ANNEX 3

Presentations

PRESENTATIONS

The texts of three presentations from organisations attending the workshop, and one letter from an organisation unable to attend, are presented.

1. PRESENTATION BY KENYA WILDLIFE SERVICE

MUTONGA/GRAND FALLS HYDROPOWER PROJECT

1:0 THE KENYA WILDLIFE SERVICE MANDATE:

The main goals of KWS can be summarized as follows:-

1:1 To conserve the natural environmental of Kenya and their fauna and flora for the benefit of present and future generations and as a national and world heritage.

1:2 To use wildlife resources of Kenya sustainably for the economic development of the nation and for the benefit of the people living in wildlife areas.

Within these broad goals, the Service recognises the importance of co-ordination on land use both at the national and local levels and sets for itself the task or promoting the development of improved coordination mechanisms. For ecological and economic reasons, it is imperative that biodiversity of our protected and non-protected areas are not adversely affected by man's activities.

There is therefore the need to reconcile the interest of conservation and economic development. The conservation efforts should be supplemented and supported by those development activities which shape the environment.

2:0 THE PROJECT:

2:1 The Tana and Athi River Development Authority (TARDA) and Japan International Co-operation Agency (JICA) have both signed an agreeement for the latter to finance the construction of the 6th Hydro-electric plant along the Tana River at Mutonga and Grandfalls. The project is intended to provide water for Irrigation, public and industrial water supplies, fisheries, tourism and hydropower generation. Already five hydropower projects have been established along the Tana together with a number of irrigation projects.

3:0 KWS CONCERNS:

As the custodian of the flora and fauna in this country, the Service is concerned about the possible impacts of the proposed project on both the protected and non-protected areas within the Tana River environs. KWS has reviewed the feasibility report prepared

by Nippon Koei Co. Ltd. on this project and here below are our concerns and recommendations regarding the project.

3:1 Downstream of the Tana River, the Service has one of the most delicate ecosystems under its management, the Tana River National Primate Reserve. This Reserve is the only place in the world where the endangered and endemic Red Colobus and Mangabey monkeys are found. Within the Tana Delta, there are also found mangrove forests and wetland habitats which are important and famous for their large and varied biodiversity of fauna and flora. Among the faunal biodiversity found within the Tana Delta are wetland birds, a variety of fish species and large herbivores like hippos, topis, buffaloes, etc. The impounding of the Tana River is expected to affect the river flooding and sedimentation patterns and regimes and this will certainly have negative impacts on the biodiversity and on the socio-economic activities of the people who reside along the River.

3.1.1 Numerous studies on the riverine forests in the lower Tana have concluded that the river's hydrological regime is crucial for the survival of these forests and therefore wildlife. The sustenance of the forests is greatly dependent on flooding while the growth is closely related to the rise and fall of the overbank flow. Studies done also show that the composition and structure of the forests and relative abundance of plants and animals ahve definite relationship with the distribution of flood plain landforms.

3.1.2 Flooding and sedimentation are crucial for the sustenance of the Lower Tana Econsystem. It is therefore of paramount importance that detailed studies be undertaken to help in the understanding of the dynamics and functioning of the ecosystem. The information presented in the report under review on this aspect hardly contains adequate data to facilitate the understanding of the changes in the regime of the river and susbsequent effects on the hydrology of the flood plains.

3.1.3 To mitigate the expected negative impacts of the proposed project on the flooding and sedimentation regimes of the river, it is proposed that the dam(s) be designed in a manner that will allow or facilitate artificial flooding. KWS is concerned that no data or empirical evidence is provided in the report to ascertain the reliability and effectiveness of artificial flooding. Neither has information been provided on how the artificial flooding will be managed. Without adequate flooding and subsequent soil water and nutrient recharge, forest growth would not be supported in a dry area like the Tana. In a semi-arid area like the Tana, critical minimum flood levels and frequencies must therefore be defined and attained.

3.1.4 The report reveals that by impounding the river at the Grand Falls, it will take about 30 months for the dam to fill and duing the same period, the project will only release 30% of the average river flow. This means that for 2½ years the downstream ecosystem will be adversely affected due to lack of adequate siltation and flooding. The report does not give any clear indication of the consequences of this reduced sedimentation-flood levels on the biodiversity downstream. The report does not even consider the effects of reduced water flows during the 2½ years if closely followed by a long dry spell. The report does not further consider the impact of this situation on the socio-economic status of the local communities who reside in the lower Tana.

3.1.5 The KWS has a programme for the management of Tana River Primate Reserve which involves habitat creation in areas currently not forested, habitat enrichment in degraded forest sites and habitat management in areas of successional vegetation. The intention is to increase the size of the existing riverine forest patches, connect patches via forest corridors and enrich primate food resources. The other activity proposed is the planting of primate food resources which would more specifically improve the recovery rate of the habitat. All these programmes are designed to increase the primates carrying capacities of the forest patches and lessen isolation among the existing populations. In designing these management programmes it was assumed that the natural flooding and sedimentation regimes of the river will remain. Any change in the flooding and sedimentation regimes of the river will therefore render the management plans which are ear-marked to be funded by World Bank GEF unattainable. The change will further put the viability of the Reserve at a great risk.

3.2.6 If it is assumed that artificial flooding is a feasible solution, then a detailed management plan and structure should be put in place to oversee and control the operation of the flood-sedimentation release. The report does not address this issue in detail. It should be noted that the management aspect is so crucial that it can not be entrusted to one organisation. There are a number of interested parties in this project and the management programme must take into account this fact. TARDA, for example, has not been able to audit the environmental parameters of the other projects in operation, thus calling for the composition of a Board.

3.1.7 KWS feels that the study has not provided adequate information that can be relied on as far as flood simulation is concerned. Apart from the discharge level at Garissa, there is no data that has been used in this study. It is KWS position that reliable hydrological simulations can only be achieved if reliable, detailed and representative data is used. The hydrological simulation conducted was only based on discharge data collected at Garissa gauging station. Consideration was never given to other sources of discharges i.e. the numerous laggas and small streams that feed into the Tana River. There is for example, no treatment of any discharge to the north of the reservoir. How then can the study talk of the best project option at this stage. One can only decide on the most realistic alternative after undertaking detailed analysis. What is presented in the current study is scanty and is not the kind of data expected in a project of this scale and scope. Apart from inadequate data, KWS believes that the simulation models used in the study have not been validated and one of the main TOR for the consultancy was to update and validate the RIBASIM model or use an alternative model. Neither of this was done.

3.2 The study has not given any comprehensive data on animal and plant ecology in the project area and the expected impacts. There are currently no comprehensive surveys done in the Tana River basin plant and animal diversity. Neither have detailed surveys and inventories of fish in the Tana River been undertaken. It is therefore not possible to conduct a full EIA without this important and essential information and data.

3.3 It is KWS position that since the project envisages human resettlement programme, detailed data on spatial distribution of the populations in both the upstream and downstream must be gathered to facilitate the understanding of the impacts of the

programme. Moving people closer to the protected areas will definitely cause human-wildlife conflict.

3.4 The existence of large water body (200 square km) as proposed in the study next to the parks and reserves is of great concern to the Service. Wildlife are likely to be lured out of the parks/reserves to such a water body thus causing human wildlife conflict.

3.5 Given the concerns outlined in the preceding paragraphs, KWS feels that the third stage of the study must look into the following:

3.5.1 The study must come up with adequate information (data) on flood simulation that can be tested over time. The Service should be provided with a set of predicted changes in flow rates, sedimentation and flooding at each of protected areas thus Meru, Kora,Bisanadi, North Kitui, Arawale, Tana Primate and the Tana Delta. It is the feeling of KWS that there are currently no flooding data in the Tana basin and this should be collected over a period of time. The current practice of conducting a study over a period of 2-3 months is quite unrealistic. This is a very large project with possible devastating negative impacts on the environment that adequate time must be apportioned for data gathering. KWS feels that the current report lacks adequate data and information which could be relied upon to facilitate the choice of a project option. Without proper data it is absolutely difficult to assess the impacts of the project on the downstream resources. As far as KWS is concerned, no Environmental Impact Assessment for the project has been done. Adequate and authoritative data must be generated before a full EIA can be conducted.

3.5.2 The third phase of the study should quantify all forms of discharge into the Tana especially the laggas and the other small streams both before and after the reservoir. How frequent are these discharges and their volumes? It is absolutely necessary that in the phase three of the study the hydrological simulation should be undertaken using modified (RIBASIM and RIVAMOR) models or alternative models altogether.

3.5.3 The current study report appear to recommend the Low Grand Fall and Mutonga as project option whose design should incorporate sedimentation and flood release. KWS strongly recommends that the third phase of the study should present detailed discussion on the management of sedimentation-flood release. The discussion should provide details on the success or failure and management of similar project elsewhere in the world. It will be difficult for KWS to accept a project design without a parallel example.

3.5.4 There should be a presentation in the third phase of a complete inventory of flora and fauna particularly in Tana River Primate National Reserve and the Tana Delta region. This should be accompanied by the expected impacts and mitigation measures of the project on both plant and animal ecology. The study should give a clear indication of the ecological requirements of fish species viz-a-viz, the project impacts.

3.5.5 The phase three study should clearly define the parameters and mechanisms for the reservoir management since the flood sedimentation control mechanism will be extremely crucial for the sustenance of the Tana River downstream ecosystems.

3.6 KWS recognizes the importance of this project to the economic development of the country. However, it is not ready to support the implementation of the project without

adequate data to facilitate its proper assessment. It therefore recommended that adequate financial resources be allocated and devoted to the gathering of necessary data. It is also recommended that more time should be allocated to the third phase study in order to give the consultants adequate time to collect and analyse data on this most complex river system. A period of not less than one year is recommended. There should be no reason to hurry the implementation and completion of Phase III of the study since according to the Kenya Power and Lighting Hydropower Generation Master Plan, Mutonga and Grand Falls are not of immediate priority.

3.7 Lastly, KWS strongly recommends that all concerned and interested parties in this project should be involved and consulted on various aspects of the study during Phase III of the EIA Study. It is particularly recommended that the inputs and recommendations of Kenya Power and Lighting Co. Ltd. be solicited during the study.

3.6 SUMMARY

This project will have impacts yet unknown in the entire Tana Basin. Adequate information on flooding and siltation must allow for proper understanding of the impacts. Flooding simulation is quite central to the implementation of the project and KWS feels there is presently no adequate information. The sustenance of the ecosystem downstream must be quaranteed before the implementation of the project. There must be practical flood control measures geared towards the achievement of sustainable utilization of the ecosystem. Sight should not be lost of the fact that Kenya is a signatory to the Biodiversity Convention and the Ramsar convention. The main objective of the two conventions is to conserve biodiversity. It is therefore important that all issues related to biodiversity conservation in this project be thoroughly examined before the implementation of the project can be contemplated.

2. PRESENTATION BY JEREMIAH J.M. NYAGAH, EGH

JEREMIAH J.M. NYAGAH
P.O. BOX 37
EMBU

February 10th, 1995

The Managing Director
TARDA
Co-operative House
P.O. Box 47309
NAIROBI

Dear Sir,

RE: TARDA/JICA FEASIBILITY STUDY OF THE PROPOSED MUTONGA/GRAND FALLS HYDROPOWER PROJECT

I have expressed my interest in this matter and have indicated so elsewhere.

I have seen and somewhat been involved in a way here and there during all the present existing TANA RIVER hydropower dams development projects of: Kindaruma, Gitaru, Kamburu, Masinga, and Kiambere. These dams have touched and affected Embu district perhaps more than they have touched to other Districts of Machakos, and Kitui/Mwingi, land surface/area wise.

I know in these development such matters as touching on:

1. Land compensation e.g. as touching on: land valuations and methods of payments affected owners and other considered affected.

2. Land areas appropriated - be it the absolutely necessary/needed land for the environmental dam protection purposes, or doubtfully otherwise.

3. Wananchi's consideration by TARDA for: easy and convenient accessibility to water in various forms of use - human or agricultural (irrigation?).

4. Matters affecting environment e.g.

   - Soil erosion and afforestation measures for conservation and development / maintenance,

   - Silt control by possible construction of weirs or simple dams along the several seasonal river / streams feeding the Tana, etc

5. Matters affecting/concerning the road communication networks - be these main (tarmac or all - weather maintained) or simply local access roads, etc.

6. Matters touching possible available share of the socio-economic benefits to the locals during the construction period and perhaps afterwards during the future maintenance period. I have in mind especially in the initial bush clearing, implementation of environmental measures of soil conservation, dams silt protection, and afforestation measures, etc.

I have also in mind the other socio-economic service providing facilities of security and health nature in particular, etc.

I have too in mind the need to complete the once mooted/proposed aspects of the Kiambere dam to Kiambere hill and the vicinity area water supply concurrently with that for Mwingi and Kyuso areas in Kitui (now Mwingi) District.

I have too the need to maintain and develop the Kiambere dam health facilities for the good of people living on both sides of the river - as possibly also its need to serve some of the other areas in/along the proposed new dam if the Kamburu/Gitaru/Kiambere dam tarmac road was continued down stream to completion.

If my mind serves me right, I must remind that the "MATE" Rd i.e. Ena / Ugweri / Karurumo / Kanyuambora / Ishiara / Tunyui / Itugururu / Meru Road was to be put to tarmac road - as was also the road to connect with it starting from MWINGI (at the Thika/Garissa Rd. through Kyuso Kase, Grandfalls, and Clokariga (in Tharaka area).

There are other vital internal Link roads also that need to be made all weather roads e.g.

- Ishiara to Mwingi/Grand Falls Road through the Iriira bridge
- Kiambere to link with the above Mwingi/Grandfalls Rd
- To continue to completion the tarmac Kamburu/Gitaru/Kiambere dam Road, to join the 'Mate' road or otherwise at an appropriate point near the proposed new dam - i.e. across Muminji and Evurori locations of Siakago Division, Embu District.

Use of the set aside dam prouctive/environmental land area

From experience of the past, it is vital to put in mind that no land should be required to be set aside for the above mentioned purpose other than that which was absolutely essential and necessary.

- That if in future any TARDA etc land usage, especially agriculturally, the local people should be given first option in its use.
- Original sole purpose of protecting the dam environmentally be reviewed. That all that (now seemingly excessive) land now not absolutely required for the sole original environmental protection of the now already completed dams be returned to the Embu owners the Embu Trust Land Unit without considering it to be national

or state land. It was in good faith that the Embu people surrendered the said land for the national benefit of hydropower generations/developments along the Tana River banks. Such land thus returned will be very useful to sove aleviate the pressing pressure in landlessness of the wananchi.

I will avail myself to explain these points during the proposed workshop in the Panafric Hotel, Nairobi between 20th to22nd March 1995.

Thank you.

Yours faithfully,

JEREMIAH J.M. NYAGAH, EGH

cc. 1. Tha Chairman
Embu D.D.C
EMBU

2. The Embu MPs -
Minister Kamwithi Munyi
Hon. Norman Nyagah (Gachoka Constituency)
Hon. Gerald Ireri (Siakago Constituency)
Hon. Ndwiga (Runyenjes Constituency)

3. The P.C. Eastern Province.

3. PRESENTATION BY EAST AFRICAN WILDLIFE SOCIETY

COMMENTS BY THE EAST AFRICAN WILD LIFE SOCIETY ON THE MUTONGA/GRAND FALLS HYDROPOWER PROJECT - INITIAL ENVIRONMENTAL ASSESSMENT STUDY WORKSHOP AT ICIPE HQ, NAIROBI

20 - 22 MARCH 1995.

It is a great pleasure for the East African wild Life society (EAWLS) to have the opportunity to participate in this very important workshop on the proposed Mutonga/Grand Falls hydropower project. The society expresses sincere gratitude to Tana and Athi River Development Authority (TARDA) and the Japanese International Co-operation Agency (JICA) for organising it. We believe this important workshop provides a forum for discussion and sharing experiences by all interested parties.

The mission of the EAWLS is to promote conservation and wise use of wildlife and the environment in East Africa. We are working towards an East Africa where sustainable development and ecological considerations are incorporated into all development programmes.

The Society is playing an increasing role in public lobbying and advocacy. The most recent and perhaps most vigorous of the Society's lobbying campaigns was to save Kenya's largest delta ecosystem, the Tana River delta wetlands, from commercial exploitation and resultant environmental degradation. This culminated in Presidential decree towards the formulation of a management plan for the area which will ensure both conservation and wise use of the delta's resources.

The EAWLS has had a long history of involvement in conservation issues in the lower Tana basin. The society has funded several research/monitoring projects in and around the Tana River National Primate Reserve (TRNPR) with a view to enhancing conservation of the riverine forests which are the habitat of two endangered and endemic primate species, the Tana River Red Colobus and the Tana River Crested Mangbey.

Turning to the purpose of this workshop and in view of the above, the Society is concerned about development activities in the upper Tana River Catchment areas that might have adverse environmental impacts on the ecosystems downstream.

Members of the East African Wild Life Society's Council and Scientific & Technical Committee are appreciative of the opportunity to review the report emanating form the pre-feasibility study which comprised Phase 2 of the ongoing work focused on the implementation of the proposed Mutonga/Grand Falls hydropower project.

The EAWLS commends TARDA and JICA for studying the proposed dams effects on downstream communities and ecosystems, and in particular for including the innovative option of artificial annual floods and silt release to restore downstream ecosystems.

Volume 1 concludes (P5-32-p-34) that the most feasible of the four construction options is that of the combination of two dams, Low Grand Falls and Mutonga. The conclusion appears to have been reached on the basis of:

1. economic analysis, and

2. environmental findings which suggest that upon completion the project will be able to recreate the natural flooding patterns in the pre-delta and delta areas.

We are not in a position to make detailed comments on the economic aspects but appreciate the opportunity to hear what other participants have to say.

However, we are concerned with environmental issues downstream. The pre-feasibility study may not have had sufficient time to study the full ramification of the effects of the construction. We suggest that the selection of specific options at the preliminary stage may be premature. We trust a thorough Environmental Impact Assessment of all options will be done in Phase 3.

EAWLS is not opposed to national development projects of this type. We wish to lend positive support to the project by proposing the following issues to be incorporated in further work prior to the adoption of final decisions.

1. The report states (p5-31) that the next project stage is to develop operating plans that would produce a twice a year surge in flow of 600 cu m/sec at Garissa, and suggests that this will restore the environment to some normality. We are unable to ascertain the connection between this figure and the actual flooding pattern. We are unable to see any specific information on how the river floods, what role is played by the incoming laghas, or how much of the flood comes from the breeches in the constantly shifting riverbanks, etc. Past studies do not provide data on the flooding of the delta. Since EAWLS has an active programme in the Tana Delta, we are becoming increasingly aware of the local situation and we are beginning to assess the problems. We believe that it is unlikely that we can mitigate the effect of such dams before the natural flooding is fully analysed and understood. Therefore field data on flooding, maps illustrating the flooding patterns, and methods of predicting changes in flooding are required.

2. The management of the planned release of water is of concern to us. Can practical methods be agreed upon, established and maintained between institutions with different interests? The report states (p5-31) that utilisation of the reservoir to create the floods will result in a 3% loss in total power production. Can KPC confirm this? It seems unlikely that a dam built for storing and releasing water for hydropower can so easily be used for creating huge floods through periodic release of the very water which it normally conserves. Has this ever been done elsewhere in this country or the region? Also, who would be liable for loss or damage caused

by these simulated floods? Therefore the issues associated with both the management and legality of water storage, and variable use must be studied in greater detail before any option is selected, and KPC should be actively involved in the study and in defining the recommendations.

3. The report explains that the various dam options have different effects, if unmitigated, on the natural resources and their economic use. But, there is a lack of specific references, the findings appear to be guesstimates or assumptions. Proper modelling is required and data collected on all the resources including the flood recession agriculture, riverine forest, mangroves, etc. The earlier JICA report focused on Phase 1 noted (Chapter G1.13) a number of reservations on the use of the model RIBASIM and the model RIVMOR in predicting the effect of the proposed dams. These models were used in the preparation of this report. Were they revised or refined? The present report gives no information regarding alternations to the models. Therefore data should be collected and models constructed to simulate the effects of changes in the flooding patterns in terms of both time and magnitude.

4. Silt plays a vital role in the fertility of downstream ecosystems. But, data concerning the actual silt load of the river in terms of both quality and quality, the differing patterns of erosion between the present and future downstream situation, how far particles are transported and where and how they are deposited are lacking. Silt generated from upstream locations is generally trapped within the reservoir, but the report implies that in this case significant amounts of silt will be released in the twice yearly surge flows. Critical assessment of these aspects is required prior to any construction. Therefore data collection and assessment focused on attributes of the siltload inclusive of the variability which may be produced in both the origin and amount of particles produced under a large scale reservoir containment and flood release system is necessary.

In conclusion, EAWLS considers that the Grand Falls/Mutonga project is certainly worthy of careful consideration as it is of significant value in terms of hydropower generation for Kenya. However, it can succeed only if it is effectively planned, implemented and operated. A vital part of the planning process is to ensure that it is environmentally sustainable. Being a large and complicated project with much of our present knowledge being limited to flows in the main channel and very little monitoring capacity presently on the ground, it is vital that the project be properly studied and subsequently reviewed. We feel that the present report does not effectively cover all of the concerns. Indeed, the "priorities" listed for attention in the first JICA report (p IV-3) do not appear to have been included in the present review of the second phase. For example, the linkages between the hydrology and the activities in the delta which were to be explored through implementation of monitoring programmes are not adequately addressed. In addition, there seems to be an omission of the Terms of reference and recommendations for phase two. This is an error which we think needs an explanation.

We appeal to TARDA and JICA that there is no substitute for the establishment of good data bases, accurate models of the pre-delta and delta areas, and thorough analysis of possible impacts before any decision are set. We request that the issues raised above be included in the Terms of Reference for the next phase. We suggest that as the most active organisation, in

terms of both information gathering and community programme development, in the Tana Delta that EAWLS be given the opportunity to enter into collaboration with the consultants who undertake the next phase.

We trust that through effective co-operation and planning the long term monitoring requirements of the Tana River Basin as a whole as well as the study and data analysis needed prior to implementation of this specific project can be effected. Such collaboration should be able to begin the process which will allow for the full potential of this development, both from the environmental and social point of view as well as the economic to be realised.

4. LETTER FROM IUCN, The World Conservation Union

Dear Mr. Masika

Mutonga/Grand Falls Hydropower Project; Initial Environmental Assessment

Thank you for inviting IUCN to the Workshop in Embu last week, to discuss the Initial Environmental Assessment of the new hydropower project on Tana river. I found the discusssions stimulating.

Further to my inputs at the workshop, I would like to record our main comments, so that they can be incorporated in the overall assessment.

1. Main impacts of the proposed dam

We agree witht he observations which were made at the workshop that themain impact will not be the construction on the reservoir itself, but it will be the effects which a dam will have upon the river downstream of the dam.

Our main concern is that we should try and maintain fluctuations in the flow of the river which simulate the natural situation. In this respect, we think that a new dam could have very positive effects on the environment, as it might enable the authority to ameliorate the partial regulation of the river flow which has been created by the operation of Masinga and Kiambere reservoirs.

We are not advocating large, uncontrolled floods every year, but we would like to see a means of releasing sufficient amounts of water from time to time, to create a "proper flood" on the lower floodplain and Tana Delta.

We therefore support the recommendations that the engineering consultants be requested to design a dam which will allow release of water through the turbine tunnel or through an additional sluice gate, well below the spill-way.

2. Operating policy and rules

We are concerned that the authority responsible for the maintenance and operation of the dam may have a different view about the need for downstream floods. We therefore wish to stress the need to have a clear policy agreed before the commissioning of the dam, and to have a regular monitoring of the operating rules during the operational like of the dam.

WE also want to stress the need for monitoring of the water release, to ascertain whether a release of a slug of water in fact results in recharge of the groundwater and inudation of the floodplain.

3. Link with Tana Delta

We strongly support the comments which the Chair made in his closing speech, regarding the need for collaboration between the hydropower project consultants and the Tana Delta Steering Committee. We hope that TARDA, as the leading agency in both initiatives, will be able to facilitate this collaboration.

4. Silt content and composition

There was a considerable amount of debate about the origin of the sediment in Tana river, and the need for silt release from the reservoir. Our main concern in this respect is that the particles which are particularly important for the delta are suspended sediments and organic matter. We would postulate that this originates from the slopes of Mt. Kenya.

Whilst we do not dispute the fact that erosion will occur below the dams, and in the stream-bed, we are not convinced that this sediment contributes a great deal to the capacity of Tana River to rejuvenate the floodplain and the delta.

Clearly, a lot more study is required in this area.

5. Mangroves

We know from other delta ecosystems that mangroves play an important role. They provide for a large number of direct benefits tot he local people, but are also the breeding grounds for a number of sea fish species. We also know that mangroves require a certain amount of fresh water, and that flooding is necessary for the development of magrove forests.

We therefore recommend that a study is carried out to determine how often the mangrove stands in Tana delta will be flooded after construction of a new dam, and what this means for the off-shore fishing industry.

In this respect, we wish to draw your attention to the uncertainty of existing topographic information in the delta, and now need for an accurate survey of the levels and micro-contours in the delta.

6. Management of the reservoir buffer zone

The proposed reservoir can be seen as a protected area. Recent debates in Africa about protected area buffer zone management indicate that there is a neeed to incorporate the people living outside the protected areas, in order to ensure better protection.

We would want to propose that this option is also considered for the management of the reservoir buffer zone.,

7. Conclusion

I was pleased with the discussions at the workshop, and hope that this was only the first step in a long process of public participation and cross-sectoral collaboration.

I would like to take the opportunity to thank you for the good collaboration which IUCN ha received from TARDA during the past years. I have been very fortunate to be part of this

strengthening working relationship, and I will miss it after my departure from Kenya next month.

Prof. Steven Njuguna and Dr. Geoffrey Howard will maintain the contact between this office and TARDA, in particular with reference to the Tana Delta Wetlands and the Mutonga/Grand Falls hydropower project. In this respect, I hope that you will not hesitate to contact Dr. Howard if you require further clarification any of the above points.

Yours sincerely

Dr. Marts Friederich
Coordinator EA Environmental
Planning Programme

c.c. J-I, Pyrot; IUCN Wetlands Programme, IUCN HQ
Ms E. Sugita; JICA Nairobi.

ANNEX 4

Comments by the JICA Study Team

COMMENTS BY THE JICA STUDY TEAM

Page and section reference	JICA Study Team Comments
p.7. 4.1.2	The Team carried out an economic analysis on the dam raising of LGF as shown in the attached Table. It was clearly found that the staged development of LGF to HGF is not economically feasible.
p.8. 4.1.6	Future water needs in Districts up to 2020 were forecasted in the Report. (Volume 1 of Progress Report 2). Future water needs in the neighborhood of the dams will be studied in the Detailed Design stage to design the local water supply system. Main concern in Phase 2 feasibility study stage was to examine the feasibility of the project.
p.12. 5.1	The report studied irrigation development and compensation costs as the cost of negative effects of the dam. (Volume 1 of Progress Report 2).
p.24. 1.4	A system to ensure that initial runoff immediately after rains in the Kathita catchment is synchronised with silt release and flood release should be put in place. Artificial floods will not be released whenever it rains in the Kathita catchment, but silt release may be carried out, depending on the findings of Phase 3 studies into the feasibility of silt release from the Kathita.
p. 30. 3.1	Water will be released from Grand Falls dam. Issues of sediment loads will be examined in Phase 3 and also in greater detail as part of the separate, parallel study proposed during this workshop.
p. 30. 3.1	Details of feasible flood and other flow release will be examined in phase 3, including the desirable residual flows. Environmentally desirable residual flows will be further considered in greater detail as a part of the separate, parallel study., proposed during this workshop.

Disbursement Schedule for LGF Dam Raising (Unit:1,000 US$)

Description	Total	1st Yr.	2nd Yr.	3rd Yr.	4th Yr.	5th Yr.	6th Yr.
Low Grand Falls (Stage 1)							
1. Infrastructure	35,921	28,737	7,184	0	0	0	0
2. Reservoir clearing	1,400	0	420	560	420	0	0
3. Diversion tunnel	43,241	25,945	17,296	0	0	0	0
4. Main dam & saddle dam	200,115	0	30,017	70,040	70,040	30,017	0
5. Spillway	67,292	0	3,365	26,917	26,917	10,094	0
6. Intake	10,460	0	5,230	5,230	0	0	0
7. Power tunnels/shafts	3,906	0	0	2,930	977	0	0
8. Powerhouse,civil	15,450	0	0	3,090	6,180	6,180	0
9. Tailrace	12,235	0	2,080	8,197	1,958	0	0
10.Electrical Works	55,733	0	0	0	27,867	27,867	0
Subtotal	445,753	54,681	65,592	116,964	134,358	74,158	0
11.Engineering and construction management	44,575	5,468	6,559	11,696	13,436	7,416	0
12.Land Acquisition and Compensation	15,169	4,551	3,034	3,034	3,034	1,517	0
Total	505,497	64,700	75,185	131,694	150,827	83,090	0
Economic Adjustment (89.0 %)	449,893	57,583	66,915	117,208	134,236	73,950	0
Low Grand Falls Dam Raising (Stage 2)							
1. Infrastructure	21,467	17,174	4,293	0	0	0	0
2. Reservoir clearing	1,600	480	640	480	0	0	0
3. Diversion tunnel	0	0	0	0	0	0	0
4. Main dam & saddle dam	100,057	30,017	40,023	30,017	0	0	0
5. Spillway	33,646	10,094	13,458	10,094	0	0	0
6. Intake	0	0	0	0	0	0	0
7. Power tunnels/shafts	0	0	0	0	0	0	0
8. Powerhouse,civil	0	0	0	0	0	0	0
9. Tailrace	0	0	0	0	0	0	0
10.Electrical Works	27,867	0	13,933	13,933	0	0	0
Subtotal	184,637	57,765	72,348	54,524	0	0	0
11.Engineering and construction management	18,464	5,776	7,235	5,452	0	0	0
12.Land Acquisition and Compensation	15,169	4,551	6,068	4,551	0	0	0
Total	218,270	68,092	85,650	64,527	0	0	0
Economic Adjustment (89.0 %)	194,260	60,602	76,229	57,429	0	0	0

Economic Cash Flow Low Grand Falls Dam Raising (Unit : mil. US$)

Year	Cost	Benefit	Benefit - Cost	Present Worth F.	Present Value	
0	57.58		-57.58	1.00000	-57.58	
1	66.92		-66.92	0.90909	-60.83	
2	117.21		-117.21	0.82645	-96.87	
3	134.24		-134.24	0.75131	-100.85	
4	73.95		-73.95	0.68301	-50.51	
5	0.66	56.18	55.52	0.62092	34.47	
6	0.66	55.98	55.32	0.56447	31.23	
7	0.66	55.79	55.13	0.51316	28.29	
8	0.66	55.59	54.93	0.46651	25.63	
9	0.66	55.40	54.74	0.42410	23.22	
10	0.66	55.21	54.55	0.38554	21.03	
11	0.66	55.01	54.35	0.35049	19.05	
12	0.66	54.82	54.16	0.31863	17.26	
13	0.66	54.63	53.97	0.28966	15.63	
14	60.60	27.22	-33.38	0.26333	-8.79	
15	76.23	27.13	-49.10	0.23939	-11.75	
16	57.43	27.03	-30.40	0.21763	-6.62	
17	0.72	85.76	85.04	0.19784	16.82	
18	0.72	85.46	84.74	0.17986	15.24	
19	0.72	85.16	84.44	0.16351	13.81	
20	0.72	84.87	84.15	0.14864	12.51	
21	0.72	84.57	83.85	0.13513	11.33	
22	0.72	84.27	83.55	0.12285	10.26	
23	0.72	83.98	83.26	0.11168	9.30	
24	0.72	83.69	82.97	0.10153	8.42	
25	0.72	83.40	82.68	0.09230	7.63	
26	0.72	83.11	82.39	0.08391	6.91	
27	0.72	82.82	82.10	0.07628	6.26	
28	0.72	82.53	81.81	0.06934	5.67	
29	0.72	82.24	81.52	0.06304	5.14	
30	0.72	81.95	81.23	0.05731	4.66	
31	0.72	81.67	80.95	0.05210	4.22	
32	0.72	81.38	80.66	0.04736	3.82	
33	0.72	81.10	80.38	0.04306	3.46	
34	0.72	80.81	80.09	0.03914	3.14	
35	0.72	80.53	79.81	0.03558	2.84	
36	0.72	80.25	79.53	0.03235	2.57	
37	41.37	79.97	38.60	0.02941	1.14	
38	0.72	79.69	78.97	0.02673	2.11	
39	0.72	79.41	78.69	0.02430	1.91	
40	0.72	79.14	78.42	0.02209	1.73	
41	0.72	78.86	78.14	0.02009	1.57	
42	0.72	78.59	77.87	0.01826	1.42	
43	0.72	78.31	77.59	0.01660	1.29	
44	0.72	78.04	77.32	0.01509	1.17	
45	0.72	77.77	77.05	0.01372	1.06	
46	0.72	77.50	76.78	0.01247	0.96	
47	0.72	77.23	76.51	0.01134	0.87	
48	13.79	76.96	63.17	0.01031	0.65	
49	0.72	76.69	75.97	0.00937	0.71	
50	0.72	76.42	75.70	0.00852	0.64	
51	0.72	76.15	75.43	0.00774	0.58	
52	0.72	75.89	75.17	0.00704	0.53	
53	0.72	75.62	74.90	0.00640	0.48	
54	0.72	75.36	74.64	0.00582	0.43	
55	0.72	75.10	74.38	0.00529	0.39	
56	0.72	74.84	74.12	0.00481	0.36	
	732.61	3,787.07	3,054.46		-3.98	IRR = 9.9%

ANNEX 5

Workshop Participants

WORKSHOP PARTICIPANTS

1. INVITED GUESTS

	Organisation		Numbers attending
1.	Kenya Wildlife Service		3
2.	National Museums of Kenya		1
3.	IUCN - The World Conservation Union		0
4.	Ministry of Environmental and Natural Resources		6
5.	Director of Water, MoW		1
6.	Director of Fisheries		0
7.	Kenya Power & Lighting Co.		2
8.	District Representatives	Tana River District	3
		Garissa District	0
		Mwingi District	3
		Tharaka Nithi District	13
		Embu District	5
		Meru	1
9.	East African Wildlife Society		3
10.	World Bank		1
11.	Ministry of Energy		0
12.	WWF - World Wide Fund for Nature		0
		Total	36

2. ALPHABETIC LIST OF WORKSHOP PARTICIPANTS AND SUPPORT STAFF

	NAME		ORGANISATION	STATUS
1.	Allan	A.Y.		
2.	Amdany	David	DO 1 Mwingi	Delegate
3.	Arum	G.	KENGO	
4.	Asetto	Rose	TARDA	Support staff
5.	Becha	H.B.	EAWS	Delegate
6.	Bobotti	O.K.	TARDA	
7.	Bradley	J.L.	Knight Piesold	
8.	Campbell	Dr. K.L.	Natural Resources Institute	JICA Study Team
9.	Campbell	Ian	RPS International	
10.	Chege	Nyaguthii	NGO Council	
11.	Chete	M.	EAWS	Delegate
12.	Dianga	Alex	IRIS	
13.	Disney	John	NRI	
14.	Duthie	D.	EDG - Oxford	
15.	Ferguson	Mrs W.	Consultant	
16.	Gachigi	John K.	DSDO - Tana River Dist.	Delegate
17.	Galugalu	S.	CDA - Tana River District	Delegate
18.	Gatheru	S.	N.M.K	Delegate
19.	Gathoni	Mary	TARDA	Support staff
20.	Gichuki	Phillip	ENNRBDA	
21.	Govani	Hamish	Acropolis Kenya	
22.	Guchu	C.	PAS	
23.	Hodgson	N.	Acropolis Kenya	
24.	Hoopervoret	Mr.	Dutch Embassy	
25.	Imoto	H.	JICA Staff	
26.	Ita	S.M.	EPZA	
27.	Itane	Murithi	Meru	Delegate
28.	Itome	M.M	Tharaka Nithi CC	Delegate
29.	Kagwima	F.	MP - Tharaka	Delegate
30.	Kaimba	G.M.	Tharaka	Delegate
31.	Kaindi	J.N	TARDA	
32.	Kalya	E.	NGO Council	
33.	Kamau	Mrs. J.W.	TARDA	
34.	Kamau	P.C.	TARDA	
35.	Kamwara	S.	Kamanyaki	Delegate

(continued)

	NAME		ORGANISATION	STATUS
1.	Kanake	Geofrey	Tharaka Nithi	Delegate
2.	Kanyi	Gabriel N.	Tharaka Nithi	Delegate
3.	Karani	Joseph	Embu	Delegate
4.	Karekia	J.W.	ENNRBDA	
5.	Kariuki	K.	TARDA	
6.	Kiai	S.P.M.	NEAP	Delegate
7.	Kiarie	D.W.	TARDA	
8.	Kilonzo	J.M.	Water	Delegate
9.	Kilonzo	Mary	TARDA	Support staff
10.	Kinuthia	S.		
11.	Kirui	M.L.	NEAP	Delegate
12.	Kiss	Agi	World Bank	Delegate
13.	Kivuti	Lenny	Geomaps	
14.	Koech	Prof. M.	Director, NEAP	Delegate
15.	Larsen	S.	PAS	
16.	Lefebure	H.	EDF	
17.	Luke	Q.	WWF - NMK	
18.	M'Arimi	A.M.	TARDA	
19.	M'Rithaa	Gertrude	TARDA	Support staff
20.	Maathai	Prof. J. Wangari	Green Belt Movement	
21.	Machira	Francis	Chakanga Tharaka	Delegate
22.	Mainda	Abel, K.		
23.	Martens	Dr. Els	KWS - Netherlands	Delegate
24.	Maruyama	S.	Nippon Koei	JICA Study Team
25.	Masika	D.W.	M.D. TARDA	CHAIRMAN
26.	Mavuti	Prof. K.	University of Nairobi	
27.	Mbecha	H.B.	EAWL	
28.	Mbugua	E.	PAS	
29.	Mbuvi	D.M.	University of Nairobi	
30.	Migwe	M.M.	Chairman Tharaka Nthi CC	Delegate
31.	Migwi	Mark Njeru	Tharaka Nithi CC	Delegate
32.	Minai Maina	J.	GOK Agriculture - Embu	Delegate
33.	Miyesa	M.F.	DMD, TARDA	
34.	Mpungu	Jeninifer	CARE - Kenya	
35.	Muema	Mary	TARDA	
36.	Mueni	Miriam	TARDA	Support staff
37.	Mugao	Blasius	Tharaka North	Delegate
38.	Mukeku	M.P.	TARDA	
39.	Mulandi	B.S.	TARDA	

(continued)

	NAME		ORGANISATION	STATUS
40.	Murafi	M.K.	Embu	Delegate
41.	Murgor	M.	TARDA	
42.	Muriuki	Dominic	EPZA - IPS	
43.	Musomba	W.	PAS	
44.	Muthigani	P.	PAS	
45.	Muthuri	Prof. F.M.	Kenyatta University	
46.	Mutiso	Prof.	Muticon	
47.	Mutungei	J.M.	MOALD - Tana River District	Delegate
48.	Mwangi	D.	KP&LC	
49.	Mwangi	E.M.	JKUCAT	
50.	Mwangi	Wangu	Econews Africa	
51.	Mwanundu	Sheila	Howard Humprey (K) Ltd	
52.	Nagashima	T.	Res. Rep. - JICA	
53.	Ndemwa	W.M.	NEAP	Delegate
54.	Ndua	Josphat	Acropolis Kenya	
55.	Ng'weno	Fleur	Kenya Wetlands Working Grp	
56.	Ngari	J.		
57.	Ngaruma	N.	TARDA	
58.	Njagi	A.M.	KP&LC	
59.	Njangi	James	Gituma	Delegate
60.	Njagi Wakiondo	S.J.	Former MP Tharaka	Delegate
61.	Njue	Dr. A.	Kenyatta University	
62.	Ntiba	Dr. M.J.	University of Nairobi	Delegate
63.	Nyagah	J.J.M., EGH	Former Minister	Delegate
64.	Nzainga	H.K.	NEAP	Delegate
65.	Obara	Prof. D.A.	University of Nairobi	JICA Study Team
66.	Obera	Susan	TARDA	Support staff
67.	Olenkako	Francis N.	KWS	Delegate
68.	Omorwa	E.	Mwingi	
69.	Omurwa	Eric	DDO - Mwingi	Delegate
70.	Ongegu	Mrs J.N.	TARDA	
71.	Ottichillo	W.	KWS	Delegate
72.	Patel	Nayan	Heavy Eng.	
73.	Rashid Mrafi	Mwalim	GOK MPND - Embu	Delegate
74.	Read	Colin	TARDA	
75.	Rotich	N.K.	EAWS	Delegate
76.	Rukwaru	P.K.	Mukuthima (Tharaka)	Delegate

(continued)

	NAME		ORGANISATION	STATUS
81.	Rutere	Eng. J.K.	Kaburu Orina & PN	
82.	Sehmi	Mandhi	Acropolis Kenya	
83.	Shete	M.	EAWL	
84.	Simitu	Lawrence	DWE Mwingi	Delegate
85.	Sugita	E.	JICA	
86.	Sumikawa	K.	Nippon Koei	JICA Study Team
87.	Thomas	Michael	Laikipia Research Pro.	
88.	Toroitich	Magrina	TARDA	Support staff
89.	Tsalwa	S.M.	NEAP	Delegate
90.	Tsalwa	S.M	OP Govt Chemist	
91.	Wakanene	K.		
92.	Waweru	Jane	TARDA	Support staff
93.	Waweru	Tabitha	TARDA	Support staff
94.	Yamaura	N.	JICA	

ANNEX - C

PROCEEDINGS OF WORKSHOP NO.3

REPUBLIC OF KENYA

MINISTRY OF ENERGY

FEASIBILITY STUDY

ON

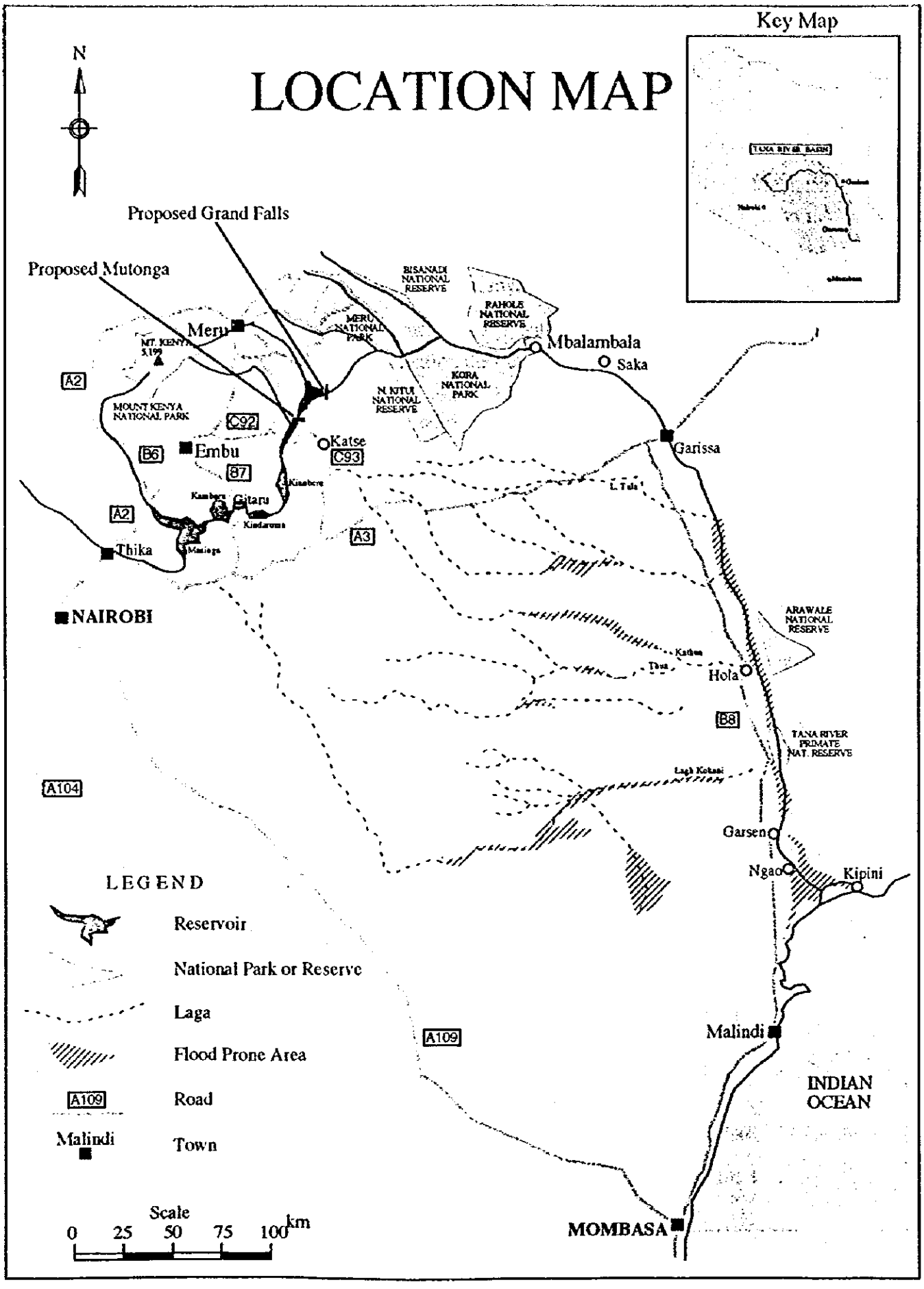
MUTONGA/GRAND FALLS HYDROPOWER PROJECT

DRAFT FINAL REPORT

PROCEEDINGS OF WORKSHOP 3

26-29 JANUARY 1998, NAIROBI

JAPAN INTERNATIONAL COOPERATION AGENCY


LOCATION MAP
Key Map
N
Proposed Grand Falls
Proposed Mutonga
Meru
Mbalambala
Saka
Garissa
Embu
Katse
Thika
NAIROBI
Hola
Garsen
Ngao
Kipini
Malindi
MOMBASA
INDIAN OCEAN
A2
A3
A104
A109
B6
B7
B8
C92
C93
MOUNT KENYA NATIONAL PARK
MERU NATIONAL PARK
BISANADI NATIONAL RESERVE
RAHOLE NATIONAL RESERVE
KORA NATIONAL PARK
N. KITUI NATIONAL RESERVE
ARAWALE NATIONAL RESERVE
TANA RIVER PRIMATE NAT. RESERVE
LEGEND
Reservoir
National Park or Reserve
Laga
Flood Prone Area
Road
Town
Scale
0 25 50 75 100 km

CONTENTS

ACKNOWLEDGEMENTS

The Ministry of Energy of the Republic of Kenya and the Japan International Cooperation Agency (JICA) wish to recognize the contribution by various Government Departments, Parastatal Organizations, Non-Governmental Organizations, groups and individuals who made it possible to carry out and successfully conclude the studies leading up to Workshop III for Mutonga/Grand Falls Hydropower Project.

Of these special appreciation goes to the Ministry of Water Resources, the Ministry of Environment and Natural Resources, Tana and Athi Rivers Development Authority (TARDA), Kenya Power and Lighting Company Ltd. (KPLC) and Kenya Power Company (KPC) for invaluable support during the course of the entire activity.

Also worthy of special mention is the JICA Study Team comprising of professional staff from Japan and Kenya who worked under the guidance of Nippon Koei Co. Ltd., a reputable firm of consulting engineers and were to produce an overwhelmingly comprehensive study report to facilitate deliberation during Workshop III.

MOE/JICA would also like to register their appreciation to the Chairman and members of the Steering Committee for their diligence and commitment which ensured the successful launching of Workshop number 3.

Special tribute goes to the corps of rapporteurs and to the secretariat for their tireless efforts on the compilation and timely production of the Workshop Proceedings.

Many others contributed significantly at the various stages of the study and during the Workshop. It is not possible to list them down individually, but their work is evident in this document.

OPENING SPEECHES

SPEECH BY THE HON. CHRISANTHUS B. OKEMO MINISTER FOR ENERGY DURING THE OFFICIAL OPENING OF MUTONGA III HELD AT KCCT MBAGATHI ON 26TH JANUARY, 1998

THE JICA REPRESENTATIVE, MR. A. MATSUMOTO
MANAGING DIRECTOR TARDA, MR. M. MIYESA,
PROJECT CONSULTANTS,
DISTINGUISHED GUESTS,
LADIES AND GENTLEMEN,

It is my pleasure and honour to be here today to open this very important workshop on Mutonga/ Grand Falls hydro-power project feasibility study.

On behalf of my ministry, I would like to take this opportunity to welcome you all to the Mutonga/ Grand Falls hydro-power project feasibility study workshop.

This is the third in a series of workshops held to publicly discuss the results of a study commissioned by the government of Kenya in 1993 to formulate an optimal plan for the development of the Mutonga/ Grand Falls hydro-power project on the Tana river.

The government of Kenya in recognition of the social-economic growth stimulus provided by an efficient and vibrant basic infrastructure, and consistent with its policy to regularly update its 20-year electric power development plan requested the government of Japan through bilateral technical cooperation to provide appropriate technical assistance to carry out the feasibility study on the largest of the remaining suitable dam sites on river Tana, whose development would have a significant impact on the local and national social-economic scope.

The current twenty year power development plan projects the demand for energy at 5.3 Billion kilowatt hours (or units) and at 912 (megawatts) for peak power in the year 2000/01, rising to 13.8 Billion units and to 2,400 megawatts, respectively by year 2016/17. To meet this projected demand, various electricity supply options have to be investigated on a regular basis in order to ascertain the least economic cost supply packages. It is in this context that the Mutonga study has been carried. In addition to hydro-power generation option, other supply options such as geothermal power and fossil fuel based generation covering both petroleum and coal fired plants are also investigated.

On the basis of the twenty year least cost power development plan which was recently updated and rolled over to cover the period 1997 - 2017, for the first 5 years of the plan, the following electric power generation projects, with a combined capacity of 550.5 Megawatts will be implemented (by the date indicated against each project) to meet the projected demand for electricity:-

(i) A 30 megawatt rehabilitated gas turbine plant at Kipevu by fiscal year 1998/99;

(ii) A 75 megawatt medium speed power plant at Kipevu by 1999/2000;

(iii) A second 75 megawatt medium speed power plant also at Kipevu by 1999/2000. This particular plant will be implemented by an independent power producer (IPP) who will sell power to KPLC on the basis of a long-term power purchase agreement (PPA).

(iv) Another 110 megawatt medium speed diesel power plants to be constructed on fast-track basis and will be developed built, owned and operated by IPPs who sell power to KPLC on the basis of power purchase agreements (PPAs).

(v) A 72.5 Megawatt third unit at Gitaru hydro-power station by 1999/2000;

(vi) A 64 megawatt geothermal power plant at Olkaria north-east (Olkaria II) by 2001/2002;

(vii) A second 64 megawatt geothermal power plant at Olkaria, west (Olkaria III) by 2001/2002. This will be the first geothermal plant to be developed by an IPP.

(viii) A 60 megawatt hydro-power plant on river Sondu-Miriu by 2003/04.

Consistent with the least-cost power development plan, the following transmission lines will be constructed by KPLC to ensure efficient delivery of electric power from these power stations to various demand centres within the country:-

(i) A 132 kilovolt (KV) line from Kipevu to Rabai, Mombasa by 2000.

(ii) A 220 kilovolt line from Kiambere on Tana River to Embakasi, Nairobi by 2000.

(iii) A 220 kilovolt line from Gitaru power station to Kamburu power station on river Tana by 2000

(iv) A 132 kilovolt line from Kilifi to Malindi.

(v) A 220 kilovolt line from Olkaria power station to Nairobi by 2002.

(vi) A 220 kilovolt line from Nairobi north to Dandora, Nairobi by 2001.

(vii) A 132-kilovolt line from Sondu-Miriu power station to Kisumu by 2003.

Turning back to the subject of today's workshop, the Mutonga / Grand Falls project, study is expected to assess the project's technical and economic viability as well as the environmental impact of the dam construction on the reservoir area and the downstream river corridor.

The study was divided into three stages and this workshop is expected to discuss in details the findings of the feasibility study in the third phase of the exercise.

Phase I of the study covered the initial environmental impact assessment (EIA) while phase ii looked at the best option for dam configuration, linking both engineering and environmental aspects of the project. Workshops to discuss the reports of these two stages were held in September 1994 and march 1995 respectively.

Ladies and gentlemen,

During this four day workshop, the study team will be presenting to you the findings of the stage 3 study which commenced in April 1995 after workshop no. 2. The study was divided into two parts consisting of line system survey, for the feasibility design, construction cost estimates and the project evaluation.

Economic indices of the alternative development schemes in respect of power development indicate that the low Grand Falls followed by Mutonga offers the optimum benefit for this project.

However, a review of the existing five reservoirs on the Tana indicate important implications for this project. Some of the critical issues that need to be fully addressed include:

(i) The impact on displaced population numbering about 1017 households;

(ii) Impact on agriculture and local food supply, water and sanitation and plant cover and sedimentation, among others.

The challenge to all the participants in this workshop, who are drawn from a wide spectrum of professions and interest, is to offer relevant and timely contributions which will enable us to chart the best course for the next proposed phase of hydro-power development in the Tana river basin.

With these remarks, it is now my pleasure to declare the Mutonga/ Grand Falls Workshop 3 officially open.

THANK YOU.

SPEECH BY MR. ATSUSHI MATSUMOTO, DEPUTY RESIDENT REPRESENTATIVE, JICA KENYA OFFICE, ON THE OCCASION OF THE OPENING CEREMONY FOR THE MUTONGA/GRAND FALLS HYDROPOWER PROJECT WORKSHOP 3 AT KENYA COLLEGE OF COMMUNICATION TECHNOLOGY ON JANUARY 26, 1998.

Honorable Minister of Energy, Mr. Chrisanthus Okemo, Representatives of Donors and NGOs, Distinguished Guests, Ladies and Gentlemen:

On behalf of Japan International Cooperation Agency (JICA) and Mr. Minoru Tagami, Resident Representative of JICA, Kenya Office, I feel extremely honoured to be able to address you on this occasion of the opening ceremony of the Mutonga/Grand Falls Hydropower Project Workshop 3.

This Workshop is being conducted for the purpose of discussing PUBLICLY results of the Feasibility Study JICA undertook according to a request from the Government of Kenya to the Government of Japan for the development of the Mutonga/Grand Falls Hydropower Project to meet her need in deed for energy and water.

As JICA is the official agency for the implementation of technical cooperation programmes of the Japanese Government, we were entrusted with this Study as one of our fresh tasks in Africa following the experiences mostly in South-East Asia.

Our Organization strives and whenever possible tries to contribute to the economic and social development of developing countries and at the same time promote international cooperation. Ever since its foundation in 1974, JICA's mission statement has been "human development, national development and bringing people together". In this regard, we attach a lot of value to the development of human resources for the sake of a prosperous world.

The JICA Study Team is made up of consulting members from Nippon Koei Company Limited and their colleagues who have been selected by JICA through competition of technical proposals which include the technical transfer of study methodology of Kenyan counterparts. The team started the Study from August 1993 and comprehensive development plans are formulated which provide the foundation of national development, and economic, effective implementation plans are proposed.

This Study envisaged four alternative development plans which would contribute to production of hydroelectric power as well as water supplies to agriculture and municipalities, further to floods regulations. To formulate an optimal plan for the Mutonga/Grand Falls Hydropower Project, the Study covered not only its technical and economic feasibility, but also a wide range of environmental aspects, including the impact of dam construction of the reservoir area and that on the downstream river corridor.

Then, regarding the specific plan which is considered most important among the proposed plans for a project's implementation, a full analysis is carried out for identifying required technologies, costs, organizations, operation and maintenance, for the purpose of determining the feasibility of a project's implementation and defining details of a project.

The JICA Study Team presented the draft final report to the Government of Kenya towards the end of last year and shall prepare the final report for this project based on the comments from the Kenyan Government and participants present at this workshop. JICA is especially interested in obtaining comments from the participants in the area of environmental assessment. The Kenyan Government delivered some of the reports to the formally invited participants whom we trust have studied them thoroughly for we would like to see active participation from all the participants and would not like to see anyone leave this forum dissatisfied with the reply to any question they may have. At the moment, the study related to the environment is currently not sufficient so we have asked the Kenyan Government to further conduct a study on the environmental conditions for the project before it is finally adopted because of the huge impact it could have on the people living around that area. I believe your active participation particularly in this area shall be of great assistance in finalizing this part of the study.

In the mean time, it is no secret that lately around the world, a phenomenon known as "aid fatigue" along with the economic crisis in South-East Asia has appeared in industrialized countries despite the ever increasing need to assist another country which may be in need to assist another country which may be in need. To counter this, the Japanese Government and JICA are seeking a way of ensuring that the international aid can do much not only for the better development of a country but also for contributing to the world peace and cooperation.

In this sense, JICA's activities should be open and, in addition to the Kenyan counterparts, the participation from the donors and NGO communities with your sincere and constructive comments are most welcome and essential.

Finally, I would like to extend my sincere appreciation to you all for your cooperative appearance in this workshop. The true goal of this gathering in not to realize the proposed project but to realize where we are now and where we are going to for the coming generation.

Thank you.

1 PROJECT INTRODUCTION

1.1 PRESENTATION

1.1.1 Location and Development Options of the Project

The Tana, which stretches about 1000 km from the peak of Mt. Kenya to the Indian Ocean, is Kenya's largest river with high potential of water resources. Currently, there are 5 existing dams with hydropower stations contributing about 60% of the Country's installed capacity.

The Mutonga/ Grand Falls project is located in the downstream of the existing Kiambere dam on the Tana with 2 main tributaries namely Mutonga and Kathita. The project is envisaged as 4 development options i.e.

1. Mutonga Dam
2. Low Grand Falls
3. Mutonga and Low Grand Falls
4. High Grand Falls.

1.1.2 Study Objectives

Objectives of the Feasibility Study were:

- To exploit indigenous energy resources and develop Mutonga / Grand Falls for achievement of self-sufficiency in energy supply to meet the increasing energy demand, as well as to contribute to water supplies with regulation of reservoir.
- To formulate an optimal plan for the Mutonga / Grand Falls Hydropower Project and assess its financial and economic feasibility.
- To undertake Environmental Impact Assessment, which will incorporate considering a wide range of environmental aspects, including not only the impact of dam construction on the reservoir area, but also that on the downstream river corridor.

1.1.3 Current phase and activity of the project

A water resource development project is usually initiated by a pre-feasibility study and is then followed by a feasibility study, leading to the implementation phase, which includes design and construction. This project is currently at the feasibility study stage.

At each phase, integrated activity is required between engineering and environment aspects of the project.

The project's downstream environment emerges as a unique area with a 600 km long river corridor which encompasses a flood plain, primate reserves and the Tana Delta. This indicates the need for careful development assessment on potential negative impacts of major development projects.

The current phase of the study, tries to assess as much as possible the impacts on the Tana River environmental systems. However, an Additional Environmental Assessment

on managing the river flow regime in order to maintain the downstream environment was found necessary before the project proceeds to the implementation phase.

1.1.4 Overall flow of the feasibility study

The feasibility study has been undertaken in three stages. Stage 1 was the Initial Environmental Assessment between February 1994 and September 1994 and included Workshop No.1. Stage 2 was Definitive Plan for selection of options and took place between September 1994 and March 1995 with the Workshop No.2 at its end. Stage 3 is the Feasibility Study on the selected option and commenced in April 1995, leading to workshop No.3.

1.1.5 Stage 1 study and Workshop No.1

During the Stage 1 study, initial environmental assessment was carried out on a quantitative basis to assess the potential impacts of the project to both the upstream and downstream environments.

Assessment was undertaken for the phases of construction, infilling and operation. It was found for instance in the operating phase, that the potential impacts would be generally positive in the upstream but negative in the downriver corridor.

Issues highlighted included the impact of dam construction on the upstream population that would be displaced and the change of river flow regime that will affect the biannual floods downstream.

During the Workshop No.1 held in March 1994, the following observations were made:

i) Implementation of the project would be acceptable with appropriate considerations and provisions on the possible negative environmental impacts.

ii) Negative environmental impacts would be highlighted on the resettlement of the population in the reservoir area as in the case of other dams. However, due consideration should be given on the impacts on the population and natural environment in the downstream river corridor.

iii) The impact on the change of the river flow regime especially on the biannual flood in the riverine corridor should be assessed to at least maintain the current flow regime.

1.1.6 Stage 2 study and Workshop No. 2

During the Stage 2 study, definite plan selection was carried out to select the most appropriate plan among the four options. The option of Low Grand Falls (LGF) plus Mutonga was rated as the most feasible because of higher net benefits. No appreciable difference among the options was detected for both irrigation and the control of large floods. Regarding environmental effects upstream, the results showed that there was a greater requirement for resettlement in respect of High Grand Falls (HGF). The longer infilling period for High Grand Falls (HGF) would have more negative impacts on the environment, whereas the study showed that LGF can accommodate flood release with decreased negative impacts.

The results of the preliminary examination on the viability of the selected plan showed positive net benefit with normal flood release at discount factor of 10% accruing from power generation and appreciable benefit, although not large, from irrigation. However, there would be no appreciable benefit as regards large floods. The impacts on the upstream populations would result in displacement of the population. Resettlement of that population would be within the vicinity of the reservoirs and would largely be on a land for land basis. In the downstream, the dam would be large enough to provide the storage capacity to allow normal biannual flood releases so as to minimise negative impacts on downstream systems.

During the Workshop held in March 1995 the following observations were made:

i) Low Grand Falls plus Mutonga incorporating normal flood release was rated the best option.

ii) The displaced communities to move to areas nearest to their former homes, and compensation should be land-for-land plus cash to compensate for loss of land.

iii) Artificial flooding will require due reference to any dam with a system of releasing flood and detailed assessment of the impacts of the flooding to the downriver environment.

iv) A parallel study, which is the Additional Environmental Assessment, would be required to deal with downriver environmental issues that would not be able to be incorporated in the stage 3 study due to lack of time and funding.

1.1.7 Stage 3 study

The results of stage 3 study will be presented in detail during this workshop. Conclusion drawn from the study with regard to implementation indicated that:

- Additional environmental assessment will be carried out before the implementation of the project for the purpose to set up river flow management. Two years will be required for the assessment.
- The project will be implemented in sequence of low Grand Falls followed by Mutonga, to be commissioned in 2008 for Low Grand Falls and in 2012 for Mutonga.

1.2 DISCUSSIONS AND OBSERVATIONS

Comments and observations made during the session included the following:

Q. How many local personnel (Engineers, sociologists etc) were involved in the study up to this stage? This is because of the colossal amount of data involved in the report. Has the study taken into account the following: a). Extreme cases caused by flooding at the sides (banks). b). The size of the tunnels. c). Has the study put in place adequate contingencies to cater for the time frame of the project implementation.

A. Local expertise and counterpart personnel were involved in all the three stages of the study. In stage 3, Acropolis Kenya Ltd. and Otieno-Odongo Consulting Engineers were involved in the Environmental Impact Study Assessment. The response for a), b) and c) were deferred until the following day during the

engineering presentation group discussions. Managing Director of TARDA clarified that his organisation was involved only in stages 1 and 2 but not 3.

Q. What does the study have in place in respect to deterioration of water quality and siltation downstream.

A. The response was deferred until the following day during the upstream and downstream presentation on the environment and the group discussions.

Q. What Environmental Assessment guidelines did the Study Team use especially on standards on water quality since no guidelines exist in the country so far.

A. World Bank, UNEP and Kenyan Standards were used in the study. It was re-affirmed that the guidelines in existence are in line with those of the World Bank, UNEP and ADB.

Comment: The country has an acute water shortage and the Tana being the largest source therefore, maximum storage and use is of cardinal importance, hence the Grand Falls is the largest and best option which must be fully utilised.

Since the Project implement programme has been extended to the year 2008, this should then avail the opportunity to carry out more detailed study to determine the best option for development.

2 ENGINEERING STUDY

2.1 OVERVIEW

Result of the engineering study consisting of the result of feasibility study and the summary of engineering study were presented by the JICA study team, referring the Executive Summary on the first day of the workshop. Following explanations of the engineering study, general discussion was made among all participants. On the 2nd day, discussion of the engineering study was carried out by participants who had interest on the engineering study and the JICA study team.

2.2 PRESENTATION

JICA study team explained the result of the feasibility study that has two components; 1) Plan formulation and 2) Project evaluation by following the executive summary as follows:

2.2.1 Plan Formulation

Optimum Development Scheme

The optimisation study in Plan Formulation was carried out in terms of power development, additional effect from irrigation and municipal water supply and artificial flood release. As a result, the Low Grand Falls (LGF)+ Mutonga scheme was selected as the optimum development option given its positive economic indicators. Other options that had been the subject of the study included development of the Mutonga only, the Low Grand Falls only and the High Grand Falls.

Further, the Low Grand Falls plus Mutonga was considered more appropriate from environmental viewpoints as its entailed less resettlement problem, had shorter impounding period and would ensure more sediment release than the High Grand Falls.

Accordingly, the Low Grand Falls plus Mutonga scheme was judged to be the optimum development scheme from integrated viewpoints of economic and environmental advantages.

Component Optimisation of the selected Plan

Through the comparison study, the reservoir water level, dam type and installed capacity of the selected plan were optimised.

Optimum Installation Timing

The installation year of the Low Grand Falls and Mutonga was studied by changing the installation to seek the least cost of the expansion plan. The study revealed that the earliest implementation of the Low Grand Falls and the Mutonga hydropower plants would contribute to the least cost of the national power grid.

2.2.2 Project Evaluation

Project evaluation was carried out for the selected option and the serial development of Low Grand Falls and Mutonga.

Economic Evaluation

The Project was assessed economically viable by the serial development of two schemes.

Financial Evaluation

The serial implementation of the Project was assessed as financially viable, and its loan repayment capability was confirmed.

Artificial Flood Release

The economic viability of the project was examined in line with the provision of the artificial flood release facility, taking into account environmental aspects, concept of cost allocation, and establishment of a monitoring system for the downstream corridor at the implementation stage.

2.2.3 Summary of Engineering Study

The summary of engineering study composed of:

1) Site conditions,
2) Power survey,
3) Preliminary design and
4) Construction plan and cost estimate:

Site conditions

The subject of the study in this section included:

- Location and topography
- Meteorology and Hydrology
- Geology

Power survey

This activity covered the following area:

- Existing power supply system
- Power demand forecast
- Transmission line

Preliminary design

Areas of attention for the preliminary design were:

- Preliminary design of the Low Grand Falls scheme

- Preliminary design of the Mutonga scheme
- Artificial flood and sediment release facility

Construction plan and cost estimate

- Construction plan and cost estimate considered the following aspects:
- Construction schedule
- Construction cost of the Low GF scheme
- Construction cost of the Mutonga scheme

2.3 DISCUSSIONS

2.3.1 Discussions During General Assembly

Q. The study should have taken into account the environmental changes in the entire Tana basin in order to guard against project failure. The example of Bura Irrigation Project was cited, which at the time of implementation did not take account of the frequent change of the river course, thus adversely affecting the success of the project.

The view was expressed that the study should have come up with the natural flow of the Tana River and its effects before and after the current power development.

Kenya's population growth is on the increase, estimated at 30 million at the time of commissioning the project and it is not clear whether the study has incorporated this demographic change in the report.

A. The study reveals that since 1957 to 1990, there has not been any significance change in average river flows. Change in flow regime is primarily due to climatic changes and at the same time there is very little water diversion for other uses than hydro electric power generation.

Q. In view of the scarcity of water in this country, it is deemed appropriate to consider construction of a large dam, rather than a small one whose life span is 50 years. This is because a large dam will accommodate the increasing demand for water.

In the current Project Development Strategy, has the study taken into account the Environment impacts in the immediate environs and upstream. During two years Environmental Assessment period is it possible to a locate time to study the impacts of the larger dam (High Grand Falls) before the decision is made on the final option. Another participant expressed similar sentiments. In addition, he wanted clarification on the matters of sedimentation and storage aspect in relation to existing dams.

A. The scope of the study is based on the outcome of the previous studies such as National Water Master Plan (1992), Kenya Power Development Study (1987 and 1992), and the Kiambere Implementation Study.

Based on the economic and environmental considerations as explained in the project introduction, more benefits accrue from the implementation of Low Grand Falls plus Mutonga. High Grand Falls has more adverse effects on the

environment, on resettlement, infilling period and sediment release and has a greater effect on the adequate supply of water to downstream users.

Comment: The scarcity of water due to alternative water demand upstream and the need for adequate storage in whatever development option was emphasised. In view of the fact that, there is increasing demand for water in the Coastal Region and Tana River being an alternative source to Athi and Mzima Springs, the storage sites available must be maximised to meet current and future water demands.

Similar sentiments were echoed by another workshop participant who also emphasised the importance of rainfall patterns, water evaporation rates, land use systems, and an optimum solution of water storage for the whole course of the river.

Q. During Workshop II, it was recommended that small dams and weirs be constructed on the tributaries upstream with a view to reducing siltation into the new reservoirs and cater for domestic water supplies and irrigation. It was observed that this particular aspect is not reflected in the Stage III report.

A. Siltation is an important factor of watershed management. However, it did not feature in the present study as it is outside the scope of the project development.

Q. The current study is focused more on hydropower production, whereas emphasis should be multi-purpose option.

The storage capacity of low Grand Falls is about 1/3 of the total storage capacity of the High Grand Falls, but the work fill volume 22 million m^3 of water, whereas Low Grand Falls is about 5 million m^3. Since the two share the same axis, it appears that the fill for the High Grand Falls is over-estimated and hence renders the Project unviable. The fill volumes should be re-examined.

A. High Grand Falls option requires steep increase of dam volume due to topography therefore the increase in power and irrigation benefits are not able to meet the added cost of the project. The future urban and municipal demands are small, and can be met without a dam.

Reactions to Presentation of Major Findings

Q. In view of the recommendation that the Additional Environmental Assessment be carried out to quantify the multiple use of water, could the study reassess the selection of the option?

A. There are specific terms of reference defining a specific scope of work, therefore comments which are outside the scope of work will not be addressed by this study. However, it is suggested that a comprehensive study that deals with the overall water resources development of the Tana Basin would contribute to reassess the option.

Q. What will happen to the findings of this workshop?

A. All the findings of the workshop will be discussed by the steering committee and form the basis for the Additional Environmental Assessment study as well as studies during the detailed design phase.

2.3.2 Group Discussion: Engineering Study

Site Conditions

Q. The Grand Falls dam site may be seated on a fault. What you are referring to as a minor fault may not be minor. Has this been adequately assessed?

A. Seismicity tests were done, including boring and geological tests but indicated no live faults in the dam site area.

Q. How then do you account for the 90 degrees change in river course?

A. There must have been some structural change in the past but from geological investigations on the dam site and surrounding area have not revealed a fault.

Q. Referring to page 3-13 of Main Report, does it not appear from the impounding that may occur during construction, the pressure might be so much that it may cause structural damage and water loss from the dam structure at a later stage?

A. After exhaustive consideration on this aspect, we don't think this may pose any serious future problem on the dam structure.

Q. Was it established whether the fault is active or not?

A. Geological and seismicity studies have not revealed any active faults. A large intensity for seismicity which would occur at a site close to a seismic zone such as Rift Valley was not necessary to be applied.

Q. From page T-39 of the main report, Low Grand Falls sediment inflow is given as 1.52 million m^3 and that of High Grand Falls as 2.62 million m^3 where is the extra sediment from since we are talking about the same site only different dam heights?

A. High Grand Falls has sediment that would otherwise settle at Mutonga and Low Grand Falls. However, in the case of Low Grand Falls some of the sediment will have been trapped at Mutonga. Fig. F-24 illustrates sediment flow diagram.

Q. Was a full geological feasibility study done to establish the bottom of the dam? This question was prompted by the use of the word "assumed" in Fig. S-16.

A. Borings were made and acceptable depths established (Fig. S-8 and S-9). Therefore "assume" is not an accurate description.

Q. If the rocks have a low permeability, then why use curtain grouting? If curtain grouting is used at the depth shown, a lot of blasting will be required which may introduce fissures and cracks.

A. It is difficult to establish exactly where fissures and cracks are. Therefore curtain grouting is recommended especially when a large dam is concerned. Also, it is an international requirement that grouting be undertaken for dam of this size.

Environmental Assessment

Q. Was sedimentation from the land use practices near the reservoir taken into account and what percentage will this contribute?

A. This was examined under the environmental assessment study. The proportion of the contribution will be determined during the additional assessment study.

Q. During the dam impoundment, will waters be released downstream?

A. The water act requires that a minimum flow be maintained whenever abstractions are done.

Q. Can the infilling period (27 months) be extended so as to reduce the negative impacts downstream?

A. This can be done but flows released downstream would still be lower than average.

Q. How will upstream water abstractions for user such as horticulture affect the planned reservoir volume?

A. The analysis of irrigation upstream was done by updating water use investigated in the National Water Master Plan.

Comment: There is need for a study to assess the impact of horticultural development in order to develop a water management package to avoid a situation where the river may literally dry up.

Power Survey

Q. Would the study also consider extending power supply to Garissa and other downstream districts.

A. The decision to extend power supply to the said area lies with MOE and KPLC.

Plan Formulation

Development Options were explained by the Study Team. It was clarified that of the four development options, the LGF + Mutonga was found to be the optimum scheme on the basis of economical and environmental considerations at the end of stage 2 of the study. The Steering Committee, after considering these findings, approved the full feasibility study on the selected option to be carried out.

It was appreciated that though a scheme that would develop LGF and later raise it to HGF is technically feasible, it would be less economic than LGF + Mutonga.

A general observation was that, this being the last site with potential for developing large capacity storage, it would be prudent to maximise the reservoir size in order to realise such benefits as flood control. However, after considering various water uses and potential environmental impacts, this was found to be infeasible.

Q. From Pg. S-3 of the Executive Summary, the height difference between the Grand Falls dam site and Kora Rapids should be about 250m not 200m.

A. This will be checked and corrected.

Q. Refer to pg. T-40 of the Main Report: Embankment figures: the variation is rather too big for dams on the same axis.

A. Difference in embankment is due to the relatively flat topography of the area above the level of Low Grand Falls.

Q. Refer to pg. T-40 of the Main Report: Live Storage figures: High Grand Falls has four times as much impoundment as Low Grand Falls. This should be investigated further.

A. Live storage of LGF and HGF were calculated by using 1:5,000 scale topographic maps.

Q. Refer to pg. T-40 of the Main Report: Dead Storage figures: Dead storage figures seem too much yet the main sources of sediment are Mutonga river and Kathita only as upstream dams will reduce sediment deposit for High Grand Falls. A related question was also asked: dead storage is oversubscribed. Why not reduce it and use the dam for river flow regulation?

A. Minimum operating level studies were done taking into account sediment flow and this was the optimised result. No appreciable difference in minimum operating level was obtained when irrigation was considered. Besides a large dead storage increases the life of the reservoir as it serves to deposit sediment.

Q. Is there an optimum height at which the High Grand Falls breaks even?

A. The dam height exceeding the LGF contributes to steep increase of embankment volume and loss of water head between the Kiambere and Grand Falls site. This results in a less feasible option.

Q. Water use considerations should be given higher priority. Therefore decision should be reached not from an economic point of view only.

More details of the High Grand Falls should be given such as intake, gates, etc

Dead storage for High Grand Falls is too large. Low level outlet should be considered.

A. As explained in the project introduction, the assessment of integrated aspect of economy and environment concluded that the optimum to be the LGF plus Mutonga for which the preliminary design was carried out.

Q. Why are concrete type dams recommended when embankment material is so readily available in the area?

A. Concrete type is recommended because of it is more economical and is also able to incorporate the sand flushing facility in the body of the concrete.

Q. With costs notwithstanding, does it not appear that the 27-month infilling period for the HGF reservoir will not be too long a period considering the wider national interests served by having the larger water storage?

A. The simulated infilling period creates an artificial drought downstream whose damage is extensive and the effects of which can be expected to persist beyond the infilling period. Infilling periods for HGF may also be longer than 27 months.

Q. Regarding the data for simulation to determine various possible scenarios, what period of time was considered? What are the climatic predictions over the lifetime of the dams?

A. The team used daily rainfall and river flow data measured from 1957 to 1990. Existing upstream dams were built into the simulation models using this data. Lower rainfalls may be expected due to global climatic change.

Q. Could the values indicated on page 4-39 of the main report regarding various other non-energy water uses be incorporated into the economic evaluation for all the options so as to give a full comparative analysis.

A. Although the figures were provided, they do not give the actual social benefits in monetary terms.

Q. Participants wanted to know whether the height of the dam was optimised in relation to the topography of the area to maximise water storage and power generation.

A. In regard to dam height, two options, Low Grand Falls and High Grand Falls (HGF) were considered. After analysis the Low Grand Falls option was found to be more economic. A dam height greater than that of Low Grand Falls but less than that of High Grand Falls would result in high cost and in the loss of head between Kiambere tail-water and the Grand Falls site.

Comment: There was concern on the cost per unit for the combined Low Grand Falls and Mutonga option. Participants maintained that given the costs per unit at Mutonga and Low Grand Falls are 9.1 and 7.9 US cents/KWh respectively, the indicated combined cost of 6.9 seems too low.

Q. Is proposed input timing of LGF and Mutonga appropriate?

A. If the project were to proceed, its timing would be determined by analysis during formulation of the National Power Development Plan.

Preliminary Design

Q. Will the diversion tunnel have any other use?

Was a weir type of spillway, which does not have maintenance costs, considered instead of gated spillway?

Sand flush facility and the intake are at the same level. Shouldn't the sand flush facility have been lower?

A. The diversion tunnel may be useful if low-level output is put up.

Weir type spillways are used where the dam is wide to accommodate the flood volumes equivalent to the extreme flood, 1:10,000 year in this case. The gated spillway is adopted because the dam is not wide enough for a weir type spillway.

Studies were carried out to determine the level of the sand flush facility so that bed load can be flushed out.

Q. From graph on page 5-5 of the executive summary a draw down of up to 1100 m^3/sec in 48 hours seems to be unrealistically high. Doesn't this pose a risk to the dam structure?

A. Three release patterns base don analysis of existing "normal" floods were examined. The one referred to gave the highest figure, but reservoir draw down is not large. However, the actual discharge rate will be determined at the detailed design stage according to the results of the additional environmental assessment.

Q. Historically, mechanical systems are known to present unique operational problems yet preliminary design suggests so many of these, such as spillway gates and flood release?

A. Given the fact that the dam is not wide enough for a weir type spillway, a gate spillway remains the only option. Also since the flood release facility is embodied in the main dam, only a mechanical release system is suitable.

Q. The intake and spillway have been designed adjacent to each other, doesn't this pose the risk of trash getting into the turbines?

A. A raking facility is provided at the power intake of the turbines but the issue will be further considered at detailed design stage.

Q. There is fear that the interface between concrete and rockfill dams might present unique operational problems that may need to be addressed at detailed design stage.

A. This is not a new concept internationally.

Q. The rockfill portion of the combined dam at Low Grand Falls should be slightly higher than the concrete portion. This will ensure that when the reservoir is full, water will overflow from the concrete part thus preventing erosion on the rockfill portion.

A. This will be addressed at the detailed design stage.

Q. It was felt that releasing 490 million m^3 which amounts to 51% of the live storage in six days is a very fast draw down which may result in pressure build up problems at the junction between concrete and rockfill portions of the combined dam.

A. Flood release will be at the beginning of the rainy season. Thus there will be inflows into the reservoir to replenish what is being released. Simulation studies show that this release is feasible.

Q. Is it possible to apply an underground pass similar to the Kiambere power station?

A. Construction of an underground powerhouse was considered and found not to be feasible since the available head is small and the topography of the site is not suitable.

Construction Plan and Cost Estimate

Q. If Low Grand Falls is constructed first, how will construction of Mutonga project be affected by the head waters of Low Grand Falls?

A. A coffer dam will be constructed at the Mutonga site during the implementation of Low Grand Falls to prevent inundation of Mutonga site.

Q. What exchange rate was used?

A. The exchange rate was the rate as of June 1997 (US$1 = Ksh.54).

Q. Project cost seems to be high. How do you estimate the construction costs?

A. In deriving the cost estimate, international unit rates were used for generating equipment and hydro-mechanical works. For civil works these were compared and adjusted according to the labour, material and equipment costs in Kenya.

Project Evaluation

Q. In the financial evaluation, what was the basis of assuming on 85% financing? Won't the 15% local portion constrain timely funding of the project?

A. OECF loaning conditions were applied. These are also comparable with other internationally accepted loaning conditions.

Other Aspects of Engineering Study

Q. There is doubt about the accuracy of data given in a table on Pg S-1 of the executive Summary.

A. These data are from previous studies.

Q. The distance of the project site from Nairobi seems to underestimated at 150 km.

A. The 150 km distance quoted in the report is the air distance. It was recommended that the shortest distance by road should also be given.

Q. Is the sediment from Kiambere, which is the source of the sediment that eventually flows into the proposed reservoirs?

A. The latest data was gathered during 1995, which was a wet year and therefore a relatively high sediment load. It is therefore considered to be good data to work with. However, the majority of sediment input to the proposed reservoirs is from the Mutonga and Kathita Rivers.

Comment: Universities should be involved in the additional Environmental Impact Assessment study for measuring sediment data for the sake of continuity after the study is complete. It was further clarified that though this falls under TARDA's responsibilities, it would be useful to the universities.

Q. Would the study consider proposing an access road from Mwingi the project area to Tharaka-Nithi district?

A. Road expansion is beyond the scope of the project. But the project proposes access road between Kiambere and Low Grand Falls as a minimum requirement.

Q. In view of the above comment, did TARDA carry out a parallel study to quantify the other accruable benefits?

A. This was not possible as there was no immediate funding arrangements for such a parallel study.

Q. Has the proposed project taken into account the possible future developments such as Kora Rapids in terms of available discharge and head?

A. The previous study indicated the possibility of hydropower development in the downstream although the scope of this study excluded its examination.

Q. It was suggested that in addition to the tarmac road to be built from Kiambere to the dam site as part of the project, the existing C93 road to Mwingi via the proposed project area to the districts across the river be upgraded.

A. This is a good proposal, but if incorporated within this project, it would make it very costly. The relevant authorities may however follow this up using separate financing.

Comment: There was concern on whether any contrary comments arising from this discussion will be accommodated in subsequent stages of the study.

Q. Instead of the proposed scheme to raise Masinga storage capacity is it possible to achieve the same objective by implementing the proposed project and thereby reduce the associated environmental costs for both sites?

A. Masinga, being the overall storage for all dams downstream, will still remain the main regulating reservoir even after the implementation of Low Grand Falls and Mutonga.

Comment: The involvement of local universities, professionals and other personnel is important for the continuity of the project. It was therefore suggested that the implementing agency should ensure that this is done during forthcoming stages.

3 UPSTREAM ENVIRONMENTAL ASSESSMENT

3.1 OVERVIEW

The upstream catchment area includes a wide range of ecological zones including alpine glaciers, afro-alpine, moorland, high altitude forest, semi-arid and arid areas. It covers several districts including Meru, Nyambene, Tharaka-Nithi, Embu, Mwingi and Mbeere Districts. This section examines the upstream environmental impacts of the proposed project with special emphasis on resettlement and compensation.

Most of the rainfall generally varies with altitude with the upper catchment receiving higher amounts of rainfall, which decreases as one approaches the proposed dam areas. The area has diverse population densities, which varies from high density in the high agricultural areas to low densities in marginal areas of the proposed reservoirs.

Within the upper catchment area there is intensive land use while in the vicinity of proposed dams the land use is extensive farming with emphasis on pastoralism. The land use practices in the catchment have contributed to environmental degradation and accelerated soil erosion contributing to sedimentation of the Tana tributaries and the existing dams.

Within the Tana Catchment:

- Most of the rain falls in the upper catchment covering only 10% of the basin.
- Rainfall is highly seasonal but bi-modal, more or less distinctly recognised as long and short rains.
- The Bi-modal pattern of rainfall is usually reflected in bi-annual floods downstream
- The project is largely arid and semi arid.

3.2 PRESENTATIONS

The presentation laid emphasis on the six issues that are associated with the proposed project. These are:

- Households and population affected.
- Land Tenure
- Infrastructure and Services
- Household surveys
- Resettlement options and Compensation
- Power Transmission Line

Reservoir Area Households & Population

Projections and field estimates were used to determine number of households directly affected, including those in:

- Area of inundation (Reservoir Area)
- Buffer zone (100 metres)
- Special Management Zone (SMZ)

Land Tenure

It was indicated that land adjudication has not taken place in Mwingi and Tharaka-Nithi districts. However ownership status as perceived by individual household owners differs from officially recognised status.

This needs to be considered during discussions of resettlement and compensation.

Infrastructure and Services

Tana Bridge will be flooded and as such it will require a new bridge and modified road alignment. Other facilities directly affected by the reservoir will include; schools, health centres / dispensaries, markets, churches, boreholes and cattle dips.

Household Surveys

- Thirty-one villages and 304 households were sampled
- 16% of families have already been displaced by previous project upstream.
- 98% had heard of the project. However, the idea of the project is clear to only 13% of those interviewed with a large majority stating that it was Not Quite Clear, Not Clear, or had Never Been Explained.
- Despite this, the project was acceptable to 65% of respondents to the questionnaires
- Sentiment from public meetings confirmed this view
- While many respondents did not have a clear idea of the project they were of the opinion it would be beneficial
- Expected benefits of the project included: Irrigation (33%), Infrastructure (40%), Employment (20%)
- The main reason for concern and lack of acceptance of the project was stated as the fear that residents might lose land without receiving suitable replacement (35%)
- The two-week morbidity incidence is 30%. The main causes of morbidity include malaria, which accounts for 40% of cases. This already high incidence is likely to rise following inundation of the reservoirs

Water Supply

- The main source of water is rivers (42%) during the wet season and 68% during the dry season). Water is within 1 Km for 24% of households and within 3 Km for 50%
- Access to the reservoir for water supplies will therefore be especially important and supplies of piped water would represent a substantial increase in the standard of living, and open up larger areas for potential resettlement

Resettlement Options and Compensation

- The proposal for resettlement within the Special Management Zone (SMZ) is therefore realistic, and, moreover, is most likely to be viewed favourably by those impacted

- Within the SMZ, resettlement should be on the basis of sufficient land plus cash assistance during the transition period

Potential Resettlement Areas

- Successful resettlement requires:
- Former livelihoods, or equivalent, restored
- Host populations provided with necessary support
- Infrastructure upgraded
- Both resettlers and hosts involved in planning
- To the extent possible, preferences expressed by the local population should be honoured

Local Preferences for Resettlement

Most respondents expressed a desire to:

- resettle close to their existing location
- relocating with family members, or
- with people from the same village

86% of respondents preferred employment in mixed farming and animal husbandry. Most of the remainder prefer farming alone

Effects of Relocation in Special Management Zone

- The displaced population can be resettled within SMZ
- Carrying capacity within the area indicates a necessary shift away from livestock towards more intensive agricultural activities within SMZ
- Requires rural development programme

Pre-Reservoir Situation

In the pre-reservoir situation there will be Riverine forest, grazing land, arable land and bush. However with the project implementation there will be:

- Loss of riverine forest, and hence need for riverine forest species raised in nurseries and planted as a buffer zone.
- Narrow buffer zone to allow intensive management and protects reservoir from eroded sediments.
- Increased land pressure in adjacent areas leading to increased erosion and collapse of farming system
- Need for improved conservation based farming systems, destocking and on farm tree planting requiring active support, particularly in area nearest reservoir.
- Loss of infrastructure and increased pressure on remaining infrastructure, thus new and improved schools, churches, water suppliers need to be constructed

Power Transmission Line

- Right of way (ROW) largely passes through Special Management Zone
- Associated impacts include:
- Reduced area available for resettlement in SMZ (by 16 km^2)
- Increased access
- Runoff erosion, especially during construction
- Contamination from chemical ROW maintenance techniques
- Vegetation damage and habitat loss ROW
- Bird hazards from transmission lines
- Aircraft hazards from transmission lines and towers.

3.3 DISCUSSIONS

3.3.1 Summary of Discussions

The following issues were raised during the general assembly and during the group discussions.

The communities affected should themselves be allowed to choose the best alternative compensation as the group or the study team does not have the ultimate mandate of the people in the project area.

The group noted that the SMZ provided for is not adequate and thus the study should redress this issue. Further the study should look into the relationship between the inhabitants of the SMZ *vis-à-vis* the new settlers/displaced persons.

Further studies on the environment need to be carried out with a view to coming up with an updated environmental audit report nearer to the time at which resettlement is to take place.

The group felt that there is a potential for cultural conflict between the displaced persons and host clans in SMZ.

The group felt that the issue of water for irrigation has not been fully addressed.

The group was of the opinion that sufficient and clean water should be made available to the persons/communities in SMZ, this will ensure that proper sanitary conditions are maintained as such reducing pollution in the reservoir.

The group felt that infrastructure and facilities must be compensated/improved to ensure that the local people identify themselves with the project.

The study had indicated that the mode of land compensation to be either land for land and cash but after discussions the group was of the view that the matter addressed by the affected persons who will determine the best option.

The group also observed that re-evaluation of the land be carried prior to project commissioning.

The group noted that several human activities such as deforestation, and forest fires in Mt. Kenya and the use of agrochemicals in farmlands will impact the water quality

upstream. The group suggested the following measures should be used to arrest the above problem.

- An Integrated approach to catchment management by NGOs, GOK, institutions and other stakeholders.
- Creating awareness through extensive services through the local administration and use of legal framework where necessary.
- The group proposed analysis of pesticides and herbicides in use in the upper catchment as its not been covered by the previous studies.

3.3.2 Discussions: Upstream Environment

Q. Has the study incorporated Biodiversity that will be lost during project implementation?

A. This aspect was fully covered in phase 2 of the study that included a Biodiversity analysis along the riverine corridor. It was also indicated that the Biodiversity issue was fully covered including values of the loss to the community in phase 3 studies.

Comment: It was noted that in phase 3 study only two human diseases were only identified i.e. Malaria and Bilharzia, and as such suggested further studies on the following diseases: Human diseases including typhoid, amoebiasis, sleeping sickness, and livestock diseases including trypanosomiasis / Nagana, schistosomiasis, Rift Valley Fever and liver flukes.

It was noted that the effect of the mentioned diseases should be studied in relation to human and animal livestock production around the dam. It was further suggested that people in Special Management Zone (SMZ) should be assisted and encouraged to practice intensive farming methods such as poultry keeping, pig farming, zero grazing, bee keeping in order to cope up with increased population and land pressure.

A. The group agreed to have these views incorporated in the Additional Environmental Assessment.

Q. It was felt that the previous study had not fully taken into account the expected costs and losses of the infrastructural facilities during project implementation and the authority responsible for compensating the resulting losses.

A. The task force already recommended by the group will be expected to handle all aspects of relocation, resettlement and compensation of all losses.

Q. How has the study addressed the issue of sensitising the affected community on the subject of cash compensation, to ensure that there is no misappropriation of funds meant for resettlement, especially money for land purchase and development.

A. It is necessary to create community awareness through such forums as schools, barazas, workshops and community groups and in churches on the actual financial benefits accruing from the compensation to the family members affected.

The task force appointed should work in close liaison with displaced persons to ensure all aspects of compensation and resettlement are exhausted to avoid future conflicts.

Further, the task force should not be restricted to only one mode of compensation but should adopt other modes e.g. compensation in kind (i.e. provision of building materials) to avoid embezzlement of compensation money. However, this should be handled with care, as it is prone to corruption.

A further study in regard to land acquisition at SMZ is required. It was also observed that the SMZ may not be able to accommodate all the displaced persons and hence people need to be given the opportunity to identify land for purchase elsewhere and the cost be met by the implementing agency.

In order to accommodate gender balance, the group suggested that women representatives from the affected area be incorporated in the task force.

Q. What parameters has the study put in place to measure or indicate the level of success of the project/dam to the general environment?

A. It has been proposed by the study that a monitoring institution/unit should be put in place.

Q. How has the study addressed the provision of social amenities such as water, electricity to communities in SMZ?

A. The group highly recommended that such amenities as electricity and drinking water be supplied.

Q. Is the Kibuka Falls (Grand Falls) going to be affected by Dam construction? It was noted that the falls have religious implications for the local community. Are the local people aware of this new development?

A. Yes it will be affected since it falls within the project area. The community is already aware of of the proposed project. Therefore there is need for psychological preparedness through undertaking of necessary cultural practices by elders of the community.

In recognition of the cultural values of this site, it was proposed that the dam be renamed Kibuka Dam other than Low Grand Falls.

In this regard it was also noted that such naming would be in order so long as the necessary consultations are carried out with all of the local communities, representing the different cultural traditions, and the legal authorities.

Q. What would be the cost of further studies or mitigation on the translocation of Kibuka and are there any funds set-aside for this purpose.

A. The issue was not incorporated in the current study and should be referred to the proposed task force and elders charged with the responsibility of displacement and compensation.

Q. How will the cultural or traditional artifacts be salvaged?

A. Detailed studies on cultural artifacts need to be carried out to determine ways of salvaging them in consultation with the local elders and National Museums of Kenya in order to avoid conflicts.

It was confirmed that previous studies did not exhaust fully the modalities of salvaging and therefore a further study would be required in the proposed additional Environmental Assessment.

Q. How are the local communities going to benefit from the fishing activities around the dam?

A. The local people should be sensitised to adopt fish production, consumption and marketing as a new way of life given the changing socio-economic environment.

Q. It was proposed that a revisit of the river model simulations be undertaken to make it more elaborate in terms of nutrient retention capacity and how this will affect the dam production.

A. It was indicated that the initial model was basically to determine whether the dam was going to cause any significant effect to nutrient availability in relation to downstream environments. Further it was clarified that simulation models in the phase 3 study were specifically based on hydropower production and fishing. Hence given the possibility of multipurpose use, additional studies should be carried out to analyse these questions in more detail.

Q. Experience has shown that construction of dams brings in new aquatic animals such as hippos and crocodiles into the new environment. How has the study addressed this issue and particularly coexistence of the said animals and the human community?

A. The creation of the buffer zone in the study will function to provide a barrier between the animals inhabiting the dam and the community settled in the SMZ. They should be fenced to restrict the movement of the said animals. Similarly the community will not have direct access to the dam and this will further enhance water quality, as the wetlands in buffer zone will be conserved, and at the same time reduce transmission of human diseases.

Q. What measures have been undertaken to avoid the introduction / transportation of water hyacinth from fishing areas already affected into the reservoir through fishing gear and equipment.

A. Currently TARDA and KPC have embarked on a surveillance program on all the dams and will soon come up with guidelines and regulations to curb introduction of fishing equipment from other areas.

Similarly the fisheries department has already control mechanisms on the methods and controlled fishing activities.

There is a need for a deeper research and monitoring of both at micro and macro levels of all reservoirs as the water hyacinth seeds are airborne.

It was also noted that the issue was not incorporated in the study and should be given due consideration in any future studies.

Q. From the presentation by the group, it was suggested that compensation for the displaced persons be by land for land and/or cash. However, there was a feeling that this could create a culture of dependency whereby communities rely on implementing agencies for materials and economic support.

A. There is a need to sensitise the affected communities on the consequences of resettlement to avoid dependency.

Q. Noting that there is a possibility that the upstream population may refuse to move out of the reservoir site, has the issue been addressed in the study?

A. During the sample survey the local community indicated willingness to move. It was also noted that the Land Act clearly stipulates that in case of compulsory acquisition, the population is compelled to move.

Q. Noting that the study did not include all the stakeholders, how is this issue going to be addressed?

A. The Ministry of Energy will endeavour to ensure that all stakeholders are incorporated in further studies, planning and implementation of the project.

Q. How will the Special Management Zone (SMZ) without irrigation component would accommodate the carrying capacity of the increased population?

A. All development plans for all districts in the study area show that proposed areas of irrigation fall outside the Special Management Zone. It was further indicated that in upper catchment of Tharaka-Nithi pump irrigation as opposed to gravity flow would be costly. Further to this, in the SMZ the terrain makes it difficult to find suitable irrigation sites. Irrigated agriculture would also require packages involving expensive inputs, particularly fertilisers and pesticides.

Comment: Further assessment studies need to be carried out to establish expected environmental and sanitation conditions in the special management zone following increased population in order to minimise impacts on water quality.

Q. It was suggested that the study should identify the body to be charged with the responsibility of land compensation management. Land acquisition should be undertaken on current for both the projects to avoid duplication of compensation.

A. The project is the property of the government of Kenya and the GOK machinery in place will be adhered to in land acquisition and compensation.

The study has recommended land for land compensation as the best alternative on previous experiences and the recommendation of the World Bank.

Q. Concern was expressed that a broad based consultation was not undertaken with the relevant stakeholders e.g. NGO's, CDV'S, DDC as required for such a major project in category A.

It was also indicated that there is a need to quantify in monetary terms the value of cultural and historical sites, biodiversity and social impacts.

Concern was expressed about the technological transfer as most work had been done by outside consultants.

A. It was pointed out that stakeholders have been involved through field surveys, local leaders and public workshops.

Q. Irrigation was not looked at seriously especially on Mwingi side where it was felt that the soils were good enough for canal irrigation. If enough water is supplied within the Special Management Zone (SMZ) we may minimise the pollution of the dam.

A. These areas are marginal in terms of soils and rainfall. Irrigation production may require a change of cropping patterns that may not be suitable to local people. The proposed irrigation schemes through District Development plans are outside SMZ.

Water will be supplied to the SMZ for both animal and human consumption. This would alleviate sanitation problems and reduce pollution of the dam and minimise contracting water borne disease.

Q. If the existing Katama bridge linking Mbeere and Mwing districts is submerged, is it not going to affect the local communities and how will it be compensated?

A. If Katama Bridge will be submerged then an alternative means of crossing the river will have to be provided. Consideration has been given to the provision of vehicle access across the crest of Mutonga Dam.