

**Republic Of Rwanda  
Ministry of Infrastructures**

**ENERGY WATER AND SANITATION  
AUTHORITY (EWSA)**



**Electricity Access Rollout Programme  
(EARP)**



**BEST PRACTICES AND SCREENING TOOLS IN  
MAINSTREAMING ENVIRONMENTAL AND SOCIAL  
SAFEGUARDS INTO EARP**

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## ACRONYMS

EARP: Electricity Access Roll-Out Program  
CU: Coordination Unit  
EIA: Environmental Impact Assessment  
EMF: Electromagnetic Field  
EMMP: Environmental Mitigation and Monitoring Plan  
ESD: Environmentally Sound Design  
ESMP: Environmental and Social Management Plan  
EWSA: Energy, Water and Sanitation Authority  
GoR: The Government of Rwanda  
OHL: Overhead Transmission Lines  
RDB: Rwanda Development Board  
REMA: Rwanda Environmental Management Authority  
RP: Resettlement Plans  
SF6: Sulphur Hexafluoride  
GIS: Geographical Information Systems  
PMU: Programme Management Unit  
IUCN: International Union Conservation of Nature  
USAID: United States of America for International Development  
FAO: Fund for Agriculture Organisation  
EPA: Environmental Protection Agency  
UN: United Nations  
NGO: Non-Governmental Organisation

## INTRODUCTION

### ABOUT THESE GUIDELINES AND BEST PRACTICES

The Government of Rwanda (GoR) through the Ministry of Infrastructures intends to initiate through EWSA The Rwanda Electricity Access Rollout (EARP). The activities under EARP such as construction of transmission lines and substations can be expected to have minor direct and indirect impacts on villages and hamlets where the proposed transmission lines pass, both positive and even negative if mitigation measures and compensation is not undertaken effectively.

The aim of these guidelines and application of Environmentally Sound Design (ESD) principles in planning and carrying out EARP activities is to assist EWSA to avoid potentially costly mistakes and often makes EARP activities more sustainable over the long run.

These guidelines include literature on environmental impacts associated with EARP activities, ESD, and best management practices for mitigating potential impacts that will help EWSA to establish a mechanism to determine and assess future potential environmental and social impacts of the EARP, and then set out mitigation, monitoring and institutional measures to be taken during implementation and operations of the proposed EARP investments/activities, to eliminate their adverse environmental and social impacts, offset them, or reduce them to acceptable levels.

These guidelines are developed to help EWSA staff, its contractors and partners meet the challenges posed by the need for Environmentally Sound Design (ESD) in EARP activities. These guidelines should be a reference for EWSA staff, EWSA contractors and partners on national environmental procedures and requirements.

More specifically, these guidelines should help EWSA environmental and social staffs write concept papers and creating proposals, as well as implementation plans and associated mitigation, monitoring and evaluation plans that conform to national and international environmental procedures. They should be a reference for EWSA staff for evaluating and classifying project papers, proposals, implementation plans, and mitigation, monitoring and evaluation plans.

The following EARP activities are covered:

- New Construction of Conventional Substations
- Extension of Conventional Substations
- Extension of GIS Facilities (within existing conventional substations)
- Construction of High Overhead Transmission Lines (OHL)
- Construction of Underground Cables (UGC)
- Rehabilitation and Extension of Medium and Low Voltage Urban/Rural Grids

These guidelines are only a summary and guidance for experienced professionals in the Electrification sector and cannot be a substitute for detailed sources of technical information or design manuals for EARP subcomponents. Users are assumed to have sufficient background and experience in the technical aspects of EARP subcomponents design.

## **ENVIRONMENTALLY SOUND DESIGN (ESD)**

*(Much of the material in this section was drawn from ENCAP, Environmental Guidelines for Small-Scale Activities in Africa 2<sup>nd</sup> Edition, 2005 website: [www.encapafrika.org](http://www.encapafrika.org)).*

### **Definition of Environmentally Sound Design (ESD)**

In the context of EARP activities, Environmentally Sound Design (ESD) is the design and implementation of EARP activities and subprojects such **that the environmental harm associated with a particular development objective is kept to a practicable minimum.**

ESD is necessary to prevent:

- Failure of economic or social development projects due to environmental causes,
- Damage to the environment, which imperils future economic and social development.

ESD is prevention-based across the project lifecycle. Prevention begins with the choice of *means* by which a development objective is achieved.

For example in the case of EARP activities, the development objective (or goal) of a project or activity may be to increase electricity access to households. Potential means to achieve this objective include among others; construction of towers and substations, clearing of land and vegetation, use of oil lubricants for the transformers, etc. . ESD dictates that each alternative be considered, and that the environmental impacts associated with each choice be weighed *alongside* technical, economic and social criteria.

Once the means are chosen, ESD also takes a prevention-based approach to the specifics of project design. Can changes in location, construction techniques, or operating practices significantly reduce critical environmental damage?

Finally, where negative impacts cannot be entirely prevented or minimized by design choices, ESD mandates that they be mitigated during project operation, or remediated after the project is decommissioned.

### **Environmental Impact Assessment: A Process for ESD**

Environmental Impact Assessment (EIA) is a formal process for identifying the likely effects of particular activities or projects on the environment and on human health and welfare.

As such, we view EIA as a tool to organize, facilitate and document the practice of Environmentally Sound Design (ESD). In other words, **Environmentally Sound Design is the goal or objective of any EIA process.**EIA is useful to both project designers and planners and those who must assess project proposals for funding.

EIA provides a structure for clearly listing environmental review requirements. Such review requirements are “safety checks” for environmental soundness.

The documentation required by the EIA forms a basis for anyone making an environmental evaluation of a projects design and implementation. Evaluators may include funders, regulatory agencies, and the implementing organization itself.

The systematic nature of the EIA process reduces the errors and oversights, which are likely when people use ad hoc approaches to environmental design. In addition to assessing a project’s potential negative environmental impacts, EIA encompasses the development of mitigation measures and management plans to reduce such impacts.

## **The relationship of Environmentally Sound Design to Sustainable Development**

**Sustainable Development** is the overall objective of any process of economic and social development. Meaningful movement towards more sustainable development requires both: (1) that development activities themselves be sustainable; and (2) that a set of enabling conditions be fulfilled. Because ESD occurs at the project or activity level, it addresses the first sustainability requirement: ESD is essential to implementing **sustainable activities**.

As its name implies, ESD is primarily concerned with environmental sustainability. However, since ESD involves **environmental justice**, it also has an important application to **social sustainability**. Environmental justice is the idea that the poor should not bear a disproportionate part of the economic and health burdens of environmental degradation.

## **Environmentally Sound Design and Best Development Practices**

ESD requires that possible environmental damage associated with projects be predicted and its effects mitigated. This is not sufficient, however. Environmentally sound design must also adhere to a set of principles which apply to sound project design, management and implementation in general. The following principles represent a current consensus on "best practices" in development projects:

- Assure technical feasibility
- Understand the social and policy context
- Secure stakeholder commitment
- Engage in supportive capacity-building
- Practice adaptive management.
-

Each best practice has specific applications to ESD. These applications are discussed below.

### **Assure Technical Feasibility**

All projects must be **technically feasible**. The construction techniques, materials, and technologies employed must meet their intended purpose over the lifetime of the project.

In the area of the environment, technical feasibility means that the design is appropriate and robust in terms of the environmental conditions of the project site(s). Environmental conditions include climate (e.g., patterns of rainfall, temperature ranges), soil types, aquifer characteristics, and the probability of extreme events such as cyclones and earthquakes.

### **Understand Social and Policy Context**

Projects and activities do not exist in isolation. They are implemented within an environmental, social, economic and institutional context. This context can determine whether a project or activity is viable or even desirable. Social and policy context issues particularly important to ESD include:

**National Environmental and Resource Management Policy.** Project design and implementation should conform to national environmental laws and regulations. They should be compatible with national environmental strategy (in the case of Rwanda, “Organic Law on Protection and Conservation of Environment” and “National EIA Guidelines”).

**Local or Traditional Systems of Resource Management and Allocation.** Systems of land tenure and resource management have clear relevance to most rural development projects. In rural areas of most of African countries, land tenure is often a mix of modern (land title) and traditional systems—and projects must frequently obtain approval for land or resource use through *both* systems.

Moreover, traditional systems of resource management are often *gender-specific*. That is, customs may assign the responsibility for monitoring and managing a given resource only to women, or only to men. Project designers cannot assume that the men in a community can speak for the women, or vice versa.

**National Economic Policy and Ongoing Policy Reform.** Rwanda like many African governments are pursuing sectoral or structural adjustment programs to stimulate economic growth and international trade. Examples of macroeconomic tools used in such programs include altering exchange or interest rates, reducing government budgets, promoting market liberalization and enhancing the role of the private sector. These reforms can influence—both positively and negatively—how resource users manage their environment.

### **Secure Stakeholder Commitment**

*Stakeholders* are those groups most directly affected by the project. This includes the intended beneficiaries, the funders, and those whose use of, or access to, local resources is likely to be affected. Here, we focus on residents of local communities and users of local resources.

A project will maintain its environmental soundness only if proper operation and maintenance procedures are followed. Without stakeholder commitment, these proper procedures are likely to be violated. In the worst case, the project may actually do more harm than good.



### **Capacity-Building**

Capacity-Building is an essential complement to and means of securing stakeholder commitment. In an environmental context, capacity building means helping local users or project beneficiaries to acquire:

- The knowledge or skills required to operate and maintain a project in an environmentally sound manner
- An understanding of how project activities affect environmental health, and why these operation and maintenance practices are important. Such understanding is essential to secure stakeholder commitment.

### **Adaptive Management**

Under adaptive management, managers adjust the way they carry out a project in response to feedback from the field. Adaptive management requires both project monitoring and decision-making based on monitoring results.

As applied to the environment, adaptive management means changing project operation or design when monitoring shows unexpected, adverse environmental outcomes. Adaptive environmental management requires an **Environmental Monitoring and Mitigation Plan (EMMP)**, and explicit allocation for environmental monitoring and evaluation activity in the project budget. Monitoring and mitigation plans identify funding sources and responsibility for monitoring and evaluation from the onset of project design.

### **ESD and Community Participation**

The need for community participation is a clear consequence of applying “best development practices” to the environmental aspects of project design and implementation. Community or stakeholder participation beginning early in the design process is key to at least three of these practices:

**Assuring technical feasibility.** The detailed knowledge community members have of local conditions is often critical in anticipating and identifying a project’s potential environmental impacts.

**Securing stakeholder commitment.** By participating in design, implementation and monitoring, participants gain *ownership* and *responsibility*, as well as a clear understanding of objectives and anticipated outcomes. Ownership, responsibility and understanding create incentives to identify and mitigate adverse impacts.

**Practicing adaptive management.** Local participants are in the best position to monitor long-term environmental effects of project activities, and monitoring is a key aspect of adaptive management. Further, local participants or communities need the understanding and capacity to adapt activities to future change after donor support ceases.

Finally, community participation is an important mechanism for assuring environmental justice. Development activities often involve tradeoffs between economic or social development and environmental quality. External authorities should not impose these tradeoffs unilaterally. Because local residents must *live with* the environmental consequences of activities, it is only just that they understand and have a voice in any tradeoffs that are ultimately made.

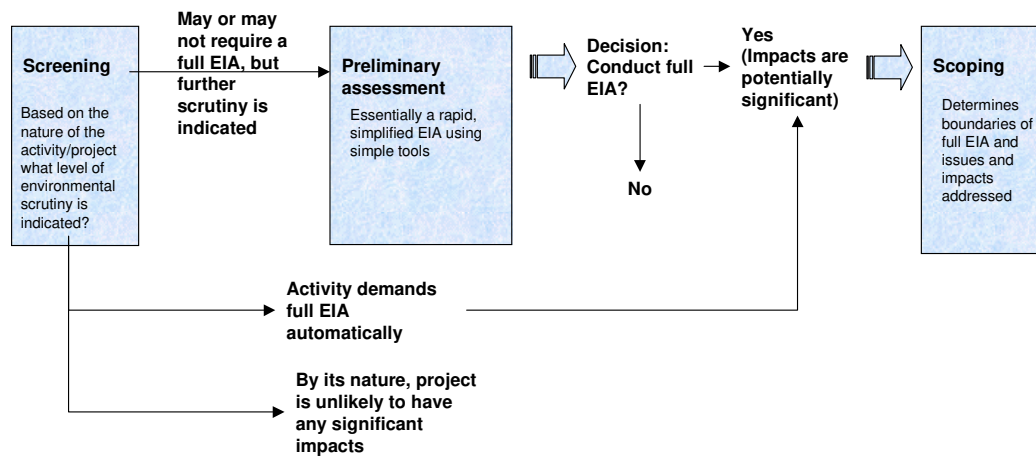
## SCREENING TOOLS AND PRELIMINARY ASSESSMENT

In this section, we will describe the types of information needed to conduct the screening and preliminary assessment steps of the EIA process. Some practical, basic tools and methods to use are also introduced.

### INTRODUCTION

The EIA process consists of:

- Gathering information to acquire an **understanding of the project**;
- **Screening**, in order to reach a decision regarding what further steps of the EIA process, if any, will be conducted;
- **Preliminary Assessment**, a rapid and streamlined version of a full EIA. Preliminary assessments are performed when screening indicates that further scrutiny is needed, but that a full EIA is not automatically required. Preliminary assessment produces a decision as to whether a full EIA should be undertaken;
- **Scoping**, an exercise to define the bounds of the full EIA study, should one be needed.



All EIA processes involve screening. The section below focuses on:

- Types of information required to gain an understanding of the project and to screen it successfully, and
- A set of relatively simple tools useful for the screening and preliminary assessment stages

## INFORMATION REQUIREMENTS

To screen a project for potential environmental impacts, certain information about the community and physical environment at the project site is needed. Some of this information will already have been collected to develop the project objectives. But additional data will likely be necessary to identify alternative methods of accomplishing the project objectives and to evaluate their respective impacts on the environment.

### **Environmental Characteristics of the Project Site or Area**

The environmental data required will vary depending on the project or program. In general, however, the following data will be needed:

- General climatic information (e.g., annual rainfall patterns, longer-term flood and drought cycles, wind patterns);
- Land-use patterns (e.g., agricultural, urban, protected area);
- Resource use by the people (e.g., forestry, aquaculture, agriculture, fishing, natural grasslands for grazing);
- Type of habitats present (e.g., mangrove, forest, desert, grassland);
- Physical characteristics (e.g., soil type, topography, erosion potential, presence of streams, ground water characteristics);
- Biological characteristics (e.g., animal and plant species present and their significance, i.e., food source for the people, endangered species);
- Status of any protected areas (national or other parks, reserves, or other as defined by national or other laws) that could be affected by the action, including protected areas in any possible zone of impact (direct or indirect, upstream or downstream), description of location, characteristics, conditions; and
- Location and information about designated, classified, or gazetted forests (if not defined as a protected area per se under national or other law) as well as identification of any relatively undegraded forest, even if not classified or gazetted.

### **Economic and Social Data**

Economic and social information useful for screening purposes usually includes:

- Crops and livestock raised, and associated agricultural practices (e.g., tillage and harvesting methods, pesticide and fertilizer use);
- Agriculture, rain-fed or irrigated;
- Local water sources and usage;

- Community resources (e.g., raw building materials, land ownership and distribution, work patterns, role of women);
- Local sanitation facilities and hygiene practices;
- Population size and demographics (e.g., principal diseases, health and family planning practices, sex/age distribution);
- Local religion, culture, and traditions;
- Literacy levels and educational training facilities; and
- Community organization, leadership, communication, and types of occupations.

### **Map-Based Information Resources**

Effort should be devoted to collecting and using available maps to identify and chart the location and movement of human and natural resources. Maps may display environmental or economic/social information, or they may combine the two categories. Map resources to look for include:

- **Topographical and physical maps** at the scale 1/10000 to 1/20000 provide information on: inhabited areas; major wind directions; waterways and water bodies; different types of vegetation cover; sensitive and fragile areas; protected forests; and, classified forests.
- **Maps, plans and sketches of the proposed project or activity** provide information on: land use around the selected site; areas disturbed during construction, and type of disturbance; existing or planned solid waste collecting systems, especially for urban projects; and, existing or planned liquid waste collection systems.

### **Sources of Environmental Data**

At least some of the environmental data required for the screening and preliminary assessment will already exist. Sources of information include:

- Direct observation during a site visit;
- Local counterparts;
- Local villagers, farmers, and residents;
- Regional meteorological stations;
- Local government agencies, such as the Ministry of Agriculture or Forestry, or local agricultural extension workers;
- Airport;
- Local university or training centers;
- Local NGOs, consultants, and experts;
- National Conservation Strategy for Sustainable Development (IUCN);
- National Environmental Action Plan;

- National Report on Environment and Development prepared for the UNCED Rio 1992 conference;
- Tropical Forestry Action Plan;
- USAID Environmental Sector Assessment (sometimes referred to as Environmental Threats Assessment);
- USAID Biodiversity Assessments (in place or likely in process);
- GIS data bases (consult Ministry of Environment or Natural Resources or equivalent);
- UN Agencies such as UNEP, FAO, etc. (which has supported international soils and water resource inventories in many areas).

## Sources of Economic and Social Data

Most of the economic and social data required for the screening and preliminary assessment should be easily obtainable. Sources of information include:

- Direct observation
- Local counterparts
- Local Farmers and Villagers
- Local NGOs

These sources may supplement or replace official statistics, depending on the availability and relevance of official data

## TOOLS FOR SCREENING AND PRELIMINARY ASSESSMENT

### Checklists

Checklists are widely used in EIA processes to guide decision-making, especially during the prefeasibility and planning phases of the project lifecycle, when it is most critical to anticipate adverse impacts and to include mitigating measures in projects. Checklists are designed:

- To help *identify significant negative impacts* by providing the right questions to ask regarding the various project activities and the respective environmental components that may be affected. Checklists can be used to determine environmental impact thresholds, thus indicating whether a full-scale EIA is needed for a particular project;
- To provide a *systematic approach* to the environmental screening of development projects. A checklist forces the assessment to consider a standardized set of activities or effects for each proposed action, thus bringing uniformity to the assessment process;

- To indicate *how and why certain project activities have environmental impacts* which will allow planners to transfer those principles to the screening of projects not specifically addressed by the checklists;
- To assist in *identifying appropriate mitigation measures* to be incorporated into the project design; and,
- To *increase environmental awareness and understanding* of the relationship between environmentally sound practices and sustainable development.

Checklists offer the advantage of simplicity. They bring structure to gathering and classifying information, to identifying potential environmental impacts, and to thinking about possible mitigation options. They also help in reaching tentative conclusions on the extent of environmental impact.

It is important to note that, no matter what the structure of checklists, a variety of sources can be used to develop them; local individuals, experts, and other concerned parties. A simple checklist is comprised of the following categories:

- **Project activity.** Identifies the nature of the proposed project and the scope of its activities and tasks.
- **Potential environmental impacts.** Lists the potential impacts of the proposed project such as threats to a particular species, reduced visibility, materials soiling, etc.
- **Recommended mitigation strategies.** Lists some potential remedies to the identified impacts. Mitigation options can refer to either the pre- or post-construction phase.
- **Degree of Environmental Impact.** Synthesizes the assessment of impacts and potential remedies and indicate the environmental impact of the proposed project, ranging from severe to acceptable.

### Types of Checklists

**Simple Checklists.** As the name implies, these are simple lists of environmental factors, conditions or characteristics whose presence or absence is to be noted. They usually provide no guidance on: (a) the assessment of impacts on these factors, (b) any useful predictive techniques, or (c) the type of data needed.

**Descriptive Checklists** provide guidance on assessment, with corresponding information on appropriate measurements and predictive techniques.

**Scaling Checklists** attempt to indicate the importance of impacts to decision-makers.

**Questionnaire Checklists** can provide a thorough and useful step-by-step procedure, particularly useful to non-experts.

### Interaction matrices

The main disadvantage of checklists—that they generally fail to link specific development activities with given impacts—led to the development of matrices, perhaps the most popular and widely used EIA methodology (Bisset, 1987).

Typically, matrices combine two checklists. Alternative actions (measures, projects, sites, designs) are listed as column headings, while the rows are the criteria (environmental outcomes) that should determine the choice of alternative.

In each cell of the matrix, a conclusion can be listed indicating whether the alternative action is likely to have a beneficial or adverse effect relative to the indicated criterion. In some matrices, the conclusion is stated as a numerical value or symbol indicating the level of intensity of the effect. There is an opportunity, moreover, to apply relative weighting to the various criteria when evaluating the completed matrix (EPA, 1993).

An interaction matrix allows the identification of cause-effect relationships between specific activities and impacts, but does not easily distinguish between direct and indirect impacts. The entries in the cells of the matrix can be either qualitative or quantitative estimates of impact. Each cell can also be divided diagonally to display an estimate of both impact severity and significance.

Matrices are useful for impact identification and for displaying the results of both impact analysis and impact assessment.

## **Network analyses**

Network Analysis relies upon an understanding of the ecological relationships among the environmental features in a project area. Environmental features are generally interconnected in some functional manner and the connections, displayed in a network or "web," depict which features are related to others. A project will directly impact one or more features and the network is used to indicate what other features may be subsequently affected indirectly. An "impact network" can then be constructed to display the project actions and which features may be affected directly and through secondary, tertiary and higher-order impacts. Network analysis is useful for impact identification.

## **Overlays**

This technique has always been extremely useful in identifying areas that have high environmental sensitivity. The technique entails the separate mapping of various critical environmental features - wetlands, steep slopes, soils, floodplains, bedrock outcrops, wildlife habitats, vegetative communities, and cultural resources—at the same scale as the project's site plan. The environmental features are mapped on transparent plastic in different colors. The maps are then overlain on the project map to highlight the areas of highest environmental sensitivity (EPA, 1993).

Geographical Information Systems (GISs) are used to computerize the overlay process. Environmental features are mapped, and the mapping digitized and stored in the GIS database. The mapped features can be combined to produce computer-

generated displays of one or more environmental features in a specified geographical area. If the GIS mapping is conducted systematically, information acquired on specific projects can be combined, and the GIS database becomes more detailed over time (EPA, 1993).

Even if resources or time do not allow to physically construct overlays or to use a GIS system, comparing the maps of information about the setting with maps or plans that are available of the proposed action can be very useful. The comparison should explore how various kinds of resources/areas may or may not overlap with the geographic area affected by the proposed action. You will need to be careful about comparing maps of different scales, so you will often not have a precise indication of areas of overlap, but you will be able to see areas of potential conflict that need to be investigated further.

### **More Advanced Screening Tools used in Environmental Impact Assessment (EIA)**

The three categories of tools described in the box all attempt to produce numerical estimates of the environmental impacts of projects or activities. Because such estimates are never certain, all of the techniques described here are particularly concerned with the *range* of likely outcomes, or the *probability* of a particular result.

***Simulation Modeling (Impact Prediction)*** In this approach to environmental impact assessment, the principal cause-effect relationships of a proposed action are set out in a mathematical model capable of predicting future environmental conditions. Such models come in all degrees of complexity, from simple variations on mass balance equations (e.g., for estimating nitrate-nitrogen in groundwater) to highly complex multivariate systems. Some models include statistical routines for estimating error associated with model outputs. All but the simplest involve computer modeling. (EPA, 1993)

Environmental effects that have been mathematically modeled include: thermal plumes, noise, transportation, air emissions, stormwater runoff, pollutant transport in water, pollutant transport in soils, risk assessment, ecological risk assessment, and wasteload allocations (EPA, 1993).

***Risk Assessment*** refers to analyses that assess the potential risk of harm a project or activity will impose on individuals, communities, and ecosystems. Risk assessment begins with predictions of the conditions likely to result from a project or activity. It then must evaluate the risk these conditions pose to individuals, communities and ecosystems.

***Cost-Benefit Analysis*** is a formalized accounting of the anticipated costs and benefits of an action. Cost-benefit analysis is of particular use when comparing alternative forms of an action. The "costs" of an action include, but are not limited to the economic costs, the risks to long-term environmental quality and public health, and the impacts to natural and man-made resources. Benefits include monetary benefits, but also extend to beneficial changes in the quality of life, protection of sensitive environmental resources, and long-term enhancements to human health and welfare. Under costs-benefit analysis, both costs and benefits are usually assigned monetary values. This entails difficult and possibly controversial value judgements—e.g., what is the monetary value of one case of childhood asthma?



## CHOOSING TOOLS

The table below compares the advantages and disadvantages of the four simpler Screening Tools used in EIA discussed here. Typically, there are several alternative methods available to perform a single EIA task.

High-level criteria to apply when selecting a method include (text adapted from Lee, 1997):

**Appropriateness.** The assessment method chosen should be *appropriate* to the specific task for which it is to be used—that is, the method should produce the needed output. For example, during scoping, fairly simple assessment methods can provide 'order of magnitude' assessments of impact which may be entirely appropriate. Sophisticated methods which provide very detailed and precise output are probably not appropriate at this stage of the EIA process. On the other hand, simple methods may be too crude and approximate for use in some of the later stages of impact prediction.

**Economy.** A method should be *cost-effective*. That is, it should permit an environmental analysis of the required quality to be completed as economically as possible. The resource needs of the alternative assessment methods available for similar kinds of tasks vary considerably. (Factors affecting resource requirements include: quantity and quality of data input required, the quantity and skills of staff required for their use, the overall length of time required to obtain usable output, etc.) **It is important to recognize that environmental impact assessment studies are not primarily undertaken as research studies to advance knowledge but as inputs to planning and decision-making processes for which time, technical and cost constraints are operative.**

The ranking of alternative assessment methods may differ from project to project. For example, in some circumstances, considerations of economy may conflict with those of appropriateness, replicability, and consistency. If so, a trade-off between these different goals of good assessment practice will have to be faced. However, in a well-organized EIA system, the resolution of such conflicts should not be a serious problem.

In conclusion, please note that:

- Sophisticated and resource-intensive methods are often not the most appropriate ones to use in practice;
- Resource constraints on EIA studies, though real, should not be an obstacle to best practice when (1) the impact studies to be prepared by developers are commenced sufficiently early in the planning and design process, and (2) careful consideration is given in the selection and correct use of appropriate EIA methods;
- As experience shows, the costs of satisfactorily conducted EIA studies normally account for a very small percentage of a new project.

## Application, Advantages and Disadvantages of various EA Tools for Screening and Preliminary Assessment

EA Tool	Application to specific EIA tasks	Advantages	Disadvantages	Ease of application
<b>Checklists</b>	<ul style="list-style-type: none"> <li>• Identify potential impacts: good</li> <li>• Predicting impacts: threshold determination only</li> <li>• Determining significance of impacts: threshold determination only</li> </ul>	<p>Useful for structuring initial stages of assessment</p> <p>Help to ensure that vital factors are not neglected</p> <p>Easy to apply, particularly by non-experts</p>	<p>Danger of “tunnel vision”, limiting consideration to items on a given checklist</p> <p>May deal only with the environment and do not indicate causal linkages between activities and impacts</p>	<b>not difficult</b>
<b>Matrices</b>	<ul style="list-style-type: none"> <li>• Identify potential impacts: excellent</li> <li>• Predicting impacts: fair</li> <li>• Determining significance of impacts: fair/good</li> </ul>	<p>Indicates causal linkages between activities and impacts</p> <p>Can include weights to signify relative impact significance</p> <p>Can help to distinguish among phases of project development (design, operation, construction, abandonment, etc.)</p>	<p>Danger of “tunnel vision”, as with checklists, which can be overcome by expanding the matrix</p>	<b>moderately difficult</b>
<b>Overlays</b>	<ul style="list-style-type: none"> <li>• Identify potential impacts: good</li> <li>• Predicting impacts: n/a</li> <li>• Determining significance of impacts: n/a</li> </ul>	<p>Excellent for showing spatial dimension and location of impacts</p> <p>Most useful for assessing alternative routes for linear developments, such as pipelines, roads, transmission lines, etc.</p>	<p>Deals less successfully with timing, reversibility, and probability of impacts</p> <p>Sharp boundary definitions can be misleading; transitions within and among land types can be less dramatic than mappings may</p>	<b>moderately difficult</b>

			indicate	
<b>Networks</b>	<ul style="list-style-type: none"> <li>Identify potential impacts: excellent</li> <li>Predicting impacts: excellent</li> <li>Determining significance of impacts: excellent</li> </ul>	<p>Provides visual summaries that are easily understood and communicated to decision-makers and the public</p> <p>Useful for identifying important indirect impacts</p>	<p>May oversimplify relationships; can be hard to show adequate level of detail to illustrate individual system impacts</p> <p>As with all other methods above, static analysis does not show changes over time</p> <p>Doesn't show relative significance of impacts</p>	<b>difficult</b>

Table adapted from (Bisset, 1987) and (Chatzimikes, 1983)





## ENVIRONMENTAL ISSUES AND BEST PRACTICES ASSOCIATED WITH EARP.

### EARP IN BRIEF

According to the World Energy Council (2008) some two billion people in rural areas of developing countries do not have adequate energy sources to allow fulfillment of the basic human needs of nutrition, warmth and light - let alone the possibility of harnessing energy for productive uses that might allow them to escape from the cycle of poverty and Rwanda as a developing country is not an exception.

The Government of Rwanda, in its effort to sustain economic growth, has increased and stabilized the power production since the severe power shortages in 2004. However, infrastructure bottlenecks in the urban areas and limited access in the rural areas have emerged as a significant constraint. One of three major strategic objectives of the Economic Development and Poverty Reduction Strategy (EDPRS 2008-2012) is to expand access while also improving the quality and lowering the cost of economic infrastructure – especially transport, power, and communications. The Government of Rwanda (GoR) also exercises a strong leadership role in donor coordination and has begun to work with donors on a clearer division of labour by identifying areas of individual donor comparative advantage.

In connection with the mentioned strategy, the Government of Rwanda through the national Energy, Water and Sanitation Authority (EWSA) is embarked on a country-wide *Electricity Access Program* to realize the primary EDPRS target for the electricity sector of tripling access by 2012 to about 16 percent of households and at least 50 percent of identified public institutions in health, education and local administration. This will require about 230,000 with new grid connections, and will also include efforts to reach rural consumers and service providers currently off the national grid.

In this regard, EWSA has established a new Electricity Access Scale-up Roll-out Program (EARP) as a part of its corporate structure. The program will be implemented within the framework of a Sector Wide approach (SWAp) to encompass all donors active in the sector under one common sector investment program. The overall investment envelope for the first SWAp time (2009-2013) is estimated at \$378 million, for the program period covered by the Prospectus that has been endorsed by all the Partners and key sector institutions in Rwanda, including EWSA.

The Prospectus outlines the overarching spatial least cost rollout plan and priority connection targets through the medium term, the rollout strategy and the financing policy platform for the EARP. Additionally, the EARP implementation will be subject to a monitoring, evaluation and results framework as well as the oversight and accountability process of regular reviews as agreed with the energy sector working group (SWG), chaired by MININFRA on advice from the Partners.

The Rwandan transmission system is composed of 370 km 110 kV and 70 kV lines linking the southern substation Mururu II to Gikondo as well as the 70 kV line from Jabana to Rwinkwavu. The transmission system has also eleven 110kV substations, and four 70kV substations that supply all Country.

According to the high energy demand, The Rwandan transmission system require also the construction of new generation units and the Hydropower plants are more appropriate regarding to the profitability and the environmental protection. It is in this aim that two Hydropower plants **NYABARONGO** and **RUKARARA** are under construction in order to be able to increase the production capacity and to assure also some spinning reserve to reinforce the stability of the Rwandan network. To allow the evacuation of the energy produced from the two power plants, it is required to build a step-up substation at Rukarara and an 110kV transmission line from Rukarara to Kilinda Substation. The step-up substation and transmission line for Nyabarongo is included within another project.

The EARP include among others the following subcomponents:

- Construction of the new 110/30kV RUKARARA substation;
- Construction of the new 110kV Overhead transmission line 36km between KILINDA and RUKARARA
- Construction of a new 110/30kV RULINDO substation
- Rehabilitation and upgrade of 110/30kV GIFURWE substations
- Rehabilitation and Upgrade of 30kV distribution line 60km RULINDO-BYUMBA-GATUNA

## SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION - ISSUES AND GUIDANCE

### MAJOR ENVIRONMENTAL AND SOCIAL IMPACTS

#### **Positive Impacts**

The benefits of EARP activities such as high and medium voltage lines and construction of sub-stations will mainly be:

- Job creation during the lines and sub-station construction works, as well as creation of access roads and additional income will be a significant source of financial resources for low-income households;
- Development of economic activities: increase, processing and sale of agro-pastoral and handicraft products as a result of the roads to be constructed;
- Improvement of the living conditions of the targeted populations, particularly women (processing of market gardening and arboriculture products and sale of agricultural and livestock products).

#### **Temporary Negative Impacts**

##### **Physical Environment**

During the construction works, there could be hydrocarbon leaks from machines on the worksite which could pollute the soil to a limited extent. The compacting of earth fills can reduce soil permeability and thereby channel runoff water. On the other hand, loose earth used to backfill pylon piles can increase the vertical permeability of the soil and bring polluted surface water (through intensive farming or effluents from living bases, for example) into the water table. The air could be slightly polluted by gas emissions from worksite machines and by noise. These temporary impacts from the construction sites are quite limited in space and time. As regards the hydrography of the environment, there will be no disruption as a result of the works on the lines.

##### **Natural Environment**

The local fauna and flora may be disrupted by the activities of the worksites and noise caused by the transmission lines construction works. However, after the works, the fauna and original vegetation will be restored around the project structures. There will also be risks of poaching by the site workers.

##### **Agricultural Activities**

Contractors of EWSA will have to go into the properties at different times: creation of access roads to the power line route which will be subsequently abandoned. These various operations may cause damage of crops and the soil. It may also happen that drainage or irrigations systems, fences, hedges or paths are damaged.

#### **Permanent Negative Impacts: Line Construction**

##### **Physical Environment**



A medium-voltage aerial line might be affected by any shifting of soil in geologically unstable areas. Some steep hill slopes could be prone to problems arising from erosion (rockfall or landslides). By erecting pylons away from these unstable areas, the project shall be able to avoid the risks of rockfall.

### **Biodiversity and Ecosystems**

The savannah slashing and tree cutting in the corridors created in forest massifs, which are required in order to erect pylons and provide access tracks, could destroy a particular type of endemic (medicinal) flora or valuable tree species; however, the solution is to lay the lines well above the vegetation and trees (citrus orchards, etc.) using raised pylons, and thus avoid destroying the vegetation beneath them, unless it is herbage. The site access works, fixtures and installations (pylon platforms and cables) will produce the same impacts: loss of vegetation. Generally, the vegetation is rapidly restored to its original state through spontaneous regeneration.

Regarding the birdlife, while the risk of accidental collision into conductors is probable, that of MV electrocution is practically inexistent, as the conductors are so far apart; the number of bird deaths by such accidental midflight collision is insignificant, compared to those from predator attacks (birds of prey, snakes, carnivorous animals, etc.) in the area. This mortality has no effect on the population of any species, given their high reproductivity.

### **Agro-economic Activities**

There are three categories of losses concerning farm land: Temporary loss of land usage during track construction and site installation, Loss of usage of land on which pylons are erected, Losses relating to parcel development, in cases where pylons are erected on irrigated land.

Land use for installation of lines poses no constraints on agricultural activity, unless the activities themselves are detrimental to the security of the line. It will only entail construction of the required tracks on the land areas concerned, without dispossessing the owners.

The height of electricity line conductors can be adapted to the type of farming activities normally conducted in the area (orchards and irrigation). The main constraint is due to the pylons, which are generally placed at 400-meter intervals. The positioning of the pylons somewhat limits the arable areas and may hinder development of irrigated or irrigable land.

### **Habitat:**

The major negative impacts of the EARP activities will be:

- Purchase of land situated within the project right-of-way (for pylons, sub-station sites,
- and very rare cases of lines over housing areas);
- Reduction of value of land located in the immediate vicinity of the sub-stations or lines, especially where there are houses;
- Limited agricultural activity below transmission lines, and especially restrictions on certain forms of irrigation;
- Temporary reduction of density of trees and other forest species;
- Visual impact of transmission line, which runs through or over inhabited areas.

EWSA shall avoid expropriation. The aerial transmission lines can be seen from afar and will have more or less significant visual impacts, whether they are near inhabited areas or are installed away from them. The electromagnetic fields (EMF) created by the lines near the inhabited areas could distort the images on television or computer screens - even though standardized equipment is now adapted to function within magnetic fields. Similarly, the functioning of certain appliances could be disrupted by a passing incident on a line (lightning, circuit breakers flipping or tripped, etc.). Such incidents are generally limited to just a few cases per year.

### **Health**

Health may be affected somewhat by the electromagnetic field (EMF), noise pollution and ozone produced by the transmission lines. There could be some risk of leukemia for children living in the immediate vicinity of the lines.

### **Land Use Planning**

It is recommended that the transmission lines should not be installed in residential areas, urban suburbs or constructible areas, since these must be protected so as to guarantee future quality living conditions. The transmission line route does not threaten the agricultural activities of rural areas, and it is compatible with land usage in farming areas. Reservations are expected concerning protected natural areas, given the risk of degradation of the natural sites and landscape, which are of ecological or esthetic importance. The ecological, agricultural and landscape constraints must be assessed through detailed examination of the real impact of the works on the protected areas.

### **Easements and Cultural Sites/Landscape**

Regarding cultural or archeological sites, there is an extremely low risk of damage during the digging for the pylon foundations and construction of access tracks.

## **Permanent Negative Impacts of Substations**

### **Physical Environment**

During construction of the sub-stations, the soil and run-off water could be contaminated by machine oil leaks and effluent from the sites. Wind-blown dust could pollute the air. Noise made by the machinery could also be a source of disturbance at the sites. In the operation phase, the transformer station could pose risks of contamination of the water table by the insulating oil from the transformers. It should be noted that the transformers are compliant with the regulations relating to liquid dioxin compounds. The oils containing PCB have all been eliminated. Weeding around the station shall be carried out manually, thus avoiding the use of herbicides that pollute the environment. There is always the risk of explosion of transformers, causing fire outbreak and spillage of the dielectric oils they contain.

### **Natural Environment**

The direct impact on the natural environment concerned shall be negligible if sub-station sites or areas that transmission line sections and deviations cross are of particular interest in terms of flora and fauna. The sub-stations shall generally be constructed on small plots (less than 5 ha) of government or communal land that has

been significantly modified by human activity, and shall not entail any particular impact on the inexistent natural resources.

### **Human Environment**

The socio-economic impacts of a sub-station in the urban environment will be determined by the visual impact of the equipment and structures (gantry cranes, transformers, fences, etc.), which has been scaled down significantly. Noise pollution will be from the transformer windings or fans installed in the air-oil coolers. As many of the sub-stations are generally near roadways, the noise will be partly drowned out by that of traffic, except at night.

### **Impacts Relating to Sulfur Hexafluoride (SF6)**

Compressed SF6 gas will be used in certain airtight compartments of electrical equipment in the transformer stations. The use of SF6 (a heavy gas) in a confined area presents the risk of asphyxia, since it reduces oxygen content. Ventilation of the areas concerned, in addition to permanent surveillance of the gas volumes, will help to eliminate the risk of SF6 accumulation outside the compartments. SF6 is a stable gas, heavier than air, not harmful to humans, non-toxic and non-corrosive. It is also non-explosable and non-inflammable. It is a greenhouse gas that contributes very little to greenhouse gas emission, being found in very weak concentrations. For example, its contribution is 0.01% compared to that of CO2, which is 60%. SF6 does not contribute to the impoverishment of the ozone layer.

## **ENHANCEMENT AND MITIGATION**

### **MEASURES TO ENHANCE THE POSITIVE IMPACTS**

The positive impacts of the EARP activities will essentially be indirect, and will be evident only in the operating phase of the new networks. Their enhancement will depend directly on the quality of maintenance of the equipment under the responsibility of EWSA, which will guarantee the connected population regular and reliable power supply and user security. The positive outcomes will be socio-economic: development of small-scale activity in all sectors (agriculture and stockbreeding and value-adding processing of their products by cold chains; sawmills, carpentry workshops, boiler shops, tailoring and embroidery enterprises, hairdressing, soap-making, oil mills, etc. Easier access to agricultural inputs, bank credit and microcredit in the areas benefitting directly from EARP activities will enable the population to invest in different trade and artisanal sectors, thereby improving the populations' living conditions. The main livelihood in EARP targeted areas is agriculture.

Considering the dynamism of women in those areas, they are bound to be the main beneficiaries of the project, though it has not been designed to cover the gender angle. During the works implementation, an effort will be made to create the maximum number of jobs for the workers in the areas concerned. The contractors will endeavour to favour artisans and traders of the region for delivery of the required services.

## **MEASURES TO REDUCE TEMPORARY IMPACTS**

The local population shall be notified, prior to the start of works, of provisional limited access to certain areas for security reasons. The sites shall remain well marked out (signboards, indicators, blinking lights, etc.) and protected by security barriers, set up in conjunction with the highway services of the districts, sectors, Imidugudu, etc. Road deviations shall be organized as necessary. The machinery used shall have soundproofing devices to limit sound nuisance to the extent possible. The vehicle exhaust levels shall be according to constructors' standards. Soil compacted during the works shall be ploughed to restore its natural aeration and pedologic properties; the herbaceous, shrub or tree vegetation destroyed shall be restored.

## **PERMANENT MEASURES TO REDUCE IMPACTS**

### **Physical Environment of Sub-Stations and Lines**

#### **During the Construction Phase**

The worksites shall be located away from sensitive areas. They shall be marked and access thereto prohibited; site accommodations shall have adequate and required sanitation facilities; waste and various solid wastes from site accommodations shall be collected for disposal. The materials extraction sites shall be rehabilitated at the end of the works.

The surfaces of sub-stations shall be procured by EARP Coordination Unit; they shall be drained and covered with gravel or pebbles to avoid modifying the ground and surface water regimes on lands within their areas of activity. The risks of groundwater waste and polluting oil contamination shall be taken into account

All land necessary for the lines shall be occupied on a temporary basis. The works shall be carried out in dry weather; access tracks shall be reduced to a minimum to ensure maximum preservation of the soil structure and to avoid deterioration of the sites. Equipment shall be consistent with international standards and specifications relating to the emission of exhaust fumes and noises, accidental leaks or spills. Steps shall be taken to avoid erosion risk on slopes by building dikes as is the case with terrace cultivation.

#### **In the operational phase**

Periodical maintenance shall be carried out so as to minimize soil disruption. There shall be no direct measures to reduce noise from transformers and lines, except placing them far away from residential areas and building suitable fences.

#### ***Natural Environment***

Compensatory forestation shall be carried out each time trees are felled, and the choice of species to be planted will be done taking into consideration native species

adapted to the climate. Workers shall be sensitized on fauna and flora protection measures to ward off poaching. Sites shall be rehabilitated with due consideration given to the rapid resumption of faunal activity.

*Farming*

The works shall be organized preferably after harvests, and damage to crops shall be compensated; packed terrain (carting on access roads) shall be ploughed after the works up to 50 cm. Pylons shall be positioned at locations in such manner as to avoid damage on farmlands along roads, highways and land boundaries. Their height shall take into consideration some constraints (irrigation, orchards, etc...). Thus, the agricultural modernization potential (mechanization, consolidation, and irrigation) shall be preserved in active farming areas. The contractors shall also strive to: (i) preserve drainage and irrigation systems wherever possible, (ii) temporarily stop work in case of exceptionally bad weather that would likely worsen the damage, and (iii) clean up sites by removing all debris and residues.

*Housing and Health*

EWSA shall, as a precautionary measure, ensure that the new transmission lines are not placed overhead of residential areas so as to effectively protect residents against electromagnetic fields. EWSA shall compensate all owners of homes located in the danger zone. Beyond a radius of 30 m away from the conductor, electric fields lessen significantly. National (If available), International EU and WHO standards regarding limits of public exposure to electromagnetic fields shall be respected.

*Living Environment and Landscape Quality*

Visual impact can be controlled by placing the lines away from tourist sites. The surroundings of substations shall be landscaped for visual impact. The visual impact of transmission line shall be achieved avoiding ridgeways and using landscape features to reduce visibility.

**TABLE 1: ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES: GENERAL GUIDANCE**

IMPACT DESCRIPTION	MITIGATION MEASURES	EARP SUBCOMPONENT TYPE
<b>PRECONSTRUCTION/DESIGN</b>		
1. Land acquisition for substation construction, overhead line installation and upgrading of urban/rural grid and loss of income due to acquisition of agricultural land and plantation forests.	Resettlement Plans (RP) detailing compensation schemes, grievance mechanisms, monitoring and evaluation plan, and institutional arrangements will be prepared and implemented consistent with Government of Rwanda and donor requirements.	Construction of substations High voltage overhead transmission lines Medium and low voltage urban/rural grid
2. Land acquisition will require relocation of some households.	Prior to any site works, EWSA shall undertake compensation and relocation in coordination with affected families and local authorities.	Construction of substations High voltage overhead transmission lines
3. Disturbance to agricultural land uses through permanent and temporary land acquisition	Carry-out detailed design of ROW and towers in a way that minimizes disturbance to agricultural land. Utilize tower designs that minimize ROW width and land use impacts. Adjust power line span length to avoid specific tower pad impacts.	Construction of substations High voltage overhead transmission lines

	As far as practical, schedule construction works to take place after crop harvesting	
4. Safety risks due to presence of UXO	EWSA and subcontractors shall engage qualified organizations to remove UXOs prior to site works.	Construction of substations High voltage overhead transmission lines Medium and low voltage urban/rural grid
5. Lack of consultations with local authorities on route selection	During Feasibility Study and detailed design, EWSA and EARP Coordination Unit shall coordinate with local authorities regarding selection of suitable alignments for transmission and distribution lines to ensure minimal impacts to affected communities.	High voltage overhead transmission lines Urban/Rural grid
<b>CONSTRUCTION</b>		
6. Vegetation clearing for construction of new conventional substations and provision of buffer zones for high voltage lines	EWSA and EARP Coordination Unit shall coordinate with affected families and local authorities for compensation of trees lost following Government/donor policies  Contractors shall confine vegetation clearing within required area, unnecessary cutting of trees shall be prohibited  As much as possible, contractors shall undertake vegetation clearing through manual methods. Use of herbicides shall be prohibited.  Contractors shall replant disturbed sites	Construction of substations High voltage overhead transmission lines Medium and low voltage urban/rural grid
7. Increased exploitation of forest products	Workers shall be prohibited from hunting and gathering other forest products	High voltage overhead transmission lines
8. Direct discharge of construction run-off may cause siltation of watercourses. Improper storage and disposal of excavation spoils, wastes and other construction materials could adversely affect water quality and flow regime.	Run-off and drainage control shall be provided in construction areas to avoid siltation of nearby watercourses.  Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical.  Earth, stones and solid wastes will be properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.	Construction of substations GIS Facilities Under ground 110/220 KV cable High voltage overhead transmission lines Medium and low voltage urban/rural grid
9. Flooding of adjacent areas	Proper drainage shall be installed to avoid flooding of surrounding properties.	Construction of substations Under ground 110/220 KV cable
10. Improper storage and handling of fuel, lubricant and other hazardous substances could contaminate soil and water.	Fuel and other hazardous substances shall be stored in roofed, concrete-lined and bunded areas.	Construction of substations GIS Facilities Under ground cable
11. Oil leaks during replacement of old transformers.	Prior to replacement, old transformers shall be carefully checked to ensure that there are no oil leaks.  In case oil leaks occur, abatement and clean up measures shall be immediately implemented by the contractor to avoid contamination of soil and water resources.	Extension/Upgrading/Rehabilitation of substations

	Handling, storage, transport and disposal of old transformers shall be undertaken following national and local regulations. Required permits shall be secured by the Contractor.	
12. Elevated noise and dust emission levels may be experienced by nearby households and other sensitive receptors.	<p>The following measures will be implemented to minimize impacts to local communities during construction:</p> <p>Provision of cover on haul trucks transporting filling materials, gravel, excavated soil and other construction materials,</p> <p>Access roads shall be regularly cleaned to keep these free from debris</p> <p>Water spraying on exposed areas near residential and commercial areas to suppress dust emission,</p> <p>Proper maintenance of equipment and use of mufflers, as appropriate, to minimize noise,</p> <p>Speed restrictions for trucks and vehicles shall be enforced to minimize dust and noise emission</p> <p>Scheduling of noise generating activities during daytime, as much as possible, to avoid disturbance to nearby communities; if evening construction is necessary, affected households and groups should be notified beforehand</p> <p>Ensure all vehicles and equipment are properly maintained to meet emission standards and are covered by valid operating permits</p>	<p>Construction of substations</p> <p>GIS Facilities</p> <p>Under ground cable</p> <p>High voltage overhead transmission lines</p> <p>Medium and low voltage urban/rural grid</p>
13. Disruption to traffic movements may occur due to construction related activities.	<p>Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made.</p> <p>Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities.</p> <p>Design travel routes for construction vehicles to avoid areas of congestion</p>	<p>Construction of substations</p> <p>GIS Facilities</p> <p>High voltage overhead transmission lines</p> <p>Under ground cable</p> <p>Medium and low voltage urban/rural grid</p>
14. Irrigation canals in adjacent agricultural land, dykes may be damaged during construction.	Any damage to irrigation channels shall be immediately repaired and damages shall be compensated, as appropriate.	<p>Construction of substations</p> <p>High voltage overhead transmission lines</p> <p>Medium and low voltage urban/rural grid</p>
15. Access roads used during transport of construction materials and equipment may be damaged.	Restoration of damaged roads shall be undertaken upon completion of construction.	<p>Construction of substations</p> <p>GIS Facilities</p> <p>High voltage overhead transmission lines</p>

		Underground cable Medium and low voltage urban/rural grid
16. Failure to restore temporary construction sites.	All temporary construction sites will be cleared of debris and structures, ground shall be leveled (as necessary), revegetated (as necessary) and restored before turning over to communes and households.	Construction of substations GIS Facilities High voltage overhead transmission lines Underground cable Medium and low voltage urban/rural grid
17. Possible conflicts with and/or disruption to local community	If construction worker camps are required, select the locations in consultation with local authorities  Train workers on suitable interactions with local community including prevention of transmissible diseases	Conventional substations High voltage overhead transmission lines Medium and low voltage urban/rural grid
18. Health risks due to unhygienic conditions at workers camps (if any).	Basic medical care shall be provided at camp sites.  Workers shall be provided with potable water supply and hygienic sanitation facilities.  Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented.  Health and safety orientation shall be conducted for construction workers.	Construction of substations GIS Facilities High voltage overhead transmission lines Under ground cable Medium and low voltage urban/rural grid
19. Safety hazards during construction	Workers will be oriented on safe practices and shall be provided with appropriate personnel protective gear (e.g., safety shoes, hard hats, safety goggles).  There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas.  Appropriate lighting shall be installed in construction areas when works occur after dark	Construction of substations GIS Facilities High voltage overhead transmission lines Under ground cable Medium and low voltage urban/rural grid
<b>OPERATION</b>		
20. Flooding of adjacent areas	Drainage facilities within and around the substation site shall be properly designed and constructed to avoid flooding of surrounding properties during operation phase.	Substations
21. Safety hazards	An emergency response plan, adequate fire-fighting facilities and proper training of employees on fire prevention and control shall be provided.  Unauthorized persons shall not be allowed within plant premises and adequate warning signs shall be provided.	Substations GIS Facilities
22. Impacts to water quality due to sewage generation	Toilets with septic tanks at office facilities shall be provided.	Substations GIS Facilities
23. Pollution due to use of	Use of herbicides to control vegetation height within	High voltage overhead



herbicides	the right-of-way shall be prohibited.	transmission lines Medium and low voltage urban/rural grid
24. Soil and water contamination due to leaks of hazardous substances	<p>PCB-containing equipment shall not be used.</p> <p>EWSA shall secure hazardous substance management permit prior the operation.</p> <p>Leaks shall be repaired immediately and waste oil shall be stored and disposed of consistent with applicable national laws and regulations.</p> <p>There shall be provisions for concrete-lined transformer bays as well as drainage and oil-water separator to handle spills, leaks and oily water run-off that could emanate from the transformers.</p>	Substations
25. Gas leaks during operation could pose hazards to the environment and plant personnel	<p>Substation equipment containing SF6 is gas-tight. The plant will be equipped with continuous gas monitoring apparatus such that any leakage would be discovered at an early stage and shall be repaired immediately.</p> <p>In case of leaks, inhalation of SF6 is nontoxic but may cause asphyxiation when oxygen level in the air is low. Provision of adequate ventilation throughout the plant premises will prevent this condition.</p> <p>A manual on safety procedures during operation and maintenance of the GIS facilities shall be developed and corresponding training of plant personnel shall be carried out prior to operation.</p>	GIS Facilities

## ENVIRONMENTAL MONITORING AND INSTITUTIONAL REQUIREMENTS

### DESIGN AND CONSTRUCTION WORKS PHASE

From the outset, the EARP designers received advice from the "Environmental and Social Safeguards Section of EWSA. During the works, the contractor and representatives of the relevant Ministries and their district authorities shall ensure that the laws in force are applied: protection of physical, natural and human environment. The contractors shall implement mitigation measures during construction phase as described in the Environmental Management Plan.

### OPERATIONAL PHASE

Monitoring of noise and electromagnetic fields: These factors shall be measured periodically at the sub-stations and in houses near lines and sub-stations. International standards set by WHO for public exposure limits shall be met.

Follow-up of the population’s grievances: As part of the population’s participatory approach, a grievances register shall be opened in the municipalities affected by the various EARP components. The population shall be invited to enter their remarks in the register. EWSA shall respond to the claims made and take all necessary steps to address them.

**TABLE2: ENVIRONMENTAL MONITORING ISSUES: GENERAL GUIDANCE**

ISSUE	SUBCOMPONENT TYPE AND LOCATION	MEANS OF MONITORING	FREQUENCY OF MONITORING
<b>PRECONSTRUCTION/DESIGN</b>			
1. Permanent and temporary land acquisition, agricultural loss and tree cut down will be compensated properly before construction,	<input type="checkbox"/> Conventional substations - new <input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Urban/Rural Grid	Site inspection	Once
2. PCBs not used in substation transformers or other EAR subcomponent facilities or equipments.	<input type="checkbox"/> Conventional substations	Check design	Once
<b>CONSTRUCTION</b>			
3. Herbicides are not used to clear vegetation along the ROW	<input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Urban/Rural grid		
4. Coordination with appropriate agencies on electricity, telephone lines and other utilities or structures to avoid damage to these facilities during installation	<input type="checkbox"/> UGC route <input type="checkbox"/> High voltage Overhead transmission lines <input type="checkbox"/> Urban/Rural grid	Check for proof of coordination with concerned agencies or utility companies	Once before excavation work per subproject comment
5. Siltation and pollution of water courses and flow obstruction due to direct discharge of construction run-off, improper storage and	EARP Subcomponent sites and adjacent areas <input type="checkbox"/> Conventional substations <input type="checkbox"/> GIS <input type="checkbox"/> Under ground 110/220	Site inspection	Quarterly

disposal of excavation spoils, wastes and other construction materials	<p>kV cable</p> <p><input type="checkbox"/> High voltage</p> <p>Overhead transmission lines</p> <p><input type="checkbox"/> Urban/Rural grid</p>		
6. Flooding of adjacent areas properties due to poor drainage at the construction site	<p>EARP Subcomponent sites and adjacent areas</p> <p><input type="checkbox"/> Conventional substations</p> <p><input type="checkbox"/> Under ground 110/220 kV cable</p>	Site inspection, interviews with adjacent households, business owners and occupants of other nearby structures	Quarterly
7. Storage, collection and disposal of solid waste	<p><input type="checkbox"/> Conventional substations</p> <p><input type="checkbox"/> GIS substations</p> <p><input type="checkbox"/> Under ground 110/22 kV cable</p> <p><input type="checkbox"/> High voltage</p> <p>Overhead transmission lines</p> <p><input type="checkbox"/> Urban/Rural grids</p>	Site inspection	Quarterly
8. Collection and disposal of sewage	<p><input type="checkbox"/> Conventional substations</p> <p><input type="checkbox"/> GIS substations</p> <p><input type="checkbox"/> High voltage</p> <p>Overhead transmission lines</p> <p><input type="checkbox"/> Under ground 110/22 kV cable</p> <p><input type="checkbox"/> Urban/Rural grids</p>	Site inspection	Quarterly
9. Soil and water contamination due to improper storage and handling of fuel, lubricant and other hazardous substances.	<p>EARP Subcomponent sites and adjacent areas</p> <p><input type="checkbox"/> Conventional substations</p> <p><input type="checkbox"/> GIS</p> <p><input type="checkbox"/> Under ground cable</p> <p><input type="checkbox"/> High voltage</p> <p>Overhead transmission lines</p>	Site inspection	Quarterly
10. Maintenance of access roads to keep this free from debris and restoration of areas used	<p><input type="checkbox"/> Conventional substations</p> <p><input type="checkbox"/> GIS substations</p>	Site inspection with interview with adjacent	Quarterly

temporarily during construction	<input type="checkbox"/> High voltage Overhead transmission lines <input type="checkbox"/> Under ground 110/220 kV cable <input type="checkbox"/> Urban/Rural grids	households, business owners and occupants of nearby structures	
11. Excessive noise emission	<input type="checkbox"/> Conventional substations <input type="checkbox"/> GIS <input type="checkbox"/> UGC <input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Urban/Rural grids	Site inspection with interview with adjacent households, business owners and occupants of nearby structures	Quarterly
12. Excessive dust emission	<input type="checkbox"/> Conventional substations <input type="checkbox"/> GIS <input type="checkbox"/> UGC <input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Urban/Rural grids	Site inspection with interview with adjacent households, business owners and occupants of nearby structures	Quarterly
13. Provision of cover on trucks transporting construction materials and excavation spoil	EARP Subcomponent sites and adjacent areas <input type="checkbox"/> Conventional substations <input type="checkbox"/> GIS <input type="checkbox"/> UGC <input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Urban/Rural grids	Site inspection with interview with adjacent households, business owners, occupants of nearby structures, and local traffic officials	Quarterly
14. Impacts on/damages to crop productivity and other vegetation in adjacent fields or along the transmission lines	<input type="checkbox"/> Conventional substation <input type="checkbox"/> Over head lines <input type="checkbox"/> Urban/Rural grids	Site inspection with interview with affected households	Quarterly
15. Obstruction of traffic flow	Roads in the vicinity of EARP subcomponent sites <input type="checkbox"/> Conventional substations <input type="checkbox"/> High voltage overhead	Site inspection with interview with adjacent households, business owners, occupants of nearby	Quarterly

	<p>transmission lines</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Under ground cable</li> <li><input type="checkbox"/> Medium and low voltage urban/rural grid</li> </ul>	<p>structures, and local traffic officials</p>	
16. Damages to irrigation canals in adjacent agricultural land, dykes	<p>EARP Subcomponent sites and adjacent areas</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Conventional substations</li> <li><input type="checkbox"/> High voltage overhead transmission lines</li> <li><input type="checkbox"/> Urban/Rural grids</li> </ul>	<p>Site inspection with interview with adjacent households, business owners and occupants of nearby structures</p>	Quarterly
17. Damages to access roads used during transport of construction materials and equipment	<p>Access roads to subproject sites</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Conventional substations</li> <li><input type="checkbox"/> GIS</li> <li><input type="checkbox"/> UGC</li> <li><input type="checkbox"/> High voltage overhead transmission lines</li> <li><input type="checkbox"/> Urban/Rural grids</li> </ul>	<p>Site inspection with interview with adjacent households, business owners, occupants of nearby structures, and local traffic officials</p>	Quarterly
18. Provision of safe access across excavated roads and sidewalks	<ul style="list-style-type: none"> <li><input type="checkbox"/> UGC routes</li> <li><input type="checkbox"/> High voltage Overhead transmission lines</li> <li><input type="checkbox"/> Urban/Rural grids</li> </ul>	<p>Site inspection with interview with adjacent households, business owners, occupants of nearby structures, and local traffic officials</p>	Quarterly
19. Provision of health and safety orientation to workers	<ul style="list-style-type: none"> <li><input type="checkbox"/> Conventional substations</li> <li><input type="checkbox"/> GIS</li> <li><input type="checkbox"/> High voltage overhead transmission lines</li> <li><input type="checkbox"/> Under ground cable</li> <li><input type="checkbox"/> Urban/Rural grids</li> </ul>	<p>Check to proofs that orientation or training have been conducted (e.g. training materials, minutes of meetings, attendance sheets), interview</p>	Once upon site mobilization of workers

		s with workers	
20. Provision of adequate safety equipment to workers, safe water supply, sanitation facility and first aid supplies	<input type="checkbox"/> Conventional substations <input type="checkbox"/> GIS <input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Under ground cable <input type="checkbox"/> Urban/Rural grids	Site inspection, interviews with workers	Quarterly
21. Restoration of affected roads and sidewalks	<input type="checkbox"/> Conventional substations <input type="checkbox"/> GIS <input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Under ground cable <input type="checkbox"/> Medium and low voltage urban/rural grid	Site inspection	Once upon completion of subcomponents
<b>OPERATION</b>			
22. Herbicides are not used to control vegetation within the ROW	<input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Urban/Rural grid	Site inspection, interviews with operating personnel and nearby communities	Semi-annual
23. Flooding of adjacent properties due to poor drainage of subproject sites	<input type="checkbox"/> Conventional substations	Site inspection	Semi-annual
24. Safety hazards	<input type="checkbox"/> Conventional substations <input type="checkbox"/> High voltage overhead transmission lines <input type="checkbox"/> Under ground cable <input type="checkbox"/> Medium and low voltage urban/rural grid	Site inspection and interviews with operating personnel	Semi-annual
25. Impacts to water quality due to sewage generation	EARP Subcomponent sites and adjacent areas <input type="checkbox"/> Conventional substations	Site inspection and interviews with adjacent households	Semi-annual

	<input type="checkbox"/> GIS		
26. Soil and water contamination due to leaks of hazardous substances	<input type="checkbox"/> Conventional substations <input type="checkbox"/> GIS	Site inspection	Semi-annual
27. Gas leaks during operation could pose hazards to the environment and substation personnel	<input type="checkbox"/> GIS	Site inspection, interview with the personnel	Semi-annual

## **INSTITUTIONAL ARRANGEMENTS AND CAPACITY BUILDING REQUIREMENTS**

In accordance with institutional arrangements and the Environmental Guidelines in Rwanda, REMA is responsible for the environmental and social monitoring of projects. The Environmental and Social Safeguards Section of EARP shall deal with environmental matters associated with EARP activities. The Section shall ensure that the bidding documents for civil works include the environmental mitigation measures applicable to EARP subcomponents that will be implemented by contractors

The section should be reinforced to deal specifically with environmental and social issues related to power generation, electricity transmission and distribution, transformer stations and the use of insulating oils, etc. The need for support shall be addressed over two years in three major components:

- Seminars and training for better understanding of the EARP’s environmental and social promotion targets
- Human and logistical reinforcement of the structure (hiring managerial staff, equipment, transportation, etc.).
- Technical support - a consultant.

To ensure a consultative and quality approach, EARP shall set up a committee to evaluate environmental monitoring, comprising:

- The “Environment-Social Safeguards-Section” of EARP
- The Environmental Unit of MININFRA and EWSA
- Rwanda Environmental Management Authority (REMA)
- The Directorate of Environment and Compliance in Rwanda Development Board (RDB)
- Representatives of the population (NGOs, population, civil society, etc.).

## **PUBLIC INFORMATION AND/OR CONSULTATION PROCEDURES AND REMEDIES**

The populations and District Authorities shall be consulted during the EARP subcomponents design and Environmental and Social management Plan (ESMP)

execution phase. This participatory approach shall continue during finalization of the line routes study to minimize damage to farms and nature value sites, and to protect housing. Damage to private property shall be identified and compensated by EWSA. Owners who do not approve of the terms and conditions of compensation may seek administrative or legal redress. According to the procedure put in place, the persons to be compensated shall be identified by EWSA, in collaboration with the Project Manager and Regional Lands and Surveys Services or religious leaders.

## **PUBLIC CONSULTATIONS AND INFORMATION DISSEMINATION REQUIREMENTS**

The different EARP subcomponents shall be designed based on national development guidelines drawn up in a participatory manner. The population and District Authorities shall be consulted during the EARP subcomponents design and ESMP execution phase. Within the participatory approach framework, fieldwork comprising information sessions and consultations shall be conducted, allowing for discussions with different stakeholders representing:

- District Authorities, Mayors and Deputy Mayors
- Industrial and small-scale companies
- Women's, farmer, livestock and commercial associations
- NGOs
- Civil society - the population - etc.

This participatory approach shall continue during finalization of the line routes study to minimize damage to farms, nature value sites, and to protect houses. Damage to private property shall be identified and compensated by EWSA. Owners who do not approve of the terms and conditions of compensation may seek administrative or legal redress. According to the procedure put in place, the persons to be compensated shall be identified by the EWSA, in collaboration with the Project Manager and National/District Lands and Surveys Services or religious leaders.

In addition, the participatory approach shall be considered during: Socio-economic surveys conducted among the population and local authorities concerned; Validation seminars organized for all project stakeholders; Visits to rural communities during EARP subcomponents preparation and which continued up to the EARP subcomponent's technical evaluation phase. These visits shall bring to light the population's expectations and the strong political shall of the national authorities who view the subcomponent as a vehicle for change in the economic development framework of the affected communities. Development of the various EARP components in close collaboration with all institutions of the sector; they constitute a response to the constraints on the country's rural electrification development and service quality improvement required by the customers and Local Authorities. Design, by consulting with other donors involved in the electricity networks development sector in the country, to ensure collective consistency and synergy.

The rural electrification project must meet certain information dissemination and participatory approach requirements set out by REMA. They can be summarized as follows:



- Provide simple and understandable information for the entire population concerned so as to elicit ownership and enable the project to achieve its objectives.
- Disseminate general information about the Government's programme relating to the rehabilitation and extension of the Project Manager's equipment and structures throughout the country;
- Provide all required information relating to project design, organization of work sites and works, clearly identifying the socio-economic benefits to the population, tourism development, health centres, handcraft, PMU and industries that may relocate; demonstrate the project's harmlessness to the natural environment and biodiversity; demonstrate the benefits to the population.
- Disseminate information about potential expropriation risks, the temporary displacement of some commercial activities (trading stalls), and damage to private property during the works, and the possible and intended Relocation Plan and compensation provided for persons that may suffer damage.
- Distribute the draft Environmental and Social Assessment and the Environmental and Social Management Plan to project-affected parties and request feedback in order to improve the document and the project content;
- Address issues concerning the location of worksites and construction sites;
- Hold discussions with target persons or groups on ambiguous or contested issues; correct or, if applicable, complete the ESMP taking into account the remarks made;
- Broadcast the final version or summary of the ESMP through the media.

**APPENDIXES: EARP SUBCOMPONENT SPECIFIC ENVIRONMENTAL MITIGATION AND MONITORING: SUBCOMPONENT: SPECIFIC GUIDANCE**

**APPENDIX 1. NEW CONSTRUCTION OF CONVENTIONAL SUBSTATIONS**

**TABLE 1.1. : ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FOR NEW CONVENTIONAL SUBSTATIONS**

<b>Impact description</b>	<b>Mitigation Measures</b>
<b>Preconstruction</b>	
1. Land acquisition for substation construction and loss of income due to acquisition of agricultural land and plantation forests.	<input type="checkbox"/> Resettlement Plans (RP) detailing compensation schemes, grievance mechanisms, monitoring and evaluation plan, and institutional arrangements will be prepared and implemented consistent with GOV and ADB requirements.
2. Land acquisition will require relocation of some households.	<input type="checkbox"/> Prior to any site works, shall undertake compensation and relocation in coordination with affected families and local authorities.
3. Disturbance to agricultural land use through permanent and temporary land acquisition	<input type="checkbox"/> As far as practical, schedule construction works to take place after crop harvesting
4. Safety risks due to presence of UXO	<input type="checkbox"/> EWSA & EARP CU shall engage qualified organizations to remove UXOs prior to site works.
<b>Construction</b>	
5. Vegetation clearing for construction of new conventional substations	<input type="checkbox"/> EWSA & EARP CU shall coordinate with affected families and local authorities for compensation of trees lost following Government/ADB policies <input type="checkbox"/> Contractors shall confine vegetation clearing within required area, unnecessary cutting of trees shall be prohibited <input type="checkbox"/> As much as possible, contractors shall undertake vegetation clearing through manual methods. Use of herbicides shall be prohibited. <input type="checkbox"/> Contractors shall replant disturbed sites

<p>6. Direct discharge of construction run-off may cause siltation of watercourses. Improper storage and disposal of excavation spoils, wastes and other construction materials could adversely affect water quality and flow regime.</p>	<p><input type="checkbox"/> Run-off and drainage control shall be provided in construction areas to avoid siltation of nearby water courses.</p> <p><input type="checkbox"/> Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical.</p> <p><input type="checkbox"/> Earth, stones and solid wastes will be properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.</p>
<p>7. Flooding of adjacent areas</p>	<p><input type="checkbox"/> Proper drainage shall be installed to avoid flooding of surrounding properties.</p>
<p>8. Improper storage and handling of fuel, lubricant and other hazardous substances could contaminate soil and water.</p>	<p><input type="checkbox"/> Fuel and other hazardous substances shall be stored in roofed, concrete-lined and bunded areas.</p>
<p>9. Elevated noise and dust emission levels may be experienced by nearby households and other sensitive receptors.</p>	<p>The following measures will be implemented to minimize impacts to local communities during construction:</p> <p><input type="checkbox"/> provision of cover on haul trucks transporting filling materials, gravel, excavated soil and other construction materials,</p> <p><input type="checkbox"/> access roads shall be regularly cleaned to keep these free from debris</p> <p><input type="checkbox"/> water spraying on exposed areas near residential and commercial areas to suppress dust emission,</p> <p><input type="checkbox"/> proper maintenance of equipment and use of mufflers, as appropriate, to minimize noise,</p> <p><input type="checkbox"/> speed restrictions for trucks and vehicles shall be enforced to minimize dust and noise emission</p> <p><input type="checkbox"/> scheduling of noise generating activities during daytime, as much as possible, to avoid disturbance to nearby communities; if evening construction is necessary, affected households and groups should be notified beforehand</p> <p><input type="checkbox"/> Ensure all vehicles and equipment are properly maintained to meet emission standards and are covered by valid operating permits</p>
<p>10. Disruption to traffic movements may occur due to construction-related activities.</p>	<p><input type="checkbox"/> Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made.</p>

	<input type="checkbox"/> Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities. <input type="checkbox"/> Design travel routes for construction vehicles to avoid areas of congestion
11. Irrigation canals in adjacent agricultural land, dykes may be damaged during construction.	<input type="checkbox"/> Any damage to irrigation channels shall be immediately repaired and damages shall be compensated, as appropriate.
12. Access roads used during transport of construction materials and equipment may be damaged.	<input type="checkbox"/> Restoration of damaged roads shall be undertaken upon completion of construction.
13. Failure to restore temporary construction sites.	<input type="checkbox"/> All temporary construction sites will be cleared of debris and structures, ground shall be leveled (as necessary), revegetated (as necessary) and restored before turning over to communes and households.
14. Health risks due to unhygienic conditions at workers' camps.	<input type="checkbox"/> Basic medical care shall be provided at camp sites. <input type="checkbox"/> Workers shall be provided with potable water supply and hygienic sanitation facilities. <input type="checkbox"/> Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented. <input type="checkbox"/> Health and safety orientation shall be conducted for construction workers.
15. Possible conflicts with and/or disruption to local community	<input type="checkbox"/> If construction worker camps are required, select the locations in consultation with local authorities <input type="checkbox"/> Train workers on suitable interactions with local community including prevention of transmissible diseases
16. Safety hazards during construction	<input type="checkbox"/> Workers will be oriented on safe practices and shall be provided with appropriate personnel protective gear (e.g., safety shoes, hard hats, safety goggles). <input type="checkbox"/> There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas. <input type="checkbox"/> Appropriate lighting shall be installed in construction

	areas when works occur after dark
<b>Operation</b>	
17. Flooding of adjacent areas	<input type="checkbox"/> Drainage facilities within and around the substation site shall be properly designed and constructed to avoid flooding of surrounding properties during operation phase.
18. Safety hazards	<input type="checkbox"/> An emergency response plan, adequate fire-fighting facilities and proper training of employees on fire prevention and control shall be provided. <input type="checkbox"/> Unauthorized persons shall not be allowed within plant premises and adequate warning signs shall be provided.
19. Impacts to water quality due to sewage generation	<input type="checkbox"/> Toilets with septic tanks at office facilities shall be provided.
20. Soil and water contamination due to leaks of hazardous substances	<input type="checkbox"/> Power companies must secure hazardous substance management permit prior the operation. <input type="checkbox"/> PCB-containing equipment shall not be used. <input type="checkbox"/> Leaks shall be repaired immediately and waste oil shall be stored and disposed of consistent with applicable laws and regulations. <input type="checkbox"/> There shall be provisions for concrete-lined transformer bays as well as drainage and oil-water separator to handle spills, leaks and oily water run-off that could emanate from the transformers.
21. Noise from substation operation	<input type="checkbox"/> Equipment shall be regularly checked and maintained in good order <input type="checkbox"/> Natural barrier (such as trees) to absorb noise shall be installed

**TABLE 1.2. : ENVIRONMENTAL MONITORING PLAN FOR NEW CONVENTIONAL SUBSTATIONS**

<b>Issue</b>	<b>Location</b>	<b>Means of Monitoring</b>	<b>Frequency of Monitoring</b>
<b>Preconstruction</b>			

1. Permanent and temporary land acquisition, agricultural loss and tree cut down will be compensated properly before construction	<input type="checkbox"/> Construction sites	Site inspection and interview with affected households (if possible)	Once
2. PCBs not used in substation transformers or other project facilities or equipments.	<input type="checkbox"/> Construction sites	Check design (then, site inspection during installation)	Once
<b>Construction</b>			
3. Siltation and pollution of watercourses and flow obstruction due to direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
4. Flooding of adjacent areas properties due to poor drainage at the construction site	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with adjacent households, business owners and occupants of other nearby structures	Quarterly
5. Storage, collection and disposal of solid waste	<input type="checkbox"/> Construction sites	Site inspection	Quarterly
6. Collection and disposal of sewage	<input type="checkbox"/> Construction sites	Site inspection	Quarterly
7. Soil and water contamination due to improper storage and handling of fuel, lubricant and other hazardous substances.	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection	Quarterly
8. Maintenance of access roads to keep this free from debris and restoration of areas used temporarily during construction	<input type="checkbox"/> Access roads to construction sites	Site inspection, interview with adjacent households, business owners and occupants of nearby structures	Quarterly
9. Excessive noise emission	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
10. Excessive dust emission	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
11. Provision of cover on trucks	<input type="checkbox"/> Construction	Site inspection, interviews	Quarterly

transporting construction materials and excavation spoil	sites <input type="checkbox"/> Adjacent areas	with residents living nearby and local traffic officials	
12. Obstruction of traffic flow	<input type="checkbox"/> Roads in the vicinity of construction sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
13. Damages to irrigation canals in adjacent agricultural land, dykes	<input type="checkbox"/> Adjacent areas to construction sites	Site inspection, interviews with adjacent households, business owners and occupants of nearby structures	Quarterly
14. Damages to access roads used during transport of construction materials and equipment	<input type="checkbox"/> Access roads to construction sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
15. Provision of health and safety orientation to workers	<input type="checkbox"/> Construction sites	Check for proofs that orientation or training have been conducted (e.g. training materials, minutes of meetings, attendance sheets), interviews with workers	Once upon site mobilization of workers
16. Provision of adequate safety equipment to workers, safe water supply, sanitation facility and first aid supplies	<input type="checkbox"/> Construction sites	Site inspection, interviews with workers	Quarterly
17. Restoration of affected roads and sidewalks	<input type="checkbox"/> Adjacent areas to construction sites	Site inspection	Once upon completion of subprojects
<b>Operation</b>			
18. Flooding of adjacent properties due to poor drainage of subproject sites	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
19. Safety hazards	<input type="checkbox"/> Substation sites	Site inspection and interviews with operating personnel	Semi-annual
20. Impacts to water quality due to sewage generation	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
21. Soil and water contamination due to leaks of hazardous substances	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
22. Elevated noise from substation	<input type="checkbox"/> Substation sites	Site inspection and	Semi-annual

operation	<input type="checkbox"/> Adjacent areas	interviews with operating personnel	
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## APPENDIX 2. EXTENSION/UPGRADING OF CONVENTIONAL SUBSTATIONS

**TABLE 2.1: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FOR CONVENTIONAL SUBSTATIONS-EXTENTION**

Impact Description	Mitigation Measures
<b>Construction</b>	
1. Direct discharge of construction run-off may cause siltation of watercourses. Improper storage and disposal of excavation spoils, wastes and other construction materials could adversely affect water quality and flow regime.	<input type="checkbox"/> Run-off and drainage control shall be provided in construction areas to avoid siltation of nearby watercourses. <input type="checkbox"/> Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical. <input type="checkbox"/> Earth, stones and solid wastes will be properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.
2. Flooding of adjacent areas	<input type="checkbox"/> Proper drainage shall be installed to avoid flooding of surrounding properties.
3. Improper storage and handling of fuel, lubricant and other hazardous substances could contaminate soil and water.	<input type="checkbox"/> Fuel and other hazardous substances shall be stored in roofed, concrete-lined and bunded areas.
4. Oil leaks during replacement of old transformers.	<input type="checkbox"/> Prior to replacement, old transformers shall be carefully checked to ensure that there are no oil leaks. <input type="checkbox"/> In case oil leaks occur, abatement and clean up measures shall be immediately implemented by the contractor to avoid contamination of soil and water resources. <input type="checkbox"/> Handling, storage, transport and disposal of old transformers shall be undertaken following national and local regulations. Required permits shall be secured by the contractor.
5. Elevated noise and dust emission levels may be experienced by nearby households and other sensitive receptors	The following measures will be implemented to minimize impacts to local communities during construction: <ul style="list-style-type: none"> <li><input type="checkbox"/> provision of cover on haul trucks transporting filling materials, gravel, excavated soil and other construction materials,</li> <li><input type="checkbox"/> access roads shall be regularly cleaned to keep these free from debris</li> <li><input type="checkbox"/> water spraying on exposed areas near residential and</li> </ul>

	<p>commercial areas to suppress dust emission,</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> proper maintenance of equipment and use of mufflers, as appropriate, to minimize noise,</li> <li><input type="checkbox"/> speed restrictions for trucks and vehicles shall be enforced to minimize dust and noise emission</li> <li><input type="checkbox"/> scheduling of noise generating activities during daytime, as much as possible, to avoid disturbance to nearby communities; if evening construction is necessary, affected households and groups should be notified beforehand</li> <li><input type="checkbox"/> Ensure all vehicles and equipment are properly maintained to meet emission standards and are covered by valid operating permits</li> </ul>
6. Disruption to traffic movements may occur due to construction-related activities.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made.</li> <li><input type="checkbox"/> Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities.</li> <li><input type="checkbox"/> Design travel routes for construction vehicles to avoid areas of congestion</li> </ul>
7. Irrigation canals in adjacent agricultural land, dykes may be damaged during construction.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Any damage to irrigation channels shall be immediately repaired and damages shall be compensated, as appropriate.</li> </ul>
8. Access roads used during transport of construction materials and equipment may be damaged.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Restoration of damaged roads shall be undertaken upon completion of construction.</li> </ul>
9. Failure to restore temporary construction sites.	<ul style="list-style-type: none"> <li><input type="checkbox"/> All temporary construction sites will be cleared of debris and structures, ground shall be leveled (as necessary), revegetated (as necessary) and restored before turning over to communes and households.</li> </ul>
10. Health risks due to unhygienic conditions at workers' camps.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Basic medical care shall be provided at camp sites.</li> <li><input type="checkbox"/> Workers shall be provided with potable water supply and hygienic sanitation facilities.</li> <li><input type="checkbox"/> Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented.</li> <li><input type="checkbox"/> Health and safety orientation shall be conducted for construction workers.</li> </ul>
11. Safety hazards during construction	<ul style="list-style-type: none"> <li><input type="checkbox"/> Workers will be oriented on safe practices and shall be provided with appropriate personnel protective gear (e.g., safety shoes, hard hats, safety goggles).</li> <li><input type="checkbox"/> There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas.</li> </ul>

	<input type="checkbox"/> Appropriate lighting shall be installed in construction areas when works occur after dark
<b>Operation</b>	
12. Flooding of adjacent areas	<input type="checkbox"/> Drainage facilities within and around the substation site shall be properly designed and constructed to avoid flooding of surrounding properties during operation phase.
13. Safety hazards	<input type="checkbox"/> An emergency response plan, adequate fire-fighting facilities and proper training of employees on fire prevention and control shall be provided. <input type="checkbox"/> Unauthorized persons shall not be allowed within plant premises and adequate warning signs shall be provided.
14. Impacts to water quality due to sewage generation	<input type="checkbox"/> Toilets with septic tanks at office facilities shall be provided.
15. Soil and water contamination due to leaks of hazardous substances	<input type="checkbox"/> Power companies must secure hazardous substance management permit prior to the operation. <input type="checkbox"/> PCB-containing equipment shall not be used. <input type="checkbox"/> Leaks shall be repaired immediately and waste oil shall be stored and disposed of consistent with applicable laws and regulations. <input type="checkbox"/> There shall be provisions for concrete-lined transformer bays as well as drainage and oil-water separator to handle spills, leaks and oily water run-off that could emanate from the transformers.
22. Noise from substation operation	<input type="checkbox"/> Equipment shall be regularly checked and maintained in good order <input type="checkbox"/> Natural barrier (such as trees) to absorb noise shall be installed

**TABLE 2.2: ENVIRONMENTAL MONITORING PLAN FOR CONVENTIONAL SUBSTATIONS-EXTENSION**

Issue	Location	Means of Monitoring	Frequency of Monitoring
<b>Preconstruction</b>			
1. PCBs not used in substation transformer or other project facilities or equipments.	<input type="checkbox"/> Conventional substation sites	Check design (then, site inspection during installation)	Once
<b>Construction</b>			

2. Siltation and pollution of watercourses and flow obstruction due to direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
3. Flooding of adjacent areas properties due to poor drainage at the construction site	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with adjacent households, business owners and occupants of other nearby structures	Quarterly
4. Storage, collection and disposal of solid waste	<input type="checkbox"/> Construction sites	Site inspection	Quarterly
5. Collection and disposal of sewage	<input type="checkbox"/> Construction sites	Site inspection	Quarterly
6. Soil and water contamination due to improper storage and handling of fuel, lubricant and other hazardous substances.	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection	Quarterly
7. Maintenance of access roads to keep this free from debris and restoration of areas used temporarily during construction	<input type="checkbox"/> Access roads to construction sites	Site inspection, interviews with adjacent households, business owners and occupants of nearby structures	Quarterly
8. Excessive noise emission	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
9. Excessive dust emission	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
10. Provision of cover on trucks transporting construction materials and excavation spoil	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
11. Obstruction of traffic flow	<input type="checkbox"/> Roads in the vicinity of construction sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
12. Damages to irrigation canals in adjacent agricultural land, dykes	<input type="checkbox"/> Adjacent areas to construction sites	Site inspection, interviews with adjacent households, business owners and occupants of nearby structures	Quarterly

13. Damages to access roads used during transport of construction materials and equipment	<input type="checkbox"/> Access roads to construction sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
14. Provision of health and safety orientation to workers	<input type="checkbox"/> Construction sites	Check to proofs that orientation or training have been conducted (e.g. training materials, minutes of meetings, attendance sheets), interviews with workers	Once upon Site mobilization of workers
15. Provision of adequate safety equipment to workers, safe water supply, sanitation facility and first aid supplies	<input type="checkbox"/> Construction sites	Site inspection, interviews with workers	Quarterly
16. Restoration of affected roads and sidewalks	<input type="checkbox"/> Adjacent areas to construction sites	Site inspection	Once upon Completion of subprojects
<b>Operation</b>			
17. Flooding of adjacent properties due to poor drainage of subproject sites	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
18. Safety hazards	<input type="checkbox"/> Substation sites	Site inspection and interviews with operating personnel	Semi-annual
19. Impacts to water quality due to sewage generation	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
20. Soil and water contamination due to leaks of hazardous substances	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
23. Elevated noise from substation operation	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with operating personnel	Semi-annual

### APPENDIX 3. GIS (WITHIN EXISTING CONVENTIONAL SUBSTATIONS) - EXTENSION

**TABLE 3.1: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FOR GIS SUBSTATIONS-EXTENSION**

Impact Description	Mitigation Measures
<b>Construction</b>	
1. Direct discharge of construction run-off may cause siltation of water courses. Improper storage and disposal of excavations spoils, wastes and other construction materials could adversely affect water quality and flow regime.	<input type="checkbox"/> Run-off and drainage control shall be provided in construction areas to avoid siltation of nearby water courses. <input type="checkbox"/> Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical. <input type="checkbox"/> Earth, stones and solid wastes will be properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.
2. Improper storage and handling of fuel, lubricant and other hazardous substances could contaminate soil and water.	<input type="checkbox"/> Fuel and other hazardous substances shall be stored in roofed, concrete-lined and bunded areas.
3. Disruption to traffic movements may occur due to construction related activities.	<input type="checkbox"/> Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made. <input type="checkbox"/> Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities. <input type="checkbox"/> Design travel routes for construction vehicles to avoid areas of congestion
4. Access roads used during transport of construction materials and equipment may be damaged.	<input type="checkbox"/> Restoration of damaged roads shall be undertaken upon completion of construction.
5. Failure to restore temporary construction sites.	<input type="checkbox"/> All temporary construction sites will be cleared of debris and structures, ground shall be leveled (as necessary), revegetated (as necessary) and restored before turning over to communes and households.
6. Health risks due to unhygienic conditions at workers' camps.	<input type="checkbox"/> Basic medical care shall be provided at camp sites. <input type="checkbox"/> Workers shall be provided with potable water supply and hygienic sanitation facilities. <input type="checkbox"/> Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented. <input type="checkbox"/> Health and safety orientation shall be conducted for construction workers.
7. Safety hazards during	<input type="checkbox"/> Workers will be oriented on safe practices and shall be

construction	<p>provided with appropriate personnel protective gear (e.g., safety shoes, hard hats, safety goggles).</p> <p><input type="checkbox"/> There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas.</p> <p><input type="checkbox"/> Appropriate lighting shall be installed in construction areas when work occurs after dark</p>
<b>Operation</b>	
8. Safety hazards	<p><input type="checkbox"/> An emergency response plan, adequate fire-fighting facilities and proper training of employees on fire prevention and control shall be provided.</p> <p><input type="checkbox"/> Unauthorized persons shall not be allowed within plant premises and adequate warning signs shall be provided.</p>
9. Impacts to water quality due to sewage generation	<input type="checkbox"/> Toilets with septic tanks at office facilities shall be provided.
10. Gas leaks during operation could pose hazards to the environment and plant personnel	<p><input type="checkbox"/> Substation equipment containing SF6 is gas-tight. The plant will be equipped with continuous gas monitoring apparatus such that any leakage would be discovered at an early stage and shall be repaired immediately.</p> <p><input type="checkbox"/> In case of leaks, inhalation of SF6 is non-toxic but may cause asphyxiation when oxygen level in the air is low. Provision of adequate ventilation throughout the plant premises will prevent this condition.</p> <p><input type="checkbox"/> A manual on safety procedures during operation and maintenance of the GIS facilities shall be developed and corresponding training of plant personnel shall be carried out prior to operation.</p>

**TABLE 3.2: ENVIRONMENTAL MONITORING PLAN FOR GIS SUBSTATIONS-EXTENSION**

Issue	Subproject Type and Location	Means of Monitoring	Frequency of Monitoring
<b>Construction</b>			
1. Siltation and pollution of watercourses and flow obstruction due to direct discharge of construction runoff, improper storage and disposal of wastes and other construction materials	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
2. Storage, collection and disposal of solid waste	<input type="checkbox"/> Construction sites	Site inspection	Quarterly

3. Collection and disposal of sewage	<input type="checkbox"/> Construction sites	Site inspection	Quarterly
4. Soil and water contamination due to improper storage and handling of fuel, lubricant and other hazardous substances.	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection	Quarterly
5. Maintenance of access roads to keep this free from debris and restoration of areas used temporarily during construction	<input type="checkbox"/> Access roads to construction sites	Site inspection, interviews with adjacent households, business owners and occupants of nearby structures	Quarterly
6. Excessive noise emission	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
7. Excessive dust emission	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
8. Provision of cover on trucks transporting construction materials and excavation spoil	<input type="checkbox"/> Construction sites <input type="checkbox"/> Adjacent areas	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
9. Damages to access roads used during transport of construction materials and equipment	<input type="checkbox"/> Access roads to construction sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
10. Provision of health and safety orientation to workers	<input type="checkbox"/> Construction sites	Check to proofs that orientation or training have been conducted (e.g. training materials, minutes of meetings, attendance sheets), interviews with workers	Once upon Site mobilization of workers
11. Provision of adequate safety equipment to workers, safe water	<input type="checkbox"/> Construction sites	Site inspection, interviews	Quarterly



supply, sanitation facility and first aid supplies		with workers	
12. Restoration of affected roads and sidewalks	<input type="checkbox"/> Adjacent areas to construction sites	Site inspection	Once upon completion of subprojects
<b>Operation</b>			
13. Impacts to water quality due to sewage generation	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
14. Soil and water contamination due to leaks of hazardous substances	<input type="checkbox"/> Substation sites <input type="checkbox"/> Adjacent areas	Site inspection and interviews with local residents	Semi-annual
15. Gas leaks during operation could pose hazards to the environment and substation personnel	<input type="checkbox"/> Substation sites	Site inspection, interview with the personnel	Semi-annual

## APPENDIX 4. HIGH VOLTAGE OVERHEAD TRANSMISSION LINES (OHL)

**TABLE 4.1: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FO OHL**

<b>Impact Description</b>	<b>Mitigation Measures</b>
<b>Preconstruction</b>	
1. Land acquisition for overhead line installation and loss of income due to acquisition of agricultural land and plantation forests.	<input type="checkbox"/> Resettlement Plans (RP) detailing compensation schemes, grievance mechanisms, monitoring and evaluation plan, and institutional arrangements will be prepared and implemented consistent with Government of Rwanda (GoR) and donor requirements.
2. Land acquisition will require relocation of some households.	<input type="checkbox"/> Prior to any site works, EWSA & EARP CU shall undertake compensation and relocation in coordination with affected families and local authorities.
3. Disturbance to agricultural land uses through permanent and temporary land acquisition	<input type="checkbox"/> Carry-out detailed design of ROW and towers in a way that minimizes disturbance to agricultural land. Utilize tower designs that minimize ROW width and land use impacts. Adjust power line span length to avoid specific tower pad impacts. <input type="checkbox"/> As far as practical, schedule construction works to take place after crop harvesting
4. Safety risks due to presence of UXO	<input type="checkbox"/> EWSA and EARP CU shall engage qualified organizations to remove UXOs prior to site works.
5. Lack of consultations with local authorities on route selection	<input type="checkbox"/> During FS and detailed design, EWSA and EARP CU shall coordinate with local authorities regarding selection of suitable alignments for transmission and distribution lines to ensure minimal impacts to affected communities.
<b>Construction</b>	
6. Vegetation clearing for provision of buffer zones for high voltage lines	<input type="checkbox"/> EWSA and EARP CU shall coordinate with affected families and local authorities for compensation of trees lost following Government/donor policies <input type="checkbox"/> Contractors shall confine vegetation clearing within required area, unnecessary cutting of trees shall be prohibited <input type="checkbox"/> As much as possible, contractors shall undertake vegetation clearing through manual methods. Use of herbicides shall be prohibited. <input type="checkbox"/> Contractors shall replant disturbed sites
7. Increased exploitation of forest products	<input type="checkbox"/> Workers shall be prohibited from hunting and gathering other forest products
8. Direct discharge of construction run-	<input type="checkbox"/> Run-off and drainage control shall be provided in

<p>off may cause siltation of watercourses. Improper storage and disposal of excavation spoils, wastes and other construction materials could adversely affect water quality and flow regime.</p>	<p>construction areas to avoid siltation of nearby watercourses.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical.</li> <li><input type="checkbox"/> Earth, stones and solid wastes will be properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.</li> </ul>
<p>9. Elevated noise and dust emission levels may be experienced by nearby households and other sensitive receptors.</p>	<p>The following measures will be implemented to minimize impacts to local communities during construction:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> provision of cover on haul trucks transporting filling materials, gravel, excavated soil and other construction materials,</li> <li><input type="checkbox"/> access roads shall be regularly cleaned to keep these free from debris</li> <li><input type="checkbox"/> water spraying on exposed areas near residential and commercial areas to suppress dust emission,</li> <li><input type="checkbox"/> proper maintenance of equipment and use of mufflers, as appropriate, to minimize noise,</li> <li><input type="checkbox"/> speed restrictions for trucks and vehicles shall be enforced to minimize dust and noise emission</li> <li><input type="checkbox"/> scheduling of noise generating activities during daytime, as much as possible, to avoid disturbance to nearby communities; if evening construction is necessary, affected households and groups should be notified beforehand</li> <li><input type="checkbox"/> Ensure all vehicles and equipment are properly maintained to meet emission standards and are covered by valid operating permits</li> </ul>
<p>10. Disruption to traffic movements may occur due to construction-related activities.</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made.</li> <li><input type="checkbox"/> Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities.</li> <li><input type="checkbox"/> Design travel routes for construction vehicles to avoid areas of congestion</li> </ul>
<p>11. Irrigation canals in adjacent agricultural land, dykes may be damaged during construction.</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Any damage to irrigation channels shall be immediately repaired and damages shall be compensated, as appropriate.</li> </ul>
<p>12. Access roads used during transport of construction materials and equipment may be damaged.</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Restoration of damaged roads shall be undertaken upon completion of construction.</li> </ul>
<p>13. Failure to restore temporary construction sites.</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> All temporary construction sites will be cleared of debris and structures, ground shall be leveled (as necessary), revegetated (as necessary) and restored before turning over to communes and households.</li> </ul>

14. Health risks due to unhygienic conditions at workers' camps.	<input type="checkbox"/> Basic medical care shall be provided at camp sites. <input type="checkbox"/> Workers shall be provided with potable water supply and hygienic sanitation facilities. <input type="checkbox"/> Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented. <input type="checkbox"/> Health and safety orientation shall be conducted for construction workers.
23. Conflicts with and/or disruption to local community	<input type="checkbox"/> Maximize number of local people employed in construction works <input type="checkbox"/> If construction worker camps are required, select the locations in consultation with local authorities <input type="checkbox"/> Train workers on suitable interactions with local community including prevention of transmissible diseases
15. Safety hazards during construction	<input type="checkbox"/> Workers will be oriented on safe practices and shall be provided with appropriate personal protective gear (e.g., safety shoes, hard hats, safety goggles). <input type="checkbox"/> There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas. <input type="checkbox"/> Appropriate lighting shall be installed in construction areas when works occur after dark
<b>Operation</b>	
16. Pollution due to use of herbicides	<input type="checkbox"/> Use of herbicides to control vegetation within the right-of-way shall be prohibited.

**TABLE 4.2: ENVIRONMENTAL MONITORING PLAN FOR OHL**

<b>Issue</b>	<b>Location</b>	<b>Means of Monitoring</b>	<b>Frequency of Monitoring</b>
<b>Preconstruction</b>			
1. Permanent and temporary land acquisition, agricultural loss and tree cut down will be compensated properly before construction.	<input type="checkbox"/> Subproject sites	Site inspection and interview with affected households (if possible)	Once
<b>Construction</b>			
2. Coordination with appropriate agencies on electricity, telephone lines and other utilities or structures to avoid damage to these facilities during installation	<input type="checkbox"/> Subproject sites	Check for proof of coordination with concerned agencies or utility companies	Once before excavation work per subproject comment
3. Herbicides are not used to clear vegetation within the ROW	<input type="checkbox"/> ROW	Site inspection, interviews with	Quarterly

		construction personnel and adjacent communities	
4. Siltation and pollution of watercourses and flow obstruction due to direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
5. Storage, collection and disposal of solid waste	<input type="checkbox"/> Subproject sites	Site inspection	Quarterly
6. Collection and disposal of sewage	<input type="checkbox"/> Workers' camp	Site inspection	Quarterly
7. Soil and water contamination due to improper storage and handling of fuel, lubricant and other hazardous substances.	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection	Quarterly
8. Maintenance of access roads to keep this free from debris and restoration of areas used temporarily during construction	<input type="checkbox"/> Subproject sites	Site inspection, interviews with adjacent households, business owners and occupants of nearby structures	Quarterly
9. Excessive noise emission	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
10. Excessive dust emission	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
11. Provision of cover on trucks transporting construction materials and excavation spoil	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
12. Impacts on/damages to crop productivity and other vegetation in adjacent fields or along the transmission lines	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection with interview with affected households	Quarterly
13. Obstruction of traffic flow	<input type="checkbox"/> Roads in the	Site inspection,	Quarterly

	vicinity of subproject sites	interviews with residents living nearby and local traffic officials	
14. Damages to irrigation canals in adjacent agricultural land, dykes	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with adjacent households, business owners and occupants of nearby structures	Quarterly
15. Damages to access roads used during transport of construction materials and equipment	<input type="checkbox"/> Access roads to subproject sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
16. Provision of safe access across excavated roads and sidewalks	<input type="checkbox"/> Subproject sites	Site inspection with interview with adjacent households, business owners, occupants of nearby structures, and local traffic officials	Quarterly
17. Provision of health and safety orientation to workers	<input type="checkbox"/> Subproject sites	Check for proofs that orientation or training have been conducted (e.g. training materials, minutes of meetings, attendance sheets), interviews with workers	Once upon site mobilization of workers
18. Provision of adequate safety equipment to workers, safe water supply, sanitation facility and first aid supplies	<input type="checkbox"/> Subproject sites and workers' camps	Site inspection, interviews with workers	Quarterly
19. Restoration of affected roads and sidewalks	<input type="checkbox"/> Adjacent roads	Site inspection	Once upon completion of subprojects
<b>Operation</b>			
20. Safety hazards	<input type="checkbox"/> Subproject sites	Site inspection and interviews with operating personnel	Semi-annual
21. Herbicides are not used to control vegetation within the ROW	<input type="checkbox"/> ROW	Site inspection, interviews with operating personnel	Semi-annual

		and adjacent communities	
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## APPENDIX 5. UNDERGROUND CABLE SUBCOMPONENTS (UGC)

**TABLE 5.1: ENVIRONMENTAL IMPACT AND MITIGATION MEASURES FOR UGC SUBCOMPONENTS**

<b>Impact Description</b>	<b>Mitigation Measures</b>
1. Lack of consultations with local authorities on route selection	<input type="checkbox"/> During FS and detailed design, EWSA and EARP CU shall coordinate with local authorities regarding selection of suitable alignments for transmission and distribution lines to ensure minimal impacts to affected communities.
<b>Construction</b>	
2. Direct discharge of construction run-off may cause siltation of watercourses. Improper storage and disposal of excavation spoils, wastes and other construction materials could adversely affect water quality and flow regime.	<input type="checkbox"/> Run-off and drainage control shall be provided in construction areas to avoid siltation of nearby watercourses. <input type="checkbox"/> Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical. <input type="checkbox"/> Earth, stones and solid wastes will be properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.
3. Flooding of adjacent areas	<input type="checkbox"/> Proper drainage shall be installed to avoid flooding of surrounding properties.
4. Improper storage and handling of fuel, lubricant and other hazardous substances could contaminate soil and water.	<input type="checkbox"/> Fuel and other hazardous substances shall be stored in roofed, concrete-lined and bunded areas.
5. Elevated noise and dust emission levels may be experienced by nearby households and other sensitive receptors.	<p>The following measures will be implemented to minimize impacts to local communities during construction:</p> <input type="checkbox"/> provision of cover on haul trucks transporting filling materials, gravel, excavated soil and other construction materials, <input type="checkbox"/> access roads shall be regularly cleaned to keep these free from debris <input type="checkbox"/> water spraying on exposed areas near residential and commercial areas to suppress dust emission, <input type="checkbox"/> proper maintenance of equipment and use of mufflers, as appropriate, to minimize noise, <input type="checkbox"/> scheduling of noise generating activities during daytime, as much as possible, to avoid disturbance to nearby communities; if evening construction is necessary, affected households and groups should be notified beforehand



	<input type="checkbox"/> Ensure all vehicles and equipment are properly maintained to meet emission standards and are covered by valid operating permits
6. Disruption to traffic movements may occur due to construction-related activities.	<input type="checkbox"/> Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made. <input type="checkbox"/> Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities. <input type="checkbox"/> Design travel routes for construction vehicles to avoid areas of congestion
7. Access roads used during transport of construction materials and equipment may be damaged.	<input type="checkbox"/> Restoration of damaged roads shall be undertaken upon completion of construction.
8. Failure to restore temporary construction sites.	<input type="checkbox"/> All temporary construction sites will be cleared of debris and structures
9. Health risks due to unhygienic conditions at workers' camps.	<input type="checkbox"/> Basic medical care shall be provided at camp sites. <input type="checkbox"/> Workers shall be provided with potable water supply and hygienic sanitation facilities. <input type="checkbox"/> Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented. <input type="checkbox"/> Health and safety orientation shall be conducted for construction workers.
10. Safety hazards during construction	<input type="checkbox"/> Workers will be oriented on safe practices and shall be provided with appropriate personnel protective gear (e.g., safety shoes, hard hats, safety goggles). <input type="checkbox"/> There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas. <input type="checkbox"/> Appropriate lighting shall be installed in construction areas when works occur after dark

**TABLE 5.2: ENVIRONMENTAL MONITORING PLAN FOR UGC SUBCOMPONENTS**

Issue	Location	Means of Monitoring	Frequeny of Monitoring
<b>Construction</b>			
1. Coordination with appropriate agencies on electricity, telephone lines and other utilities or structures to avoid damage to these facilities during UGC installation	<input type="checkbox"/> Subproject sites	Check for proof of coordination with concerned agencies or utility companies	Once before excavation work per subproject comment

2. Siltation and pollution of watercourses and flow obstruction due to direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
3. Flooding of adjacent areas properties due to poor drainage at the construction site	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with adjacent households, business owners and occupants of other nearby structures	Quarterly
4. Storage, collection and disposal of solid waste	<input type="checkbox"/> Subproject sites	Site inspection	Quarterly
5. Collection and disposal of sewage	<input type="checkbox"/> Subproject sites	Site inspection	Quarterly
6. Soil and water contamination due to improper storage and handling of fuel, lubricant and other hazardous substances.	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection	Quarterly
7. Maintenance of access roads to keep this free from debris and restoration of areas used temporarily during construction	<input type="checkbox"/> Access roads to subproject sites	Site inspection, interview with adjacent households, business owners and occupants of nearby structures	Quarterly
8. Excessive noise emission	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
9. Excessive dust emission	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
10. Provision of cover on trucks transporting construction materials and excavation spoil	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
11. Obstruction of traffic flow	<input type="checkbox"/> Roads in the vicinity of subproject sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly

12. Damages to access roads used during transport of construction materials and equipment	<input type="checkbox"/> Access roads to subproject sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
13. Provision of safe access across excavated roads and sidewalks	<input type="checkbox"/> Subproject sites	Site inspection with interview with adjacent households, business owners, occupants of nearby structures, and local traffic officials	Quarterly
14. Provision of health and safety orientation to workers	<input type="checkbox"/> Subproject sites	Check for proofs that orientation or training have been conducted (e.g. training materials, minutes of meetings, attendance sheets), interviews with workers	Once upon Site mobilization of workers
15. Provision of adequate safety equipment to workers, safe water supply, sanitation facility and first aid supplies	<input type="checkbox"/> Subproject sites	Site inspection, interviews with workers	Quarterly
16. Restoration of affected roads and sidewalks	<input type="checkbox"/> Subproject sites	Site inspection	Once upon completion of subprojects
<b>Operation</b>			
17. Safety hazards	<input type="checkbox"/> Subproject sites	Site inspection and interviews with operating personnel	Semi-annual

## APPENDIX 6. REHABILITATION OF MEDIUM AND LOW VOLTAGE URBAN/RURAL GRIDS

**TABLE 6.1: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FOR REHABILITATION OF MEDIUM AND LOW VOLTAGE URBAN/RURAL GRIDS**

Impact Description	Mitigation Measures
<b>Preconstruction</b>	
1. Land acquisition for upgrading of urban/rural grid and loss of income due to acquisition of agricultural land and plantation forests	<input type="checkbox"/> Resettlement Plans (RP) detailing compensation schemes, grievance mechanisms, monitoring and evaluation plan, and institutional arrangements will be prepared and implemented consistent with Government of Rwanda (GoR) and donor requirements.
2. Safety risks due to presence of UXO	<input type="checkbox"/> EWSA and EARP CU shall engage qualified organizations to remove UXOs prior to site works.
3. Lack of consultations with local authorities on route selection	<input type="checkbox"/> During FS and detailed design, EWSA and EARP CU shall coordinate with local authorities regarding selection of suitable alignments for transmission and distribution lines to ensure minimal impacts to affected communities.
<b>Construction</b>	
4. Pollution due to use of herbicides	<input type="checkbox"/> Use of herbicides to clear vegetation within the right-of-way shall be prohibited.
5. Direct discharge of construction run-off may cause siltation of watercourses. Improper storage and disposal of excavation spoils, wastes and other construction materials could adversely affect water quality and flow regime.	<input type="checkbox"/> Run-off and drainage control shall be provided in construction areas to avoid siltation of nearby watercourses. <input type="checkbox"/> Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical. <input type="checkbox"/> Earth, stones and solid wastes will be properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.
6. Elevated noise and dust emission levels may be experienced by nearby households and other sensitive receptors.	<p>The following measures will be implemented to minimize impacts to local communities during construction:</p> <input type="checkbox"/> provision of cover on haul trucks transporting filling materials, gravel, excavated soil and other construction materials, <input type="checkbox"/> access roads shall be regularly cleaned to keep these free from debris <input type="checkbox"/> water spraying on exposed areas near residential and commercial areas to suppress dust emission, <input type="checkbox"/> proper maintenance of equipment and use of mufflers, as

	<p>appropriate, to minimize noise,</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> speed restrictions for trucks and vehicles shall be enforced to minimize dust and noise emission</li> <li><input type="checkbox"/> scheduling of noise generating activities during daytime, as much as possible, to avoid disturbance to nearby communities; if evening construction is necessary, affected households and groups should be notified beforehand</li> <li><input type="checkbox"/> Ensure all vehicles and equipment are properly maintained to meet emission standards and are covered by valid operating permits</li> </ul>
7. Disruption to traffic movements may occur due to construction-related activities.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made.</li> <li><input type="checkbox"/> Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities.</li> <li><input type="checkbox"/> Design travel routes for construction vehicles to avoid areas of congestion</li> </ul>
8. Irrigation canals in adjacent agricultural land, dykes may be damaged during construction.	Any damage to irrigation channels shall be immediately repaired and damages shall be compensated, as appropriate
9. Access roads used during transport of construction materials and equipment may be damaged.	<input type="checkbox"/> Restoration of damaged roads shall be undertaken upon completion of construction.
10. Failure to restore temporary construction sites.	<input type="checkbox"/> All temporary construction sites will be cleared of debris and structures, ground shall be leveled (as necessary), revegetated (as necessary) and restored before turning over to communes and households.
11. Health risks due to unhygienic conditions at workers' camps.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Basic medical care shall be provided at camp sites.</li> <li><input type="checkbox"/> Workers shall be provided with potable water supply and hygienic sanitation facilities.</li> <li><input type="checkbox"/> Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented.</li> <li><input type="checkbox"/> Health and safety orientation shall be conducted for construction workers.</li> </ul>
12. Safety hazards during construction	<ul style="list-style-type: none"> <li><input type="checkbox"/> Workers will be oriented on safe practices and shall be provided with appropriate personnel protective gear (e.g., safety shoes, hard hats, safety goggles).</li> <li><input type="checkbox"/> There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas.</li> </ul>

	<input type="checkbox"/> Appropriate lighting shall be installed in construction areas when works occur after dark
<b>Operation</b>	
13. Pollution due to use of herbicides	<input type="checkbox"/> Use of herbicides to control vegetation within the right-of-way shall be prohibited.

**TABLE 6.2: ENVIRONMENTAL MONITORING PLAN FOR REHABILITATION OF MEDIUM AND LOW VOLTAGE URBAN/RURAL GRIDS**

Issue	Location	Means of Monitoring	Frequency of Monitoring
<b>Preconstruction</b>			
1. Permanent and temporary land acquisition, agricultural loss and tree cut down will be compensated properly before construction.	<input type="checkbox"/> Subproject sites	Site inspection and interview with affected households (if possible)	Once
<b>Construction</b>			
2. Coordination with appropriate agencies on electricity, telephone lines and other utilities or structures to avoid damage to these facilities during installation	<input type="checkbox"/> Subproject sites	Check for proof of coordination with concerned agencies or utility companies	Once before Excavation work per subproject comment
3. Herbicides are not used to clear vegetation within the ROW	<input type="checkbox"/> ROW	Site inspection, interviews with construction personnel and adjacent communities	Quarterly
4. Siltation and pollution of water courses and flow obstruction due to direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
5. Storage, collection and disposal of solid waste	<input type="checkbox"/> Subproject sites	Site inspection	Quarterly
6. Collection and disposal of sewage	<input type="checkbox"/> Subproject sites	Site inspection	Quarterly
7. Maintenance of access roads to keep this free from debris and restoration of areas used temporarily during construction	<input type="checkbox"/> Subproject sites and access roads	Site inspection, interview with adjacent households, business owners and occupants of	Quarterly

		nearby structures	
8. Excessive noise emission	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
9. Excessive dust emission	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby	Quarterly
10. Provision of cover on trucks transporting construction materials and excavation spoil	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
11. Impacts on/damages to crop productivity and other vegetation in adjacent fields or along the transmission lines	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection with interview with affected households	Quarterly
12. Obstruction of traffic flow	<input type="checkbox"/> Roads in the vicinity of subproject sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
13. Damages to irrigation canals in adjacent agricultural land, dykes	<input type="checkbox"/> Subproject sites and adjacent areas	Site inspection, interviews with adjacent households, business owners and occupants of nearby structures	Quarterly
14. Damages to access roads used during transport of construction materials and equipment	<input type="checkbox"/> Access roads to subproject sites	Site inspection, interviews with residents living nearby and local traffic officials	Quarterly
15. Provision of safe access across excavated roads and sidewalks	<input type="checkbox"/> Subproject sites	Site inspection with interview with adjacent households, business owners, occupants of nearby structures, and local traffic officials	Quarterly
16. Provision of health and safety orientation to workers	<input type="checkbox"/> Subproject sites	Check to proofs that orientation or	Once upon site

		training have been conducted (e.g. training materials, minutes of meetings, attendance sheets), interviews with workers	mobilization of workers
17. Provision of adequate safety equipment to workers, safe water supply, sanitation facility and first aid supplies	<input type="checkbox"/> Subproject sites	Site inspection, interviews with workers	Quarterly
18. Restoration of affected roads and sidewalks	<input type="checkbox"/> Access roads to subproject sites	Site inspection	Once upon completion of subprojects
<b>Operation</b>			
19. Safety hazards	<input type="checkbox"/> Subproject sites	Site inspection and interviews with operating personnel	Semi-annual
20. Herbicides are not used to control vegetation within the ROW	<input type="checkbox"/> ROW	Site inspection, interviews with operating personnel and adjacent communities	Semi-annual



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