Private Sector Hydropower Development Project - 2

Manual for Preparing Environmental Management Plan (EMP) for Hydropower Projects

Department of Electricity Development, HMG Nepal, in Collaboration with United States Agency for International Development and International Resources Group

IRG

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Manuals in this series:

Manual for Preparing Scoping Document for Environmental Impact Assessment (EIA) of Hydropower Projects.
Manual for Preparing Terms of Reference (TOR) for Environmental Impact Assessment (EIA) of Hydropower Projects, with Notes on EIA Report Preparation.
Manual for Preparing Environmental Management Plan (EMP) for Hydropower Projects.
Manual for Reviewing Scoping Document, Terms of Reference (TOR) and Environmental Impact Assessment (EIA) Reports for Hydropower Projects.
Manual for Preparing Initial Environmental Examination (IEE) Report for Hydropower Projects.
Manual for Public Involvement in the Environmental Impact Assessment (EIA) Process of Hydropower Projects.
Manual for Developing and Reviewing Water Quality Monitoring Plans and Results for Hydropower Projects.
Manual for Prediction, Rating, Ranking and Determination of Significant Impacts in Environmental Impact Assessment (EIA) of Hydropower Projects.

FOREWORD

Environmental Impact Assessment (EIA) is one of the proven tools of facilitation to achieve the goal of environmentally and socially sound and sustainable development. The incorporation of EIA in hydropower projects in Nepal was initiated in the early eighties. However, with the enforcement of the Environment Protection Act, 2053 (EPA53) and the Environment Protection Rules, 2054 (EPR54) in 1997, the integration of EIA in hydropower projects has now become compulsory. Large-scale hydropower projects were gaining attention for the integration of EIA prior to the enforcement of EPR. But, they were all initiatives from the donor agencies. At present, we have our own national system of EIA. A large number of proposed and on-going hydropower projects have already completed an EIA study. Some of them have been approved by the government agencies and are in the process of implementation. However, in the course of gaining experience about the processes and procedures of EIA implementation, we have become aware that the process needs to be improved.

In March 2000, the Department of Electricity Development (DOED), the National Environmental Impact Assessment Association of Nepal (NEIAAN), International Resources Group (IRG), and the US Agency for International Development (USAID) organized a one-day interagency workshop. The objective of this event was to carry out a SWOT analysis of the EIA process for hydropower projects in Nepal. A major conclusion of the participants was that the EIA process could be improved and streamlined by producing a series of manuals that would clarify the requirements at each stage in the process. Thus, the DOED, in collaboration with IRG, has developed sectoral manuals for improving the EIA process for hydropower projects. The draft manuals produced under this program have been refined through a series of interagency workshops.

A workshop to finalize the *Manual for Preparing Environmental Management Plan (EMP) for Hydropower Projects* and the *Manual for Reviewing Scoping Document, Terms of Reference (TOR) and Environmental Impact Assessment (EIA) Reports for Hydropower Projects* was conducted in Kathmandu from 24 to 25 May 2001. A total of 38 participants consisting of senior representatives from the DOED, The Ministry of Water Resources (MOWR), the Ministry of Population and Environment (MOPE), the Department of Forests, the Department of Water Induced Disaster Prevention, the Department of Roads, Nepal Electricity Authority, the National Environmental Impact Assessment Association of Nepal (NEIAAN), Melamchi Water Supply, Butwal Power Company, Himal Power Limited, Lamjung Electricity Development Company, Bhote Koshi Power Company, IRG, METCON Consultants, and the US Agency for International Development. This publication is the result of the dedicated effort of the participants.

I sincerely hope that these manuals will be useful to streamline the present practice of EIA relevant to hydropower projects in Nepal. I am confident that these manuals will considerably improve the current practices of EIA in Nepal, making the system more beneficial, meaningful, and efficient for achieving environmentally and socially sound and sustainable hydropower development in Nepal.

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1. INTRODUCTION

An Environmental Management Plan (EMP) is a part of the overall Environmental Impact Assessment (EIA) process for hydropower development in Nepal. The purposes of the EIA are to identify and quantify impacts and formulate mitigation strategies to minimize adverse impacts caused by project development. By comparison, the formulation and implementation of an EMP provides a solid foundation to put into practice the mitigation strategies during project construction. Furthermore the EMP lays the framework for continued assessment of potential impacts through the application of Monitoring and Auditing.

An EMP is often integrated directly into an EIA report on hydropower projects, but it may vary greatly in size and content. Sometimes a developer may regard the EMP simply as a legal requirement in the licensing process, and makes it brief. On the other hand, a developer may produce a detailed mitigation and monitoring plan to incorporate within the EIA report.

The fact that an EMP is approved does not confer, not even imply, any exceptions from the existing legislation of the Kingdom. It is therefore of utmost importance that the formulation and implementation of the EMP should, as far as possible, be cost effective, practical and accurate. Thus, the principle objective of this manual is to guide the developer, whether public or private, to ensure that all mitigation measures recommended by the EIA are implemented and to provide a basis for examining whether the mitigation measures implemented are effective.

1.1 Environmental Problems in Nepal

Environmental problems in Nepal fall into two basic categories:

- *natural events* which are not easy to predict and prevent; e.g., earthquakes, storms, landslides, floods, droughts, etc, and
- *human activities* that cause environmental problems that can be avoided, prevented or mitigated by integrating environmental considerations at an early stage in development project planning.

Most of Nepal's environmental problems have been the consequence of an excessive utilization of natural resources, implementation of development projects without environmental considerations due to lack of understanding, and unplanned growth of urban areas and industries. Following uncoordinated processes in which environmental considerations have been ignored has exacerbated the declining environmental conditions in Nepal.

Nepal is continuously putting an immense effort in implementing major economic development projects for poverty alleviation, to provide a better economic future for its people. The major development initiatives that have taken place in the past, however, were too often not considered from an environmental perspective. As a

result, development projects implemented for overall economic development have created environmental problems such as floods, erosion, landslides, deforestation, desertification, pollution and decline in human health, which in fact lead to further poverty. Such adverse effects have, in some instances, negated the very objectives of the development projects.

1.2. Environmental Policy and Legislation in Nepal

Considerations for the environment in Nepal's development polices have not been made in the past. Only recently has Nepal adopted environmental and administrative procedures and instructions to address the environmental effects of development projects. The Seventh Five-Year Plan was the first to consider environmental concerns in the planning process. However, lack of coordination between sector-specific programs, combined with inadequately trained human resources and inadequate budgetary provisions, has resulted in an inability to implement the policy enunciated in the Plan.

Four major achievements were made during Eighth Five-Year Plan (2049-2054). They were:

- endorsement and implementation of the *National Conservation Strategy*,
- formulation of a concrete environmental policy,
- establishment of the Ministry of Population and Environment; and,
- enactment of environmental protection legislation.

Beside these, the subsequent endorsement of national and sectoral-specific EIA Guidelines by the government were another milestone achieved during Eighth, and the ongoing Ninth, Five-Year Plan periods.

At present, an integration of EIA in development projects has become legally binding through the enforcement of the *Environmental Protection Act 2053* (1997) and the *Environmental Protection Rules 2054* (1997) and the 1st amendment *Environmental Protection Rules 2055*.

1.3. Environmental Impact Assessment in Nepal

Since enforcement of the *EPR54*, for all projects mentioned in Schedule 2 of EPR54 the application of EIA procedures has been made mandatory. Each project under consideration is screened to determine whether it should undergo an Initial Environmental Examination (IEE) or the EIA process. The *EPR54* contains schedules of project types. The need for considering an EIA or IEE for a project is determined by consulting the schedules presented in the *EPR54*.

An IEE is a relatively simple procedure. While IEE does undergo the Screening process, it does not need to undergo a Scoping process. A list of anticipated impacts and corresponding mitigation measures to be implemented are the end results of an

IEE analysis. If, however, the project has to undergo the full EIA process, a series of more involved steps are required to be undertaken at each stage of the project cycle. The EIA includes Screening, followed by Scoping, Public Involvement (participation, consultation), Impact Identification and Impact Prediction, Analysis of Alternatives, a Mitigation Plan, and an EMP. The EMP includes Environmental Monitoring and Auditing.

There are three major decision points occur during EIA preparation and implementation (Annex 1), as follows:

1. The Scoping study should be made during the project feasibility period. Based on the output of the Scoping exercise a Terms of Reference (TOR) is prepared. According to the *EPR54* (as amended), both of these documents are submitted to the Ministry of Population and Environment (MOPE) for approval, after review by the Department of Electricity Development (DOED) and the Ministry of Water Resources (MOWR).

2. Based on the approved TOR, the developer then completes an EIA Study and submits it to MOWR through DOED. After review, MOWR then sends it to MOPE. Approval of the EIA report invariably provides conditions that must be complied with during the project construction process. With the completion of this step, the developer is permitted to go ahead with Project Construction.

3. Implementation of the EMP takes place during the project construction phase. Environmental monitoring is a part of the EMP and continues over the entire project cycle. MOPE has to give its decision at different stages of the project cycle, based on an examination of the information obtained. An Environmental Audit is carried out by MOPE after the project has been in operation for two years, in order to examine whether everything has gone as intended and predicted.

2. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

2.1. Definition of an EMP

The Environmental Management Plan (EMP) is a document to be prepared as a part of the EIA report. An EMP includes project monitoring, auditing, and project management. The requirement for producing an EMP within the EIA implementation in Nepal has been clearly mentioned in EPR 54. To date, the lack of specific guidelines for this process has been a major obstacle for the proper implementation of EMPs in Nepal.

Since an EMP includes project monitoring and auditing, it is most appropriate to provide some introduction to the types of monitoring and auditing which should be prepared for the EMP within an EIA Study, and that should be conducted during project implementation.

2.2. The Objectives of an EMP

The key objectives in the formulation of an EMP are these:

- formulate a Monitoring Plan for baseline, impact and compliance monitoring; and
- formulate an Environmental Auditing Plan to be implemented after Project Construction.

2.3. Appropriate Time for the Implementation of an EMP

The initial formulation of an EMP should be carried out in the process of EIA preparation during the feasibility stage of the project cycle. The subsequent implementation of an EMP should be carried out during project construction and operation.

2.4. The Context

In the process of EIA preparation, the major areas of significant impacts of a development project are identified. The EIA prescribes mitigation measures in order to minimize adverse impacts and to enhance beneficial impacts. The mitigation measures are implemented before, during and after project construction.

2.5. Need for EMP Manual

The EPR54 has a provision for the formulation and implementation of an EMP for a proposed project. A broad framework of monitoring and mitigation plans to be employed is necessary in order to achieve the effective implementation of an EMP in the process of project construction. The prescribed mitigation measures may not always be effective. Therefore, a series of alternative techniques and a combination of several techniques should be provided so that the proponent has a choice in employing different methods of EMP implementation. The selection of these techniques will depend upon the availability of adequate time, adequate financial resources and appropriate human resources.

2.6. Responsibility for EMP Formulation and Implementation

As per *EPR54* the proponent should prepare the EMP implementation provisions as a part of the EIA Report. The approving agency should examine the EMP given in the EIA report with regard to cost effectiveness and practicability upon its application. If found practical and cost effective, the approving agency should recommend the implementation of the EMP parameters to the project proponent.

3. PRINCIPLES AND PROCEDURES OF AN ENVIRONMENTAL MANAGEMENT PLAN

3.1. Introduction

There are two components of an EMP - 1) Environmental Monitoring, and 2) Environmental Auditing.

3.2. Monitoring

To begin with, the differences and similarities between *monitoring, surveillance* and *surveys* should be clarified. There are very close links between them.

> *Monitoring* is *an activity undertaken to provide specific information on the characteristics and functions of environmental and social variables in space and in time.* Monitoring is an 'action-oriented' activity, designed to determine the extent to which environmental mitigation strategies are working.
>
> *Surveillance* is the *repeated measurement of a variable in order to detect a trend.* Surveillance, therefore, involves a *space/time* dimension.
>
> *Surveying* defines *a pattern of variation* of a parameter and the involved space. The implementation of a survey both in terms of space and time dimensions becomes surveillance.

A serious shortcoming of most EIAs is the absence of baseline data and impact monitoring during the construction and operation of large development projects. Without such data, it is impossible to test impact predictions and the success of measures for mitigation. Furthermore, the lack of appropriate ecological monitoring impedes scientific progress in impact prediction and assessment, and makes it difficult to learn from experience.

Environmental Monitoring is one of the most important components of an EIA. It is essential for:

- ensuring that impacts do not exceed the established legal standards;
- checking the implementation of mitigation measures in the manner described in the EIA report; and,
- providing early warning of potential environmental damage.

3.2.1 Principles of Monitoring

Certain principles of EIA Monitoring should be considered, and not overlooked. If the EIA Monitoring process is to generate meaningful information and improve implementation of mitigation measures, it is better to accomplish the following activities:

- carefully determine the indicators to be used in Monitoring activities;
- collect meaningful and relevant information;
- apply measurable criteria in relation to chosen indicators;
- pass objective judgments on the information collected;
- draw tangible conclusions based on the processing of information;
- make rational decisions based on the conclusions drawn; and,
- recommend improved mitigation measures to be undertaken by the developer.

3.2.2. Types of Monitoring

Various types of Monitoring activities are currently in practice, each of which is relevant to an EIA Study. The main types are:

a) Baseline Monitoring
A survey should be conducted on basic environmental parameters in the area surrounding the proposed project before construction begins (Pre-Audit Study). Subsequent Monitoring can assess the changes in those parameters over time, against the baseline.

b) Impact Monitoring
The physical, biological, and socio-economic and cultural parameters within the project area must be measured during the period of project construction and operation in order to detect environmental changes which may have occurred as a result of project implementation.

c) Compliance Monitoring
This form of Monitoring employs a periodic sampling method, or a continuous recording of specific environmental quality indicators or pollution levels, to ensure project compliance with recommended environmental protection standards.

Monitoring should be regular and performed long-term. Interruptions in Monitoring may result in having insufficient data to draw accurate conclusions concerning project impacts.

The main aim of EIA Compliance Monitoring is to provide the information required to ensure that project implementation has the least possible negative environmental impacts, and all possible positive impacts, in the project affected area.

3.2.3 Intensity of Monitoring

It is not possible to monitor every single one of the parameters that were investigated during the impact identification process. Therefore, a selection or "Scoping Out" should therefore be made of the most important and critical

parameters that will best reflect the impacts of the project on its surrounding environment.

The level or intensity of monitoring is to be determined on the basis of the known variability of each parameter, together with the potential severity of the environmental impacts that are being monitored.

3.2.4 Development of Monitoring Indicators

For each of the impacts and corresponding mitigation measure indicators to be measured during project construction should be developed. The indicators selected should reflect the condition of that particular component upon the measurement. For example, if the number of the fish species has decreased after the construction of project, it indicates that the habitat for the fish in the river has changed.

3.2.5 Institutional Aspects

Institutional factors determining the effectiveness of Monitoring should not be underestimated. There needs to be a firm institutional commitment by the agencies responsible for the monitoring process, particularly in regard to the following:

- willingness on the part of the institutions and the organizational personnel involved to support the Monitoring process with the necessary level of resources and authority;
- maintaining continuity in the Monitoring program;
- developing the technical capabilities of the personnel involved;
- maintaining integrity or honesty and transparency of the process,
- taking decisions on the basis of a thorough review of results;
- making Monitoring information available to all agencies concerned; and
- making the necessary institutional reforms within the planning and implementing agencies.

According to EPR54, the concerned body shall monitor and evaluate the impact of the implementation of the project on the environment. The project proponent will have primary responsibility for carrying out the different monitoring activities, as per the EMP as part of the EIA. The concerned agencies check whether the project proponent is carrying out monitoring activities as per the EIA, and if the prescribed mitigation measures are being implemented.

The reporting structure for EIA monitoring depends upon the nature of the project and the analysis undertaken by the agencies concerned. The information should be organized in a well-developed format and presented in regular reports, allowing for easy presentation at decision-making and review meetings.

The agencies concerned have to be responsible for the enforcement of the decisions taken in the review meetings. If decisions are not implemented by the agencies responsible, legal measures should be initiated to guarantee implementation.

3.3. Environmental Auditing

3.3.1 Principles of Auditing

The term "Audit" is usually associated with the professions of finance and accounting. Auditing refers to the examination and assessment of a certain type of performance. In the case of an EIA, an Audit should assess the actual environmental impact, the accuracy of prediction, the effectiveness of environmental impact mitigation and enhancement measures, and the functioning of monitoring mechanisms. As per EPR54, the Audit should be undertaken after the project has been operational for two years. It is usually performed once for each project.

3.3.2 Types of Audit

The following types of audit are recommended for different aspects of the EIA process:

a) **Decision Point Audit:** It examines the effectiveness of EIA as a decision-making tool.

b) **Implementation Audit:** It ensures that consent conditions have been met.

c) **Performance Audit:** It examines the effectiveness of project implementation and management.

d) **Project Impact Audit:** It examines environmental changes arising from Project Implementation.

e) **Predictive Technique Audit:** It examines the accuracy and utility of predictive techniques by comprising actual against predicted environmental effects.

f) **EIA Procedures Audit:** It critically examines the methods and approach adopted during the EIA Study.

Audits are not required in all cases. At the project approval stage, however, both the project proponent and the authorizing agency should consider whether the application of a particular auditing technique is likely to result in new information or an improvement in management practices. Particular attention should be given

to the cost-effectiveness of any proposed Audit and to the technical difficulties likely to be encountered.

Since the EIA concept is relatively new in Nepal, the use of Environmental Audits will play a significant role in evolving a systematic approach to the application of EIA.

Environmental Auditing should compare monitoring results with data generated during the pre-project period. Comparisons can be made with similar projects or against standard norms. Relating actual impacts with predicted impacts will help in evaluating the accuracy and adequacy of EIA predictions.

3.3.3. Intensity of Auditing

As per EPR 2054, Environmental Auditing should take place one time after two years of project operation. Not all the parameters considered at monitoring stage are required to be audited. Therefore most significant parameters reflecting environmental and social aspects of the project implementation should be taken into consideration. This process of 'Boiling down' to significant importance for auditing can be determine by scoping the issues to be considered.

3.3.4. Development of Auditing Indicators

Indicators should be developed for most significant parameters to be examined during auditing. The indicators should reflect the condition of that particular component upon the measurement.

3.3.5. Institutional Aspects

It is mentioned in EPR54 that an audit of environmental impact assessment shall be carried out by MOPE two years after the project is in operation. Auditing should be done in close cooperation with other relevant agencies, concerned and affected parties, and the project proponent. However, the project proponent should also carry out auditing of the project to assess the impact of the project.

The Audit is a crucial stage of Project Implementation, because it may indicate a need to improve the Project Implementation in order to reduce or prevent unwanted consequences. The Audit requires the involvement of a multi-disciplinary team of experts including government officials, the proponent and the representation of local people. The duration of this Audit Study might be as brief as one month or up to six months in the case of a large project.

4. ENVIRONMENTAL MANAGEMENT PLAN PROCEDURES

An EMP is a document to be developed during EIA preparation. An EMP refers to the documentation pertaining to project Management, Monitoring and Auditing of the

implementation of mitigation measures, and the verification of predicted impacts in the project cycle. The requirement for an EMP in project implementation is vague so far in Nepal. However, the *National EIA Guidelines 1993* and *EPR54* provide some guidance on the requirement of Monitoring and Auditing, but not on the Project Management option. The following are general procedures for the implementation of Monitoring and Auditing Plans on development projects.

4.1 Monitoring and Plan

4.1.1. Monitoring

A monitoring program is essential in order to collect up-to-date baseline conditions and for evaluating environmental impacts and the effectiveness of the mitigation measures adopted. The EIA monitoring process should generate meaningful information and improve the implementation of mitigation measures. According to the *EPR 54*, the concerned body shall monitor and evaluate the implementation of the project on the environment. However, the project proponent will be primarily responsible for carrying out different activities as mentioned in the EMP, as a part of the EIA, with the help of local people, bodies and concerned parties. The concerned body may check if the project proponent is carrying out monitoring activities as per the EIA and if the proposed mitigation measures are being implemented. The information obtained from these activities should be presented to the authorizing agency on a regular basis and also made available to all concerned agencies. The project proponent should have an Environmental Unit in order to monitor project impacts, contractors' compliance with the agreed working procedure regarding environmental issues and the effectiveness of mitigation measures. The following sections identify the types of monitoring required, monitoring schedule, and the parameters to be monitored.

4.1.1.1. Baseline Monitoring

A Baseline Study is required to compile and maintain a database on environmental conditions prior to the implementation of the project. This is especially important if the Project Implementation is delayed due to unforeseen circumstances and information given in the EIA needs to be updated. The baseline data recorded before the Project Implementation will facilitate the comparison of the information obtained during the monitoring activities and in auditing of the project. The main parameters, but not limited to, needed to be considered during baseline monitoring for hydropower projects are as follows:

a) **River Flow Rate.** Gauging stations should be established at the weir site and at powerhouse site to collect accurate information on the seasonal variation of the river flow rate and the contributions of the major tributaries between the weir and powerhouse sites. The stations will also give a more accurate account of flood levels.

b) **Glacial Lakes.** Any glacial lakes in the river basin should be studied in detail and regularly monitored to identify the potential for Glacial Lake Outburst Floods (GLOFs).

c) **Water Quality, Air Quality and Noise Level.** As far as possible, with the help of portable equipment the primary data for water quality, air quality, and noise levels should be collected.

d) **Stability of Slopes.** The fragile slopes in the project area should be monitored regularly to provide early warning of potential landslides. The condition of slopes should be monitored before and after the monsoon.

e) **Community Forestry.** Community forestry has been introduced in many parts of Nepal. Forest user groups (FUGs) are a new phenomenon; existing FUGs are only a few years old and their management systems are not well established. The effectiveness of FUGs in managing the forests should be monitored with the help of the District Forest Office in the project area.

f) **Seasonal Variations in Fisheries.** Investigation of seasonal variation in fish populations, fish migration and spawning should be carried out. Seasonal monitoring should be conducted to establish a more accurate account on the fish population in the project area and their migration and spawning behavior. Monitoring should focus on fish distribution and spawning in the section of the river that will be de-watered due to the project.

g) **Settlements.** The settlements in the project area may be expanded significantly due to opening of over-land transportation services resulting in increased traffic and trade, and to the supply of electricity. Both of these events are expected to occur. The growth of settlements will increase the significance of environmental impacts. Baseline Monitoring should be carried out periodically to determine changes in human population and structure, trade and other socio-economic activities, including the local institutions and the status of public facilities, religious sites and cultural artifacts.

4.1.1.2. Compliance Monitoring

The following activities should be conducted to ensure compliance with the recommendations of the EIA Study:

a) Following the completion of the detailed design and the tender documents, confirm that all the mitigation, compensation and rehabilitation measures recommended by the EIA Study have been incorporated.

b) During contract negotiations, confirm that the designs and working methods proposed by the contractors have taken into account the environmental considerations mentioned in the tender documents.

c) At the beginning of the construction, confirm that the arrangements regarding temporary use of land for labour camps, material storage and construction activities are satisfactory.

d) At the time of land acquisition, check to ensure that the acquisition process is in accordance with the *Land Acquisition Act 2034* and/or any project specific guidelines. Also, check that Project Persons have received adequate compensation within the stipulated time.

e) During construction, confirm on a regular basis that all the agreed working conditions and procedures, regarding various environmental considerations, are followed satisfactorily.

f) During construction and upon completion of construction, ensure that all requirements regarding clean up and reinstatement have been satisfactorily met.

g) During the operation of the project, ensure that a minimum river flow is maintained down stream of the dam, particularly during the dry months.

h) During operation, ensure that encroachment on any forests, wildlife habitats and/ or ecologically sensitive areas that might exist does not take place.

4.1.1.3. Impact Monitoring

The actual impacts caused by Project Implementation should be closely monitored during the construction and operation of the project to examine the effectiveness of the mitigation measures. The following activities need to be conducted for impact monitoring:

a) Hold regular meetings with the local people and listen to their concerns to assess the impacts of the project on the community and the environment.

b) During construction, regularly assess the stability of disturbed slopes. This is particularly necessary during the monsoon season.

c) During construction, inspect the levels of air, noise, and water and land pollution at regular intervals and compare with national standards and baseline data.

d) During and after construction, conduct regular fish sampling to assess impact of the project on the fish population and their spawning and migratory behavior.

e) With the help of the forest user groups, regularly monitor the condition of the local forest, and the use and trafficking of forest products.

f) Monitor the spoil disposal practices.

g) Monitor storage techniques for fuel and explosives kept in the project area to ensure safety to people and the environment.

h) Check the water supply and sanitation situation in the labour camps and the construction areas, and regularly test the quality of water being supplied to the construction workers.

i) Regularly check the health of the workers to ensure that there is no spread of communicable diseases. Also, regularly check the construction safety, ensuring the maintained health of the workers.

j) With the help of the local police, monitor the occurrence of criminal and socially undesirable activities.

k) Monitor the gender issues related to the project to ensure that neither males nor females bear an unfair share of negative impacts.

l) For at least three years following land acquisition, regularly survey the social and economic conditions of displaced families whose land and properties have been acquired by the project.

4.1.2. Monitoring Plan/Schedule

The Monitoring Plan includes the description of types of monitoring, the parameters to be monitored, and methods to be used and schedules for operating monitoring activities. The following examples, *inter alia*, selected from an EIA of a hydropower project illustrate the formulation of monitoring plan.

Table 1. Environmental Monitoring Plan: Baseline Monitoring

Parameter	Indicators	Method	Location	Schedule
Physical Environment				
River Hydrology	Flow rate of river and its tributaries	Gauging station	Just Upstream of diversion dam and tailrace outlet, and downstream of diversion dam and tailrace outlet	Continuous during dry season and regularly during other seasons
Glacier Lakes	Glacier lakes in the basin: lake geometry and volume, possibility of GLOF, and possibility of mitigation measures such as draining	Glaciological hazard mapping in aerial photographs, satellite imagery, ground photographs, and site observation	High Himalayas within catchment area upstream of project	During the design stage
Water Quality	Temperature, pH, turbidity TSS, DSS, hardness, NaCl, oil and grease, coliform, DO, BOD, COD, P, S, chlorophyll, pH, Pb	Water sampling and testing, and comparison to ambient standards.	See: *Water Quality Manual*	See: *Manual for Developing and Reviewing Water Quality Monitoring Plans and Results for Hydropower Projects*
Air Quality	Total suspended solid particulate, SO_2, CO_2, NO_2, PbO_2. Dust accumulation from construction activities in house, vegetation, surrounding areas	Low-volume sampler, inspection, measurement, and comparison of data with ambient standards	In and around construction sites and along access roads	During the construction phase
Slopes	Stability and degrees of slopes	Site observation, pillars	Near unstable slope areas	At least three times a year: before, during and after the monsoon season.
Biological Environment				
Forest and Vegetation	Forest management	Discussions with user groups, local people and the District Forest Office, field observation	In/around construction sites/camps, access roads, markets	As per requirement but not less than once a year.
Fisheries	Size of fish populations, changes to spawning and migratory habits	Fish sampling and discussions with local fishermen	Upstream of project and downstream from power house	At least three times a year: before, during and after monsoon
Socio-economic and Cultural Environment				
Settlements	Growth of settlements in the project area	Discussions with local people, VDCs, observation	Along access roads	Once a year
Public Health	Types of diseases and incidence of disease in the project area and local community	Discussions with local people and the health professionals at the local health post/hospital	Project affected VDCs	Quarterly during construction phase Once a year during operational phase
Law and Order	Levels of crime different types of crime, prostitution, etc in the project area.	Discussions with the local people and the local police	Project affected VDCs	Quarterly during construction phase

Table 2. Environmental Monitoring Plan: Compliance Monitoring

Parameters	Indicators	Method	Schedule
Implementation of EIA recommendations	Incorporating of EIA recommendations into project documents	Review of detailed design, project specification and tender documents	Following completion of tender documents
Incorporation of the environmental considerations from the tender documents into the contractor's proposed work plan	The presence, in the contractor's work plan, of each of the environmental considerations from the tender documents.	Review of proposed work plans, submitted by contractor	During contract negotiations
Construction logistics	Contractors' arrangements regarding labour camps materials storage and construction activities	Site observation	Beginning of the construction period
Property	Land/property acquisition procedures	Discussions with the local people and the project management	At the time of land acquisition
Implementation of all environmental conditions mentioned in the tender documents	Arrangements for slope protection, pollution prevention, protection of vegetation, fish and wildlife, use of local laborers, safe construction, public health and public relations	Site observation and discussion with project management and local people using a checklist	Continuous during the construction period
Clean-up and reinstatement of the project area	Completion of the different aspects of project clean-up	Site observation	At the end of the construction period, before operation

Table 3. Environmental Monitoring Plan: Impact Monitoring

Parameters	Indicators	Method	Location	Schedule
Physical Environment				
Slopes	Degrees of slopes, stability of slopes, changes from the baseline data	Site observation	Near unstable slope areas	Continuously during construction
Water Quality	Temperature, pH, turbidity TSS, DSS, hardness, chloride sodium, oil and grease, Coliform, DO, BOD, COD, P, S, Chlorophyll	Water sampling and testing, and comparison to ambient standards.	See: *Water Quality Manual*	See: *Manual for Developing and Reviewing Water Quality Monitoring Plans and Results for Hydropower Projects*
Air Quality	Total suspended solid particulate, SO_2, CO_2, NO2, PbO_2. Dust accumulation from construction activities in house, vegetation, surrounding areas	Low-volume sampler, visual inspection, measurement, and comparison of data with ambient standards	In and around construction sites and along access roads	Continuous observation and sampling during construction
Biological Environment				
Fisheries	Size of fish populations, changes in spawning and migratory habits	Fish sampling and discussions with local fishermen	Upstream of project site and downstream from powerhouse	At least three times a year: before, during and after monsoon
Forest and Vegetation	Number of trees, health of trees, presence of ground cover	Discussions with user groups, local people and the District Forest Office, field observation	In/around construction sites/camps, access roads, markets	Twice a year during construction
Socio-economic and Cultural Environment				
Water supply and sanitation in the project area	Presence and quality of water supply in local homes and construction areas, adequacy of sewerage system	Site observation, water testing and interviews with local people	Affected VDCs and construction camps	Continuously during construction
Public health	Types of diseases and amount of disease in the project area and local community	Discussions with the local people and the health professionals at the local health post/hospital	Affected VDCs and construction camps	Monthly during construction
Resettlement and Rehabilitation	Social and economic conditions of the displaced people	Discussions with the displaced people, observation	Resettlement site(s)	Regularly for at least three years following land acquisition
Economy	Number of local people employed by project	Records kept by project management	Project site	Twice a year during and after construction
Infrastructure	Number of households included in rural electrification by project	Records kept by project management	Affected VDCs	Two years after project completion

The monitoring plan and schedules can be expanded and elaborated based on the types and scales of the projects to be considered.

4.2 Auditing and Plan

4.2.1. Auditing

An Environmental Audit should be carried out after two years of Project Operation. Information from monitoring output should also be utilized for carrying out the Environmental Audit. In general terms the Environmental Audit should gather information on the following areas:

- The condition of natural/social/economic resources prior to Project Implementation and after Project Construction is completed;
- Whether the impacts forecast by the EIA occurred and, if so, the extent of these impacts.
- Whether or not mitigation measures implemented are effective to control adverse impacts or enhance beneficial impacts;
- Whether or not all landscapes degraded due to Project Implementation have been restored to their original (or better) conditions;
- What are the impacts of boom-bust scenario among the workforce involved in Project Implementation and the local economy; and,
- The overall effect on the local economy of Project Implementation.

Specifically, the following activities, and others as deemed necessary, need to be addressed for environmental auditing:

- How have the environmental conditions changed from the baseline conditions?
- Are there any problems relating to slope stability in the project area?
- Have slope stability and erosion control measures adopted by the project been effective in minimizing slope instability, erosion and landslides?
- What is the quality of water in the river and its tributaries? Did it change significantly from the baseline condition?
- Are there any bare or degraded areas around the project? What is the condition of the quarry sites, borrow areas, and the spoil disposal areas?
- How are the local forest user groups functioning?
- What is the condition of the local forests?
- How are the families resettled by the project adapting to their new host communities?
- How have the local construction workers adapted to the loss of their jobs following the end of construction activities?
- What is attitude of the local people towards the project?
- What has been the impact of the project on the local and national economy?

The brief checklist can be expanded based on the project type, location and scale of the hydropower project.

4.2.2. Auditing Plan/Schedule

The following is an example of a plan for carrying out an Environmental Audit. The example used is that of a hydropower project, for purposes of illustrating the auditing activity.

Table 4. Environmental Auditing Plan

A) PHYSICAL ENVIRONMENT

i. Air Quality

Parameters	Indicators	Location	Methods	Sources
Quality of Air	Total suspended solid particulate, SO_2, CO_2, NO_2, PbO_2, dust accumulation from construction activities in houses, vegetation, surrounding areas	Weir, access road, power house, and construction plant areas	Low-volume sampler, visual inspection, measurement, and their comparison with ambient standards	Analysis of data, information from local people, observation

ii. Noise and Vibrations

Parameters	Indicators	Location	Methods	Sources
Noise	Noise levels and their comparison with ambient standards	Weir, access road, powerhouse, construction plant areas, and nearby villages	Decibel meter	Measurement and information from local people
Vibration of Structures	Any case of hearing impairment Cracks existed in houses, and compensation	Construction sites, locations of cracked buildings	Interview, observation	Local people, observation

iii. Water Quality

Parameters	Indicators	Location	Methods	Sources
Water Quality	Temperature, pH, turbidity TSS, DSS, hardness, chloride sodium, oil and grease, coliform, DO, BOD, COD, P, S, chlorophyll, NO_2, CO_2, SO_2	Headworks and power house sites	Water samples collected from different source and comparisons with baseline data and ambient water quality	Analytical data

iv. Disposal of Spoils and Construction Wastes

Parameters	Indicators	Location	Methods	Sources
Disposal of construction spoils	Initiated erosion Affected the aesthetic value Affected forest and agriculture	Designated sites	Observation/ interview	Local people and observation
Side casting of excavated soils and wastes	Initiated land erosion Local drainage Project	Intake, adits, powerhouse sites, access roads	Observation/ interview	Local people and observation

v. Erosion and Slope Stability

Parameters	Indicators	Location	Methods	Sources
Erosion and Slope Stability	Eroded and unstable areas on natural slopes, collected data	Intake, road and powerhouse sites	Observation, measurement	Local information photographs, observation
	Adequate drainage facilities such as catch drains, herringbone drains, side drains Number of disturbed areas due to the lack of drainage	Powerhouse, intake, roads and mostly in unstable areas	Observation, photographs, etc	Local information, observation
Plantation of disturbed slopes	Revegetation of disturbed slopes	Cut slopes and area where vegetation was cleared	Visual observation, photographs	Local information, observation

B) BIOLOGICAL ENVIRONMENT

i. Forest and Vegetation

Parameters	Indicators	Location	Methods	Sources
Loss of timber	Number of new houses in the project area Number of tea stalls and restaurants established during construction	Project site, roadside and the vicinity of project area	Counting, observation, records	Local people, observation
	Volume of fuel wood trade, location of timber depots and fire wood sale in the Project Construction area	Project site, markets and settlement areas	Records, observation	Local people, available information, observation
	Number of stumps of cut trees in nearby forest	Forest area nearby	Examination of forest	Local people, observation
Alternative energy for cooking for labour force	Volume and type of fuel used in the project area	Project sites	Records from the contractors	Local people, observation
Harvesting and trade of medicinal plants	Sales of medicinal herbs increased	Project sites and the market	Information form local people and market	Local people
Physical Condition of Forest	General condition of forest nearby	Forest near project site	Observation	Information and available local people

ii. Wildlife

Parameters	Indicators	Location	Methods	Sources
Wildlife	Wildlife hunting, trapping and poaching by workforce	Forest area near the project site	Interview with local people and photographs	Local people, observation
	Trading of wildlife products (dried meat, hides, furs)	Project site and market	Observation interview and photographs	Local people, observation
	Frequency of the birds and mammals seen in the project site before and after the project	Project area	Observation Interview	Local people

iii. Fisheries

Parameters	Indicators	Location	Methods	Sources
Fisheries	Species of fish occurrence and abundance as compared with pre-project levels	Sampling stations at the project sites	Sampling	Local fishermen
	Fishing activities of workforce	Project site	Interview	Local people
	Use of explosives, electric rod and nets	Project site	Interview	Local people

C) SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

i. Employment Opportunities

Parameters	Indicators	Location	Methods	Sources
Employment Opportunity	Number of local laborers employed in the Project Construction	Project site	Analysis of records, interview	Records from contractor and local people
	Number of women in workforce	Project sites	Records	Local people, records of contractor

ii. Trade, Commerce and Industry

Parameters	Indicators	Location	Methods	Sources
Trade, Commerce and Industry	Number of shops increased / decreased during construction Number of shops still in operation	Roadsides and in project sites	Records, interview	Records and local people
	Establishment of industry in vicinity of project site	Project sites and surroundings	Records, interview	Observation and local people
	Effects on already existing local and traditional industries	Local area	Records, interview	Local people
	Rentals of houses and land space, before, during and after the project	Local area	Inquiries, interview	Local tenants and local people

iii. Compensation

Parameters	Indicators	Location	Methods	Sources
Compensation	Use of compensation received	Local area / Out of the area	Survey and interview	Local people

iv. Occupational and Safety Hazard

Parameters	Indicators	Location	Methods	Sources
Occupational and Safety Hazard	Types and numbers of accidents occurred during construction	Project sites	Records, interview	Records from contractors and local people
	Adequacy of occupational safety measures provided by the project	Project sites	Records, interview	Records from contractors and local people
	Facility of first aid emergency services provided	Project site	Records, interview	Records of office and local people
	Compensation to the loss of life or disability	Project site	Records, interview	Records of contractor, office of project management and local people

v. Public Health

Parameters	Indicators	Location	Methods	Sources
Public Health	Cases of communicable diseases as compared to the number and types of disease, which existed before the project.	Project site, health posts and hospitals	Records, interview	Medical records from local health post/ hospital, interview

vi. Undesirable Activities (Social Problems/Crimes)

Parameters	Indicators	Location	Methods	Sources
Alcohol and Drug Abuse	Liquor production and consumption and comparison with levels before the project	Project site	Survey, in-depth interview	Local people, observation
Law and Order	Level of disputes and crimes	Project site	Survey, interview	Local people, police, project management office
Child labor	Number of child labor (employed/ used)	Project site	Survey, interview	Records from contractor and local people
Clean-up	Temporary workforce sites cleaned and restored to original condition	Project area	Visual inspection, interviews with relevant people	Contractors, local people, observation

vii. Damages and Complaints

Parameters	Indicators	Location	Methods	Sources
Damage and Compensation	Types of damages made on personal properties	Project site and its vicinities	Survey, interview, observation	Local people, observation, records
	Damages to local infrastructure such as roads, irrigation and bridges	Within the periphery of project area	Survey, interview, observation	Concerned agencies, local people
	Compensation for maintenance and rehabilitation of infrastructure	Project area	Interview, records	Concerned agencies project management and local people
	Losses caused by blasting, vibration and noise and compensation paid	Project area and its vicinity	Records, interview	Local people and project management

viii. Coordination and Communication

Parameters	Indicators	Location	Methods	Sources
Coordination and Communication	Coordination among district administration, DDC, VDC, politicians, project management, contractors, laborers, and local people	District headquarters and project site	Records and interview	District headquarters government line agencies, project management, local people, VDC/DDC officials, local leaders, contractors and labour representatives
	Information dissemination to workers, and local people about the Project Implementation	Project site and vicinity	Mass meetings, public notices	Local people, project staff, and laborers

ix. Economic Condition

Parameters	Indicators	Location	Methods	Sources
Socio-Economic Change	Changes in land use - patterns	Project area / VDCs	Interview/ survey, observation	Farmers and local entrepreneurs, observation
	Changes in local economy (standards of living)	Project area / VDCs	Interview/ survey, observation	Local people, business community, observation
Price Rise	Rise in the price in essential commodities as compared to the prices of these goods before construction and adjusted for inflation.	Local Market	Market survey	Local people, shop keepers

The Auditing Plan and Checklist can be expanded, elaborated or modified based on the types and scale of the project implemented. Site-specific evaluation or auditing for road construction has been presented in Annex 2.

4.2.3. Pre-Audit Study

If five or more years have passed between the original EIA study and the probable date of commencement of construction activities, it may be necessary to carry out a Pre-Audit Study. The purpose of a Pre-Audit Study is to update the knowledge on baseline information of the project area. The information obtained during the EIA Study and in the Pre-Audit Study will form the basis for designing detailed monitoring activities to be carried out during construction and operation. The monitoring indicators and monitoring schedule should be developed during Pre-Audit Study.

A multi-disciplinary team of experts consisting specialists such as environmental engineer with analytical skills, biologist, geologist or pedologist, socio-economist or anthropologist, wildlife or fisheries expert, and forester (and others as appropriate) should be formed and coordinated by a well trained and experienced Team Leader. This team should be commissioned to conduct a Pre-Audit Study of the project location. The time duration for such a study may vary from 3 to 6 months depending upon the size of the project. The objectives of carrying out the Pre-Audit Study are to:

- document benchmarks of all resources likely to be affected by Project Implementation, and
- record all changes in resources availability that have taken place during the time lapsed between the EIA Study and the Pre-Audit Study.

The cost for implementing a Pre-Audit Study will depend upon the scale and the size of the project. The Pre-Audit Study is required only if significant time has elapsed between the EIA Study and Project Implementation.

Monitoring Indicators and Schedules developed during the Pre-Audit Study (according to Table 1) should be implemented during Project Construction. The monitoring activities comprise the measurement of Baseline, Compliance and Impacts. Although it is not clear about the duration of Project Construction, normally two to four years has been taken as an appropriate duration.

Laboratory analysis of the sampled materials collected from the field, photographic documentation, etc, and meetings with local people and project personnel should take place at regular intervals. Since Monitoring is a well coordinated and a well-defined long-term activity, the appropriate cost is not possible to estimate but depends largely on the size, scale and duration of the project.

Annex 1: The EIA Process in Nepal

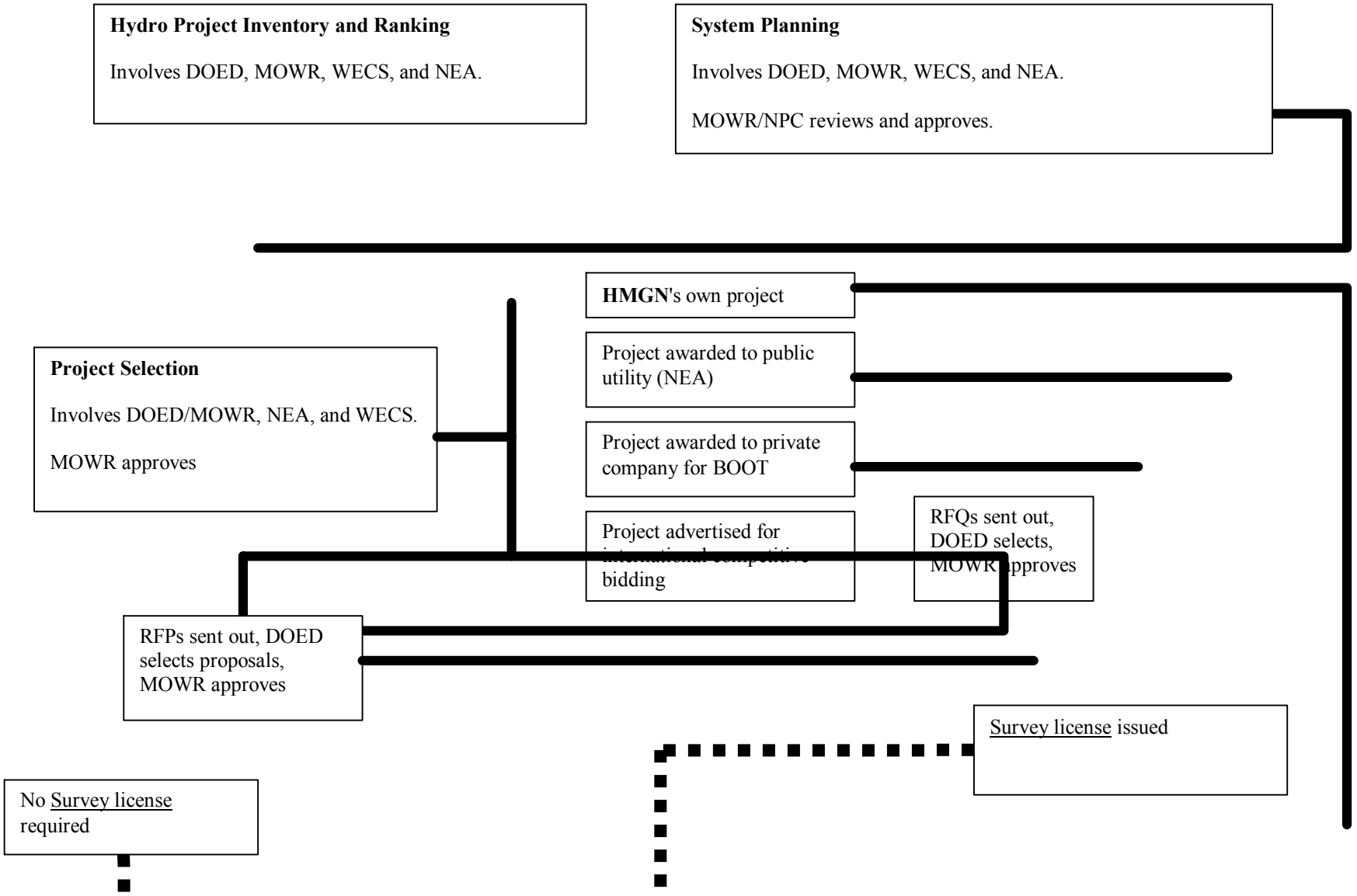
Annex 2: An Example of a Site-Specific Evaluation Checklist for a Road Project

Checklists and their Characteristic			
Sites Specific Evaluation Checklists	**Relevant Yes/no**	**Judgment C/A/I**	**Comment**
1. For the clearance of vegetation in the construction area, did the contractor obtain permission from FUG and DOF for felling of the forest trees?			
2. Are shrubs, foliage and branches of the felled trees, stockpiled in order to use them for brush layering while applying bioengineering in the degraded area?			
3. Has the clearance of forest affected the ground vegetation and initiated the erosion process in the area?			
4. Are the spoils and topsoil and other wastes, stockpiled at the bottom of the remaining trees in the area?			
5. Has the contractor in collaboration with the local FUGs or DOF, made an arrangement for establishing a fuel depot in the area?			
6. Is the workforce involved in collecting, hunting and selling of forest products, wildlife and fishes from the river?			
7. Are eroded and unstable areas stabilized through protective works?			
8. Are cross road drainage, side drainage and surface drainage, constructed wherever they are required?			
9. Is the topsoil removed from the process of cut and fills, subsurface excavation and quarrying, stripped and stockpiled in different places for the future use?			
10. Are excess fill materials disposed of at designated areas, compacted, leveled and covered with topsoil for vegetation growth?			
11. Did disposal of excess fill materials create environmental damage?			
12. Have quarries and burrow-pits used for excavation of construction materials followed the following specifications: • restricted to small area • confined to existing quarry sites • not close to tree cover • 60m away from dwellings • 200 m. away from archeological and cultural sites?			
13. Have stockpiling of top soil, sub-soil, rocks and other construction materials followed the following specifications: • 10m away from the drainage line • on the land with less than 10 slope • no disturbance on the trees and vegetation • no disturbances on houses and prime agricultural land?			
14. Are the workforce camps established at the designated areas?			
15. Are the facilities for the workforce as specified in section of field report provided?			
16. Are the toilet and other wastes disposed at specified safe areas?			
17. Is the workforce camp after its use, fully rehabilitated and restored to the original condition?			
18. Are there measures to control the dust and noise pollution in the area, during the construction period applied?			
19. Are the hazardous materials such as petrol, diesel, kerosene, lubricants, explosives, etc, stored in safe places where leakage and mishandling are not possible?			
20. Are the degraded places, bare areas disturbed by the construction camps, rehabilitated and restored to original condition?			

Annex 3: List of Participants at the EMP and Review Manuals Workshop

Mr. K.B. Chand	Department of Electricity Development
Mr. L.M. Singh	Department of Electricity Development
Mr. B.B. Thapa	Department of Electricity Development
Mr. M.P. Dhungel	Department of Electricity Development
Mr. R.K. Shilpakar	Department of Electricity Development
Mr. Sudesh K. Malla	Department of Electricity Development
Mr. S.M. Bajracharya	Department of Electricity Development
Mr. D.B. Singh	Department of Electricity Development
Mr. C.B. Shrestha	Department of Electricity Development
Mr. K.R. Joshi	Department of Electricity Development
Mr. R.K. Shrestha	Department of Electricity Development
Mr. Amitabh Rajouria	Department of Electricity Development
Mr. P.K. Shah	Department of Electricity Development
Mr. Shakeb Afsah	International Resources Group
Mr. Govind Ghimire	METCON Consult - IRG
Dr. S. Gorzula	International Resources Group
Ms. Laura Graham	International Resources Group
Dr. R.B. Khadka	National Environmental Impact Association of Nepal/IRG
Dr. Don Messerschmidt	International Resources Group
Mr. Bharat Sharma	METCON Consult - IRG
Mr. Tony Carvalho	US Agency for International Development
Mr. Madha Prasad Baral	Ministry of Water Resources
Mr. P.R. Aryal	Ministry of Water Resources
Mr. Nab Raj Singh	Ministry of Water Resources
Mr. B.R. Manandar	Ministry of Population and Environment
Mr. Ashok K. Saraf	Ministry of Population and Environment
Mr. Shiva Adhikari	Department of Roads
Mr. Janaki Sangraula	Nepal Electricity Authority
Ms. Marie-France Houle	Lamjung Electricity Development Company
Mr. Viney B.	Lamjung Electricity Development Company
Mr. Laxman Kharat	Melamchi Water Supply
Dr. Sandip Shah	Bhote Koshi Power Company
Ms. Sabala Shrestha	Butwal Power Company
Mr. P.P. Adhikari	Nepal Hydropower Association
Mr. Sagar Raj Gautam	Department of Water Induced Disaster Prevention
Mr. Ramesh Shakya	Independent Consultant
Dr. Harald O. Skar	Himal Power Limited
Ms. Hasina Shrestha	National EIA Association of Nepal

Annex 1: LOGIC DIAGRAM OF THE EIA PROCESS, Stage 1 "Process for Selection of Developer."



HMGN's own project
No survey license

Developer receives Survey license

Stage 2 "Scoping and TOR"

Developer prepares Scoping Document.

DOED reviews the Scoping document

rejects

DOED accepts and forwards to **MOWR** with its comments

MOWR reviews the Scoping document

rejects

MOWR accepts and forwards to **MOPE** with its comments

MOPE reviews the Scoping document

rejects

NOTE: EPR54 (with amendment) allows applicants to submit both documents together

Developer receives Letter of approval for Scoping document

DOED forwards Letter of approval to the **Developer**

MOWR forwards Letter of approval to **DOED**

MOPE approves and send Letter of , with or without notes, approval to **MOWR**

Developer prepares Terms of Reference

DOED reviews the Terms of Reference

rejects

DOED accepts and forwards to **MOWR** with its comments

MOWR reviews the Terms of reference

rejects

MOWR accepts and forwards to **MOPE** with its comments

MOPE reviews the Terms of reference

rejects

Developer received Letter of Approval for Terms of reference

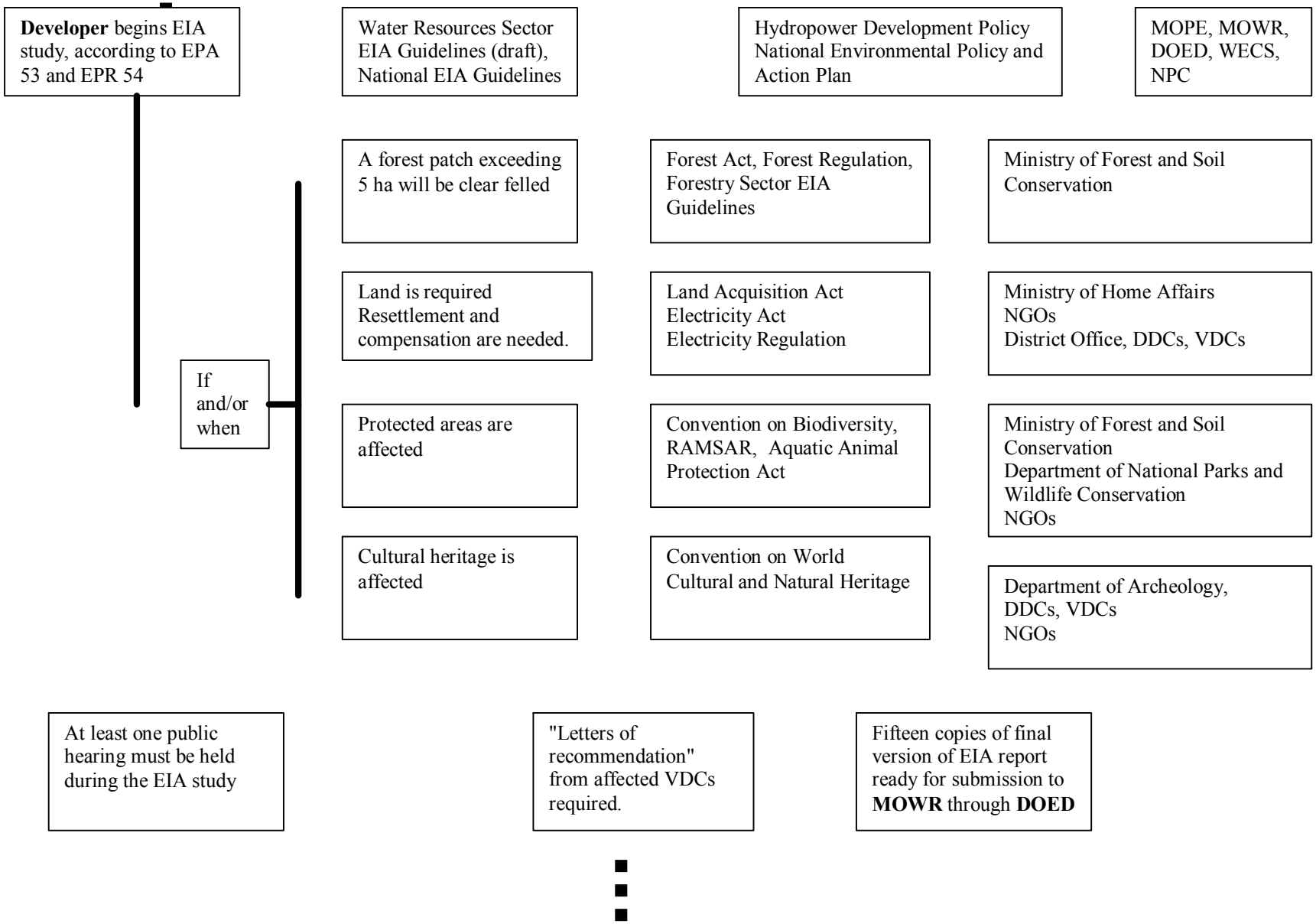
DOED notifies **Developer**

MOWR forwards Letter of approval to **DOED**

MOPE approves and sends Letter of appoval, with or without notes, to **MOWR**

The **Developer** begins the EIA study

Stage 3 "EIA study"



Stage 4 "Submission of EIA"