REVIEW

OF THE

Environmental Management Division

THEUN-HINBOUN POWER COMPANY LIMITED

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BY

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List of Abbreviations

ADB	Asian Development Bank
AP	Affected Persons
CUSO	Canadian University Services Overseas
EdL	Electricite du Lao
EMD	Environmental Management Division
FAO	Food and Agriculture Organization
FCZ	Fishery Conservation Zones
GDP	Gross Domestic Product
GPS	Global Positioning System
GIS	Geographical Information System
GoL	Government of Lao PDR
Ha	Hectares
kg	Kilogram
k	Kip
LEK	Local Ecological Knowledge
LARReC	Living Aquatic Resources Research Centre
LOGFRAME	Logical Framework
MCP	Mitigation and Compensation Program
MDR	Minimum Downstream Release
MRC	Mekong River Commission
m^2	Square Meters
m^3	Cubic Meters
mg/l	milligram per litre
NACA	Network of Aquatic Centre in Asia Pacific
NGO	Non Government Organization
NTFP	Non Timber Forest Products
NTU	Nephelometric Turbidity Units
NT	Nam Theun
NBCA	National Biodiversity Conservation Area
PDR	Peoples Democratic Republic
PRA	Participatory Rural Appraisal
RDC	Regional Development Coordination
STEA	Science, Technology and Environment Agency
THPC	Theun Hinboun Power Company
T-H	Theun Hinboun
TSS	Total Suspended Sediments
VAC	Village Administrative Committee
VDC	Village Development Committee
WCS	Wildlife Conservation Society

Review of the Environmental Management Division For Theun-Hinboun Power Company Limited

A. BACKGROUND

1. In 1998, the Theun-Hinboun Power Company Limited (THPC) commenced with commercial operations of a "Run-of-River" diversion dam on the Theun River in central Laos. This dam diverts approximately 110 m^3/s of water through a 6-kilometer tunnel under a mountain range into a 210 MW power station. The water is then released into the Hai River, that then flows into the Hinboun River, which finally flows to the Mekong River.

2. After several years of operation, THPC determined that the social and physical environmental impacts from the project were greater than originally forecasted. Accordingly, THPC engaged a consulting firm to investigate such impacts, and thereafter THPC adopted a 10-year Mitigation and Compensation plan (MCP) in 2000. The MCP identified the following as the major impacts from the project:
   - Loss of dry season riverbank gardens, which were an important source of food and income.
   - Loss of access to traditional fishing and fish breeding areas, which are an important protein source for villagers.
   - Erosion along sections of the Hinboun River, which caused loss of land and access to clean water supplies.
   - Losses of income by villagers due to delays by the company in taking action to solve the problems caused by the project.

3. As proposed in the MCP, in 2001, THPC established the Environmental Management Division (EMD) within the company to address the issues raised in the MCP, which provided that approximately 3,000 families in 57 villages had been impacted by the project. One of the first actions by EMD was the development of a management strategy in the form of a logical framework (Logframe) to implement activities to mitigate identified project impacts.

4. A significant number of Logframe activities have been initiated over the last 18 months, and preliminary indications are that such activities are showing relatively good progress.

5. One of the provisions of the Logframe was that a review should be undertaken every two years. THPC decided to undertake this review within the first quarter of 2004 with the overall objective being to examine the effectiveness of THPC's mitigation and compensation activities; and in particular, to examine the strategy and actual implementation of Logframe activities as well as the operations of EMD, and to make, where appropriate, recommendations to improve EMD's performance with such matters.

6. This report summarizes that review.

B. METHODOLOGY

1. Three independent consultants specializing in watershed management, community development and fisheries were chosen to make up the review team. Their terms of reference are provided in Annex 3.

2. During the initial briefing, the General Manager emphasized that the primary purpose of the review was to investigate all activities within EMD's Logical Framework and provide constructive criticism and recommendations where appropriate.

3. The review team spent 27 days working out of the project office in Hinboun District, Khammouane Province in the center of the project area. A large number of project documents and consultant reports were reviewed. EMD staff members were interviewed both in the office and in village situations. Discussions with affected villagers were carried out routinely throughout the course of the review. Villagers were interviewed both with and without project staff present. Each team member took on specific review tasks related to their area of expertise. A representative subset of villages was visited by individual team members within the headpond area, within the Nam Hai Hinboun area and in the Pak Kading area.

4. An interim meeting was conducted between the review team and project management just over half way through the review to provide preliminary observations and solicit feedback from management.

5. Ongoing discussions were held with EMD staff throughout final preparation and report writing phase to solicit their response to the review team's ideas.

C. MAIN FINDINGS & RECOMMENDATIONS

The following are the main findings and recommendations made by the Team. Please note that they are listed in order as such issue is presented in Section D of this report, as denoted by the number in brackets following each finding and recommendation.

1. The Social Impact Compensation Strategy is well conceived and the implementation of activities are largely successful. However, attempts to directly replace lost protein from fish and living aquatic resources consumption in APs diet are still at an early stage of planning and implementation. (1.0)

2. Steps should be taken to directly compensate APs in impacted communities, where appropriate, for loss of livelihood opportunities and social impacts arising from declines in living aquatic resources during the period between dam construction and the start of livelihood restoration activities in the implementation of the MCP (a period of 3 – 5 years in most villages). This issue was recognised under the Compensation and Mitigation principles of the Logframe Summary under the heading "Social Impacts"[1]. This could possibly take the form of material (i.e., non-cash) assistance paid once-only to the village

[1] Logical Framework: 2001 – 2006. To Implement the 10 Year Mitigation and Compensation Plan of Theun Hinboun Power Company Limited. February 2002. Page 2 of 7.

for a widely beneficial project agreed on by the community alone (e.g., a new roof on the school or repairs to the village temple). Villages would receive this compensation according to the recognised level of impacts (perhaps ranked High, Medium or Low) and taking into account previous direct assistance offered. (1.0)

3. The villages in the lower Nam Kading area should be brought into the main framework of EMD activities as soon as possible, through preferably pro-poor household intervention strategies, both at the inter and intra-community levels. It is clear that EMD now has many potential strengths, lessons learned and experience from other areas to selectively target the needs of these villages. (1.0)

4. Given the complex nature of many social mitigation activities and the simple socio-economic status of many APs within impacted villages, the Review Team recommends closer supervision of project villages over an extended period. While many activities have been introduced in many villages and some activities have already been successfully adopted by more progressive farmers in most villages, there is a risk that many otherwise appropriate activities might ultimately be abandoned in some villages without on-going support from EMD. EMD staff should not feel bound to targets set within the Logframe. The Review Team believes that the on-going presence of both senior and junior project staff is required in most project villages to maximize any developmental benefit. The project should take care not to "water itself down" by expanding activities to an increasing number of villages while attempting to meet ambitious targets. At the same time, there is a need to expand the Project to meet the needs of fishery-related targets and impacted villages not yet reached. Hence, the Project has a dilemma under the existing staffing levels. (1.0, 2.0, 3.6)

5. There is a real concern that the poorest sectors of the impacted communities, and those heavily reliant on living aquatic resources for their livelihoods and diets, and thus, the most likely to be impacted by the Project, may not been adequately included in activities to date. This situation is partly due to inherent difficulties in including the poorest sectors in a principally agricultural production-oriented development strategy and partly as a result of delays in conceiving and incorporating an appropriate fishery management component within the project. (1.0 and 2.0)

6. The project should include in the Logical Framework a program to promote sustainable living aquatic resources co-management and education for APs, through appropriate community-based, participatory and inclusive methods. This will require more resources and the recruitment of at least two new staff and innovative partnerships and institutional arrangements to be successful. (1.0, 4.7, 6.1, 7.0)

7. While the staff of EMD are doing an excellent job, the review team believes that staffing increases will be required if they are to meet both the maintenance requirements of villages with existing activities, and villages that will have activities initiated in the future. Staffing procurement, however, should proceed slowly, so that the present work environment of EMD is not diluted. In the interim, a more rigorous priortization of the villages might ensure that those most impacted receive assistance earlier in the program. (1.0, 7.0)

8. THPC should investigate whether non-Project villages should be included in EMD activities due to dam-related fishery and aquatic resources decline. From observations

and limited villager interviews by the Review Team, it appears that members of non-Project villages nearby and upstream of the Headpond are or were former users of the aquatic resources in the Nam Theun and Nam Gnouang rivers and may have suffered declines in availability of the resource due to Project impacts. (1.0, Other Issues)

9. The community development aspects of the Project rate very well when compared to other projects in Lao PDR undertaking similar tasks. (2.0)

10. To date, the Project has mostly worked at the village level, however, it is recommended that it should start to consider looking more at a household level to see if certain sectors of the village (e.g. resource poorest and/or landless groups) have been left out of the process of project intervention activities and development. If this proves to be the case, specific activities should be tailored to address their specific problems and needs. (2.5)

11. The project should attempt to do some analysis to try and gain a holistic overview of the Project. Use available data from each work section to understand the past and present situation of the activities, through use of mapping and presentation in GIS format. (2.5)

12. The Project should have clearer guidelines concerning data collection and analysis responsibility. Those who collect the data should play a role in designing the format and priorities for data collection, and likewise should be involved in analysis with minimum input from outside consultants, apart from where skills gaps exist. (2.5)

13. Introducing new institutions (e.g., VDC, increased women's involvement and Savings & Credit Fund) to the village requires a slow and continuous approach, and cannot be achieved rapidly or simply. Only through a steady presence, build-up and strengthening of these institutions can sustainable and long term results be ensured. (3.1.2)

14. Pumping costs of both vegetable gardens and dry season rice fields should be at least partially born by EMD until cash crop production becomes normalized. Given the high cost of diesel, the project should work to improve efficiency of irrigation systems, support the conversion to high value commercial crops with much reduced irrigation requirements and promote the gradual conversion of the diesel pumps to electricity. The importance of the future smooth running of the pumps to the irrigation program adopted cannot be over-emphasised. (3.5, 3.6.2)

15. The initial results are encouraging in the Headpond area, in spite of the recognition that positive agronomic changes will be exceedingly difficult to engineer. The widespread adoption of innovations in the long term will require continued efforts by EMD, including ongoing veterinary care, extension, future agronomic inputs as compensation, support for activities considered to be high risk and, occasionally, government cooperation in enforcing regulations. (3.6.1)

16. EMD staff recognizes the difficulty associated with development of permanent cultivation in areas formally used for shifting cultivation and are on the right track. They should re-intensify their work supporting subsistence and commercial livestock rearing, high quality fodder production and carefully balanced soil fertility management for selected subsistence and commercial crops in Headpond area. An outside NGO should be considered to set up a community forestry program. (3.6.1)

17. The dry season irrigated rice program has achieved impressive results in a short space of time. However focusing on such high yields with heavy inputs comes with certain risks, should yields not be realized. The project may be spreading itself out too thinly on the ground by increasing the number of villages that it is working in before village support systems initiated by the project have matured. (3.6.2)
18. There were repeated requests for better veterinary care within the Nam Hai-Hinboun Plain villages and the review team feels there are opportunities to make substantial improvements to animal health in the region. At a minimum, an improved vaccination program might be considered. (3.6.2)

19. The project should install an automatic stage recorder at the bridge on the Nam Hai to assist in characterizing stream flow when water samples are being collected from the Nam Hai-Hinboun system. EMD should investigate the relationship between magnitude and nature of Nam Hai discharge as it affects river channel erosion and turbidity. With a better understanding of this relationship, it will be possible to determine trends in changes to river turbidity from one year to the next. (4.2.3, 5.5)

20. No more vegetative erosion control techniques along the banks of the Nam Hai should be considered. Changes in fencing and animal access along the banks of the Nam Hai bring only marginal benefits towards erosion reduction and should be abandoned unless the activity's primary goal is to increase productivity for village production systems. (4.3, 5.5)

21. Sloughing of drying stream banks and then easy incorporation by rising water is likely the dominant process that generates the turbidity surges reported in the Fisheries report. The review team is uncertain that the regulation of power house discharge alone as suggested by the Fisheries report, will substantially improve the fisheries without some concurrent river bank stabilization. (4.3.2)

22. EMD should make changes to the monitoring of bank collapse for different reaches of the Nam Hai to determine whether the bank collapse is proceeding at an accelerated, constant, or reduced rate with the passage of time (4.3.2, 5.5)

23. A long-term, appropriate and on-going fisheries and aquatic resources monitoring programme should be established, which utilises and recognises the importance and benefits of Local Ecological Knowledge (LEK), as well as traditional scientific data collection methodologies, in understanding and responding to the past and ongoing changes occurring at local and basin levels. The approach should be relatively cheap, methodical, easy to implement and analyse data collected, accessible and useful for all interested stakeholders and involve a wide cross-section of APs in impacted communities. (4.6, 6.1)

24. EMD should consider retaining qualified consultants or international organization to conduct comprehensive ecological and biodiversity studies downstream of the dam in the Nam Kading NBCA to ascertain the present health of the riverine-dependent ecology in the light of the present minimum downstream release (MDR) of 5 m^3/s. This would provide useful new data to compare against pre-project knowledge and predictions of potential downstream impacts to living aquatic resources, birds, mammals, riparian vegetation and possibly other flora and fauna of interest. The knowledge gained can be

used to assess the costs and benefits (ecological and economical) of any future changes in MDR. (5.4)

25. EMD's management is efficient and effective. (7.0)

26. The management style of EMD should continue more or less it its present form. The review team has nothing to offer that might improve what is already an effective system, at its present size. (7.0)

27. Steps should be taken to gradually introduce focused, small-scale, locally appropriate aquaculture promotion activities, initially at a pilot-level in certain suitable communities, with a long-term view to expansion to more villages. The best prospects for small-scale aquaculture lie in the Nam Hai-Hinboun plain and so initial efforts should be focused in this area, but not discounting potential future interest by APs in Headpond and lower Nam Kading villages. The interventions could take the form of a mixture of cost subsidisation of pond construction and limited external material inputs (e.g., fish seed), appropriate training (preferably in-village) and on-going extension and back up for participants. However, it should be recognised that the poorest groups of Lao rural society face significant constraints to entry into aquaculture and so this component should not take precedence over efforts to promote sustainable management of wild living aquatic resources. (Other Issues)

28. Sufficient recognition should be given to the possibility that some livelihood intervention strategies of EMD, especially promotion of intensive dry season rice cultivation, may actually have unintended negative or non-beneficial impacts on the health of aquatic ecology, wetland habitats and living aquatic resources-dependent livelihoods in general. While it may be decided by stakeholders that the economic benefits appear to outweigh the ecological and economic costs of resource degradation, at least APs should be made aware of potential risks and who in the community is likely to bear them. This could be a potential topic of research by project staff, a foreign volunteer or Lao MSc or PhD students of agricultural/natural resources management disciplines. (Other Issues)

D. REVIEW AND ANALYSIS OF LOGFRAME ACTIVITIES

1.0 Compensation and Mitigation Strategy

The Review Team finds the Social Impact Compensation Strategy well conceived. The nature and scope of social compensation activities comes as a loose package, including both mandatory involvement in core activities and optional involvement of villagers in activities that fit with individual household's needs. The avoidance of direct cash compensation for most impacts is supported by the review team, as is the use of subsidized agricultural activities, the payoffs from which go towards topping up the Savings and Credit fund.

There are concerns, however, that there are communities that have not been identified as being impacted by the Project (see "Other Potential Logframe Issues" section for further details), and not all households have received full compensation for lost livelihood opportunities from fisheries and aquatic resources decline.

Therefore, in order to match the existing local livelihood strategies and the needs of APs, it is recommended that an inclusive, participatory and adaptive aquatic resources co-management program be established within the Logframe. A living aquatic resources management program should be viewed as an important and integral part of the Logframe because without such a program there is a real concern that the poorest sectors of the impacted villages will slip through the safety net provided by other Logframe measures and activities. In addition, there is a concern that if the aquatic resource base declines even further, then intra-village wealth disparities may well widen because generally the poorest of a village rely more heavily upon living aquatic resources for their livelihood base as compared to the wealthier members of a village.

With regard to potential Project impacts on living aquatic resources, it is recommended that for villages that have been identified to have suffered declines in the local living aquatic resource base (including, but not necessarily limited to fish, reptile, amphibian, crustacean, mollusc, gastropod, insect, and plant species) with associated negative impacts on household nutritional status and incomes in the donor and recipient river basins, should be offered a one-off, non-cash compensation payment on a sliding scale, depending on the relative scale of potential loss born by that village. The amount offered should vary according to a number of criteria, including the size of the village, the location and distance from the impact (i.e. villages along the Nam Hai and middle Nam Hinboun should be eligible for greater compensation than villages along the lower Nam Hinboun, for example) and amount of other development assistance offered to date. A typical amount offered (which may, or may not, accurately reflect actual losses suffered) might vary between $1,000-$5,000 per village and should be spent on material assistance for any mutually agreed upon project that is beneficial to all members of the community, like repairing the school, temple or village meeting hall. This compensation would be recognised as compensation by THPC for past damage caused, and not as a substitute for other ongoing project activities or initiatives.

2.0 Community Assessment and Organizations

Completing community assessment has been carried out efficiently. The initial development of VDC has been carried out in a rapid manner in order to meet project targets. The community development aspects of the project rates highly, when compared to other rural development projects undertaking similar tasks. The Logframe reflects an ambitious number of beneficiaries and wide range of activities to be undertaken over a diverse range of villages. In most cases, ambitious targets have been met.

The Review Team recognizes the difficulty that EMD management faces in walking the line between expanding to new project villages to address the needs of all Affected Persons (APs) and accepting a lower level of interactions and observations in villages already established. EMD has demonstrated their ability to maximize the portion of project money that directly and materially benefits local villagers while keeping overheads low.

However, in a project of this size, and with such ambitions, and with the current staffing levels, there are concerns that EMD is attempting to do too much, for too many villages, in too much of a hurry. Most of the villagers are quite new to many of the ideas being proposed by EMD, and as the intense wave of activities recedes with project staff moving

on to new villages, such villagers may well prove unable to benefit from the new innovations and ideas that had been proposed. In some villages, confusion was noted in the minds of some villagers regarding the project's motives and mode of operation. Occasionally, women did not appear to be actively involved in any community decisions in spite of their role in implementing the activities. There were signs that some of the innovations that had been introduced had been ignored, if not abandoned by a portion of the APs. Finally, there were signs that some of the poorest members of the villages were, for a number of reasons, unable to fully participate in project activities. The Review Team believes that all these early signs are a signal that EMD should increase, not decrease their presence in many villages. Stable village development takes time. While this may affect the speed of introduction of new project activities in new villages, in the long run this strategy should yield more impressive and sustainable results.

2.5 Socio-economic baseline and monitoring surveys

This survey has followed the recommendations of consultant, Anthony Bott, with the objectives to monitor changes and improvements resulting from the project's intervention. The data has been collected annually since 2002 throughout all impacted villages. Six families are selected from each village as representatives, with 2 families each from better off, medium, and poor socio-economic status. Information detailing all income and outgoings in one year focuses on expenses in production and health. The data is entered in a spreadsheet, (MS Excel) and analysis is later done by staff using pie charts to show the changing household GDP, which is used as an indication of progress. Theoretically the data can be useful for determining appropriate interventions for different villages. The staff of the Saving and Credit fund have done a good job in collecting this survey data.

The collected data may indicate the GDP of those families but the sample size and the information collected is a bit limited to extrapolate the results to the whole village. Health is an important category of a family's expenses, especially for communities located in remote areas. It can be the largest expense of the family and can affect their working ability and production. However, in the case of the Theun–Hinboun impact area where most communities have access to roads, markets and education, these are also important baseline factors which deserve consideration

The staff should discuss what it expects or requires from these annual surveys and design them accordingly. The involvement of project staff, especially those who collect the data for the whole process will allow them to relate information directly to serve directly with the project work. The project can still present changes in a family's GDP to outside groups (e.g. government, INGOs) that are interested. However, the EMD should think about a set of data that the staff could utilize fully to improve their implementation of activities.

Some other suggested items of expenses apart from the agricultural production system should be collected in those sample families. Education is a category of expense that the project should consider to add into the current survey format. The main project's expectation is to improve people's livelihoods and better education gives opportunities for people to upgrade their lives. Another category to represent the economic status of a household is debt and the reasons for that debt. Debt can be in the form of money or rice, and can be incurred with different entities such as relatives, other villagers and banks. Another group of expenses that should not be overlooked, are consumer goods such as

electrical appliances which are increasingly popular among communities having new access to electricity and are prepared to spend large amounts of their savings for. Even though the project would prefer villagers to spend or invest their money in a productive way, such data would show how people prioritize their expenses. . These categories do not need to be detailed, but could just show the total sum of each one. Thus the staff do not have to spend too much time on it.

Apart from quantitative data collection, a few lines for qualitative data about changes in family status and the underlying reasons, plus staff observations are strongly recommended. For example, note new road access to the village or that a tobacco company has begun contract farming with a few families. The village data will help back up the family data and also some information that might not apply in those family's cases would not be left out. Other people who do not go to this village or new staff that have to collect the data can gain basic information from reading project documentation and would not have to rely on word of mouth. A semi-structured interview or informal discussion related to changes would be a simple way to collect this information. This will permit staff who collect the data to conceptualize the situation better and start analyzing data immediately in the field.

The data will be accumulated each year, so it is recommended that the project should discuss with the staff of each section whether with additional data, they can make use of this socio-economic survey as well. Thus, this survey will not be merely a pile of information that might have to wait for several years to be analyzed and understood. Some guiding instruction from outsiders may be necessary for providing the techniques, but the analysis and application should be done mainly by the EMD project.

With lots of data accumulated progressively each year in Excel form, some of the above suggested analyses and studies should be made. Thus, these analyses should be presented in visual format, for which a Geographical Information System (GIS) package is recommended. This could illustrate geographical differences between villages, river basins, impact areas, etc. For instance, the economics of communities where people practice twice annual rice cropping and have good road and market access could be compared to communities in the Headpond area where people do not have paddy rice fields, but have heavier reliance on collection of NTFPs. Additionally, the numbers that will be used for comparison should be calculated in percentages.

Planners at all levels, from decision makers to section leaders can understand ground situations from a geographical picture which can help them to plan future actions or priorities in a more strategic and coherent manner. In addition, it is very useful for communicating with local authorities and villagers in understanding the situation and plan for improved results together with the project.

There are some Lao teachers at the National University of Laos (NUOL) who have expertise in this and have previously worked with the project. The project already has good maps available and has done some presentation in GIS, but not yet as a data analysis tool. It is recommended that the project should allocate one staff member who knows the context and activities in the field well to concentrate on this. Preferably that person should be familiar with GIS already.

3.0 Social Mitigation Implementation

The Social Mitigation Implementation has shown good progress and the Review Team complements EMD for their substantial efforts. The wide range of activities considered for implementation within the affected villages were selected with considerable care. The Review Team feels the chosen innovations accurately reflect both the needs of the majority of villagers and, to a large degree, are the most likely innovations that would be adopted. While the initial results are impressive, the widespread adoption of innovations in the long term will require continued efforts by EMD, including ongoing extension, future agronomic inputs as compensation and support for activities considered to be high risk.

The Lao villagers' perception of development has been based largely on a paternalistic welfare mode. People tend to rely on government for advice and funds rather than initiate something on their own. The idea of the Village Development Committee (VDC) comes from the government's decentralization policy that aims to make villagers more self-reliant and be able to initiate their own development activities. Nowhere has the VDC approach been an unqualified success.

The VDCs established by EMD only partially meet developmental objectives. Rather than initiate development, the VDC is acting primarily as a channel to receive project innovations. This is largely because the concept of VDCs, in spite of being so well promoted in Laos development circles, rarely works as expected. Ultimately, most village activities are the responsibility of the existing Village Administrative Committee (VAC). In some cases, the VDC can create a conflict of interests and result in an overlap of work among the VDC and VAC. Confusion or inaction of VDC members is not easily addressed with infrequent visits by EMD staff.

The project should adopt a plan that allows for a continuous follow up and support to the VDC. This might initially involve refresher training for VDCs every 3 or 4 months so members can more fully understand their roles and duties. Although the VDC should implement development activities, the VAC should be encouraged to provide an advisory capacity. This will help VAC not to feel inferior and for VDC to gradually gain confidence and recognition from the VAC and villagers.

Informal discussion and regular visits by the staff are important to strengthening new institutions. The project should spend considerable time working with the VDC and VAC. They should also spend more time working directly with individual households. This will facilitate a clearer understanding of whether the activities and plans are understood by VDC, VAC, and different village groups including the poor and women. In addition, this scrutiny will be useful to determine if the VDC is accountable and whether it unfairly supports certain groups or families in the village. Many organizations working in Lao PDR fail to address this potential problem until it becomes entrenched.

Currently, EMD staff prepares the necessary reports for THPC. However, in the future, it may be appropriate for the villagers to provide some of these reports, and thus, consideration must be given of how to achieve this effectively. Initially, the villagers will require lots of support for such reporting to be useful for project feedback. For instance a simple form could carry the following headings: Activity, Outcomes, Challenges, Lessons Learned, Next Step (i.e. who is responsible for what between the community and the project). This will guide the VDC to think in a more meaningful way

with logical steps of activity monitoring, learning, problem solving and planning. The project might have to specify the date of writing the report so that it eventually becomes a discipline. However, this is not an easy transition for villagers with limited education and unfamiliarity with such procedures. The staff that work with the VDC and VAC should know the existing local political situation and work to bridge any gaps in understanding between the two.

The project has tried to involve women in various activities to increase their role in decision making related to project activities. The reviewer was unable to assess the level of women's participation in all activities, in particular in village level decision making. However, women in the interviewed villages seemed to be familiar with project activities and their objectives. Women appeared to understand that project activities are provided to mitigate the impact from the construction of the dam and not to just support development activities.

The value of the gender awareness training that was carried out in villages should be assessed to determine whether the single session was successful in involving women in the development process. This could be assessed by informally and randomly interviewing both men and women of different ages / education / ethnicity / economic / social / political status to determine what they understand and expect from the process of project activities.

The project uses PRA as a process to determine a village's main problems and to prioritize village development activities with the villagers. At the end of the session, the agreed development activities should be followed by a simple draft of each activity that later on is used as a guideline in planning detailed activities. The project and the villagers should refer back to these results regularly. If changes are required, they should come from discussion and with the agreement of the project, VDC, VAC and villagers. Otherwise, participation in making village development plans becomes meaningless.

3.3 Improved water supply for domestic and garden use

The present focus on dug wells in impacted communities is strongly supported. The mode of entry, the means of dispersal of funds and the involvement of villagers in planning, digging, lining and protecting the wells has been successful. This increased success experienced within water supply over the last year comes in part from the abandoning of tube well installation with hand pumps, for hand dug wells which are simpler to develop and maintain, as well as offer work opportunities to villagers during their construction. Most villages appear to have options to develop hand dug wells. In reviewing water quality data, well water quality is usually of better quality that was available to villagers pre-diversion. The Review team noted that villagers have taken to digging their own wells in some communities (e.g. B. Vangtakong) after witnessing the successes of the project-promoted wells.

Gravity flow water supplies have their own problems and require special management, and thus, it is important to have agreements regarding management and maintenance established as soon as possible. This will provide villagers a sense of ownership and consequently they will take responsibility for managing the water system. A domestic water user's group might not need to be set up separately but rather combine with other

existing groups e.g. irrigation group or VDC so as not to increase the number of groups unnecessarily.

3.4 Health and sanitation

This activity appears to be going well and the health workers should be commended on their successes to date. Project installed toilets were being used. Insecticide soaked mosquito nets have been widely distributed and were found in most homes, including those of the very poor.

A birth spacing program has been quite successful to date. However, there are a few cases where both men and women are reluctant to make use of any family planning technique. The project should try to find out how to reach such people and address their concerns so that their resistance does not become more widespread in the village.

With the nature of the health and sanitation program working with small target groups and with a small number of villages, it seems to be able to reach the household level quite well, compared to otherprojects. In addition, the performance of activities under this program seems to show good results. Thus, the project should consider initiating health and sanitation activities into other villages that have not yet received other major program activities i.e. like the agricultural production and savings and credit fund. This is to assure those villages of the involvement of the project in the foreseeable future. In addition, starting a health program before setting up a VDC does not create so many potential problems as may occur, for instance, with large interventions in improving agricultural production.

3.5 Household garden development

The network of pumps, village distribution systems, concrete storage containers and garden allotments appear to be working well and reflect a substantial investment on the part of the project. The initial mechanical and agronomic training, options for cash cropping and horticultural tree planting has been well thought out and, initially, at least the full involvement of villagers appears to have occurred. In almost all participating villages, most newly planted fruit trees were found to be in good condition and thriving, indicating that most farmers were serious about raising them. Insect damage was affecting some longans and litchees but mangoes were thriving. Given the planting spacing, much of the garden area will eventually be dominated by productive orchard. Some cash crops - onions, peppers, young maize and cabbage have been grown and sold in the market on a small scale by a few entrepreneurial farmers.

These gardens provide the farmer with the opportunity to greatly increase their production of a range of fruits and vegetables to meet local consumption utilizing the water supplied by the project. However, many if not most, of the farmers involved in the household garden activities are not yet able to make the major developmental leap to supplying for markets. Some of the horticultural species appear to be susceptible to insect attack and require some form of treatment. To ensure the enthusiasm of villagers to maintain these household gardens, reluctant farmers must be encouraged to continue to grow a range of vegetables that will meet both local needs and have potential to be marketed. Currently, EMD provides for pumping costs for the initial phase of these gardens with the view that they are later successful enough to provide for such costs.

However, EMD should consider extending such support for farmers that have difficulties or unforeseen events arise that prohibit the success of such gardens. Ultimately, a closer connection between village farmers and local and regional markets will occur. In the interim, the project should continue with their agronomic support for these gardens.

3.6 Improved livestock/farm crop system

The current Logframe activities to address livestock / farm crop system are important to achieve the goal of assisting the affected persons to meet their basic needs. The nature of the existing production system of the Nam Theun Headpond and Nam Hai-Nam Hinboun area differ markedly and this in turn affects the kinds of activities that might be adopted.

3.6.1 Head Pond Area

Improving socio-economic conditions within the head pond area presents a daunting challenge. Many projects have tried and ultimately failed to convert land with such marginal soils to productive sedentary agriculture. The problems associated with transforming traditional shifting cultivators to permanent cultivation are many, but hinge on the fact that there are too many technical, social and economic parameters that must be integrated seamlessly together for diverse peoples to be possible within normal project horizons. While there is no question that the right sort of agronomic / livestock system can sustain farmers within the Headpond villages, there is no certainty that any project, no matter how well managed and how efficient their village level facilitators, and how appropriate the technologies and ideas, can count on a clearly successful outcome.

However if any project can succeed in these endeavors, it would be a project such as EMD. The project works within a longer term time-frame than most projects, they have chosen a wide range of good technologies, some of which will be appropriate for each individual household and they have a mandate to compensate farmers for a range of impacts. Small successes have been experienced in the area of livestock rearing and irrigated garden development. The food-for-work scheme allows the farmer to participate in an enterprise, such as sedentary agricultural production on upland soils that s/he otherwise would consider too risky. If the return on investment of time for any agricultural endeavor falls below a critical threshold, farmers will rationally decide to abandon that activity. This appears to be occurring on the newly cleared uplands within the Headpond area this year. This is a fundamental problem with the government policy to develop sedentary agriculture on marginal soils, prone to noxious weed infestation. Slash and burn agriculture, in spite of government prohibition, looks better to the farmer than unproven options provided by projects. To convince these shifting cultivators, the project must demonstrate an appropriate range of innovations to the farmer and giving him or her enough time to adopt them within the framework of their own production system. Provided the project safety net is in place to ensure basic food security, gentle but firm dissuasion of shifting cultivation should be implemented by the project.

The Review Team feels strongly that EMD should continue to work on the developing of permanent cultivation in areas formally used for shifting cultivation. To not do so would ensure that the farmers would have to either return to shifting cultivation or quit the area. The present range of activities put in place by EMD is

appropriate and supported by the team. However, an increased EMD presence is required in the Headpond area.

- In almost all situations, some combination of penned, commercial livestock rearing, high quality fodder production and carefully balanced soil fertility management (as now promoted by the project) are central to this goal. Livestock production, particularly well fed, vaccinated, penned pigs seems to provide an ideal entry point for most farmers in the Headpond area and should be energetically exploited. The requirement to grow and make use of good fodder species in the many underutilized areas around the household has many positive environmental spin-offs. The fodder trees must be viewed as a cash crop of sorts, greatly increasing in value after being processed through livestock. Non-palatable fodders must be able to meet some demonstrable use to villagers (such as smothering Imperata spp) before they will be adopted.

- Improving the productivity of shifting agriculture by encouraging improved species of swidden species has been successful in some areas of Central America and was the dominant farming system of Timor in the 1970s. By promoting vigorous leguminous species that grow after the crop is harvested, the farmer can improve the soil's productivity and greatly reduce weed infestation. In Central America, farmers using velvet bean[2] as the swidden replacement can return each year to the same plot and grow good crops of maize. Phosphorus would also be required in any cropping system for upland soils that occur around the Headpond.

- EMD's recent proposal to develop a relationship with a trader to produce maize on these rain fed lands around the Headpond is a good short-term solution for the upcoming season. This will provide the farmer with more experience of managing new crops and more importantly, strengthen the linkage between the farmer and the market. Inter-planting of legumes with maize can improve nutrient value of crop residue and pulses may find some value in mother and child nutritional programs to increase protein in the diet.

- The lack of good forest management of the Headpond area has greatly reduced the productive capacity of the region. The ongoing impoverishment of the more valuable timber species without enrichment planting, shifting cultivation, the extensive extraction of valuable timber and NTFP without any idea of sustainability, the presence of free grazing animals, and the lack of effective implementation of reasonable and rational regulations makes the local forest a hugely mismanaged resource. Potential productivity gains to be made by better forest management are thought to be impressive.

- Improved forest management provides an opportunity to develop productive, sustainable management of marginal soils. However, as long as trees are considered the property of the state and not the individual or village community, the state should not expect that the individual or village will have any interest in preserving, let alone

[2] Mucana spp. It is understood that farmer's initial response to velvet bean was poor. A wide variety of velvet bean are available and the project should consider exactly for what purpose the velvet bean will be put. Some are more vigorous and less palatable, others less drought resistant and more palatable etc. In any case, the project should try to find the variety most suited to the headpond soils and type of farming system that might evolve.

planting trees. To the contrary, farmers will actively prevent the establishment of trees because the trees will shade out the products that the government allows them to collect. Many villagers within the Headpond area acquire a substantial portion of their income from NTFPs, but are unwilling to invest substantial efforts to better manage the forest within which these plants grow. To overcome this problem, it is necessary to develop a village-led forest management plan in which the villagers are equal partners with the forest department and the wealth of the forests is shared. The local villagers should be the managers of the forest and the government should facilitate the process and as productivity and profitability grows, collect much needed taxes. In all countries that have been successful in developing community forestry programs, the hardest step was getting the Forest Department to relinquish their bureaucratic, but ineffective control of the forests for a more flexible model. The possibility of inviting an NGO into the Headpond area to nurture a community forestry program should be considered.

3.6.2 Nam Hai Hinboun Area

The dry season irrigated rice program has achieved impressive results in a short space of time. The 365 hectares under dry season rice production this year represents one of the largest project managed irrigation networks in Laos. Last year's very high yields are almost unprecedented in irrigation development. After devastating crop failures resulting from extensive river flooding in September 2002, the bumper dry season crops produced under this program were enthusiastically received by most participating villagers. Not only are farmers generally very pleased, but also government officials are sitting up and taking note of EMD's spectacular performance against the background of the dismal failures of most irrigation projects in Laos. The review team congratulates EMD on this notable success.

There are risks associated with use of pump irrigation as well. The high level of inputs recommended by the project exceeds even what most progressive non-project farmers in the area are willing to use. Generally yields of 4.5 tons per ha are considered good for dry season irrigated rice. The project's goal of > 6 tons is exceptional and reflects a high level of management in water distribution, fertilizer usage and pest management. Problems with pests, pump breakdowns and reluctance of farmers to join this program or to borrow money to purchase the levels of inputs recommended by EMD were observed. While these problems were being effectively addressed by the EMD team, it is uncertain how such a high level of managerial input can be maintained, particularly as the program is still growing. The astonishing results of 2003 will be difficult to sustain. The Review Team has concerns that the project may be spreading itself out too thinly on the ground by increasing the number of villages that it is working in before the original villagers have truly accepted and can deal with the risks associated with this new agronomic regime.

In certain villages (e.g. Ban Kengkhot) it was noted that there has been a high attrition rate of farmers from practising dry season irrigated rice between the first and second years, mostly over concerns of debt repayment and high operating expenses. It is understood that EMD is currently modifying the program structure that has caused such attrition rate; otherwise, it is rather difficult for this activity to attract the participation of the poorest and most marginalized families in a village. In addition, there is concern that without ongoing and intense agronomic, mechanical and

managerial input from the project, a range of unforeseen factors could cause a gradual or some cases precipitous decline in adoption. Consequently:

- The on-going presence of the project agronomist with dry season rice farmers will be required for some years to come to ensure that farmers can take advantage of technical opportunities that may be available to deal with normal and unusual cropping concerns. Whether the present staffing is sufficient to ensure this presence is uncertain.

- If there were any means by which the risk adverse villagers could be recaptured back to the program, it would enhance social equitability within the village. Discussions with the Deputy Manager indicated that a number of options were being considered by EMD. Lower yield targets with lower inputs might be necessary to attract risk adverse farmers.

- Because of the number of pumping schemes now under the direction of the project, more consideration must be given to making major repairs on failed pumps during the irrigation season. Normal maintenance and minor repairs can be made by the village trained pump operator. While the efforts of EMD staff to keep these pumps running is highly commended, the intensity of such efforts cannot be maintained indefinitely. Village irrigation schemes should always have a functioning and well-maintained backup pump ready to go in the event of a major pump breakdown. In villages where this is not the case, an alternate pump should be requisitioned from the government before any future dry season irrigation is planned. An independent, mobile, skilled mechanic should be readily available, to be reached directly by the water user's group representative in the event of a major mechanical breakdown.

Given the high cost of diesel pumping, the project should be considering options to

- Support the improved efficiency of irrigation systems by upgrading main and secondary canals to reduce water loss.

- Support the conversion to high value commercial crops with much reduced irrigation requirements compared to rice, as conditions present themselves[3].

- Promote the gradual conversion of the diesel pumps to electricity

With regards to promotion of improved livestock management, the strategy adopted and steps taken so far are generally sound, but the benefits will take some time, likely many years, to reach the majority of households. In the meantime, there are possibly a number of steps that can be taken to reach far more people in a relatively short space of time. One possible step, which was commented on by villagers along the Nam Hinboun, is that present livestock vaccination efforts are not reaching most animals that require it, and owners are still enduring economic losses from annual livestock mortality and disease. Many people requested that greater efforts be made to vaccinate regularly against the main diseases that afflict their livestock, especially cattle, buffalo and swine. The Review Team understands that THPC has had discussions with District governors and agriculture officials about how to effectively

[3] Some farmers were already growing sweet corn along the periphery of the irrigated rice block.

enforce existing regulations concerning issues like penning and annual vaccination of livestock and further efforts in this regard are encouraged.

3.9 Women's activities and silk production

The project supported silk production by introducing new varieties of mulberry and silkworm in Kapab and Sob Gnouang villages, (Headpond area) at the beginning of the mitigation period. However, due to setbacks in early years; low production; and a great flood in 2002 destroying a building the project had supported for raising silkworms, the activity has not been successful. Moreover, villagers in this area now tend to concentrate their labor and time on other rain-fed permanent agriculture activities. This has led to difficulties continuing this activity. Only a few families still keep silk worms and have returned to traditional farming techniques again.

Therefore, the project has decided to stop this activity for a while until conditions improve in the future. There are still mulberry plants left in the fields that children pick the fruit to eat and some women sell occasionally, but at a low price of 1000 k/kg. Making jam and tea from mulberry leaves are interesting possibilities to try, but any attempt should start small and test palatability and quality control first among a small group e.g. THPC staff and some of their guests.

3.12 Savings and credit fund for activity support

To date, the project has established Savings and Credit funds in 49 communities where most of them have grown gradually and steadily. The present total funds saved in the Savings and Credit fund now amounts to over 1 billion kip (i.e. equivalent to over $100,000 US at an exchange rate of 10,000 k / $1 US). There is a perception amongst staff and villagers that this activity has provided the best return on time and financial resources invested into it by the project, and the staff feels justifiably proud of its success so far.

The Savings & Credit fund section has performed very well, at least in part due to good teamwork. The staff have carefully adapted various recommendations provided by consultants to address specific community needs. The project staff encouraged participation by opening accounts of their own in some villages.

The amount of the fund in each village varies with the socio-economic condition of the village. For instance, Ban Thabak, a mainly trading village has more economic opportunities than Ban Kaengfakkham, a small village in which people's income relies heavily on marginal agricultural production. Sustainability of the Savings & Credit fund depends on the activities promoted by the project be it dry season rice, rain fed agriculture, and other income generating activities. The successful outcome and adoption of the first project activities promoted in the village is crucial, particularly for the poor. If villager's first experience results in failure, they will lose confidence and may not wish to become involved again. For this reason, all activities promoted, no matter how small should receive close attention.

Management capacity of the Savings & Credit fund management teams in each village could be categorized as good, average and poor. Regular visits should be planned to solve problems, give suggestions, and audit the accounts every 3, 2 and 1 month

respectively, in accordance to capability of the project staff. The frequency of visits and categories of Savings & Credit fund management groups should be reviewed regularly. For the poorly managed groups with fundamental challenges — e.g. lack of education, especially in the Headpond area — some refresher training courses should be provided until they can manage it properly.

An annual financial analysis is suggested for this particular activity in order to evaluate sustainability of overall aspects of the Savings & Credit fund in the sense of being a rotating credit fund and one-off up-front payments. This will be a good reflection of levels of dependence on the project support as well as an indicator of the most significant groups of beneficiaries. Thus the project staff would be able to predict the project's direction and intervene better.

Apart from this, there are examples of people, mainly the poor, who do not want to participate in dry season rice production for fear of low returns from rice production, as a result of negative experience from flood and drought in the years 2002 and 2003, and an inability to return the grants. The project staff should closely observe this group and work more at household level to forecast potential involvement of this group in the following season.

At present, the project's Savings & Credit fund section suggests the villagers deposit the fund under a regular individual savings account at banks rather than a regular village saving & credit fund to maximize interest payments. The project staff should explore the pros and cons of accepting higher interest rates with the higher potential risks attached.

4.0 Environmental Mitigation and Monitoring

4.1 Construction Site Re-vegetation

Progress reports indicated that all major disturbed areas had been evaluated and treated as required. All construction sites viewed appeared to be re-vegetated or have become self armored from subsurface stones. No sites were observed to be suffering from serious surface erosion.

4.2 Water Quality Monitoring Program

The water quality program is well conceived and is providing THPC with data that will be essential as it determines if and how individual impacts will be mitigated.

4.2.1 Laboratory

The Water Quality Lab was found to be in excellent order and capable of providing reliable analysis of pH, electrical conductivity, dissolved oxygen, biological oxygen demand, nitrates, phosphates, color, turbidity, and fecual coliform. Total suspended sediment samples are sent out to Vientiane on a quarterly basis. The staff responsible for the sampling was familiar with equipment function, maintenance and normal calibration procedures. Good management supervision and support of water quality field staff was noted.

4.2.2 Water Quality Data Management

Water quality data management is excellent. All data was entered into spreadsheets in a format recommended by the water quality consultant. The filing system was clear and all data was readily accessible. Most of the data was eventually sent to the water quality/ fisheries consultant where it was analyzed. At the time of the team review, that report was not available to the consultant so some aspects of water quality management activities cannot be considered.

Given the high skill level of the EMD water quality technician and supervisor, it is recommended that all preliminary analysis of data should be carried out by local EMD staff. At present, data that is entered into project spreadsheets is being worked up in simple graphs and tables. Some of the tables such as those presented by the fisheries consultant showing turbidity changes downstream with different flow regimes, could be prepared by EMD on an annual basis to reduce costs of outside consultants. Without a direct relationship between the person responsible for data collection and its analysis, there can be a loss of important information. If the anomaly is immediately recognized, it can be investigated in the field during the event. This would provide an opportunity to determine what processes affect the data that appears to be unusual. If the technician is only responsible for collecting data, he will be less inclined to recognize, let alone investigate unusual events as they occur in the field.

4.2.3 Field Measurement Equipment

Field measurements including pH, electrical conductivity, dissolved oxygen and turbidity[4] are carried out by hand held equipment. The technician is well versed in the maintenance and calibration of the equipment. The following might be of use in streamlining and upgrading the data base collection that may become crucial to deciding mitigation options open to EMD.

All water quality data on the Nam Hai and Nam Hinboun should be collected with good information about the discharge, timing of discharge from the power plant and portion contributed by the natural flow of the Nam Hai itself. It is recommended that an automatic stage recorder be installed on the Nam Hai at the bridge and measured at hourly intervals. A pressure transducer might be the most convenient sensor to install in this stage recorder. This would assist in improving the understanding of the relationship between water quality and discharge in the rainy season when the Nam Hai is also contributing to the flow. A stage discharge curve could easily be developed based on the present 0, 55 and 110 m^3/sec delivery from the surge pond. The daily hydrograph developed from this stage recorder would be a crucial part of the database required to clearly understand the intensity and occurrence of stream bank erosion and downstream turbidity.

[4] Turbidity is measured in nephelometric units (ntu) and provides a measure of the opacity or cloudiness of water. Total Suspended Sediments (TSS) is a measure of the weight of sediments suspended in a liter of water in units (mg/l). Depending on the amount of sand, silt, clay and organic matter in a water sample, different amounts of each affect turbidity in a different way. However, for a given river at a given level of discharge, with a constant portion of type of suspended solids, there is usually a close, linear relationship between turbidity and TSS. Turbidity is much easier to measure and as far as the fisheries specialist (R. Schouten) was concerned, the most important aspect influencing fish productivity. For certain types of analysis, turbidity measurements may well be all that is required.

A handheld laser rangefinder may be useful for the measurement of bank-to-bank distances across the Nam Hai. These instruments are becoming much cheaper than previously (<$US 200) and can be quite accurate over a wide range of distances 20 to 1000 meters. While any relatively solid material, (tree trunk, river bank etc) can make a good target for reflection, more precise measurements can be made by installing a simple reflective tape at the desired target. The rangefinder might be used to speed up data collection[5] when measuring stream bank widening of the Nam Hai.

While a simple photograph makes an excellent record of the conditions of a river bank, making a pair of photographs taken 1 meter apart provides the opportunity to record the bank stereoscopically as well. Usually a meter stick is provided for scale within the photographs. Simple stereo pairs made up of such photographs can be used to document slope failures and slumps in a quick and cost effective manner. A simple stereoscope is required to view the photographs in three dimensions and provide an estimation of volume of concave or convex bank forms. These would be stored within the project digital photo archive.

4.2.4 Water Quality Sampling

The monthly water quality sampling program has been well thought out and well executed over the last two years to address a wide range of potential water quality issues. The sampling sites chosen provide an opportunity to understand the dynamic nature of water quality variation throughout the project area. The data collected is reliable and readily accessible. Based on these results, the Water Quality Consultant has had a chance to determine more accurately project impacts and their effect on villagers and fish. The more intensive 24 and 36 hour water quality collection periods initiated under this program have provided some conclusions of importance to the understanding of suspended sediment and flow. The fishery report concluded that the reduction in fish yield in the Nam Hai and Hinboun was caused by the intermittent releases of water during the dry season.

As will be discussed below, before the THPC can properly weigh the benefits associated with the regulation of discharge to the Nam Hai, it will have to be sure of the relationship between water quality, (turbidity) and natural and powerhouse generated discharge, particularly as related to fluctuations and erosion processes along the full length of the Nam Hai. Modifications to the way in which data is collected may assist in further refining this understanding. All water samples collected for turbidity should be sorted according to the nature of the discharge of the Nam Hai at the Ban Nakham bridge and their distance from the bridge. This will permit the researcher to discern the hydrological features that affect erosion processes that, in turn, influence turbidity. While fluctuations of flow may cause turbidity spikes, it is uncertain whether on-going bank collapse, in the absence of fluctuations might still generate turbidities, and heavy bed loads that fish and other aquatic life cannot tolerate.

4.3 Erosion Rate Results and Methodology on the Nam Hai

[5] Such a range finder might also find use in normal survey work when estimating size of rice fields, length of road ways etc.

The consultant has made a cursory inspection of the Nam Hai channel and believes a third significant form of stream bank erosion not considered by previous studies is occurring. The presence of this form of erosion may also have relevance to any mitigation program. Many of the stream banks within the intermittent wetted width of the Nam Hai were dominated by very fine sands and coarse silts that, while slightly cohesive when wet, become loose and easily raveled when dry. With each drying cycle, a layer of loose material is formed, waiting to be picked up by the next cycle of increased discharge. Reducing velocity of water will not slow this type of erosion. If this form of erosion is common, it follows that reducing the surge alone by buffering the fluctuation of discharge, rather than stopping them, will not reduce the river's ability to pick up diurnally sloughed off fine sands and silts along the bank.

4.3.1 River Cross Section for Sedimentation Study

Three cross sections on the Nam Hinboun were surveyed and pegs installed to determine whether bedload from the Nam Hai is creating sediment wedges on the Nam Hinboun. The first repeat survey has yet to be carried out so no data is available. More reference points within the river channel might make it easier to re-survey the cross section. Provided they were placed where they would not interfere with boat navigation or villager's use of the river, re-enforcing bars pounded deep into the alluvial sediment along the transect could provide the additional reference required. If these were painted fluorescent orange, they would be easier to locate when the cross section is being re-surveyed. It is likely that the monitoring will reveal transitory sand bars that grow and wane with seasons and individual storms.

4.3.2 Measurement of Stream Bank Collapse

Considerable effort has gone into the measurement of steam bank collapse on the Nam Hai. Consultants have provided EMD a wide range of estimates for final bank width[6] of the Nam Hai and an equally diverse range of recommendations what, or if, anything can be done to slow the process. To this point, THPC is fortunate to have done nothing to act on consultant recommendations because at least two ideas almost certainly would have exacerbated the situation.

Because of the uncertainty involved with the riverbank widening of the Nam Hai, EMD began monitoring a number of banks along the Nam Hai to determine the rate of bank failure. Based on data collection so far from all the sites, the average rate of bank failure appears to be around 2 m per year[7]. While it is useful to have an idea of the magnitude of bank erosion, if any mitigation is eventually deemed essential, it will be imperative that EMD know: 1.) Where the bank failure is most severe; 2.) What hydrological events are most responsible for bank erosion; 3.) How does the observed bank erosion influence downstream TSS, turbidity and bedload; and 4.) Is there any indication that the bank failure process and/or magnitude and duration of turbidity pulses are changing over time?

[6] 200, 500 and even 1000 meters final width has been estimated by various consultants.

[7] Considered another way, land lost by bank collapse amounts to 3 ha each year or 270,000 tons of sediment introduced into the Nam Hai each year. On a daily basis this translates to an average of 740 tons. If all river eroded sediments was removed in suspension, with an average annual discharge of 100 m^3 /sec, the TSS would average 80 mg/l in any sample taken over the year. In fact some portion, maybe 30% moves as bedload.

Previously collected data and analysis will be essential to this assessment.

- In 1997, a Norconsult expert walked the whole length of the Nam Hai during which time he identified the "most exposed areas for bank erosion, sections where widening and canalization is recommended and areas where the river course is recommended to be cleared from trees and other objects". Stream bank cross-sections were also completed. However, no mitigation work was carried out at that time and the powerhouse began operations. In response to subsequent serious bank erosion on the Nam Hai, one year after operations began, another survey of its complete banks was conducted. Some armoring was proposed and implemented adjacent to the road bridge crossing. To date the Norconsult report still represents the most detailed assessment and mitigation plan of the whole Nam Hai river channel. It is recommended that the original drawings of the Nam Hai riverbank location developed by Norconsult be found and more recent planimetric surveys of riverbank location be superimposed onto the pre project map to get an accurate assessment of exactly what is happening along all reaches of the Nam Hai.

- EMD has taken topographic base map and the 1992 aerial photographs, and overlain 2001 Landsat Imagery to get an idea of the scale of changes in river bank location along the Nam Hai. It is assumed that the change between 1981 and start up of project in 1998 was minimal. Consequently most of the change in riverbank location is likely the result of the increased and fluctuating flow being released from the surge pond to the Nam Hai. Based on cursory field observations, this assumption appears reasonable. The review team recommends the acquisition of most recent satellite image taken in the same season to compare with the 2001 imagery. This will provide further information on the speed of riverbank collapse on the Nam Hai.

Using this pre and post Nam Hai channel location as a base, the ongoing monitoring program should continue to monitor changes along the river at a large number of stream reaches and when failures of sufficient magnitude occur, plot them on the base map differentiating measurements taken immediately before and immediately after the rainy season. The rate of bank collapse for different reaches should continue to be documented to determine whether the bank collapse is proceeding at an accelerated, constant or reduced rate with the passage of time. If there is a gradually reducing rate of collapse, this may indicate that equilibrium is approaching between the new discharge regime and the reformed river channel. Conversely if an acceleration of bank collapse is recorded at some sections, local and downstream impact might warrant the placement of bank armoring. In addition to the benchmarks for ongoing observation, the use of a laser range finder to ease measuring channel width at the same locations might be considered.

By tying in the sampling sites to include reaches with specific recommendations developed by Norconsult, it will be possible to determine: 1.) Whether the magnitude of riverbank collapse had been correctly predicted before the powerhouse began operating; and 2.) Whether the original mitigation recommendations of that report are still relevant. If, for example, the riverbanks that Norconsult predicted would receive the most severe problems do indeed have the most obvious erosion, and areas where they considered no work was required are still undamaged, this would indicate that their recommendations are valid. Should the Nam Hai sediment issue become of

increasing concern to THPC, revisiting the mitigation recommendations of that consultant would be appropriate.

4.6 Review fishery monitoring and management

During their site visit, the Review Team has had limited chances to review the actual fishery monitoring and management activities, as this study took place between May 2002 and June 2003, under the supervision of an external fishery consultant (Roel Schouten), and the final report was not available at that time. A total of 145 fishers in 29 villages in the two river basins were hired to provide fisheries data for the consultant to achieve the following goals[8]:

- To develop reliable information to assist THPC management understand project impacts and plan and execute appropriate mitigations
- To develop an improved understanding of the biological, social and economic characteristics of the fishery in the Kading, Theun, Hai and Hinboun river systems.
- To develop baselines to measure the benefits of mitigation measures, the impacts of other proposed hydropower projects and changes in community utilization of the resource.

During the course of villager interviews in impacted villages in all three zones there was opportunity to talk with a number of fishers who had been involved with the one-year fishery survey. They seemed quite glad to take part, as they were financially rewarded (70,000 k/month) for their efforts in recording data on special forms for the survey on a daily basis. In particular, they were required to give details of date and time of recording data, fish local names, weight, length, fishing gear, fishing location and whether the fish was for home consumption, sale, processing or other uses. The fish were identified against a code number in a photo flipchart for back checking against the scientific name later. Some fish that could not be identified by fishers were preserved in formalin for later collection and identification in Vientiane. Project staff paid the participating fishers and collected the forms on a monthly basis and the raw data was entered into a Microsoft Access Database. . However, due to the volume of data, this process was not finished until January 2004. All data analysis was subsequently conducted by Schouten.

Comments on survey process: While it is admirable that great efforts were made to collect a large amount of new fishery data over a vast geographic range, there may be some tentative conclusions that can be drawn about the value of this process for the future:

- Staff should be kept fully informed of the objectives, purposes and intended outcomes of the study throughout the process. This was not fully apparent from discussions with some staff members involved in data collection or processing.
- Data analysis, where possible should be handled by local staff and the database should be as user friendly as possible in Lao and English languages. This generally seemed to be the case.
- Field data collection on such a large scale presents both logistical and practical problems, many related to accuracy of data received. Indeed, both Roel Schouten and

[8] Fishery Evaluation and Mitigation Logframe 2002 - 2003. Project Document.

Peter Wallis related that some of the data was contradictory or suspect on close examination, and thus, some of the data had to be discarded. Sometimes, focused qualitative data from key persons can provide more useful data than vast amounts of quantitative data. This is especially true for long term past trends and changes in the fishery.

- Paying participants for data collection can be useful in some instances. It can also encourage dependence and reluctance to provide data without payment in future for similar or other project-related activities.
- Field staff should be encouraged to collect qualitative information whilst working with villagers, which can often provide valuable feedback on such areas as historical fisheries trends, odd events or observations noted by fishers and local ecological knowledge (LEK), not otherwise collected in the more quantitative-oriented data sheets.

Even with the results of the Schouten survey, it is recommended that a long term monitoring of fisheries should be established as soon as possible. In addition, the Project must decide how to move forward with practical fisheries-related interventions that benefit the widest number of APs, who despite changes to the environment, still show high dependence on living aquatic resources as part of their livelihood strategies.

4.7 Fish conservation education and village rules

From discussions with AP's, EMD staff and reading earlier reports, the unsustainable fishing practices of most concern are the continuing use of explosives in the upper Hinboun and Nam Theun-Kading rivers and the use of bagnets (*dtong*) blocking tributaries during flood recession on the lower Nam Hinboun River.

4.7.1 Action to date:

The EMD convened a series of three meetings (one for each main impact area) in June 2002 for representative fishermen from the 145 fishers in 29 villages who were taking part in the yearlong fishery monitoring survey. A summary of the main points to emerge from the meeting were as follows[9]:

- Most villages have a fish conservation zone in their village area[10]
- There are regulations in place for fish conservation that were "sent down" by the District authorities or created by the village committee itself for the local situation.
- Participants said they have never formally had the chance to discuss fish conservation issues with other villages and have mostly felt that the regulations have been imposed on them from above.
- Some villages have no conservation zone, while in others "conservation pools" (formerly deep pools which functioned as important dry season refuges of fish) have become filled with sediment in recent years and now hold far fewer fish. (This point specifically refers to the Nam Hai-Hinboun system)
- Implementation of regulations is weak.

[9] Anon. Project document. "Summary of the fisher's meetings" 2pp.
[10] The existence of a FCZ in theory, does not ensure that it is managed in practice, and most villages were found to be indifferent to managing it specifically for conservation purposes

- Village boundaries and areas of responsibility are still not clear between some villages.
- Outsiders sometimes come into area to use explosives for fishing, which is hard to control.
- When persons using illegal fishing methods have, on occasion, been apprehended and sent to District authorities, no further action has been taken against them.
- Use of explosives is a very difficult issue to discuss at village level.
- There are some new fishing methods (e.g. mask and spear gun) not currently addressed by current government regulations.

The meeting proposed the following methods for "enhancing fishery conservation":

- Starting from amongst the participants at the meeting, conservation issues will be addressed by them in collaboration with village authorities.
- The villages were to request the District Administration to take action against those who do not respect the regulations.
- The villagers would like the government (or district authorities) to introduce new regulations that cover fishing methods not currently included.
- To improve conservation measures between villages (where fishing grounds overlap), then villages should meet together to discuss the issues and sign an agreement.

4.7.2 Review Consultant's comments on fishery conservation regulations and other local resources management issues:

In the course of discussions with AP's, especially along the Nam Hinboun River, the issue of general fishery conservation measures and fishery conservation zones (FCZs) was frequently a topic raised with villagers present. While the majority of villages visited had some fishery rules at least on paper, it was often found that the regulations governing aquatic resource use were usually no different from the official regulations concerning illegal fishing methods (i.e. forbidden to use poisons, explosive devices or electricity in fishing), rather than any specific conservation measures that might be applied such as minimum mesh size or seasonal restrictions. The FCZ itself, where present was typically a pool (*wang sanguan*) that was close to the village and used to be deep, where fish were known to congregate in the dry season. Nowadays, it was found most of these pools on the Nam Hinboun are filled with sediment and villagers see little benefit in keeping them as FCZs. Indeed, nearly every village reported that the river all along its length is much shallower than before the dam was built.

It was unusual to find a village that said they had ever caught anyone fishing illegally or imposed a fine on offenders, although there were one or two exceptions (e.g. Ban Pahang Neua and Ban Gang). Even during the course of field visits by the consultant there were many second hand accounts of explosives use and on 17/3/04, our boatman on the Nam Kading below the dam site pulled two identical size cyprinids (*Barbodes* sp.) from the water which had apparently been killed by explosives the day before. It was generally found that villagers were wary of talking directly about the use of explosives in most areas visited, but this is understandable. Despite this, it is thought that the problem of explosives is absent or uncommon in the majority of villages, but there remain certain villages or areas where it is still being practiced, and it is recommended that serious consideration be given of how to stop the practice of fishing with explosives.

The meeting of fishery study participating fishers has so far been a one off event, as no follow-up meeting has been arranged to further discuss the issues raised in the first meeting and any concrete outcomes taken from the measures proposed. To keep villagers interested and informed about the results of the study, it is important to provide follow-up news and feedback, so the exercise is not merely an extractive one.

It is recommended that the villagers themselves are the best guardians of local living aquatic resources, and as such, should be integrally involved in all stages of planning, implementation and enforcement of local conservation measures. Fines levied for infractions of regulations, should ideally be collected at the local level and used for village development activities, rather than at the District level. Villages need to be empowered to understand (through opportunities for networking, exchange of information and education) wider basin issues and take responsibility for their local natural resources.

From field visits and discussions with APs, especially along the middle and lower Nam Hinboun River, there seems to be strong conflicts of interest concerning management of aquatic natural resources. A good example is the concession system for the *dtong* fishery, practiced by blocking tributary streams draining flooded forest, fields and wetland areas to catch fish migrating back to the main river channel. Several fishermen talked to from Ban Pakan expressed their dissatisfaction with the present system, where a relatively wealthy individual can buy the concession rights to a particular stream from a village and the District administration, sometimes paying up to $2,000 in total to both. Local villagers are then excluded from using the stream in the vicinity of the *dtong* and there is little or no outside scrutiny or inspection. Likewise, it seems that little or none of the concession fee going to the District administration is spent on enforcement of regulations (like minimum mesh size) or fishery improvement and there are large discrepancies between the amount said to be paid by concessionaires and amount said to be received at the District level.

Villagers complained that the nets totally block the streams and catch even the smallest of fish and crustaceans (i.e. shrimp), thus impacting and reducing future fish stocks. This is definitely an area of fishery management, potentially impacting fish recruitment to the whole Nam Hinboun river system, which needs further study and consideration of options. One of these might be the possibility of THPC buying off the *dtong* fishery at selected sites (could be considered a compensation measure for impacted communities), with revenue going only to village authorities, and studying if there is any subsequent local improvement in fish catches, either in the short or long term. However, this would be no substitute for other efforts to generally reduce the intensity of the present *dtong* fishery through discussions with district and village authorities and local APs.

Interestingly and ironically, a slightly different situation is pertaining on the lower Nam Kading. Here, apparently a limited *dtong* fishery has been operating for not more than ten years in the area. In Ban Pak Soun, for example, about six years ago the villagers decided to set up a *dtong* just above the mouth of the Nam Soun stream, which enters the Nam Kading by the village. Instead of being a privately owned operation, this was a community owned fishery where families in one unit (*nuay*) of the village pool resources and labor to make and run a *dtong*. Each unit took turns in

operating their *dtong* for a day during the flood recession and all benefits were shared equally amongst the participating families. On a good day it was possible to catch between 200 – 300 kg of fish, according to the villagers. However, for the last few years the villagers in Ban Pak Soun and Ban Pak Pang downstream have been told that the use of the *dtong* is forbidden by District authorities, according to national laws. A Pakkading DAFO official reported that they had been warning the villagers to stop for the past two years, and would fine them and confiscate their gear if caught again, but it was hard to really stop the villagers.

4.8 Fishermen to Fishermen Training

EMD had originally planned to take 10 upland (i.e. Headpond village) fisher group leaders to Nam Ngum Reservoir and 10 lowland (i.e. Nam Hai-Hinboun Plain) fisher group leaders to a "Mekong location", but such activity had not been undertaken before the Review. Although the plan had originally seemed like a good idea to EMD, it lacked a rationale and justification for the choice of locations. The choice of Nam Ngum reservoir is not an ideal one for Headpond fishers as the basic conditions and environment at Nam Ngum reservoir are significantly different from those pertaining at the Theun-Hinboun Headpond. The only location in Lao PDR that is perhaps comparable, might be the Nam Song Diversion Dam in Vientiane Province, but at a smaller scale. However, it is not clear what could be gained from such a visit for both parties. Fishers generally are fairly adaptive to new circumstances, so long as there are still fish to be caught, and this was clear on the Headpond during the Review. At several villages, fishers were busy making new gillnets with large mesh (16 cm) and weights to hold them down. The nets were designed to fish at depths of down to 8 m to target the new appearance of large tilapia and common carp in the Headpond, which now tend to dominate catches. Fishers should be recognised as the experts of their local environment, due to their intimate year round knowledge of its characteristics and nature, often referred to as Local Ecological Knowledge (LEK).

It is recommended that for future "fisher to fisher" contact or exchange, it would make more sense to encourage intra-basin networking of fishers with a goal of not trying to maximize those fishers catches, but to get them talking about practical steps that they can take within their own communities to conserve and manage the fishery for the future. They should come together to exchange their local experiences, learn about what has worked and what has not and understand the bigger picture of the common links between them and the river system they utilize. It should be a process-orientated approach, recognizing the complexity of the environment and socio-cultural setting. For this reason, it is recommended that the EMD draw on the experiences of community-based co-management of natural wetlands in Savannakhet Province, for any future fisher exchange visits, which can be arranged and facilitated through the RDC[11], Savannakhet. The RDC has considerable practical experience in facilitating such visits and encouraging a participatory approach to development.

5.0 Research

[11] The Regional Development Coordination (RDC) is a locally-based initiative at the Livestock and Fishery Office of the Savannakhet Provincial Agricultural and Forestry Office. It's mission is to, "influence, encourage and assist development institutions to devise systems of livestock and aquatic resources management that are socially equitable, ecologically sustainable and contribute to the alleviation of poverty"

5.1&2 Headpond sedimentation

A number of reports have been written by consultants related to the Headpond and the nature of sediment movements and the effectiveness of the annual flushing process. The nature of sediment loading appeared to be more complex than originally thought and ongoing measurements will be required to better understand the process and provide a good estimate of progressive sediment capture by the Headpond.

5.3 Monitor and Evaluate Changes in Nam Theun and Nam Hinboun Watershed Land and Water Resource Uses and Impact on THPC Efficiency

The 2001 Landsat Imagery[12] provided a check on the condition of the forests including amount of shifting agriculture being conducted within the watershed. Based on the land use and hydrological information available at the project site and when compared with other catchments throughout Asia, the Nam Theun-Kading and Hinboun watersheds can be considered to be in reasonably good hydrological condition.

Within the Headpond area there are newly pioneered roads, some associated with commercial logging and large village and agricultural clearings that will likely experience considerable sheet and gully erosion in the coming rainy season. However, provided good drainage management is carried out, newly created terrace systems are maintained according to plans laid out by Ecolao and vigorous annual crops or permanent tree crops are encouraged on exposed ground, this hazard will be considerably reduced. As most of the soils in the head pond area are fine textured, they are likely to have only temporary residence in the Headpond and not contribute to reduction of capacity of the reservoir. The primary purpose of erosion control, then, is to maintain soil fertility and land surface integrity.

The overall hydrological effects of present changes in land use and forest cover on water resources- (water quality, quantity, and timing of flows) are low and not likely to measurably alter THPC operating efficiency. However forest mismanagement remains a concern and should be closely monitored.

5.4 Evaluate Riparian Release

Initially, activity for this Logframe item was to commence in the first half of 2002[13], but such activity was postponed in order to focus on activities at the village level. The current riparian release of 5 m^3/s is an important issue because the river downstream of the dam is still extensively utilized by local villagers for upland rice cultivation, transportation, gold panning, collection of NTFPs (especially sticlac) and fishing. Villagers talked to in Ban Kengbit and Ban Phon Ngam make regular dry season excursions in to the Nam Kading National Biodiversity Conservation Area from between 1 – 30 days, mostly with the intention of collecting sticlac (*kee-see*), sandalwood (*mai dam*) and fishing for subsistence and sale.

[12] The most recent Landsat imagery available should also be procured to monitor ongoing forest clearing and shifting cultivation within the Nam Theun, Nam Hai and Nam Hinboun watersheds. .EMD has developed an excellent GIS system using topographic base maps. Among other themes, a 2001 Landsat image was overlain on this topographic base map. The comparison of 2001 and 2004 imagery will confirm the actual intensity of shifting cultivation over the last three years in the project area.
[13] See Quarterly Compliance Reports for 4th Quarter 2001 and 1st Quarter 2002.

Prior to the project, there were serious concerns raised by various parties about the impact of a riparian release of less than 10 m^3/s on wildlife and the general riverine ecology. [14]

Having walked down below the dam site (first few kilometers by boat) for a day in mid-March to observe level of usage and present condition of the riverine ecology and from talking to villagers, the Fisheries Specialist is of the opinion that it is still an area of high conservation significance with the continued presence of a varied fish, mammalian and avian biodiversity. There were fresh signs of Asian elephant (Elephas maximus) using the river not far below the dam, relatively abundant bird life and small mammal signs. Our guide from Ban Kengbit told us that he had caught on rod and line two *pba kang* (Luciocyprinus striolatus) during the last year, which as a rare, top of the aquatic food chain predatory cyprinid is of high conservation significance to the state of the fishery overall. The fact that a population of *pba kang* still remains below the dam is of great significance and suggests that the riparian release may not be as destructive to fish biodiversity downstream in the Nam Kading as some observers feared. However, it is equally important that the riparian release should not be lowered without a full and comprehensive study to ensure that any change in the riparian release does not result in negative impacts to the present biodiversity, and at a minimum, efforts should be taken to maintain the present state of the biodiversity.

It is recommended that the project undertake, as soon as possible, full and comprehensive ecological and biodiversity studies to determine the present state of the riverine habitats within the Nam Kading NBCA including aquatic fauna studies beyond just ichthyofauna. These studies will provide useful new data for the Nam Kading NBCA that can be compared against pre-project knowledge and impact predictions.

5.5 Erosion Control on Nam Hai

The bank collapse and resulting suspended sediment and bed load in the Nam Hai is one of the major impacts of the Nam Theun diversion because of its effect on water quality, fisheries and to a lesser extent, transportation within the Nam Hai-Hinboun system. The project has invested considerable resources to understand the nature of riverbank erosion, how it affects water quality and how it influences downstream fish populations. The general consensus was that there was little that should be done about the bank collapse, particularly if the only significant impact was in terms of a loss of an average of 1 or 2 meters of stream bank each year. More recently, a large amount of water quality data has been collected which concluded that fisheries decline could be largely attributed to the fluctuating discharge issuing from the power plant.

While final results from the bioengineering structures along the Nam Hai are not available, it is the opinion of the Review Team that such vegetative erosion control techniques are unlikely to significantly alter the progression of bank erosion of the Nam Hai. This conclusion comes primarily from the fact that existing vigorous vegetation of all descriptions, (including willows further downstream on the Nam Hinboun) has been almost completely destroyed below the high dry season water line as a result of the present discharge regime in place since the powerhouse began operation. Simply, no riverine vegetation has evolved to survive the intermittent discharge imposed by the

[14] Norplan A.S. 1995. Impact Studies for the Theun-Hinboun Hydropower Project, Laos. Draft Final Report, 10 November 1995. Ministry of Industry and Handicrafts, Hydropower Office, Vientiane.

powerhouse throughout the dry season. While it will be possible to establish vegetation above the dry season high water mark, bank undercutting below the established vegetation will still cause the bank to collapse. The presence of frequent large trees with vigorous well-established root systems falling into the channel illustrates the limited (and possibly negative[15]) value of vegetation to overcome this problem.

Fencing of banks and changes to land use along the Nam Hai would bring only marginal benefits. Such efforts should be considered only if they are concerned with increasing productivity for village production systems.

The Reviewer has investigated all available reports and visited a number of sites along the Nam Hai and believes that some small changes in EMD's monitoring research program could lead to better decisions about what if any mitigation might be appropriate. These changes include:

- Install an automatic stage recorder at the bridge on the Nam Hai to assist in characterizing stream flow when water samples are being collected.

- Acquire all available maps, aerial photographs, Landsat images, profiles and cross-sections of the Nam Hai.

- Draw out a 1:2,000 planimetric map showing progressive changes of the stream banks of the Nam Hai over the last 7 years.

- Revisit the 1997 Norplan Report that recommends bank armoring along selected reaches of the Nam Hai.

- Refocus the riverbank collapse monitoring to investigate the predictability of stream bank collapse by tying to Norplan's recommended mitigation plan.

- Measure Nam Hai Channel immediately before and after the rainy season to determine proportional role of dry season fluctuation flow of stream bank collapse.

- Make use of rangefinder to efficiently determine bank width along the Nam Hai.

- Tie water quality sampling to represent uniform discharges as well as fluctuation power plant induced and natural discharge along the Nam Hai.

- Where past data provides accurate determination of discharge of the Nam Hai, revisit data sets to permit comparisons between different sampling dates.

The Review Team is uncertain that the regulation of powerhouse discharge alone, as suggested by the fisheries consultant (Schouten), will substantially improve the fisheries without some concurrent riverbank stabilization. A more focused approach to bank collapse monitoring in conjunction with water quality monitoring could greatly improve the decision as to if, or what, armoring should be carried out along the banks

[15] Trees with large root systems that become undercut act as levers and actually ply large quantities of soil into the stream channel as they collapse. Once in the steam channel, they can hinder navigation, but act as fish refuges.

of the Nam Hai by determining location and degree of erosion at specific stream reaches.

The more discriminating water-sampling program as described above would provide turbidity data that could be compared from one year to the next. Over a few years, this data would provide trends regarding any change in turbidity generation.[16] Until more discriminating data collection is carried out it will be impossible to say anything about trends.

In any case, there is still the possibility that leaving nature to take its course maybe environmentally the best approach to the Nam Hai sedimentation problem and not merely a good excuse to do nothing. While mitigation may not be possible, good data will be invaluable to any future trans-basin project.

5.6 Investigate fish hatchery

Based on the consultant's observations, experience and conclusions drawn from a wide cross-section of poverty alleviation focused, small-scale aquaculture and aquatic resources management experts from across the SE Asian region at a Food and Agriculture Organization (FAO)/ Network of Aquaculture Centres in Asia-Pacific (NACA) meeting in Bangkok during February, 2002,[17] the consensus was that there is little benefit to be derived from supporting or developing large centralized hatcheries primarily because:

1. They are rarely able to reach remote areas, are expensive and often fail after withdrawal of support.
2. Opportunities for poor people to become involved in hatchery production and trade are denied.

In the Reviewer's opinion, any intervention or support for hatchery development should be focused on supporting local, small-scale initiatives by APs themselves, using appropriate technologies and developing fry distribution networks. Good examples of these working in practice can be found in Savannakhet province and future training could be requested from the RDC, an institution with considerable experience in developing participatory approaches and capacity in livestock and aquatic resources management. However, as there appears to be little or no experience in fish raising amongst all impacted communities at present, then small-scale hatchery development should be a secondary goal to building interest in and capacity of APs in small-scale aquaculture as a first step. The Resource Farm (formerly "Demonstration Farm"), is not suitable for development as a hatchery site, but can be used for holding fry in ponds or net cages for later distribution to farmers as fingerlings. The project thus could provide

[16] . Some villagers have observed that they are finding more opportunities to get clean water from the lower Nam Hai now than in the first year after the power house was started up in 1998. Whether this is so should be investigated further by more village interviews.

[17] **FAO & NACA**. 2002. *Focusing Small-scale Aquaculture and Aquatic Resource Management on Poverty Alleviation*. (Eds. Friend R and S. Funge-Smith). Food and Agriculture Organization of the United Nations, Bangkok.

a valuable role in overcoming the current constraint to farmers of no local fry availability.

5.7 Feasibility of fish ladder for dam

A study was conducted on the feasibility of constructing a fish passage facility at the Nam Theun Diversion dam in early 2002 by an RMR consultant.[18] Using a very narrow knowledge base concerning fish migrations on the Nam Theun system, the consultant concluded that there were three possible options (price range of $1,260,000 - $3,080,000) of which a 'Trap-and-Transport' type arrangement was most feasible at the site. The consultant recommended that a temporary small-scale fish way was operated and monitored by an external consultant at the dam for 12 months, from which "…..a subsequent review of the first phase to determine the requirement for, and final cost of, a permanent fish passage solution", could be used. This year long experimental study alone would have cost $110,000.

The EMD subsequently did not proceed with the proposed study as it was considered to have insufficient details and justification, and failed to maximize execution of activities by Lao expertise and local communities. Under the circumstances, the Review Team believes this was the correct decision. It should be recognized that the main upstream migration of fish has been blocked by the Nam-Theun Dam since 1998[19] and any opportunity for successful, partial mitigation of these runs through building an experimental fish passage facility was lost in the first few years post dam closure.

It appears there are several relatively successful fish passes of various designs operating at some low dams (< 10 m head) and weirs in northern Australia, but they operate under very different social, cultural and economic conditions to Lao PDR. The issue of mitigating fish passage at dams and weirs in the tropics is a complex one with few simple answers and no examples of successful mitigation to learn from in Southeast Asia.

Any attempt at mitigation through retrofitting a fish pass is most likely to be partly successful for a limited number of species, of a certain size and biological characteristics at certain periods of the year. Furthermore it is important to link the development of any fish passage strategy to a whole catchment approach for maintaining fish populations and healthy aquatic resources. Therefore, keeping in mind this holistic approach, it is impossible to delink the present Nam Theun flow regime from any future upstream projects, and thus, it would be of little value to consider a fish pass at this stage because of additional impacts that may be caused by potential upstream projects.

6.0 External Environmental Impacts

6.1 Support to Village/GOL fish conservation awareness programs

[18] Thorncroft, G. 2002. Fish passage at the Diversion Weir on the Nam Theun. THPC report, March, 2002.

[19] Warren T.J. 1999. *A monitoring study to assess the localized impacts created by the Nam Theun-Hinboun Hydro-scheme on fisheries and fish populations*. Final Report. Prepared for the Theun-Hinboun Power Company (THPC), Vientiane, Lao PDR

A main recommendation for future village-level fish conservation awareness programs is that the project recruits at least two full time Lao staff, with knowledge and experience in participatory techniques of natural resource co-management and preferably, a good understanding of Lower Mekong Basin aquatic resources issues. With this skills base, the staff would be ideally suited to introduce a gradual process of aquatic resources co-management and education, facilitating participation from affected communities, local government, THPC and other stakeholders with interests in sustainable use of the river systems. One staff member would be responsible for the Nam Theun-Kading Rivers system and the other for the Nam Hai-Hinboun river system, although they would obviously have to work closely together on some issues, but mostly they would work with the communities in their own respective river basins.

Their main roles and duties are envisaged as:

- Establishing a network of village representatives in each basin who would meet together on a regular basis (i.e. 3 or 6 months) with other relevant stakeholders to discuss issues related to sustainable management of the aquatic resources.
- Encouraging local strengthening of village capacity to co-manage their aquatic resources (not just limited to the river, but lakes, swamps, streams, rice fields and other wetlands)
- Monitoring and collection of basic data related to aquatic resources management from village, district and provincial levels and keeping various stakeholders informed of results.
- Organizing village "Aquatic Environment Awareness Days", which would be held in the village primary school with the full involvement of the teachers, students and any interested villager (i.e., open to all). The basic concept of the day would be a series of hands-on activities, which raises awareness of the participants to the aquatic resources and ecology in their local area, through use of simple tools and equipment (e.g. hand-held magnifying glasses, thermometers, petri dishes, small fish tanks and nets). The approach would encourage the combining of the local ecological knowledge of the villagers and standard scientific knowledge in an innovative, creative and educative manner. Drawings, clay modeling, pond and river dipping, competitions, understanding simple food chains and webs, simple water chemistry, etc., can be introduced in the day. It takes the classroom into the real world around the students, something rarely done in the standard "chalk and talk" approach to teaching. Above all, the exercise should be fun!
- Aim at producing a book or publication which maps and documents the aquatic resources of each basin, through collaborative research of the villagers themselves, such as has been achieved through the "*Thai Baan*"[20] research project in Thailand.

7.0 Management

To date, the project is well managed, and human and financial resources have been well allocated. In terms of on-the-ground progress, this project has generally performed much

[20] The "Thai Baan" research project (*ngan wijai Thai baan*) utlilizes a novel approach to natural resources management where the villagers themselves become the co-researchers with outside facilitators, which uses the villagers own local ecological knowledge to understand the processes and relationships involved between humans and ecosystems. Because of local involvement, the villagers take a much greater interest and pride in the results than standard, scientific extractive data collection. Further details can be obtained from David JH Blake, fishery consultant for Review Panel.

better than either government or NGO backed development initiatives attempting similar activities throughout Southeast Asia. The reasons for EMD's success stems from

- careful recruitment of highly motivated staff with proven skills
- being able to operate in a relatively unencumbered manner compared to NGOs
- choosing implementation activities that have had success elsewhere in Laos and
- providing staff with strong financial and logistic support to carry out their own activities with minimum of interference and yet effective checks and balances.

A rigorous monitoring system based on a detailed activity Logframe is being followed in which each section head prepares monthly and annual reports that are submitted to the EMD Manager who in turn compiles the reports and submits them to the General Manager in Vientiane. The section head reports are usually in a spreadsheet format and provide concise details of achievement of various project targets whether they relate to wells dug and functioning or initiation of new village Credit and Savings Fund Schemes. More subjective information, which might require substantially more reporting time, such as why some project activity is proceeding more slowly than expected, is reported verbally to the EMD Manager. Management felt this was a more effective way of minimizing time on report writing for staff with heavy field schedules. Monthly meetings are conducted to monitor activities and discuss such problems. Liaison with provincial and district government offices appears to be adequate to permit efficient performance of project. Based on the obvious project results at village level, this management structure is working well.

Management of the complex array of EMD activities is made possible by careful adaptation of a logical framework to conceptualize, implement and monitor the project. The management stressed to the review team that their report should follow the Logframe format so that its recommendations could be considered in EMD's upcoming Project Logframe review.

As noted in several places in this report, there are a number of concerns expressed by the Review Team about the current capacity of the EMD staff to adequately reach all the impacted villages and monitor/backstop all the activities initiated. In addition, given the recommendation to gradually introduce an appropriate long-term living aquatic resources co-management and education program, it is almost essential that further staff and expertise are added to EMD

Other Potential Logframe Issues

1/ During meetings with EMD Manager and staff, the following interventions were raised as possible fishery mitigation measures:

"Develop initially in each impacted village small fish culture ponds in family garden/orchards that have been developed with water supplies. Initially 6 volunteer model demonstration families should be supported in each village and ponds stocked with the indigenous species phapaak

(Barbodes gonionotus) or phaduk (Clarias sp[21].). This is considered an important diet supplementation measure to the work being done to increase small livestock."

The basic rationale behind this measure is fairly sound, small-scale fish raising can be a central part of a Lao small-holder's livelihood diversification strategy and efficiently use on-farm resources. Small, well-managed fishponds can provide relatively large amounts of animal protein at low-cost to replace wild fish depletion in an integrated farming system. The water held in the ponds can also be a useful alternative source of water for irrigation of fruit trees and vegetables planted around the pond banks. However, there are a number of important risks and assumptions, which must be addressed first in considering such a strategy:

- How will the 6 "volunteer model demonstration families" be chosen? Will they be ones already being supported with small livestock raising? Will the ponds, fish seed and other inputs be subsidized or depend entirely on the farmer's own capital, labor and credit standing to start?
- Will the ponds be earthen or concrete? Small shaded concrete ponds can be successfully used to raise catfish (Clarias sp.) in Lao PDR near urban areas (where concentrate feed is more readily available), but in rural areas it is generally necessary that the farmer must have a readily-available cheap source of high animal protein food available daily (e.g. earthworms, insects, termites, etc), which may often be hard to procure. Without daily feeding and regular water changes the system becomes uneconomic. Hand or machine dug earth ponds from 200 - 400 m^2 in size with omnivorous / herbivorous fish spp. can provide enough animal protein to feed a small family, providing they hold water for most of the year and are well managed with sufficient feed and fertilizer inputs. The dilemma will obviously arise as to whether it is more economic to feed on-farm protein feed sources (cassava leaves, yam leaves, rice bran, etc.) to fish or livestock and likewise, whether to use animal manure on vegetable beds or in the fish pond. Integration of animals, fish and crops (fodder and food) is the ideal answer where on-farm energy flows are maximized, but this often requires much project input, training and extension services to achieve wide adoption.
- The terrain of most Headpond irrigated gardens do not lend themselves to fishpond construction, due to the lack of flat land. This is a serious constraint for most farmers, so the present concentration on promoting small livestock rearing could be the best strategy.
- In the gardens on the Nam Hai-Hinboun plain, there is more flat land available, but there is a high risk of flooding and the sandy, free-draining nature of the soils means that water seepage would be high, at least in initial years without puddling or other water conservation measures. Also, there remains the question of how much land from one rai (1,600 m^2) the farmers would be willing to sacrifice for a fishpond?
- From experience in lowland parts of Lao PDR and NE Thailand, the most suitable land type for building fishponds is flat paddy land. The soils generally offer better water retention capacity (especially where clays and loams are present) than the more sandy riverbank / levee soils of the gardens / orchards and in cases where the fields are irrigated water ceases to be scarce in the dry season. Relatively high yields of fish (800 – 1,000 kg/ha) can be easily obtained in such circumstances, given good

[21] Of the Clarias spp. commonly used in aquaculture, only two are native (C. macrocephalus and C. batrarchus) to Lao PDR, but the former may be commonly hybridized with a non-native species of Clarias (C. gariepinus). Hence, there is a risk from both disease-spread and hybridization, through stocking of exotic species of catfish, as with other introductions of exotics

management and utilization of locally available feed inputs and resources. With the present (March, 2004) price of cultured fish in Bolikhamsai/Khammouane markets at 15,000 – 18,000 k/kg, this compares favorably against the economics of dry season rice production (typically 5 – 6 T/ha). Assuming the median price of paddy rice to be 1,500 k/kg and fish to be 15,000 k/kg, the income / ha would be approx. as follows:

Fish raising in ponds.. 12 – 15 million k/ha (6 – 8 months growing period)
Dry season rice …….. 7.5 – 9 million k/ha (4 – 5 months growing period)

Wet season rice……... 3.0 – 4.5 million k/ha (at typical yields of 2 - 3 T/ha)

On the costs side, rice growing needs far higher external inputs than fish raising to achieve the kind of yields quoted above, inclusive of fertilizer; ploughing (tractor hire & fuel); irrigation; labor for transplanting & harvesting; transport and threshing costs[22]. All these costs will greatly reduce the potential profit margins from dry and wet season rice. With fish raising, the only overhead input cost necessary is the purchase of fry or fingerlings (100 – 300 k each) which can be stocked at a rate of approx. 2 – 3 fish / $m^{2.}$ The other costs, by using locally available feed inputs and animal manure are just opportunity costs to the farmer. Hence, the potential profit margins from fish raising are much higher for one crop and risks from disease or pests are lower than rice cultivation. However, there are also more potential spin-offs from practicing fish culture, such as the availability of pond water for growing vegetables and fruit trees around the banks and the opportunities for integration with livestock like ducks and pigs, which further increase the utility value of the fish pond.

- Apart from land, the main entry requirement for farmers to aquaculture is the costs of digging a pond. It can either be the opportunity cost of a farmer's own labor in hand digging a pond (possible for small ponds) or the financial cost of hiring other's labor or a mechanical digger. The latter option is relatively expensive in the project area ($0.5 – $2.00 / m^3, according to inquiries), which is a constraint to wide adoption by most villagers. If the project could investigate subsidizing pond construction costs to a reasonable level for interested farmers (i.e. $0.5); provide appropriate advice on location and pond design; and offer extension and training to farmers in small-scale aquaculture, then this might help stimulate spread of adoption in the impact area.
- Flooding is a risk often cited by farmers in the Hinboun plain as a reason for not practicing fish raising or digging ponds and is an issue of common concern for both rice and fish culture. It was noticed that the bunds of the rice fields are often no more that 15 – 20 cm high and offer little protection against floodwaters. If ponds were dug by farmers via Logframe activities, it is recommended that they have bunds built around them of at least 100 cm height which offers increased protection against floods of low magnitude, but almost certainly not against the massive floods of the type experienced in 2002.
- Damming small streams is another option open to farmers, but again they are susceptible to floods and sedimentation and many get washed out every year in Laos losing all stocked fish. Proper outflow systems and the ability to by-pass heavy flows are essential to reduce the risks associated with flooding, which are frequently over-looked by villagers. It is also desirable with such barrage ponds to fit some kind of simple self-drainage device like a base pipe and plug to allow complete harvest.

[22] In one Nam Hinboun village, Ban Vang Mon, the villagers calculated direct investment costs for dry season rice to be equivalent to about 2.4 million kip per hectare.

- Theft of fish is a common problem experienced by farmers in many parts of Laos, as fish in fields and streams have traditionally been regarded as a common property resource. This was certainly the case at villages visited in the Nam Hinboun plain, which could be a potential deterrent to some farmers wanting to invest in fish raising.

➢ *"Develop further fish traps where feasible in the wild Nam Hai / Hinboun tributaries, repair existing ones and train villagers in their maintenance"*.

This might be possible and popular in some villages on certain tributary streams or public low lying areas currently under-utilized, but care should be taken to avoid totally blocking streams or channels important for wild fish migrations as these can often be more valuable to local villagers through gaining access to fields and wetlands in the rainy season than any artificial stocking could achieve. Ideally, if any stocking is to take place it should be with native species only (e.g. pba paak (B. gonionotus)), after the risk of flooding has passed (ie. mid-late Oct.) to avoid risk of escapes. Same comments apply as for barrage ponds above as to design and to avoid or minimize flood risks.

➢ *"Run 'fish in rice' demonstrations with volunteer farmers growing dry season rice in the Nam Hinboun"*

At present, the rice fields are not suitable for stocking fish, due to small bunds and shallow water. While it is technically possible and often been a popular development idea in the past to integrate fish and rice culture, there are in fact many constraints to this practice and there are few successful examples in Lao PDR to point to, with the possible exception of a few northern provinces (e.g. Xieng Khouang) where it has long been practiced. Of high concern to farmers is the loss of rice field area for channel digging and/or trap ponds, which often causes them to be reluctant to fully adopt the recommendations. Under the present system of high inorganic fertilizer inputs and the commencement of insecticide use, like methyl parathion (*Folidon*), the consultant is concerned about water quality and possibly public health problems occurring. Obtaining good quality fish seed when it is required is a continual constraint for all fish culture in isolated parts of rural Laos, especially during the cool season when irrigated rice is grown. A final major constraint addressed above is the risk of theft. In conclusion, fish-cum-rice is not so recommended for promotion through the Logframe as raising fish in ponds, which potentially can offer much higher yields, longer harvest periods and a greater range of benefits to farmers in the long term. This is an area of the project that would benefit from focused, relevant research on certain socio-economic or ecological aspects, perhaps carried out by Lao Masters degree or PhD candidates at the National University or overseas.

➢ *"Fish pond development by water diversion from regulating pond"*

At this stage it is uncertain if this option is technically feasible or what the future plans are for attempts at improved re-regulation of water from the powerhouse outflow to mitigate downstream erosion and sedimentation. Therefore, the reviewer is in no position to comment specifically. But in general terms, as mentioned above, any attempts at fish culture promotion should be focused on promoting small-scale aquaculture of native species of fish, which can be integrated into existing farming systems and involve participation of local people in the process. If such a development accompanied a large conversion of land to irrigated rice, it may well be detrimental to the already degraded wild fishery of the Nam Hai plain. But, in any case, project aquaculture interventions should be considered of secondary importance to promotion of sustainable living aquatic resources management in the MCP framework.

2/ <u>Expansion of area and villages presently considered impacted by Project</u>.

During the site review, the team visited Ban Phon Tan and Ban Dong Bang of Khamkeut District to evaluate possible impacts from the Project. In Ban Phon Tan (about 3kms as the crow flies from the Headpond), the Village Leaders and a small group of village elders informed the team that there are around ten persons who still regularly go fishing in the Nam Theun, but before the project, there more individuals who would go fishing in the Nam Theun. The villagers further stated that there have been a serious decline in the catches since the dam was built.

At Ban Dong Bang, which is located well upstream of the Headpond (on the east side) and 2 – 3 hours walk from the Nam Theun, many people (reportedly around two thirds of the population, although there were differing estimates), make trips to middle Nam Theun for fishing and collection of NTFPs. These trips may be short (one day) or sometimes involve several nights away and are most common in the dry season, when there is less agricultural work near the village, and the river is more accessible by foot. There are many rapids and deep pools on this stretch of the river, and fish can be caught by a wide variety of methods. However, villagers acknowledged that fish catches have declined considerably in recent years, although are not sure of the reasons for the decline.

As upstream and downstream longitudinal fish migrations have been effectively halted by the dam and Headpond, then it is possible that the dam has caused, or added to the decline experienced by villagers in Ban Dong Bang. Therefore, it is recommended that a detailed river user and livelihood studies should be undertaken of the villages upstream (Nam Theun and Nam Gnouang rivers), downstream and nearby the donor river, to ascertain exactly the number and extent of impacted villagers.

ANNEX 1 Non-Timber Forest Products (NTFPs)

From the fact that the natural resources in the project area are still in relatively good condition, people especially in the Headpond area have gained considerable cash income from collecting NTFPs. A study of NTFPs and the market chains would be interesting. At some point, data collected in the socio-economic survey about family consumption and income from various NTFP should be analyzed separately and it might show a significant relationship to which families are among the better off, average and the poor. It might show a large part of some communities' income is from NTFP, instead of the agricultural activities that the project is currently supporting. This also might mean access to roads and markets that are a secondary impact of the T-H Dam project may have influenced a decline of NTFPs.

However, it is also worthwhile for the project to separately study the NTFPs for their potential benefit on people's consumption levels, cash income from foods, handicrafts, medicine and many other things. A couple of sites could be selected, 1-2 communities at the Headpond area such as Ban Kaengbit where now people spend lots of their time collecting NTFPs; and Nam Hai and Nam Theun area – one village in a good road access location and the other one in a more isolated location. It can be a comparative study of three different areas or the project may want to concentrate to where NTFP are most abundant. It should be a monthly survey for a whole year round and for every second year that will allow the project to have a good understanding and to see the trends. The staff should visit the villages regularly so they can combine this study, with other project activities. IUCN is one organization that has long experience in this field, so the project should discuss and get information from them.

Apart from the study of collecting NTFPs, market chains and value added should be included. From observations, people generally sell raw products and their prices are determined by traders who come to the villagers. The project can intervene to secure fair prices for the villagers or to add value of these NTFPs (i.e., group the people together and negotiate the price with several traders). Simple data should be collected about where all the products go and how much price increases occur at each stop until reaching the end consumer. This perhaps can give a good indication of how the project staff can help local people get a fair price.

The project also has an idea to cultivate some possible NTFPs (e.g., cardamom and rattan). The project should be aware of differences in their quality and popularity between the wild and planted types. In addition, those NTFPs should give financial return in a short period of time so that people can see the benefit and want to invest their land, time, money and labor in with the precondition that there is a market available. A similar idea promoted by the district in the area is planting eagle wood "*mai ketsanaa*". People theoretically will be able to gain profit after 5-10 years, which is not practical for villagers having limited land. Selling seedlings is another option but this kind of business seems to fold easily like with the cases of teak, cashews and eucalyptus, mainly because the villagers realize that it takes too long to get an uncertain profit.

ANNEX 2: Data Analysis

The project has been implementing several activities (i.e., agriculture, animal raising, savings and credit fund, health and sanitation, and water supply) and each has carefully collected their own data with good systematic recording since commencement in 2001-2002. Most of the data is concerned with how each activity has progressed throughout the year. Such data can be useful for other project purposes. The data can be used by staff to evaluate activities each year before making plans for the next year. It can also help assess whether the project has reached to every group of people or whether this process of mitigation really allows equal opportunities for every group as intended, especially for the poor and women.

The project can use available information from each section to help make simple analyses. For instance, listing the households in each village who have accessed each activity introduced by the project (i.e., savings & credit fund, dry season rice, permanent rain fed agriculture, animal raising, health and sanitation). If those activities have been implemented for more than one year, compare the data to see the changes in the number and groups participating in each activity to see who really benefits from the project. This simple analysis can illustrate many things.

If the analysis shows a positive result then this can be valid evidence to show to other stakeholders. However, there are other possibilities such as a small number of people participating in the activity in the first year and then a steady increase in the following years. The reasons might be the group who join the activity later is the "wait and see group", who have resources but want to make sure first the activity will succeed. So only when they see the actual benefits and success, will they participate in the program. On the other hand it might be the opposite scenario, where the number of participating households is decreasing each year or it has not changed at all. The project should investigate the reasons whether the group is left off because people are already rich; the activity has failed; or they do not have sufficient resources and knowledge (i.e., labor and land), they are women or of certain ethnicity; they are poor but more interested in other activities and do not want to work hard. If this investigation shows that the most vulnerable group, such as the one lacking resources and knowledge, are not participating in the program, then the project is urged to do some qualitative studies focusing on understanding this group. The project can provide special assistance to this group but with agreement from the VDC, VAC and other households so that it will not create misunderstanding among them of why the project treats them differently. The project should be aware that the longer this group is left off, the more difficult it will be for them to keep up with the others and increasing the likelihood of wider wealth disparity between groups in the long run.

Some foreign or Lao students, at least at bachelor degree level, who are interested in researching this kind of topic should be encouraged to use Theun-Hinboun Dam as a research site.

ANNEX 3: Terms of Reference

REVIEW OF THE ENVIRONMENTAL MANAGEMENT DIVISION THEUN-HINBOUN POWER COMPANY LIMITED

REVIEW GENERAL TASKS

1. A three-person team will undertake the review. The results required from the team will be a reports with recommendations, where appropriate, pursuant to the following subject headings:

   a) Strengthening target communities in organizational and financials skills to manage development initiatives.

   b) Improvement of community water supplies and public health.

   c) Strengthening protein production through livestock and fishery development.

   d) River Garden Compensation: Village garden – orchard development.

   e) Compensation for loss of Income: Strengthening food crop production security.

   f) Watershed Land use and Headpond (Reservoir) sedimentation.

   g) Wild fishery impact evaluation and mitigation.

   h) Erosion Mitigation and Monitoring.

   i) Changes Required.

   j) Executive Summary and Recommendations.

REVIEW SPECIFIC TASKS

2. The team with assistance from independent translators, or EMD staff, which ever is appropriate or necessary, shall:

   a. Undertake field inspections of all activities initiated; and

   b. Hold discussions with affected persons (AP's), local government and local community leaders and short term advisors to EMD; and

   c. Examine reports and EMD records relevant to its activities.

3. The activities to be assessed shall include, but not necessarily restricted to:

   a. Community Strengthening and Organization.

      - Gender awareness development and women participation in activity planning.

- Participatory rural appraisal for and planning for appropriate mitigations.
- Village Development Committee formation and operation.
- Socio – economic baseline sampling and monitoring.

b. Community Health and Water Supplies.

- Water supply improvement program.
- Water quality monitoring program.
- Access to water mitigations.
- Household toilet and village sanitation program.
- Disease control program.
- Birth spacing, midwife and other training programs.
- Integration of house with garden water supplies - village planning.

c. Strengthening Protein Production.

- Livestock development and extension.
- Livestock Service Center development.
- Wild fish trap development.

d. River Garden Compensation.

- Establishment of small-scale pump/pipe irrigation systems for house garden/ cash crop/fruit orchard development.
- Contoured garden development-Headpond Theun River.

e. Compensation for Loss of Income: Strengthening Food Crop Production Security.

- Development of permanent terraced agriculture systems in Headpond.
- Development of dry season irrigated rice production in Hinboun River.

f. Watershed Land Use and Headpond (Reservoir) Sedimentation.

- Headpond sedimentation monitoring.
- Headpond inflow suspended sediment monitoring.
- Promotion of correct land use practices for soil and water conservation in headpond watershed.
- Other sediment studies.

g. Wild Fishery impact evaluation and Mitigation.

- Fishery evaluation Logframe design.
- Progress in survey data collection and analysis.
- Fish Passage feasibility at weir.
- Fish Ponds.

h. Erosion mitigation and monitoring.

- Hai river erosion studies completed.
- Erosion and sediment monitoring.
- Initial erosion mitigation measures.

i. EMD.

- Organization Structure and Management policy.
- Planning, implementation and reporting.
- Staffing arrangements.

Required Qualifications

4. The required qualifications for the review team are as follows:

a. Community Organization and Development Specialist

Specific experience should include strengthening rural community organizations to manage technical interventions, micro-finance schemes, socio-economic assessment and monitoring, community health and community participation in project planning and management. At least 10 years of developing country experience; experience in Southeast Asia highly desirable. Experience working with bilateral or multilateral organizations, international/national NGOs, or foreign Government officials is important, and experience with private sector companies would be an advantage. Work experience that includes working on mitigation of major industrial or natural resource development project impacts on local communities is desirable, but not essential.

University qualifications required that include subject majors relevant to social and public health sciences.

Scope of review will include paragraphs (8) and (9) a-b of this Terms of Reference.

b. Natural Resources Management and Environmental Specialist

Specific experience should include environmental impact assessments and mitigation in natural resource development projects, land use planning and agriculture systems that include steep land watersheds, and natural resources management assignments in relation to soils and soil erosion, water utilization, and sedimentation. At least 10 years of developing country experience; experience in Southeast Asia highly desirable. Experience working with bilateral or multilateral organizations, international/national NGOs, or foreign Government officials is important, and experience with private sector companies would be an advantage. Work experience that includes development of community participation in the planning of natural resource development and management is essential.

University qualifications required with subject major relevant to environmental science and natural resource management.

Scope of review will include paragraphs (8) and (9) d-f and (9) h-i of this Terms of Reference.

c. Fisheries Specialist

Specific experience should include assessment of the impacts of dams on freshwater fisheries and the mitigation of such impacts, and knowledge of fish migration patterns in tropical river systems and familiarity with small-scale community-led aquaculture and wild-capture fisheries management. At least 10 years of developing country experience; experience in Southeast Asia highly desirable. Experience working with bilateral or multilateral organizations, international/national NGOs, or foreign Government officials is important, and experience with private sector companies would be an advantage. Work experience that includes development of community participation in the planning of fisheries development and management is essential.

University qualifications required with subject major relevant to fisheries.

Scope of review will include paragraphs (8), (9) c & (9) g of this Terms of Reference.

5. Assignment Duration and Timing

5. The review is currently schedule to commence in March 2004.

6. The total field duration for the review will be 30 days with approximately 16 days for field visits, 5 days for document review at EMD office, 5 days for draft report preparation and 4 days for return travel. It is anticipated that 1-2 days will be necessary to finalize the report, which will be undertaken via email.

Assignment Conditions

7. The review panel will be able to travel to affected villages without the presence of THPC/EMD personnel or government officials. The review panel will also have the flexibility to determine which villages to visit and when to visit them.

8. The review panel will be free to contact all groups or individuals it deems necessary to fulfill this Terms of Reference. In addition, the review panel will have full access to all project-related documents and information.

9. The following procedure will be used to prepare and finalize the report:

a. Before leaving Laos, the review panel will prepare a draft report and issue such report directly to THPC before departing Laos;

b. THPC will review the draft report and submit comments, if any, to the review panel;

c. Review panel would incorporate the comments, and issue a revised draft report to THPC;

d. Steps b to c would be repeated until no further comments; and

e. Review panel would issue a final report to THPC.

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