May 2012

ENVIRONMENTAL ASSESSMENT GUIDELINE FOR FORESTRY ACTIVITIES

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Foreword

In 1999, the National Environment Commission published six sectoral environmental assessment guidelines for the mining, roads, industries, hydropower, power transmission lines and forestry sectors. These guidelines were intended to guide different project proponents through the process of acquiring an environmental clearance for their projects. These sectoral guidelines were later revised in the year 2003 to make them more practical and relevant to the Bhutanese context and also to streamline with the provisions of the Environmental Assessment Act 2000 and its Regulation 2002.

The revised sectoral guidelines of 2003 have played a very instrumental role in guiding the proponents and the sector agencies in the Environment Assessment (EA) process. However, these sectoral guidelines were long overdue for revision and through the World Bank IDF grant the guidelines were revisited and proposed for revision. All the relevant stakeholders were consulted several times for this revision and through the expert input from both local and international consultants the guidelines were revised to align with the changing government policies and rules and with the long-term objectives of protecting our pristine environment.

The NEC is grateful to the World Bank for their financial assistance to revise and update these guidelines. The revision and updating of these guidelines were accomplished through close consultation with all the relevant stakeholders. We would also like to express our gratitude and appreciation to all the ministries and stakeholders for their active participation, support and inputs. The NEC would also like to thank the team from the Centre for Science and Environment, New Delhi for their hard work and inputs in updating these guidelines especially Mr. Chandra Bhushan, Mr. Sujit Kumar Singh and Ms. Swati Singh Syambal. We are confident that the revised guidelines will be more useful documents that facilitate and expedite the environmental clearance process.

The environmental assessment process endeavors to mitigate and prevent undesirable impacts of developmental activities. It is in no way intended to hamper socio-economic development in Bhutan but to guide project proponents and sector agencies in making right investments in land, manpower, technology and mitigation measures to ensure that their projects have the least possible impacts on the environment. It's the sincere wish and hopes of NEC that all the stakeholders' make the best use of these guidelines, which in turn will help in protecting our fragile ecosystem. Sound implementation of these guidelines will go a long way in minimizing the negative impacts of developmental activities on Bhutan's environment.

Dr. Ugyen Tshewang
Secretary, NEC

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List of Abbreviation

AAC	Annual Allowable Cut
APs	Affected Parties
BAP	Biodiversity Action Plan
BAT	Best Available Technology
CA	Competent Authority
CSE	Centre for Science and Environment
DG	Diesel Generator
EA	Environmental Assessment
EC	Environmental Clearance
EIA	Environmental Impact Assessment
EMP	Environment Management Plan

EHS	Environmental Health and Safety
FDM	Fugitive Dust Model
FMU	Forest Management Unit
HAPs	Habitat Action Plans
NEC	National Environment Commission
NOC	No Objection Certificate
PAHs	Polycyclic Aromatic Hydrocarbons
PAP	Project-affected Population
PCE	Pollution Control Equipment
PM	Particulate Matter
R&R	Resettlement and Rehabilitation Plan
SAPs	Species Action Plans
ToR	Terms of Reference

CHAPTER 1

An Introduction to the Forest Sector

1.1 Background

Due to significant impacts on bio-diversity, forestry activities in most countries today require an Environmental Impact Assessment (EIA) study before they are accorded environmental clearance. This holds true for Bhutan as well. It is regulated ***under the Environmental Assessment (EA) Act, 2000 and Regulation for Environmental Clearance of Projects 2002.*** The EA Act and its Regulation establishes procedures for the assessment of potential effects of strategic plans, policies, programs and projects on the environment, and for the determination of policies and measures to reduce potential adverse effects and to promote environmental benefits. According to the EA Act, Environmental Clearance (EC) is mandatory for any project/ activity that may have adverse impact(s) on the environment. The Regulation for Environmental Clearance of Projects 2002 defines responsibilities and procedures for the implementation of the EA Act concerning the issuance and enforcement of environmental clearance. According to the legal framework, the National Environmental Commission (NEC) is the nodal agency for administering and granting Environmental Clearance (EC).

The scope of the guideline is as follows:

- Provide guidance and assistance to various stakeholders involved in the EA process.
- Assist the regulatory agency and EIA practitioners to understand the main areas of concern and use that understanding to enhance the quality of the EIA study and report.
- Inform the regulatory agency and EIA practitioners about the best environmental management practices in the forestry sector.
- Assist the regulatory agency to better assess the EIA report and arrive at a sound decision.

1.2 An Introduction to Environmental Impact Assessment (EIA)

According to the United Nations Environment Programme's Division of Technology, Industry and Economics, an EIA is a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, finding ways and means to reduce the adverse impacts, shaping projects to suit the local environment, and presenting options to decision-makers.

An EIA can bring about both environmental and economic benefits, such as reduction in costs and time taken for implementation; and design of a project, lesser intervention of legalities and regulations. A properly conducted EIA lessen conflicts by promoting community participation, informs decision-makers, and helps lay the base for environmentally sound projects (See Box 1: *Integration of EIA in the project cycle*).

1.3 Generic steps in the EIA Process

The EIA process comprises of six key steps:

i. **Screening**: Screening helps decide whether an EIA is required for a project or not. An appropriately designed screening system can prove to be an effective tool to prevent the squandering of time and money on assessing projects with insignificant environmental impacts.

ii. **Scoping**: Scoping is considered the backbone of an EIA process, and is ideally undertaken at the project planning stage. The main objective of the scoping process is to establish the environmental and social priorities, set the boundaries for the study and define the Terms of Reference (ToR). Systematic and well planned scoping forms the basis of an effective and efficient EIA process. It also helps avoid unfocused and voluminous reports. Ideally, the role of scoping is to determine three key issues: (a) Site alternatives, (b) Design alternatives, (c) Justifications for the project.

SCOPING HELPS FIND ANSWERS TO QUESTIONS LIKE:

- What are the issues to be addressed?
- How should one proceed with the EIA study?
- What is the extent of the analysis needed?
- What is the infrastructure needed?
- What kind of people should be involved in the assessment?

iii. **Baseline data generation**: Baseline data provides a detailed description of the existing status of various environmental and social components in the study area. Both primary and secondary data is collected to describe this status.

iv. **Impact assessment**: In this step, the characteristics of potential impacts are identified, evaluated and predicted using the baseline information on one hand and the features of the project on the other (cause-effect relationship). Impact predictions are normally done by using common methodologies and models, expert judgements etc.

v. **Mitigation of impacts**: At this stage, the possible preventive, remedial and compensatory measures for each adverse impact are determined and recommended.

vi. **Environment Management Plan**: An environment management plan (EMP), also referred to as an impact management plan, is usually prepared as part of the EIA reporting process. It translates recommended mitigation and monitoring measures into specific actions that have to be carried out by the proponent. Depending upon specific requirements, the plan may be included in the EIA report or can be prepared as a separate document.

1.4 Good practices in EIA

An EIA should not be used just as a tool for obtaining an environmental clearance; rather, the project implementer should see it as a management tool for sound planning of the roads forestry projects. On the other hand, it should be the responsibility of competent authorities to ensure that the project causes minimal environmental impacts and brings maximum economic/ecological benefits as a whole.

The effectiveness of the EIA process depends on many guiding factors – these include: (a) the extent and kind of legal support it is getting in the host countries, (b) how the EIA is being conducted, (c)the stakeholders involvement at different stages, (d) the quality of the EIA report, (e) accreditation status of consultants who prepare the EIA, (f) how the environmental, social and economic findings are presented, (g) accreditation status of consultants who prepare the EIA, (h)composition and skills of the review committee.

As a good practice, it is always recommended to conduct an Initial Environmental Examination (IEE) of the project to determine if it requires an EIA or not. It is also advisable to involve the public from the very beginning in the scoping process and in all the other phases of project development (*See Figure 1.1: Best Practices in EIA*).It is also recommended to consider the size, scale, site sensitivity and pollution potential while deciding the study area, duration and scope of EIA.

Best practices in an EIA process include preparing a report which is comprehensive and focused, and contains only the significant parameters instead of data and information which are irrelevant to the overall assessment of the project. The extent of the assessment required should be decided after careful examination of likely impacts on the environmental and existing socio-economic settings while dealing with forestry projects in eco-sensitive areas.

Box 1: Integration of EIA in the project cycle

Forestry project is accomplished in six stages: (1) Project concept (2) Pre-feasibility (3) Feasibility (4) Design and engineering (5) Implementation and (6) Monitoring and evaluation. Environment Impact Assessment plays an important role in every stage of this cycle. Most of the EIA activities take place during the pre-feasibility and feasibility stages. Between project concept and pre-feasibility stage, the EIA process involves site selection, screening, initial assessment and scoping on significant issues. Detailed EIA assessment starts at the project feasibility stage. This includes an evaluation of significant impacts, including the gathering of baseline information, prediction and quantification of impacts, and a review of the EIA by the regulatory agency.

Following these initial steps, environmental protection measures are identified, environmental operating conditions are determined, and environmental management is established. In the last phase of the feasibility study, the monitoring needs are identified, and an environmental monitoring programme and environment management plan are formulated.

Environmental monitoring is designed to generate information on the actual impact due to the project activity, compliance with environmental conditions and the effectiveness of the environmental mitigation measures. The environmental management plan, which describes the mitigation measures, is considered in the project cycle right from the implementation of the project (during construction, operation and maintenance); the plan's aim is to reduce the environmental impacts.

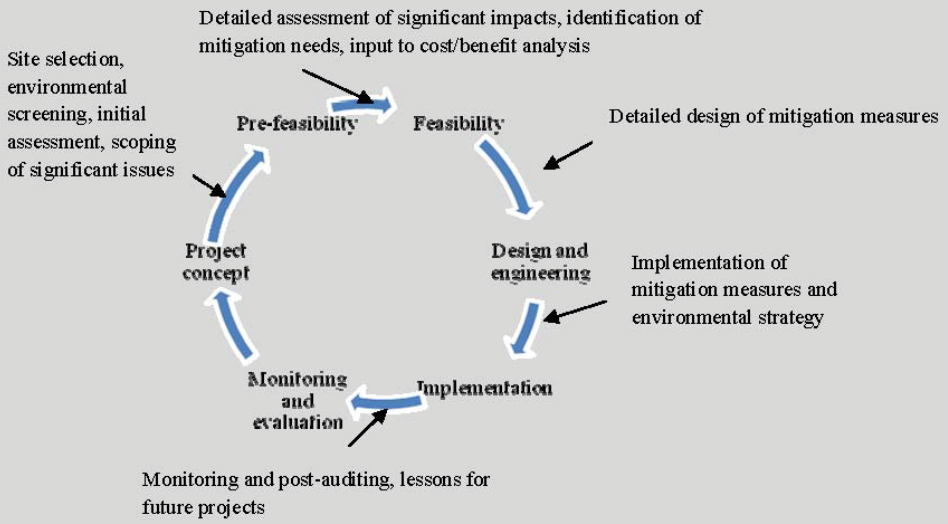
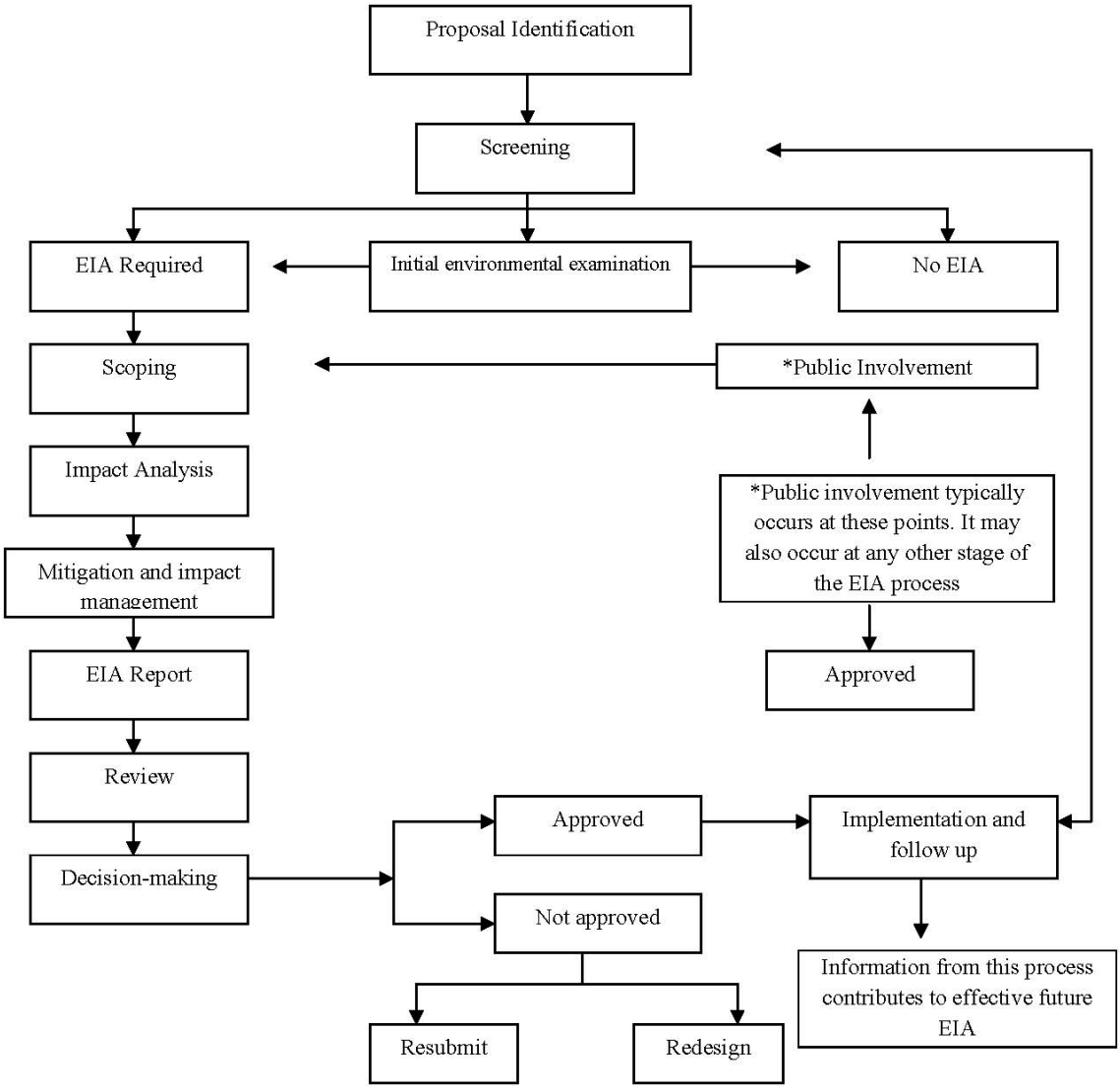


Figure 1.1: Best practices in EIA



1.5 Environmental and socio-economic impacts of forestry activities

Forestry sector in Bhutan majorly comprises of the timber and logging activities to meet the construction and fuel demands of the country. According to the Forest Department, Bhutan, the requirement of timber would increase from 2 million cubic feet to an estimated requirement of 2.5 million cubic feet by 2013. Over a period of time, the commercialization of this sector for the usage of timber, plantations and agro-chemicals has lead to the exploitation of the rich natural resources. Development and the increasing population are exerting pressure on the forest resources. Currently, the major causes of deforestation are logging activities, forest fires and overgrazing.

Some of the potential impacts due to forestry related activities on the environment are mentioned in *Table 1.1*.

Table 1.1: Impact due to forestry activities

Activities/Issues	**Potential Impacts**
Land	• Land acquisition • Displacement and loss of livelihood. • Impacts on indigenous people, *if applicable*. • Loss of common properties. • Slope destabilization • Erosion and loss of topsoil • Change in land use pattern
Water	• Site runoff increases sediment load in the nearby water bodies. • Decrease in groundwater recharge • Contamination of nearby water-bodies due to spillage/leak from logging machinery, use of DG sets, use of chemicals for the treatment of timber. • Impact on watersheds • Eutrophication of nearby water-bodies
Air and Noise Environment	• Localized air and noise pollution • Dust emissions due to activities such as saw-milling and other wood transformation activities. • Noise due to harvesting and logging operation
Biodiversity	• Fragmentation of forested habitat; • Loss of habitat • Establishment of non-native invasive plant species; • Visual and auditory disturbance due to the presence of machinery, workers and associated equipment • Impact on feeding, nesting and breeding grounds • Increased risk of poaching and hunting of animals
Solid Waste	• Activities such as logging/saw milling lead to generation of wood chips/saw dust • During construction of access roads, generation of debris, waste rock etc.

CHAPTER 2

Scoping

2.1 Introduction

The primary function of scoping also referred to as setting the Terms of Reference (ToR) of an EA, is to establish the environmental priorities and set the boundaries for the study. The objective of the ToR is to make the assessment process concise and focused, and avoid creating a voluminous or data deficient report. The ToR provides the benchmark for data collection and limits the possibility of inefficiency in the EA process. It is also acts as a benchmark to be used by the competent authority/NEC to decide whether the EIA report has been compiled after meeting all the requirements or not.

There are various tools that can be used for scoping, such as ***questionnaire checklists, network method, comparison with other similar projects, matrix and ad-hoc methods, etc***. The selection of scoping tools largely depends on the size of the project and the existing environmental and social setting.

The ToR given below is a generic one and can be framed as per the project requirements. The ToR has been made keeping into consideration the major forestry activities in the country such as logging and timber, forest products and plantations. While framing the ToR, ground realities, background information of the study area, site sensitivity, existing laws, rules, guidelines, policies etc., and project-specific peculiarities need to be added to make it relevant and realistic. Site visit is also recommended before framing the ToR; this enhances the scope of the EA process and makes it more efficient.

2.2 Terms of Reference (ToR) for forest projects

The ToR of forest projects should include the following:

2.2.1 General information

- Executive summary of the project, which summarizes the project characteristics, environmental and social issues, and the proposed mitigation measures.

- Information about the project proponent and his/her experience in sector with following details (a) Name of the project (b) Name of the applicant (c) Present mailing address including telephone number, fax, and email (if any) (d) Name of the environmental focal person (e) Telephone number of environmental focal person

- The justification for the project and consideration of alternative site for Forest Management Units (FMU's), if applicable, with reference to environmental and social concerns.

- Project financial statement and the project activity schedule.

- Name of organization/consultant preparing the EIA report, qualifications and experience of experts involved in the EA assessment and report preparation.

- List of all regulatory approvals, clearances and No Objection certificate (NOC) required for the project and the status of these approvals.

- A declaration stating that the information disclosed in the EIA report is correct.

2.2.2 Essential maps and cartography for EA of forest project

- A map with an appropriate scale specifying the project site, district and geog boundaries, rivers and/or streams, nearby towns, roads, settlement/s, approach road/s, internal roads, camp sites, cable crane lines/ropeways etc. If a registered land is involved, indicate the *Thram* number and the boundary.

- A map indicating the land use pattern of the project area including a satellite imagery of the study area with explanatory note.

- Area map of the study area indicating features such as drainage patterns, locations of indigenous settlements and major constructions, or any polluting sources nearby or in the forest area, if applicable.

- A map marking the sensitive zones in the study area, such as protected areas, biological corridors, critical watersheds, areas housing endangered, threatened and endemic species, species of ecological importance, religious and archaeological sites, etc.

- Provide topography details in percentage or degrees for the following:

    a) Max. slope = (%)
    b) Min. slope = (%)

- Function map
- A contour map of the area with appropriate scale.

Note: Depending upon the type, size and location sensitivity, NEC can decide the study area and recommend appropriate scale for Environmental Assessment.

2.2.3 Project description

- Area acquired for the proposed project and land use patterns with explanatory notes.

- Information on existing land use pattern of the study area (*Refer Table 2.1: Land use details*)

Table 2.1: Land use details

Land Use	Area	Tenure	Affected Households

- Details of the topography of the study area, and local area hydrology.

- Land ownership patterns of the acquired land

- Inventory of water bodies such as rivers, lakes, springs, streams or any water bodies in the project area

- Presence of sensitive areas (if any) such as forests, national parks, biological corridors, historical or archaeological sites, etc in the study area

- Details of the Annual Allowable Cut (AAC).

- Layout plan of proposed project development, activity areas with facilities such as drainages, sewage disposal, communication facilities, access/approach roads, forest roads, boundary wall, landscape, waste disposal etc; wherever applicable.

- Demolition works, if any, quantity of demolition waste produced and its management plan.

- Enlist the beneficial impacts due to the project activity, as mentioned in *Table 2.2.*

Table 2.2: Project beneficiaries

Dzongkhag	**Geog**	**Village**	**Town**	**Type of Benefit**	**Households (no.)**
Total Beneficiaries					

2.2.4 Information on technologies and resource requirement

- Technology to be adopted, including details of equipment to be used (*See Table 2.3*).

Table 2.3: Equipment to be used by the project

Type of machine	Number	Remarks

- Expected quantity of construction material required for setting up of FMUs such as wood in volume, its sourcing and mode of transportation.

- Description of requirement of utilities and services their capacities, raw materials requirement and associated pollution potential and environmental safeguard for pollution abatement and control.

- Extraction Volumes: Provide details regarding the average expected quantity of forest product that will be extracted each year. e.g. m^3 of logs harvested / year. Name the month/season of the year when the activity will be undertaken.

- Details of methodology/technique to be used in extraction.

- Resources and manpower required for project implementation

- Plantations: Where areas are to be replanted/planted the following information should be given: (i) size of the area (ii) number of seedlings to be planted (iii) type of species (iv) source of seedlings (v) time for plantation (vi) protection and care of plantations

- Forest products required (this is applicable only to afforestation / reforestation activities) List and quantify the forest products required by the project in the *Table 2.4* below.

Table 2.4: Forests products required by the project

Item	Quantity required	Unit	Purpose to the project

2.2.5 Baseline data

- Provide details of land use based on the following categories: *Kamshing, Chusing, Tseri, Orchard, Tsamdo, Sokshing,* broadleaf forest, conifer forest, scrub forest and others.

- Details of soil, slope analysis, vulnerability to landslides, etc.

- Detailed information on existing natural drainage/run-off patterns at the project site.

- Data on ambient air quality: This should include parameters such as PM10, gaseous pollutants, and site-specific information on existing meteorological conditions (it may be primary or secondary data) such as temperature, humidity, rainfall and wind speed and direction, wherever applicable.

- Information on potential sources of fugitive emissions.

- Ambient noise data at the project site, including the different activities that are likely to generate noise.

- Details of perennial streams/rivers/other water bodies within and proximate to the project area (*Refer Table 2.5*).

Table 2.5: Details of perennial streams/rivers/other water-bodies within and proximate to the project area

Name of water course	Is watercourse inside or outside the project area?	Approximate distance to watercourse from the project area (km)	Identify possible impacts on watercourse

a. Socio-economic

- Describe with the help of maps the number of villages getting affected, scope of land acquisition and how it is important from investment perspective. The report should provide option for alternative or any substitute to avoid or minimize land acquisition with appropriate justification.

- If land acquisition is involved, the report should give the extent of land to be acquired for the project along with name of affected people with following information:

    a) Village-wise list of the affected persons or family-wise,

    b) The extent and nature of land and immovable property to be acquired from affected persons (*Refer to Table 2.6*).

Table 2.6: Loss and disturbance to existing services, houses, infrastructure and cultural and heritage sites

Type of Loss	(No.)	Description of disturbance
Services (list)		
Houses		
Infrastructure		
Cultural Sites		Distance in m from disturbance
Heritage Sites		Distance in m from disturbance

    c) A list of persons who are likely to lose their employment or livelihood or likely to be alienated wholly or substantially from their main sources of trade, business, occupation due to acquisition

    d) A list of indigenous groups, vulnerable communities etc., if any

    e) Any cultural or heritage sites which are likely to be impacted.

b. Bio-diversity

- Baseline data to be given on description of existing situation of the forest cover at the proposed project area including forest types, forest density, type of plant species, areas having unique habitat, endemic, threatened or declining species, or species of high economic and cultural value to society or ecosystem.

- Obtain a list of vegetation, animals and birds from the nearest forest office and attach these finding to the EA.

- Conduct village interviews on the occurrence of vegetation, animals and birds in the project area and document the findings. Compare the finding with the list provided by forest office. Attach these finding to the EA.

- Location or identification of any area that may be considered restricted areas from a biodiversity perspective, if applicable.

- Type of forest being diverted for non-forest use and status of forest cover.

- A study on endangered/threatened avifauna including location or identification of any area that may be considered restricted areas from an avifauna impact perspective.

- Authentication and verification of the wildlife corridor by the competent authority.

2.2.6 Impact assessment

- Impact due to land acquisition, including impact on indigenous communities, if applicable.

- Impact of project on biodiversity.

- Impact of project on local hydrology.

- Impact due to slope destabilization caused due to cutting, filling, if the project employs construction of access roads.

- Impact of project and allied activities on nearby water-bodies.

- Impact of project and allied activities on ambient air.

- Impact of project and allied activities on ambient noise.

- Impact of project due to construction of access roads, setting up of FMUs, transportation of material, construction of cableway, ropeway, l etc.

- Impact due to generation of sewage in FMU camps.

- Impact of chemicals used for preservation of wood/timber.

- Impact due to various auxiliary activities such as saw-milling, wood transformation activities, DG sets on ambient air and water bodies.

- Impact due to transportation of raw materials and products.

- Beneficial impacts of the project.

2.2.7 Mitigation and Environment Management Plan (EMP)

The EMP should discuss the mitigation measures to be taken against each impact, the timeline for completion, the responsible departments for implementation, the plan budget,

post-project monitoring provisions and the process of reporting to the concerned regulatory authority.

- Preparation of a Resettlement and Rehabilitation plan (R&R) if displacement is involved. The plan should include details of the compensation provided, including land-for-land compensation, employment or money; provisions at the resettlement colony (such as basic amenities including housing, educational facilities, infrastructure and alternate livelihood potential); a clear timeline for implementation; responsibility; budgets; grievance mechanism, etc.

- A detailed mitigation plan for biodiversity protection and conservation.

- Proposals for environmental management during initial stage of project such as construction of access roads, site preparation, etc.

- Mitigation plan for slope protection.

- Details of water pollution control measures.

- Detailed plan for air quality management.

- Plan for solid or any hazardous chemicals used as wood preservatives.

- Management plan for FMUs/other forest activities.

- Soil protection and conservation plan

- Details of energy and water conservation measures.

- Management plan for sewage and solid waste generated from FMU camps.

- Identification of risk-prone areas based on potential risks and mitigation measures for the same.

- Road safety measures planned to reduce road accidents.

- The organizational set-up and requirement of manpower for environmental, health and safety management, including clear responsibilities.

- A detailed mitigation plan and EMP for improving and enhancing socio-economic condition in and around the project site

CHAPTER 3

Impact Assessment

3.1 Introduction

The scientific and technical reliability of an EA study depends on the skills of the EA practitioners/reviewers, who estimate and review the nature and magnitude of the environmental change that the proposed project may entail. Impact prediction and evaluation is a vital exercise for assessing impacts, deciding alternatives, setting down mitigation measures and developing an environmental management plan. Predicting the magnitude of impacts and evaluating their significance is the core exercise of impact assessment. This process is also known as impact analysis and can be broadly broken down into three overlapping phases:

- *Identification*: To specify the impacts associated with each phase of the project and the activities undertaken

- *Prediction:* To forecast the nature, magnitude, extent and duration of the main impacts; and

- *Evaluation:* To determine the significance of residual impacts after taking into account how mitigation will reduce a predicted impact.

In assessing environmental impacts and their significance, some key concerns have to be kept in mind:

- Identity who or what is affected
- Description of how they are affected
- Evaluation against a set of consistent assessment criteria

Normally, in impact assessment, potential impacts can be categorized into various parameters ranging from its type and nature to magnitude and reversibility, each signifying its importance in impact prediction and decision making (*See Table 3.1: Parameters which determine impact characteristics*).

3.2 Impact identification

In the EA of a forestry related project, the potential impacts are globally well documented, and do not normally require extensive impact identification. However, there are some impacts such as displacement, loss of livelihoods, influence of topography and meteorology on water and air pollution, feasibility with respect to land use, geological characteristics, other sensitive receptors such as forest/biodiversity etc., which are site-specific and can only be identified once the data on them is available or generated. There are various tools that can be used for impact identification, such as questionnaires, checklists, network method, comparison with other similar projects, matrix and ad-hoc methods.

To ensure effective impact identification, one should always opt for a simple, logical and systematic approach. As a good practice in EA, it is always recommended to consider all potential project impacts and their interactions. At the same time, it is important to ensure that indirect and cumulative effects which may be potentially significant are not unintentionally omitted. All the identified impacts may not require a detailed analysis and evaluation – the level of detailing should match the scale, sensitivity and complexity of the impact. The choice of the chosen methodologies should reflect these criteria.

Table 3.1 Parameters which determine impact characteristics

Parameters	Description
Type	Positive or negative
Nature	Direct, indirect, cumulative
Magnitude or severity	Low, moderate, high
Timing	Short term, long term, intermittent, continuous
Duration	Temporary/permanent
Reversibility	Reversible/irreversible
Significance	Local, regional or global

Source: *EIA Training Resource Manual*, Second Edition 2002, United Nations Environment Programme (UNEP), p 263

3.3. Impact prediction

Predictions of impacts are normally based on commonly used qualitative and quantitative methods and models. Expert judgment and comparison with similar projects can also be used for impact prediction. While there are a number of models for predicting impacts on physical environment (air, water and noise), modeling socio-economic and cultural impacts is difficult and is generally done through qualitative assessment or economic analysis. A model can be effective only if the input data is correctly inserted. The use of models, therefore, should be done with care and prudence considering factors like availability and reliability of data.

The sophistication of the prediction methods to be used should be kept in proportion to the 'scope' of the EA. For instance, a complete mathematical model of atmospheric dispersion should not be used if only a small amount of relatively harmless pollutants is emitted. However, if the project has a very high air pollution potential – as in the case of a large open-cast mine — then all possible modeling exercises should be done to predict the impact on ambient air quality. All prediction techniques involve assumptions and uncertainties. While quantifying and stating an impact, these assumptions should be clearly identified. Also, uncertainty of prediction in terms of probability and the margins of error should be mentioned. *Table 3.2 gives the list of general prediction models/methods used for assessing the impact of forest related projects.*

Table 3.2: General models/methods used for impact prediction

Impacts	**Assessment method/model**
Soil erosion(if applicable)	• Soil loss models such as revised universal soil loss equation (RUSLE)
Ecology(if applicable)	• Ecological models • Comparative evaluation of conservation value • Expert opinion
Land use(if applicable)	• Map overlay techniques • Comparative valuation against structure and/or local plans
Socio-economic(if applicable)	• Cost-benefit analysis • Metaphors and analogies: Experience gained in similar kinds of projects is used to predict the socio-economic impacts. • Extrapolative methods: Prediction based on the linear extrapolation of current trends. • Normative methods: Desired socio-economic goals specified, and an attempt made to project the social environment backwards in time to examine whether existing or planned resources and environmental programmes are adequate to meet the goals.
Potential risk and disaster	• Risk assessment

3.4 Impact evaluation

In impact evaluation, the predicted adverse impacts are judged for their significance. Therefore, the criteria for evaluating the significance of impacts and their effects should be set in advance (*See Box 2: Impact evaluation criteria*).The criteria for evaluating the significance should be based on local standards wherever possible. Where local standards are not available, acceptable international standards should be used (e.g. IFC, WHO or USEPA standards and guidelines of others countries, etc.). In all cases, the choice of the appropriate standard must be robust, defensible and relevant to the local situation. If there are no appropriate existing standards available, then the criteria should be developed and their use must be clearly explained in the EA. As a good practice in impact evaluation, it is better to use established procedures or guidelines, or relevant criteria which are comparable. While doing impact evaluation, it is equally important to understand the nature and characteristics of impacts on potential target areas, such as air, water, land, human beings, etc. to understand the significance, importance and intensity (*See Box 3: Possible evaluation criteria for determining impact significance*). It is also essential to find out the answers to the following three questions:

- Are there residual environmental impacts?
- If yes, are these likely to be significant?
- If yes, are these significant effects likely to occur? Is the probability high, moderate or low?

Box 2: Impact evaluation criteria

- Comparison with laws, regulations or accepted national or international standards
- Consistency with international conventions or protocols.
- Reference to pre-set criteria such as conservation or protected status of a site, features or species.
- Consistency with government policy objectives.
- Comparison with best practices
- Existing environmental and social stress in the area.
- Extent of impact on biodiversity
- Acceptability to local community or general public.

Severity of the impact (reversible or irreversible).

Box 3: Possible evaluation criteria for determining impact significance

- No impacts
- No significant impacts without or with available and practicable mitigative measures
- Impacts, but significance not quantifiable
- Significant impacts even with available and practicable mitigative measures

Impacts cannot be mitigated

CHAPTER 4

Mitigation and Environment Management Plan (EMP)

4.1 Introduction

Mitigation is the process of providing solutions to prevent negative impacts, or reduce them to acceptable levels.

The objectives of mitigation are:

- To enhance the environmental and social benefits of a proposal;
- To avoid, minimize or remediate the adverse impacts; and
- To ensure that the residual adverse impacts are kept within acceptable levels.

A good project should incorporate environmental and social alternatives at the initial stages of project development. However, there are some which can be managed only after impact identification and prediction.

Mitigation measures can be classified into structural and non-structural measures.

- ***Structural measures*** include design or location changes, engineering modifications and construction changes, landscape or site treatment, mechanization and automation, etc.

- ***Non-structural measures*** include economic incentives, legal, institutional and policy instruments, provision of community services and training and capacity building. Non-structural measures are increasingly being used now. They can be applied to reinforce or supplement structural measures or to address specific impacts.

An Environmental Management Plan (EMP) is a framework for the implementation and execution of mitigation measures and alternatives. It usually covers all phases of the project, from pre-construction to the decommissioning of the mine. The plan outlines mitigation measures that will be undertaken to ensure compliance with environmental laws and regulations and to eliminate adverse impacts. The objectives of an EMP, thus, are:

- To ensure that mitigation measures are implemented;
- To establish systems and procedures for this purpose;

- To monitor the effectiveness of mitigation measures; and
- To take any necessary action when unforeseen impacts occur.

The EMP outlines:

- The technical work schedule to carry out the mitigation, including details of the required tasks and reports, and the necessary staff skills and equipment;

- The detailed accounting of the estimated costs to implement the mitigation plan;

- A plan for operation or implementation of the mitigation plan, including a staffing chart and proposed schedules of participation by the members of the project team, and activities and inputs from various government agencies/stakeholders.

The EMP should also address the formation of a monitoring committee, with the objective of finding out whether different pollution-related issues and social development programmes related to health, education, roads, infrastructure, employment etc., are keeping to the time schedule or not. In case of delays, the reasons for the delays need to be identified and suggestions made for removing them.

EMP and post-project monitoring

A good EMP should contain the following:

- A summary of all potential impacts
- A detailed description of recommended mitigation measures
- A time-line for implementation of mitigation measures
- Resource allocation and responsibilities for implementation
- A programme for surveillance, monitoring and auditing
- A statement of compliance with relevant standards
- A contingency plan when the impacts are greater than expected

The programme for surveillance, monitoring and auditing should clearly identify the following:

- Parameters for monitoring all significant impacts, including socio-economic impacts and post project impacts.
- Monitoring locations, including sample surveys, to assess the socio-economic impacts

- Frequency of monitoring
- Reporting frequency to the regulatory agency
- Provision for annual environmental and social audit of the project

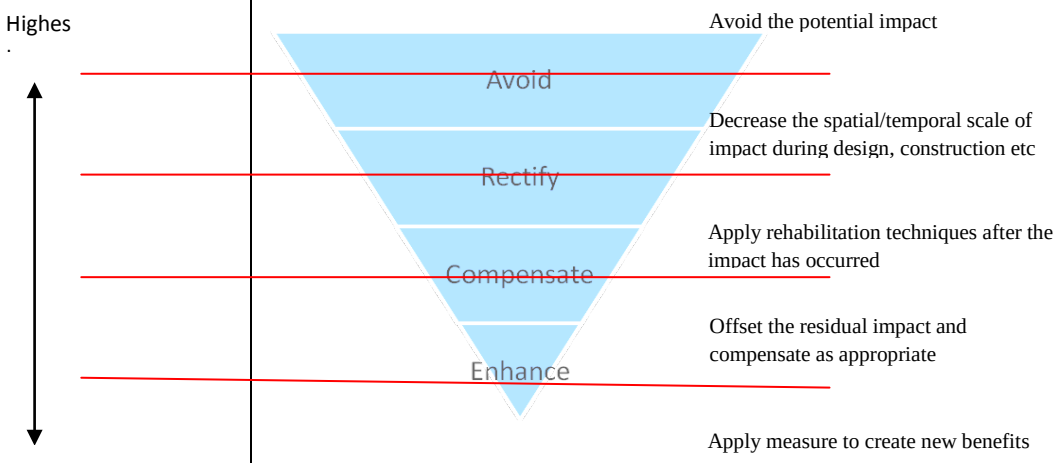
4.2 Mitigation measures and EMP for forest related activities and projects

The mitigation measures that can be adopted for forestry related projects are given in *Table 4.1*below.

Table 4.1: Mitigation measures and EMP for forest related projects

Mitigation measures for biodiversity	• Sensitive natural environments and protected habitats should be identified early in the planning process so that alternate project site/area may be considered for FMUs. (*See Figure 4.1: Hierarchy of biodiversity mitigation measures*). • The FMUs should be immediately restored in a time bound manner once used for timber with plantations. • If the site is very sensitive, the best practice in an EA is to conduct an independent biodiversity assessment, rather than making it a part of the EA process. The mitigation measures for biodiversity include a Biodiversity Action Plan (BAP) for biodiversity conservation, Species Action Plans (SAPs) where mitigation is targeted for the protection of a specific species, and Habitat Action Plans (HAPs) to protect the habitats of rare and endangered species ***Compensation for Habitat Fragmentation or Loss***, wherever applicable The choices for compensatory measures include: a) Re-establishment of wildlife habitats b) Creation and restoration of habitat areas (for compensating biologically impoverished landscapes) c) Creation of protected habitat units d) Relocation of wildlife species displaced to other suitable habitat areas. • ***Preventing Vehicle-Wildlife Collisions*** a) For projects located near eco-sensitive hotspots, many wildlife deaths can be prevented by careful placement of the alignment and appropriate roadside plantings. Measures used to discourage animals from moving onto the road surface are: b) Regulating traffic during times when animals are most active, usually at night c) High fences (>3 m) in areas heavily used by large ungulates must be constructed in close consultation with wildlife ecologists.

Figure 4.1 Hierarchy of biodiversity mitigation measures



Source:Modified from UNEP 2002 and Rio Tinto, 2005

Mitigation measure to reduce impact on land	• Rotation of Forest Management Units (FMUs) within 5 years. • Minimizing the area of ground clearance • Avoiding sensitive sites, such as those which include steep hillsides, and areas erosive in nature. • Balancing filling and cutting requirements through route choice in case of road construction • **Slope Protection:** Some of the well-established engineering measures for slope protection include: a) Terraced or stepped slopes to reduce the steepness of a slope. A berm (or risberm) is the level section between slope faces, riprap, or rock material embedded in a slope face, sometimes combined with planting. b) Retaining structures, such as gabions (rectangular wire baskets of rocks), cribs (interlocking grid of wood or concrete beams, filled with earth or rock), or other types of wooden barricades and gridwork, usually battered back against the slope • **Topsoil management** The best practices for topsoil management are as follows: a) Reestablishment of forest cover as soon as possible after clearing b) Scrap the topsoil prior to drilling and blasting, applicable during road construction. c) Scraped topsoil should be used immediately for plantation/agriculture. d) If it is not possible to use the topsoil immediately, then it should be stacked at a designated area. The location of the storage site should ensure that it does not lead to erosion. The probability of erosion is high if the storage site is proposed at an elevated area. e) If the topsoil is to be stored for a long duration, it should have a vegetal cover of, preferably, leguminous species (grasses and shrubs).

Mitigation measures for conservation and protection of water resources	• Natural drainage should not be affected by FMUs/forestry activities • Check dams should be constructed in areas prone to high run-off. • FMU camps should not be located close to water bodies • All the chemicals, wood preservatives, fuel etc. should be stored on a RCC lining with embankments all around. • Logging related operations should be avoided from the water bodies such as rivers, streams, etc. • No labour camps should be located near the water bodies. • All the waste generated from the camps should be collected, stored and disposed in environmentally suitable manner.
Mitigation Measures to prevent air and noise pollution	• Use of Pollution Protective Equipment (PPE) such as masks, ear-plugs, goggles, helmets etc. • Providing silencers or enclosures for noise generating machines such DG sets, etc; • Water spray • Construction of metalled roads • Speed control of vehicles during transportation of materials
Mitigation measures for socio-economic environment	• Training to local people for employing them in the proposed project • Mechanism for providing effective guidance in financial planning to effected people • Best practices in land acquisition and R&R are as follows: a) Land should not be acquired without the consent of the majority of the project-affected population. The project proponent should receive 'free, prior and informed consent' from the affected population. b) The affected population should include not only landholders but also people dependent on forest for livelihood. c) The R&R plan should be a comprehensive framework within which compensation, and community development plans are integrated and the roles of local communities, governments and project proponent are clearly delineated d) Compensation for land should be based on the current market price. e) There should be a provision for land-for-land compensation for indigenous communities. f) The R&R plan should be framed in consultation with the PAP. g) The affected population should have a say in the selection of the resettlement site and design of the housing and other infrastructure facilities. h) Attempt should be made to resettle the displaced people as near as possible to the project sites, so that they can obtain access to facilities as well as economic benefits generated from the project. i) Basic amenities should be provided at the new resettlement site. This should include roads, safe drinking water, sanitation facilities, educational and health facilities, etc. j) All unskilled and semi-skilled direct employment created in the project should ideally go to the affected population. k) Financial assistance and training for self-employment should be provided to the affected population.

Sanitation and solid waste management in FMU camps	• FMU camps should have a proper arrangement for sewage management • Domestic waste should be used for bio-composting, the compost can be used for nursery development. • Proper management and disposal of solid waste generated due to logging, plantations, agro-chemical waste, etc.
Mitigation measures adopted during logging related activities	• Avoid logging in the rainy season and establish criteria for logging on slopes and near water and clearly mark areas that should not be harvested/ felled. • Locate log landing in well drained, easily accessible areas downslope so a straight skid road can be followed. • After the harvesting of a timber crop, the land must remain in forest use. • Use of low impact harvesting equipment
Plantation management and harvesting	• Replanting as soon as possible after cut • Planting of cover crops between rotations; addition of fertilizer to compensate for nutrient loss
Occupational health and safety	• Fuel storage area should have a proper fire-fighting system. • Use of PPE (helmets, ear plugs, goggles, mask) • Plan for forest fire management • First Aid Kit • Proper signage for landslide prone areas.

CHAPTER 5

Review of an EIA report for forestry related activities

5.1 Introduction

The purpose of reviewing an EIA report is to take decisions with respect to the following:

- Should the project be cleared in the form proposed by the project proponent?
- Should the project be modified to reduce the impacts and then cleared?
- Is the 'No project' option justified, considering the social and environmental costs vis-à-vis the benefits to be accrued from the hydropower development?
- If the project is cleared, then what conditions may be prescribed for compliance by the project proponent during design, construction and operation of the project?

5.2 Composition of the EA review team

To ensure a proper review of the EIA report, the review committee should include experts from diverse fields with a good understanding of forestry related issues and various forestry activities and potential impact areas. The reviewers should be technically sound and competent enough to review the report. They should be able to make valuable suggestions/ recommendations to the project proponent for taking corrective action. Ideally, in the case of forestry activities, the team should comprise of the following experts:

- **A biodiversity expert/botanist** who can review the biodiversity issues, biodiversity conservation and afforestation plan.
- **A civil engineer/expert** required during construction of access roads and construction and other civil activities in FMUs.
- **An environmental scientist/engineer** to overview the adequacy of mitigation options suggested for air, water and waste management.
- **A groundwater expert/hydrologist** to review and assess the hydrology of the study area and the drainage pattern.
- **A social science expert/anthropologist** to review the social issues and the resettlement and rehabilitation plan.
- **A geologist** to review the geological risks and associated impacts.
- **A safety engineer and occupational health expert** who can review the levels of safety, mechanization, occupational hazards and mitigation strategies to combat hazards at the planning and operational stages.
- **Nominees** of the regulatory agency.

5.3 Reviewing an EIA report for forestry related project activities

While reviewing the EIA report, the following key aspects needs to be carefully examined:

- Has the EIA report evaluated the beneficial and adverse impacts of the project properly and clearly?
- Which are the unavoidable adverse impacts? Are they acceptable?
- Is the proposed mitigation plan sufficient to manage and control all adverse impacts?
- What kinds of safeguards need to be incorporated to ensure that the mitigation plan is implemented effectively?
- What are the parameters which need to be monitored during project construction and operation so that the state of the environment can be studied throughout the project life?
- Is the project acceptable to the local communities?
- Are the concerns of the local communities genuine and has the EIA report adequately addressed these concerns?
- Will the project improve the socio-economic status of the local communities?

Guidelines for using the reviewer checklist:

By using the *reviewer checklist for a forestry project*, the reviewer will be able to gauge the acceptability of the EIA report. This can eventually assist in determining the environmental feasibility of the project being assessed.

Scorecard approach: The checklist is designed to follow a "scorecard" approach, using a possible scoring range of 0-10. Scores for each relevant item in the checklist are totaled, and a calculation of the percentage of the total possible score is made.

Relevance: The checklist is a generic checklist for forestry projects. Not all questions may be relevant to all the forestry projects. Therefore, the first step is to determine the ***relevance*** of each question, for the specific project being considered. For each question that is relevant, "1" is entered in the box under Column "A" of the checklist, "Is question relevant for *this* project?" Because the number of relevant parameters varies from project to project, the possible total score for each EIA report will vary accordingly.

Adequacy: It is then necessary to determine the ***adequacy*** of the EIA report in answering only those questions that are judged to be relevant. Under the "adequacy" heading (Column "B"), the reviewer is asked to assign a numeric score from 0-10. The numeric scoring for the various elements of the EIA report, based on their level of completeness, clarity, and quality, is as follows:

9-10: **Excellent:** Information provided is clear, comprehensive and detailed, with no gaps or weaknesses.

7-8: **Good:** Information provided is comprehensive, has only very minor weaknesses which are not of importance to the decision-making process.

5-6: **Adequate:** Information provided has some minor weaknesses, but the deficiencies do not strongly compromise the decision process; no further work is needed to add to the environmental information.

3-4: **Weak:** Information provided has gaps and weaknesses which will hinder the decision process; some additional work is needed to complete the information.

1-2: **Very poor:** Information provided has major gaps or weaknesses which would prevent the decision process from moving ahead; major work is required to rectify.

0: **Absent:** Information needed for decision-making is not included in the report, and needs to be provided in its entirety.

Importance: It is also necessary to determine the importance. In many cases, some of the issues is relevant for the project but is not very important or significant in impact assessment. For instance; name of project, project schedule is relevant for the project but it has not much importance in environmental and social impact assessment. Therefore, while assigning the value for ***importance***, reviewer should always keep in his/her mind the level of importance, a) relevant but least important, b) relevant but average important, c) relevant but most important.

In addition, for each relevant item, the reviewer is instructed to fill in comments for each relevant item. This should be made a mandatory procedure, so that the justification for assigning a specific value for adequacy as well as importance is well documented. For those items where the information provided in the EIA report is not adequate, it should be indicated in the far-right column what types of information are still required, in order to adequately address the question.

As a rule of thumb, an EIA report achieving a score in the range of 50-60% or higher should be considered acceptable. Borderline scores, or scores much lower than this limit, indicate that the EIA report is likely not acceptable. It should be noted, that while this design (i.e., using a numeric scorecard, and requiring reviewers to provide comments and justifications for their itemized determinations) is intended to minimize subjectivity, this "semi-quantitative" approach cannot totally eliminate all subjectivity from the review process, because the assignment of numeric scores is itself, by nature, a subjective process.

At the end of each section of the checklist, space is left for “other questions.” The space provided here may be used to elaborate on the listed questions in each section (referencing the question number), or to add questions that may have specific relevance for the project being reviewed.

Overall Evaluation: There are six components that need to be evaluated to give the total score.

1. Applicant Information
2. Project Description
3. Baseline information
4. Impact Assessment
5. Mitigation and Environmental Management Plan (EMP)
6. Other Requirements

The final section of the checklist provides a framework for giving an overall evaluation of the EIA report. Each topic covered in the checklist is assigned a score, from 1-10, according to the same system used in the main section of the checklist. The resulting value provides a further basis for determining whether or not the environmental information presented is adequate (“acceptable” or “not acceptable”) for making an informed determination about the quality of the EIA report. This is simply a way to cross-check the results that were obtained through a detailed itemized review of the EIA report *(Refer reviewer checklist).*