The Federal Environmental Protection Authority

Guidelines for Dams and Reservoirs

NOT FOR CITATION

This guidelines is still under development and shall be bin-

Ethiopia

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Introduction

This guidelines focuses on the construction and operation of dams and reservoirs for various purposes. They highlight major issues and potential impacts that should be taken into account during the preparation and assessment phases. The appropriate enhancement and mitigation measures should be integrated as early as possible, preferably in the project design.

1. Major Types of Intervention in the Dams and Reservoirs Sub-Sector

The construction and operation of dams and reservoirs include several activities or components that can potentially induce significant environmental and social impacts:

- River diversion, including the construction of diversion canals.
- Land clearing and relocation/demolition of existing infrastructures in the future reservoir.
- Construction of secondary dykes.
- Population resettlement.
- Construction of access roads.
- Construction, maintenance and closure of labour camps and other temporary infrastructures.
- Construction of the dam: digging, blasting, construction of foundations, transportation and storage of material, operation of heavy machinery, etc.
- Exploitation of borrow pits (on-site and off-site).

2. Specific Characteristics of Dams and Reservoirs Projects

The description and justification of a hydropower project shall cover at least the following elements:

- Spatial requirements (reservoir and dam area as well as other sites required for works).
- Project layout characteristics (including site location map).
- Land tenure and ownership.
- Affected groups (directly or indirectly).
- Resettlement requirements and proposed transition and compensation means.
- Natural and human resources requirements.
- Water regulation works (dams, dykes, sluices, etc.).
- Anticipated hydrological changes (upstream and downstream, seasonal floods, etc.)
- Anticipated induced seismicity.
- Dam and reservoir characteristics (area, volume, height and levels).
- Access roads.
- Temporary infrastructures (cofferdams, materials storage areas, waste areas, labour camps, etc.).
- Existing and proposed location of human settlements and public services such as health centres and accident and emergency units.
- Construction activities (land clearing, burning, excavation, blasting, extracting, dredging, filling, compacting, waterways crossing, use of heavy machinery, etc.).
- Anticipated liquid, solid (including waste) and gaseous emissions, and sources of nuisances (at construction and operation stages).
- Construction schedules and costs.
- Management and operation of the dam and reservoir (water flow, minimum flow

3. Major Issues Related to Dams and Reservoirs Projects

The main issues related to dam and reservoir projects can be summarised as follows:

Crosscutting Theme	Major Issues	Relevant or not
Poverty	• Economic activity, employment and incomes. • Compensation for losses. • Access to benefit, particularly for adversely affected people. • Skill and knowledge requirements. • Knowledge on project implications and opportunities. • Availability of and access to infrastructures and services.	
Environment	• Hydrology and limnology of watershed. • Landslides, erosion and sedimentation. • Ecosystems of particular interest. • Wildlife habitat. • Mercury methylation. • Heritage and cultural sites.	
Population	• Involuntary resettlement and migration. • Population characteristics and dynamics • Land uses. • Traditional agriculture, livestock and natural resources exploitation activities. • Water access and rights. • Quality of life. • Traditional lifestyle and local customs. • Landscape and aesthetics.	
Health Outcomes	• Vector-borne and other communicable diseases. • HIV and sexually transmitted infections. • Injuries. • Malnutrition.	
Gender	• Women’s workload.	

4. Potential Impacts, Enhancement and Mitigation Measures

The potential impacts outlined below are presented by crosscutting theme (one table per theme) to clearly identify the potential in - teractions between a dam and reservoir project and a specific transversal issue. The components considered under each crosscut - ting theme were selected for their relevance to the particular issue.

4.1 Poverty

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Economy	- Increase in economic activity and employment. - Induced development due to new opportunities such as in fisheries and dam related projects (irrigation, hydropower, etc.) - Disruption of existing activities particularly floodplain agriculture and artisanal fisheries downstream. - Loss of livelihood for those who are living and/or cultivating the land in the flooded areas. - Disruption of activities in catchment areas, particularly if they represent potential sources of pollution for the reservoir. - Benefits not accessible to people adversely affected by the project.	- Give preference to local employment (men and women) and local inputs (food, basic material) to the extent possible. - Offer appropriate compensations or alternative income opportunities to men and women having a reduced access to or loosing productive means. - Ensure that the poor and other vulnerable groups can continue to safely satisfy their basic needs. - Whenever possible, give an opportunity to men and women who are directly loosing from the projects to benefit from new jobs or revenue-generating opportunities (e.g. induced development).

Povertyy cont.….

Information, education and communication	• Exclusion of specific groups due to a lack of knowledge. • Development of additional skills for those taking advantage of new opportunities. • Uncertainty and increased perturbations due to a lack of information and communication. • Limited knowledge on safety measures and behaviours that can lead to accidents.	• Assist groups of individuals (men and women) who may lack the capacity to apply for a job to prepare an application, if they want to. • Provide adversely affected people, men and women, with the training required to benefit from new opportunities. • Inform men and women on potential project benefits and identify individual behaviours that would contribute to achieve those benefits. • Develop and implement a literacy program especially aimed at poor people and women. • Plan information, education and communication activities during and after project implementation to increase awareness of all users (men and women) on safety measures that shall be followed.
Access to infrastructures and services	• Development of new infrastructures. • Destruction of existing infrastructures in the dam and reservoir area. • Reliable water supply for irrigation, domestic and other uses. • Contamination of domestic water supplies due to the mismanagement of the reservoir. • Increased pressures on existing social services due to migration. • Increased prices of services (water, electricity, etc.).	• Before construction, consult concerned ministries to verify the adequacy of current and proposed infrastructures. • Involve the population (men and women) in the maintenance and management of new infrastructures to ensure their sustainability. • Ensure adequate social services, including drinking water supplies, for addressing the basic needs of the local populations, non-resident workers and migrants. • Assist social service administrations in coordinating their efforts to offer additional services and improve service delivery if required. • Promote safety net measures to protect the poor and other vulnerable groups against a service price increase. • Establish quality control for water supplies.

4.2 Environment

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Air	• Degradation of air quality by dust, heavy machinery atmospheric emissions and waste disposal. • Increase in ambient noise during construction.	• Install and operate air pollution control equipment. • Near the residential areas, avoid noisy works after regular working hours. • Maintain vehicles and machinery in good condition in order to minimise gas emissions and noise. • Use dust and noise attenuators, such as vegetation hedges along transport corridors in order to minimise noise and the aerial transport of dust.
Water	• Flood control. • Interruption of surface water flows during and after construction. • Changes in the level of groundwater table resulting from changes in the drainage and water flow. • Contamination of surface and underground waters by wastewater and hazardous materials. • Alteration of water flow downstream impairing agricultural activities on floodplains. • Proliferation of aquatic weeds in reservoir and downstream impairing dam discharge, irrigation schemes, navigation and fisheries. • Degradation of the reservoir water quality. • Salt-water intrusion in estuary and upstream.	• Do not hamper drainage of surface water and plan for restoration measures after construction. • Plan and set up on-site sanitary facilities for the disposal of wastewater. • Maintain vehicles, machinery and equipment in good condition in order to avoid leaks and spill of hazardous materials (hydrocarbons, chemical products, etc.). • Ensure a safe management of hazardous materials (hydrocarbons, chemical products, etc.). • Take all precautions during the refuelling of vehicles and machinery, and forbid the refuelling near water bodies. • Avoid crossing permanent waterways; if necessary, locate the crossing where the banks are stable and the waterway the most narrow. • Conserve the vegetation along water bodies and near wetlands. • Plan emergency response measures in case of accidental spill. • Assess the relevance of clearing the vegetation before flooding the reservoir. • Apply appropriate weed control measures. • Control land uses, wastewater discharge and agricultural chemical inputs in watershed. • Limit retention time of water in reservoir. • Maintain a minimum flow to prevent salt-water intrusion.

Environment cont..

Soil	• Runoff erosion resulting in sedimentation problems. • Contamination of soils from spilling of hazardous materials. • Landslides and other types of soil movements in the works areas. • Soil compaction and erosion during construction. • Soil erosion due to water level changes in the reservoir. • Loss of productive soils by flooding. • Soil destabilisation as a result of excavation. • Scouring of riverbed downstream of the dam due to the low content of sediments in water. • Salinisation of floodplain soils, particularly in arid and semi-arid regions	• Avoid areas sensitive to erosion. • Carry out the construction works in the dry season. • Limit the circulation of heavy machinery to minimal areas. • Avoid establishing access roads along steep slopes; instead, locate the access roads perpendicularly or diagonally to the slope. • Use existing borrow pits rather than creating new ones; after the works, restore borrow pits by stabilising slopes and facilitating vegetation regeneration. • Stabilise the soils in order to reduce potential erosion. • At the end of construction works, level off the soils and facilitate vegetation regeneration. • Implement integrated watershed management in order to control soil erosion. • Prevent land clearing in watershed and facilitate the reforestation of cleared areas. • Design the works in order to release sediments (hydraulic release). • Dredge accumulated sediments. • Regulate water flow to minimise soil salinisation.
Ecosystems	• Destruction of ecosystems of particular interest. • Degradation of ecologically sensitive areas. • Loss of biodiversity.	• Design the project by taking into account ecosystems of particular interest and ecologically sensitive areas. • Protect equal areas of ecosystems of particular interest to offset losses. • Establish a perimeter of protection around sensitive ecosystems such as wetlands and unique habitats sheltering endangered species. • Minimise the length of work in ecologically sensitive areas. • Avoid flooding wetlands and protected areas.
Flora	• Destruction of vegetation. • Loss of forest products (fuel wood, timber, non-timber forest products, medicinal plants). • Bio-accumulation of methyl mercury in the tissues of fish-eating wildlife species, affecting their vital organs and central nervous system, especially in acid and anaerobic conditions.	• Minimise the land clearing areas around the reservoir. • Recuperate the forest products extracted from land clearing and identify mechanisms to distribute the products to the local population. • In regions where conditions can favour mercury methylation, remove as much as possible the vegetation and organic matter on the ground before flooding, and manage the reservoir to minimise methyl mercury production (e.g. gradual flooding, reduced water retention time, etc.)

Envirnoment cont.…

Fauna	Creation of a new fish habitat in the reservoir facilitating fisheries development. Loss of existing wildlife and fish habitats. Disruption of wildlife migrations. Increase in poaching due to non-resident workers. Adverse impact on fishes due to changes in water flow and limnology, disruption of fish migrations, and degradation of water quality.	Design the project by taking into account wildlife reproduction areas and migration corridors. Do not carry out any work in reproduction areas during the reproduction periods. Minimise sedimentation in spawning grounds downstream. Relocate animals before flooding the reservoir. Control illegal fishing and hunting, particularly by non-resident workers. Maintain a minimum water flow for fishes. Provide appropriate means of passage for fishes. Preserve spawning grounds. Facilitate the development of culture fisheries in reservoir as a mean of compensation.
Natural and cultural heritage	Loss of sites of cultural, archaeological or historical importance by flooding.	Before construction, carry out an archaeological search in the potential areas containing artefacts and preserve discovered artefacts. Negotiate with traditional authorities the preservation of important cultural, religious, historical and aesthetic sites and resources and agree on potential compensation for the communities. During construction, ensure an archaeological surveillance in the potential areas containing artefacts and in case of a discovery, advise the concerned authorities. Involve traditional authorities in monitoring cultural, religious, historical and aesthetic sites and resources during the various phases of the project.

4.3 Population

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Demographic trends	Increase in the population due to migrants attracted by new economic opportunities (trade, fisheries, irrigated agriculture). Increased ethnic diversity after migration. Temporary imbalance between men and women due to male workers, which can lead to an increase in sexually transmitted diseases.	Work closely with host communities to facilitate the integration and acceptation of migrants (men and women). Establish labour camps at a reasonable distance from villages. Whenever possible employ women or married men with nearby families. Assist non-resident workers in order to encourage their families to join them.
Migration and resettlement	Decreased standard of living for involuntarily displaced people. Inappropriate living conditions for non-resident workers and their families. Constraints in adjusting to resettlement and changes in productive activities. Population pressure due to the arrival of non-resident workers and migrants attracted by new economic opportunities. Unplanned human settlements.	Provide equivalent or better housing and accompanying facilities to involuntarily displaced men and women in accordance with consultation results. Plan adequate settlement areas with appropriate housing and services (water and sanitation) for non-resident workers and their families. Provide temporary food supplies to involuntarily displaced men and women, as needed. Provide complementary training /support to men and women to facilitate adjustment during the transition period. In accordance with priorities of displaced men and women, ensure appropriate funding for resettlement as well as for productive land compensation to men and women owning or occupying/cultivating the land. Establish access mechanisms to land in the watershed in order to control unorganised settlements.

Population cont..

Natural resources and land management	• Sustainable management of water resources. • Loss of productive land and natural resources in flooded areas. • Disruption of natural resources exploitation activities, particularly fisheries. • Derangement of livestock grazing and traditional agriculture, particularly flood recession agriculture. • Insufficient arable land to satisfy subsistence agricultural needs. • Loss of territory for local populations. • Changes in land and water uses, access and rights, that can lead to social conflicts. • Rivalry associated with incompatible water uses upstream and downstream. • Increased pressure on natural resources due to migration. • Restricted activities within the watershed that can be potential sources of pollution for the reservoir (agriculture, livestock herding, deforestation, etc.).	• Take into account the various land uses while designing the project in order to minimise the loss of land, particularly productive land. • Coordinate project works with the various land users (men and women). • Involve traditional authorities in the design of the project, particularly in siting settlements and in defining flooded areas. • Wherever possible, compensate the loss of land by protecting an equivalent land area in the region. • Offer compensation or alternative revenue opportunities to men and women loosing land and/or productive means, e.g. to owners and those occupying/cultivating the land. • Develop alternative grazing areas to compensate for those lost. • Prevent food insecurity by allocating land and credit to food cropping. • Regulate dam releases to partially replicate natural flooding regime. • Create water user organisations, involving men and women, to effectively manage water resources and ensure equitable sharing among users. • Select resettlement sites respecting natural resources capacity. • Integrate land management priorities into land planning instruments to take into account various land uses. • Clearly define water rights and establish water user fees in consultation with concerned stakeholders. • Build on the respective knowledge and experience of women and men in water management.
Quality of life	• Improvement in quality of life due to new economic opportunities and adequate compensations for losses. • Disruption in the quality of life due to nuisances such as noise, dust and traffic related to construction works. • Disruption of indigenous people's lifestyle and customs. • Social conflicts associated with the venue of migrant workers and new settlers (divorces, ethnic tension, etc.). • Degradation of the visual quality of the landscape due to land clearing, construction works, new infrastructures, etc.	• Establish a formal consultation mechanism with local authorities to discuss issues disturbing inhabitants and to find solutions satisfying all parties. • Train workers (men and women) in the field of environmental protection. • Implement a communication plan to inform men and women on project activities and potential nuisances. • Involve local authorities in monitoring implementation activities and compensation agreements, ensuring a good representation of men and women. • Favour resettlement areas allowing indigenous people to preserve their lifestyle and customs. • Ensure appropriate support from social services to facilitate the transition and to prevent conflicts within families or among groups. • Favour an architectural design integrating the new infrastructures into the landscape.

4.4 Health Outcomes

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Communicable diseases	Improvement in health conditions due to better access to domestic water. Changes in exposure to: Water borne diseases e.g.: diarrhoea and cholera associated with poor sanitary conditions and misuse of reservoir water for domestic purposes, leptospirosis associated with rodent urine. Water related diseases e.g.: malaria, onchocerciasis, filariasis associated with increases in vector breeding and contact. Water contact diseases e.g.: schistosomiasis and swimmer's itch associated with domestic and occupational behaviour. Water washed diseases e.g.: scabies and skin infections associated with poor sanitary and hygienic conditions. Sexually transmitted infections e.g.: HIV/AIDS associated with migration, construction and economic change. Zoonoses associated with project location e.g.: trypanosomiasis, Rift Valley Fever. Respiratory infections e.g.: TB associated with crowding.	Provide appropriate domestic water supply to address additional needs. Facilitate the implementation of appropriate latrines and other sanitation facilities. Information, education and communication about safe uses of reservoir water and occupational safety. Environmental management for vector control; contact avoidance via settlement location and design, use of bednets and repellents, construction of jetties; rapid diagnosis and treatment; focal insecticide and molluscicide application. Strengthen medical services to ensure rapid diagnosis and treatment and enhance diagnostic skills, taking into consideration the particular needs of men and women. Safe food storage and handling. Implement HIV/AIDS prophylaxis for men and women through appropriate health promotion as well as wide distribution and use of condoms; employment opportunities for project-affected women; provision of family accommodation for workers. Project resettlement housing designed to avoid crowding, and provide ventilated kitchens and efficient stoves. Implement a referral system for severe cases. Assure supplies of appropriate drugs. Refer also to measures proposed under Environment and Poverty crosscutting themes as they address many health determinants of communicable diseases.
Non-communicable diseases	Poisoning of downstream domestic users or fish consumers associated with excess mineralization of reservoir water or high concentrations of methylmecury in fish tissues.	Monitor quality of domestic water and fish. In regions where the conditions can favour mercury methylation, inform the population to avoid eating fish species in which methylmercury is likely to accumulate (fish-eating and long-living species).

Heath cont…

Malnutrition	• Increased access to capture fisheries fulfilling basic local needs. • Increased access to irrigated agricultural land in drawdown zones. • Deterioration of nutritional status due to loss of land or resettlement as well as to disturbed production and markets.	• Ensure that part of the crop production is directed to local markets to maintain or increase food supply. • Plan for complementary food supply during the transition period when subsistence food supply may decrease. • Strengthen medical services to ensure rapid diagnosis and treatment.
Injuries	• Increased risk of accidents for the local population due to working sites and increased traffic. • Appearance of or increase in domestic and communal violence. • Increased risk of drowning. • Work injuries.	• Develop, communicate and implement safety and preventive measures for the population (such as traffic calming devices). • Control access to working sites. • Install and maintain appropriate signs. • Plan stabilisation and evacuation of injured. • Prevent communal and domestic violence through awareness. • Plan lifesaving equipment and measures. • Ensure that downstream villages are informed in advance of water fluctuations. • Develop, communicate and implement safety and preventive measures for workers (men and women). • Plan equipment for moving heavy loads such as donkey carts and ergonomic equipment for men and women.
Psychosocial disorders and well-being	• Stress and anxiety associated with involuntary resettlement, rapid social change, loss of traditional authority, loss of spiritual assets, uncertainty and locus of control, severance, exclusion, and marginalisation, gender related problems and domestic disputes leading to suicide, physical and mental abuse, child marriage, labour and sale, and communal violence • Well-being associated with improved income, stability, work opportunities, settlements, health, empowerment, education and training.	• Refer to measures proposed under other crosscutting themes as those address many causes of psychosocial disorders and factors contributing to well-being.

4.5 Gender

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Division of labour (paid and unpaid work)	Reduced time allocated to water supply for women and children due to more reliable sources. Increase in workload due to resettlement and additional constraints in accessing natural resources such as firewood.	Provide means to women and children to further reduce time and efforts devoted to water supply (donkey, wheelbarrow, etc.). Provide sufficient time and resources to women to facilitate resettlement. Ensure that natural resources accessibility is maintained or improved after project implementation (availability and required efforts).
Income generating activities (money or kind)	Local jobs obtained by women during construction or operation phases. Opportunities to increase income and diversify revenue sources through induced development. Women not compensated for the loss of land used for traditional cropping. Reduced available income for women when user rights represent additional expenses. Limited participation of women in project benefits due to cultural barriers.	Offer project employment opportunities to men and women, encourage women to apply and select candidates according to their competencies. Ensure that women have access to existing and planned facilities to take advantage of business opportunities. Ensure that not only land owners but also those occupying / cultivating the land are compensated for the losses associated with land expropriation / flooding . Ensure that women are consulted in determining water user rights. Ensure that project promoters do not reinforce cultural barriers affecting negatively women.
Access to and control over productive factors	Unequal access to productive land through the compensation process. Loss of control over water resources when women are not involved in decision-making processes. Water right allocation does not respond to women priority needs.	Ensure that men and women affected by the project can access productive land to compensate for land losses. Use criteria recognising user rights when allocating productive land to affected people men and women. Provide women with an opportunity to make their needs known to project decision-makers. Recognise the specific demands and capabilities of women in water management.
Involvement of women in societal organisation	Involvement of women in decisions related to water management. Women get organised to make their water needs and priorities better known to decision-makers as well as to protect their access rights.	Establish management committees involving women and men in the management of water resources. Ensure that women are involved in user right collection and allocation decisions. Facilitate the creation of women groups when women express an interest in being better organised and represented.

4.6 Participation

Component	Potential Beneficial and Adverse Impacts	Enhancement and Mitigation Measures
Consultations	Integration of men's and women's concerns into the project design. Increased support for the project among affected populations. Exclusion of specific groups from consultations, particularly women. Water user rights determined without consultations.	Consult affected men and women at all phases of the project, including for establishing water rights. Provide the opportunity to all affected groups to participate in consultations by offering adapted consultation mechanisms. Use consultations to identify traditional patterns of right and responsibilities concerning water uses and to determine ways to increase the involvement of excluded groups (in particular women). Inform men and women consulted on how their concerns were taken into account.
Civil society strengthening	Creation of community-based organisations in water management. Lack of collaboration between the river basin authority and community-based organisations involved in water management. Loss of power for traditional leaders.	Ensure that men and women have the opportunity to organise themselves in groups representing their collective interests. Develop a network of community-based organisations in water management that would be represented at the river basin level. Establish a consultation mechanism with traditional authorities to ensure that their views are considered during the planning and implementation phases.

5. External Factors

The following external factors may significantly reduce the benefits associated with a dam and reservoir project, and even jeopardise its success:

- **Poor land use practices**

Poor land use practices in the watershed, such as deforestation, can result in increased sedimentation in the reservoir and changes in water quality. Integrated watershed management, addressing all land uses in the watershed, can help to mitigate such problems.

- **Earthquake**

Some evidence demonstrates a link between the creation of a reservoir and earthquakes in seismic areas. Indeed, a reservoir may advance in such areas the occurrence of an earthquake, possibly resulting in more frequent but less destructive events (World Bank, 1991).

- **Immigration**

The venue of migrants attracted by new economic opportunities such as fisheries can generate several problems like overexploitation of natural resources, social conflicts and increased health risks. The appropriate planning of human settlements and social services to respond to additional needs can reduce problems associated with immigration.

6. Hazard Management

The main hazards associated with a dam and reservoir project are:

- **Dam rupture**, causing sudden flooding of the downstream area and resulting in the loss of human lives and serious economic damages.
- **Health hazard** such as drowning and injury due to unpredictable draw down and downstream flow rate fluctuation.

In order to prevent or minimise these hazards, appropriate risk management measures shall be designed and implemented.

7. Environmental and Social Monitoring

The following table presents potential indicators that could be used to monitor the implementation of a dam and reservoir project. The appropriate indicators for a specific project shall be selected according to the project context, major anticipated impacts and the cost of data collection and processing.

Component	Indicators
Poverty	
Economy	• Number of jobs created (directly and indirectly) and occupied by men and women. • Proportion of jobs obtained by adversely affected people. • Level of satisfaction of adversely affected men and women toward compensations and alternatives offered (survey).
Information, education and communication	• Understanding of safety measures (survey).
Access to infrastructures and services	• Number of reliable domestic water points (evolution over time). • Funds dedicated to social services. • Change in service prices.
Environment	
Air	• Annual rainfall. • Greenhouse effect gas emissions.
Water	• Parameters of WHO Guidelines for Drinking Water Quality. • Volume of water stored in the reservoir. • Water flow downstream of the dam. • Volume of water used by type of use.
Soils	• Volume of sediments transported in the reservoir. • Quality of sediments.
Ecosystems	• Area of particular ecological interest affected by the project.
Flora	• Cleared area due to the project.
Fauna	• Fish populations in the reservoir and downstream. • Change in wildlife populations in the influence area of the project. • Level of methylmercury in fish-eating species (if applicable).
Natural and cultural heritage	• Number of natural and cultural sites affected by the project.
Population	

Component	Indicators
	additional traffic, etc.

Monitoring cont…

Component	Indicators
Health Outcomes	
Communicable diseases	• Prevalence rates of diseases such as malaria, schistosomiasis, diarrhoea and HIV. • Number of vector breeding sites and vector density. • Availability of condoms, impregnated bed nets, mosquito repellents. • Outpatient attendance records. • Quantity of drugs supplied and used from health services and local shops.
Non-communicable diseases	• Prevalence rate of poisoning cases.
Malnutrition	• Number of men, women and children affected by seasonal hunger. • Height/weight monitoring of children.
Injuries	• Number of violent events reported by the police and social services. • Drowning rate. • Construction site occupational health and safety records.
Gender	
Division of labour	• Time allocation of women before and after the project.
Income-generating activities (money or kind)	• Proportion of women involved in construction and/or maintenance activities. • Proportion of the family income earned by women before and after the project.
Access to and control over productive factors	• Level of satisfaction of women toward project investment decisions and management methods (survey).
Involvement of women in societal organisation	• Number of women and men involved in management committees and/or in user right collection and allocation decisions.
Participation	
Consultations	• Time spent on and frequency of consultations related to user rights.
Civil society strengthening	• Number of community-based organisations created to manage water resources.

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