after project construction.			✓				
Consider choice of weir instead of gated type spillway.			✓				
Consider the proximity of the sand flushing and power intake facilities.			✓				
The format of presenting the final report should be changed to the following format for easy reading: a) Executive Summary, b) Main Report, c) Detailed Appendices	✓						
Workshops should continue to be held even during later stages of the project.		✓	✓	✓	✓	✓	✓
The involvement of local universities, specialists and counterpart personnel should be part of the implementation of this project.	✓	✓	✓	✓	✓	✓	✓



## 1.2 UPSTREAM ISSUES

RECOMMENDATION	Considered by Feasibility Study	Additional Environment Assessment	Detailed Design Stage	Construction Stage	Infilling Period	Comprehensive Basin Study	Kenya Government
The resettlement should be orderly and adequate				✓	✓		✓
There should be a responsible institution, preferably a task force, made up of knowledgeable people from the implementing agency, the community and the Government			✓	✓	✓		✓
This task force will identify the land to be settled on and let the land owners decide which deal they would prefer, but with the guidance of the task force; e.g., those who own land elsewhere can be paid in cash, while the rest can take both cash and land as approved, appropriately considering the need of each household.			✓	✓			✓
Institution/task force mandated to handle the resettlement issue should have a significant women representation/gender balance. The DDC's or the task force should set the displacement time table			✓				
That the two hectares being floated by the JICA team is not enough for dry arid environment of the resettlement area. More land should be sought further away from the current estimated area of the special management area to give people adequate settlement land.		✓	✓				
That the money to be paid per acre should be determined by all the stakeholders on the date of acquisition.				✓			
That where appropriate water for domestic use and irrigation should be supplied by the project at the Special Management Zone			✓	✓			
Proper and careful conservation of Mt. Kenya and Nyambene forests. Water catchment management by all concerned i.e. Ministries, NGO's etc in the entire upstream catchment area. This will require intervention measures i.e. soil conservation, dam management awareness creation and concerted effort by all in the upstream catchment						✓	✓
The integrated approach should be used to make sure all the laws and relevant authorities are in place to effect safety measures to check pollution							✓
That an Environmental audit be initiated for purposes of monitoring issues affecting the upstream corridor.						✓	✓
That the infrastructure and social facilities that will be lost in the establishment of the reservoir should be costed/quantified and internalised in the final project document.	✓						
Calculations on the compensation requirements should be reviewed appropriately at the prevailing market rates in the final project document/costings.			✓				

There is need for community education/sensitisation on the benefits of resettlement compensation to minimise cases where some family members, especially women and children are left to suffer when male heads of households decide to misuse or misappropriate the cash accruing from compensation.			✓	✓			
As much as possible, compensation benefits could also consider cash in kind, e.g. provision and delivery of building materials to affected households			✓	✓			
There is need for further consultations by either the study team or the task force on resettlement on the issue of settling people as a block as this might not be acceptable to all.		✓					
The issue of what happens to the livestock when the owners have been relocated/resettled in relatively reduced farm sizes should be addressed e.g. improved range management and quality stocking.			✓	✓			
The local people should be encouraged and assisted to practice intensive livestock farming such as zero grazing, modern bee keeping techniques and poultry. The role of irrigation should be emphasised to maximise the benefits of the displaced community.				✓			
The next environmental study should incorporate surveillance and control programs on livestock related diseases such as Nagana, Rift Valley fever, etc. The same approach should be observed in human health and disease control		✓					✓
International standardised methods applied when handling cultural artifacts should be applied when dealing with plants with significant cultural values/implications.				✓	✓		
Nurseries/seed banks should be established as a measure of restoration and replacement of lost biodiversity along dam sides.				✓			
Artificial wetlands be established along the Buffer zones to trap any pollutants directed at the reservoir.				✓			
The Additional Environment Assessment should revisit and review the model presented on water quality - nutrients and particulate matter		✓					
With the increasing population and land use there is, within the reservoir and upper catchment, a need for periodical studies on the use of pollutants caused by chemicals, herbicides and pesticides which should also include heavy metals e.g. mercury.		✓					
Further studies should be carried out to ascertain the current and future pollution levels from farming, sanitation and industrial sources, in the upstream environment e.g.; use of poisonous pesticides and weed killers should be analysed		✓				✓	
Further studies on reservoir conditions should be done to ascertain suitable fish species.		✓					
In order to exploit fully the fisheries development potential once the dams are established, the local people should be encouraged and assisted to venture into the fishing industry.							✓

The population should also be sensitised on the need to use modern methods of fish production and marketing as well as its nutritional and economic value						✓	✓
Detailed topographical and soil surveys should be carried out to decide proper identification of site, after which an irrigation impact study should be carried out to find out suitable cash crops and subsistence crops			✓				
TARDA and all the relevant stakeholders should be fully involved in future project activities, to enhance consultation and effective implementation, as it is charged with the responsibility of managing the Tana River Basin		✓	✓	✓	✓	✓	✓
Fair distribution of infrastructure and attendant facilities on project site - e.g. camp sites and access roads - should be given due consideration, and not be seen to be favouring one side (district) along with the project area. (Refer General Assembly to Fig S14) Mwingi and Mbeere favoured against Tharaka-Nithi.			✓	✓			
The project preparation should be subjected to a Logical Framework (Log-Frame) Analysis where aspects such as overall goals, objective(s); activities, specific roles assigned to implementers and objectively verifiable indicators (OVI's) are clearly outlined and measurable to ease project monitoring and evaluation. New agreement between JICA and the GK should include the task force.		✓	✓	✓			✓
Grand Falls Dam should be renamed Kibuka Hydropower Dam to retain its original historical and cultural name.							✓
It was noted that displaced communities have in the past been haphazardly settled therefore interfering with their lifestyles. It was recommended that the affected community be physiologically prepared to move out of the reservoir area within a specified time frame by setting out a displacement timetable			✓	✓			✓
It was also felt that funds be set aside to cater for socio-cultural losses such as shrines, artifacts etc. as well the restoration and replacement of lost biodiversity local.				✓			
Land tenure systems should be adequately considered prior to the design and implementation stages		✓	✓	✓			✓
There is need to hasten land adjudication and registration activities so as to transfer land ownership to individual to ease compensation.							✓
Emanating from recent experience, there is possibility of the water hyacinth being transported to the reservoirs through fishing gears, and a mechanism should be established to regulate and control the spread of the hyacinth							✓
Need for deeper research and monitoring of the breeding patterns of fish in the river		✓					

### 1.3 DOWNSTREAM ISSUES

RECOMMENDATION	Considered by Feasibility Study	Additional Environment Assessment	Detailed Design Stage	Construction Stage	Infilling Period	Comprehensive Basin Study	Kenya Government
A study be commissioned to consider a model that precipitated current conditions resulting from the impact of the existing dams. In addition efforts be made to develop models associated with scenarios of each of the proposed dams and options or combination thereof, with a view to designing a sustainable human settlement programme that would have little or zero effect on the down-stream communities.	✓	✓				✓	
There is need for a Participatory Rapid Assessment Study (PRA) on land issues		✓					
There is need to encourage the design and implementation of population programmes, to ensure an economically viable population structure that permits efficient nutrition and health programme							✓
The time length between infilling of the reservoir and the maintenance of the critical water volume in the river channel should be carefully worked out in collaboration with downstream communities		✓	✓	✓	✓		✓
Modalities be worked out to address the issue of loss of income among the downstream communities which is likely to emerge during the in-filling period				✓	✓		✓
Capacity of flood release be built in the dams and the necessary management system worked out at whatever cost			✓				
Flood release dynamics be designed so as to sustain downstream ox-bow lakes, while at the same time ensuring the promotion of the requirements of the fishing communities in the delta. Experience of the Rufiji, Ruvuma and Pangani rivers in Tanzania be drawn upon, especially in connection with fish reproduction systems associated with the interface of fresh water and sea water (mixing).		✓	✓				
An ecological monitoring system covering the entire Tana River Basin be put in place.						✓	✓
Management modalities be worked out so as to ensure that riparian forests and flood-plain grasslands are not stressed by artificial withholding of water in the proposed dams as a result of design omissions. In this regard guarantees should be put in place to ensure the twice-yearly flood regime			✓	✓		✓	✓
A detailed study be undertaken on the dynamics of the riparian and flood plain flora and fauna communities, to ensure a sound foundation for the recommended monitoring system		✓					

In order to maintain sediment and nutrients balance within the downstream ecosystem, the execution of the proposed artificial flood release should ensure maximum passage of these elements.			✓	✓			
While ensuring maximum release of nutrients and sediments that may be trapped in the proposed dams, it is imperative that sustainable development of downstream production systems be articulated on integrated management of existing and proposed dams in the Tana basin.						✓	✓
There is need to cost the value of bio-diversity in the downstream environment and incorporate the findings in the design of the proposed dams with a view to, not only ensuring power generation, but also enhancing downstream production systems		✓					
A comprehensive socio-economic survey be undertaken as a component of the proposed E.I.A. with a view to developing new IRRs based on valuation of environmental variables		✓					
The enactment of the Environmental Bill 1995 should be expedited in order to permit the creation of the National Environmental Management Authority (NEMA), which will be in a position to establish regional frameworks that would respond to interests of communities residing in the Tana Basin, while ensuring sustainable regulations of river flow based on integrated watershed management							✓
In the event that the above recommendation is not feasible, it would be necessary to review the TARDA Act so as to enhance its functions in the context of the recommendations made in this report.							✓
Modalities be worked out in order to mandate a University to undertake the task of developing the proposed Tana River environmental monitoring system							✓
Necessary steps be undertaken to build the budget for the monitoring task in the project funding with a view to sustaining it on an annual basis through the involvement of Kenya Power Company (KPC) and other relevant agencies.			✓				✓
As part of creating awareness among the stakeholders in the Tana Basin and with a bid to ensuring efficient and effective utilisation of reports generated by the mandated University Agency operating the environmental monitoring system, there is need to develop appropriate training packages							✓
Steps be undertaken to conduct an evaluation/auditing of the E.I.A reports for each of the existing dams, so as to provide a sound foundation for the design of the proposed additional environmental assessment	✓						
Efforts be made to incorporate recommendations made in this report in the design of the proposed additional environmental assessment while at the same time involving Community Based Organisations (CBOs), NGO's, individual community members, leaders, Government Agencies e.g: the DDCs), etc.		✓					✓

The dams be designed with the priority objective of sustaining the downstream ecosystems while gradually improving the livelihood of human population through enhancement of existing production systems		✓	✓		✓		
The downstream communities be considered when designing the transmission of the power grid						✓	✓
A fish ladder be provided for.			✓				

#### 1.4 GENERAL ISSUES

RECOMMENDATION	Considered by Feasibility Study	Additional Environment Assessment	Detailed Design Stage	Construction Stage	Infilling Period	Comprehensive Easin Study	Kenya Government
For future workshops, the secretariat should draw guidelines on issues to be tackled without limiting or compromising peoples' thinking.		✓	✓	✓		✓	✓
Study reports should be sent out in good time to enable participants to read them and attend workshops fully prepared.		✓	✓	✓		✓	✓
Modalities be worked out to widely circulate the Terms of Reference (TOR) for the proposed Environmental Impact Assessment so as to encourage stakeholders co-operation.		✓					

## 2 ORGANISED BY MAJOR TOPIC

(Note: Some recommendations may appear under more than one topic)

RECOMMENDATION	PROJECT STAGE						
	Considered by Feasibility Study	Additional Environment Assessment	Detailed Design Stage	Construction Stage	Infilling Period	Comprehensive Basin Study	Kenya Government

### 2.1 BIODIVERSITY

Nurseries/seed banks should be established as a measure of restoration and replacement of lost bio-diversity along dam sides.				✓			
"Artificial" wetlands be established along the Buffer zones to trap any pollutants directed at the reservoir. <i>(Note: JICA Study Team considers this to be impractical and that the major source of pollutants will be the Mutonga and Kathita Rivers)</i>				✓			
There is need to cost the value of bio-diversity in the downstream environment and incorporate the findings in the design of the proposed dams with a view to, not only ensuring power generation, but also enhancing downstream production systems		✓					
Emanating from recent experience, there is possibility of the water hyacinth being transported to the reservoirs through fishing gears, and a mechanism should be established to regulate and control the spread of the hyacinth							✓
A detailed study be undertaken on the dynamics of the riparian and flood plain flora and fauna communities, to ensure a sound foundation for the recommended monitoring system		✓					

### 2.2 CATCHMENT MANAGEMENT

Proper and careful conservation of Mt. Kenya and Nyambene forests. Water catchment management by all concerned i.e. Ministries, NGO's etc in the entire upstream catchment area. This will require intervention measures i.e. soil conservation, dam management awareness creation and concerted effort by all in the upstream catchment						✓	✓
The integrated approach should be used to make sure all the laws and relevant authorities are in place to effect safety measures to check pollution							✓

That an Environmental audit be initiated for purposes of monitoring issues affecting the upstream corridor.						✓	✓
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### 2.3 COMMUNITY PARTICIPATION

Efforts be made to incorporate recommendations made in this report in the design of the proposed additional environmental assessment while at the same time involving Community Based Organisations (CBOs), NGO's, individual community members, leaders, Government Agencies e.g. the DDCs), etc.		✓					✓
Workshops should continue to be held even during later stages of the project.		✓	✓	✓	✓	✓	✓
As part of creating awareness among the stakeholders in the Tana Basin and with a bid to ensuring efficient and effective utilisation of reports generated by the mandated University Agency operating the environmental monitoring system, there is need to develop appropriate training packages							✓
For future workshops, the secretariat should draw guidelines on issues to be tackled without limiting or compromising peoples' thinking.		✓	✓	✓		✓	✓
Study reports should be sent out in good time to enable participants to read them and attend workshops fully prepared.		✓	✓	✓		✓	✓
Modalities be worked out to widely circulate the Terms of Reference (TOR) for the proposed Environmental Impact Assessment so as to encourage stakeholders co-operation.		✓					
There is need for community education/sensitisation on the benefits of resettlement compensation to minimise cases where some family members, especially women and children are left to suffer when male heads of households decide to misuse or misappropriate the cash accruing from compensation.			✓	✓			

### 2.4 ENGINEERING

Carry out detailed geological mapping of the project area			✓				
Optimise the dead storage level			✓				
Consider provision for installation of a third generating unit.			✓				
Consider the use of diversion tunnel after project construction.			✓				
Consider choice of weir instead of gated type spillway.			✓				
Consider the proximity of the sand flushing and power intake facilities.			✓				
The downstream communities be considered when designing the transmission of the power grid.						✓	✓
Fair distribution of infrastructure and attendant facilities on project site - e.g. camp sites and access roads - should			✓	✓			



be given due consideration, and not be seen to be favouring one side (district) along with the project area (Refer General Assembly to Fig S14) Mwingi and Mbeere favoured against Tharaka-Nithi.							
Capacity of flood release be built in the dams and the necessary management system worked out at whatever cost			✓				
That where appropriate water for domestic use and irrigation should be supplied by the project at the Special Management Zone			✓	✓			

## 2.5 FISHERIES

Assess the need for fish ladders to facilitate movement of fish up/down the reservoir.		✓					
A fish ladder be provided for.			✓				
Further studies on reservoir conditions should be done to ascertain suitable fish species.		✓	✓				
Need for deeper research and monitoring of the breeding patterns of fish in the river		✓					
In order to exploit fully the fisheries development potential once the dams are established, the local people should be encouraged and assisted to venture into the fishing industry.							✓
The population should also be sensitised on the need to use modern methods of fish production and marketing as well as its nutritional and economic value						✓	✓
Emanating from recent experience, there is possibility of the water hyacinth being transported to the reservoirs through fishing gears, and a mechanism should be established to regulate and control the spread of the hyacinth							✓

## 2.6 FLOOD RELEASE

Identify and formulate institutional mechanisms for proper flood releases for the benefit of all stakeholders.		✓					✓
Flood release dynamics be designed so as to sustain downstream ox-bow lakes, while at the same time ensuring the promotion of the requirements of the fishing communities in the delta. Experience of the Rufiji, Ruvuma and Pangani rivers in Tanzania be drawn upon, especially in connection with fish reproduction systems associated with the interface of fresh water and sea water (mixing).		✓	✓				
In order to maintain sediment and nutrients balance within the downstream ecosystem, the execution of the proposed artificial flood release should ensure maximum passage of these elements.			✓	✓			
While ensuring maximum release of nutrients and sediments that may be trapped in the proposed dams, it is imperative that sustainable development of downstream						✓	✓

production systems be articulated on integrated management of existing and proposed dams in the Tana basin.							
Capacity of flood release be built in the dams and the necessary management system worked out at whatever cost			✓				
Management modalities be worked out so as to ensure that riparian forests and flood-plain grasslands are not stressed by artificial withholding of water in the proposed dams as a result of design omissions. In this regard guarantees should be put in place to ensure the twice-yearly flood regime			✓	✓		✓	✓

## 2.7 GENERAL

The format of presenting the final report should be changed to the following format for easy reading: a) Executive Summary, b) Main Report, c) Detailed Appendices	✓						
Workshops should continue to be held even during later stages of the project.		✓	✓	✓	✓	✓	✓
The involvement of local universities, specialists and counterpart personnel should be part of the implementation of this project.	✓	✓	✓	✓	✓	✓	✓
TARDA and all the relevant stakeholders should be fully involved in future project activities, to enhance consultation and effective implementation, as it is charged with the responsibility of managing the Tana River Basin.		✓	✓	✓	✓	✓	✓
The project preparation should be subjected to a Logical Framework (Log-Frame) Analysis where aspects such as overall goals, objective(s); activities, specific roles assigned to implementers and objectively verifiable indicators (OVI's) are clearly outlined and measurable to ease project monitoring and evaluation. New agreement between JICA and the GK should include the task force.		✓	✓	✓			✓
Grand Falls Dam should be renamed Kibuka Hydropower Dam to retain its original historical and cultural name.							✓
There is need to encourage the design and implementation of population programmes, to ensure an economically viable population structure that permits efficient nutrition and health programme							✓
The enactment of the Environmental Bill 1995 should be expedited in order to permit the creation of the National Environmental Management Authority (NEMA), which will be in a position to establish regional frameworks that would respond to interests of communities residing in the Tana Basin, while ensuring sustainable regulations of river flow based on integrated watershed management							✓
In the event that the above recommendation is not feasible, it would be necessary to review the TARDA Act so as to enhance its functions in the context of the recommendations made in this report.							✓

As part of creating awareness among the stakeholders in the Tana Basin and with a bid to ensuring efficient and effective utilisation of reports generated by the mandated University Agency operating the environmental monitoring system, there is need to develop appropriate training packages							✓
For future workshops, the secretariat should draw guidelines on issues to be tackled without limiting or compromising peoples' thinking.		✓	✓	✓		✓	✓
Study reports should be sent out in good time to enable participants to read them and attend workshops fully prepared.		✓	✓	✓		✓	✓
Modalities be worked out to widely circulate the Terms of Reference (TOR) for the proposed Environmental Impact Assessment so as to encourage stakeholders co-operation.		✓					
Modalities be worked out in order to mandate a University to undertake the task of developing the proposed Tana River environmental monitoring system							✓
Necessary steps be undertaken to build the budget for the monitoring task in the project funding with a view to sustaining it on an annual basis through the involvement of Kenya Power Company (KPC) and other relevant agencies.			✓				✓

## 2.8 INFILLING PERIOD

The time length between infilling of the reservoir and the maintenance of the critical water volume in the river channel should be carefully worked out in collaboration with downstream communities		✓	✓	✓	✓		✓
Modalities be worked out to address the issue of loss of income among the downstream communities which is likely to emerge during the in-filling period				✓	✓		✓

## 2.9 INSTITUTIONAL

Management modalities be worked out so as to ensure that riparian forests and flood-plain grasslands are not stressed by artificial withholding of water in the proposed dams as a result of design omissions. In this regard guarantees should be put in place to ensure the twice-yearly flood regime			✓	✓		✓	✓
There should be a responsible institution, preferably a task force, made up of knowledgeable people from the implementing agency, the community and the Government			✓	✓	✓		✓
Institution/task force mandated to handle the resettlement issue should have a significant women representation/gender balance. The DDC's or the task force should set the displacement time table			✓				
An ecological monitoring system covering the entire						✓	✓

Tana River Basin be put in place.							
Modalities be worked out in order to mandate a University to undertake the task of developing the proposed Tana River environmental monitoring system							✓
Necessary steps be undertaken to build the budget for the monitoring task in the project funding with a view to sustaining it on an annual basis through the involvement of Kenya Power Company (KPC) and other relevant agencies.			✓				✓
Modalities be worked out to address the issue of loss of income among the downstream communities which is likely to emerge during the in-filling period				✓	✓		✓
Workshops should continue to be held even during later stages of the project.		✓	✓	✓	✓	✓	✓
The involvement of local universities, specialists and counterpart personnel should be part of the implementation of this project.	✓	✓	✓	✓	✓	✓	✓
TARDA and all the relevant stakeholders should be fully involved in future project activities, to enhance consultation and effective implementation, as it is charged with the responsibility of managing the Tana River Basin.		✓	✓	✓	✓	✓	✓
Identify and formulate institutional mechanisms for proper flood releases for the benefit of all stakeholders.		✓					✓

## 2.10 IRRIGATION

Detailed topographical and soil surveys should be carried out to decide proper identification of site, after which an irrigation impact study should be carried out to find out suitable cash crops and subsistence crops			✓				
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## 2.11 MONITORING

Modalities be worked out in order to mandate a University to undertake the task of developing the proposed Tana River environmental monitoring system							✓
Necessary steps be undertaken to build the budget for the monitoring task in the project funding with a view to sustaining it on an annual basis through the involvement of Kenya Power Company (KPC) and other relevant agencies.			✓				✓
A study be commissioned to consider a model that precipitated current conditions resulting from the impact of the existing dams. In addition efforts be made to develop models associated with scenarios of each of the proposed dams and options or combination thereof, with a view to designing a sustainable human settlement programme that would have little or zero effect on the down-stream communities.	✓	✓				✓	
An ecological monitoring system covering the entire Tana River Basin be put in place.						✓	✓

Steps be undertaken to conduct an evaluation/auditing of the E.I.A reports for each of the existing dams, so as to provide a sound foundation for the design of the proposed additional environmental assessment	✓						
A detailed study be undertaken on the dynamics of the riparian and flood plain flora and fauna communities, to ensure a sound foundation for the recommended monitoring system		✓					
The next environmental study should incorporate surveillance and control programs on livestock related diseases such as Nagana, Rift Valley fever, etc. The same approach should be observed in human health and disease control		✓					✓

## 2.12 RESETTLEMENT

The resettlement should be orderly and adequate				✓	✓		✓
There should be a responsible institution, preferably a task force, made up of knowledgeable people from the implementing agency, the community and the Government			✓				✓
This task force will identify the land to be settled on and let the land owners decide which deal they would prefer, but with the guidance of the task force; e.g., those who own land elsewhere can be paid in cash, while the rest can take both cash and land as approved, appropriately considering the need of each household.			✓	✓	✓		✓
Institution/task force mandated to handle the resettlement issue should have a significant women representation / gender balance. The DDC's or the task force should set the displacement time table			✓				
Fair distribution of infrastructure and attendant facilities on project site - e.g. camp sites and access roads - should be given due consideration, and not be seen to be favouring one side (district) along with the project area. (Refer General Assembly to Fig S14) Mwingi and Mbeere favoured against Tharaka-Nithi.			✓	✓			
That where appropriate water for domestic use and irrigation should be supplied by the project at the Special Management Zone			✓	✓			
There is need for community education/sensitisation on the benefits of resettlement compensation to minimise cases where some family members, especially women and children are left to suffer when male heads of households decide to misuse or misappropriate the cash accruing from compensation.			✓	✓			
There is need for further consultations by either the study team or the task force on resettlement on the issue of settling people as a block as this might not be acceptable to all.		✓					
The issue of what happens to the livestock when the owners have been relocated/resettled in relatively reduced farm sizes should be addressed e.g. improved range management and quality stocking.			✓	✓			

The local people should be encouraged and assisted to practice intensive livestock farming such as zero grazing, modern bee keeping techniques and poultry. The role of irrigation should be emphasised to maximise the benefits of the displaced community.				✓			
International standardised methods applied when handling cultural artifacts should be applied when dealing with plants with significant cultural values/implications.				✓	✓		
It was noted that displaced communities have in the past been haphazardly settled therefore interfering with their lifestyles. It was recommended that the affected community be physiologically prepared to move out of the reservoir area within a specified time frame by setting out a displacement timetable			✓	✓			✓
Land tenure systems should be adequately considered prior to the design and implementation stages		✓	✓	✓			✓
There is need to hasten land adjudication and registration activities so as to transfer land ownership to individual to ease compensation.							✓
There is need for a Participatory Rapid Assessment Study (PRA) on land issues		✓					

### 2.13 RESETTLEMENT: COMPENSATION

That the two hectares being floated by the JICA team is not enough for dry arid environment of the resettlement area. More land should be sought further away from the current estimated area of the special management area to give people adequate settlement land.		✓	✓				
That the money to be paid per acre should be determined by all the stakeholders on the date of acquisition.				✓			
That the infrastructure and social facilities that will be lost in the establishment of the reservoir should be costed/quantified and internalised in the final project document.	✓						
Calculations on the compensation requirements should be reviewed appropriately at the prevailing market rates in the final project document/costings.			✓				
As much as possible, compensation benefits could also consider cash in kind, e.g. provision and delivery of building materials to affected households			✓	✓			
It was also felt that funds be set aside to cater for socio-cultural losses such as shrines, artifacts etc. as well the restoration and replacement of lost biodiversity local.				✓			

### 2.14 SOCIAL AND ENVIRONMENTAL LEAST COST RANKING

There is need to cost the value of bio-diversity in the downstream environment and incorporate the findings in the design of the proposed dams with a view to, not only ensuring power generation, but also enhancing		✓					
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downstream production systems							
Steps be undertaken to conduct an evaluation/auditing of the E.I.A reports for each of the existing dams, so as to provide a sound foundation for the design of the proposed additional environmental assessment	✓						
A comprehensive socio-economic survey be undertaken as a component of the proposed E.I.A. with a view to developing new IRRs based on valuation of environmental variables		✓					
The dams be designed with the priority objective of sustaining the downstream ecosystems while gradually improving the livelihood of human population through enhancement of existing production systems		✓	✓		✓		

## 2.15 WATER QUALITY

The Additional Environment Assessment should revisit and review the model presented on water quality - nutrients and particulate matter		✓					
With the increasing population and land use there is, within the reservoir and upper catchment, a need for periodical studies on the use of pollutants caused by chemicals, herbicides and pesticides which should also include heavy metals e.g. mercury.		✓					
Further studies should be carried out to ascertain the current and future pollution levels from farming, sanitation and industrial sources, in the upstream environment e.g.; use of poisonous pesticides and weed killers should be analysed		✓				✓	

## 2.16 WATER USE

Review and identify the use of water in the lower and upper catchment zones.		✓				✓	
Carry out further analysis and quantify multiple use of water benefits.		✓				✓	











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