

**STRENGTHENING EDC'S CAPACITY FOR  
ENVIRONMENT REVIEW AND MANAGEMENT  
OF POWER SECTOR PROJECTS**

Prepared for

His Majesty's Government of Nepal  
Ministry of Water Resources  
Electricity Development Center

Under the

USAID/Nepal Private Electricity Project  
Contract No 367-C-00-95-05117-00  
Project No 367-1073-3

**Final Report**

**April 1996**

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## 1 Introduction

This report reviews the environment assessment (EA) process in Nepal including the standardized Environmental Impact Assessment (EIA) procedures for infrastructure projects. It then focuses on specific requirements and roles for environmental review, environmental management and environmental monitoring of public and private sector power projects licensed by EDC, including generation, transmission, distribution and rural electrification projects.

- Section 1 This section elaborates on the background and scope of work for the environment work package for the PEP assignment
- Section 2 Reviews the current policy and legal framework for incorporating environment concerns in project planning, and details the project-specific EIA process, procedures and roles for environment management of power sector projects
- Section 3 Reviews conceptual and practical issues in environment review and management of power sector projects which all EDC's project officers should be conversant with
- Section 4 Considers options for strengthening EDC's internal capabilities relevant to its role in environmental management of power sector projects (via EDC's licensing and one-window responsibility)
- Section 5 Provides recommendations on updating environment provisions in the Electricity regulations

The Appendices provide information packages with background material for EDC's internal use, and suggestions on information packages EDC may make available to licensees

### 1.1 Background

Since passage of the Electricity Act (1992), Nepal has been pursuing a parallel strategy of public and private sector investment in the power sector. Generation, transmission and distribution segments of the power industry have been opened to competition. Multiple arrangements for project financing and ownership are now permitted.

The Electricity Act (1992) and supporting Electricity Regulations (1993) under which licenses are issued for public and private sector projects specify requirements for field survey programs and studies which address technical and non-technical concerns associated with developing project sites. Environmental review and mitigation is required through all phases of the project cycle from design through construction and operation. HMG's goal is to mitigate adverse project impacts and enhance positive project effects on the natural and socio-culture environment. Formal socio-economic and environmental impact assessments of the proposed developments must be prepared by the project proponent during the survey license stage. Such activities include developing the requisite environmental management, public consultation, resettlement (if required), and post-project environmental monitoring programs. The environmental management studies prepared by the project proponent must follow the generic National EIA Guidelines and the related process set out by HMG, as well as any other specific requirements introduced by EDC in the Electricity Regulations, or otherwise noted in project-specific licenses. The Environmental Impact Assessment (EIA) process established by HMG includes public consultation and interagency review steps.

The measures identified for avoidance, mitigation and compensation, once approved, are implemented by the project proponent as an internalized project cost

Environmental reports prepared by the project proponent at various stages in the project cycle (ie feasibility study and design, construction and operation) are the main instruments used by HMG to ensure full compliance with relevant environmental standards and regulations in force in Nepal. EDC's responsibility in this regard is twofold. Firstly, EDC has to ensure the Electricity Regulations and provisions in the individual survey and production licenses fully conform to the guidelines and direction provided by HMG on environment protection and management. Secondly, EDC has to play an active role overseeing and facilitating implementation of the IEA and EIA studies prepared by the project proponent, including the public consultation and interagency coordination components, and subsequent impact monitoring activities once the project is operational.

The policy context for incorporation of environment concerns in development activities in Nepal is well established. Socioeconomic and environment factors are widely recognized as critical considerations in sustainable development and are becoming routine considerations in all phases of infrastructure planning and development - particularly in the power sector. In broad terms, projects that degrade the natural capital of a nation on which future growth may be dependent are avoided, to the extent that mitigation measures to bring the project within acceptable parameters and tradeoffs are not feasible. In international practice, environment impact assessments initiated early in the project cycle have become an integral part of the approach to internalize environmental costs in the project. This practice helps reduce risk of delay or outright cancellation of projects due to unforeseen circumstances. Moreover, as public concern and interest in environment matters in Nepal is growing, involvement of legitimate stakeholders in all phases of the project cycle is now required by law. Most important, the consultation is to include the population affected by the project and legitimate local NGO's. To further strengthen this aspect there is a mandatory requirement for a Compensation Fixation Commission to assess compensation levels for persons with property affected by any public or private sector project.

Legally binding guidelines for the environment study and approval process which are to be followed by all line ministries and agencies responsible for public and private sector infrastructure projects were issued by NPC, on behalf of HMG in 1993. While the current national guidelines are not exclusive to the power sector, HMG's policy is that full EIA's and a public consultation process is required for power generation projects over 5 MW capacity. Rural electrification projects require an Initial Environmental Examination (IEE). Major transmission and distribution projects will require either a full EIA, or a more simplified IEE, depending on the potential scale and significance of the impacts, as decided in a formal screening process which each project must pass through. Preparation of IEE's and EIA's by the project proponents (licensees), monitoring of the implementation of mitigation measures during project construction, and post-project environmental monitoring fall under EDC's purview as part of EDC's role in setting up and administering the survey and production licenses under the one-window system. However, final rulings that are required on specific environmental compliance matters or issues may be vested with another HMG authority (eg MOPE). EDC will therefore be required to maintain close linkages with such environmental bodies in future, as these organizations are established and become fully operational.

HMG is planning to introduce an Environment Act shortly. It is anticipated the forthcoming Act will further strengthen the Environment Protection Council's (EPC) role in policy level matters, and also provide authority for the new Ministry of Population and Environment to frame environmental guidelines and standards, establish environmental permits requirements, etc, as deemed appropriate for infrastructure projects in all sectors. Line ministries and agencies such as EDC will be expected to continue to play a vital role in the project-level EIA process, along the lines indicated in the current National EIA Guidelines (1993). Thus, further elaboration of

requirements, role, and responsibilities of EDC for project-level environmental assessment, mitigation, post-construction monitoring and public consultation and interagency coordination was considered to be important in the PEP

It is also important to note that EDC has taken initial steps to ensure that public and private sector licensee's implement environmental study and management programs, in keeping with the HMG guidelines provided to date. This report and recommendations are in the context of reinforcing EDC's capability in this respect

## **1.2 Purpose of Report**

Assistance from the Private Power Project as defined in the Terms of Reference (TOR) for this assignment is in the form of review and recommendations regarding issues, approaches and procedures for incorporating environmental and socioeconomic concerns in EDC's program of activities. Existing policies, regulations and guidelines on social and environmental impact assessment of power projects and related compliance are reviewed as a prerequisite to making formal recommendations on

- ▶ Provisions in the Electricity Regulations concerning environmental and socioeconomic matters which may be clarified or updated
- ▶ Data, information packages and other guidelines which EDC should assemble for internal use or make available to licensees to facilitate their work
- ▶ Activities EDC must either lead or support to facilitate successful implementation of environmental management programs, public consultation and interagency coordination
- ▶ Steps to strengthen EDC's institutional linkages for its environment review and monitoring role
- ▶ Steps to strengthen EDC's staff capabilities and operating capability in this area

Strengthening EDC's role in the one-window system for private developer and government interaction is an underlying consideration

## **1.3 Scope of Work**

In respect to the objectives noted above, the terms of reference for the advisor for this Phase of the PEP is to provide draft report to EDC and USAID/Nepal based on the following activities

- (1) Review and elaboration of the evolving environment process (EA) process in Nepal and EDC's role in the process relating to its licensing responsibilities
- (2) Review of present project-level environmental and social planning criteria, guidelines and standards covering hydropower and thermal generation projects, and transmission and distribution projects
- (3) Review of provisions in the Electricity Regulations on environment management responsibilities including preparation of the EIA, public consultation mechanisms, implementation of mitigation programs for adverse social and environmental impacts, and treatment of residual impacts during construction and operation phases of hydropower projects
- (4) Assessment of possible future requirements and priorities for incorporating and/or updating socioeconomic and environmental provisions in the Electricity Regulations and survey and production licenses for transmission and distribution projects

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- (5) Recommendation on institutional arrangements, EDC's interaction with other government agencies, and internal organizational measures to help EDC effectively function as the one-window entity for private developer-government interaction on environmental management matters
- (6) Recommendation on training for EDC staff on environment and socio-economic topics which can be incorporated in the USAID project training program and subsequent training programs

And based on feedback, proceed with detailed work to

- (7) Recommend on and support EDC in the assembly of a draft guideline or information package to provide to licensees of hydro power generation projects on the EA process and EIA requirements
- (8) Recommendation on internal guidelines on the public consultation process that has to be followed for generation, transmission and distribution projects, (eg type and nature of contact with legitimate stakeholders, etc )

## **1 4 Approach**

The approach adopted for implementing the technical assistance was to work with EDC staff and prepare a report Working discussions to review interim findings and recommendations are to be arranged

## **2 Current Situation**

Nepal has made considerable progress over the past decade defining requirements for environmental review and management of infrastructure projects. Guidelines for project-specific assessment cover both public and private sector projects. While separate environmental legislation is still pending, HMG's current environmental guidelines are legally binding as government directives. Moreover, for the power sector, HMG authorities responsible for de-monopolizing the power industry and setting in place the legal and regulatory framework for private power promotion and licensing were cognizant of policies evolving in the environmental field at that time. Consequently, the Electricity Act and the Electricity Regulations contain the basic provisions for environment protection and management.

This section of the report reviews the overall policy framework and environment review process in force in Nepal today including the project-specific EIA procedures. Institutional roles in environmental review, management and monitoring of projects licensed by EDC including generation, transmission, distribution and rural electrification projects are then considered.

### **2.1 Policy and Legislative Framework**

HMG policies on environment protection and resource management have been evolving in step with other national initiatives to promote poverty alleviation and sustainable development. Projects that will degrade natural capital on which the future growth of the nation may be dependent are to be avoided - to the extent that mitigation measures to bring the project within acceptable parameters and tradeoffs are not feasible. Environmental impact assessments (EIA's) initiated early in the project cycle for major infrastructure projects are thus an integral part of HMG's approach to internalize environmental costs directly in project, and avoid unforeseen circumstances that will jeopardize timely implementation of the necessary public and private investments. This is a basic and fundamental policy approach that is both economically efficient and environmentally sound. To achieve full and transparent assessment of all relevant issues, involvement of persons affected by the project and all legitimate stakeholders is a mandatory requirement at all stages of the project cycle.

Nepal's current policies on environment protection and management also reflect Nepal's participation in regional and international treaties and conventions with environmental implications, as well as numerous project-specific agreements with funding partners.

#### **2.1.1 National Policy Framework**

Domestic concern about the environment is understandable given the scope and magnitude of growing environmental stresses, and corresponding implications for national development including

- Increasing population density and absolute population growth
- Rising per capita resource use and waste generation
- Growing threats of pollution of air, water and land resources
- Growing threats to health and quality of life in rural and urban areas (housing, water supply, sanitation, health services, education services)

and prerequisites for sustainable growth through

- Efficient exploitation and use of natural resources including water resources
- Efficient utilization of both indigenous and imported energy resources

- The need to arrest and reverse degradation of land and soils caused by natural and man-made factors
- Concerns for conservation and protection of limited or threatened wildlife and other biological resources

National-level policy and project-level procedures on incorporation of environment concerns in all sectors of development planning evolved under the successive 5-year Development plans of HMG

**Table 2-1**

**Main Steps in Evolution of HMG Policy on  
Environment Management of Infrastructure Projects**

5th and 6th Plan Periods	Process of gradual incorporation of environment study of major infrastructure projects jointly funded by Donors
7th Plan Period (1985-1991)	<ul style="list-style-type: none"> <li>▶ Establishment of mandatory requirement for an EIA of major development projects undertaken by HMG</li> <li>▶ Development of HMG's National Conservation Strategy</li> </ul>
8th Plan Period (1991-1996)	<ul style="list-style-type: none"> <li>▶ Issue of the first set of National EIA Guidelines Nepal Rajpatra (Gazette) 19 July 1993</li> <li>▶ Issue of informal sectoral and sub-sector EIA Guidelines (Water and Energy Sector)</li> <li>▶ Preparation of national Environmental Legislation and initial steps to establish a national institutional system for project-level Environment Screening IEE EIA's including agency roles</li> </ul>
It is expected the 9th Plan will elaborate further measures and investments in environmental review and to firm up institutional capabilities including the Ministry of Population and Environment (MOPE) role	

**2.1.2 Legislative and Administrative Framework**

The mandatory requirement for environment review of development projects is provided in various government policy directives, and consolidated in the National EIA Guidelines (1993) issued by NPC. Following interagency-task force work coordinated by NPC, the umbrella national-level Environment Act has also been drafted and is awaiting parliament approval. The legislation is multi-sectoral in nature and will enable the new Ministry of Population and Environment (MOPE) to prescribe legal measures for study and mitigation of all potential sources of air, land and water degradation adversely impacting on natural and social environments. This legislation will include MOPE authority to frame environmental rules, standards and guidelines, and decide on future environmental permit requirements, as appropriate. MOPE will be responsible for update and provide future revisions of the national EIA guidelines. It would have jurisdiction to develop, or coordinate development of additional sectoral guidelines through line Ministries and agencies directly responsible for supervising development projects in the different sectors.

Current provisions for environmental management of power sector projects, as set out in the various Acts and Regulations for the power sector as shown in Table 2-2

Table 2-2

**Current Environment Provisions in Power Sector Acts  
and the Electricity Regulations**

Acts and Regulations	Specific Environmental Provisions
Hydro power Development Policy (1992)	Clause 5(s) To Minimize Environmental Hazards the construction or operation of hydroelectric projects shall be made in such a way that it would have minimum adverse effect on the environment'
Water Resources Act (1992)	<p>Clause 19 Water Resources not to be Polluted</p> <p>(1) His Majesty's Government may by notification published in the Nepal Gazette prescribe pollution tolerance limits for water resources</p> <p>(2) No one shall pollute water resources by way of using or putting any litter industrial wastes poison chemical or toxicant to the effect that the pollution tolerance limit of the water resource as prescribed is exceeded</p> <p>Clause 20 Not to Cause Substantial Adverse Effect on Environment While utilizing water resources it shall be done so in such a manner that no substantial adverse effect be made on the environment by way of soil erosion flood landslide or similar other cause</p>
Electricity Act (1992)	Clause 24 No Substantial Adverse Effect be made on Environment While carrying out electricity generation transmission or distribution it shall be carried out in such a manner that no substantial adverse effect be made on the environment by way of soil erosion flood, landslide, air pollution, etc
Electricity Regulation (1993)	<p>Rule 12(f) Application for Production License shall include Analysis of environmental effect (measures to be taken to minimize adverse effects due to the project on the environment the social and economic effect of project on said area the utilization of local labor source and material benefits to be taken by local people after the completion of the project training to be provided to local people in relation to construction maintenance and operation facilities to be required for construction site safety arrangements and effect on landowners due to operation of the project details of people to be evacuated (relocated) and necessary plan for their rehabilitation should also be shown)</p> <p>Rule 13 (g) Application for Transmission License shall include (same as Rule 12(f) for production license)</p>

The existing survey and production licenses issued by EDC to public and private developers have clauses which automatically invoke requirements in the Acts and the Electricity Regulations, as well as compliance with the National EIA Guidelines. Individual licenses may also include special provisions to address special environmental or socioeconomic concerns that are unique to the project, when warranted. Options to strength the specification of environmental requirements directly in the Electricity Regulations are suggested in Section 5 of this report.

HMG's current administrative framework for the environment process provides that line Ministries and HMG agencies, such as EDC, must directly oversee the IEE or EIA as required for projects under their jurisdiction. The agencies must first screen the project using HMG guidelines to determine the required level of environmental study. While the project proponent is responsible for conducting the studies with their own interdisciplinary study team, the regulatory or sponsoring government agency has to ensure that the required project-level environmental assessment, mitigation, post-construction monitoring and public consultation procedures framed by MOPE, or otherwise in HMG regulations, are followed. MOPE and other concerned agencies will sit on the interagency committee that meets at critical

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milestones on the environment review of specific projects, and thus provide project-specific input directly through this mechanism

It is important to highlight that HMG intends that the EIA for larger projects is used as a framework for arranging interagency coordination and public consultation. As noted in the National EIA Guidelines

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*"EIA can be viewed as both a process and as a mechanism for decision-making. As a planning tool, an EIA presents methodologies and techniques for identifying, predicting and evaluating environmental impacts during the formulation and feasibility stages. The output from the EIA process presents decision-makers with information necessary to determine whether or not the project should be implemented." (National EIA Guidelines, page vi)*

*"Scoping for EIA should be an open exercise and done with wide public involvement. It should also include review agencies and representatives of agencies associated with development projects." (National EIA Guidelines, page vi)*

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Further to the provisions in the power sector Acts and Regulations, HMG also has laws which designated environmentally protected areas. Laws relating to the avoidance or mitigation of adverse project effects on these areas must be considered. Table 2-3 shows the major protected areas in Nepal. Figure 2-1 illustrates the location of the major protected areas in Nepal.

There are a number of other HMG Acts and Regulations which may have bearing on the implementation mechanisms decided for programs to mitigate adverse impacts of projects. Among these Acts and Regulations which potential mitigation programs would have to reference or refer to include

- Land Acquisition Guidelines (1993)
- Forest Act (1993) and 1995 Amendments
- Forest Rules (1995)
- Agriculture Development Bank Act (1967)
- Municipality Act (1992)
- Municipality Workers Regulations (1993)
- Village Development Committee Act (1993)
- Village Development Committee (Working Procedures) Rules (1994)
- District Development Committee Act (1992)
- District Development Committee (Working Agreements) Regulations (1993)

The relevance of these Acts and Regulations as regard to specific project activities, impacts and mitigation measures would be considered in the EIA.

**Table 2-3**

**Major Protected Areas in Nepal National Parks and Wildlife Reserves**

National Parks	Year Gazetted	Area (km <sup>2</sup> )
		10,974
Royal Chitwan Also Designated as a World Heritage Site (UNESCO)	1973	932
Sagarmatha - Also Designated as a World Heritage Site (UNESCO)	1976	1 148
Langtang	1976	1,710
Rara	1976	106
Khaptad	1984	225
Royal Bardia	1988	968
Shey Phoksundo	1984	3,555
Makalu Barun	1992	2,330
<b>Wildlife Reserves</b>		2, 154
Royal Suklaphanta	1976	155
Koshi Tappu	1976	175
Parsa	1984	499
Dhorpatan	1987	1 325

**2 1 3 Regional and Bilateral Agreements**

The EIA Guidelines require identification and review of all national and international agreements which HMG is a party to that may affect or be influenced by the project This specifically includes consideration of any regional agreements or treaties where environmental concerns are relevant For example, multi-purpose storage projects licensed by EDC may require that the facilities be designed and operated to ensure minimum releases in rivers at border points, consistent with any water sharing agreements with riparian countries Any such issues are to be identified in the project EIA and incorporated in the project design and operating practices

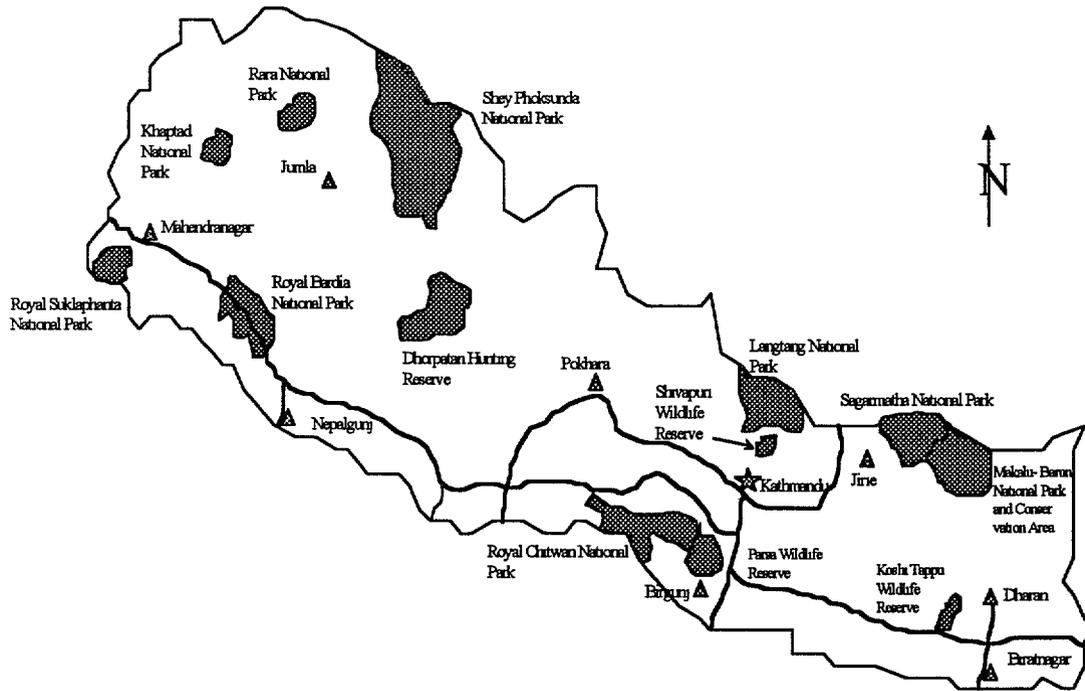
**2 1 4 International Agreements on the Environment**

Nepal is signatory to a number of broader international conventions such as concerning habitat, biodiversity and cultural heritage protection which must also taken into account during the EIA of projects Project activities which directly or indirectly affect the protected zones, or other properties covered by such agreements must be identified and the avoidance or mitigation measures identified For example, Nepal is currently a signatory to

- (a) **Biosphere Reserves**  
Power projects which may be planned for lands which are designated as UN Biosphere Reserves, national parks, nature reserves or conservation areas will have to observe terms and conditions set out in this UN Charter
- (b) **Convention on International Trade in Endangered Species (CITES)**  
Nepal is a signatory to this agreement (1975) which classifies species according to criteria where measures to protection or control of access to habitat is important (classifications include for example (eg , I - species threatened with extinction, II - species which could become endangered, III - species that are protected (CITES 1983), E - Endangered, V - Vulnerable, R - Rare)
- (c) **International Tropical Timber Agreement**  
Nepal is signatory to a plant protection agreement consigned by governments in the Asia and Pacific Region (1956)
- (d) **Ramsar Convention**  
Nepal is an international flyway for migrating waterfowl in South Asia. Because of the region's importance to wildfowl, especially as waterfowl habitat, Nepal has signed the Convention on Wetlands of International Importance [Ramsar] 1971. This agreement may have a bearing on development potential of wetland areas as hydroelectric sites and may be a concern in transmission route selection
- (e) **World Heritage Site Convention**  
In recognition of its cultural heritage and the need to protect its antiquities, Nepal has signed the Convention Concerning the Protection of World Cultural and Natural Heritage [Paris] 1972. This convention will affect any project which might be sited on lands containing cultural or heritage resources

The project-specific EIA must identify and relevant international conventions which have bearing on the project impact area and project activities, and indicate how compliance is to be arranged and assured

Figure 2-1 Nepal's Main National Parks  
and Wildlife Reserves



## 2.2 Environmental Review Process Elements

As noted, the environment review and management process currently in effect for public and private sector infrastructure projects is set out in the National EIA Guidelines issued by NPC in 1993. This process will remain in effect until superseded by new guidelines issued by MOPE, under the authority of the forthcoming Environment Act.

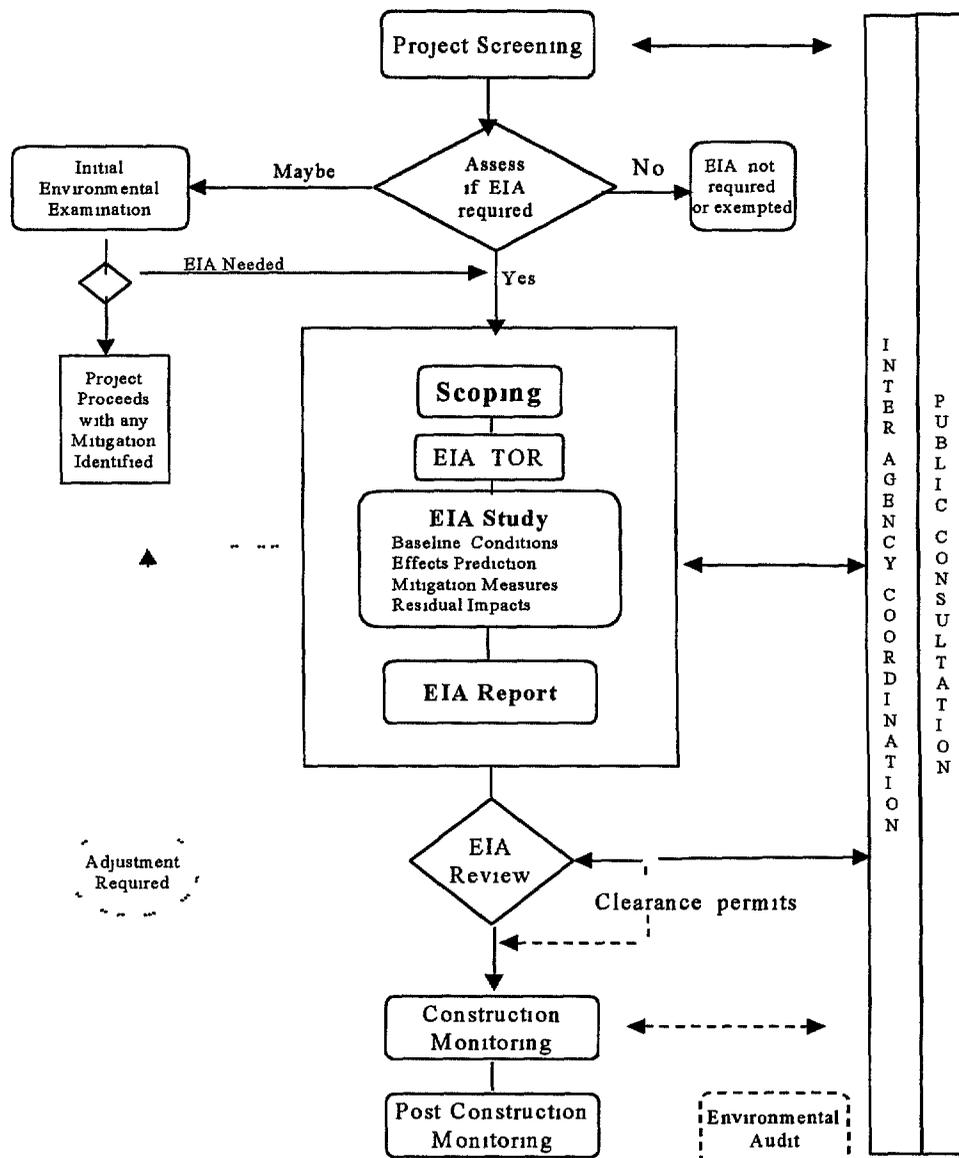
### 2.2.1 General

The main elements of the environment review process is illustrated in Figure 2-2. Specific stages include:

- Project Screening
- Initial Environmental Examination (IEE)
- Environmental Impact Assessment (EIA)
- Environment Review

- Environment Monitoring
- Environmental Auditing

Figure 2-2 Environment Process in Nepal  
(EIA Guidelines 1993)



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These stages as they relate to power projects are briefly described as follows

## 2.2.2 Project Screening

Once a power project has been identified it is screened to establish if a screening report, an EIA, an IEE, or if no further formal environmental review of the project is necessary. The project screening steps include

- Project Classification
- Formal Screening
- Screening Decision

The EIA guidelines provide an initial method of classifying projects based on critical threshold values

Schedule 1	Automatically requiring an IEE
Schedule 2	Automatically requiring an EIA
Schedule 3	Requiring an EIA if on land designated as environmentally sensitive

Larger power projects are immediately classified as Schedule 2 projects, (ie those requiring a full EIA as listed in Schedule 2 of the National EIA Guidelines). Smaller projects will automatically require an IEE if they are classified as Schedule 1 projects. If the need for an EIA is not automatic, or otherwise not obvious, formal screening is then initiated. Notification to the project proponent should be issued. At this stage, any significant effects associated with the project are considered and suitable screening methodology is selected. Screening involves considering the project attributes (cost, size, location), special resources, problems, impact on environmentally sensitive areas, etc., generally using a matrix or check list and a set of screening questions.

At present NPC, with line Ministries sponsoring the project (ie EDC and MOWR for power projects), as well as the project proponent itself are responsible for screening. If a formal screening report is required it is prepared by the project proponent at the proponent's cost. The report is submitted to the sponsoring government agency, EDC in the case of power projects.

The suggested table of contents for a project screening report is as follows <sup>1</sup>

- Purpose and Scope of Study
- Project Description
- Impact Identification
- Conclusions and Recommendations
- Appendixes
- Screening Forms
- Screening Matrix
- Maps and Diagrams
- Lists of Sources and Contacts

Based on the screening report HMG (ie an interagency committee organized by EDC) will decide (1) if no further environment study is required, or (2) an IEE is required, or (3) a full EIA is required. The

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<sup>1</sup> WECS Report Reference 10 Appendix A

decision will be based on criteria currently set out in the EIA guidelines plus any further directives by MOPE on this matter. The requirement for public consultation during the screening process is not clearly identified in the EIA Guidelines. The decision to hold public consultation on the screening report would therefore be made by HMG, but the screening report itself and the decisions subsequently arising from HMG review the report would be a matter of public record.

Table 2-4 illustrates how the different power projects are treated for purposes of environment review, interagency and public consultation. These requirements can be read in reference to the process diagram in Figure 2-2. However, it is noted that the threshold values for classifying projects are under review and further recommendations are expected in the forthcoming Water Sector Guidelines.

**Table 2-4**  
**Type of Environment Study and Review for Power Projects**  
**by Category of Project**

Power Project Type	Screening	IEE	EIA	Inter-Agency Consultation	Public Consultation
Generation (Under 1 MW)	No license issued by EDC. See Table 2-5 for Environment Review Requirement				
Generation (Above 1 MW and Under 5 MW)	Proceed to automatic IEE	yes	No formal requirement	Yes	Yes For PAP and all legitimate Stakeholders
Hydro Generation (Over 5 MW)	Proceed to automatic EIA	No	Yes	Yes	Yes For PAP and all legitimate Stakeholders
Thermal Generation (Over 5 MW)	Proceed to automatic EIA	No	Yes	Yes	Yes More limited than for hydro projects
Transmission	Confirm classification proceed to IEE or EIA	Maybe	Yes for large projects	Yes	Yes For PAP and all legitimate Stakeholders
Distribution	Yes Classify based on threshold value	Maybe	Maybe	Only if IEE or EIA is required	Only as indicated in IEE or EIA
Rural Electrification	Schedule 1 classification proceed to automatic IEE	Yes	No unless IEE says yes	Yes	Yes For PAP and all legitimate Stakeholders
All Projects require Compensation Fixation Committee to address loss of property or relocation					

A further distinction on the requirements for licensing and environment study of generation projects at the lower end of the size spectrum is shown in Table 2-5.

Table 2-5

**Environment Review and Licensing Requirements  
for Projects Under 5 MW Size**

Project Size	Formal License Requirement	Formal Environment Study Requirement
Under 100 kW	No License Required from EDC	Not specified in EIA Guidelines
100 kW to 1000 kW	No license Notification of project required to be made to EDC before construction starts	Not specified in EIA Guidelines
Above 1000 kW	Full License Procedure	IEE as specified in National Guidelines
		Full EIA for projects above 5 MW

**2.2.3 Initial Environment Examination (IEE)**

An IEE is conducted when specified (designated as Schedule 1 project), or when the requirement for a full EIA is not clearly established. The purpose of an IEE is (1) to determine if a full EIA is warranted, or, (2) otherwise decide whether significant effects and mitigation measures are needed during project implementation. If the IEE is considered to be sufficient to show clear solutions to adverse environmental and socioeconomic impacts, a full project EIA is not needed. Formal notification to this effect should be issued by EDC to the project proponent. The other HMG Agencies on the interagency review of the project, and particularly MOPE, would necessarily have to agree with the decision. Figure 2-3 illustrates the relationship between the project screening and IEE stages of evaluation.

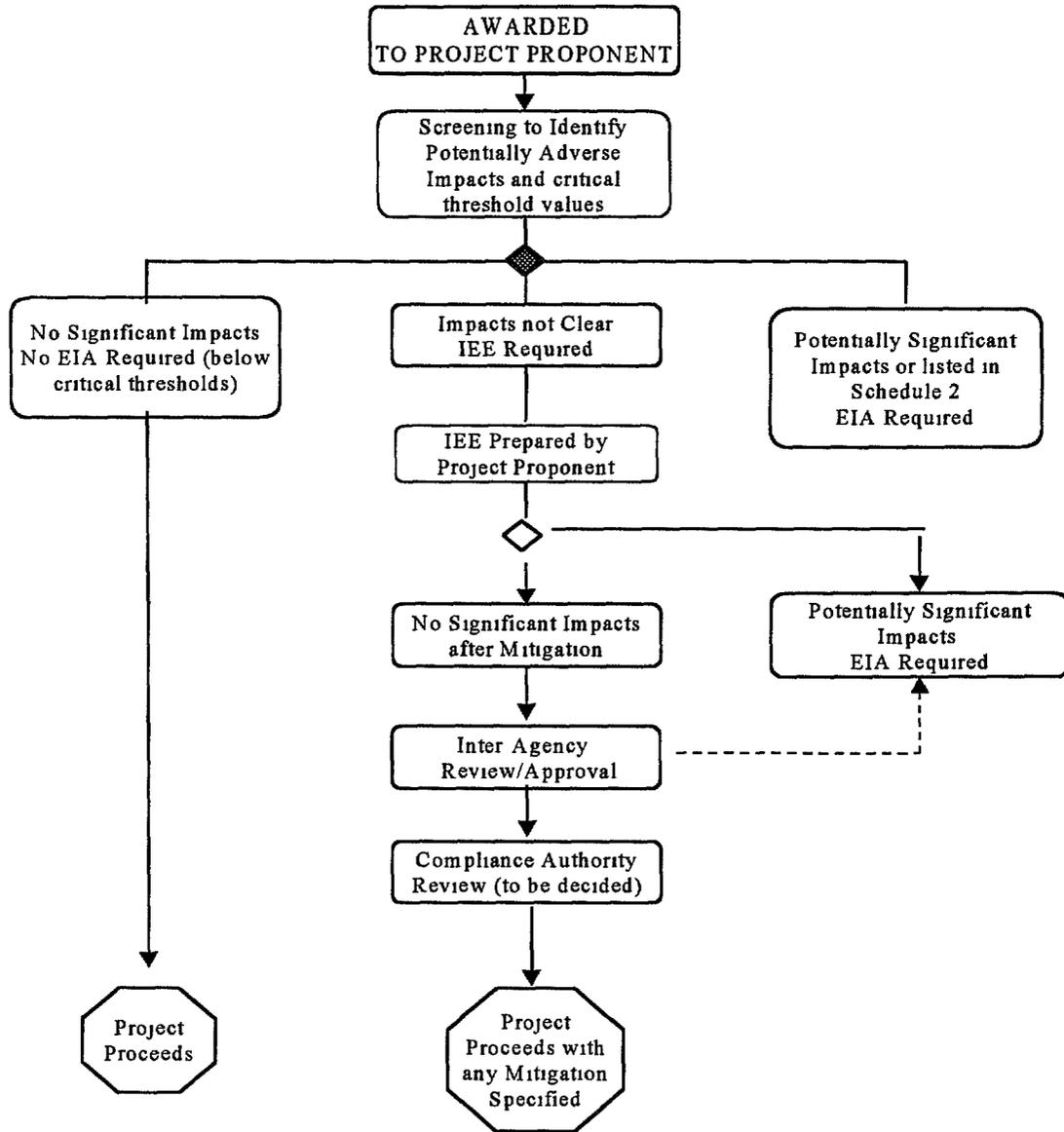
The IEE is in effect a mini EIA. It is prepared by the project proponent at their cost. EDC is responsible to ensure the project proponent has the appropriate guidelines, has access to relevant information and has any cooperation with government agencies, necessary to conduct the IEE. Formal requirements for public consultation during the IEE are indicated in the National EIA Guidelines.

Stages of the IEE as indicated in NPC and further elaborated in WECS guidelines on IEE's include

- Terms of Reference for the IEE Study Team
- Project Description
- Documentation of Existing Environment Conditions
- Impact (Effects) Prediction
- Mitigation and Compensation Assessment
- Documentation and Reporting
  - Draft Report
  - Distribution for Inter-Agency Review
  - Formal Presentation to Public and Government
  - Incorporation of Review Comments and Public Input
  - Finalization of Draft Report
- HMG Decision on whether a full-scale EIA is needed

As noted in Table 2-4 generation projects between 1 and 5 MW, rural electrification projects and some transmission and distribution projects may require an IEE.

Figure 2-3 Screening/Initial Environment Assessment



## 2.2.4 Environmental Impact Assessment (EIA)

Full EIA's are required for major generation and transmission projects. The EIA is an in-depth analysis of likely significant impacts of the project and identification of steps to mitigate significant adverse effects to accepted standards. The project EIA is prepared during the survey license period. An approved EIA report is required before a production license is issued by EDC, otherwise the production license is made subject to approval of the project EIA and all its sub-components. The main steps are briefly described as follows with reference to Figure 2-2.

- (a) **Scoping** The purpose of the scoping phase is to provide a detail outline of overall EIA study process and requirements. The main issues, methodologies and scope of the EIA study are established during this phase. Interagency coordination meetings and public consultation meetings on the criteria and methodology are initiated during the scoping phase. Activities and outputs from the scoping phase, as indicated in the National EIA Guidelines, must include
- A plan for public involvement during the EIA
  - A plan for collecting relevant data and information for baseline monitoring
  - Notification and information to public on the EIA
  - Identification of major issues of public concern
  - Evaluation of the seriousness of potential environment and socioeconomic issues
  - Establishment of priorities and areas of focus for study in the EIA
  - Strategy for addressing priority issues

As provided in the National EIA Guidelines, HMG's intention is to establish an open consultative process for the EIA, starting with the front-end scoping phase. Relevant groups to involve in the scoping phase through the interagency and public consultation mechanism are discussed in Section 3.6 of this report. Stakeholders generally include power sector agencies, environment agencies, other central and local government involved with specific aspects of the project, affected communities and people, local NGO's operating in the project area, and the general public including and other interested organizations such as I/NGO's.

- (b) **Terms of Reference** The next major activity involves preparation of the Terms of Reference (TOR) for detailed EIA study. This serves as the contract document for the inter-disciplinary team of the licensee or the consultant hired by the licensee. The TOR must reflect findings of the scoping phase in terms of the emphasis to be placed on different potential issues. Sample guidelines for the EIA TOR are shown in Appendix C.

At present there is no mandatory requirement in the National EIA Guidelines for EDC to review the EIA TOR, or require adjustments to the TOR prepared by the licensee, unless this is specified in the license agreement. However, HMG agencies who participate in the scoping will also review of the adequacy of the EIA report finally produced under the TOR, thus indirect approval is implicit. The requirement for formal EDC/MOWR review and approval of the TOR is also under review.

- (c) **Baseline Studies** After the licensee's full EIA study team is assembled, environmental and socio-economic base-line data from the project site and surrounding impact area is collected. Various data collection procedures and techniques are used including primary surveys and use of secondary data sources. Knowledge of base-line conditions is required to subsequently estimate how the project

will lead to positive or adverse changes in baseline conditions. Baseline conditions will also be used to establish the quantitative and qualitative indicators for the construction and post-construction environment monitoring programs.

- (d) **Effect Prediction** The prediction of environmental effects is an essential link between the baseline studies and the monitoring program. Potential environmental and socioeconomic impacts (both direct and indirect) are identified in this phase. Direct effects are the immediate physical effects and direct alterations to the environment expected from the project. Indirect effects are effects that are induced or stimulated by the project activities. Typically four major steps are involved: (1) identification and classification of all effects arising from the project, (2) quantification of the effects, to the extent possible, (3) evaluation of the full impact of significant effects on baseline conditions and baseline trends, and, (4) determination if mitigation and compensation measures are required.

Effects prediction should also take into consideration the potential cumulative effects resulting from the incremental impact of the project when added to other past, present, and reasonably foreseeable future projects in the same area. The effects included for prediction may include, for example, land, air, water, ecology, social, cultural and economic effects and human health effects.

- (e) **Alternative Analysis** After potential effects of the basic project configuration are identified, a systematic environmental comparison of alternative project strategies, sites, technologies and designs is prepared. The evaluation of alternatives for a Hydro power project, for example, would typically consider such issues as:
- Size and scale of the project
  - Technical and design alternatives (eg. adjustments in the dam height, inundation area, dam design, and operational procedures to minimize negative impacts)
  - Site and location alternatives for major infrastructure to minimize negative impacts
  - Timing and phasing of project implementation to optimize beneficial impacts
  - Alternative mitigation approaches for significant adverse impacts

This stage of the EIA has to proceed concurrently with the mitigation assessment for the preferred scheme. Generally this is accomplished after a few iterations of analysis using preliminary data. It is desirable that alternative project strategies are assessed in regard to their relative environmental impact, capital and recurrent cost, institutional and monitoring requirements, etc. The alternative comparison would necessarily be done in conjunction with other engineering and technical design work intended to optimize the project from overall economic, technical and social perspectives.

- (f) **Mitigation** After direct and indirect effects are classified the appropriate avoidance, mitigation and compensation actions are identified for each significant adverse effect. Mitigation must be sufficient to meet all quantitative standards (eg. air and chemical emissions limited to daily maximum or annual average concentrations as specified in HMG standards, or acceptable proxies for HMG standards). Opportunities to enhance the beneficial aspects of the project such as temporary and permanent employment and positive aspects of induced development are also identified.

- (g) **Residual Effects** Adverse environmental and socioeconomic effects that cannot be totally eliminated, after mitigation measures are taken into account, are known as residual effects. These effects remain after all standards and guidelines have been met. Residual effects are, thus, by definition, considered acceptable or tolerable, but they must nevertheless be identified. Stakeholder consultation on the residual effects is important. It must be recognized that subjective judgments, involving values, opinions and beliefs come into the picture in considering residual impacts as well as results of scientific study. A comprehensive EIA for a large project may identify options available to further deal with residual effects. Among these options include simply accepting the residual effects, using further compensation options whether monetary or other to offset adverse residual effects, and, doing research to find a better solution to such residual effects in future.
- (h) **EIA Report** Information, analysis and judgments applied in previous steps in the EIA study process are consolidated in a draft EIA report. A standardized format for EIA's is necessary to permit effective review by the stakeholders and to ensure the EIA covers all issues adequately. The table of contents suggested in Schedule 5 of the National EIA Guidelines indicates an EIA report must minimally consist of the following sections:
- Executive Summary
  - Project Description
  - Baseline Information
  - Identification of Environmental Impacts
  - Alternative Analysis
  - Mitigation Measures
  - Review of Policy and Legislation
  - Monitoring
  - Auditing
  - References

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*It is also important that three documents are produced as part of the EIA report. These are*

- ▶ *Environmental Management Plan*
- ▶ *Resettlement Plan*
- ▶ *Monitoring Plan*

*A comprehensive Resettlement Plan is required only when projects involve significant involuntary resettlement activities*

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As noted the EIA is prepared during the feasibility study and the survey license period. The final project design would be prepared after the production license is issued and after the EIA report is approved. Therefore the environment management plan, resettlement plan and monitoring plans may be further adjusted at the detailed design stage normally during the production license period.

## 2 2 5 Environmental Review and Approval

The draft EIA report prepared by the environment team of the licensee is submitted to EDC. This is required as part of the survey license. EDC staff would perform an initial check to verify all the required elements of an EIA are covered in the report, based on the guidelines for the content and format of EIA reports. If major deficiencies are noted, EDC may require the project proponent to resubmit the report. Once the report is acceptable to EDC, the report must then be made available to concerned government agencies and the public for review and comment. A check list of items to facilitate this review is noted in the EIA Guidelines and further elaborated in Appendix B-4. Agencies and groups who would participate in the review are similar to those involved in the EIA scoping phase, i.e.

- The project proponent
- EDC (the licensing agency)
- Other HMG line Ministries and Agencies associated with implementation of the project
- The Environment Division of NPC and/or the appropriate Division of the new Ministry of Population and Environment
- Legitimate non-government organizations and appropriate representatives of the population affected by the project

At present the composition of the interagency review group and the specific responsibilities for interagency review group are being considered by HMG. Any variations to the current system will be indicated in the forthcoming Water Sector Guidelines to be issued under MOPE/MOWR authority.

EDC's formal written acceptance of the EIA report, after the HMG review process is completed would constitute environmental clearance of the project. Specifically, the environment management plan and environment monitoring plan, and if needed a resettlement plan would be cleared after any necessary adjustments are made and the reports resubmitted to EDC. Requirements for formal issue of an environmental permit or other certification by the new MOPE have yet to be specified.

## 2 2 6 Environmental Monitoring

Environmental monitoring is needed to ensure compliance with legal standards, to ensure the avoidance, mitigation and compensation measures identified in the EIA are properly implemented by the project proponent, and generally to provide HMG with advanced warning of any unanticipated negative consequences of a serious nature. As part of the EIA report an environmental monitoring plan must be prepared encompassing three types of monitoring:

- (a) **Baseline Monitoring** Activities and field data collection for "pre-project" conditions, undertaken as part of the EIA itself (but possibly extending past the formal EIA study period such as to obtain seasonal and time-series annual profiles for certain hydrological or biological parameters). These data are to enable comparison of changes in baseline conditions in physical, biological, cultural and socio-economic conditions at the project site and within the project impact area resulting from project construction and operation.
- (b) **Impact Monitoring** To measure the impact of project activities leading to net changes from the baseline environment and socioeconomic, health and other conditions (as established in baseline monitoring), during the construction and operation stage, and to verify and adjust implementation of mitigation measures prescribed in the Environment Management Plan,

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- (c) **Compliance Monitoring** Where necessary to continuously or periodically sample specific environmental quality indicators (eg water and air quality) to ensure ongoing conformance to legally prescribed quantitative standards. Compliance monitoring more broadly is concerned with verifying proper implementation of the EIA recommendations as approved.

In the current system, the licensee is responsible for undertaking the baseline and impact monitoring activities, and may be responsible for certain aspects of compliance monitoring. For larger projects, a surveillance monitoring team may also be established to provide overall coordination of all aspects of baseline, impact and surveillance monitoring. The licensee must provide EDC with copies of monitoring reports at specified intervals.

## 2.2.7 Environmental Auditing

Environmental auditing is prescribed in the EIA Guidelines (1993), but is not mandatory. It is generally reserved for large projects which are multi-purpose in nature or projects located in or impacting on very sensitive environmental areas. Audits are undertaken by the government agency responsible for approving the project immediately after project construction. The need for an environmental audit is to be established during the interagency meetings in the EIA review stage with MOPE input. The intention to conduct an Environment Audit should be included in the Production License along with any necessary provisions for the project developer that would facilitate the audit.

The purposes of the audit range from providing independent verification of the adoption of the mitigation measures by the project proponent to assessing the effectiveness of the EIA study in identifying and predicting significant effects, and the effectiveness of impact and compliance monitoring. In this respect audits may be used by HMG agencies to improve the EIA guidelines issued to project proponents, and to improve environmental management practices generally. Audits are also a mechanism to train agency staff responsible for environmental coordination. As such the agency bears the cost of the audit rather than the project proponent.

## 2.3 Existing Guidelines and Procedures

Various generalized and specific guidelines currently exist which describe the environment management process and procedures for project specific EIA's for power projects. EDC will necessarily maintain an up-to-date inventory or library of the available guidelines, and make information packages available to licensees. The type of guidelines currently available are indicated as follows:

### 2.3.1 Nepal Guidelines

The main guidelines are the National EIA Guidelines (1993) which set out the process for environment review and management of infrastructure projects in all sectors and the respective roles of HMG agencies and project proponents. Schedules attached to the current Guidelines include:

Schedule 1	Projects Requiring an Initial Environment Examination Report (IEE)
Schedule 2	Projects Requiring an Environment Impact Report Assessment (EIA)
Schedule 3	Environment Impact Assessment (Concerns) Based on Project Sites
Schedule 4	Format Terms of Reference (RFP for and EIA)

Schedule 5	Environmental Impact Report Format
Schedule 6	Format for EIA Annexes

In addition to the generic National EIA Guidelines, the environment unit at WECS working closely with the Environment Division of NPC has developed guidelines for water and energy projects. These are available from WECS and include

- Guidelines for Initial Environmental Assessment of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 459, Updated Nov 1995
- Guidelines for Environmental Monitoring of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 460, Updated Nov 1995
- Guidelines for Environmental Auditing of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 461, Updated Nov 1995
- Network Resource Guide, Gender Analysis Section, WECS Report 3/2/090/96/1/1, Seq No 482, Nov 1995

As noted MOPE/MOWR will also be shortly considering the release of sectoral guidelines for the Water Resources Sector

There are also a number of guidelines, regulations, standards and other requirements issued by other HMG Ministries and agencies such as covering forestry, agriculture, and roads projects. These deal more specifically with implementation measures such as watershed management, afforestation and slope stabilization, river training, etc which may be elements of mitigation programs for power projects. Ideally MOPE's Environment Division, once it is fully functional, would compile a list of such guidelines and provide the list to EDC in interagency meetings. These should be compiled or cross-referenced by EDC and made accessible to licensees.

Other HMG regulations that are not specifically guidelines include procedures for interaction with regional, municipal and local authorities and their responsibilities. These are noted in Section 2.1.2.

### 2.3.2 Multilateral Agencies

Among other 'guideline models' which can be used or adapted in Nepal are the operational directives, guidelines and criteria developed by Multilateral Lending Agencies such as the ADB and World Bank. Such guidelines provide a useful reference, in the absence of specific Nepalese guidelines on how to address certain issues. EIA's for public sector projects licensed by EDC which involve financial participation by Multi-lateral Agencies may also need to demonstrate compliance with the external Lending Agencies own guidelines, as part of borrowing requirements. Examples of World Bank guidelines available for reference are shown in Appendix B-6 and include

- (a) **Guidelines for Use of Expert Panels** The Bank advises that for major, highly risky or contentious projects with potentially serious multi-dimensional environmental concerns, the project proponent should engage an advisory panel of independent, internationally recognized environmental specialists to advise on key elements of the EIA. Guidelines for use of an expert panel are required.

- (b) **Guidelines for Public Involvement/Consultation** As required by HMG, the Bank also expects the project proponent to take the views of affected groups and local Non-Government Organizations fully into account in project design and implementation, and in the preparation of the EIA's
- (c) **Involuntary Resettlement Guidelines** It is preferred that involuntary resettlement be avoided or minimized. Where this is not possible, a resettlement program must be developed which provides justification for resettlement and delineates the procedures that will be followed. For project involving significant resettlement activities, a Resettlement Plan must be developed.
- (d) **Guidelines for Projects Affecting Tribal People** The World Bank itself will not assist development projects that knowingly encroach on traditional territories being used or occupied by tribal people without provision of adequate safeguards.
- (e) **Cultural Property Guidelines** HMG and the Bank support the preservation of cultural properties and seeks to avoid their loss.
- (f) **Guidelines for Projects Affecting Designated Wildlife Areas** International norms are to seek a balance between preserving the environmental values of the world's more important remaining wildlands, and converting some of them to more intensive, immediate human uses.
- (g) **Air Quality Guidelines (for thermal projects)** Primary airborne emissions from power stations include sulphur oxides, nitrogen oxides and particulate matter. Secondary pollutants include sulphates, nitrates and ozone that results from chemical transformation of primary pollutants in the atmosphere at a rate that depends on many factors including temperature, dispersion, moisture content and exposure to sunlight. Most governments have established emission criteria to assess projects.

As part of this assignment, guidelines from international agencies were assembled and placed in the PEP project office. Appendix A lists the guidelines available. These cover generation, transmission and distribution projects as well as other rural development projects.

## **2.4 Institutional Roles for Environment Review and Management of Power Sector Projects**

The National EIA Guidelines identify generic roles for the project proponent (public and private sector) and the concerned government agencies in HMG's EA process. These roles may be redefined once the new MOPE is fully operational, but the basic principle is expected to be maintained whereby the lead HMG Department or agency that sponsors, or is otherwise responsible for the project, will play the main role coordinating the project-specific EIA activities undertaken by the licensee.

Institutional capacity is also an important consideration in defining such roles, particularly in the early years as the EA system becomes operational and participants become experienced. General observations on institutional capacity in this regard are:

- ▶ Institutional capacity takes time to develop.
- ▶ The major institutional elements, guidelines and administrative mechanisms for environmental management in the power sector are in place and roles are largely defined.

- ▶ NEA has functional environment unit which has some experience with in-house EIA's for NEA projects recently licensed by EDC
- ▶ WECS has an environment unit which has already produced sector-specific guidelines
- ▶ There is environmental expertise in the private sector in Nepal which private power can draw upon to form their EIA teams
- ▶ At the policy level, the Environment Protection Council is in place
- ▶ The new MOPE has been established with a comprehensive mandate for reviewing and updating environment management procedures to be followed by HMG agencies and for private sector projects

At present HMG's institutional capability is generally strongest for project-specific environment study stages (ie , screening and IEE, Interagency and Public consultation and EIA work) Institutional capabilities for environmental monitoring and auditing have yet to be fully developed NEA, for example, will have to develop its capabilities in this area and private sector licensees are required to establish this capability Capabilities within HMG agencies including EDC for environmental monitoring and auditing are at present limited Significantly, what is most lacking at present for fully mature institutional capacity is the ability to undertake sectoral and basin EA's This is an important concern for the power sector as discussed in Section 3-2

### 2 4 1 Roles in the EA Process in the Power Sector

Table 2-6 summarizes the main roles of organization in the EA process for power sector projects This refers to the process previously illustrated in Figure 2-2

**Table 2-6**

#### **Primary Roles Institutional in Power Sector Environment Management Process**

Activity	EDC	Project Proponent	Other HMG Agencies
<b>Sector Wide (Prior to Licenses being Issued)</b>			
Power Sector EA	Participate	na	Lead responsibility to be decided (eg MOWR WECS EDC NEA MOPE)
Region or Basin EA	Participate	na	
System Planning Project Screening	Participate	na	
<b>Project-Specific (After Survey License)</b>			
Project Screening  (not required for generation projects above 5 MW as they proceed to automatic EIA)	<ul style="list-style-type: none"> <li>▶ Circulate up to date generic screening guidelines</li> <li>▶ Issue notification on screening decision on requirement for no EIA IEE or EIA</li> <li>▶ Arrange meetings with other HMG agencies as required</li> </ul>	<ul style="list-style-type: none"> <li>▶ Prepare Screening Report if required</li> </ul>	<ul style="list-style-type: none"> <li>▶ MOWR and MOPE concurrence on screening decision plus any other agencies involved</li> </ul>

*Strengthening EDC's Capacity for Environment Review  
and Management of Power Sector Projects*

Activity	EDC	Project Proponent	Other HMG Agencies
IEE Study  (not required for generation projects above 5 MW)	<ul style="list-style-type: none"> <li>▶ Circulate up-to-date generic IEE guidelines</li> <li>▶ Facilitate data collection access</li> <li>▶ Review and acceptance of IEE report</li> <li>▶ Set meeting with other HMG agencies and public consultation as required on IEE decision</li> <li>▶ Issue notification on IEE decision</li> </ul>	<ul style="list-style-type: none"> <li>▶ Prepare TOR for IEE</li> <li>▶ Hire IEE study team</li> <li>▶ Prepare IEE Report</li> <li>▶ Present at Inter Agency and Public Consultation Meetings as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>▶ Provide access to data required in IEE study</li> <li>▶ Participate in Interagency meetings</li> </ul>
EIA Study	<ul style="list-style-type: none"> <li>▶ Circulate up-to-date generic EIA Guidelines</li> <li>▶ Facilitate data report and information access when requested</li> <li>▶ Periodic progress review</li> <li>▶ Verify completeness of EIA</li> </ul>	<ul style="list-style-type: none"> <li>▶ Preparation of TOR for EIA</li> <li>▶ Hire and supervise EIA study team</li> <li>▶ Prepare EIA Report</li> </ul>	<ul style="list-style-type: none"> <li>▶ Provide access to data required in EIA study</li> </ul>
Inter-Agency Coordination	<ul style="list-style-type: none"> <li>▶ Set up and coordinate Inter Agency Meetings</li> <li>▶ Document meetings</li> </ul>	<ul style="list-style-type: none"> <li>▶ Proponent's team participates</li> <li>▶ Document meetings attended for EDC</li> </ul>	<ul style="list-style-type: none"> <li>▶ Participate in EIA milestone meetings</li> </ul>
Public Consultation	<ul style="list-style-type: none"> <li>▶ Coordinate Public Consultation Meetings in all phases of the IEE/EIA process</li> <li>▶ Issue of required public notices</li> <li>▶ Initiation of Compensation Fixation Committee Meetings</li> </ul>	<ul style="list-style-type: none"> <li>▶ Proponent's team participates</li> <li>▶ Document meetings attended for EDC</li> </ul>	<ul style="list-style-type: none"> <li>▶ Participate in public meetings as appropriate</li> <li>▶ Selected Ministry Representatives to participate on Compensation Fixation Committee</li> </ul>
Implementation	<ul style="list-style-type: none"> <li>▶ Review progress reports during implementation</li> <li>▶ Arrange environmental Audit if determined necessary after project completion</li> </ul>	<ul style="list-style-type: none"> <li>▶ Implement measures in the approved Environment Management Plan for avoidance mitigation and compensation</li> </ul>	<ul style="list-style-type: none"> <li>▶ Provide any support role required</li> </ul> <p>(Other HMG agencies may be involved in sub-projects eg access road infrastructure relocation resettlement program)</p>
Baseline Monitoring	<ul style="list-style-type: none"> <li>▶ Circulate generic guidelines</li> </ul>	<ul style="list-style-type: none"> <li>▶ Conduct baseline monitoring program according to plan submitted in Scoping phase</li> </ul>	<ul style="list-style-type: none"> <li>▶ Ensure data access</li> </ul>
Impact Monitoring	<ul style="list-style-type: none"> <li>▶ Circulate generic guidelines</li> <li>▶ Maintain in house data base</li> </ul>	<ul style="list-style-type: none"> <li>▶ Conduct impact monitoring program according to plan in EIA</li> </ul>	<ul style="list-style-type: none"> <li>▶ Review and comment on impact report</li> </ul>

Activity	EDC	Project Proponent	Other HMG Agencies
Compliance Monitoring	<ul style="list-style-type: none"> <li>▸ Circulate generic guidelines</li> <li>▸ Circulate report to HMG agencies</li> <li>▸ File report for public access</li> </ul>	<ul style="list-style-type: none"> <li>▸ Undertake activities required and provide access and data</li> </ul>	<ul style="list-style-type: none"> <li>▸ Review and comment on compliance report</li> </ul>
Environmental Auditing	<ul style="list-style-type: none"> <li>▸ Decision on need for audit</li> <li>▸ Arrangement of government team or subcontractor</li> <li>▸ Circulate report to HMG agencies</li> <li>▸ File report for public access</li> </ul>	<ul style="list-style-type: none"> <li>▸ Provide access and data</li> </ul>	<ul style="list-style-type: none"> <li>▸ Input on decision on Audit (MOPE especially)</li> <li>▸ Review and comment on audit report</li> </ul>

## 2.4.2 Project EIA's

Roles specific to the EIA's for power project are summarized in Table 2-7. The survey license requires licensees to submit progress reports every six months. The public consultation plan and the interagency coordination plan may introduce more frequent meetings and reporting involving EDC and the licensee.

Table 2-7

### EDC, Licensee and Other HMG Agency Roles in Power Project EIA's

EIA Activity	EDC	Project Proponent	Other Agency
Terms of Reference	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines</li> <li>▸ Informally review EIA TOR as drafted by Licensee</li> </ul>	<ul style="list-style-type: none"> <li>▸ Prepare TOR and hire EIA Study Team</li> </ul>	<ul style="list-style-type: none"> <li>▸ None</li> </ul>
Scoping	<ul style="list-style-type: none"> <li>▸ Ensure Licensee has National EIA Guidelines</li> <li>▸ Provide generic EIA Guidelines with EDC for type of power project</li> <li>▸ Set up Inter Agency and Public Consultation Meetings</li> <li>▸ Coordinate meetings and any public notifications</li> </ul>	<ul style="list-style-type: none"> <li>▸ Prepare material for scoping meetings</li> <li>▸ Prepare scoping report including</li> <li>▸ Public Consultation Plan</li> <li>▸ Baseline Data Collection Plan</li> </ul>	<ul style="list-style-type: none"> <li>▸ Attend and provide input at scoping meetings</li> <li>▸ Agree on types of data each agency will make available</li> <li>▸ Agree on interagency meeting schedule</li> </ul>
Baseline Field Survey	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines</li> <li>▸ Assist with information access via other HMG Agencies</li> </ul>	<ul style="list-style-type: none"> <li>▸ Conduct baseline survey and field questionnaires according to plan</li> </ul>	<ul style="list-style-type: none"> <li>▸ Provide access to data as needed for baseline survey</li> </ul>
Effects Prediction	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines</li> </ul>	<ul style="list-style-type: none"> <li>▸ Analyze likely indirect and direct project effects</li> </ul>	<ul style="list-style-type: none"> <li>▸ Individual agencies consulted as necessary</li> </ul>
Mitigation Measures	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines</li> </ul>	<ul style="list-style-type: none"> <li>▸ Identify avoidance mitigation and compensation measures for significant effects</li> </ul>	<ul style="list-style-type: none"> <li>▸ Individual agencies consulted as necessary</li> </ul>

EIA Activity	EDC	Project Proponent	Other Agency
Alternative Assessment	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines</li> <li>▸ Provide input to demand side alternative assessment</li> </ul>	<ul style="list-style-type: none"> <li>▸ Assess alternative project designs scale timing phasing etc</li> </ul>	<ul style="list-style-type: none"> <li>▸ Individual agencies consulted as necessary</li> </ul>
Environment Management Plan	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines</li> <li>▸ Review plan for completeness</li> <li>▸ Circulate plan with EIA</li> </ul>	<ul style="list-style-type: none"> <li>▸ Prepare plan</li> </ul>	<ul style="list-style-type: none"> <li>▸ Review and provide comment on plan</li> </ul>
Environment Monitoring Plan	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines</li> <li>▸ Review plan for completeness</li> <li>▸ Circulate plan with EIA</li> </ul>	<ul style="list-style-type: none"> <li>▸ Prepare Plan</li> </ul>	<ul style="list-style-type: none"> <li>▸ Provide up-to-date quantitative standards</li> <li>▸ Review and provide comment on plan</li> </ul>
Resettlement Plan	<ul style="list-style-type: none"> <li>▸ Identify if resettlement plan is required</li> <li>▸ Provide generic guidelines</li> <li>▸ Arrange for first meeting of Compensation Fixation Committee</li> </ul>	<ul style="list-style-type: none"> <li>▸ Prepare draft plan for EIA</li> </ul>	<ul style="list-style-type: none"> <li>▸ Participate as appropriate on Compensation Fixation Committee</li> </ul>
Draft EIA Report	<ul style="list-style-type: none"> <li>▸ Provide generic guidelines on report format</li> <li>▸ Review report for completeness</li> <li>▸ Circulate report for review</li> <li>▸ Issue notification of acceptance and approval of final report</li> </ul>	<ul style="list-style-type: none"> <li>▸ Prepare and submit report</li> </ul>	<ul style="list-style-type: none"> <li>▸ Review and provide comment on report</li> </ul>

Table 2-7 assumes EDC operates the same with NEA as it does for private sector licensees. An important distinction is the EDC must function as the one-window for private developers. Thus NEA, in its capacity as a public corporation may directly undertake certain liaison activities without enlisting EDC's assistance, but informing EDC, which has discretion as to the role it will play.

### 3 Review of Conceptual and Practical Issues in Environment Management of Power Projects

EDC staff responsible for coordinating and reviewing environment management activities undertaken on projects licensed by EDC are the intended audience for this section of the report. The aim is to highlight some of the main issues and concepts relating to environment management of power projects. Appendix A lists a number of detailed reference documents that have been assembled for the PEP on these and other topics. These documents should be included in a new environment section of EDC's technical reference library and made accessible to staff.

#### 3.1 Concept of Sustainable Development

The concept of sustainable development is a starting point in explaining the rationale for environmental management. Sustainability is implicit in the approach HMG has selected for environment management of power and other infrastructure projects, and it is an integral part of HMG's development policy more broadly. Sustainability has been defined in general terms as, "*development without going beyond environmental carrying capacity (of an area, town or country) including the regenerative and absorptive capacity of the area*"<sup>1</sup>. There are three component parts of sustainability: environmental, economic and social sustainability. These definitions have been used by development agencies such as the World Bank in program planning. And they are underlying principles of HMG's own Conservation Strategy and the basis for the National EIA Guidelines. Detailed definitions include:

Environmental Sustainability	Protecting both the sources of resources and the sinks for wastes. This requires consideration of the assimilative capacity of the environment or area being affected by a project without impairing it and holding depletion rates on resources extracted from the area equal to the rate at which renewables can substitute.
Economic Sustainability	Maintenance of three main types of capital (physical or man-made capital, natural capital, and social or human capital). Such capital is to be maintained in order to provide a basis for future generations to develop economically. Consideration of the irreversibilities in planned use of such resources is important.
Social Sustainability	Use resources in ways that increase social equity and fairness while reducing social disruptions. Poverty reduction is, for example, a main goal of social sustainability.

Other terms associated with the sustainability concept include:

- ▶ **Physical Capital** Infrastructure such as roads, power stations and buildings
- ▶ **Natural Capital** Natural environment (wildlife, vegetation, forests, air, water, soils, wetlands, etc.) that are relied on to provide a flow of goods and services from the natural capital for both intrinsic and human benefit. The flow can be renewable or depleting. Sustainability means not depleting the natural assets while deriving benefit from the assets. This is analogous to drawing an income from natural capital. Irreversible consumption of such capital is thus liquidation, not income, which leaves nothing for future generations.

<sup>1</sup> R. Goodland, *Environmental Sustainability and the Power Sector Impact Assessment*, 1994.

- ▶ **Human Capital** Investments in education, schools health and nutrition **Social Capital** is similar and defined as people, their capacity levels, institutions, education, information and knowledge (ie the institutional and cultural basis for society)

**Table 3-1**

**Themes of Environmental Sustainability**

<b>Concept Rules of Environmental Sustainability (Adapted from Goodland Ref 19)</b>	
Output Rule	Wastes emissions from a project should be within the assimilative capacity of the local environment without unacceptable degradation of its future waste absorptive capacity Standardized emission standards are set for this purpose
Input Rules	Renewable Harvest rates of renewable resource inputs should be kept within the regenerative capacity of natural systems
	Non Renewable Depletion rates of non renewable should be equal to rate at which renewable substitutes are developed
<b>Degrees of Environmental Sustainability</b>	
Weak	Assumes different types of capital (physical natural and human) are substitutes It is a starting point which at least recognizes the different forms of capital
Strong	Approach maintains the different types of capital intact separately
Absurdly Strong	Never depletes anything Living off over mature stocks or yields from capital only
<b>Approaches to Restoring Natural Capital</b>	
Regeneration	Replace natural capital that is destroyed such as during construction (replanting and afforestation programs)
Relieve pressure	Relieve pressure on natural resources and sensitive habitat such as due to loss fragmentation or increased disturbances resulting from access (ie mitigation actions)
Efficiency	Efficient use of resources obtained from natural capital
<b>Enabling Conditions</b>	
Adoption of Participation Approaches and Transparency	To achieve consensus on activities and use of environment resources as well as mitigation activities (eg regeneration relieving pressure efficiency)
Increased Local Empowerment	Local ability to influence decisions and ability to direct human and financial resources to critical problems
Increased Literacy etc	To permit full participation in the process

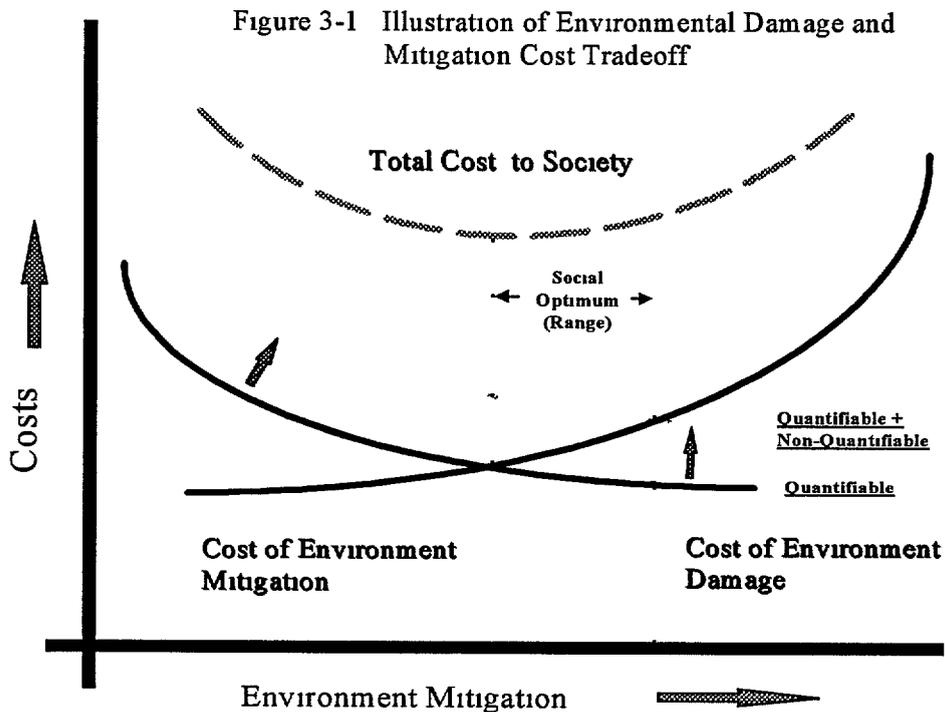
In order to bring the concepts noted in Table 3-1 into the process for environmental management and review of power projects, two approaches are currently used These are

- ▶ Internalization of quantifiable environmental mitigation costs in the total project costs (ie , cost of avoidance, mitigation, compensation measures)
- ▶ Incorporation of non-quantifiable externalities in key decisions where decision tradeoffs are made This includes, for example, the fundamental choice of whether to proceed with the project, and selection of project alternatives, (eg the importance of fish, wildlife and plant diversity in an area, etc )

In the first instance, costs of mitigating potentially significant, adverse environmental and social effects are internalized as project costs. Some costs are readily identifiable such as family relocation or compensation measures for loss of property, or the cost mitigation actions that are discrete in nature such as programs for restocking fish in a river. Environmental and social impact mitigation measures are thus translated to monetary terms and factored into the overall economic decision-making framework.

Externalities are more difficult to incorporate. There are for instance empirical problems in valuing many of the non-tangible aspects of natural capital such as biodiversity and inter-generational access to clean air and water. Thus these non-quantifiable environment costs are treated as externalities (until such time as they can be valued in monetary terms). The externalities are explicitly brought into the decision process as non-quantifiable tradeoffs. For this reason stakeholder involvement in the decision process is essential. This field of study of externalities is not static. New techniques are being introduced to value in economic terms what are today considered to be non-quantifiable externalities.

Figure 3-1 illustrates the basic, but critically important concept of balancing the cost of environmental damage with costs of mitigation. The lower cost (damage) curve in Figure 3-1 shows quantifiable impacts. Adding the cost (damage) of externalities would shift the curve outward. The objective is to arrive at a socially optimal solution, or least-cost, to decide the tradeoff point between quantifiable environmental damage (costs) and mitigation (costs). Environmental damage that would remain after the socially optimal level of mitigation is achieved is a residual effect, as noted in Section 2.2.4. The environmental standards that Nepal adopts (MOPE responsibility) will, in effect, establish Nepalese society's collective or consensus decision on what is environmental damage is tolerable. This is in terms of the residual environmental effects remaining after mitigation steps are taken.



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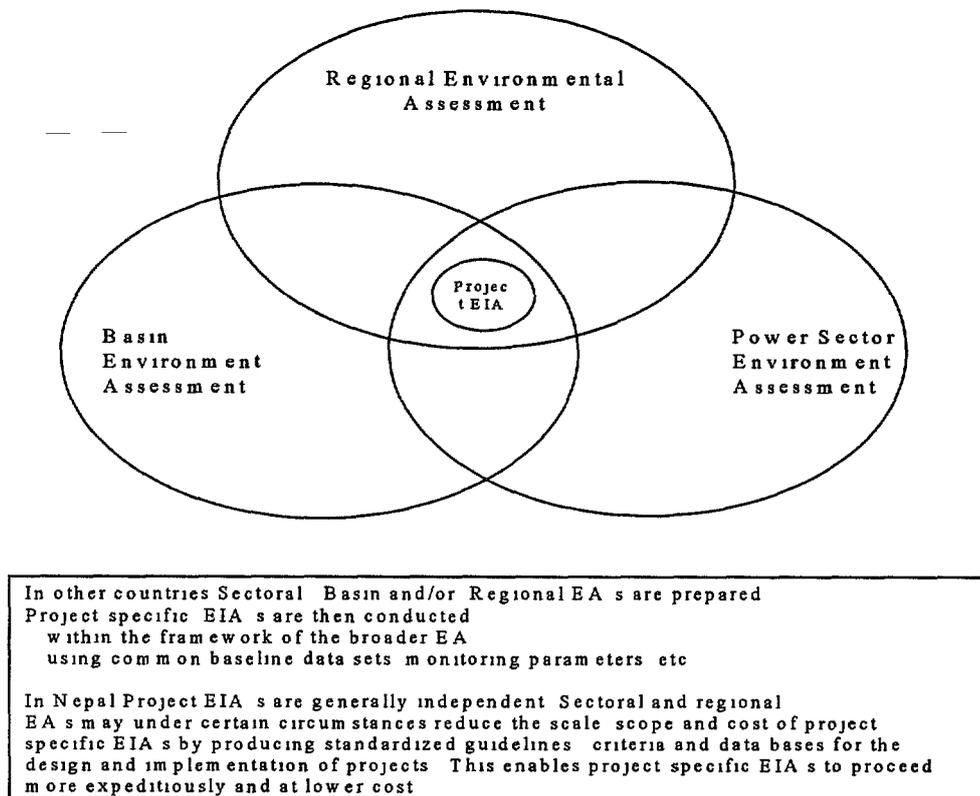
## 3.2 Types of Environmental Assessments

Three major types of environmental assessments have become common for the power sector. These are:

- ▶ **Project-specific EA's or (EIA's)** Used to determine the impacts and mitigation measures needed for specific generation and transmission projects. HMG's approach to preparing project-specific EIA's was outlined in Section 2. This is the current focus of EDC's environment activity.
- ▶ **Regional EA's** Used to establish common environmental parameters, data-bases, monitoring requirements etc., where a number of similar but significant development activities with potentially cumulative impacts are planned for a reasonably localized geographic area, such as several projects in one river basin or watershed.
- ▶ **Sectoral EA's** Typically are used for the design of sector investment programs, and usually address the separate and common or combined effects of a mixture of projects proposed for the next few years.

Figure 3-2 illustrates the relationship between different types of EA's and project EIA's.

Figure 3.2 Types of Environmental Assessments



Sectoral and regional EA's may under certain circumstances reduce the scale, scope and cost of preparing project-specific EIA's. This is achieved by producing standardized guidelines, criteria and data bases (eg baseline hydrometric, socioeconomic, biotic data and other ecological sensitivity data and trend lines) which enable project-specific EIA's to proceed more expeditiously. Regional and sectoral EA's may also overlap with one another.

In Nepal, the preparation of regional EA's focused on the major river drainage basins in the country would be highly desirable from a number of perspectives. These include

- ▶ Environmental study
- ▶ Basin planning and optimization
- ▶ Overall risk reduction

From the environmental perspective, the preparation of basin EA's will clearly help HMG amass data for the entire basin. Among other uses, this will enable assessment of individual projects within the basin framework and as a larger ecosystem, as apposed to considering each project separately as it arises. Issues common to all potential project sites in the basin such as hydrology and hydrologic conditions, erosion and sedimentation characteristics, GLOF hazard and risk, minimum flow requirements, fisheries impacts and water use balances could be assessed in one go, or at minimum in a consistent manner. The appropriate data collection instruments, facilities and simulation models would necessarily be established during the EA, and time series data would be generated. Decisions could then be based on a more reliable and comprehensive information than would otherwise be possible. Basic decisions could also be made on design parameters that would be acceptable for classes of projects or possible for individual sites in the basin. While these steps can significantly reduce the cost of individual project EIA's, the approach would also help address a concern where project EIA's are prepared independent of one another, and potentially optimized on different criteria with limited reliable data.

Project EIA's may also have a different emphasis or treat issues in a different or conflicting way. This is particularly important considering that EIA's in one basin may be undertaken by organizations responsible for different sectors (eg hydro power, irrigation, industry, forest development, tourism, etc) with all projects impacting on the same basin environment. To a certain extent, the current national guidelines help to address this issue by standardizing EIA study approaches across sectors.

From a planning perspective, one major advantage of basin EA's is that the planning, analysis and other data collection work required to prepare the EA will help to set the stage for preparing full multi-purpose basin optimization and development plans. In the latter, a full range of power, non-power and multi-purpose development projects would be identified for the basin. Optimization criteria would be consistently applied. Similarly, such work would consider an institutional framework appropriate to capture all potential non-power benefits of water resources projects in the basin. This is important, because individual projects may be optimized for their bankability (eg, primarily power related size, storage etc, impacting on cost level which is essential where private sector financing is involved). Thus a broader framework may be useful to optimize non-power benefits, particularly considering the regional nature of water resource development. The basin approach has been used in other countries and generally a Basin Development Authority is established.

There are five major basins in Nepal which all eventually feed the Ganges system<sup>2</sup>. All the basins have different hydrologic, hydraulic, sedimentation and environmental features. These basins and some of the major rivers in each basin are illustrated in Map Figure 3-3.

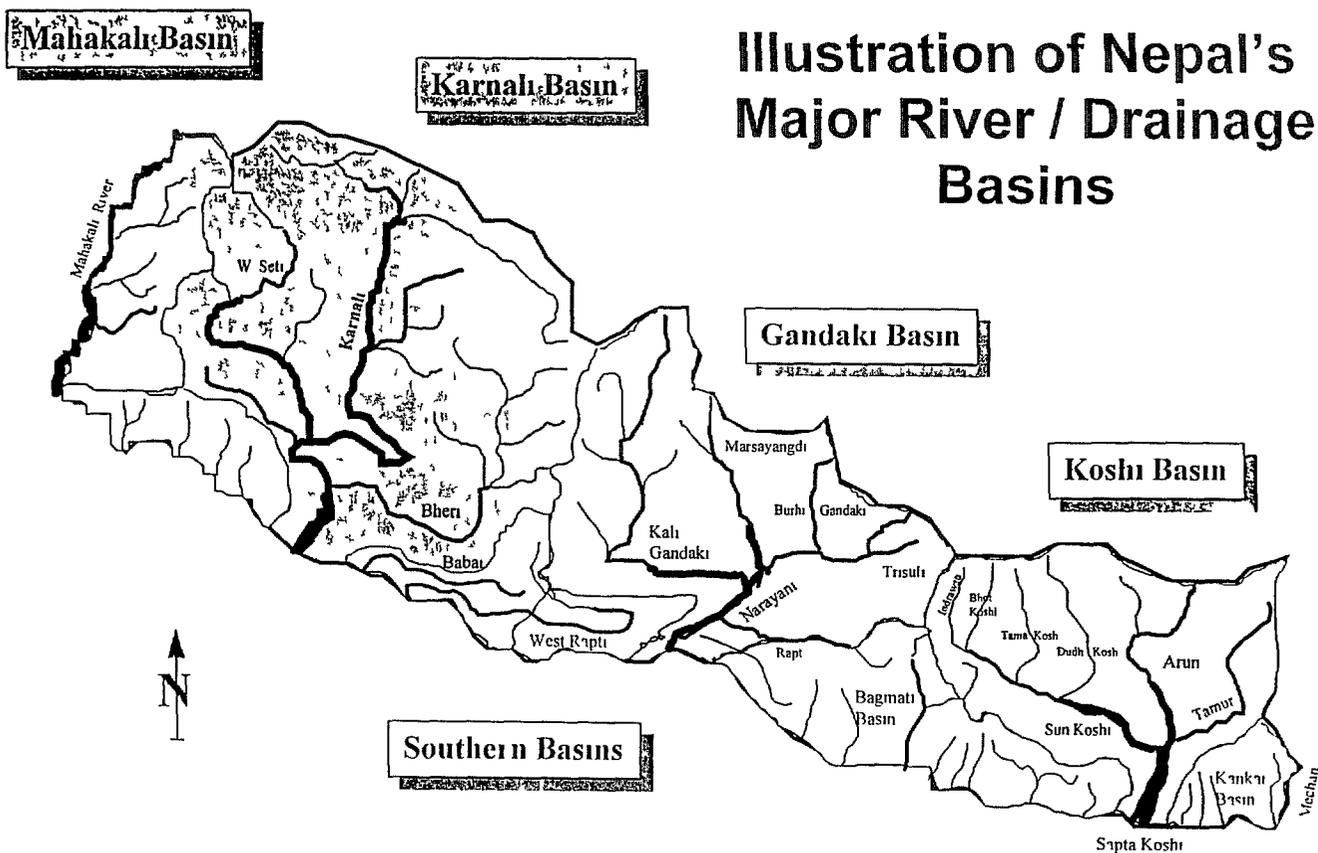
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<sup>2</sup> Erosion and Sedimentation in the Nepal Himalaya WECS 1988

HMG will undoubtedly conduct basin EA's at some point in the future. In the meantime it is recognized the costs of preparing basin EA's is high. Thus until sufficient funds are allocated for this purpose, project-specific EIA's as funded directly by the licensees (ultimately the power consumers), remain the sole course for EDC to follow at present.

Figure 3-3

### Illustration of Nepal's Major River / Drainage Basins



### 3.3 Cross-Sectoral Issues

In the preparing an EIA for power projects a number of issues may be encountered that are cut across different economic or planning sectors and areas of government jurisdiction. Proper study of all environmental issues is clearly a multi-disciplinary undertaking. As a reference, the World Bank Operational Directives (Reference 19) provide a check list of potential issues for EA's that are cross-sectoral in nature. These are shown in Table 3-2 and include

**Table 3-2**  
**Cross-Sectoral Issues to be Addressed in Power Sector EIA's**

Cross Sectoral Issues in Project EIA's	Description
Atmospheric Pollution	The effect on the project on increasing or reducing atmospheric emissions that may be of concern locally (such as road dust or construction dust) or more regional effects such as greenhouse ozone depletion, acid rain or trans boundary release of airborne toxic pollutants
Agro-chemical Releases	Careful assessment of impacts of the project on containment, concentration or dispersion of pesticides and fertilizers as they affect downstream water quality (eg. toxic chemical concentrations in reservoirs that may be released in flushing)
Biological Diversity	Conservation of endangered or rare plant and animal species, critical habitat and protected areas
Cultural Properties	Protection of archaeological sites, historic monuments and historic settlements
Hazardous and Toxic Material	Safe transport, storage, use and disposal of any hazardous or toxic materials
Induced Development and Other Socio Cultural Aspects	Effects of secondary growth of settlements and infrastructure including boomtowns that may be created by the project that have environmental consequences or impact on local government services and performance
International Treaties and Agreements on Water Resources	Status of current or pending agreements on water flow or quality that may be affected by the project
International Waterway	Status any agreements on water navigation that may be affected by the project altering the quantity and quality of water flows
Involuntary Resettlement	Adequate consultation and compensation measures for treatment of involuntary settlement of persons affected by the project
Land Settlement	Due to complex physical, biological, socioeconomic and cultural impacts, land settlement should be considered
Natural Hazards	Whether a project will be affected by natural hazards (eg. earthquakes, floods, landslides and GLOF)
Occupational Health and Safety	Inclusion of a formal plan to promote occupational and worker safety
Watersheds	Protection and management of watersheds with dams, reservoirs and irrigation systems
Wetlands	Conservation and management of wetlands (eg. estuaries, lakes, marches and swamps)
Wildlands	Protection of wildlands including compensatory (relocation etc.) measures for adverse impacts

Identification and evaluation of cross-sectoral issues is necessary during the EIA

### 3.4 Project Specific Issues

Professional staff of HMG agencies in the water resource sector (including EDC, NEA, WECS and MOWR) have varying degrees of exposure to environmental review of power projects. It is generally recognized that degree of concern or likely significance of potential environmental impacts of hydro, thermal, transmission, distribution and rural electrification projects depend on a number of factors including the scale of the project itself, and the degree of environmental sensitivity of the immediate project site and impact area. Potentially significant impacts can be both positive or negative, and both quantifiable and non-quantifiable as noted in Section 3.1. Negative and positive benefits may also be offsetting. Table 3-3 illustrates broad effects of a hydro power project in these terms.

**Table 3-3**  
**Illustration of Categorization of Potential Effects of Projects Positive and Negative**

	Quantifiable	Non-Quantifiable
Potential Negative Effects (addressed by avoidance mitigation and compensation measures)	<p>Example</p> <ul style="list-style-type: none"> <li>▶ Temporary or permanent loss of land from other productive use</li> <li>▶ Cost to treat or mitigate pollution releases and impacts on water, air, land, etc.</li> <li>▶ Need for relocation of persons affected by the project</li> <li>▶ Need for relocation of public infrastructure (eg roads, bridges, buildings)</li> <li>▶ Access Road and transmission right of way impacts</li> <li>▶ Strain on local government services with influx of temporary work force</li> </ul>	<p>Example</p> <ul style="list-style-type: none"> <li>▶ Potential negative health effects from change in air or water quality or disease vectors</li> <li>▶ Impact of land clearing on erosion and sedimentation rates</li> <li>▶ Loss of scenic value</li> <li>▶ Potential negative aspects of induced development</li> <li>▶ Loss or fragmentation of habitat impacting on biodiversity</li> <li>▶ Increased pressure on sensitive aquatic life, flora and fauna</li> <li>▶ Psychological impacts of loss of ancestral areas or disturbance of heritage sites</li> </ul>
Potential Positive Effects (consider value added investments to enhance effects)	<p>Example</p> <ul style="list-style-type: none"> <li>▶ Power supply benefits locally and for the national economy</li> <li>▶ Potential flow regulation (irrigation and flood protection) benefits</li> <li>▶ Potential fisheries benefits in reservoir</li> <li>▶ Stimulation of the local economy through local purchases and job creation</li> <li>▶ Improvement in local tax base</li> </ul>	<p>Example</p> <ul style="list-style-type: none"> <li>▶ Contribution to poverty alleviation</li> <li>▶ Potential enhancement of health through improved access to services</li> <li>▶ Improved road access for rural and regional development opening markets for local produce and input of services</li> <li>▶ Potential for positive induced or secondary economic development</li> </ul>

Sections which follow highlight typical effects for different type of power projects

#### 3.4.1 Hydro Projects

The potential for significant positive and adverse environmental and socioeconomic impacts of hydro power projects depend on the type of project (ie run-of-river versus storage), scale and location of project, requirements for road and transmission corridors and the environmental sensitivity of the location of the major project infrastructure. Table 3-4 illustrates typical concerns for storage projects.

Table 3-4

**Illustration of Potential Environmental Issues  
for Hydro Power Storage Projects**

	Project Affected Areas (Zone of Influence)			
	Upstream	Project-Site	Down Stream	Access Road and Transmission
<b>Potential Physical Effects</b>				
<b>Air Quality</b>	<ul style="list-style-type: none"> <li>▸ Construction and transport activity dust and noise emissions</li> </ul>			
<b>Water Flow Regime</b>	<ul style="list-style-type: none"> <li>▸ Hydrometric conditions</li> <li>▸ Potential backwater effect producing seasonal flooding and water logging</li> <li>▸ Longer term change in backwater effect as reservoir silts</li> <li>▸ Short and long term impacts of diverting upstream tributaries and possible check dams on tributaries</li> </ul>	<ul style="list-style-type: none"> <li>▸ Reservoir filling rates and releases</li> <li>▸ Reservoir drawdown rates and associated impacts</li> <li>▸ Peaking release effect on river flows and stages</li> </ul>	<ul style="list-style-type: none"> <li>▸ Seasonal effect of dewatering on downstream hydraulic regime</li> <li>▸ Seasonal scouring of downstream river bed</li> <li>▸ Minimum dry season release based on downstream requirements</li> <li>▸ Supply interruption during construction and diversion</li> <li>▸ Need for re-regulation weir and river training measures</li> </ul>	<ul style="list-style-type: none"> <li>▸ Localized temporary construction impact on flow and water availability downstream of river crossings</li> </ul>
<b>Water Quality (Physical effect)</b>	<ul style="list-style-type: none"> <li>▸ Effects of natural and man made erosion changing runoff and sediment load characteristics</li> </ul>	<ul style="list-style-type: none"> <li>▸ Evaporation and thermal stratification in reservoir</li> </ul>	<ul style="list-style-type: none"> <li>▸ Sediment and other waste release from construction activity</li> <li>▸ Change in sediment load from baseline conditions during reservoir operation</li> <li>▸ Timing of sediment releases from flushing operations</li> </ul>	<ul style="list-style-type: none"> <li>▸ Temporary additional sediment release from construction activity</li> </ul>
<b>Soils Erosion and Siltation</b>	<ul style="list-style-type: none"> <li>▸ Erosion from land clearing adding to reservoir and downstream silting</li> <li>▸ Watershed management practices</li> </ul>	<ul style="list-style-type: none"> <li>▸ Rate of siltation of reservoir and loss of reservoir capacity</li> <li>▸ Reservoir shoreline erosion</li> <li>▸ Slope stabilization in reservoir area</li> </ul>	<ul style="list-style-type: none"> <li>▸ Degree of loss of natural downstream silt cycle ( to flood plain)</li> <li>▸ Effect on bank erosion</li> <li>▸ Permanent change in downstream siltation and landform patterns (eg river islands channel bars, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>▸ Erosion accelerated by access road and transmission construction works</li> </ul>

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	Project Affected Areas (Zone of Influence)			
	Upstream	Project-Site	Down Stream	Access Road and Transmission
<b>Terrain and Other</b>	<ul style="list-style-type: none"> <li>Water table change</li> </ul>	<ul style="list-style-type: none"> <li>Local sources of construction materials</li> <li>Borrow pit and waste disposal pollution and rehabilitation/restoration issues</li> <li>Water table change and potential salinization issues</li> <li>Aeashtetic impacts of road transmission and project facilities</li> </ul>		
<b>Land Loss and Inundation</b>	<ul style="list-style-type: none"> <li>Protection of land and public access control for watershed management activities</li> </ul>	<ul style="list-style-type: none"> <li>Loss of land to inundation and permanent facilities</li> <li>Temporary and permanent loss of land for camps and construction facilities</li> </ul>	<ul style="list-style-type: none"> <li>Land use change</li> <li>Enhanced protection of downstream land and property from floods</li> </ul>	<ul style="list-style-type: none"> <li>Temporary and permanent loss of land for access road and transmission</li> <li>Access through private land for patrol and maintenance</li> </ul>
<b>Other Physical Hazards</b>	<ul style="list-style-type: none"> <li>Potential occurrence and effect of GLOF rock and landslide hazard (natural)</li> </ul>	<ul style="list-style-type: none"> <li>Seismic considerations for safe design of facilities</li> <li>Hydro-geological effect of storage water mass</li> <li>Construction induced rock slides and landslides from vibration blasting or drilling operations</li> </ul>	<ul style="list-style-type: none"> <li>Dam safety consideration and emergency water release impacts</li> </ul>	<ul style="list-style-type: none"> <li>Flood landslide other mass wasting hazards at river crossings for road and transmission facilities</li> </ul>
<b>Potential Biophysical and Bio-Chemical Impacts to Assess and Mitigate</b>				
<b>Water Quality (Bio-chemical effects)</b>	<ul style="list-style-type: none"> <li>Fertilizer other agriculture chemical and pesticide use upstream adding to reservoir toxins and nutrients</li> </ul>	<ul style="list-style-type: none"> <li>Effects of anaerobic decomposition of biomass in reservoir</li> <li>Other change in nutrient and oxygen depletion in reservoir water</li> <li>Toxic or other buildups in reservoir sediment</li> </ul>	<ul style="list-style-type: none"> <li>Temporary downstream water quality effects during construction (chemicals and toxins camp sewage etc )</li> <li>Periodic or seasonal release of toxic or other buildups in reservoir sediment</li> <li>Chemical properties of reservoir water</li> <li>Potential for reduced pollution from downstream industries converting to power</li> </ul>	<ul style="list-style-type: none"> <li>Temporary downstream water quality effects during construction (chemicals and toxins camp sewage etc )</li> </ul>

	Project Affected Areas (Zone of Influence)			
	Upstream	Project-Site	Down Stream	Access Road and Transmission
<b>Fish and Aquatic Ecosystem</b>	<ul style="list-style-type: none"> <li>▸ Impairment of fish migration to upstream tributaries and habitat/ spawning grounds by check dams</li> </ul>	<ul style="list-style-type: none"> <li>▸ Permanent impairment of fish migration at dam/weir site</li> <li>▸ Loss of fish and other aquatic habitat at site</li> <li>▸ Opportunity for active reservoir fisheries with native and desired species</li> <li>▸ Possibility of re-stocking fish after temporary construction disturbance</li> </ul>	<ul style="list-style-type: none"> <li>▸ Disturbance of aquatic habitat during construction</li> <li>▸ Impact of hydrology change on limnology of downstream river sections</li> <li>▸ Impairment of fish migration</li> <li>▸ Loss and disturbance of aquatic habitat by permanent flow and water quality change</li> </ul>	<ul style="list-style-type: none"> <li>▸ Local habitat disturbance at river crossing during construction</li> </ul>
<b>Vegetation</b>	<ul style="list-style-type: none"> <li>▸ Loss or pressure on rare or endangered species of ecological significance by clearing loss fragmentation or increased public access to natural habitat during construction and long term</li> <li>▸ Effects of land use change on longer term vegetation cover, species composition, growth rates</li> </ul>			
<b>Wildlife</b>	<ul style="list-style-type: none"> <li>▸ Direct loss of wetlands habitat and breeding grounds for aquatic fowl</li> <li>▸ Pressure on rare or endangered species through loss fragmentation of habitat and open public access and land use changes around sensitive habitat</li> <li>▸ Potential increase in waterfowl and amphibian populations in reservoir area</li> <li>▸ Temporary and long term effects of water quality change on food chain and availability</li> <li>▸ Need for wildlife rescue and relocation (selected critical species)</li> <li>▸ Potential hazard to large birds from transmission lines and design approaches</li> </ul>			
<b>Cash Crops and Cattle</b>	<ul style="list-style-type: none"> <li>▸ Disturbance during construction</li> <li>▸ Land use change impacts</li> </ul>	<ul style="list-style-type: none"> <li>▸ Disturbance during construction</li> <li>▸ Loss of agriculture or grazing land to inundation and permanent facilities</li> <li>▸ Effects on lakeside farming activity</li> </ul>	<ul style="list-style-type: none"> <li>▸ Disturbance during construction</li> <li>▸ Loss of nutrient-rich silt in natural/ seasonal replenishment cycle</li> <li>▸ Irrigation benefits from improved flow regulation</li> </ul>	<ul style="list-style-type: none"> <li>▸ Loss of agriculture land to permanent facilities</li> </ul>
<b>Forested Areas</b>	<ul style="list-style-type: none"> <li>▸ Loss of forest cover and species through clearing and cutting</li> <li>▸ Impact on fuelwood and fodder availability from clearing and pressure from project workers</li> <li>▸ Loss or destruction of forested areas through changes in land uses</li> <li>▸ Long term impact on changes in species cover and growth rates</li> <li>▸ Potential timber harvest from reservoir clearing</li> <li>▸ Role of reforestation and replanting schemes</li> </ul>			<ul style="list-style-type: none"> <li>▸ Impacts of forest cutting clearing and increased public access</li> </ul>
<b>Potential Social and Socio-Economic Impacts to Mitigate or Enhance</b>				
<b>Involuntary Resettlement</b>	<p>Involuntary relocation of populations in inundation area and other land required for permanent facilities Adequate compensation or rehabilitation of project affected persons in new communities All planning activities for new communities including job training</p>			

	Project Affected Areas (Zone of Influence)			
	Upstream	Project-Site	Down Stream	Access Road and Transmission
<b>Cultural and Religious Heritage</b>	<ul style="list-style-type: none"> <li>▶ Potential for avoidance of cultural religious or heritage areas</li> <li>▶ Inundation or other loss of ancestral lands</li> <li>▶ Loss or relocation of historical, cultural and religious properties</li> <li>▶ Effect of reservoir drawdown on future recreational and other lakeshore activity</li> <li>▶ Aesthetic impacts of facilities near sites</li> </ul>		<ul style="list-style-type: none"> <li>▶ Potential loss or relocation of historical or religiously significant cultural properties</li> </ul>	
<b>Other Economic Activity</b>	<ul style="list-style-type: none"> <li>▶ Potential impairment or improvement of river navigation options (current and future)</li> <li>▶ Potential relocation of other public infrastructure (roads bridges buildings)</li> <li>▶ Benefits derived from local availability of electricity and relieving pressure on traditional energy sources (ie fuelwood)</li> <li>▶ Effect on lakeside and other property values in the project impact area</li> <li>▶ Effect of reservoir drawdown on lakeside tourist and commercial operations and potential aesthetic impacts on tourist areas of significance</li> <li>▶ Benefits of improved road access to area for crop marketing etc</li> </ul>			
<b>Health</b>	<ul style="list-style-type: none"> <li>▶ Possible increase in water born disease vectors (construction phase and long term)</li> <li>▶ Psychological impacts on local population of change in rural sociology social status relocation and migration of workers</li> <li>▶ Potential for improved access to health service through improved regional and local access</li> <li>▶ Sanitary and health problems from construction camps</li> </ul>			
<b>Employment</b>	<ul style="list-style-type: none"> <li>▶ Loss of employment and income from businesses on lands required for the project</li> <li>▶ Temporary and permanent job creation for construction and operation activities</li> <li>▶ Indirect employment providing local goods and services</li> <li>▶ Job relocation and training schemes to maximize use of local people</li> </ul>			
<b>Induced Development</b>	<ul style="list-style-type: none"> <li>▶ Cultural conflicts between long-term residents and immigrant workers</li> <li>▶ Avoidance of unplanned settlements</li> <li>▶ Overtaxing of local government services and facilities</li> <li>▶ Water sharing arrangement for downstream users and other extension services</li> </ul>			
<b>Other Externalities to Consider</b>				
<b>Green House Gas Emissions</b>	<ul style="list-style-type: none"> <li>▶ Displacement of greenhouse gas emissions from alternative thermal generation</li> </ul>			
<b>International Treaties</b>	<ul style="list-style-type: none"> <li>▶ Conformance to International Conventions for protection of sensitive areas</li> <li>▶ Conformance to International Treaties on river flows and beneficial sharing issues</li> </ul>			
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>▶ Potential for pressure on rare and sensitive species in the project impact area</li> </ul>			

Appendix B-4 provides an example check list for review of IEE and EIA studies for hydro power projects. The classification of environmental studies (IEE, EIA) is nevertheless relatively new in Nepal. Environmental studies have been undertaken in the past, in parallel with the various project preparation studies. Table 3-5 illustrates the relationship between hydro power project studies, environmental studies and the stage of licensing of project.

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Table 3-5

Relationship Between Level of Project Study  
and Level of Environment Study

Traditional Categories for Level of Study of Hydro Projects in Nepal	Equivalent Level of Environment Study (by New Definitions)	Corresponding Stage in EDC's Licensing
Reconnaissance	Environment Screening Study	Project Not Licensed
Pre-Feasibility	IEE Level Study	Survey License
Feasibility	EIA Level Study	
Detailed Design and Tender	Refinement of <ul style="list-style-type: none"> <li>▸ Environmental Management Plan</li> <li>▸ Resettlement Plan (if Required)</li> <li>▸ Monitoring Plan</li> </ul>	Production License
Operation Phase	Environmental Monitoring and Audit	

3 4 2 Thermal Generation Projects

Nepal currently has a limited number of diesel and multi-fuel thermal plant for peaking operation on the interconnected grid, fired by HFO, and some isolated generation Conventional steam (oil, gas and coal-fired) plants, which inherently have significant environmental effects are not envisaged in Nepal's power system planning at this time, nor are nuclear plant All thermal plant over 5 MW require a full EIA including monitoring programs to ensure adverse effects are kept under control Plants between 1-5 MW require an IEE These threshold values are expected to be reviewed once the MOPE is fully operational and mainly to distinguish between urban and rural locations for thermal plant

Potential natural and social environmental effects are possible throughout the entire project cycle of a thermal power station The significance of potential impacts clearly depends on factors such as the fuel used (type and quality), the generation technology including presence of on-site air and liquid waste treatment, size of plant, on-site fuel storage requirements, and the environmental sensitivity of the site, or its proximity to sensitive areas For the relatively small thermal projects Nepal may consider, the effects on the natural environmental would be expected to be localized, and primarily those associated with site selection itself (ie avoidance of highly sensitive sites for locating thermal plant) Other issues that need to be routinely addressed include the normal construction impact mitigation measures, care with fuel transport and storage (eg, accidents and oil spill control during loading, unloading) at the plant site, control of air emissions (SO<sub>x</sub>, NO<sub>x</sub>, particulates (which may contain trace metals)), liquid and solid waste disposal from operations, and noise abatement

Atmospheric emissions from power stations may adversely affect air and water quality, vegetation and human health. This may be both in the immediate vicinity of the plant and downwind of the plant Some crops are sensitive to pollutants (eg, ground level ozone and SO<sub>2</sub>), and crop yields may be reduced under very adverse pollution conditions which can be created by combined effect of multiple pollution sources, and not just thermal power stations For large thermal power stations, air emissions may be a local and regional concern for trans-boundary acid rain Any liquid effluent or thermal (cooling water) discharges into rivers and streams would have to be mitigated for potential thermal and chemical shock effects on

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aquatic life. Other potential effects relate to mitigation of the construction of transmission and new road access if required, and control of leach effects from waste disposal facilities which may drain into nearby surface or ground water sources. Appendix B-5 provides a detailed listing of the main waste streams from thermal plant and environmental management issues.

For multi-fuel and diesel plant (air cooled) plant envisaged in Nepal, the total air emissions (single point emission standards such as tons/day), and increases in ambient air pollution concentration would be expected to be well within international standards (noted in Appendix B-6), and Nepalese standards. Nevertheless all liquid and air emission levels and compliance with standards will have to be assessed in the EIA. Many of the potential effects of thermal plant can be reduced or eliminated through mitigation programs. Prudent handling, storage, and recycling or re-use of wastes can significantly reduce waste management concerns. Wherever possible, existing sites and rights-of-way will be used to minimize land consumption.

Thermal power projects can also produce social and community impacts. The most prominent effects are those related, directly or indirectly to control of the influx of construction workers, maximizing opportunities for local employment creation, regional development, and local community impacts including spending in the local host community and surrounding region.

Table 3-6 summarized the typical environmental effects of thermal projects that will need to be considered in an IEE or EIA.

Table 3-6

Potential Environmental Effects of Thermal Projects

	Project Affected Areas		
	Project-Site	Waste Disposal Sites (if required)	Access Road and Transmission Connection
<b>Potential Physical Effects</b>			
<b>Air Quality</b>	<ul style="list-style-type: none"> <li>▶ Construction activity/traffic dust and noise control</li> <li>▶ From fuel supply (road transport)</li> <li>▶ Air emissions from power plant operations (eg SO<sub>x</sub>, NO<sub>x</sub>, particulates (which may contain trace metals))</li> </ul>		
<b>Water Supply</b>	<ul style="list-style-type: none"> <li>▶ No issue unless site is adjacent to river or stream (such as for open cycle cooling water supply)</li> </ul>	- NA	<ul style="list-style-type: none"> <li>- Temporary construction impact of road or possibly transmission work on at river crossings</li> </ul>
<b>Water Quality (Physical effect)</b>	<ul style="list-style-type: none"> <li>▶ Storm drainage and runoff control</li> </ul>	<ul style="list-style-type: none"> <li>▶ Runoff control</li> </ul>	<ul style="list-style-type: none"> <li>▶ Temporary sediment release from construction activity at river crossing related to above</li> </ul>
<b>Soils Erosion</b>	<ul style="list-style-type: none"> <li>▶ Slope stabilization as appropriate at project site</li> </ul>	<ul style="list-style-type: none"> <li>▶ Slope stabilization as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>▶ Erosion accelerated by access road and/or transmission construction works</li> </ul>

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	Project Affected Areas		
	Project-Site	Waste Disposal Sites (if required)	Access Road and Transmission Connection
<b>Terrain and Other</b>	<ul style="list-style-type: none"> <li>▸ Local sources of construction materials</li> <li>▸ Borrow pit and waste disposal pollution and rehabilitation/restoration issues</li> <li>▸ Aesthetic impacts of road transmission and other project facilities</li> </ul>		
<b>Land Loss</b>	<ul style="list-style-type: none"> <li>▸ Loss of land for site</li> <li>▸ Temporary and permanent loss of land for camps and facilities</li> </ul>	<ul style="list-style-type: none"> <li>▸ Loss of land and access</li> <li>▸ Land use change around disposal site</li> </ul>	<ul style="list-style-type: none"> <li>▸ Temporary and permanent loss of land for access road and transmission</li> <li>▸ Periodic access through private land for patrol and maintenance</li> </ul>
<b>Other Physical Hazards</b>	<ul style="list-style-type: none"> <li>▸ Construction induced rock slides and landslides from construction vibration blasting or drilling operations</li> </ul>	<ul style="list-style-type: none"> <li>▸ NA</li> </ul>	<ul style="list-style-type: none"> <li>▸ Flood landslide other mass wasting hazards at river crossings for road and transmission facilities</li> </ul>
<b>Potential Biophysical and Bio-Chemical impacts to Assess and Mitigate</b>			
<b>Water Quality (Bio chemical effects)</b>	<ul style="list-style-type: none"> <li>▸ Ground water pollution effects during construction (chemicals and toxins camp sewage etc )</li> <li>▸ Ground water or surface water pollution effects of leakage or spillage during operation</li> </ul>	<ul style="list-style-type: none"> <li>▸ Ground water or surface water effects of leaching of water from wastes</li> </ul>	<ul style="list-style-type: none"> <li>▸ Temporary downstream water quality effects during construction</li> </ul>
<b>Aquatic Ecosystem</b>	<ul style="list-style-type: none"> <li>▸ NA - only indirect via possible pollution of nearby surface water</li> </ul>	<ul style="list-style-type: none"> <li>▸ NA - only indirect via possible pollution of nearby surface water</li> </ul>	<ul style="list-style-type: none"> <li>▸ Local habitat disturbance at river crossing during construction - if involved</li> </ul>
<b>Vegetation</b>	<ul style="list-style-type: none"> <li>▸ Possible loss or pressure on rare or endangered species of ecological significance by clearing loss fragmentation or increased public access to natural habitat during construction and long-term</li> <li>▸ Potential effects of land use change on longer term ( vegetation cover species composition growth rates)</li> <li>▸ Air emission effects on vegetation</li> </ul>		
<b>Wildlife</b>	<ul style="list-style-type: none"> <li>▸ Direct loss of wetlands habitat and breeding grounds</li> <li>▸ Pressure on rare or endangered species through loss fragmentation of habitat and open public access and land use changes around sensitive habitat</li> <li>▸ Need for wildlife rescue and relocation (selected critical species)</li> <li>▸ Potential hazard to large birds from transmission lines and design approaches</li> <li>▸ Air emission effects of wildlife</li> </ul>		
<b>Cash Crops and Cattle</b>	<ul style="list-style-type: none"> <li>▸ Disturbance during construction</li> </ul>		
<b>Forested Areas</b>	<ul style="list-style-type: none"> <li>▸ Loss of forest cover and species through site and access clearing and cutting</li> <li>▸ Impact on fuelwood and fodder availability from clearing and pressure from project workers</li> <li>▸ Loss or destruction of forested areas through changes in land uses</li> <li>▸ Long term impact on changes in species cover and growth rates</li> </ul>		

	Project Affected Areas		
	Project-Site	Waste Disposal Sites (if required)	Access Road and Transmission Connection
<b>Potential Social and Socio-Economic Impacts to Mitigate or Enhance</b>			
<b>Involuntary Resettlement</b>	<ul style="list-style-type: none"> <li>▸ Involuntary relocation of populations on site other land required for permanent facilities</li> <li>▸ Adequate compensation or rehabilitation of project affected persons in new communities</li> </ul>		
<b>Cultural and Religious Heritage</b>	<ul style="list-style-type: none"> <li>▸ Potential for avoidance of cultural, religious or heritage properties</li> <li>▸ Loss or relocation of historical cultural and religious properties</li> <li>▸ Aesthetic impacts of facilities near towns or urban centers</li> <li>▸ Potential disturbance of construction activities</li> </ul>		
<b>Other Economic Activity</b>	<ul style="list-style-type: none"> <li>▸ Potential need for relocation of other public infrastructure (roads bridges buildings)</li> <li>▸ Benefits derived from local availability of electricity and relieving pressure on traditional energy sources</li> <li>▸ Benefits of improved road access to area for crop marketing etc</li> </ul>		
<b>Health</b>	<ul style="list-style-type: none"> <li>▸ Possible increase in water born disease vectors (construction phase and long term)</li> <li>▸ Psychological impacts on local population of change in local area sociology social status relocation and migration of workers</li> <li>▸ Sanitary and health problems from construction camps</li> <li>▸ Health impacts of any significant air emissions from the plant</li> </ul>		
<b>Employment</b>	<ul style="list-style-type: none"> <li>▸ Loss of employment and income from businesses on lands required for the project</li> <li>▸ Temporary and permanent job creation for construction and operation activities</li> <li>▸ Indirect employment providing local goods and services</li> <li>▸ Job relocation and training schemes to maximize use of local people</li> </ul>		
<b>Induced Development</b>	<ul style="list-style-type: none"> <li>▸ Cultural conflicts between long term residents and immigrant workers</li> <li>▸ Overtaxing of local government services and facilities</li> </ul>		
<b>Other Externalities to Consider</b>			
<b>Green House Gas Emissions</b>	<ul style="list-style-type: none"> <li>▸ Notation of effect in producing emissions</li> </ul>		
<b>International Treaties</b>	<ul style="list-style-type: none"> <li>▸ Other local regional or trans-boundary air quality impacts</li> </ul>		
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>▸ Site specific impacts depending on sensitivity of area</li> </ul>		

### 3 4 3 Transmission Projects

Transmission lines and associated facilities have an impact on natural and socio-cultural environments within, or in the immediate vicinity of the transmission corridor right-of-way (ROW), and at the substations, switchyards. Access or maintenance roads sometimes have a more significant impacts than the transmission towers and lines themselves. Adverse environmental impacts occur during both construction and O & M stages. Of concern at the construction stage is the temporary or permanent clearing of crops or natural vegetation in the right-of-way, and various physical and biotic environment effects of constructing access roads, tower foundation and substations. On steep mountain slopes exposed to erosion, concerns are to design and construct facilities in a manner that minimizes damage to the slope caused by access roads, heavy machinery, tower foundations, tower erection and line stringing. In the Tarai areas transmission towers do not present a major problem as farmers cultivate the land beneath the towers and lines. River crossings also pose engineering challenges and have potential environmental impacts during construction.

An IEE or an EIA will be required for selecting the transmission route and for input to design work. Effects of short transmission facilities clearly would tend to be localized, while long transmission lines may have regional effects. In general, the potential for impacts increases a function of line length and the environmental sensitivity of the right-of-way.

Avoidance of population centers and environmentally sensitive or protected areas is a key concern in minimizing environment impacts of transmission facilities. Regulations establish whether construction activities or other interventions can take place in or near protected areas. There is no explicit environmental preference for a particular transmission voltage level or transmission technology. For environmental and social reasons, the preference is to minimize land use, construction impacts, vegetation clearing impacts and aesthetic impacts. In tourist areas and lines closer to urban areas, there may be greater concerns for aesthetics within narrow right-of-ways (ROW) which could affect some design and routing decisions. There are also public perceptions of health risks from electromagnetic field (EMF) effects from HVAC, although there is considerable debate on the issue.

As noted in the technical literature there are also positive environmental effects for power ROW's when properly managed. The "edge" effects include increased habitat diversity and areas for feeding and nesting of birds and animals. Transmission lines may also help open remote areas. Depending on their location transmission lines may lead to induced development.

Table 3-7 illustrates typical impacts to be addressed in the IEE or EIA study for lines which would cross different areas indicated.

**Table 3-7**

**Potential Environmental Issues for Transmission Projects**

	Potential Impacts to Avoid/Mitigate/Compensate
Lines in Sensitive Ecological or Natural Park Areas	<ul style="list-style-type: none"> <li>▶ Disturbance or loss of natural vegetation from cutting and clearing during line and access road construction and maintenance</li> <li>▶ Disturbance loss or fragmentation of wildlands and sensitive wildlife habitat</li> <li>▶ Disturbance from maintenance and patrolling</li> <li>▶ Pressure on sensitive areas from better access to natural resources, via access road</li> </ul>
Areas of Dense Population	<ul style="list-style-type: none"> <li>▶ Involuntary resettlement or other disturbance or loss of homes other property or livelihood</li> <li>▶ Health perceptions and safety</li> <li>▶ E M F effects</li> <li>▶ Noise effects</li> <li>▶ Psychological disturbance</li> <li>▶ Security and safety</li> <li>▶ Visual impact and aesthetics</li> </ul>
Areas of Prime Agricultural Land	<ul style="list-style-type: none"> <li>▶ Loss of land for tower footings substations and access roads</li> <li>▶ Temporary disruption of crops drainage and irrigation systems during construction and maintenance</li> <li>▶ Disturbance to cattle and other farm operations during line and access road construction and maintenance</li> </ul>
Areas of Protected Forest	<ul style="list-style-type: none"> <li>▶ Disturbance or loss of forest land by ROW cutting and clearing</li> <li>▶ Disturbance or destruction of some forest resources for access roads</li> <li>▶ Pressure on sensitive forest stands via improved public access via access roads</li> </ul>

<b>Potential Impacts to Avoid/Mitigate/Compensate</b>	
Areas Important to Recreation and Tourism	<ul style="list-style-type: none"> <li>▶ Visual impact and disturbance to scenic values leading to reduced tourism and recreation value for tourism operations and individual businesses</li> </ul>
Areas for Migratory Bird Flyways	<ul style="list-style-type: none"> <li>▶ Potential injury death and weakening of the population if birds fly into towers and lines or through disturbance of habitat</li> </ul>
<b>Other Common or Unique ROW Impacts</b>	
Land Loss and Soil Erosion	<ul style="list-style-type: none"> <li>▶ Temporary and permanent loss of land for facilities and maintenance</li> <li>▶ Increased runoff and sedimentation from grading for access roads tower pads substation facilities</li> <li>▶ Potential alteration of hydrological patterns and streams due to maintenance roads crossing streams</li> <li>▶ Destabilization of slopes from tower and access road construction</li> <li>▶ Borrow pit rehabilitation</li> </ul>
Soil And Water Contamination	<ul style="list-style-type: none"> <li>▶ Disposal of solid wastes during construction and maintenance activities</li> <li>▶ Safe disposal of liquid wastes such as P C B s and washing wastes which can contaminate both soil and water</li> <li>▶ Health hazard due to inadequate water for drinking for construction crews</li> </ul>
Potential Fisheries	<ul style="list-style-type: none"> <li>▶ Water contamination (soils wastes and spills) from construction of access toads and through river crossings can degrade the quantity and quality of fish habitat</li> <li>▶ Soil erosion in the areas of aquaculture can also adversely effect the quality and quantity of fish habitat</li> </ul>
Other Hazards	<ul style="list-style-type: none"> <li>▶ Aircraft hazard from lines and towers</li> </ul>
Socio-economic effects	<ul style="list-style-type: none"> <li>▶ Involuntary resettlement</li> <li>▶ Avoidance/protection of religious and cultural heritage</li> <li>▶ Temporary and permanent job creation</li> <li>▶ Issues associated with influx of temporary workers</li> </ul>
Induced Effects	<ul style="list-style-type: none"> <li>▶ Resulting from improved access and power supply to local areas along the transmission ROW</li> </ul>

Criteria for environment screening of transmission projects are shown in Appendix B-3

### 3 4 4 Distribution Projects

Distribution projects in urban and semi-urban areas, for which a new license is applied, would normally be screened to establish whether an IEE or an EIA for the project is required. If an IEE or an EIA is required, the environmental assessment would apply to design, construction and operation stages of the project. Typically 11 kV, 22 kV and 33 kV lines and the larger substations are the main facilities along with any required sub-transmission. A program for routine O & M to strengthen, intensify or expand electricity distribution services in an existing license area would not generally be subject to an IEE or and EIA. The licensee should nevertheless have a set of in-house guidelines for distribution construction and maintenance crews to follow, which requires attention to environmental and social concerns. This is standard practice in western utilities and Reference 4 provides an example of working procedures. Safety concerns for siting and protection of distribution lines and substations are also addressed in the Electricity Regulations.

Environmental and socio-economic impacts which may be significant or otherwise merit special attention in distribution are shown in Table 3-8

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Table 3-8

Potential Environmental Issues for Distribution Projects

	Category of Impact	Potential Concerns and Issues
Routing and Design	Natural Physical and Biophysical Impacts	<ul style="list-style-type: none"> <li>▶ Substation location and sub-transmission line routing to avoid sensitive or protected areas in the community</li> <li>▶ Routing and detailed design of sub-transmission and substations to minimize adverse impacts on terrain such as erosion and slope stability</li> <li>▶ Plan for erosion control practices where appropriate</li> </ul>
	Socio-Cultural Impacts	<ul style="list-style-type: none"> <li>▶ Avoidance of important historical heritage and cultural sites and recreational areas in deciding sub-transmission ROW</li> <li>▶ Route selection and alter structural design to minimize obtrusive aesthetic impact (substations and sub-transmission)</li> <li>▶ Route selection and design to avoid airport flight paths and installation of markers to minimize risk</li> <li>▶ Sub-transmission route selection made in conjunction with land use zoning and in recognition of urban planning (land-use) practices</li> <li>▶ Select route and construction method to minimize traffic disturbance</li> </ul>
Construction Impact Mitigation	Natural and Physical	<ul style="list-style-type: none"> <li>▶ Minimize disturbance to local areas and landscaping to restore areas after construction</li> <li>▶ Minimize need for cutting and clearing of trees</li> <li>▶ Waste disposal procedures</li> <li>▶ Protection of scenic areas with aesthetic measures including screening berms and other visual buffers where appropriate</li> </ul>
	Social and Cultural	<ul style="list-style-type: none"> <li>▶ Compensation for land access for right-of way and permanent facilities</li> <li>▶ Equipment selection and measures for abatement of noise vibration dust impacts</li> <li>▶ Scheduling of construction activities to avoid traffic congestion</li> <li>▶ Public safety and security measures</li> </ul>
Maintenance Impact Mitigation	Natural and Physical	Incorporate in maintenance procedures (eg ) <ul style="list-style-type: none"> <li>▶ Control of oil spill or other toxic substances</li> <li>▶ Waste management</li> <li>▶ ROW maintenance (vegetation clearing and cutting)</li> </ul>
	Social and Cultural	<ul style="list-style-type: none"> <li>▶ Minimize disturbance and inconvenience to public</li> <li>▶ Public safety and security provisions</li> <li>▶ Worker safety and security provisions</li> </ul>

Generally utilities produce a set of policies and guidelines for field staff to carry out construction and maintenance operations in a manner sensitive to local community and environmental issues

**3 4 5 Rural Electrification Projects**

Rural electrification projects require an IEE under the existing National EIA Guidelines. The IEE may show that a full EIA is required, under certain circumstances. For example, if significant resettlement is a feature of the project, then a full EIA may be required. Environment and socio-economic issues would be similar to distribution projects, as noted in the previous section, but in a rural context. Greater emphasis may be placed on the socio-economic aspects of the project and natural environment given the rural setting. In particular, more extensive interviews with populations affected by the project would be conducted. Similarly, a wider range of natural environment conditions may be encountered than would be

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the case for distribution schemes in built-up areas, though the rural electrification facilities themselves would be expected to have a lower impact than larger transmission facilities

### 3.5 Public Involvement and Consultation

HMG has an explicit requirement for full public consultation on projects through the EIA mechanism. Such consultation is required at all stages of the project cycle. There are generally two levels of public consultation:

- ▶ **General Public** Those who have particular concern or expertise to offer which have relevant information on the nature and scope of environmental concern for the project such as professional in different social, physical and natural sciences disciplines, professional societies, environmental NGO's and grass roots organizations
- ▶ **Persons Affected by the Project (PAP)** Individuals and communities affected by or potentially involved in the project

Initially public consultation is established in the EIA scoping phase. Milestones for consultation meetings and public information are presented at that time and the agreed schedule of public interactions is incorporated in a formal public consultation plan. Typical milestones and aims of public consultation are shown in Table 3-9. In addition to these points of contact with the public, the Electricity Regulations require public notification at critical stages of the project cycle including the award of the production license, and submission and review of the EIA report. It is recommended that public notice also be given at the time of award of the survey license.

**Table 3-9**

**Public Consultation Framework for EIA's**

Project Phase	Milestone	Purpose of Consultation
System Planning and Pre License Period	Project Screening and Ranking	Consultation with Stakeholders on the type and range of projects to be screened, screening criteria and screening results
Survey License Period	General Public Notification of Award of Survey License (via public media, newspapers and local information meetings as appropriate)	
	EIA Scoping Meetings	Invite and inform public about project, EIA methodology and propose the public consultation plan for the balance of the project
	Other Inputs During the EIA Study	Workshops, seminars with PAP and NGO's as decided in the Public Consultation Plan  Participation of PAP's in field questionnaires and surveys as part of baseline data collection  Establishment of Compensation Fixation Committee for PAP inputs (at this stage or later)
	EIA Draft Report	Made available for general public review to allow public input to government decision on acceptability of the Project EIA including: <ul style="list-style-type: none"> <li>▶ Environmental Management Plan</li> <li>▶ Resettlement Plan (if required)</li> <li>▶ Environmental Monitoring Plan</li> </ul>
Production License Period	General Public Notification of Award of Production License (via public media, newspapers and local information meetings as appropriate)	

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Project Phase	Milestone	Purpose of Consultation
	Compensation Committee	Decisions of Compensation Fixation Committee
	Environmental Monitoring Report	Made accessible to general public (incorporated in annual report of Licensee which is a public document)
	Environmental Audit Report	Made accessible to general public if performed

The Compensation Fixation Committee is the key mechanism for direct consultation with persons most directly affected by the project or project affected persons (PAP) This includes persons who are subject to involuntary resettlement, loss of property or other economic disadvantage caused by the project The Electricity Regulations (1993) provide for establishment of a six-person Committee consisting of

- ▶ HMG appointee as Chairman
- ▶ Corporate representative of the Licensee
- ▶ Expert appointed by HMG
- ▶ Village Development Board
- ▶ Land Revenue Office
- ▶ Real Estate owner affected by the project

Decisions of the committee are binding, although there is provision under Nepalese law for appeal of decisions

### **3 6 Interagency Coordination**

Interagency coordination is essential because the implementation of power projects and the associated environment review and management activities typically involve a number of national, regional and local levels of government Larger multi-purpose projects, in particular, cover a broad spectrum of responsibilities and there may be a number of sub-projects to be managed by different HMG agencies Cross-sector issues that are to be addressed in EIA's were noted in Section 3 3 Interagency coordination is thus a fundamental requirement for an effective EIA, and the EIA process is seen by HMG to be an appropriate mechanism for broader coordination of government agency involvement in the project

As noted in Section 2-4 its is suggested that EDC arrange the interagency coordination meetings for projects licensed to the private sector The lead on setting up the Interagency coordination network for public sector projects would be decided between EDC and NEA by MOWR. Interagency coordination is typically handled at major milestones in the project cycle The key milestones are similar to the milestones for public consultation and include

- ▶ Screening Decision
- ▶ Scoping Meeting
- ▶ Baseline Data Completion
- ▶ Draft IEE/EIA Report Review
- ▶ Project Commissioning

Agencies would initially participate in screening of project This may be in advance of survey licenses being issued if a RFP solicitation approach is used by EDC Once project-specific licenses are issued, agency participation at the screening stage is important to decide on the disposition of projects that are not included in Schedule 2 (ie no automatic requirement for an IEE or and EIA) After the EIA is initiated the scoping meeting

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is used to introduce all HMG representatives from the different agencies to the project, discuss the major issues, discuss how the different agencies would be expected to be involved, and set the schedule for the remaining interagency meetings for the EIA study period and over the project cycle. For complex projects involving sub-projects administered by other agencies, more frequent meetings may be required.

Table 3-10 indicates agencies typically involved in the coordinate and consultation process. At present the procedures for establishing the interagency review group are being reviewed and proposals are made in the draft Water Resource Sector EIA Guidelines.

**Table 3-10**

**Representation in Interagency EIA Meetings by Project Type**

Project Type	Agencies Typically Represented on IEE or EIA Interagency Coordination Committee/Steering Committee	
	National-Level	Regional/Local
Small and Medium (Run-of-River) Hydro power Projects	EDC calling meetings	
	EDC MOWR NEA	MOPE DOR (access road)
Multi Purpose Storage Projects	EDC calling meetings	
	EDC MOWR DOI DHM NEA WECS	MOPE DOR (access road) Other Ministries with subprojects
Thermal Projects	EDC calling meetings	
	EDC MOWR NEA (Thermal)	MOPE NOCP
Distribution Projects	EDC calling meetings	
	EDC MOWR NEA	MOPE
Rural Electrification Projects	EDC calling meetings	
	EDC MOWR NEA	MOPE HOME DOR

Other HMG agencies (inclusive of those noted above) to either consult during the EIA for baseline data collection or effects prediction, or to bring into the interagency coordination meetings for issues that may arise, are shown in Table 3-11.

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Table 3-11

HMG Ministries and Departments with Potential Input to Project EIA's

Ministry	Department or Agency	Possible Input/Purpose of Contact
Ministry of Housing and Physical Planning	Department of Housing and Urban Development	<ul style="list-style-type: none"> <li>▸ Baseline data</li> <li>▸ Involvement in resettlement planning</li> </ul>
	Department of Drinking Water and Sewerage	<ul style="list-style-type: none"> <li>▸ Baseline data</li> <li>▸ Involvement in resettlement planning involving new towns</li> </ul>
	Solid Waste Management and Resource Mobilization Center	<ul style="list-style-type: none"> <li>▸ Baseline data</li> <li>▸ Involvement in resettlement planning involving new towns</li> <li>▸ Waste management standards and guidelines</li> </ul>
Ministry of Industry	Department of Industries	<ul style="list-style-type: none"> <li>▸ Baseline economic data on industries</li> </ul>
	Topographical Survey Branch	<ul style="list-style-type: none"> <li>▸ Baseline EIA data</li> <li>▸ Regional scale land use maps for mapping of resources and potential land use impacts</li> </ul>
	Department of Mines and Geology	<ul style="list-style-type: none"> <li>▸ Baseline economic data on mineral resources and development potential in project impact area that may have complementary environmental impacts</li> <li>▸ Potential Geology Data from Regional Geological Map for Baseline Mapping</li> </ul>
Ministry of Agriculture	Department of Agriculture Development	<ul style="list-style-type: none"> <li>▸ Possible baseline data</li> <li>▸ Possible data on programs planned in project impact area</li> </ul>
	Horticulture Services Division	<ul style="list-style-type: none"> <li>▸ Possible baseline data</li> <li>▸ Possible consultation on rare or endangered species and sensitivity</li> </ul>
	Fisheries Division	<ul style="list-style-type: none"> <li>▸ Baseline data on fisheries</li> <li>▸ Possible consultation on rare or endangered fish and aquatic species and sensitivity</li> </ul>
	Plant Protection and Industrial Entomology Division	<ul style="list-style-type: none"> <li>▸ Possible baseline data</li> <li>▸ Possible consultation on rare or endangered species and sensitivity</li> </ul>
	Department of Cooperatives	<ul style="list-style-type: none"> <li>▸ Possible baseline data on cooperative activities in project impact area</li> </ul>
Ministry of Water Resources	Department of Irrigation	<ul style="list-style-type: none"> <li>▸ Baseline EIA data</li> <li>▸ Possible major involvement in sub projects of multipurpose projects</li> <li>▸ Possible guidelines on mitigation or enhancement of irrigation impacts</li> </ul>
	Department of Hydrology and Meteorology	<ul style="list-style-type: none"> <li>▸ Baseline hydrological data</li> <li>▸ Possible consultation on hazard assessment</li> </ul>
Ministry of Tourism and Civil Aviation	Department of Tourism	<ul style="list-style-type: none"> <li>▸ Baseline EIA data</li> <li>▸ Possible consultation on mitigation or enhancement for any identified tourism impacts</li> <li>▸ Possible major involvement in sub-projects of multipurpose projects</li> </ul>
	Department of Civil Aviation	<ul style="list-style-type: none"> <li>▸ Standards for mitigation of aviation hazards of transmission projects</li> </ul>

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Ministry	Department or Agency	Possible Input/Purpose of Contact
Ministry of Local Development		<ul style="list-style-type: none"> <li>▶ Village district and regional development plans and related data</li> </ul>
Ministry of Land Reforms and Management	Department of Land Revenue	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> <li>▶ Involvement in Compensation Fixation Committee</li> </ul>
	Department of Land Reforms	<ul style="list-style-type: none"> <li>▶ Baseline EIA data on land reform planned for project impact area</li> </ul>
	Department of Survey	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> </ul>
Ministry of Public Works and Transport	Department of Roads	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> <li>▶ Possible major involvement in access road planning design construction and maintenance</li> <li>▶ Possible source of</li> </ul>
Ministry of Labor	Department of Labour	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> </ul>
Ministry of Education		<ul style="list-style-type: none"> <li>▶ Baseline socio-economic, education data</li> </ul>
Ministry of Culture and Social Welfare	Department of Archaeology	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> <li>▶ Consultation on mitigation or relocation measures</li> </ul>
Ministry of Health	Department of Health Services	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> <li>▶ Possible consultation on any identified health mitigation or avoidance measures</li> </ul>
Ministry of Forest and Soil Conservation	Department of Forest	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> <li>▶ Possible consultation on sensitivity to project activities and mitigation measures</li> <li>▶ Consultation on biomass removal in reservoirs</li> <li>▶ Transmission line routing and access road impacts</li> <li>▶ Possible involvement in watershed management programs</li> <li>▶ Possible source of guidelines</li> </ul>
	Department of Soil Conservation	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> <li>▶ Possible source of erosion control guidelines</li> </ul>
	Department of Natural Parks and Wildlife Conservation	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> <li>▶ Guidelines on activities permitted in or around parks and conservation areas</li> <li>▶ Consultation on sensitivity of project activities and mitigation measures</li> </ul>
	Department of Plant Resources	<ul style="list-style-type: none"> <li>▶ Baseline EIA data</li> </ul>

HMG participation in the EIA process from regional, district and ward levels of HMG administration would be decided on based on the nature of the project, the scope and significance of the expected impacts, and the extent to which the project impacts on different districts. In most cases the DDO and LDO's will be able to advise on this local representation. Transmission projects may, for example, impact on a number of districts. Rural electrification projects would have localized impacts in one area. Projects involving significant involuntary resettlement or large multipurpose projects with a number of associated sub-projects such as to optimize fisheries, tourism and irrigation benefits, would for example, have much wider representation on the EIA interagency committee than small run-of-river hydro projects or small diesel projects.

Documentation of the frequency and type of interagency coordination is necessary as part of the EIA. For this purpose EDC should make the licensee's EIA team responsible for documenting all meetings the licensee attends.

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Otherwise EDC would be responsible for documenting the meeting NEA could be made responsible for documenting meetings for their licenses

### **3.7 Screening and Ranking of Generation Projects**

EDC currently has an open solicitation system for all power projects Therefore EDC is primarily concerned with the arrangement and completion of project-specific EIA's for already identified sites If EDC were in future to adopt a Request for Proposal (RFP), or project-specific solicitation approach, then a formal project identification and screening process would be required to select candidate projects to offer for solicitation This process would necessarily incorporate environmental screening factors as well as public consultation factors before deciding which sites to offer for competitive tender Solicitation for thermal projects is somewhat different, as there is some flexibility in selecting thermal sites to avoid or minimize potential effects

NEA is responsible planning the incremental expansion of generation and transmission capacity on the ICS to meet forecast loads in the major load centers NEA is now undertaking a medium-hydro screening and ranking exercise as part of its system planning responsibilities Project screening includes consideration of the major technical, environmental, economic and social attributes of a long list of candidate projects If a project has clearly non-mitigable environmental impacts, such as being located in a protected area (eg, a wildlife sanctuary) where no obtrusive infrastructure development is permitted by law, then potential projects in that area are generally dropped from further consideration Screening reduces the number of potential projects to manageable and practical numbers Projects that survive the screening stage are then ranked on the basis of comparative project economics, inclusive of estimated environmental mitigation costs Attractive projects at a comparable level of study are then included in the system planning models (simulation or optimization models) which identify development sequences to achieve lowest overall cost for capital investment and operation Projects identified as part of the expansion sequence are then licensed for development either by public or private sector means They are implemented after the EIA, feasibility study (if required) and detailed design are completed and, and successful financing arrangements

The initial project screening and environment preference ranking is similar to performing a power sector EA, as discussed in Section 3.2 The different stages of screening and broad-brush criteria for environmental screening component are shown in Table 3-12 It is important to note that the National EIA Guidelines identify a requirement for transparent review and open consultation at each stage of the screening and project ranking activity EDC would necessarily be involved in the interagency committee or stakeholder review group established for the screening phase

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Table 3 -12

**Illustration of Approach for Screening and  
Ranking of Hydro Power Projects**

Project Screening Activity	Objective (Hydro Power Project Example)
Screening Preparation	Internal steps to prepare the screening methodology and long list of projects
Interagency Review of Screening	<p>HMG stakeholders review the screening methodology in a transparent and participatory process to reach agreement on</p> <ul style="list-style-type: none"> <li>▶ the list of project to be screened</li> <li>▶ screening criteria and weights</li> <li>▶ scoring of projects according to criteria</li> <li>▶ results of screening</li> <li>▶ further steps in the consultation process</li> </ul>
Public Information	Public notice of screening activity and access to information on the process
Coarse Screening	<p>To screen a large number of projects and reduce the candidate project list to a practical and manageable number Example criteria</p> <ul style="list-style-type: none"> <li>▶ current level of environmental study</li> <li>▶ estimate of affected persons (eg reservoir flooded area dam site and powerhouse transmission access road)</li> <li>▶ environmental sensitivity of the project impact area ( land use classification proxy)</li> <li>▶ biodiversity (area of habitat used as a surrogate)</li> <li>▶ length of river dewatered (km)</li> <li>▶ classification of river (eg intact rivers or not)</li> </ul> <p>Individual projects are scored against criteria The environmental score would be combined with other non-environmental screening criteria (with weights) to arrive at a shorter list of candidate projects</p>
Interagency Review	Results of first level screening
Public Consultation	Notice of screening activity and access to information on the process
Detailed Screening	<p>Incorporating any feedback from interagency and public consultation finer screening of the shortened list of candidate projects relating to potential for significant impact +ve and -ve impacts on (eg low medium or high effect on)</p> <ul style="list-style-type: none"> <li>▶ factors in first level screening plus</li> <li>▶ other existing economic activity</li> <li>▶ potential for multipurpose development</li> <li>▶ water quality (drinking irrigation fish migration other aquatic habitat)</li> <li>▶ erosion and sedimentation</li> <li>▶ cultural property</li> <li>▶ induced development</li> <li>▶ local institutional capacity to deal with influx of workers</li> <li>▶ other issues of special significance</li> </ul> <p>Based on information in environment section of available project reports secondary data sources and site visits if required</p>
Environmental Preference Ranking	Ranking of projects by normalized score ( sum of [ score of individual projects on each criteria times weight attached to criteria]) Environmental preference ranking would be incorporated in the full ranking framework to decide on projects for inclusion in system expansion planning

The methodology for the environment component of project screening is straight forward The major screening factors are assigned weights as agreed to by the stakeholders Individual projects are then scored against the criteria A qualitative composite score for individual projects is then calculated to establish a relative preference ranking for the project, from the environmental perspective The environmental preference ranking is done

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separately, but is then be combined with other technical and economic criteria for the overall ranking. This is illustrated in Figure 3-4 below.

In practice there are difficulties with the availability of data and data evenness and consistency. Therefore decisions on the scoring of projects have to be subjective and based on judgment. There are also number of conceptual issues to address such as deciding how tradeoffs within the environmental preference ranking are established. For example, one preference may be to focus on development of a number of projects in a single watershed or basin. This approach would allow consideration of intact rivers. Projects in river basin designated for development would thus receive a comparatively high score for this factor. However, as "poverty is a major source of environmental degradation", the option of using infrastructure projects as a stimulus for regional development in other basins would receive less emphasis, all other factors assumed equal. These issues would have to be addressed in the stakeholders meetings and the results reflected in the weight attached to the screening criteria.

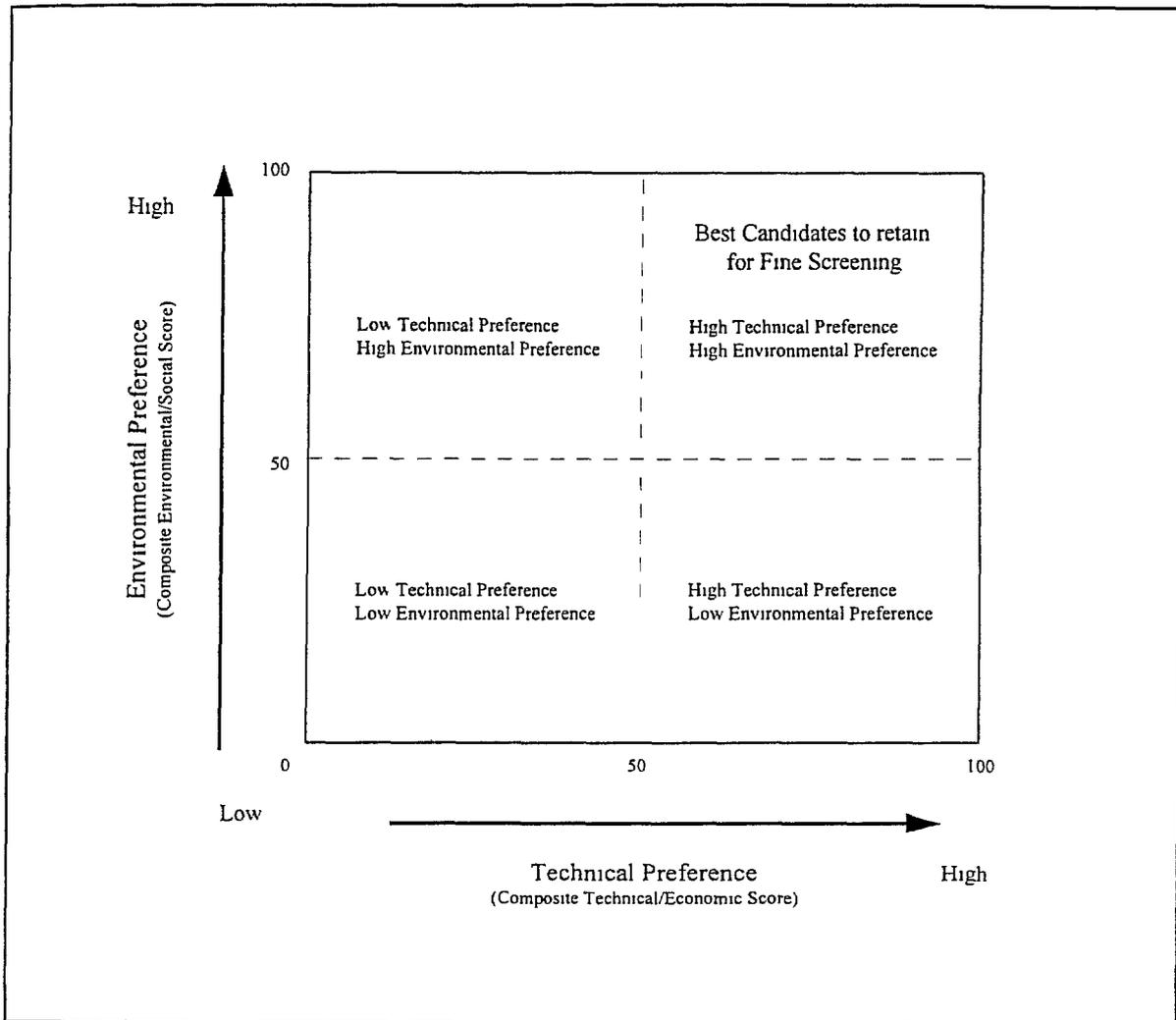


Figure 3-4 Environmental Preference and Technical Ranking Matrix

## 3.8 Methods and Approaches

There are a number of standard analytical techniques and tools that are used in IEE's and EIA's. The selection and use of techniques and tools depends on the significance of the effects being considered, the extent of baseline and time series data available, and the expertise of the environmental team.

### 3.8.1 Environmental Analysis Framework and Techniques

The national EIA Guidelines clearly identify the full range of significant project impacts are to be assessed including physical, biophysical, physicochemical, socioeconomic and cultural impacts. The sub-classification of impacts also includes:

- (a) **Direct Effects** Which alter the existing baseline conditions or trends (condition are not static with or without the project)
- (b) **Indirect Effects** Where the project affects one environment component, but this in turn may have repercussions on other environment components - hence indirect effects which may be manifest in the long term
- (c) **Cumulative Effects** Combined effects of several project impacts, or more than one project where overlapping impacts are felt

The impacts are also assessed in respect to the magnitude or scale, timing, duration, scope, and irreversibility. The environmental assessment thus requires consideration of a large number of factors. Standard methods for dealing with effects and linkages are:

- Check Lists
- Matrices
- Network Diagrams
- Field Questionnaires and Surveys

These techniques are described in more detail in the National EIA Guidelines and examples are provided in the WECS Guidelines (references in Appendix A). The screening, IEE and EIA levels of studies all utilize check lists and matrices to different levels of detail. Appendix B provides example check lists and matrices for screening of projects and review of IEE and EIA reports.

Network diagrams are particularly useful in developing and testing hypotheses on cause and effect relationships in interconnected systems. Network diagrams are used to present general and specific hypothesis, which will then be tested either in a consultation workshop, or through a study or research programs if warranted. Figure 3-5 illustrates generic hypothesis in the form of a network diagram for hydro-related impacts on fish. Similar sets of network diagrams can be set up for any physical, biophysical or socio-economic effect.

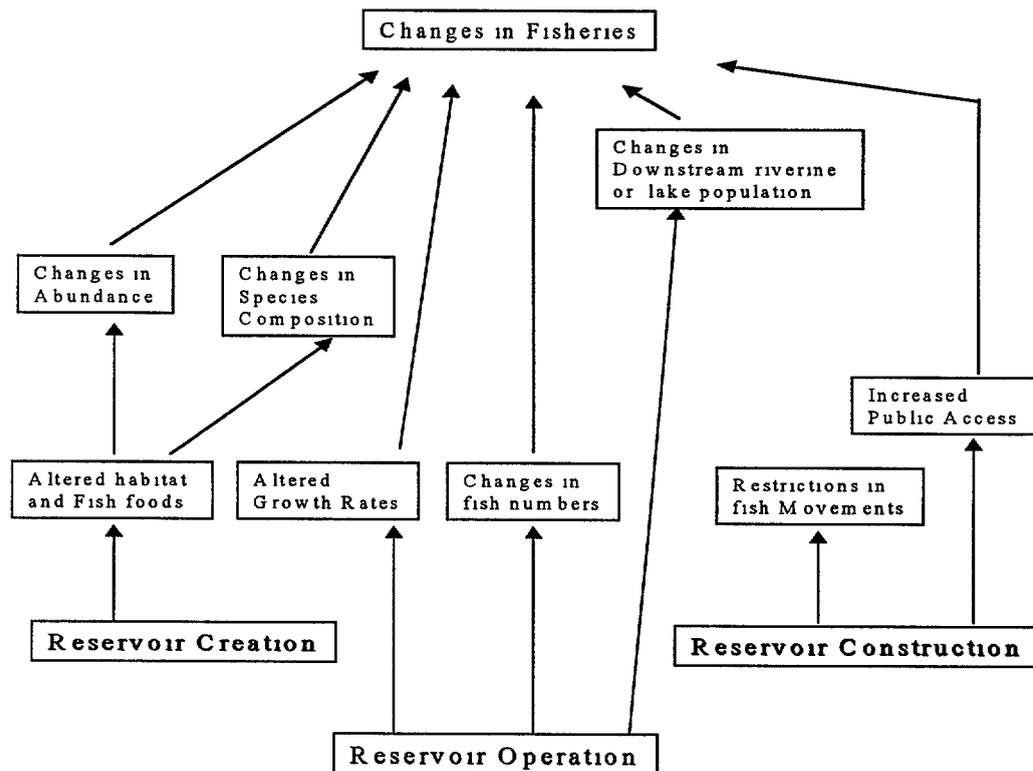
Once the significant impacts have been identified in-depth analysis of the main concerns and mitigation actions for all categories of effects are prepared. The environmental management plan will typically produce actions as noted in Table 3-13.

Table 3-13

Classification of Actions in Environment Management Plans

Type of Action	Description
Avoidance and Prevention	Measures to redesign or relocate facilities or planning project activities (scheduling alternative construction methods etc ) to avoid potentially significant adverse effects and for prevention adoption of health programs public awareness etc
Mitigation	Measures to reverse adverse impacts to accepted levels
Compensation	Measures to compensate for unavoidable adverse impacts which generally refer to monetary compensation for direct loss of property and income generating assets (eg rehabilitate displaced settlements compensate affected persons temporary and permanent property, land)
Residual Impacts	Proposal and possible adoption of actions to further alleviate what are otherwise acceptable impacts (eg impacts that have already been mitigated to meet standards)

Figure 3-5 Illustration of Network Diagram for Hydro-related Fish Impacts



### 3 8 2 Computer Models

Computer models have a range of applications in EIA study, for project design, and for assessment of project effects on the physical and natural environments. Computer models are initially useful in data base applications for baseline data collection and monitoring programs where large amounts of data are maintained and trend analysis are required. Geographic Information System Models (GIS) are particularly useful in categorizing and storing data and producing overlay maps of selected criteria. More sophisticated and specialized models are used to prediction of changes in the air, land and water baseline conditions which can then be used to predict the significance of potential project impacts.

There are some disadvantages to use of specialist computer models for EIA's in Nepal. For example, they generally require considerable data, the cause and effect relationships inherent in models are theoretical in some cases, results are complex and may be difficult to interpret for decision makers, and, specialist expertise and training is required to run models. Therefore the use of simple techniques versus modeling approaches in EIA's must be carefully weighed.

Table 3-14 illustrates the range of models currently in use that support environmental assessments. Some of these models have been used in Nepal by Nepalese experts and outside consultants.

**Table 3-14**

**Types of Models Used in Power Project Studies**

Model Types	Sub-Classifications	Applications
Geographic Information System	Various	Resource mapping and overlays for impact assessment
Water Quality Models	One-Dimensional	Various including temperatures in rivers and reservoirs precipitation and evaporation effects
	Two Dimensional	Various including temperatures in lakes and rivers and salinity thermal plume
	Three-Dimensional	Various including complex modeling of temperature sediment thermal and chemical dispersion in rivers
	Well Mixing	Various including chemical composition and distribution such as dissolved oxygen and phosphorus
	Hydrological	Various including temperature suspended solids BOD pH phosphorous and nitrate simulations
	Water Sediment Exchange	Various including release of heavy metals and radioisotopes from reservoir sediments
Erosion and Sedimentation Models	River Models (eg HEC family and equivalent models)	Changes in siltation and sediment transport in rivers and for hydraulic structures design
	Lake and Reservoir Shoreline Erosion	Shoreline erosion and protective measures
Dam Break Models	Simulation Models	Assess hydraulic aspects of dam failure and GLOF phenomenon

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<b>Model Types</b>	<b>Sub-Classifications</b>	<b>Applications</b>
Groundwater Models	One and two Dimensional Models	Predicting infiltration of pollutants into groundwater
Air Dispersion Models	Gaussian Dispersion	Air emissions from single point source (concentrations of No SO <sub>x</sub> , particulate, etc)
	Complex Source	Air emissions from multiple sources(daily weekly monthly annual mean concentrations)
	Rough Terrain	Dispersion in mountain an rough terrain
Thermal Dispersion Models	One and two dimensional models	Assess dispersion of cooling water releases from thermal plant and temperature profiles affecting aquatic life and habitat
Chlorine Plume Models	One and two dimensional models	Simulate dispersion of chlorine when used as a defoulant in water supply and discharge structures to access impact on aquatic life and habitat
Oils Spill Models	Real time trajectory Models	Spread of oil spills in rivers and lakes based on currents evaporation
	Environment Assessment Models	Assess impact of accidents including mixing effects
	Regional ecosystem impact Models	Assess longer term impacts of oil spills on fisheries activities for example
Biotic Models	Quantitative (generally have data and validation problems)	Biological impact prediction done in association with water quality models where for example productivity of fish zooplankton and bacteria are assessed  Aquatic food chain models mainly applied to fisheries management and production
	Semi Quantitative	Mainly research oriented to give heuristic approaches to policy evaluation
	Risk Analysis	Epidemiological and accident risk

Use of complex models is generally limited to assessments in major projects where effects are large and significant. Figure 3-6 illustrates the sequence of steps for using simple and more complex modeling approaches for water quality assessment.

Over a period of time, modeling capability would be expected to evolve in Nepal. In particular the use of models for Basin EA's would be a suitable approach to establish capability. Decisions would be required to establish in which Nepalese institution the investment in modeling should be made.

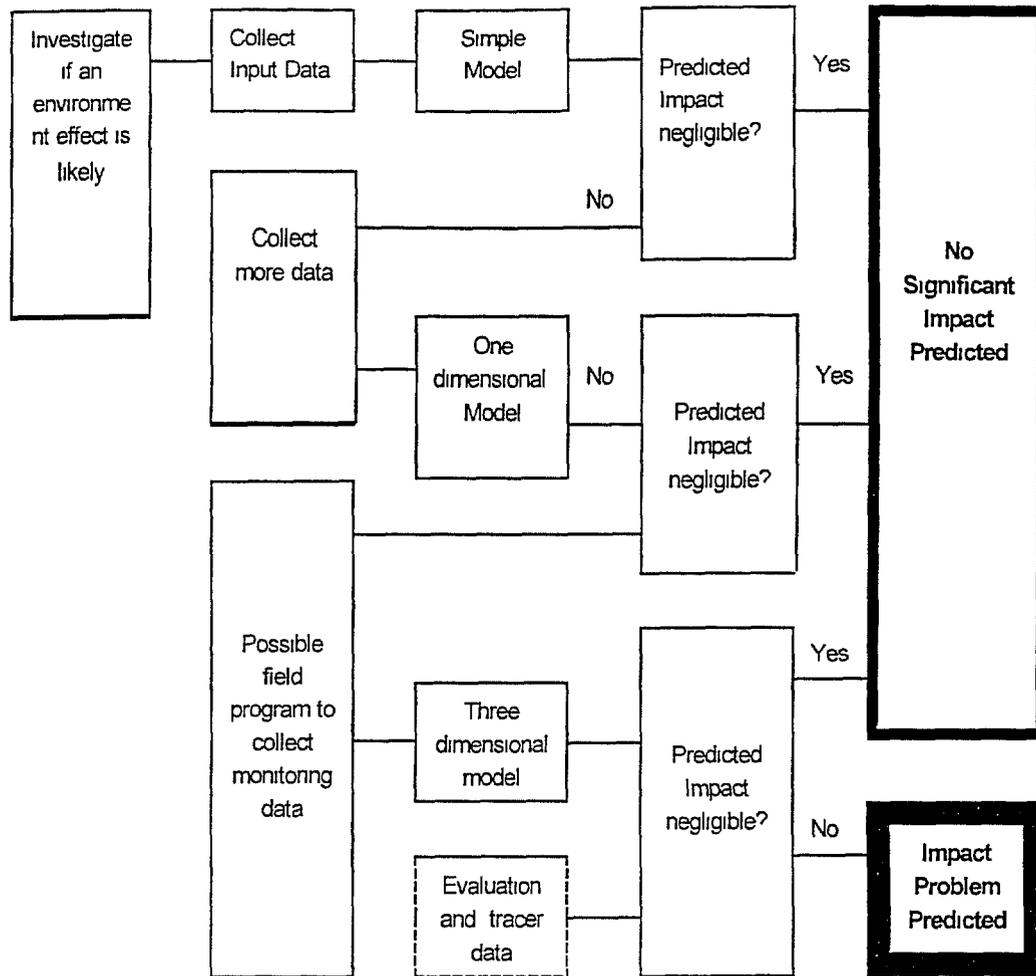


Figure 3-6 Illustration of Modeling Approaches for Water Quality Assessment

### 3 8 3 Composition of Environmental Teams

Specialists typically involved in EIA's include relevant professional from the physical, natural and social sciences disciplines. These are shown in Table 3-15. At minimal the environment team for the EIA study would consist of one well rounded, experienced professional from each of the three main disciplines i.e., physical, social and natural sciences. Other specialists would be brought in to deal with significant effects that required in depth expertise in a particular area. The priority and need for in-depth analysis is generally decided in the scoping phase of the EIA, or as otherwise obvious, and reflected in the TOR. A full complement of professionals may be engaged on major projects. Figure 3-7 illustrates the integration of the three main sciences disciplined for conducting the EIA.

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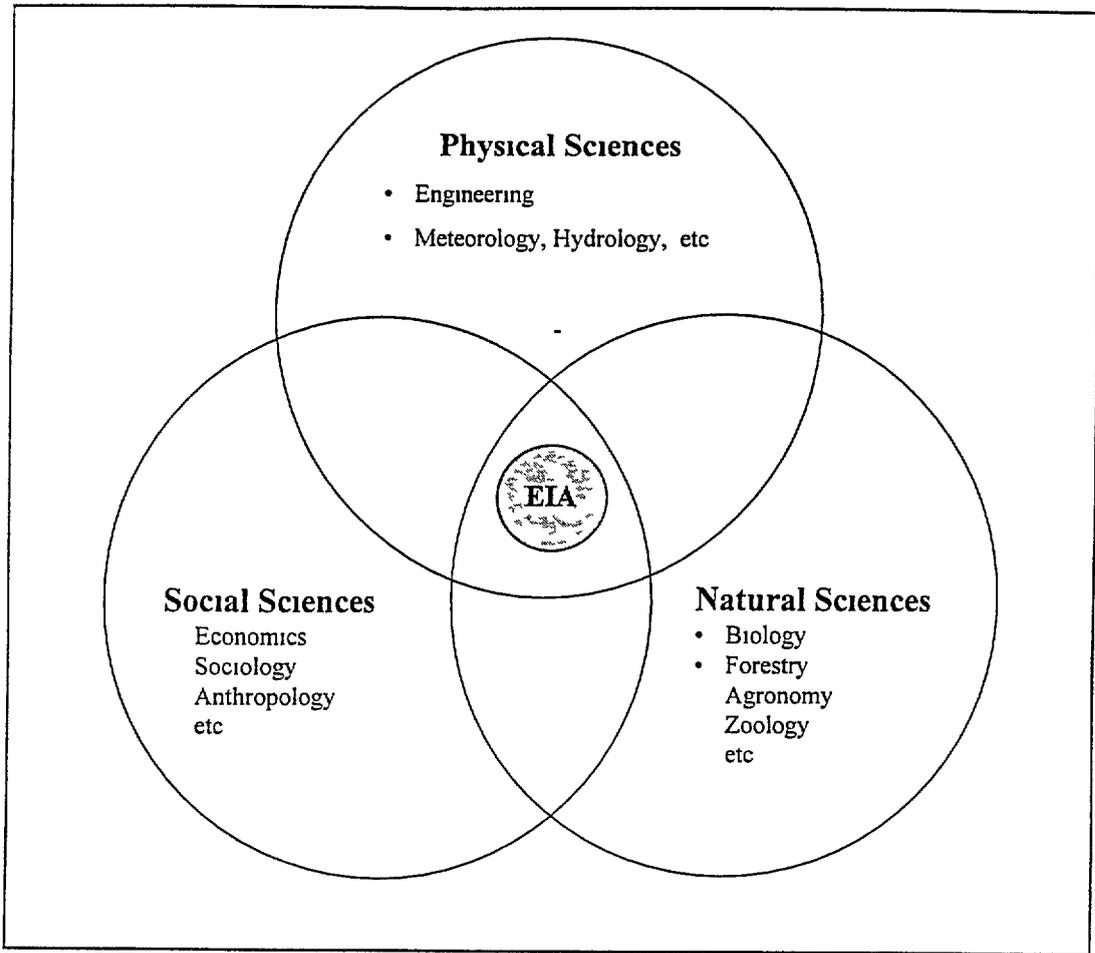


Figure 3-7 Integration of Social, Physical and Natural Sciences in EIA's

Table 3-15

Range of Professional Expertise for EIA Study Teams

Resource Impacted	Sub-Component	Specialist
Air	Air Quality Wind Patterns Climate and Hydrology Noise	Air Quality/Pollution Analyst Air Pollution Control Engineer Meteorologist Noise Expert
Land	Land Capability Soil Resources/Structure Tectonic Activity Other Unique Features	Agronomist Soils Engineer Geotechnical Engineer Various Physical Sciences
Water	Surface Water Groundwater Hydrological Balances Draining Flooding Sedimentation	Hydrologist Hydrologist/Water Pollution Engineer Hydrologist Civil Engineer Civil Engineer Civil Engineer/ Sedimentation Specialist
Flora and Fauna	Environmentally Sensitive Areas Species Inventory Productivity Biochemical	Ecologist Forester Wildlife Biologist Ornithologist Botanist Zoologist Conservationist
Human and Social	Social Infrastructure Cultural Characteristics Physiological and Psychological Well Being Economic Resettlement Planning	Social Anthropologist Sociologist Heritage specialist Social Planner Economist Urban/Resettlement Planner

### 3.9 Costs of Environmental Studies and Environment Management Activities

The cost of environmental management is largely borne by the project itself as an internalized cost of the project. This includes EIA study work and implementation of the environmental management and monitoring programs as well as any required compensation measures. Costs are clearly project and country specific. Reference points for the actual costs as provided in international experience include the following:

- ▶ EIA preparation costs rarely exceed one percent of the total project costs
- ▶ Mitigation of environmental costs can vary from 0 to 10 percent of the total project costs with 3 to 5 percent being common
- ▶ Any significant involuntary resettlement or need for relocation of other infrastructure (eg roads and bridges) can significantly increase social mitigation cost components

There is no obvious inventory of environment related costs for power projects in Nepal. It is recommended that EDC establish a simple tracking and recording system to maintain an up-to-date list of costs. This cost profile separating local and foreign costs can readily be built up based on information in the EIA reports submitted by licensees. Indirect cost to government agencies should also be estimated. It would be useful also to compile information on recently completed projects, examples for projects in Nepal if available.



## 4 Options for Strengthening EDC's Internal Capabilities for Environmental Review

The section provides recommendations on possible steps to strengthen EDC's existing internal capabilities for environment review and management of power projects, in line with EDC's mandate to supervise and facilitate licensee activities

### 4.1 Elements of a Strengthening Program

Section 2 of the report identified the role and responsibilities of EDC in environment review and management of generation, transmission, distribution and rural electrification projects. Broad guidance on the steps EDC may take to further strengthen its internal capabilities in this area are provided in HMG's National EIA Guidelines (Page 15). The guidelines indicate requirements for developing institutional capability in all HMG line agencies for environmental monitoring. These steps more generally apply to capacity for the full EIA process. The requirements are shown in Table 4-1 along with suggested steps for EDC to comply with HMG policy direction.

Table 4-1

Possible Steps to Comply with HMG Guidelines on  
Strengthening Environment Capability in EDC

Requirement in EIA Guidelines Agencies must be committed to	Example EDC Action or Response	Indicative Resource and Cost Implications for EDC
Support the monitoring process with necessary level of resources and ability	<ul style="list-style-type: none"> <li>▶ Appoint a full time internal Environment Coordinator in EDC</li> <li>▶ Consider a full-time local consultant environmental specialist to assist with developing and setting up internal procedures and on job training</li> <li>▶ Specify environmental responsibilities of all EDC staff</li> </ul>	<ul style="list-style-type: none"> <li>▶ Incremental cost of G-II staff</li> <li>▶ Incremental cost of salary and benefits for a local environment consultant on 2-3 year contract</li> </ul>
Maintain continuity in the process (meaning the EIA and monitoring roles performed by the Agency)	<ul style="list-style-type: none"> <li>▶ Establish internal procedures and guidelines for EDC officers on handling project related environment review and coordination</li> <li>▶ Establish and circulate guidelines as appropriate for use by licensees</li> </ul>	<ul style="list-style-type: none"> <li>▶ Incremental cost of developing guidelines in house or with local consultant support</li> <li>▶ Incremental cost of publishing and circulating Guidelines to licensees</li> </ul>
Develop technical capabilities of those (persons in the Agency) involved in monitoring	<ul style="list-style-type: none"> <li>▶ Prepare and implement a staff development and training program for the environment component of EDC's mandate</li> </ul>	<ul style="list-style-type: none"> <li>▶ Incremental cost of non formal and formal training as indicated in the staff development and training program</li> </ul>
Maintain the integrity and honesty of the process	<ul style="list-style-type: none"> <li>▶ Addressed by preparing guidelines and fully supporting the interagency and public consultation process for project specific IEE's and EIA's</li> <li>▶ Ensuring all public notices required are issued in a timely manner</li> <li>▶ Possibly establishing an office or center where documents can be accessible to the public</li> </ul>	<ul style="list-style-type: none"> <li>▶ Incremental costs of preparing briefs and attending meetings public notice costs etc</li> </ul>

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Requirement in EIA Guidelines Agencies must be committed to	Example EDC Action or Response	Indicative Resource and Cost Implications for EDC
Make decisions only after a thorough review of results	<ul style="list-style-type: none"> <li>▸ Comply with HMG procedures by circulation all relevant material for review by internal HMG committees</li> <li>▸ Ensuring key documents (IEE's and EIA's) are available for public and other stakeholder review</li> </ul>	<ul style="list-style-type: none"> <li>▸ Part of internal operating costs of EDC</li> </ul>
Make information from monitoring available to all agencies concerned	<ul style="list-style-type: none"> <li>▸ Maintaining interagency and public consultation networks as required in the national EIA Guidelines</li> </ul>	<ul style="list-style-type: none"> <li>▸ Incremental report reproduction and distribution costs</li> </ul>
Make necessary institutional reforms	<ul style="list-style-type: none"> <li>▸ Make the staff appointments (eg environment coordinator) indicated earlier</li> <li>▸ Develop and implement any required organizational measures (eg environment cell in the longer term) as discussed in Section 4.2</li> </ul>	<ul style="list-style-type: none"> <li>▸ Associated staffing costs and material equipment and resources for staff</li> </ul>

Based on the understanding of EDC's role as discussed in previous sections of the report, the following (Table 4-2) is suggested for consideration as elements of a full program for strengthening EDC's environment capability

**Table 4-2**  
**Example Elements of a Program for Strengthening EDC's Internal Environment Capabilities**

Strengthening Program Element/Activity	Sub-Category	Description/Purpose
EDC Policy and Procedures and Budgetary provisions on Environment Responsibilities	Internal policy/position paper (cleared as required with MOWR)	Short paper to set out and confirm the scope of EDC's responsibilities in environmental management in the short and longer-term (eg project specific EIA coordination only or broader EA responsibilities such as multi purpose project IEE and Basin EA studies) also to confirm all roles and linkages with other HMG agencies
	Environment strengthening program and budget (identified within EDC's overall annual work plan and annual budget)	Detailing all activities responsibilities as well as the time frame costs and resources for strengthening environmental capabilities in EDC Departments
Tools for Internal Use by EDC Staff	Standard Project Management System	Develop and implement computerized (project management software) for tracking and monitoring all project related environment coordination activities and project milestones (environment related or other) (see section 4.2)

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*Strengthening EDC s Capacity for Environment Review  
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Strengthening Program Element/Activity	Sub-Category	Description/Purpose
	Standard Forms	Development and use of standard forms for recording compliance with HMG procedures and internal reporting for, eg <ul style="list-style-type: none"> <li>▸ screening decision</li> <li>▸ need/acceptance of IEE</li> <li>▸ need/acceptance of EIA</li> </ul>
	Check Lists	Preparation and use of standard check lists to be used internally by EDC Staff responsible for <ul style="list-style-type: none"> <li>▸ Review of IEE and EIA documents for completeness</li> <li>▸ Checking the adequacy of Monitoring Reports</li> <li>▸ Defining and reviewing Environmental Auditing tasks</li> <li>▸ Interagency Consultation steps and meeting requirements</li> <li>▸ Public consultation requirements</li> </ul> (See suggested check lists in Appendix B)
Tools for Internal Use by EDC Staff (cont )	Databases  ( EDC should require licensees to provide EDC with electronic copies of all reports field surveys questionnaires analysis etc prepared by licensees)	Gradually develop electronic data bases on <ul style="list-style-type: none"> <li>▸ Project specific environment issues research and study obtained from licensees to be maintained by EDC</li> <li>▸ Data base on major river basins (if Basin EA s are undertaken)</li> </ul>
	Computer Models	Acquire and develop internal capabilities to use selected computer models as noted in Table 3-14 otherwise maintain a list of HMG organizations agencies and local experts where such capabilities reside and where licensees can be referred to when models are needed in EIA studies
Arrangements and support material for Interaction with Licensees	Standard Forms/Letters	For the licensee to submit to EDC when reporting on environment compliance matters (to ensure completeness and accuracy)
	Guidelines by Project Type	Preparation and circulation of specific guidelines on IEE and EIA tasks for hydro thermal transmission distribution and rural electrification projects
Arrangements and support material for Interagency Coordination	Meeting Agenda and related lists	Preparation and circulation of standardized meeting agenda and meeting documentation procedures (documents may be accessible to public)  Preparation and updating of mailing and report circulation lists
Arrangements and Support Material for Public Consultation	Model Interaction Guidelines	Preparation and circulation of workshop guidelines for EIA scoping workshops
	Mailing and Report Circulation Lists	Preparation and update of lists of all potential organizations or groups to be invited for public consultation

Strengthening Program Element/Activity	Sub-Category	Description/Purpose
	Sample Press Releases	For EDC/HMG to issue
Activity to Update Environment Provisions of Electricity Regulations	Review Mechanism to update the Electricity Regulations	Review and prepare updates to the environmental provisions in Electricity regulations (see recommendations in report Section 5)
Staffing Related Measures	Assignment of Responsibilities	Formalize responsibilities of EDC staff involved in environment matters (See Section 4 3)
	Staff development/ Awareness/ Training Program	Deliver non formal and formal training to <ul style="list-style-type: none"> <li>▸ senior EDC managers</li> <li>▸ EDC staff with responsible for project-specific licenses</li> <li>▸ EDC s environment Coordinator</li> <li>▸ other EDC staff</li> </ul> (see section 4 3)
Other Resources	Office Equipment	Provide ready access to computers plotting and map making facilities overhead presentation equipment etc
	Field Equipment and Logistics	Provide access to equipment required for any site survey/audit responsibilities (eg position locators water quality sampling equipment)  Provide access to transport for regular site visits
	Environment Reference Library (as part of EDC s overall Technical Reference Library or system)	Arrange physical space with computerized library reference system for <ul style="list-style-type: none"> <li>▸ all government standards</li> <li>▸ project specific records</li> <li>▸ reference texts and reports</li> <li>▸ subscriptions to technical journals</li> </ul>

Selected aspect of these requirements are reviewed in more detail in the following sections

## 4 2 Project Management System

There are many diverse activities involved in project-specific environmental management which EDC has to either directly control and coordinate. One option is to develop and provide standard check lists that would be used by each officer in EDC designated responsibility for specific projects (ie for the 10 existing licenses). A better alternative is to utilize standard project management software (eg, Microsoft project Manager or equivalent commercial software) to identify and track progress of all project specific environment activities. The environment activities and related milestones may be kept as one module in the project management system. All other project coordination activities could be maintained under separate modules. Initially a model or common template file would be developed. Project officers would then adapt the model for specific projects.

Steps to implement a project management system include the following activities outlined in Table 4-3

Table 4-3

**Steps Recommended to Implement a Standard  
Project Management System in EDC**

Project Management System- Activity		Responsibility/Description
1	Acquire project management software (Microsoft Project)	▶ To be done under the USAID project and EDC resources as available
2	Acquire and provide ready access to computers	▶ Computer upgrade and acquisition partly under USAID project ▶ Consideration of computers installed in offices with adequate security provisions and UPS s
3	Train project officers on software	▶ Training available from computer houses locally Can be funded under USAID project
4	Develop model project management program	▶ Example model prepared and shown as Appendix B-1 (file template available)
5	Adapt specific projects based on the model program	▶ By project officers
6	Prepare procedures for standardized project reporting and report generation form the project management software	▶ By assigned staff
7	Annually review and update of any procedures	▶ By management and project officers

As noted, Appendix B-1 provides an example of a project management template which can be further expanded

### 4 3 Organizational and Staffing Issues

The organizational structure of EDC is described in the PEP companion report, "Review of Institutional and Regulatory Arrangements for Private Investment in Nepal's Power Sector", Section 4 Considering EDC's current structure, there are broadly two options for to strengthen EDC's internal environment capability through organizational measures (1) appointment of an environment coordinator, and (2) establishment of an Environment cell with a larger number of environment staff The decision on either approach would depend on the scope of EDC's in-house environment work in the short and longer-term

*If EDC's environment role is primarily to verify proper implementation of the HMG environment management process for licenses, then appointment of an environment coordinator may be sufficient as a staffing measure for the short term.*

*A full environment unit could be established at a later stage as the level of work and the scope of work warranted. For example, if EDC is to assume some combination of lead HMG responsibility for establishing, conducting or coordinating programs for regional or basin-wise EA's, ELA's for Multipurpose projects for which a license is yet to be granted, or IEE screening of projects that will be solicited directly under an RFP approach - then establishment of a full Environment unit should be considered.*

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### 4 3 1 Short-term Staffing Measures

For this option, appointment of an Environment Coordinator, minimally at the G-II level, in the Private Power Division is recommended. This approach would fit with the current system of project responsibility in EDC. One "project coordinator" at the G-II or G-III level currently has responsibility for "a project file", and is the EDC window for handling routine contact and information flows with the licensee on all project matters<sup>1</sup>. A project coordinator may also handle more than one project. The project coordinator is thus responsible for all environmental review matters including the EIA and interagency and public consultation process associated with the project.

The Environmental Coordinator would support the activities of all the Project Coordinators, as regard to environmental review, public consultation and inter-agency coordination matters. It is also suggested this position would have specific responsibilities for maintaining the interagency and public consultation networks under which individual projects are considered, and for preparing standardized guidelines. (A decision may be needed on the extent to which the Environmental Coordinator is responsible for the interagency coordination, depending on the project scale and issues as this may cause some concerns about accountability.)

Example responsibilities of the project coordinator and environment coordinator in relation to environment activities are shown in Table 4-4.

### 4 3 2 Longer-term Staffing Measures

If the scope of EDC's environmental activities is to be further expanded beyond facilitating and monitoring licensee's work in preparing IEE's and EIA's, establishment of a full environment unit, possibly in the Planning Division of EDC may be considered. The unit may then provide environmental services to the other functions in EDC, where required, including the Privatization Division for activities noted in Table 4-4. The number of staff, professional qualifications and composition of the Environment Unit would depend on the precise nature of the duties assigned the unit.

Options to consider as possible longer term staffing targets in setting up a full environment unit in EDC unit would include:

- ▶ Introducing a natural and social sciences experts, as most EDC professionals are from physical science disciplines
- ▶ Including separate positions with dedicated responsibilities for Basin EA coordination, Multipurpose Project IEE coordination and Private Power Coordination
- ▶ Dedicated position for handling public consultation including local NGO contacts
- ▶ EA impact computer modeling specialists and a data base and mapping specialist

NEA and WECS have established environmental units. These provide organizational and staffing models for EDC if the option of establishing a unit in EDC is to be considered.

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<sup>1</sup> Correspondence may actually be addressed to the EDC Director General or a Senior Manager but this officer would be responsible for the project file.

**Table 4-4**

**Suggested Environment-Related Parts of EDC Staff Position Descriptions**

Position	Responsibilities (Environment Related)
Project Coordinator (s) in the Privatization Division	<ul style="list-style-type: none"> <li>▸ Maintaining contact with licensees for conformance with environment requirements in the Regulations licenses and other HMG guidelines</li> <li>▸ Representing the EDC interests at interagency project specific meetings</li> <li>▸ Representing EDC/Project interests in project-specific public consultation meetings</li> <li>▸ Preparing the project specific project management plan (Section 4.2)</li> </ul>
Environmental Coordinator	<p>Immediate responsibilities for the Privatization Division</p> <ul style="list-style-type: none"> <li>▸ Maintaining an up-to-date inventory of EA guidelines and all applicable HMG standards</li> <li>▸ Representing EDC in the draft and development of new guidelines and standards</li> <li>▸ Preparing Information Packages on environment matters which the Project Coordinator(s) will give to licensees</li> <li>▸ Maintaining the Interagency and Public Consultation Networks and lists of Contacts</li> <li>▸ Operating as a spokesman for EDC in Public Consultation Forums</li> <li>▸ Function as the focal point for environment concerns in EDC</li> <li>▸ Recommending updates on the Environmental provisions in the Electricity Regulations</li> <li>▸ Maintaining the technical reference library (environment section) environment concerns in EDC</li> </ul> <p>Optional</p> <ul style="list-style-type: none"> <li>▸ Providing environmental services to other EDC Divisions</li> <li>▸ Preparing the annual work plan for strengthening EDC's environment capabilities</li> </ul>

## 4.4 Internal Interactions and External Linkages

Clearly defined responsibilities for managing EDC's internal information flows and external relations are important in two respects

- For EDC to be efficient as the one window system (for private sector Licensee interaction with HMG)
- To fully comply with HMG rules on interagency and public consultation on project-specific EIA's

### 4.4.1 Internal Interactions

Interactions within EDC for environment review follow the normal lines of authority for internal reporting dealing with approval and monitoring progress on project licenses. Specific internal interactions on environment responsibilities would be clarified once the internal policy and procedures, staffing arrangements and job descriptions are established, as noted in Table 4-4

## 4.4.2 Other Government Agencies and External Organizations

EDC's staff must maintain close contact with the licensees and a range of other government agencies and external organizations throughout the environment review process, approval and monitoring phases. Table 4-5 illustrates contacts and typical information flows.

Table 4-5

EDC's External Liaison for Environment Management of Power Projects

Organization	Mode of Interaction and Information EDC Provides To the Organization	Information EDC Receives From the Organization
Licensees	<p>Generic Guidelines (eg for)</p> <ul style="list-style-type: none"> <li>▸ IEE and EIA</li> <li>▸ Interagency coordination</li> <li>▸ Public Consultation</li> <li>▸ HMG environment standards as available</li> <li>▸ Environment Monitoring</li> </ul>	<p><u>When EIA not Required</u></p> <ul style="list-style-type: none"> <li>▸ Screening Report (if required)</li> <li>▸ IEE Report (if required)</li> <li>▸ Annual Monitoring report (if required)</li> </ul>
	<p>Arranges access to various information sources available from HMG Ministries and line agencies throughout the environment study phase</p>	<p>When EIA Required</p> <ul style="list-style-type: none"> <li>▸ Scoping Report</li> <li>▸ Draft EIA Report</li> <li>▸ Final EIA Report with Environment Management Plan                             <ul style="list-style-type: none"> <li>- Resettlement Plan (if req)</li> <li>- Monitoring Plan</li> </ul> </li> <li>▸ Annual Monitoring report</li> </ul>
	<ul style="list-style-type: none"> <li>▸ Letters on Acceptance or rejection of Environment reports and proposed mitigation actions</li> </ul>	
Public Sector Licensees	<ul style="list-style-type: none"> <li>▸ As above NEA's environment unit should also maintain and up-to-date inventory of HMG requirements</li> </ul>	As above
NPC - Environment Protection Council	<ul style="list-style-type: none"> <li>▸ Copy of project specific environmental reports</li> </ul>	<ul style="list-style-type: none"> <li>▸ HMG Policy Guidelines as relevant to power sector projects</li> </ul>
MOWR	<p><u>For Approval by MOWR</u></p> <ul style="list-style-type: none"> <li>▸ Draft letter indicating requirement for Screening IEE or EIA level study</li> <li>▸ Advanced copy for clearance of any public notification</li> <li>▸ Draft letters on Acceptance or rejection of Environment reports and courses of action</li> <li>▸ Proposed changes in environment provisions in Electricity Regulations</li> <li>▸ Information packages intended for licensees</li> <li>▸ Recommendations on composition and names for the Compensation Fixation Committee</li> <li>▸ Recommendations for composition of the HMG consultation or review Committee for EIAs</li> </ul>	<ul style="list-style-type: none"> <li>▸ Approval and/or comment on such items</li> </ul>

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Organization	Mode of Interaction and Information EDC Provides To the Organization	Information EDC Receives From the Organization
	For Information & Reaction by MOWR <ul style="list-style-type: none"> <li>▶ Copies of project specific environmental reports</li> <li>▶ Copy of project-specific interagency coordination meetings (via MOWR representative)</li> <li>▶ Copy of public consultation minutes for critical meetings</li> </ul>	<ul style="list-style-type: none"> <li>▶ Comments on such items as necessary (generally via the MOWR representative on the interagency coordination committee for the specific project)</li> </ul>
WECS	<ul style="list-style-type: none"> <li>▶ Proposed changes in environment provisions in Electricity Regulations</li> <li>▶ General information packages for licensees</li> <li>▶ Copies of all project specific IEE EIA and Monitoring Reports</li> </ul>	<ul style="list-style-type: none"> <li>▶ Sectoral Environment Guidelines produced by WECS</li> <li>▶ Comments on material provided by EDC</li> <li>▶ EIA input on interagency coordination committees WECS is on ie multipurpose projects</li> </ul>
Ministry of Population and Environment	Policy Related and General <ul style="list-style-type: none"> <li>▶ Draft Environment Provisions in Electricity Regulations</li> <li>▶ Information only copies of environment packages given to licensees</li> </ul>	Policy Related and General <ul style="list-style-type: none"> <li>▶ Multi-sectoral and Sectoral Environmental Guidelines</li> <li>▶ Specific pollution and other standards and regulations</li> </ul>
Ministry of Population and Environment (cont )	Project Specific <ul style="list-style-type: none"> <li>▶ Copies of project specific environmental reports (Screening IEE EIA Monitoring and Audit)</li> <li>▶ Copy of project-specific interagency coordination meetings minutes (via MOPE representative)</li> <li>▶ Copy of public consultation minutes</li> <li>▶ Copy of notification on approval acceptance or rejection of environmental reports</li> </ul>	Project Specific <ul style="list-style-type: none"> <li>▶ Comments on such reports as necessary (generally via the MOPE representative on the interagency coordination committee for the specific project)</li> </ul>
Other HMG Agencies affected or associated with implementation of the project (eg <ul style="list-style-type: none"> <li>▶ DOR-Department of Roads</li> <li>▶ DOI-Department of Irrigation</li> <li>▶ DHM-Department of Hydrology and Meteorology</li> <li>▶ DOL Department of Labor</li> <li>▶ DOA-Department of Archaeology</li> <li>▶ DHS Department of Health Services</li> <li>▶ Ministry of Soil Conservation and Forests</li> <li>▶ DOP&amp;W Department of National Parks and Wildlife</li> <li>▶ DPR Department of Plant Resources</li> <li>▶ MOT-Ministry of Tourism</li> </ul>	<ul style="list-style-type: none"> <li>▶ Copies of project specific environmental reports</li> <li>▶ Copy of project specific interagency coordination meetings (via Ministry representative)</li> <li>▶ Copy of public consultation minutes</li> </ul>	<ul style="list-style-type: none"> <li>▶ Comments on such items as necessary (generally via the representative on the interagency coordination committee for the specific project)</li> <li>▶ Access to information data and reports required in the environmental study programs (arranged by EDC or via the Ministry or Agency Representative on the interagency coordination committee)</li> </ul>

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Organization	Mode of Interaction and Information EDC Provides To the Organization	Information EDC Receives From the Organization
Project Affected Population (PAP)	<ul style="list-style-type: none"> <li>▸ Details of project all activities</li> <li>▸ Full access to all environmental reports on the project</li> </ul>	<ul style="list-style-type: none"> <li>▸ Reaction and comment at public consultation meetings and workshops</li> <li>▸ Input to field questionnaires and surveys during IEE or EIA</li> <li>▸ Input through CFC</li> </ul>
General Public	<ul style="list-style-type: none"> <li>▸ Notice of public meetings</li> <li>▸ Full access to all environmental reports on the project</li> </ul>	<ul style="list-style-type: none"> <li>▸ Verbal and written presentations as desired by individuals and organizations</li> </ul>
Local NGO s	<ul style="list-style-type: none"> <li>▸ Invitation to public meetings</li> <li>▸ Full access to all environmental reports on the project</li> </ul>	<ul style="list-style-type: none"> <li>▸ Verbal and written presentations as desired by NGO organizations</li> </ul>

The main recommendations in regard to efficient coordination of the external contacts for environment matters are as follows

- (a) EDC would maintain a list of the main agencies that would attend interagency coordination meetings for project-specific EIA's. The group may meet annually to consider any general issues for improving agency coordination. The group would also meet for each project-specific EIA at the required milestones.
- (b) A list of agencies that would be involved exclusively in hydro, thermal, transmission and rural electrification projects would be maintained. This would also consider regional agencies. The agencies would be called, on an as required basis, to attend interagency coordination meetings.
- (c) A database or list of organizations and contacts for public consultation for project-specific EIA's would be maintained. It is recognized also that public notice would be given in local newspapers to invite any interested groups to come forward and attend public meetings.

Guidelines for the Compensation Fixation Committee which is a key mechanism for interaction with persons affected by the project may also be prepared. Guidelines may also be prepared for recommending individuals for each position on the CFC. The Electricity regulations provide direction as to the type of representation required on the CFC.

## **4.5 Staff Development and Training**

The type and level of environment training appropriate for EDC staff depends on the scope of environment work to be undertaken, the assignment of responsibility for this work, and the presence or absence of the required skills. As noted, EIA studies require the integration of inputs from physical, social and natural science disciplines. At present EDC staff is mainly composed of professionals from the physical science disciplines, mainly civil and electrical engineering. The lack of social and natural sciences expertise will not pose a major problem if EDC restricts its activities to the coordination and facilitation of the environment management process as noted in the previous sections of the report. Critical environment review decisions will be made by the interagency coordination committee of which MOPE is a member and thus the expertise required for HMG review of the EIA should be available.

Nevertheless an environment coordinator from the natural sciences discipline should be available in EDC and cross-training of EDC staff members for physical science disciplines will be needed. If EDC is to embark on a broader program of environmental work then more substantive environmental credentials will be needed by staff and there would need to be hiring and training programs.

For the present workload, EDC staff at all levels need to be aware of the main environment and socioeconomic issues associated with hydro power, thermal, transmission and rural electrification projects. Staff with more specific environment coordination responsibilities need to be fully conversant with the EIA process in Nepal, as well as interagency coordination and public consultation techniques.

Needs for training and staff development are outlined in Table 4-6, considering the Privatization Division only.

**Table 4-6**

**EDC Staff Skills Required/Training Needs**

Staff Position or Level	Skills Required/Training Needs - Environment Related -
EDC Senior Staff	<ul style="list-style-type: none"> <li>▶ General awareness of environment issues and specific EA and EIA Processes and procedures in Nepal</li> <li>▶ Awareness of Lending Agencies policy on environment</li> <li>▶ Awareness of the main tools and techniques involved in project EIA s</li> <li>▶ Awareness of the generic physical biological and social issues associated with hydro transmission distribution and rural electrification projects</li> <li>▶ Awareness of the critical issues associated with specific multi purpose projects and projects under license</li> <li>▶ Public speaking and presentation skills on EDC environment policy</li> </ul>
Project Coordinators (assigned responsibility for liaison with licensees for project files)	<ul style="list-style-type: none"> <li>▶ Awareness of project-specific EIA procedures including HMG and licensee responsibilities in Nepal</li> <li>▶ General awareness of the generic physical biological and social issues associated with hydro transmission distribution and rural electrification projects</li> <li>▶ General awareness of mitigation procedures</li> <li>▶ Knowledge and capability to develop and use environmental check lists</li> <li>▶ Awareness of EIA analysis techniques (matrix scoring network diagrams etc )</li> <li>▶ Awareness of computer models used in EIA s and impact prediction techniques</li> <li>▶ Knowledge and capabilities to use project management software</li> <li>▶ Knowledge of techniques for holding scoping workshops and running public meetings and stakeholder analysis</li> <li>▶ Public speaking and presentation skills</li> <li>▶ Awareness of the critical issues associated with and projects under license for which officers are responsible</li> </ul>
Environment Coordinator (new position recommended)	In addition to the above more substantive knowledge of issues in the natural and social sciences community involvement and public consultation in conducting EIA s and for guidelines and standards development

Staff development and training is a multi-year objective where experience and capabilities would be expected to gradually develop. Pending decisions on institutional and staffing matters, more immediate options for non-formal and formal training such as under the USAID project are shown in Table 4-7.

**Table 4-7**

**EDC Training Methods and Courses**

Staff Position or Level	Training Method/Activity	
EDC Senior Staff	Non Formal Training	(1) Internal Briefings from staff on project specific issues (2) Informal Presentations by the EDC Environment Coordinator or locally hired environmental consultant (3) Independent Reading course with pre-set materials (4) Viewing of specially ordered Video Cassettes and/or Films on Environment Issues and Experience in Other countries
	Formal Training	(5) Routine attendance of environmental awareness seminars (6) Attendance of short-courses on EIA procedures
Project Coordinators and other EDC Staff	Non Formal	(7) On job training and advice from EDC Environment Coordinator (8) Informal/internal workshops by the EDC Environment Coordinator or locally hired environmental consultant (9) Independent Reading with pre-set materials (10) Viewing of specially ordered Video Cassettes and/or Films on Environment Issues and Experience in Other countries (11) Site visits to the field with briefings
	Formal	(12) Courses on project EIA techniques such as offered at AIT AIM (Asia context) and periodically by some US organizations (US context), (13) Short term attachment in an Environment Division at a US Utility or regulatory agency (14) Attendance of seminars and workshops in Nepal (15) Computer courses (Microsoft - Power Point and Project Manager)
Environment Coordinator	Non Formal	(7) To (11) as above
	Formal	(12) To (15) as above (16) Short environmental course to give substantive background on the main concepts and the integration social natural and physical sciences work (17) Other specialist short courses on important issues in Nepal

## 5 Options for Updating Environment Provisions in the Electricity Regulations

This section provides comment on options to update or strengthen provisions in the Electricity Regulations (1993) dealing with environment matters. There is no urgent need to make such amendments at this time. Rather these recommendations may be considered as an initial input to the next regular update of the Regulations. Any update should only be considered after MOPE confirms the process, practices and allocation of responsibilities in current National EIA Guidelines will be maintained or indicates minor alterations. While no major changes in the system are anticipated, there are a number of recommendations in the draft Environmental Impact Assessment Guidelines for the Water Resources Sector (June 1994) which should be incorporated in the update. It would thus be prudent for EDC to wait for such confirmations before making amendments.

### 5.1 General Situation

The Hydropower Policy, Water Resources Act, Electricity Act and Electricity Regulations all make specific reference to the need for environment review and management of power projects. Table 2-2 cited the specific provisions in the Acts and the Electricity Regulations. The Regulations also indicate that licensees must comply with other HMG environmental rules and regulations that have bearing on the environment impacts and mitigation of adverse social impacts. This includes the National EIA Guidelines (1993).

### 5.2 Provisions to Incorporate in a Future Update of Regulations

Table 5-1 identifies specific rules and clauses in the Electricity Regulations where additional text or provisions pertaining to environment matters may be introduced.

**Table 5-1**

**Suggested Environmental Provisions for Updating the Electricity Regulations**

Electricity Regulation/Rule	Potential Update Provision
<p>Chapter 2 Rule 3 Indicating Information to be supplied to EDC on registration of 100 to 1 000 kilowatt projects. No license requirement.</p> <p>Note Plant 1.5 MW require an IEE and plant over 5 MW a full EIA.</p>	<p>Add a clause (g) to indicate the applicant should provide a statement on whether or not any sensitive environmental or social issues are expected to be encountered and how such impacts will be mitigated. This provision would ensure that the Water Resources and Electricity Acts are fully observed on small projects which are currently outside the IEE and EIA critical thresholds for full study.</p>
<b>Survey License Applications</b>	
<p>Chapter 2 Rule 4 - Indicating the nature of information to be supplied in an application for a survey license for power generation.</p> <p>Note Schedule 2 (application) in the Regulations is a one page form with no written brief to support the application.</p>	<p>A requirement exists for the applicant to provide a map to show major towns, settlements etc. 4(a) may add to the text of 4(a) or include a new clause to have the applicant provide at minimum:</p> <ul style="list-style-type: none"> <li>▸ The location of environmentally sensitive areas, wildlife reserves or game parks at or near the project site.</li> </ul>

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<b>Electricity Regulation/Rule</b>	<b>Potential Update Provision</b>
Chapter 2 page 4 Rule 5 Indicating the nature of information to be supplied in a transmission survey license application	Same as above The text of 5 (a) may be expanded to include a requirement to show the location of towns villages and environmentally sensitive areas indicate major land use and show river crossings etc that are in the proposed transmission corridor route map
Chapter 2 page 5 Rule 6 - Indicating the nature of information to be supplied in a distribution survey license application	Less important Text of 6 (a) may be expanded to include a more explicit statement on the land use mix in the service area and what items are to be included in the geographical description of the service area (eg parks, recreational areas and significant heritage properties)
At present the Regulations do not require the issue of public notice by MOWR/EDC of the award of the survey license	In the interest of a transparent and open system mandatory public notice of the award survey licenses should be considered Moreover public notice is required for initiation of the EIA (screening and scoping phases) which normally takes place during the survey license period
<b>Production License Application</b>	
Chapter 2 page 8 Rule 12 - indicating the nature of information requirements for submitting an application for a production license  Note one issue is that requirements for reports and analysis for the survey license may already be comprehensive and available So it is a question of how much to include in the production application	12 (a) could be split in to (a) and (b) sections in order to ask for a detailed description of the project separate to the request for information on the ownership of the project company  Item (f) covers environmental issues in some detail It may be more appropriate to say that the developer has to submit  (i) Environmental Management Plan - indicating environmental effects as identified in the EIA and the mitigation activities schedule costs responsibilities etc  (ii) Public Consultation Plan - indicating what has been done for public consultation and what will be done at the project implementation stage  (iii) Environmental Monitoring Plan - Indicating the monitoring program for the post project stages to monitor the effect of the project on the baseline conditions in the area before the project  (iv) Resettlement Plan indicating detailed measures and steps for relocation and rehabilitation to the extent the requirement is identified in the EIA report prepared during the Survey License period  EDC would eventually include in the Electricity Regulations the requirement to submit any environmental permits or approvals that may be required by the Ministry of Population and Environment under the forthcoming Environment Act
Chapter 2 page 9 Rule 13 - indicating requirements for submitting an application for a power transmission license	Same as above Possible specification of requirement for (i) Environment Management Plan (ii) Public Consultation Plan (iii) Environmental Monitoring Plan (iv) Resettlement Plan
Chapter 2 page 11 Rule 14 indicating requirements for submitting an application for an electricity distribution license	Same as above if the Project Screening was undertaken during the survey license and an EIA was considered to be necessary
Chapter 2 page 12 Rule 16 - indicating requirements for submitting an application for a distribution license	Consider whether mention of the availability of an IEE report and Public Consultation Plan should be made if the requirement for such was identified in the screening phase of the project  Otherwise indicate that HMG certification that no IEE or EIA was required for the project should be provided

Electricity Regulation/Rule	Potential Update Provision
<b>Other Issues</b>	
Rule 79 indicating EDC s examination of operation plant will take place,	A clear specification of where and how to include the requirement for reporting on the environmental monitoring program may be considered
Rule 91 providing comment on the requirement for an Annual report of the licensee or project company	Consider adding a comment that the contents of the report should include results of the environmental monitoring program
<p>Two further issues with the Electricity Regulation Schedules are</p> <p>(i) EDC may consider modifying the existing schedules slightly to add in some environmental statements components</p> <p>(ii) EDC may consider adding some new schedules dealing with EA reporting milestones which may be different than the six monthly reporting requirement</p> <p>(iii) EDC may incorporate any change or modification in procedure that is identified and approved in the forthcoming Water Resource Sector Guidelines such as</p> <ul style="list-style-type: none"> <li>▸ Project thresholds for IEE s and EIA s</li> <li>▸ Requirements for formal approval of the EIA TOR prepared by the Licensee</li> <li>▸ Requirements for an EIA Steering Committee as a mechanism for interagency coordination</li> </ul>	

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## **6 Summary Recommendations**

Section to be developed after discussion of previous sections with EDC

### **6 1 EDC's Role in the Environmental Review Process**

### **6 2 Update of Electricity Regulations**

### **6 3 Internal Capabilities and Efficiency**

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# **Appendices**



## Appendix A

### References and Library Material Assembled

[Note Documents referenced below were photocopied and placed in a technical reference library at the PEP office]

- 1 An Introduction to Environment Assessment Procedures Seminar Proceedings, Kenya/Canada Energy Advisory Project, 1991 (source WECS)
- 2 An Introduction to Environment Assessment Procedures Seminar Resource Material, Kenya/Canada Energy Advisory Project, 1991 (source WECS)
- 3 Assessment of USAID Environment Programs Agriculture and the Environment-Nepal Case Study, USAID, 1994
- 4 Class Environmental Assessment for Minor Transmission Facilities Design and Development Division-Transmission, Ontario Hydro, 1986
- 5 Design and Development Division, Environmental Site Selection Manual, Ontario Hydro 1980
- 6 Developing Environmental Impact Assessment Guidelines for the Industrial Sector, Workshop in Kathmandu, NPC and IUCN, 1991
- 7 Draft EIA Guidelines for the Water Resource Sector, NPC/MOW, 1994a
- 8 Environment Guidelines for Construction and Maintenance of Transmission Facilities, Ontario Hydro, 1990
- 9 Environment Impact Assessment Source Book, USAID and the Institute for International Research, 1991
- 10 Guidelines for Initial Environmental Assessment of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 459, Updated Nov 1995
- 11 Guidelines for Environmental Monitoring of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 460, Updated Nov 1995
- 12 Guidelines for Environmental Auditing of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 461, Updated Nov 1995
- 13 Guidelines for Public Safety at Hydropower Projects, Division of Dam Safety and Inspections, FERC, 1992
- 14 Impact Assessment Source Book, International Association for Impact Assessment, Volume 12, 1995
- 15 Network Resource Guide, Gender Analysis Section, WECS Report 3/2/090/96/1/1, Seq No 482, Nov

- 16 Preparing Environmental Assessments for Energy Projects in Kenya Volume 2 Appendices II, Kenya/Canada Energy Advisory Project, 1992 (source WECS)
- 17 Selected Mathematical Models in Environmental Impact Assessment in Canada Background Paper for the Canadian Environmental Assessment Research Council, University of Sherbrook, 1994
- 18 The World Bank and the Environment, 1993
- 19 World Bank, 1991 Environmental Assessment Source Book Volume I - Policies, Procedures, and Cross-Sectoral Issues World Bank Technical Paper No 139 World Bank Washington, D C
- 20 World Bank, 1991 Environmental Assessment Source Book Volume II - Sectoral Guidelines World Bank Technical Paper No 140 World Bank Washington, D C
- 21 World Bank, 1991 Environmental Assessment Source Book Volume III - Guidelines for Environmental Assessment of Energy and Industry Projects World Bank Technical Paper No 139 World Bank Washington, D C

## **Appendix B**

### **Internal Information Package for EDC Staff**

- B-1 Project Management (Computer Program) for EDC Coordination of Projects-Specific EIA Activities
- B-2 Requirements for Maintaining Internal Check Lists
- B-3 Internal Check List for Preliminary Environment Statement Project Screening
  - Annex A Hydro Generation Projects
  - Annex B Thermal Generation Projects
  - Annex C Transmission Projects
  - Annex D Distribution Projects
  - Annex E Rural Electrification Projects
- B-4 Internal Checklist for EDC Review of IEE and EIA Reports
- B-5 Environment Impacts of Thermal Projects
- B-6 Sample External Guidelines for Environmental Study
- B-7 Sample Approach for a Public Utility Environmental Policy

## **Appendix B-1**

### **Project Management (Computer Program) for EDC Coordination of Projects-Specific EIA Activities**

The computer printout in Appendix B-1 is an example of a standard project management (Gantt) schedule produced on readily available commercial package (Microsoft Project, part of Office 43). The Gantt chart itself is a standard management tool for keeping track of tasks, and can be used so for environment related tasks for project licenses issued by EDC. Activities shown in the schedule form part of EDC's project-specific licensing responsibilities under the one-window system, and reflect the requirements and activities currently in HMG's EIA Guidelines.

The task breakdown structure indicated in the left column represents typical activities that EDC project officers assigned to individual projects will have to coordinate. The Microsoft Project software can be used to show only certain numbers or grouping of tasks, tasks between certain dates or summary activities. Time scales can be altered. And there are many different types of report-making modules in the software that can be used for internal and external reporting and presentation.

It is recommended that a standardized project management template be finalized. EDC officers can set up schedules for each project (10 projects) which EDC has licensed by modifying the template to suit the activities and schedules for each project. Some activities, for example, would be relevant on a specific project while others not, and the dates would have to be set to conform to the terms in the individual licenses.

## EDC Environment Coordination- Project Specific

ID	Task Name	1996				1997				1998				1999				2000				2001			
		Q1	Q2	Q3	Q4																				
1																									
2	<b>Pre-License Activities</b>																								
3	Survey License Application Received																								
4	Provide Applicant with Information Package(s)																								
5	EDC Internal Review of Application																								
6	EDC Recommendation to MWR on License																								
7																									
8	<b>Internal Preparations on Survey License</b>																								
9	Pre Classify Project for Environment Study Level																								
10	Draft/Review License Provisions on Environment																								
11	Prepare Initial Stakeholder Analysis																								
12	Prepare EDC's Project Coordination Plan																								
13	Prepare Draft of Public Notice																								
14																									
15	MWR Issues License																								
16	Issue Public Notice																								
17																									
18	<b>Survey License Period (Illustration)</b>																								
19																									
20	Licensee Mobilization Activities																								
21	Set Representation on Interagency Coordination Committee																								
22	Issue Notice of First Meeting																								
23	Hold Screening Meeting																								
24	Issue Letter on Screening Decision (if required)																								

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## EDC Environment Coordination- Project Specific

ID	Task Name	1996				1997				1998				1999				2000				2001			
		Q1	Q2	Q3	Q4																				
25																									
26	<b>If Screening Report is Required</b>	■																							
27	Prepare Coordination Schedule for EDC Support																								
28	Provide Coordination / Data Access Support	■																							
29	Licensee Issues Draft Report	◆																							
30	Arrange Interagency Committee Review of Report																								
31	Hold Interagency Coordination Meeting	◆																							
32	Issue EDC Letter on Screening Decision	◆																							
33																									
34	<b>If IEE Report Required</b>	▾																							
35	Prepare Coordination Schedule for EDC Support																								
36	Provide Coordination / Data Access Support	■																							
37	Licensee Issues Draft Report	◆																							
38	Arrange Interagency Committee Review of Report																								
39	Hold Interagency Coordination Meeting	◆																							
40	Issue EDC Letter on IEE Acceptability	◆																							
41																									
42	<b>EIA Study Activity</b>	▾																							
43																									
44	<u>Scoping Phase</u>	▾																							
45	Hold First Interagency EIA Coordination Meeting	◆																							
46	Support Licensee with Data Access	■																							
47	Licensee Submits Draft Scoping Report	◆																							
48	Internal Review of Scoping Report																								

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## EDC Environment Coordination- Project Specific

ID	Task Name	1996				1997				1998				1999				2000				2001			
		Q1	Q2	Q3	Q4																				
49	Complete EDC Adequacy Check List																								
50	Notify Licensee if Sections are Missing																								
51	Circulate Scoping Report																								
52	<b>Hold Interagency Coordination Meeting</b>		◆																						
53	Review EIA Approach & Methodology																								
54	Review EIA Baseline Data Collection Plan																								
55	Review EIA Public Consultation Plan																								
56	Issue EDC Notification of Report Acceptability		◆																						
57																									
58	<b>EIA Terms of Reference</b>		↓																						
59	Licensee Prepares / Updates EIA TOR - Submits		◆																						
60	EDC Internal Review of TOR																								
61	Circulate TOR to HMG for review/comment																								
62	Provide Licensee with Consolidated Comment		◆																						
63																									
64	<b>Baseline Study</b>		▬																						
65	Licensee Mobilizes Study Team																								
66	EDC Facilitates Data Access as Required																								
67																									
68	<b>Six-Monthly Progress Review (s)</b>		▬																						
69	Licensee Submits Progress Report to EDC		◆																						
70	First Six Month Review																								
71	Licensee Submits Progress Report to EDC																								
72	Second Six Month Review																								

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## EDC Environment Coordination- Project Specific

ID	Task Name	1996				1997				1998				1999				2000				2001			
		Q1	Q2	Q3	Q4																				
73	Licensee Submits Progress Report to EDC							◆																	
74	<b>Third Six Monthly Review</b>							▼																	
75	Verify Progress on Effects Prediction																								
76	Verify Progress on Alternative Analysis																								
77	Verify Progress on Mitigation Analysis																								
78	Verify Progress on Residual Impact Analysis																								
79	Licensee Submits Progress Report to EDC											◆													
80	Fourth Six Monthly Review																								
81																									
82	<b>Attend Public Consultation Meetings</b>									◆			◆												
83	General Public Meeting 1	◆																							
84	General Public Meeting 2						◆																		
85	Further Public Meetings as Required											◆													
86	Project Affected Persons Meeting 1						◆																		
87	Project Affected Persons Meeting 2							◆																	
88	Other Meetings in Public Consultation Plan											■													
89																									
90	Licensee Submits Draft EIA Report											◆													
91																									
92	<b>EIA Draft Report Review</b>											▼													
93	Complete Adequacy Check List																								
94	Notify Licensee if Sections are Missing																								
95	Circulate Completed Draft for HMG Review																								
96	Hold Interagency Coordination Meeting											◆													

## EDC Environment Coordination- Project Specific

ID	Task Name	1996				1997				1998				1999				2000				2001			
		Q1	Q2	Q3	Q4																				
97	Issue Public Notice								◆																
98	Provide Public Access to Report																								
99																									
100	Follow up								◀																
101	Recommend Members of CFC																								
102	Issue EDC Acceptance Letter on EIA								◆																
103																									
104	Licensee Submits Production License Application								◆																
105																									
106	<b>Pre-Production License Period</b>								◀																
107																									
108	EDC Review of Production Application								■																
109	EDC Recommendation to MWR																								
110																									
111	<b>EDC Internal Preparations</b>								◀																
112	Draft/Review Env Provisions in License																								
113	<b>Recommend on Special Provisions</b>								◀																
114	on Environment Management Plan																								
115	on Resettlement Plan																								
116	on Monitoring Plan																								
117	on Public Consultation Plan																								
118	Arrange Interagency Meeting																								
119	<b>Hold Interagency Coordination Meeting</b>								◀																
120	Decide Requirement for Compliance Monitoring																								

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## EDC Environment Coordination- Project Specific

ID	Task Name	1996				1997				1998				1999				2000				2001			
		Q1	Q2	Q3	Q4																				
121	Decide Requirement for Environmental Audit																								
122																									
123	MWR Issues Production License																								
124	Issue Public Notice																								
125																									
126	Production License Period																								
127																									
128	Detailed Design and Tender Period																								
129	Licensee Conducts Detailed Design & Tender																								
130	Six Month Progress Reports																								
131	Licensee Issues Progress Report																								
132	First Six Month Review																								
133	Review Updated Environment Management Plan																								
134	Review Updated Monitoring Plan																								
135	Review Resettlement Plan (if Required)																								
136	Develop Compliance Monitoring Plan																								
137																									
138	Construction Period																								
139	Construction Activity																								
140	Six Month Progress Reports																								
141	Licensee Issues Progress Report																								
142	Second Six Month Review																								
143	On Implementation of Env Management Plan																								
144	On CFC Deliberations																								

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## Appendix B-2

### Requirements for Maintaining Internal Check Lists

Power Project Type	Screening Stage	IEE	EIA	Other
Generation (Under 1 MW)	For preliminary environmental statement			
Generation (Above 1 MW and Under 5 MW)		For EDC review of adequacy of IEE before clearing for HMG review		
Hydro Generation (Over 5 MW)	None as automatic decision		For EDC review of adequacy of EIA before clearing for full HMG review	Interim outputs eg <ul style="list-style-type: none"> <li>▸ Environmental Management Plan</li> <li>▸ Monitoring Plan</li> <li>▸ Resettlement Plan</li> </ul>
Thermal Generation (under 5 MW)	For preliminary environmental statement			
Thermal Generation (Over 5 MW)	None as automatic decision		For EDC review of adequacy of EIA before clearing for full HMG review	
Transmission (under 66 kV and/or short lines)	For preliminary environmental statement	For EDC review of adequacy of IEE before clearing for HMG review		
Transmission( over 66 kV and/or long lines)	None as automatic decision		For EDC review of adequacy of EIA before clearing for HMG review	Interim outputs eg <ul style="list-style-type: none"> <li>▸ Environmental Management Plan</li> <li>▸ Monitoring Plan</li> <li>▸ Resettlement Plan</li> </ul>
Distribution	For preliminary environmental statement and screening decision	For EDC review of adequacy of IEE (if required) before clearing for HMG review	For EDC review of adequacy of EIA (if required) before clearing for HMG review	
Rural Electrification	For preliminary environmental statement and screening decision	For EDC review of adequacy of IEE (if required) before clearing for HMG review	For EDC review of adequacy of EIA (if required) before clearing for HMG review	

as

## **Appendix B-3**

### **Sample Check List for Preliminary Environment Statement: Project Screening**

The following checklists are used for internal consideration of the project attributed. The forms can be used at the project screening stage where there is no obvious indication whether an IEE or EIA is required. They may be used also to prepare for the EIA interagency scoping workshop as outlined in Appendix C-3.

- Annex A     Hydro Generation Projects
- Annex B     Thermal Generation Projects
- Annex C     Transmission Projects
- Annex D     Distribution Projects
- Annex E     Rural Electrification Projects

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## Appendix B-3 - Annex A

### Sample Check List for Assessing Potential Environmental Effects of Small Hydro Projects

The following is an example of a check list form for screening and preliminary evaluation of hydropower projects. This is to assess if there is sufficient information to determine if potentially significant effects are involved, and to ensure that potentially significant issues have not been overlooked. If projects are expected to have significant effects, or are above a critical threshold (eg 5 MW) a full scale EIA is required.

Potential Issues Small Hydro Projects	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect <sup>(1 and 2)</sup>		
				Small	Moderate	Major
<b>A Summary Description of Project</b>						
Region/District Project Impact Area (primary and secondary)						
Nearest Town						
MW Capacity						
Type of Project						
Length of Access Road						
Length of Transmission Line						
<b>B Potential Environmental Issues Due to Project Location</b>						
Physical	Degree of soil erosion in watershed					
	Water quality impacts anticipated					
	Extent of land loss at site for facilities and inundation					
	Ground water impacts anticipated					
	Extent of dry season river dewatering					
	Requirements for minimum release in dewatered section					
	Downstream effects of water releases and change in hydraulic regime					
	Significant access road/transmission impacts expected					
	Presence of upstream natural hazards (eg GLOF and mass wasting)					
	Seismicity design issues anticipated					
	Need for relocation of public facilities (eg road, bridge)					

Potential Issues Small Hydro Projects		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
				No Significant Effect	Significant Effect <sup>(1 and 2)</sup>	
					Small	Moderate
Biotic	Proximity of wildlife habitat and sensitive rare or endangered species					
	Sensitivity of aquatic habitat					
	Potential for fish stock degradation					
	Proximity of facilities to forested areas					
	Proximity to parks or protected area					
	Presence of sensitive flora					
	Other Schedule 3 (National EIA Guidelines) areas affected by project					
Social / Economic	Presence of nearby settlements towns					
	Potential for downstream water use conflicts					
	Presence of religious or heritage sites					
	Likelihood of involuntary resettlement					
	Tourism or other economic impact					
	Pressure on government services					
<b>C Potential Environment Issues Associated with Construction</b>						
Physical	Local air quality deterioration and noise (construction activity and traffic)					
	Blasting drilling and ground vibration					
	Water quality effects (sediment and waste releases)					
	Accident spill control (petrochemicals)					
	Slope destabilization (induced rock and landslides)					
	Reservoir clearing (trees)					
	Borrow pit and quarry rehabilitation					
	Quarry hazards (blasting and hauling)					
	Access road					
	Transmission line construction					
Biotic	Clearing and loss of vegetation					
	Loss/fragmentation of wildlife habitat					

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Potential Issues Small Hydro Projects		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
				No Significant Effect	Significant Effect <sup>(1 and 2)</sup>	
					Small	Moderate
	Loss/fragmentation of aquatic habitat					
	Fish spawning feeding and migration					
	Wildlife disturbance					
	Other unique to site					
Social / Economic	Property loss or damage					
	Involuntary resettlement					
	Avoidance/protection of religious and heritage property					
	Disturbance to agriculture and other economic activity					
	Involvement of local people in construction					
	Worker safety and training					
	Influx of construction workers					
	Work camp sanitation disease vectors and other health effects					
	Other lifestyle and significant cultural impacts unique to project					
	Effects on government services in the area					
<b>D Potential Environment Issues Associated with Operation</b>						
Physical	Long term soil erosion (upstream watershed reservoir access road etc )					
	Water quality (sediment release)					
	Sediment control in reservoir or pondage					
	Sediment in lower river					
	Natural hazard warning systems					
Biotic	Fish and aquatic life					
	Flora impacts					
	Forest impacts					
	Wildlife impacts					
Social / Economic	Enhanced local employment					
	Public safety and security					
	Significant culture and traditional value impacts unique to project					
	Longer-term land use change					
	Impact on government and social services					
	Other induced development effects					

Potential Issues Small Hydro Projects		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
				No Significant Effect	Significant Effect <sup>(1 and 2)</sup>	
					Small	Moderate
<b>E Potential Environmental Enhancement Measures</b>						
Physical	Soil erosion control					
	Natural hazard warning					
Biotic	Fisheries benefits					
Social/ Economic	Local employment					
	Increased electricity service					
	Improved road access					
	Other unique to project					
<b>F Critical Review Criteria</b>						
Physical						
Biotic						
Social / Economic						
Notes	1 Significance of effect (H High M moderate L-Low) 2 Duration of Effect (ST-Short Term LT Long Term)					

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## Appendix B-3 - Annex B

### Sample Check List for Assessing Potential Environmental Effects of Thermal Projects

The following is an example of a checklist form for screening and preliminary evaluation of thermal projects. This is to assess if there is sufficient information to determine if potentially significant effects are involved and to ensure that potentially significant issues have not been overlooked. If projects are expected to have significant effects, or are above a critical threshold (eg 5 MW a full scale EIA is required)

Potential Issue Thermal Projects	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Mod-erate	Major
<b>A Summary Project Description</b>						
Size type cooling mode location of plant, areas served fuel supply and storage planned						
<b>B Potential Environmental Issues due to Project Location</b>						
Physical	Land use at site					
	Soil and ground water conditions at site and waste disposal area					
	Nearness to river or surface water					
	Air emissions expected that would affect human/animal health/vegetation and crop yield/ property					
	Road access issues					
	Cooling water source and requirements if any					
	Transmission line access issues					
	Other Schedule 3 (National EIA Guidelines) areas affected					
Biotic	Proximity to forest					
	Proximity to park or protected area					
	Potential for loss/fragmentation of wildlife habitat					
Social / Economic	Resettlement issues					
	Crops and vegetation effects due to any significant air emissions					
	Heritage or religious properties affected					

Potential Issue Thermal Projects	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Mod- erate	Major
Relocation of public facilities (road, bridge or building)						
<b>C Potential Environment Issues Associated with Construction</b>						
Physical	Significant site preparation issues					
	Local air quality degradation (dust and noise construction activities and traffic)					
	Vibration, drilling, blasting effects					
	Accidental oil spill control and hazardous waste disposal					
	Disposal of construction wastes and materials					
	Borrow pit rehabilitation					
Biotic	Vegetation cutting and clearing					
	Wildlife disturbance					
	Other unique to site					
Social / Economic	Property loss or damage					
	Involuntary resettlement					
	Protection/relocation of significant religious and cultural property					
	Disturbance to agriculture and other economic activity					
	Influx of temporary workers					
	Training and employment of local people					
	Worker safety and training					
Work camp sanitation and other health effects						
<b>D Potential Environment Issues Associated with Operation</b>						
Physical	Landfill waste disposal					
	Liquid and other hazardous waste disposal					
	Control of dust odors oil spills on site					
	Compliance with air emission standards					
Biotic	Effect of leaching at waste disposal sites					
	Other unique to site					
Social / Economic	Maximization of local employment					
	Training and safety of workers					

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Potential Issue Thermal Projects	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
			No Significant Effect	Significant Effect	
				Small	Mod- erate
Site aesthetics					
<b>E Potential Environmental Enhancement Measures</b>					
Physical	As appropriate				
Biotic	As appropriate				
Social / Economic	Local employment				
	Improved electricity service				
	Other unique to project				
<b>F Critical Review Criteria</b>					
Physical					
Biotic					
Social / Economic					
Notes	1 Significance of effect (H-High M-moderate L-Low)				
	2 Duration of Effect (ST-Short Term LT Long Term)				

## Appendix B-3 - Annex C

### Check List for Assessing Potential Environmental Effects of Transmission Projects

The following is an example checklist form for internal screening and preliminary evaluation of transmission projects. This is to assess if there is sufficient information to determine if potentially significant effects are involved, and to ensure that potentially significant issues have not been overlooked. If projects are expected to have significant effects, or are above a critical threshold (eg kV or length, as decided in the project screening stage), an IEE or a full scale EIA may be required.

Potential Issues Transmission Projects	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Mod- erate	Major
<b>A Summary Project Description</b>						
Voltage level line length tower design location of main substations						
<b>B Potential Environmental Issues due to Project Location</b>						
Physical	Variation in terrain in transmission right of way (ROW)					
	Erosion and slope stabilization issues (tower and access road)					
	Other significant access road impacts					
	Road crossings involved					
	River crossings involved					
	Other natural hazards (land slide and rock falls) exposure in ROW					
	Significant issues with substation location					
Biotic	ROW through forested areas					
	ROW through wildlife areas					
	Row through other ecologically sensitive areas					
	Proximity to natural park or protected area					
	Hazard to birds and flyways					
	Other Schedule 3 (National EIA Guidelines) areas affected by ROW or substations					

Potential Issues Transmission Projects	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Mod- erate	Major
Social / Economic	Involuntary resettlement issues					
	Proximity of ROW and substations to religious and cultural properties					
	Disturbance to agriculture or other economic activity					
	Presence of airport or other aviation hazard					
	Impacts of substation located near populated areas or near load center					
	Visual or other aesthetic considerations					
<b>C Potential Environment Issues Associated with Construction</b>						
Physical	Local air quality degradation (dust and noise from construction activities and traffic)					
	Slope stabilization on tower footings and access roads in adverse terrain					
	Water quality with any river crossing construction (sediment and construction waste releases)					
	Localized vibration drilling blasting effects					
	Rehabilitation of borrow pits and quarries for construction works					
Biotic	Loss of vegetation and clearing in ROW					
	Wildlife area avoidance and disturbance					
	Forest clearing in ROW					
	Control of oil spill and other pollutants/contaminant releases					
Social / Economic	Property loss or damage					
	Involuntary resettlement					
	Avoidance/relocation of cultural properties and effect of ground disturbance					
	Training and involvement of local people in construction					
	Other public inconvenience or local disturbances from construction activity					

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Potential Issues Transmission Projects		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
				No Significant Effect	Significant Effect	
					Small	Mod- erate
	Livestock and crop loss/ impacts					
Social / Economic cont	Influx of temporary workers					
	Health impacts and sanitation and work camps					
	Aesthetic measures					
	Aviation warning and hazard measures					
<b>D Potential Environment Issues Associated with Operation</b>						
Physical	Maintenance of access road and patrolling					
	Longer term erosion and slope stabilization control					
	Solid and hazardous waste disposal from operations (mainly sub stations)					
Biotic	Vegetation control and clearing in ROW					
	Control of accidental spills (waste oil petro lubricants and other pollutants)					
	Other project specific					
Social / Economic	Training/local permanent employment					
	Worker on job safety					
	Compensation for crop loss/ property damage during maintenance					
	Public security and safety measures					
	Other project specific					
<b>E Potential Environmental Enhancement Measures</b>						
Physical	Project specific					
Biotic	Edge effect in transmission ROW					
Social / Economic	Temporary and permanent local employment					
	Improved electricity service					
	Improved road access					
	Other project specific					
<b>F Critical Review Criteria</b>						
Physical						
Biotic						
Social / Economic						

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Potential Issues Transmission Projects	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
			No Significant Effect	Significant Effect	
				Small	Mod erate
Notes	1	Significance of effect	(H-High M-moderate L-Low)		
	2	Duration of Effect	(ST-Short Term LT-Long Term)		

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## Appendix B-3 - Annex D

### Check List for Assessing Potential Environmental Effects of Distribution Projects

The following is an example of a check list form for screening and preliminary evaluation of distribution projects. If projects are expected to have significant effects, or are above a critical threshold (eg MW size, as decided in the project screening stage), an IEE or a full scale EIA may be required.

Potential Issue	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Mod-erate	Major
<b>A Summary Project Description</b>						
Voltage level, line length tower design location of main substations						
<b>B Potential Environmental Issues due to Project Location</b>						
Physical	Topography of service area					
	Requirement for access roads for sub-transmission					
	Erosion and slope stabilization issues with sub-transmission towers					
	Sub-transmission road crossings of significance					
	Sub transmission stream or water crossings of significance					
	Other natural hazards (land slide and rock falls) for sub transmission and substations					
Biotic	Sub-transmission ROW through urban park or forested areas					
	Sub-transmission through other ecologically sensitive zone in service area					
	Proximity to urban park or protected area					

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Potential Issue	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
	Hazard to birds and flyway					
Social	Involuntary resettlement issues					
	Conformance to urban zoning and land use planning					
	Effects on religious or cultural properties					
	Par urban agricultural disturbance					
	Airport or aviation issues					
	Public safety and security of facilities					
	Visual impacts and aesthetics					
	Other public perceptions					
<b>C. Potential Environment issues Associated with Construction</b>						
Physical	Vehicle and construction dust noise control					
	Construction cleanup and restoration					
	Construction waste disposal (substations)					
	Waste or borrow pit rehabilitation					
Biotic	Vegetation loss and clearing					
	Tree preservation and controlled cutting					
	Degradation of vegetation					
	Control of oil spill and other pollutants/ contaminants which may release to soil or water sources					
Social / Economic	Property loss or damage					
	Involuntary resettlement					

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Potential Issue		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
				No Significant Effect	Significant Effect	
					Small	Moderate
	Avoidance/relocation of cultural properties and effect of ground disturbance					
	Traffic disturbance					
	Other inconvenience or local disturbances from construction activity					
	Training and involvement of local people in construction					
	Influx of temporary workers (small towns)					
	Health impacts and sanitation of any required work camps or construction sites (eg for substation construction)					
	Visual and aesthetic measures					
	Aviation warning and hazard					
<b>D Potential Environment Issues Associated with Operation</b>						
Physical	Erosion and slope stabilization control					
	Solid and hazardous waste disposal					
Biotic	Tree cutting and vegetation control and clearing					
	Control of accidental spills (waste oil petro lubricants and other pollutants)					
	Other project specific					
Social	Worker on job safety					
	Compensation for crop loss/property damage during maintenance					
	Public security and safety					
	Other project specific					
<b>E Potential Environmental Enhancement Measures</b>						

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Potential Issue		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
				No Significant Effect	Significant Effect	
					Small	Moderate
Physical	Project specific					
Biotic						
Social	Temporary and permanent local employment					
	Improved electricity service					
	Other					
<b>F Critical Review Criteria</b>						
Physical						
Biotic						
Social						
Notes	1 Significance of effect (H High M-moderate L-Low)					
	2 Duration of Effect (ST Short Term LT-Long Term)					

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## Appendix B-3 - Annex E

### Check List for Assessing Potential Environmental Effects of Rural Electrification Projects

The following is an example of a check list form for screening and preliminary evaluation of rural electrification projects. Rural electrification schemes will generally require an IEE, as they are listed as Schedule I Projects in the National EIA Guidelines. If projects are expected to have very significant effects, or are above a critical threshold (eg MW size, as decided in the project screening stage), a full scale EIA may be required.

Potential Issue	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
<b>A Summary Project Description</b>						
Voltage level line length tower design location of main substations						
<b>B Potential Environmental issues due to Project Location</b>						
Physical	Topography of service area					
	Soil conditions (salinity resistivity) and erosion conditions					
	Requirement for access roads for sub-transmission					
	Erosion and slope stabilization issues with sub-transmission towers					
	Sub transmission road crossings of significance					
	Sub-transmission stream or water crossings of significance					
	Other natural hazards (land slide and rock falls) for sub-transmission and substations					
Biotic	Sub transmission ROW through forested areas					
	Sub transmission through other ecologically sensitive zone in service area					
	Proximity to park or protected area					

Potential Issue	Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
			No Significant Effect	Significant Effect		
				Small	Moderate	Major
	Hazard to birds and flyways					
	Changes to wildlife population or habitat in area					
Social	Involuntary resettlement issues					
	Other property loss or changes in land values					
	Effects on religious or cultural properties					
	Agricultural (crop fodder fuelwood) and livestock disturbance					
	Aviation hazard issues					
	Public safety and security of facilities					
	Visual impacts and aesthetics					
	Other public perceptions and changes in social organization					
<b>C. Potential Environment Issues Associated with Construction</b>						
Physical	Soil erosion control					
	Interruption of subsoil and drainage patterns					
	Vehicle and construction dust noise control					
	Construction cleanup and restoration					
	Construction waste disposal (substations)					
	Landslides slumps and slips from road cuts					
	Increased suspended sediment in streams and other water supply (potable irrigation or animal)					
	Groundwater effects					
	Waste or borrow pit rehabilitation					
Biotic	Vegetation loss and clearing					

Potential Issue		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected			
				No Significant Effect	Significant Effect		
					Small	Moderate	Major
	Tree preservation and controlled cutting						
	Wildlife disturbance						
	Degradation of crops						
	Control of oil spill grease fuel and other pollutants/contaminants which may release to soil or water sources						
Social / Economic	Property loss or damage						
	Involuntary resettlement						
	Avoidance/relocation of cultural properties and effect of ground disturbance						
	Traffic disturbance						
	Other inconvenience or local disturbances from construction activity						
	Training and involvement of local people in construction						
	Influx of temporary workers						
	Health impacts and sanitation of any required work camps or construction sites (eg for substation construction)						
	Visual and aesthetic measures						
	Aviation warning and hazard						
<b>D Potential Environment Issues Associated with Operation</b>							
Physical	Erosion and slope stabilization control						
	Solid and hazardous waste disposal						
	Drainage patterns affected by maintenance activities						
Biotic	Tree cutting and vegetation control and clearing						
	Control of accidental spills (waste oil petro lubricants and other pollutants)						

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Potential Issue		Potential Environmental Effect	Possible Mitigation Measures	Degree of Impact Expected		
				No Significant Effect	Significant Effect	
					Small	Moderate
	Other project specific					
Social	Worker on job safety					
	Compensation for crop loss/ property damage during maintenance					
	Public security and safety					
	Other project specific					
<b>E Potential Environmental Enhancement Measures</b>						
Physical	Project specific					
Biotic	Project specific					
Social	Temporary and permanent local employment					
	Improved electricity service					
	Other					
<b>F Critical Review Criteria</b>						
Physical						
Biotic						
Social						
Notes	1	Significance of effect	(H High M moderate L-Low)			
	2	Duration of Effect	(ST Short Term LT-Long Term)			

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## Appendix B-4

### Checklist for EDC's Internal Review of IEE and EIA Reports

The following checklist is suggested for internal review of IEE/EIA reports received by EDC. The purpose of the checklist is to verify that the IEE/EIA reports are sufficiently comprehensive (ie no missing sections) and that the reports submitted to EDC are ready to be circulated for wider HMG review. If there are obvious or serious deficiencies in the reports and the study methodology, EDC would request the licensee to make the necessary modifications and resubmit the report.

Review Item	Yes	No	Comments
<b>Section A Report Format and Completeness</b>			
1			
2			
3			
4			
5			

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	Review Item	Yes	No	Comments
6	Are results and conclusions presented in a manner that can be understood by an informed public and HMG decision makers?			
7	Are the data and methodological limitations and key assumptions clearly presented in the report?			
8	Have project alternatives been adequately addressed? eg (i) Size and scale of the project (ii) Technical and design alternatives (eg adjustments in the dam height, inundation area, dam design, and operational procedures to minimize negative impacts) (iii) Site and location alternatives for major infrastructure to minimize negative impacts (iv) Timing and phasing of project implementation to optimize beneficial impacts (v) Alternative mitigation approaches for significant adverse impacts			
9	Does the report provide a clearly identified (i) Environmental Management Plan (ii) Environment Monitoring Plan (iii) Resettlement Plan			
10	Are the project maps in the report adequate?			
11	Are information sources and data collection instruments clearly presented?			
12	Are there any significant deficiencies in the report format and documentation?			
<b>Section B Review Parameters for Project Acceptance</b>				
<b>Impact Identification</b>				
13	Is the description of baseline conditions and the supporting baseline data comprehensive and adequate ie on the (i) Physical environment (ii) Biotic environment (iii) Social and cultural environment (iv) Local economy (v) Local Institutions			

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	Review Item	Yes	No	Comments
14	Does the project significantly impact on environmentally sensitive areas? (i) Upstream (ii) At the project site and surrounding area (iii) Downstream (iv) At access roads and transmission			
15	Is the project impact area clearly and adequately defined and classified? eg (i) Project site and high impact areas (ii) Surrounding areas or moderate impact areas (iii) Outlying or low impact areas			
16	Are the significant beneficial and adverse long-term impacts clearly identified? (i) Physical environment (ii) Biotic environment (iii) Social and cultural environments			
17	Are sensitive, rare or endangered species identified in the project impact areas? (i) Wildlife (ii) Flora (iii) Forests			
18	Are the probable risks associated with significant impacts and natural hazards clearly identified?			
19	Are the probable spatial and temporal effects of potential significant construction impacts clearly identified? (i) Timing (ii) Duration (iii) Intensity (iv) Frequency (v) Scope			
20	Have adequate provisions for dry season minimum flow been identified on a rational basis?			
21	Is significant involuntary resettlement involved in the project? and if so (i) Are resettlement issues fully addressed? (ii) Is there a requirement for preparation of a formal resettlement plan or a recommendation on this?			

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	Review Item	Yes	No	Comments
22	Is significant relocation of any existing public infrastructure required and properly addressed?			
23	Are probable secondary effects adequately addressed including induced development?			
24	Are the project impacts affected by or covered under any international conventions or treaties?			
25	Are there any significant deficiencies in the report on the identification of project effects and impact prediction?			
	<b>Mitigation Measures</b>			
26	Are mitigation measures clearly proposed in the environment management plan?			
27	Do mitigation measures appear adequate for identified impacts? (i) Physical environment (ii) Biotic environment (iii) Social and cultural environment			
28	Has adequate attention been paid to compensation for loss or damage to personal and public property?			
29	Has adequate attention been paid to training of local people and maximizing their involvement in the project labor force?			
30	Are there any significant deficiencies in the report on the identification of mitigation measures?			
	<b>Working Procedures</b>			
31	Do the quantitative standards used conform to national guidelines and regulations? eg (i) Water pollution (ii) Air pollution (iii) Other as applicable			
32	Have the costs of enhancing beneficial impacts and mitigating adverse impacts been incorporated in the economic analysis of the project?			
33	Was the scoping phase of the study adequate and documented?			

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and Management of Power Sector Projects*

	Review Item	Yes	No	Comments
34	Were the results of the consultation process clearly documented? (i) For interagency consultation (ii) For general public consultation (iii) For project affected persons			
35	Are there any significant deficiencies in the report on the working procedures?			
	<b>Implementation</b>			
36	Are institutional arrangements for implementing mitigation measures adequately addressed?			
37	Have the agencies roles and responsibilities for impact and compliance monitoring been specified in the report?			
38	Have the costs for implementing mitigation measures been fully identified?			
39	Has an assessment been made of the financial and technical capability to implement measures in the environment management and monitoring plan?			
40	Are there any significant deficiencies in the report on the implementation approach?			

## Appendix B-5

### Generic Environment Impacts of Thermal Projects

The following is a generic list of physical and biotic environment aspects of Thermal Projects that would be considered. This list excludes detailed consideration of potential socio-economic considerations and applies more broadly to steam and CT plant. Diesel plant under 5 MW would have more limited potential effects.

#### Thermal Power Station Environment Considerations

- (1) Managing environmental protection issues in power plant design and operation requires consideration of the potential for
  - ▶ liquid effluent
  - ▶ drinking water
  - ▶ plant efficiency
  - ▶ fuel strategy
  - ▶ sewage
  - ▶ air emissions
  - ▶ liquid effluent
  - ▶ solid wastes
  - ▶ monitoring and reporting
  - ▶ standards and maximum permissible levels
  - ▶ personnel training
- (2) Potentially Undesirable Elements
  - ▶ odors
  - ▶ noise
  - ▶ visual impacts
  - ▶ discharge of pollutants
  - ▶ socio-cultural impacts
  - ▶ biophysical impacts
- (3) Three main WASTE streams from power stations are
  - ▶ gaseous emissions
  - ▶ liquid effluent
  - ▶ solid waste
- (4) For each stream need to know
  - ▶ quantity of discharge
  - ▶ individual contaminants present
  - ▶ quantity of contaminant
  - ▶ source of contaminant
  - ▶ if hazardous material present

- (5) Potential Gaseous Emission Stream
- ▶ SO<sub>x</sub> (SO<sub>2</sub> major constituent, SO<sub>3</sub>)
  - ▶ NO<sub>x</sub> (NO, NO<sub>2</sub>, NO<sub>3</sub>)
  - ▶ CO<sub>2</sub>
  - ▶ particulate matter
  - ▶ trace toxic contaminants
  - ▶ vapor emissions

Different technologies (steam, CT, CC) and fuels (coal, fuel oil, gas) produce variable amounts of emissions

- (6) Potential Liquid Effluent Stream can be broken down to three types

- ▶ plant cycle
- ▶ interval drains
- ▶ storm water related

- (a) Plant Cycle may contain (mainly steam)

- boiler blowdown may contain
  - phosphatic compounds may contain
  - caustic compounds
  - hydrazine
  - others
- continuous blowdown may contain similar elements
- flushing and cleaning during plant maintenance and start up will produce similar elements
- cooling water (open systems) may have
  - chlorine
  - defouling agents
- closed systems may have
  - chromate
  - sulphuric acid
  - other
- cooling tower blowdown will contain blowdown chemicals

- (b) Internal drainage systems liquid and sludge wastes from

- oil leaks and fluid leakages
- cooling water leaks
- wash water
- consists of sludge and chemicals
- water waste needs to be treated before release

- (c) Storm water (drain run off)

- Ash pond run off needs to be contained and treated and may contain heavy metals such as
  - mercury
  - lead
  - copper
- coal pile run off needs to be impounded and cleaned before release
- oil tanks, run off from spills needs to be contained

- (7) Liquid discharge protection reasons
- ▶ recreation value
  - ▶ drinking quality
  - ▶ aquatic life protection
- (8) Limit placed on liquid waste typically for
- ▶ suspended solids
  - ▶ to prevent sludgy build up in water course
  - ▶ dissolved solids
  - ▶ hardness, scale
  - ▶ nutrients, such as
    - nitrogen
    - carbon
    - phosphorous
    - biodegradable organics
    - organic depletion
    - protein
    - carbohydrates
  - ▶ bad smells
  - ▶ COD, BOD
  - ▶ heavy metals
    - lead
    - copper
    - impacts on zinc
    - others
  - ▶ fish and human impacts at high levels
  - ▶ toxic organic compounds
    - possible carcinogenic, e.g.
    - hydrazine in boiler feed water systems is practice now charging
    - chromate
  - ▶ oil and greases
  - ▶ acidity (should be 6-9 Ph)
  - ▶ temperature
- (9) Potential Solid and Hazardous Waste Streams
- ▶ Ash from Boilers
  - ▶ Dried Solid FGD Slurry (steam only)
  - ▶ Dried and Solid Sludge from other Waste Water
  - ▶ Maintenance Wastes
- (10) Potential Solid Waste Disposal
- ▶ Potential Issues
    - dust blown ash containment
    - storm water impoundment
    - percolation and leaching

Normally solid wastes are carried to industrial or sanitary land fill

(11) Regulations and Standards

- ▶ continuously updated and expanded by government agencies
- ▶ many may conflict and not agree
- ▶ emissions with established limits and restrictions are observed

(a) Acts e g

- clean air
- clean water
- safe drinking
- toxic waste
- many other - preservation of wildlife and scenic value

(b) Limits and Restrictions on

- air emissions
- liquid effluent
- solid waste disposal

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## Appendix B-6

### Sample External Guidelines for Environmental Study Issues

#### B6 1 Suggested Guidelines for EA (EIA) Report Format

**Executive Summary**, which highlights significant findings and recommended actions in order of importance, in non-technical language not more than 20 pages in length

A discussion of the **policy, legal, and administrative framework** within which the EA is prepared

Concise **project description** including geographic, ecological, social, and temporal context, and any off-site investments that may be required by the project

**Baseline Data**, including an assessment of the dimensions of the study area and description of relevant physical, biological, and socioeconomic conditions, and any changes anticipated before the project commences. Current and proposed development activities within the project area, but not directly connected to the project, should also be taken into account

**Environmental Impacts**, including identification and assessment of the positive and negative impacts likely to result from the proposed project. Mitigation measures, and any residual negative impacts that cannot be mitigated, should be identified. Opportunities for environmental enhancement should be explored. The extent and quality of available data, key data gaps, and uncertainties associated with predictions should be identified/estimated. Topics that do not require further attention should be specified

**Analysis of Alternatives**, including a systematic comparison of the proposed investment design, site, technology, and operational alternatives in terms of their potential environmental impacts, capital and recurrent costs, suitability under local conditions, and institutional, training and monitoring requirements. For each of the alternatives, the environmental costs and benefits should be quantified to the extent possible, and economic values should be attached where feasible. The basis for the selection of the alternative proposal for the project design must be stated

**Mitigation Plan** (also known as the "environmental action plan", "environmental mitigation plan" or "environmental management plan"), including identification of feasible and cost-effective measures to reduce potentially significant adverse environmental impacts to acceptable levels, estimation of the potential environmental impacts, capital and recurrent costs, and institutional, training, and monitoring requirements of those measures. The plan should provide details on proposed work programs and schedules. The plan should also consider compensatory measures if mitigation measures are not feasible or cost-effective

**Environmental Management and Training**, including identifying the existence and role, and assessing the capability of environmental units on-site, or at the agency and ministry level. Based on these findings, recommendations should be made concerning the establishment and/or expansion of such units, and the training of staff, to the point that EA recommendations can be implemented

**Environmental Monitoring**, including specification of the type of monitoring, who would do it, how much it would cost, and what other inputs (e.g. training) are necessary

**Appendices**, including a list of those persons and organizations that prepared the EA, a list of references and personal contacts (e.g. government agency staff, university and research institute experts, etc.) used in preparing the study, and a record of interagency/forum/consultation meetings used to obtain informed views of affected people and local NGO's

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Source World Bank (1991) Operational Directive 4.01 Environmental Assessment The World Bank Operational Manual World Bank Washington, D.C.

## **B6 2 Suggested Guidelines for Avoiding Problems with Data Collection**

Environmental and sociological data collection programs should be designed to avoid the following

- ▶ Collecting data that are not relevant to the decisions to be made
- ▶ Sampling the correct parameters but timing the observations incorrectly or making an insufficient number of observations for an acceptable representation of the phenomena being studied
- ▶ Omitting key parameters from the program

Other measures include

- ▶ Have EDC or licensees placed on regular report circulation list where agencies generate secondary data relevant to the EIA or monitoring
- ▶ Establish possibility of electronic data collection to avoid entry, verification and data accuracy problems
- ▶ Ensure that surveys are pre-checked and tested to avoid problems when they are fully applied in the field

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Source World Bank (1991) Operational Directive 4.01 Environmental Assessment The World Bank Operational Manual World Bank Washington, D.C.

## **B6 3 Suggested Guidelines for Preparing the Environmental Mitigation/Management Plan**

Mitigation plans are essential elements of projects requiring IEE's and EIA's. A mitigation plan should include the following items

- ▶ Identification and summary of all the significant anticipated adverse environmental impacts
- ▶ Description and technical details for each mitigation measure, including the type of impact to which it relates and the conditions under which it is required
- ▶ Institutional arrangements -- the assignment of the various responsibilities for carrying out the mitigatory measures

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- ▶ Implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans
- ▶ Monitoring and reporting procedures to
  - ensure early detection of conditions that necessitate particular mitigation measures
  - provide information on the progress and results of mitigation
- ▶ Integration into the total project cost tables of the cost estimates and sources of funds for both the initial investment and the recurring expenses for implementing the mitigation plan

Most mitigation plans also cover technical assistance programs, staff development, procurement of equipment and supplies, and organizational changes

The Bank's decision to support a project will, in part, be dependent on the expectation that the mitigation plan will be executed effectively. Consequently, it is important to integrate the plan into the project's overall planning, design budget, and implementation. Such integration should be achieved by establishing the mitigation plan as a component of the project. Specific links should exist for funding, management and training (strengthening local capabilities), and monitoring.

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Source: World Bank (1991) Operational Directive 4.01 Environmental Assessment. The World Bank Operational Manual. World Bank, Washington, D.C.

#### **B6.4 Suggested Guidelines for Public Involvement/ Consultation on EA (EIA) Studies**

Community involvement is useful in the analysis of the distribution of project costs and benefits.

Prior to consultations with affected groups and local NGO's, the borrower should provide relevant information in a timely manner, and in a form that is meaningful, and accessible to, the groups being consulted.

The borrower should make available, at some public place to the groups consulted in preparing the EIA, the EIA report and summaries of:

- (i) the project description and objectives
- (ii) the potentially adverse effects of the proposed project, and
- (iii) the conclusions of the EIA report

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Source: World Bank (1991) Operational Directive 4.01 Environmental Assessment. The World Bank Operational Manual. World Bank, Washington, D.C.

## **B6 5 Suggested Guidelines for Involuntary Resettlement**

Involuntary resettlement should be avoided or minimized, and alternative solutions must be explored

When it is required to relocate people, the productive base and income-earning ability of those affected must be improved, so that they share the benefits of the new development, and are compensated for transitional hardships

Displaced people should at least regain their previous standard of living

Families should be able to choose from a number of acceptable alternatives, and be allowed to rebuild their lives through their own efforts

Relocates should be assisted to become socially and economically integrated into the host communities

Responsibility for relocating people rests with the Borrower, with oversight provided by the Bank

The costs of resettlement must be included in the economic and financial analyses of the project

For a more detailed information concerning the Bank's resettlement policy guidelines, and analytical and planning tools for involuntary resettlement, the reader is referred to Cernea (1988, **Involuntary Resettlement in Development Projects**, World Bank Technical Paper No 80, Washington World Bank)

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Source R. Goodland (1985), in J A Dixon, et al, (1989) **Dams and the Environment Considerations in World Bank Projects** World Bank Technical Paper Number 110

## **B6 6 Suggested Guidelines for Projects Affecting Tribal People**

The Bank must be satisfied that the Borrower can implement measures to effectively protect the integrity and well-being of tribal people

Extreme measures that perpetuate isolation from the national society and important social services, and measures that promote forced acculturation are to be avoided

The Bank will not assist with a project if it appears that tribal people have been forcibly dispossessed and cleared from the project area without being given culturally and economically viable alternatives

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Source R. Goodland (1985), in J A Dixon, et al, (1989) **Dams and the Environment Considerations in World Bank Projects** World Bank Technical Paper Number 110

## **B6 7 Suggested Guidelines for Protecting Cultural Property**

The Bank normally will not assist with projects that will significantly damage non-replicable cultural property, and will only assist those projects that are sited or designed to prevent such damage

The Bank will assist in the protection and enhancement of cultural properties encountered in Bank-assisted projects, rather than leaving that protection to chance

Deviation from the above may be justified only where expected project benefits are great and the loss of, or damage to, cultural property is judged by competent authorities to be unavoidable, minor, or otherwise acceptable

For more detailed information regarding guidelines on the management of cultural properties, the reader is referred to Goodland and Webb (1988, **The Management of Cultural Property in World Bank Assisted Projects**, World Bank Technical Paper No 62, Washington World Bank)

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Source R. Goodland (1985), in J A Dixon, et al, (1989) **Dams and the Environment Considerations in World Bank Projects** World Bank Technical Paper Number 110

## **B6 8 Suggested Guidelines for Projects Affecting Wildlands**

The Bank will normally decline to support projects involving wildlands of special concern, including areas which are recognized to be exceptionally important in conserving biological diversity or perpetuating species

Even where wildlands other than those of special concern are involved, the Bank prefers to site projects on already converted lands

Deviations from this policy must be specifically justified Where such justification is made, less valuable wildlands should be converted rather than more valuable ones

Loss of wildlands must be compensated for by including a wildland management component in the project that directly supports preservation of an ecologically similar area

For more detailed information concerning guidelines on the management of wildlands, the reader is referred to Ledec and Goodland (1988, **Wildlands Their Protection and Management in Economic Development**, World Bank Technical Paper, Washington World Bank)

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Source R. Goodland (1985), in J A Dixon, et al, (1989) **Dams and the Environment Considerations in World Bank Projects** World Bank Technical Paper Number 110

## **B6 9 Suggested Guidelines for Examining Secondary Environmental Effects of Projects**

Secondary effects on the environment are important and must be taken into account

These effects are the consequence of a population influx in the town or region, and they include water and power distribution, sewage collection and treatment, housing, schools and roads

In developed countries, the ratio between employment in the new plant and new employment in the region is usually one to seven, or one to eight. Although the conditions are different in less developed countries (LDC's), the same ratio can be applied

The Bank's Urban Development Planning and/or Financing Departments should be consulted on problems likely to arise. The goal of this guideline is only to draw attention to the potential trouble and to suggest economical solutions in certain areas, thus preventing expansion of appalling conditions such as urban slums

In the forecasts for water and power consumptions, not only the plant requirements, but also the town's future uses should be taken into consideration

Sewage collection and treatment should receive special attention, including treatment effectiveness, and environmental sensitivity and assimilative capacity of receiving waters

A pretreatment of the industrial effluent followed by treatment in a sewage plant common to both the town and the plant has advantages for both and, therefore, should be considered

Domestic and industrial solid waste disposal should be addressed in the planning stages and suitable disposal options should be identified

Adequate housing and schools should be provided, as well as roads and transportation. While the industrial project cannot always be saddled with costs for improving the general infrastructure of a town or region, these expenditures might otherwise be unaffordable

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Source: R. Goodland (1985), in J. A. Dixon, et al. (1989) *Dams and the Environment: Considerations in World Bank Projects*. World Bank Technical Paper Number 110

## **B6 10 Suggested Control Technologies for Fixed Point Sources of Sulfur Dioxide (SO<sub>2</sub>)**

The following is included for reference only. The emission criteria are applicable to all fixed point industrial sources of SO<sub>2</sub>. However, the control technology discussion presented below is primarily for fossil burning facilities: coal or oil fired power plants and steam boilers unless otherwise stated

It is expected that desulphurization technologies will play an increasing role in SO<sub>2</sub> control standards and strategies in the future. The most commonly used methods for sulfur control are grouped as follows

- (a) Fuel desulphurization processes, which consists of coal, oil and gas cleaning. With coal, desulphurization of pyritic sulfur is accomplished with heavy media floatation. Unfortunately, if the sulfur is not present in pyritic form, this technique is not effective. Oil and gas desulphurization is affected with catalytic hydrogenation to hydrogen sulphide and subsequent removal by any number of removal processes.
- (b) Fuel conversion, involves any processes which convert the entire feedstock to a lighter form including oil to gas, coal to liquid fuel, coal to gas, with subsequent hydrogen sulphide removal by processes referred to above.
- (c) Process modifications and especially modification of combustion techniques. In some countries sulfur is effectively recovered and either recycled in the operation or sold as a byproduct.

Fluidized bed combustion with lime or limestone injection and recirculation of combustion gases offers a significant reduction of SO<sub>2</sub> emissions. This process is new (1988), but vendors are willing to provide performance guarantees. As long as the purchaser recognizes he will be operating more of a chemical process unit rather than a conventional boiler, this can be an attractive possibility.

- (d) Flue gas desulphurization consists of processes which scrub SO<sub>2</sub> from the flue gas into a liquid. Scrubbing liquids can remove the SO<sub>2</sub> permanently (non-regenerable processes such as lime/limestone slurry) or temporarily (regenerable processes such as magnesium slurry or sodium solution). Regenerable systems release concentrated SO<sub>2</sub> for further use or sale (as sulfur, sulphuric acid, etc.), and allow the scrubbing liquid to be recycled. Non-regenerable systems have enjoyed the greatest level of commercial success. Regenerable systems are not as developed commercially.

These systems are cumbersome and expensive, and the non-regenerable systems require large amounts of water and create a sludge whose disposal requires careful environmental considerations and large land areas.

- (e) Fuel substitution and energy conservation -- fuel substitution includes alternate power forms such as nuclear, solar or hydropower. Alternatively, it can include blending high sulfur coals or oils with lower sulfur materials to achieve a net lower effective sulfur input. It can also include slurring, powdered coal with lower sulfur oil to achieve this net sulfur reduction.
- (f) Intermittent control strategy is a technique wherein a higher sulfur fuel is used during times when wind conditions are favorable. When wind conditions shift, (wind now blowing over a small village) a switch is made to a lower sulfur alternate fuel. This control technique, while effective, requires an accurate model of the stack plume, constant monitoring of wind and SO<sub>2</sub> levels, and an ample supply of low sulfur fuel on standby.
- (g) High stacks -- simply cause greater dilution of SO<sub>2</sub> in the atmosphere. This technique offers no protection from the acid rain problem, but provides a stop-gap measure to protect an immediate environment from excessive levels of SO<sub>2</sub>. It is not recommended as a regular means of control, and will be accepted in only the most unusual circumstances.
- (h) The variety of techniques available can be expanded in a further direction by considering combinations of techniques, such as coal cleaning (for pyritic sulfur) and fluidized bed combustion (for organically bound sulfur).

- (i) To properly determine an appropriate strategy, it is recommended that an experienced consultant be retained to examine the most reasonable alternative for a given requirement

Source World Bank (1988), Washington, D C

## **B6.11 Suggested Control Technologies for Fixed Point Sources of Oxides of Nitrogen (NO<sub>x</sub>)**

The following is included for reference only and applies to larger thermal plant. In special situations it may be difficult to adhere to the Bank's standards for controlling NO<sub>x</sub> emissions. Examples of situations where it may not be possible to be met, with acceptable modifications, include

- (a) Expansion of existing plants -- The Annual Arithmetic Mean and the maximum 24-hour peak resulting from the combination of the old units with the new ones should be no greater than the values existing prior to operation of new units. In addition, the new units by themselves should meet established standards

More simply, emission plumes from new and existing sources should not mix to the extent that combined ambient concentrations exceed maximum ambient concentrations obtained from the existing source alone. This may be accomplished by (i) increasing the stack height of the new source, (ii) changing the stack location of the new source, or (iii) reducing the new source emission levels. Furthermore, if plume mixing is not a problem the new source units should, by themselves, meet the Bank's standards

- (b) Revamping of existing plants -- Every effort should be made to decrease existing pollution levels and provide measures which will minimize concentrations without placing unreasonable economic burdens on the industry
- (c) Inversions -- When the NO<sub>x</sub> source location is in a valley or surrounded by mountains, inversion layers which may occur during certain seasons of the year could trap the stack emissions. These same emissions can drop back to ground level, stagnate there, and damage crops sensitive to both SO<sub>2</sub> and NO<sub>x</sub>. In World Bank financed projects it may be impossible to change the site locations (i.e. in the case of an existing plant). To protect human and plant life in such cases, the peak concentration should be decreased from 500 ug/m<sup>3</sup> during any 24-hour period down to 350 ug/m<sup>3</sup> during 4 hours, unless it can be shown that the emissions will not be trapped by the inversion layer
- (d) Emission control measures must be designed for each individual plant, particularly since the system must be capable of reducing more than one pollutant in most situations
- (e) Mobile source emissions are also reduced through changes in combustion chamber design (such as lower compression ratios), spark retardation (including both basic timing and a "slower" advance curve), and exhaust gas recirculation
- (f) The NO<sub>x</sub> emissions from oil-fired combustion systems can be reduced by mixing water with oil before it is sprayed into the burners. Water decreases the combustion temperatures, and can reduce NO<sub>x</sub> emissions from light-weight oils by as much as 15%. Energy-wise, however, the method is considered to be costly

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- (g) Emissions from stationary sources, such as utility and industrial combustion installations, can be reduced by a number of methods. Among these, staged combustion, low excess air operation, and flue gas recirculation are widely used.
- (h) Staged combustion is effective for control of both thermal and fuel  $\text{NO}_x$ . The method consists of initially providing less than the amount of air ( $\text{O}_2$ ) required for complete combustion. After a time delay more air is added in one or more steps or stages. The method is applicable to a wide range of fuels and facilities, from pulverized coal burners to small scale industrial boilers. Addition of this method to existing coal-burning installations has resulted in a 30% to 50% reduction of  $\text{NO}_x$  emissions.
- (i) In the low excess air method, the principal mechanism is also the lack of available oxygen for combining with either thermal activated or cracked fuel activated nitrogen atoms. This method can be combined with the staged combustion process, and can reduce nitrogen oxide emissions by 40% to 70%, without seriously increasing carbon monoxide emissions.
- (j) Flue gas recirculation has been effective in controlling thermal nitrogen oxides. The recirculation of exhaust gases to the flame regions reduces peak temperatures and oxygen availability, thus reducing nitric oxide formation. This method is more difficult to apply, since it requires increased operation controls and greater capital investment.
- (k) A number of methods are under further study for stationary power source emissions. These include burner design changes, water/steam injection, wet scrubbing with aqueous ammonia, and fluid bed combustion.
- (l) For emissions of oxides of nitrogen ( $\text{NO}_x$ ), the Bank suggests the following stationary source atmospheric discharges (as Nanograms per Joule of heat input) for a given fuel source in a fuel-fired steam generator, where the ambient air concentration is  $100 \text{ ug/m}^3$  (0.05 ppm), expressed as the arithmetic mean of  $\text{NO}_2$ .
- |                       |     |
|-----------------------|-----|
| ▶ gaseous fossil fuel | 86  |
| ▶ liquid fossil fuel  | 130 |
| ▶ solid fossil fuel   | 300 |
| ▶ lignite fossil fuel | 260 |

Source: Adapted from World Bank (1988), Washington, D.C.

## Appendix B-7

### Example Approach for Developing Public Utility (Corporate) Environmental Policy

EDC has oversight over the Electricity Act and Regulations under which all production, transmission and distribution licenses are issued. For the larger public sector organizations, it is becoming common practice to develop internal policies and procedures for environment management and review of all the public utility operations. The following illustrates how a western public utility reports on its internal environment policies and procedures. Some sections would not be applicable in Nepal but the format and scope of considerations is illustrated. References 4, 5 and 8 noted in Appendix A provide example operational guidelines for environment management for transmission and minor distribution facilities which a public utility such as NEA may develop.

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<sup>1</sup> Reproduced from Ontario Hydro Environment Performance Report, 1992

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## **Appendix C**

### **Recommendations on External Information Packages for EDC to Give to Licensees**

- C - 1 HMG's Environment Policy and Processes for Power Projects
- C - 2 IEE and EIA Guidelines
- C - 3 Sample Guidelines for EIA Scoping Workshops
- C - 4 Sample Terms of Reference (TOR) for Project IEE/EIA's

## **Appendix C-1**

### **HMG's Environment Policy and Processes for Power Projects**

It will be important to restate HMG requirements for environmental study and review of Power Projects including

- (i) The classification of all Power Projects for IEE and EIA study in relation to the critical threshold values
- (ii) The EIA process and the procedures for interagency review and public consultation, as well as a clear statement of EDC's roles and those of the project proponent

These aspects are expected to be updated and revised in the forthcoming, Environmental Impact Assessment Guidelines for Water Resource Sector (Power and Irrigation), initial draft June 1994

## **Appendix C-2**

### **IEE and EIA Guidelines**

Guidelines which EDC should make available to all Licensees

- ▶ National EIA Guidelines (1993)
- ▶ Environmental Impact Assessment Guidelines for Water Resource Sector (Power and Irrigation), June 1994 - the updated and finally approved version
- ▶ Guidelines for Initial Environmental Assessment of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 459, Updated Nov 1995
- ▶ Guidelines for Environmental Monitoring of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 460, Updated Nov 1995
- ▶ Guidelines for Environmental Auditing of Water Resources and Energy Projects, WECS Report No 6/3/161294/1/1 Seq 461, Updated Nov 1995

## Appendix C-3

### Sample Guidelines for EIA Scoping Workshops<sup>1</sup>

#### 1 Background

The purpose of the scoping phase of the EIA is to develop consensus and understanding of overall EIA study process and requirements suited to the project under consideration. The main issues, methodologies and scope of the EIA study are established during this phase. Interagency coordination meetings on the criteria and methodology are initiated during the scoping phase and initial public notice and participation is invited.

Activities and outputs from the scoping phase, as indicated in the National EIA Guidelines, must include

- ▶ A plan for public involvement during the EIA
- ▶ A plan for collecting relevant data and information for baseline monitoring
- ▶ Notification and information to public on the EIA
- ▶ Identification of major issues of public concern
- ▶ Evaluation of the seriousness of potential environment and socioeconomic issues
- ▶ Priorities and areas of focus for study in the EIA
- ▶ Strategy for addressing priority issues

HMG's intention is to establish an open consultative process for the EIA, starting with the front-end scoping phase. Stakeholders generally include power sector agencies, environment agencies, other central and local government involved with specific aspects of the project, affected communities and people, local NGO's operating in the project area, and the general public including and other interested organizations such as I/NGO's.

Following the scoping phase the Terms of Reference for the EIA study is finalized. The licensee will thus have to engage personnel for the scoping phase prior to arranging for the full EIA. It would be important that there is some continuity in personnel.

#### 2 Scoping Workshop Mechanism

The "Workshop" approach for scoping phase of EIA studies is an efficient and effective method obtaining input from many different experts and sources at the same time. The workshop method as described here would not be used for project affected persons. However it would be effective for the EIA project steering group, expert panel and public consultation with the public such as involving professional associations and NGO's. Workshops can be of any size but most effective workshop bring together about 20 - 25 people representing acknowledged experts, policy makers, representatives of government agencies and the licensees' EIA team.

The Workshop approach typically uses a series of meetings with different objectives for each meeting. The first workshop is a "brainstorming" session. The purpose is to describe the project to all participants identify available

<sup>1</sup> Adapted from Environmental Impact Assessment Scoping Workshop Approaches developed and used by Ontario Hydro in Canada.

information, information deficiencies and priorities for filling the gap between available data and data requirements

Following this a number of working hypotheses about the likely significant environment or social cause and effects. The working group focuses on these hypotheses. This approach will help overcome three major problems by minimizing

- ▶ Requirements for additional information or study, arising late in the process and thereby forcing project delays
- ▶ Requests for data to satisfy personal, academic or research interests unrelated to project approval needs
- ▶ Criticism of EA methodology, effects predictions, etc based on poor understanding of project details

The workshop approach encourages early participation of all the relevant government and concerned or affected groups and individual representatives. To be successful the scoping session requires

- ▶ Commitment - all agencies should be committed to the scoping process and be willing to use the results of these sessions in their decision-making
- ▶ Participation - opportunities must be provided for all relevant stakeholders to participate
- ▶ Communication - the most effective scoping processes require a two-way flow of information, with opportunities for consensus building
- ▶ Information - effectiveness will be a direct function of the timing, level and reliability of information provided to participants
- ▶ Flexibility - scoping methods should be adapted to project at hand, no one method is effective in all circumstances

The scoping process normally culminates with the preparation of an EA scope document for the review of all participants

### 3 Workshop Process

The activities around the scoping process workshop include

- (a) Initial Description of Tasks
- (b) Invitation to Participate in the Workshop
- (c) Scoping Meeting
- (d) Scoping Workshop
- (e) Post-Workshop Meeting

#### 3.1 Description of Tasks

During workshop planning it is necessary to identify and describe the tasks that are expected to be performed during the workshop. An example of common tasks for scoping and EIA for a hydroelectric project would be

- (1) **Identify the Main Project Actions** Project actions are physical effects of the proposed development which may subsequently lead to changes in ecosystem and social system components or baseline conditions in the area

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- (2) **Ecosystem and Social System Components** These are the main biological species and human activities which serve as the primary motivation of concern for the possible effects of the project
- (3) **Identify the Spatial Context** The area within which the actions may lead to changes in the ecosystem component
- (4) **Identify the Temporal Context** The potential temporal pattern of change in the ecosystem, including consideration of possible lags in the response of biological system components
- (5) **Develop a Hypotheses of Effects** Explicit statements of the pattern of ecological interactions through which actions may lead to changes in the ecosystem and social system components
- (6) **Screening of Hypotheses** Assessment of the logical structure of each hypothesis to ensure that the hypothesis is logically correct and to eliminate hypotheses and hence studies which are unfounded
- (7) **Evaluate the Hypotheses** A careful review of the available scientific evidence which pertains to each link (interaction) within a hypothesis This review incorporates evidence from both specific studies done for a particular development and from the general scientific literature It is essential in two regards First, it is necessary in the critical evaluation of likelihood of the hypothesized effects Second, it helps to delineate the key uncertainties surrounding the possible effects and hence to focus concern for further studies in these areas
- (8) **Document the Results** Documentation of the conclusion for each hypothesis with regard to the need for study of the proposed effects in view of both the likelihood of the effect and the feasibility of measuring the effects
- (9) **Prepare Recommendations** Recommendation of the priority issues, appropriate field studies, emphasis to be placed in baseline data collection etc , based upon the results of the previous tasks

### **3 2 Invitation to Participate in the Workshop**

During workshop planning it is necessary to identify the organizations and individuals who should participate in the workshop Depending upon the objectives of the workshop the participants could be restricted to the principal proponent and the regulatory authorities, or it could include a much larger number of participatory groups, including the general public

### **3 3 Scoping Meeting**

A scoping meeting is suggested prior to the main scoping workshop The purpose of the Scoping Meeting would be to identify the issues, actions, indicators spatial and temporal effects of the proposed project Upon completion of the meeting these are documented in a Report on the Scoping Meeting This would form the basis for discussion in the Scoping Workshop Separate tables would be prepared to list the factors discussed in the scoping meeting

An example of the list of issues compiled during the scoping meeting would be

- ▶ Effects of dewatering the river (intake to powerhouse)
- ▶ Effects of water level fluctuations

- ▶ Requirements for minimum releases
- ▶ Effects of downstream peaking flow
- ▶ Water quality
- ▶ Public perception of the project
- ▶ Access road upgrading or construction
- ▶ Effects on fish
- ▶ Effects of increased access to the area
- ▶ Conflicts with other resource users
- ▶ Erosion and downstream effects
- ▶ Wildlife effects

The main issues and sub issues would be developed under physical, biotic and social effects

### **3 4 Scoping Workshop**

At the scoping workshop participants may be divided into groups. For example, Group A may identify physical effects, Group B biotic effects, and Group C social effects. The groups listing would then be combined.

Upon identification of the hypotheses of effects the workshop participants would decide whether their involvement is necessary for the next step. A further workshop may or may not be required depending on how well the group felt the issues had been raised.

### **3 5 Post-Scoping Meeting**

Once the group is satisfied that issues are covered recommendations are then made such as

- (1) **Study** Priorities for field studies where appropriate with corresponding lab and data analyses
- (2) **Modeling** Analyses needed to be conducted with aid of simulation models to predict an effect which would otherwise be difficult to assess. Usually this also requires some field data collection in order to initialize the model.
- (3) **Review** Literature review needed to provide insight into the response to predicted physical conditions or to assess a possible effect through comparison with effects at other sites.
- (4) **Priorities** Priority issues to address in the EIA.

## Appendix C-4

### Sample Terms of Reference (TOR) for Project IEE/EIA's<sup>2</sup>

A terms of reference for the IEE or EIA will be required regardless of whether the Licensees staff (qualified staff) prepare the environment study or whether the licensee hires a consultant team. The TOR would be reviewed by EDC and would be based on standard models as well as information and priorities established in the scoping phase of the EIA.

#### 1 Introduction

State the purpose of the terms of reference, identify the project to be assessed, and explain the executing arrangements and responsibilities for the environmental assessment.

#### 2 Background Information

This section would provide brief but pertinent background for the licensee's study team who will conduct the environmental assessment. This would typically include a brief description of the major physical components of the proposed project, the project activities and schedule, a statement of the need for it and the objectives it is intended to meet, the implementing agency, a brief history of the project (including alternatives considered), its current status and timetable, and the identities of any associated projects.

If there are other significant projects HMG or the private sector has in progress, or have planned within the region which may compete for the same resources, or have parallel or overlapping impacts in the same ecosystem of watershed, they should also be identified here.

#### 3 Objectives

This section will summarize the general scope of the environmental assessment and discuss its timing in relation to the processes of project preparation, design and construction.

#### 4 Environmental Assessment Requirements

This paragraph should identify any regulations, quantitative or qualitative standards, or general guidelines which will govern the conduct of the EIA or influence the content of the report. They may include any or all of the following:

- ▶ HMG laws and/or regulations on environmental review and impact assessments
- ▶ HMG standards for pollution control or abatement

<sup>2</sup> Text and Format Adapted from the Environmental Assessment Resource Book, Volume I Annex 1.3 World Bank 1994 readjusted to HMG EIA format.

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- ▶ Regional, provincial or communal environmental assessment regulations or other rules covering the implementation of mitigation programs that may be sectoral in nature and/or require the participation of such agencies or organizations
- ▶ Environmental and social assessment regulations of any other financing organizations involved in the project eg IFC or World Bank Operational Directive 4.00, Annex A "Environmental Assessment", and other pertinent ODs, OMSs, OPNs, and Guidelines

## 5 Study Area

This section would specify the boundaries of the study area for the assessment (e.g. the basin or river system and primary and secondary project impact areas). Maps should be provided and referred to in the Appendices to the TOR.

## 6 Scope of Work

In some cases, the tasks to be carried out by the EIA team will be known with sufficient certainty to be specified completely in the terms of reference. In other cases, information deficiencies need to be alleviated or specialized field studies or modeling activities performed first to assess impacts, in which case the EIA study team may be asked to define particular tasks in more detail and submit this to the licensee who will arrange review and approval. Otherwise the main tasks would include:

### (a) Task 1 - Description of the Proposed Project

Provide a description of the relevant parts of the project, using maps (at appropriate scale) where necessary, and including the following information: location, general layout, size, capacity, etc., pre-construction activities, construction activities, schedule, staffing and support, facilities and services, operation and maintenance activities, required off-site investments, and life-span.

(Note: if there are particular types of information appropriate in the description of the project category that should be specified here.)

### (b) Task 2 - Description of the Environment

Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area. Include information on any changes anticipated before the project commences.

(Annotate or modify the lists below to show the critical information for this project category, or that which is irrelevant to it.)

- (i) Physical environment: geology, topography, soils, climate and meteorology, ambient air quality, surface and groundwater hydrology, existing sources of air emissions, existing water pollution discharges, and receiving water quality.
- (ii) Biological environment: flora, fauna, rare or endangered species, sensitive habitats, including parks or preserves, significant natural sites, etc., species of commercial importance, and species with potential to become nuisances, vectors or dangerous.

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(iii) Socio-cultural environment (include both present and projected where appropriate) population, land use, planned development activities, community structure, government services, demographics, employment, distribution of income, goods and services produced, recreation patterns, public health, cultural properties, tribal peoples, and customs, aspirations and attitudes, special or unique social and cultural aspects of the area, etc

(c) **Task 3 - Legislative and Regulatory Considerations**

Describe the pertinent regulations and standards governing environmental quality, health and safety, protection of sensitive areas, protection of endangered species, siting, land use control, etc at international, national, regional, district, VDC and Ward levels

(The TOR should specify those that are known and require the consultant to investigate for others For example if the project impacts on an area covered by an international convention this should be indicated )

(d) **Task 4 - Determination of the Potential Impacts of the Proposed Project**

In this analysis, distinguish between significant positive and negative impacts, direct and indirect impacts, and immediate and long-term impacts Identify impacts which are unavoidable or irreversible Wherever possible, describe impacts quantitatively, in terms of environmental costs and benefits Assign economic values when feasible Characterize the extent and quality of available data, explaining significant information deficiencies and any uncertainties associated with predictions of impact If possible, give the TOR for studies to obtain the missing information. (Identify the types of special studies likely to be needed for this project category )

(e) **Task 5 - Analysis of Alternatives to the Proposed Project**

Describe alternatives that were examined in the course of developing the proposed project and identify other alternatives which would achieve the same objectives The concept of alternatives extends to siting, design, technology selection, construction techniques and phasing, and operating and maintenance procedures Compare alternatives in terms of potential environmental impacts, capital and operating costs, suitability under local conditions, and institutional, training and monitoring requirements When describing the impacts, indicate which are irreversible or unavoidable and which can be mitigated To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures Include the alternative of not constructing the project, in order to demonstrate environmental conditions without it

(f) **Task 6 - Development of an Environmental Management Plan to Mitigate Adverse Impacts**

Recommend feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels Estimate the impacts and costs of those measures, and of the institutional and training requirements to implement them Consider compensation to affected parties for impacts which cannot be mitigated Prepare a management plan including proposed work programs, budget estimates, schedules, staffing, and training requirements, other necessary support services to implement the mitigating measures

Mitigation actions would typically be presented in relation to four categories as follows

Type of Action	Description
Avoidance and Prevention	Measures to redesign or relocate facilities or planning project activities (scheduling alternative construction methods etc ) to avoid potentially significant adverse effects and for prevention adoption of health programs public awareness, etc
Mitigation	Measures to reverse adverse impacts to accepted levels
Compensation	Measures to compensate for unavoidable adverse impacts which generally refer to monetary compensation for direct loss of property and income generating assets (eg rehabilitate displaced settlements compensate affected persons temporary and permanent property, land)
Residual Impacts	Proposal and possible adoption of actions to further alleviate what are otherwise acceptable impacts (eg impacts that have already been mitigated to meet standards)

(g) **Task 7 - Identification of Institutional Needs to Implement Environmental Assessment Recommendations**

Review the authority and capability of institutions at local, regional, and national levels and recommend steps to strengthen or expand them so that the management and monitoring plans in the environmental assessment can be implemented. The recommendations may extend to new laws and regulations, new agencies or agency functions, inter-sectoral arrangements, management procedures and training, staffing, operation and maintenance training, budgeting, and financial support.

The TOR can be specific as to what is required for recommendations at the local, district and/or regional levels.

(h) **Task 8 - Development of a Monitoring Plan**

Prepare a detailed plan to monitor the implementation of mitigating measures and the impacts of the project during construction and operation. Include in the plan an estimate of capital and operating costs and a description of other inputs (such as training and institutional strengthening) needed to carry it out.

(i) **Task 9 - Assist in Inter-Agency Coordination and Public/NGO Participation**

Assist in coordinating the environmental assessment with other government agencies, in obtaining the views of local NGO's and affected groups, and in keeping records of meetings and other activities, communications, and comments and their disposition.

(The TOR should specify the types of activities, e.g., interagency scoping session, environmental briefings for project staff and interagency committees, support to environmental advisory panels, public forum)

(j) **Report and Deliverables**

The environmental assessment report should be concise and limited to significant environmental issues. The main text should focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data. Detailed or uninterpreted data are not appropriate in the main text and should be presented in appendixes or a separate

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volume Unpublished documents used in the assessment may not be readily available and should also be assembled in an appendix Organize the environmental assessment report according to the outline below

- ▶ Executive Summary
- ▶ Policy, Legal and Administrative Framework
- ▶ Description of the Proposed Project
- ▶ Description of the Environment Baseline Information
- ▶ Significant Environmental Impacts
- ▶ Analysis of Alternatives
- ▶ Environment (Mitigation) Management Plan
- ▶ Environmental Management and Training
- ▶ Monitoring Plan
- ▶ Auditing
- ▶ List of References
- ▶ Appendixes
  - Inter-Agency and Public/NGO Involvement
  - List of Environmental Assessment Preparers
  - Records of Inter-Agency and Public/NGO Communications
  - Maps, Data and Detailed Sheets
  - Field Questionnaires, Analysis results and Check lists
  - Unpublished Reference Documents

The TOR should specify the hard copy and electronic copy of all reports, appendices maps, records, etc be provided to EDC (Verify that the EIA report will be the property of HMG not the licensee)

(k) **Study Team**

Environmental assessment requires interdisciplinary analysis Identify in this paragraph which specializations ought to be included on the team for the particular project category This section would indicate how long each professional would be involved and which tasks they would provide input

(l) **Schedule**

Specify dates for progress reviews, interim and final reports, and other significant events

(m) **Other Information**

Include here lists of data sources, project background reports and studies, relevant publications, and other items to which the consultant's attention should be directed A sample Table of Contents for the Draft EIA report should also be included in the attachments to the TOR

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