Additional Resources

Accompanying Document of the
Environment Handbook for Community Development Initiatives

Canadian International Development Agency (CIDA)

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Contents

Foreword

The environmental resources presented here are intended to be used to help integrate environmental concerns into small-scale community development initiatives funded by the Canadian International Development Agency (CIDA). The resources do not provide an exhaustive account of approaches and situations. Rather, each should be adapted to the specific circumstances in which it will be used. This document accompanies the *Environment Handbook for Community Development Initiatives* (second edition of the *Handbook on Environmental Assessment of Non-Governmental Organizations and Institutions Programs and Projects,* which was originally published in 1997). The References section of the handbook presents the documents consulted in developing the handbook and this accompanying document, and provides other sources of information.

We wish to offer our sincere thanks to all those who have generously provided comments and suggestions to realize this document and the related handbook. Several of the additional resources in this document have been reproduced and adapted from the following voluntary sector organizations: Care Canada, Fondation Crudem, Mennonite Economic Development Associates (MEDA), Scarboro Foreign Mission Society and War Child Canada.

1. Examples of Environmental Assessments

This section provides four examples of environmental assessments. These examples reflect levels of effort that vary according to the environmental linkages of the initiatives and their relationship to the *Canadian Environmental Assessment Act* (CEAA). The table below summarizes the different types of environmental assessment presented. Please note that the assessments are provided as examples only and that each one pertains to a specific situation.

An **environmental assessment** is a tool and a process for assessing the environmental effects (biophysical, cultural, and socio-economic; negative and positive; as well as cumulative and those that may result from potential accidents or malfunctions) of initiatives as well as the effect of the environment on such initiatives. It addresses a Canadian legal requirement (the CEAA) as well as CIDA's Policy for Environmental Sustainability.

Examples of environmental assessment	Characteristics of the environmental assessment
1. Urban Agriculture in Haiti	A relatively detailed environmental assessment that provides a thorough analysis of the initiative's environmental implications. This reflects the important environmental linkages associated with agriculture initiatives. This initiative does not include any activity that meets the definition of a "project" under the CEAA.
2. Afghan Women's Community Support	A very basic analysis of the environmental implications of the initiative, reflecting the minimal environmental issues associated with it. This initiative does not include any activity that meets the definition of a "project" under the CEAA. The analysis presents the efforts that will be taken to enhance the environmental benefits of the initiative.
3. Irrigation in San José de Ocoa, Dominican Republic	A detailed environmental assessment that includes all necessary elements as required by the CEAA and *CIDA's Policy for Environmental Sustainability*. The level of effort reflects the substantial environmental linkages associated with irrigation initiatives, as well as the fact that the initiative includes a "project" as defined by the CEAA.
4. Small-Scale Community and/or School (or Housing) Construction	A detailed environmental assessment that includes all necessary elements as required by the CEAA and *CIDA's Policy for Environmental Sustainability*. The level of effort reflects the environmental linkages associated with school construction, as well as the fact that the initiative includes a "project" as defined by the CEAA.

1.1 Urban Agriculture in Haiti

A) Description of the Urban Agriculture Initiative

The Urban Agriculture Initiative is designed for a two-year period. Its purpose is to improve the living conditions of 2,000 poor families in at least 12 slums in Port-au-Prince and Gonaïves, Haiti. Activities are planned in two areas: plant/animal production and nutritional education. This will alleviate the food insecurity of the people living in these slums. It will reduce urban environmental degradation. It will also raise the economic level of poor families.

The Urban Agriculture Initiative seeks to achieve the following goals by 2002. Two thousand poor households will sustainably achieve better living conditions by improving their diet and their organizational capacities, and by managing the rehabilitation of their environment, while also diversifying their sources of income. The following planned activities will have direct effects on the environment of the slums:

- the creation of 1,450 vegetable gardens, 100 small-scale animal production units, and 10 fruit-tree seedling and ornamental plant nurseries;
- the management of household wastes, production of compost, and recycling of non-organic material;
- the planting of trees in the communities;
- the processing of agricultural produce.

B) Environmental Conditions in Areas of Intervention

The Urban Agriculture Initiative will be carried out in slums in Port-au-Prince and Gonaïves. These slums are in urban areas. On the coast, they are called coastal slums, such as Raboteau in Gonaïves. On hillsides, they are called hillside slums, such as Fontamara 27/Mapou or Kamari in Port-au-Prince, and Biennac in Gonaïves. In the heart of the metropolitan area, they are called interstitial slums, such as Cité Siclait or Bolosse in Port-au-Prince. Finally, in peri-urban areas, they are called peri-urban slums, such as Bertin or Rivière Froide in Port-au-Prince.

All slums are characterized by buildings erected at random, with no urban planning or access to basic sanitation. Slums are overcrowded and lack access roads. There are no wide-open spaces between houses. Slums are unhealthy, as there is no drainage, and waste disposal is inadequate.

Coastal slums have saline soil. Remnants of mangrove forests may be seen. Slum dwellers plant trees, such as coconut and almond trees, and other plants, such as sugar cane. Hillside slums are often found on steep slopes, close to ravines, on thin and unstable soil. They are heavily deforested. Vacant lots are often sown with maize, pigeon peas, manioc, banana trees, and other food crops. Interstitial slums have very little or no space between houses. Slum dwellers plant a few plants in containers for ornamental or medicinal purposes. Peri-urban slums have more space between houses and some vegetation remains. Slum dwellers often plant gardens. Vacant lots are sown with the same crops as mentioned above.

Slum dwellers come from various areas of the province. Hillside slums have the same social structure as in rural areas: the *lakou* [extended family] system. Other slums, however, have an urban working class.

C) Activities Affecting the Environment

Vegetable Gardens

The aim will be to produce vegetables intensively, in small or larger spaces, in the ground or in containers, as the situation allows. The establishment of vegetable gardens will also aim to ensure

that families have a secure food supply, as well as to generate income to improve the participants' quality of life. Production techniques will be organic, and manure or compost will be used to fertilize soil. The types of vegetables produced will be local vegetables that are no longer farmed, but are well suited to local conditions. Other vegetables will also be identified for coastal slums with saline soil. Participants will be encouraged to prepare organically based growth media to produce vegetables not suited to these conditions. Other types of vegetables will be introduced and used, especially those that have already proven to be well suited to Haitian climates.

Positive Environmental Impacts: This activity will enhance the value of spaces and backyards that are generally underused. Growing vegetables in containers will create spaces for agricultural production. The gardens will make it possible to establish more favourable microclimates. They will also conserve local types of vegetables. Cultivation in the ground, in backyards, and on slopes will help to reduce surface run-off. The inclusion of organic matter will help water infiltration.

Adverse Environmental Impacts: The following will be monitored: the use of unsuitable soil, poor-quality organic fertilizers, and dirty irrigation water.

Small-Scale Livestock Breeding

Included in the initiative at the participants' request, this activity will involve producing poultry, rabbits, and guinea pigs. The breeding of these types of livestock is known. However, it is not widespread, due to a lack of means and technical supervision. Setting up these breeding units also aims to ensure food security and generate income for families, to improve their quality of life. Two uses are planned for the livestock: to be eaten at home and to be sold. These animals will be bred in cages, which can be stacked vertically or lined up horizontally. Production sites will be backyards or other spaces used for this purpose. The designated spaces are already available and adapted to the Haitian context. Some producers live in urban areas. Livestock will be fed with residues from food and market crops. Feed will also include domestic kitchen waste. Supplemental feed will be purchased from local feed suppliers to intensify livestock production, especially for poultry. Hillside slum dwellers will be encouraged to use small spaces on slopes to produce fodder for rabbits and guinea pigs. These types of crops will also play a role in protecting slopes.

Positive Environmental Impacts: This activity will produce manure to fertilize urban gardens. Some slaughterhouse waste will be used, such as dried blood in compost, or skins in crafts from re-usable materials. Breeding livestock in pens also has the advantage of eliminating risks of the animals destroying or deteriorating the environment.

Adverse Environmental Impacts: The following adverse effects will be averted through monitoring. Diseases and parasites can spread in poorly run breeding units and can also affect human health. Other adverse effects are the poor management of livestock wastes, and poor management of fodder crops.

Fruit-Tree Seedling and Ornamental Plant Nurseries

The nurseries will be developed in backyards or other spaces developed for this purpose. This activity aims to enable families to increase their income by selling seedlings or produce from fruit trees. This activity also aims to enhance the environment by restoring wooded and eroded areas, and by developing green spaces. Nurseries will occupy small spaces. Participants will be encouraged to grow seedlings in re-used or recycled plastic containers, in an organic growth medium prepared with manure or compost. Species will be mainly local, and will be chosen in consultation with the participants. Other already

introduced and adapted species will be chosen. Vegetative reproductive techniques — such as cutting, layering, and grafting — will be used to add value to the plants produced, but also to enable production in shorter timeframes. These nurseries will focus mainly on producing fruit and ornamental plants. However, small forest production will not be ruled out if demand or interest exists. The planting of trees will be conducted by individuals with plants of their choice or by local community organizations involved in environmental improvement activities. These organizations will provide survival control for the area planted. On government lands, local organizations will develop action plans with local authorities.

Positive Environmental Impacts: These include the restoration of vegetation cover, soil protection (especially on slopes), as well as the conservation and multiplication of local species.

Adverse Environmental Impacts: The adverse effects to be monitored will be the same as for vegetable gardens, though the impact is less critical for this activity.

Composting of Household Wastes

This activity will be carried out by families and neighbourhoods, and will reduce random waste disposal on streets, in ravines and on vacant lots. Organic wastes will be recycled as compost, and some non-organic wastes will be used for craft activities. Families are expected to generate income by selling compost and craft products. Families will manage wastes by selective sorting of wastes produced at home and in the immediate neighbourhood. Organic wastes will be used to produce compost, in containers designed for this purpose in urban areas. Participants may dispose of non-organic wastes at waste collection points. At the neighbourhood level, waste management will be promoted by local organizations involved in raising community awareness of, and involvement in, selective sorting of household wastes. Compost produced will be used in vegetable gardens, in nurseries, and for other plants. Compost will also be sold on the local market for this purpose.

Positive Environmental Impacts: This activity will improve the sanitation of the areas of intervention, and thus of the cities of intervention. Communities will change their habits, once they become aware of, and effectively involved in, improving the urban environment. Groundwater, soil, and coastal pollution will greatly decrease. The production of compost will play a definite role in soil improvement and the improvement of agricultural production.

Adverse Environmental Impacts: This activity will be monitored to ensure that the composting process produces compost that is contaminant-free. Environmental nuisances must also be prevented in installing the neighbourhood composting unit.

Small Recycled-Craft Workshops

This activity will use iron, glass, plastic, and paper to make decorative craft items, handy household items, or Haitian art (e.g. papier-mâché masks and fruits, paintings, pottery, toys). These products will be sold, creating jobs and generating household income.

Positive Environmental Impacts: Less non-organic waste will be disposed at dump sites and this waste will be valued more. This will make recycling easier in communities, and therefore in urban areas.

Adverse Environmental Impacts: Monitoring will be related to the work methods and techniques for producing craft items in small workshops. These methods must protect the health of participants and avoid pollution.

Workshops for Processing Agricultural Produce

This activity will process mainly fruits and vegetables bought on the market during the harvesting season. These will be sun-dried or

cooked on improved kerosene stoves, or energy-efficient charcoal stoves. The resulting products will be sold on the local market to generate household income. Organic wastes will be recycled in composting units, or in small-scale livestock breeding units. The water used to wash fruit and vegetables will be recycled to irrigate vegetable gardens.

Positive Environmental Impacts: This activity will enhance the value of highly perishable agricultural produce (fruit and vegetables). Organic wastes will be recycled to produce compost, or feed for small livestock. Wastewater will be recycled to produce plants.

Adverse Environmental Impacts: Monitoring will be related to the work methods and techniques for processing produce in workshops. These methods must protect the health of participants and consumers. They must also prevent pollution.

D) Measures to Mitigate and Monitor Adverse Environmental Impacts

For vegetable gardens, the use of unsuitable soil, poor-quality organic fertilizers, and dirty irrigation water must be monitored. Training for participants includes sessions covering these issues. Participants can then control these issues themselves. The various themes that will be discussed include soil selection criteria for vegetable production in the ground and in containers, production of contaminant-free compost and manure, and the selection of water to irrigate vegetables safely. In the latter case, wastewater recycling and rainwater harvesting will be discussed to avoid any misuse. Prerequisites are defined for setting up vegetable gardens and will be checked with all participants for the particular space they plan to cultivate. Staff will visit and accept sites before providing equipment to begin setting up the garden. Prerequisites defined include prior land use (for in-ground production), soil source for container gardens, and water source and availability. Hands-on training in composting will enable participants to gain an understanding of how to produce compost. Furthermore, for this activity, participants will sort household wastes at home and thus bring the waste needed to practise composting. These measures are already being practised through the Pilot Urban Gardening Initiative.

For small-scale livestock breeding units, breeding units must be well run and monitored to ensure that diseases and parasites do not spread and negatively affect human health. Monitoring will also help to ensure the proper management of wastes produced by these units and the sound management of fodder crops. Participants will be trained to manage the breeding units they have chosen to start up, and to produce and use fodder crops. Planned prerequisites for developing a breeding unit include access to water (availability, source) and availability of space. The size of herds, flocks or colonies will be based on the breeding guidelines of the selected species and on the producer's means (space, access to water, access to feed, availability of labour). The design of the breeding units will take into account the management of the wastes produced. Droppings will be collected and transformed into manure, or incorporated in the production of compost. There will not be much slaughterhouse waste, considering Haitian patterns of food preparation and consumption (e.g. internal organs are eaten, as is skin, after singeing and scraping off hair). Blood may be collected in the case where many animals are slaughtered and then used for food (such as blood pudding) or to prepare dried blood. Where available, some slaughterhouse wastes (such as rabbit or guinea pig skins) may be used in other production chains, if the producer does not scrape them for food. Poultry feathers may be used in making crafts. Diseases and parasites will be controlled by training participants to manage the breeding of selected types of livestock (through veterinary care

and hygienic slaughter methods). They will also be controlled through access to health prevention and veterinary treatment services. This will be done in collaboration with the Animal Production Services of the Ministry of Agriculture and Natural Resources, and other agencies working in this field, such as VETERIMED, a non-governmental organization, or the Inter-American Institute for Cooperation on Agriculture (IICA).

For fruit-tree seedling and ornamental plant nurseries, and for the planting of trees, the same measures will be applied as for vegetable gardens.

For household waste composting, monitoring of the composting process must ensure that the resulting product is contaminant-free and prevent environmental nuisances when neighbourhood composting units are installed. The composting training developed in the Pilot Urban Gardening Initiative focuses on the importance of sorting household wastes and proposes practices in this regard. This will continue in the Urban Agriculture Initiative. Production methods will be discussed with participants. For neighbourhood composting, which involves production on a larger scale, the local organizations will have access to coaching in setting up small production units. This coaching will consider the selection of the composting site and production methods. In this regard, a consultant's services will be needed to evaluate production sites proposed by local organizations. The Pilot Urban Gardening Initiative has already referred to the services of a sanitary engineering consultant to study the feasibility of this activity for four local organizations. The Urban Agriculture Initiative will follow the same approach. Compost produced will be quality-controlled on a regular basis. Laboratory analyses will track and quantify the presence of contaminants. The Urban Gardening Initiative has already used the services of the Centre de Recherche Industrielle du Québec (CRIQ) [Quebec industrial research centre] for this purpose. The Urban Agriculture Initiative will do likewise, until Haitian laboratories are set up for this type of analysis. The Faculty of Agronomy and Veterinary Medicine (FAMV) and the Faculty of Sciences are working on this. The FAMV of Université Quisqueya (UNIQ), and the Agricultural Research and Documentation Centre (CRDA), are expected to provide support in carrying out applied research in compost production.

For small recycled-craft workshops, the adverse environmental impacts to be monitored are related to the work methods and techniques for producing craft items in small workshops. These methods must protect the health of participants and avoid pollution. Attention will focus primarily on the protective equipment needed to work safely in a healthy, well-aired environment. The choice of production techniques will also be based on work already done by the National Office for Handicrafts (ONART).

For workshops processing agricultural produce, monitoring will relate to the work methods and techniques for processing produce in workshops. These methods must protect the health of participants and consumers. They must also prevent pollution. Participants will be trained in environmentally friendly processing techniques and practices, hygiene in preparing produce, and the nutritional value of produce used. Attention will focus on equipping workshops to ensure product health and quality. Contacts will be made with local organizations that have developed several traditional fruit and vegetable processing techniques in Haiti. They include the Congrégation des Petits Frères et Soeurs de Sainte-Thérèse, the Ferme des Rochelois and the Papaya Centre in the Central Plateau.

In Port-au-Prince, the key environmental risks associated with natural disasters that may influence the Urban Agriculture Initiative's activities are surface run-off and landslides in periods of heavy rain and hurricanes. However, when

hurricane Georges struck, minimal damage was reported to the Urban Gardening Initiative's activities. In Gonaïves, flooding is mostly of concern during rainy, stormy, or hurricane seasons. Participants in the Urban Gardening Initiative in these areas got around this problem by developing their gardens mainly on piles and hard roofs. Apart from the initiative discussed here, drainage works in some neighbourhoods have diminished the effect of this problem.

E) Conclusion

After reviewing the proposed activities, staff are convinced that the implementation of this initiative would have no adverse effects on the biophysical and human environment in the areas of intervention. On the contrary, the initiative was designed with the participation of slum community representatives to gain a good understanding of how to improve the living conditions of families in these slums. Environmental management of Haiti's urban areas is not simply an objective of the Urban Agriculture Initiative. It is also a basic guideline in planning the initiative. Controlling and monitoring environmental effects, as well as the effectiveness of the Urban Agriculture Initiative's mitigation measures, will form an integral part of the system for monitoring and evaluating the activities to be promoted. The initiative's progress and evaluation reports will systematically discuss these elements.

References

Association nationale des agro-professionels haïtiens (ANDAH). (2003). *La dégradation de l'environnement haïtien.* Port-au-Prince: ANDAH.

United Nations Development Programme (UNDP). (1997). *Profil environnemental de la région métropolitaine de Port-au-Prince.* Port-au-Prince: UNDP/Haïti.

1.2 Afghan Women's Community Support

Brief Summary of the Initiative

The Afghan Women's Community Support initiative will promote employment opportunities for low-income families and enhance the status of women as wage earners and decision-makers in their communities. Through training in income generation and managerial training provided to women, the Afghan Women's Community Support initiative will empower an entire community of women. It will enable them to continue their education and raise their standard of living, while providing care, therapy, and an education for their children.

Analysis of Environmental Implications

The Afghan Women's Community Support initiative is not an undertaking in relation to a physical work as defined by the *Canadian Environmental Assessment Act* (CEAA), nor is there any infrastructure development. Further, this initiative is not subject to any local environmental legislation. The initiative is comprised of training and education for Afghan women, and is not expected to have any negative impact on the environment. In fact, the initiative will have some environmental benefits.

The initiative will be implemented with caution and will take into account the environmental status of the area. The setting will be the capital city of Kabul, Afghanistan and the surrounding suburbs. The combined effects of years of war and drought have degraded the natural landscape as well as the infrastructure.

The Afghan Women's Community Support initiative includes a basic education component for participating Afghan women and their children. This educational component will include training in

environmental issues. Participating women and their families will discuss the role they can play in the protection of the environment and the sustainable use of resources, as well as practical ways in which they can assist in the rehabilitation of the environment. This activity will help build an enhanced understanding of, and respect for, the environment by the actors involved and their families.

This initiative will also include capacity building of the Afghanistan Women Council (AWC) staff in incorporating environmental issues into their organizational and management strategies. Finally, as a result of this initiative and the educational focus on the environment, the AWC will be better able to exchange this information with the many thousands of Afghan women involved in their activities in both Afghanistan and Pakistan.

1.3 Environmental Assessment Under the CEAA: Irrigation in San José de Ocoa, Dominican Republic

A) Overall Description of the Initiative

To identify the community's needs and priorities, consultation meetings were held with its members, and home visits and surveys were conducted. Potable water was declared a basic need. With this need established and agreed upon, the ADESJO (Association for the Development of San José de Ocoa) further studied the possible implementation of a water supply infrastructure, education programs on water use and management, programs to protect and reforest the water source area, and personal hygiene programs. Further consultation took place with groups of farmers, women, and cultural clubs from communities connected with the initiative, especially El Tatón, where the proposed source of water is located, and El Naranjal, the initiative's community. It was determined that the water users will contribute their labour and a fee, to be used to build the aqueduct. The fee was established according to each family's ability to pay. A small monthly fee was also agreed upon for system maintenance.

Site visits (including water flow measurements, water quality analysis, and a topographical study) were made to choose the most suitable location for building the proposed aqueduct. The site chosen is considered the best in the area because it will not dry up, even during the dry season, and will thus guarantee a constant flow of water. Social and environmental criteria were also used. Construction of the aqueduct will take eight months. Two additional months are necessary for testing. The initiative will include an intake facility, a sediment tank, four flow control structures, a reservoir tank, and distribution lines and outlets (see Figures 1, 2 and 3). The results of the topographical study were used to determine the proper size of pipes, the best route for laying pipes, keeping in mind the use of gravity, and so on. Other planned activities include the construction of the aqueduct and its associated structures, pursuit of the community's involvement, discussion and agreement on the use of water (i.e. the water is not to be used for washing coffee beans or for irrigation purposes), workshops on the importance of purifying water before drinking it, training activities on system maintenance and monitoring, meetings and workshops to inform the community about relevant environmental legislation and to discuss environmentally friendly practices.

B) Description of the Site

The initiative's site is in El Naranjal, in the municipality of San José de Ocoa. El Naranjal is a large community of 300 families. It is located in the Ocoa River basin in the northern region of the municipality of San José de Ocoa, 500 to 600 metres above sea level. The terrain is uneven and located high in the mountains, and the vegetation consists

of pine, cedar, mahogany and fruit trees, including mango, orange, and banana. Coffee is also grown here. Parts of the area serve as pastureland for cattle and other animals. Temperatures range between 20 and 23 degrees Celsius. There are a few streams in the area, and a segment of the population uses them as a source of water for irrigation.

Figure 1: Schematic drawing of the El Naranjal aqueduct

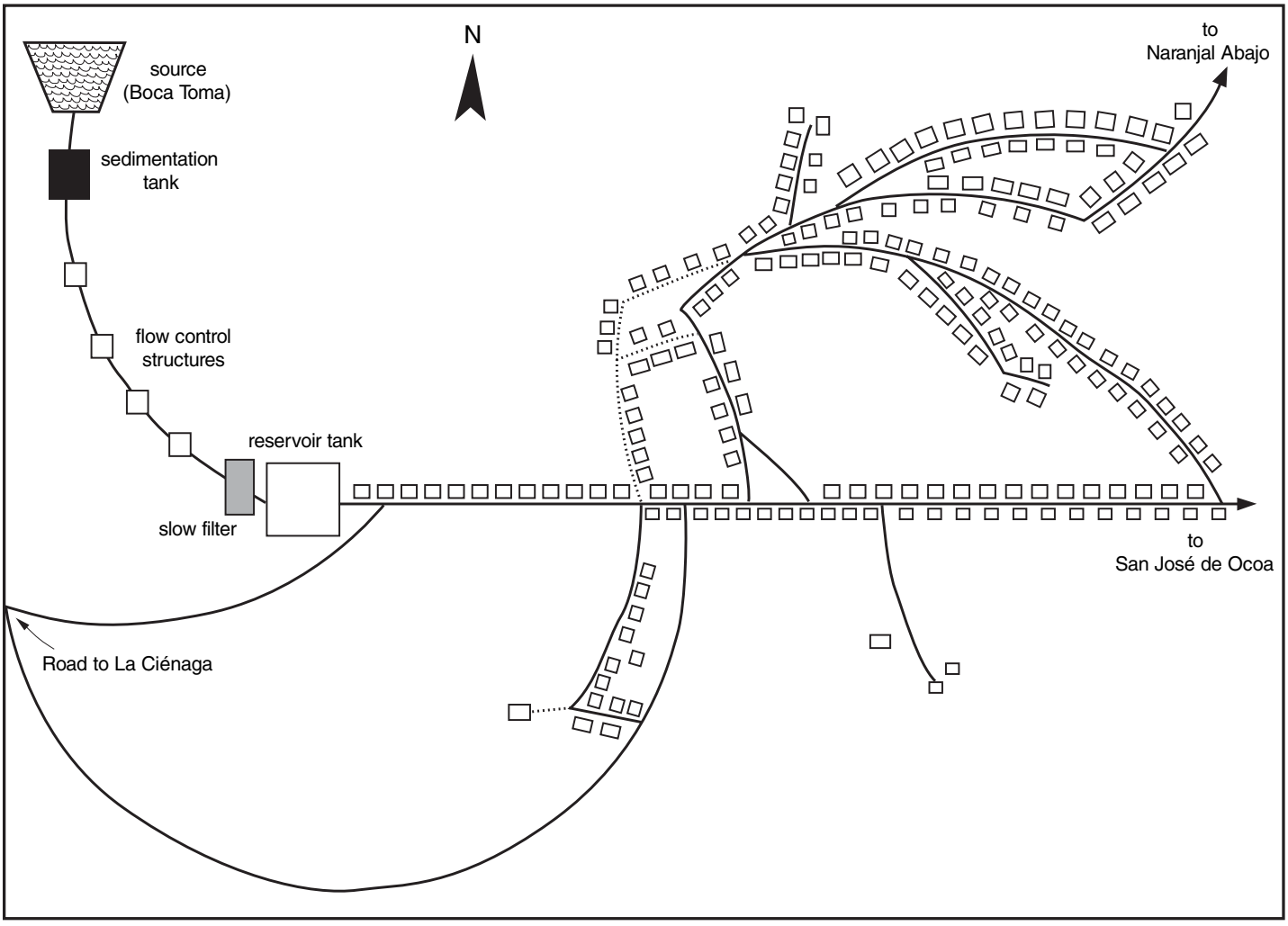
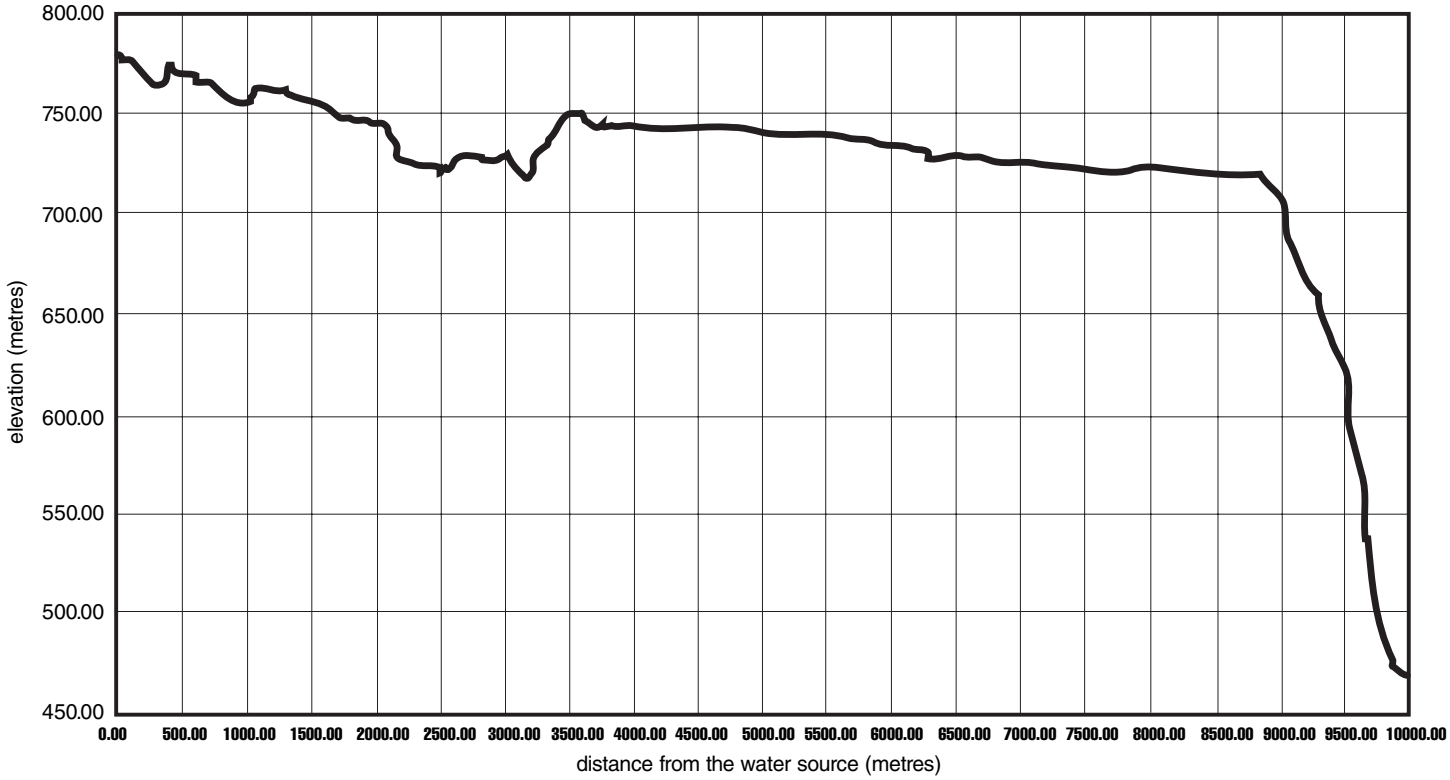


Figure 2: Topographic profile for the conception of the water distribution system



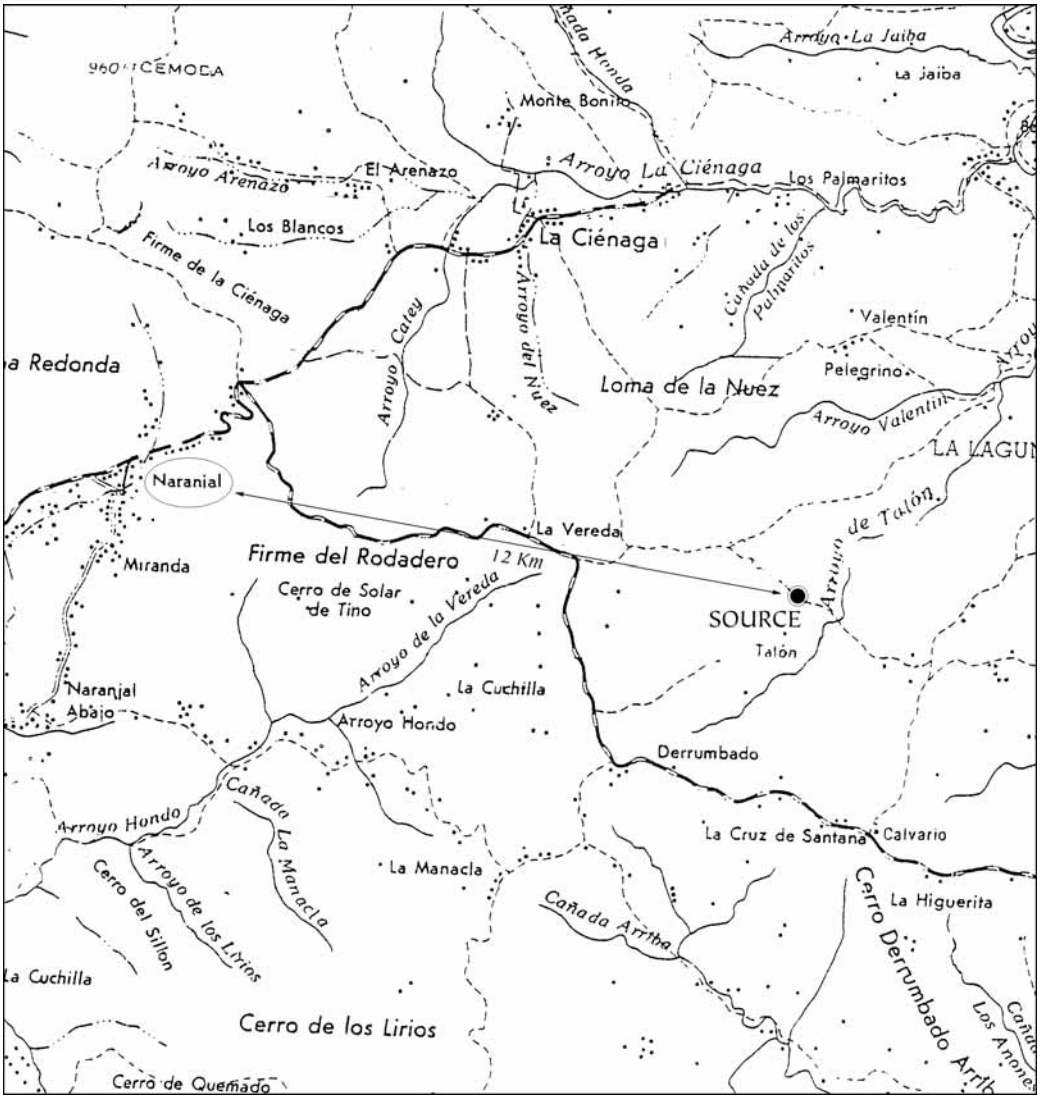
C) Environmental Legislation

The initiative is subject to the laws of the National Institute of Potable Water (INAPA), the National Institute of Hydraulic Resources (INDRHI) and the National Forests Division. Representatives from these departments were consulted and visited the site, working with ADESJO personnel and sharing their expertise, where necessary. No local environmental assessment legislation applies to this initiative. Please note that this initiative constitutes a physical work "project" as defined by the *Canadian Environmental Assessment Act* (CEAA).

D) Methodology

Consultations were undertaken with the community, and the information to produce this report was obtained through a combination of literature review, interviews, and meetings. Representatives from relevant governmental departments were also consulted. The methodology for the analysis of environmental effects and the determination of their significance was based on a global appreciation of the effects' intensity, geographical scope, and duration.

Figure 3: Map of the El Naranjal region



E) Environmental Effects and Their Significance

The initiative's effects on the environment and their significance are outlined below.

- Excavation of the aqueduct site and ditches will involve cutting some trees. This adverse effect is considered to be minor because it will be felt on a small scale and attention will be given to avoiding soil degradation (by reducing the time where excavated soil is left vulnerable to erosion, by avoiding soil movements in especially dry or rainy weather, and by planting native plant species in denuded areas close to the aqueduct and ditches).
- Minor damages to vegetation and soil where tanks are going to be built.
- Seventy percent of the water source will be diverted into the aqueduct and thus could lessen the amount of water available for people and

animals further downstream. This adverse effect is considered minor to medium because water flow will be closely monitored and water withdrawals will be adjusted according to the results of this monitoring. Moreover, consultations with the different users will take place to avoid conflict on the matter and to propose action strategies for the different users, in different locations. Such consultations can also help avoid the negative cumulative effects of multiple water withdrawals. Furthermore, the information obtained indicates that no new water supply infrastructure is planned in the near or medium future for this same water source.

- Waste products from the construction process, such as cement and piping could affect water quality. This adverse effect is considered to be minor, since close monitoring of the wastes will be ensured.
- The risk of negative effects associated with malfunctions or accidents will be minimized by appropriate maintenance and monitoring activities.

It is anticipated that the initiative will have important positive effects on the quality of life of the communities involved.

- Potable water will be readily available, thus improving the population's quality of life, particularly for women and children, who have the task of collecting water.
- Personal hygiene and sanitation will be improved by the accessibility of water.
- The quality of water for human consumption will be improved.
- The initiative will foster an attitude of cooperation and community spirit. People will do the work side by side with their neighbours, and cooperate to maintain the system and monitor its use.
- Communities will be educated on the care of natural resources, water management, and system maintenance.
- Time and energy once required to collect water will now be used in other areas to improve the population's quality of life. Other self-development initiatives may thus be started, such as raising chickens or planting fruit trees for family use.

Regarding the effects of the environment on the initiative and their significance, the area is mountainous, and there is a threat of landslides in some locations. Also, during the hurricane season, there is a possibility of serious damage occurring in the area. As well, fires in the vicinity of the water source could lead to the destruction of the forest and the water source. During the dry season, the water supply is diminished. Binding legal arrangements will be made to guarantee the protection of the source area for the aqueduct (e.g. responsibilities associated with the monitoring of water flow and quality and with the protection of the vegetation in the area around the source). These agreements will be in accordance with the Dominican Republic's laws enforced by INDRHI.

F) Public Participation and Concerns

No public concerns were noted, other than expectations related to the benefits of the initiative. The avoidance of conflict between users and communities has been discussed and addressed by mitigation measures.

G) Mitigation Measures

- Create a forest vigilance and ecological committee to reforest the area and protect the water source. Such action will improve the retaining capacity of the watershed area. This committee will have the legal authority to prevent people from starting fires or cutting down trees. This will ensure that adverse effects on vegetation and soils are minimized and of minor significance.

- The aqueduct will divert 70 percent of the water flow, and the remaining 30 percent will provide water to people and animals downstream. The amount of water taken at the source will be carefully measured to ensure that downstream communities have a sufficient supply. Several tributaries downstream from the aqueduct add to the water supply available to the population and for farm animals. In some cases, special offshoots will be made for the sake of animals. This will ensure that risks of conflicts, negative cumulative effects, and water degradation are minimized and of minor significance.
- Ditches will be dug through farm land before crops are planted and after they are harvested.
- Containing walls will be built around the water source to prevent landslides.
- The community will be educated about the importance of trees and other natural resources, as well as how to protect them.
- A program will be established to ration water during the dry season.
- A water management committee will be established to ensure that water is used properly, such as for cooking, personal hygiene, and laundry, and not for washing coffee beans or irrigation.
- Ongoing supervision by ADESJO technicians will ensure that these measures are being applied during construction and operations.

The aim of these measures is to ensure that the initiative's adverse residual environmental effects are minor. Further, because these measures and other environmental concerns are an integral part of the initiative's design, its environmental benefits will be optimized.

H) Follow-Up / Monitoring

Ongoing monitoring and evaluation will be carried on by INDRHI, the Division of Forestry, experts from the Botanical Garden's headquarters in Santo Domingo, and ADESJO to continually ascertain the initiative's environmental effects and ensure the effectiveness of mitigation measures. INAPA is the government department in charge of the use and distribution of water for human consumption. Its regulations control the various aspects of water use and quality. This organization seeks to ensure that all households have sufficient amounts of clean water at an affordable price. ADESJO collaborates with INAPA representatives on building aqueducts and irrigation systems for communities in the Ocoa region.

I) Conclusion

In our opinion, considering the mitigation measures that will be implemented, this initiative is not likely to cause significant adverse effects on the environment. We understand that the environmental assessment report and its associated documents will be deposited in the Canadian Environmental Assessment Registry (in accordance with the CEAA).

Reference

INDRHI (Instituto Nacional de Recursos Hidráulicos) and Organización de Estados Americanos (OEA). (1994). *Plan Nacional de Ordenamiento de los Recursos Hidráulicos. Diagnóstico. Documento Preliminar.* Santo Domingo: INDRHI and OEA.

1.4 Environmental Assessment Under the CEAA: Small-Scale Community and/or School (or Housing) Construction

A) Description of the Initiative

The initiative involves expanding a school by adding seven classrooms (each measuring 80.75 m^2 for a total of 565.25 m^2), and by building three additional double-compartment ventilated improved pit latrines (VIP latrines) to serve the additional clientele of this school in the town of San, Mali. The classrooms will be ventilated and lighted, with concrete walls and a galvanized sheet-metal roof. The drawing on the following page presents the school expansion plan, including existing structures (seven classrooms, three offices, three latrines and one well). The VIP latrines will be located 100 m from the classrooms, so that southwesterly winds do not blow odours toward the school. This initiative meets a need expressed by the community: several parents wish to enrol their children at this school, which is recognized for providing quality education, organizing extracurricular activities (especially environmental activities), and promoting education for girls. (More than 3,000 school-aged children do not have access to schooling.) This initiative will allow about 200 more pupils to attend school.

B) Environmental Legislation

To establish a school in Mali, a land petition must be submitted to the City Hall Housing Service. After conducting a topographic survey, the housing service will allocate the land as it did for this school. The builder must meet the technical standards defined by Malian construction regulations to promote child safety. The Ministry of Education has approved the initiative. No local environmental legislation (including local environmental assessment legislation) applies to the expansion of this school. This initiative constitutes a physical work "project" as defined by the *Canadian Environmental Assessment Act* (CEAA).

C) Description of Environment

San is a town of 30,000 inhabitants, which covers more than 4 km^2, and is devoted mainly to agriculture and animal husbandry. The rainy season extends from June to November; the dry season, from February to June.

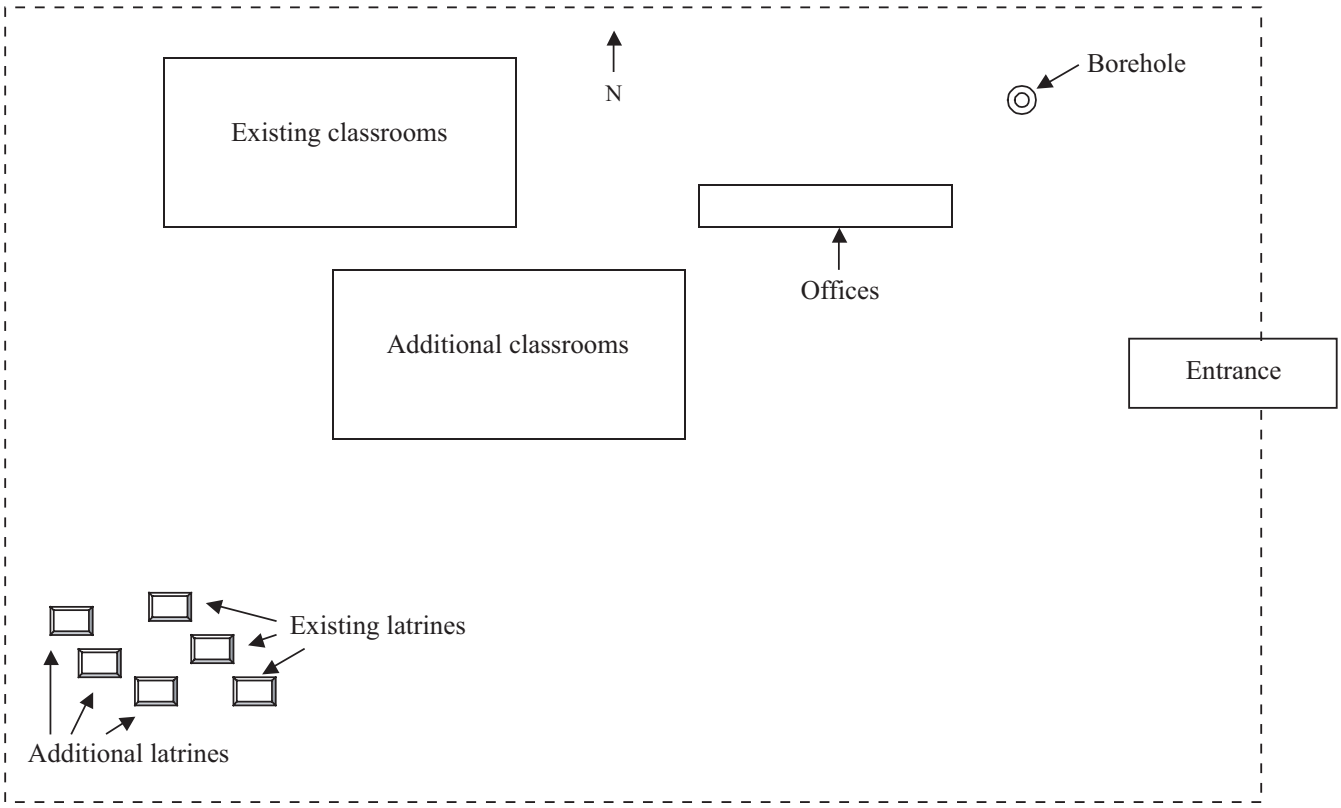
The school is located on a two-hectare property allocated to the Education Plus Committee by the City Hall Housing Service. It is surrounded by a cement-block wall for child safety. The land is broad and flat, with some trees. The site is suitable for a school, given its extensive area and its urban setting. The site is somewhat isolated, since a dirt road separates it from the town. However, it is close enough to housing (about 500 m from the school property) to allow safe, easy access for local children. No waterway or body of water is located on or near the school site. A well with a pump is located 200 m from the classrooms.

D) Methodology

The region's environmental issues, the initiative's environmental considerations and environmental assessments were discussed with the local partner and community members. The local partner was sent questionnaires based on Checklist No. 2 of the *Handbook on Environmental Assessment of Non-Governmental Organizations and Institutions Programs and Projects* to collect information to include in this environmental assessment. To complete the questionnaires, the local partner (the Education Plus Committee) consulted City Hall, the housing service, the parents' association, pupils, the prime contractor, public authorities, and teaching staff. Site visits also promote good knowledge of the environment. The analysis of effects and the determination of their significance was done following the methodology proposed in

Drawing of the school expansion (including existing structures)

Please note that this sketch is not to scale but tries to respect proportions.
Please consult the text for information about the distances between structures.



the *Handbook on Environmental Assessment of Non-Governmental Organizations and Institutions Programs and Projects*. The environmental assessment was finalized by the Canadian partner organization.

E) Analysis of Environmental Effects and Determination of Their Significance

Potential environmental effects of the initiative include the following.

- This is not a site of special environmental, historic or archaeological value. Moreover, the site will maintain the same function, that is, as a school.
- There are no problems of compatibility with the use of adjoining land (i.e. urban area, no industrial development, no dumps).
- Vendors bring in construction materials (cement, iron, sheet metal) on existing roads. The effect of the transportation of these materials is considered to be minor, given its sporadic nature. Furthermore, the quantities involved are small. Sand and gravel are found locally (desert area). The effect of extracting such materials locally is deemed to be minor, given the small quantities involved in comparison with what is available. Cumulative effects are not anticipated.

- Construction waste will be minimal. Re-usable material will be transferred to the partner for redistribution. Other waste will be removed via the collection system. Hence, the negative effects associated with the production of construction waste will be minor.
- There are no plans to cut or damage vegetation. Construction will have a minor impact on soil, since the contractor will promote sandy soil conservation practices. (i.e. Soil will be left bare as briefly as possible to avoid rainfall erosion. Soil piles will be small and low-gradient. No heavy equipment will be used. Accumulated surface soil will be spread in locations designated for planting trees.) The digging of the pit for the latrines will include a soil support structure to avoid the risk of collapse.
- Accident hazards, and risks to the health of the community and construction workers, are considered to be minor, since supervision will be provided, construction will be done during the holiday period (July, August, and September), and the site is already enclosed.
- Expanding the school could lead to heavier traffic in the area. However, the Education Plus Committee and the parents' associations consulted deem that the adverse effects of heavier traffic (noise, gatherings of people, motor vehicle traffic, etc.) will be negligible, since the site covers a very large area (two hectares). Cumulative effects are not anticipated.
- According to the information provided by school staff and a government hydraulic engineer, there are no problems related to the quantity or quality of well water. No depletion, water pollution, or conflict caused by an increase in users is anticipated. Adverse cumulative effects due to multiple extractions from the same water source are not anticipated. Water consumption will increase by about 1,500 litres per school day (from the current level of about 4,000 litres per school day). Thus, the adverse effects of this initiative on water quantity and quality are deemed to be minor. Further, mitigation measures are planned in relation to the use and maintenance of the latrines.
- VIP latrines will be located 200 m or more from the existing well to reduce the risk of contaminating this water source. Moreover, the water table will be much deeper than the pits. The latrines will be built on slightly higher ground. Nuisances related to odours and insects will be mitigated by the positioning of the latrines. Vertical vent pipes will extend about 0.5 m above the roofs. The pipes will have screens over their upper ends and will be positioned according to the prevailing wind direction. Because of the latrines' design, the potential adverse effects of water and soil pollution, as well as nuisances, will be minor. Further, mitigation measures are planned in relation to the use and maintenance of the latrines to avoid risks related to accidents or malfunctions.
- Most of the waste generated by the school is biodegradable. It is deposited in special bins separating material for composting from other waste. Waste does not come in contact with groundwater or surface water, and entails no risks for pupils. The Education Plus Committee is responsible for the school's waste management, including composting. Non-composted solid waste is collected and regularly deposited in a landfill recognized by municipal authorities. It is thus deemed that waste production will have minor adverse effects. The school does not expect to handle chemical and/or toxic substances in its activities. In the event that these products are used (e.g. in laboratory activities), the Education Plus Committee and the teachers concerned have said that they are prepared to set standards to ensure safe storage, use, treatment, and disposal.
- The initiative will tend to have important positive effects on the human environment (by improving teaching services, schooling, and their short-, medium- and long-term beneficial

effects), as well as on the biophysical environment (tree planting, environmental education, extracurricular environmental activities).

No potential environmental effects on the initiative are anticipated. According to climatic data and the City Hall Housing Service, no natural disasters are likely to affect this site. Further, no drainage or soil stability problem was identified for this site in the topographic survey conducted by the City Hall Housing Service.

F) Public Participation and Concerns

Parents' associations were consulted at a meeting. They did not raise any concerns about the initiative, other than the desire to meet the demand for school enrolment.

G) Mitigation Measures

Classrooms and latrines will be built by a government-approved construction company. The construction company will ensure compliance with Malian construction standards. It will work with local workers experienced in school and community construction. During construction, a technician will ensure that walls are strong, work is done according to standards, workers are safe, and soil is protected. The Education Plus Committee will also monitor construction.

Reforestation around the buildings is included in the school program to provide shade and protect soil. The species planted will be native to the area and thus suited to environmental conditions. They will be planted at the start of the rainy season. Any necessary maintenance will be provided by both teachers and pupils, to give pupils a sense of the importance of plants in their environment. To avoid soil erosion through rainfall run-off, rainwater will be collected in containers placed around the school during the rainy season. If necessary, the water thus collected may be used to water the trees planted. Pupils will be made aware that they must not use this water for drinking or discard anything in the containers.

Latrine maintenance: The Education Plus Committee informs us that designated members of the school staff will clean the insides of the latrines daily with material used specifically for this purpose. The vent pipes and their screens will be maintained weekly to ensure that they are not blocked or damaged. When filled to 1 m from the top of the pit, the latrines will be left fallow or abandoned after the pits are covered with soil. The Education Plus Committee indicated possible interest in activities to reclaim the content of the filled pits.

Waste management: Composting is a recent extra-curricular activity related to the greening of the school property. Activities are underway to promote the use of compost for rural and/or community agriculture. Teachers also devote special attention to environmental education and extra-curricular environmental activities. The following main themes are emphasized: health, sanitation, the re-use of paper and plastic bags, and water conservation.

Thus, the initiative's residual adverse effects will be minor and the environmental benefits will be enhanced.

H) Environmental Follow-Up / Monitoring

Construction is monitored by a technician. The Education Plus Committee is involved in the building construction and operation phases. This committee will monitor potential adverse environmental effects and ensure that the planned mitigation measures are implemented and successful. Environmental considerations will be given special attention in the reports submitted by the local partner. In future missions, representatives of the Canadian partner organization will ensure that

the monitoring of environmental issues is appropriately performed.

I) Conclusion of Environmental Assessment

In the opinion of the Canadian organization and the local partner, the San school expansion initiative is unlikely to cause significant adverse environmental effects. We understand that the environmental assessment report and its associated documents will be deposited in the Canadian Environmental Assessment Registry (in accordance with the CEAA).

Reference

Canadian International Development Agency (CIDA). (1997). *Handbook on Environmental Assessment of Non-governmental Organizations and Institutions Programs and Projects.* Hull: CIDA.

2. Participatory Appraisal Techniques

2.1 Introduction

The term "participatory appraisal" covers a number of approaches and techniques that have the common purpose of defining, sharing, and analysing citizens' knowledge, concerns, and perceptions. Voluntary sector organizations and their local partners often use these techniques in planning initiatives. The techniques can also be used in conducting an environmental assessment with local partners (see the table on the following page for further details). Participatory appraisals should involve various members of the community to ensure the representation of all social groups. Such an approach recognizes the major importance of local community members' support and involvement. In fact, the appraisals are not an end in themselves. They can introduce and strengthen dialogue, feedback, transparency, and partnerships, as well as build the capacities of community members to plan, implement, monitor, and evaluate activities.

A summary of participatory appraisal techniques is presented below and followed by a series of tool sheets that provide greater detail on specific techniques. The tool sheets are taken from: Boyle, J. and Patterson, H. (Agrodev Canada Inc.). (June 2002). *Environmental Sourcebook for Small-Scale Community Development Projects.* Working Draft Prepared for CIDA, CIDA Internal Document. The tools are provided as examples and, for the purposes of implementation, should be adapted to local needs, ideas, resources, and context, including appropriate national policies, where relevant (e.g. through the Local Agenda 21 that stems from the 1992 United Nations Conference on Environment and Development – Rio Earth Summit). Facilitators may choose to combine techniques and make any relevant modifications. Participatory appraisal techniques include the following.

- The use of secondary sources of information (e.g. documents, aerial photographs, maps) during meetings and discussions to describe major environmental issues, as well as current components of the environment, such as soil use, types of soil, types of vegetation, and so on.
- Various types of meetings, inquiries, and semi-structured discussions with individuals, selected experts, interest groups, special groups (e.g. seniors, women, youth, indigenous) and/or the population to determine socio-economic activities, characteristics of the human and biophysical environment, state of the environment, concerns, an initiative's possible

environmental effects, mitigation measures, environmental follow-up program, and so on.

- Participatory mapping (i.e. schematic drawing of the biophysical environment and its characteristics, population density, natural resources, land use, ecosystems, landmarks, service institutions, environmental issues or hazards, environmental follow-up items) to better understand the environmental setting, choose the location for a structure, and so on (see community mapping tool sheet).
- Field visits in the form of transects (i.e. lines of predetermined length, based on a predetermined grid of the territory to be described, where matters are discussed and elements are mapped) to scope environmental issues and to survey the types of environments, vegetation, land-use management, problems, human settlements, changes to the environment, and so on (see transect walk tool sheet).
- Participatory ethno-biographies and other exercises with a historical stance (i.e. people recount historical changes affecting, for example, land use, resource availability, the village's development, precipitation and the seasons, special events, economic activities, social and environmental issues, previous development initiatives, and so on) to highlight environmental issues, possible sources of conflict, their causes, and possible solutions; analyse the actual environmental setting; better comprehend possible environmental effects; select appropriate and contextually relevant mitigation measures; and identify areas for future improvement (see historical time line tool sheet and present and future tool sheet).
- Various participatory analyses and charting exercises dealing with needs, priorities, solutions, ways of life, and environmental perceptions (e.g. satisfaction with regard to the environment, areas for improvement, concerns about an initiative's environmental effects, links between development activities and the state of the environment, trends in the quality and quantity of different resources, cause-effect relationships, mitigation measures, their follow-up, and so on) (see the following tool sheets: action planning, gender division of labour, level of satisfaction matrix, ranking matrix and stakeholder analysis diagram).
- Simulation exercises and case studies with members of the community to visually explain an initiative, its components, and effects; detect possible sources of conflict or controversy; help understand a problem; examine sites, alternatives, and solutions; and assess the advantages and disadvantages of carrying out the initiative, and so on.

Participatory Techniques	Environmental Assessment						Initiative Stages					
		Scoping of issues	Determining methods	Gathering and analysing information	Determining mitigation measures	Developing a follow-up and monitoring plan		Concept	Preliminary Design	Detailed design	Implementation	Monitoring and evaluation
Community mapping		X		X				X				X
Transect walk		X		X				X				X
Historical time line		X		X				X			X	X
Present and future		X		X	X			X	X			X
Action planning			X	X	X	X				X	X	X
Gender division of labour		X		X					X			X
Level of satisfaction matrix		X	X	X					X			X
Ranking matrix			X		X				X	X		X
Stakeholder analysis diagram								X				

TOOL SHEET: COMMUNITY MAPPING

What is it?

Community mapping involves community members in drawing maps of their community resources, land use, structures, institutions, and associations.

Why do it?

Mapping can provide insight into the use of land and other resources, as well as identify important landmarks, different socio-economic groupings, access to resources, relationships and interactions within a community, and so on.

The issues raised in discussions during the mapping can provide important input into the planning of an initiative.

In the monitoring and evaluation of activities, maps drawn midway through or at the end of the initiative can be compared with the community maps from the planning phase to evaluate how the initiative has affected the community.

Who does it?

Community maps should be made by various members of the community in order for different perspectives and issues to be captured. Women, men, and children may identify different land use and resource issues. Also, people from different social status and background may have differing perspectives, ideas, and issues.

An advantage of mapping is that literacy is not required in drawing a map. Symbols and simple drawings will do.

How do you do it?

Identify people who have an interest in or may be affected by the initiative (e.g. women from a certain neighbourhood, shopkeepers in the area, farmers from the same community, and children who play in the proposed area). Ask them if you can meet with them to obtain their input into the planning of the initiative. Using markers or pens and paper, chalk or a stick on the ground, ask them to draw a map of their community. Mapping can be done as a group or individually — whatever is more appropriate.

If they are drawing a group map, ensure that the marker/stick is circulated so that everyone has a chance to add their perspective. The point is to avoid the mapping being dominated by only one person or just a few individuals.

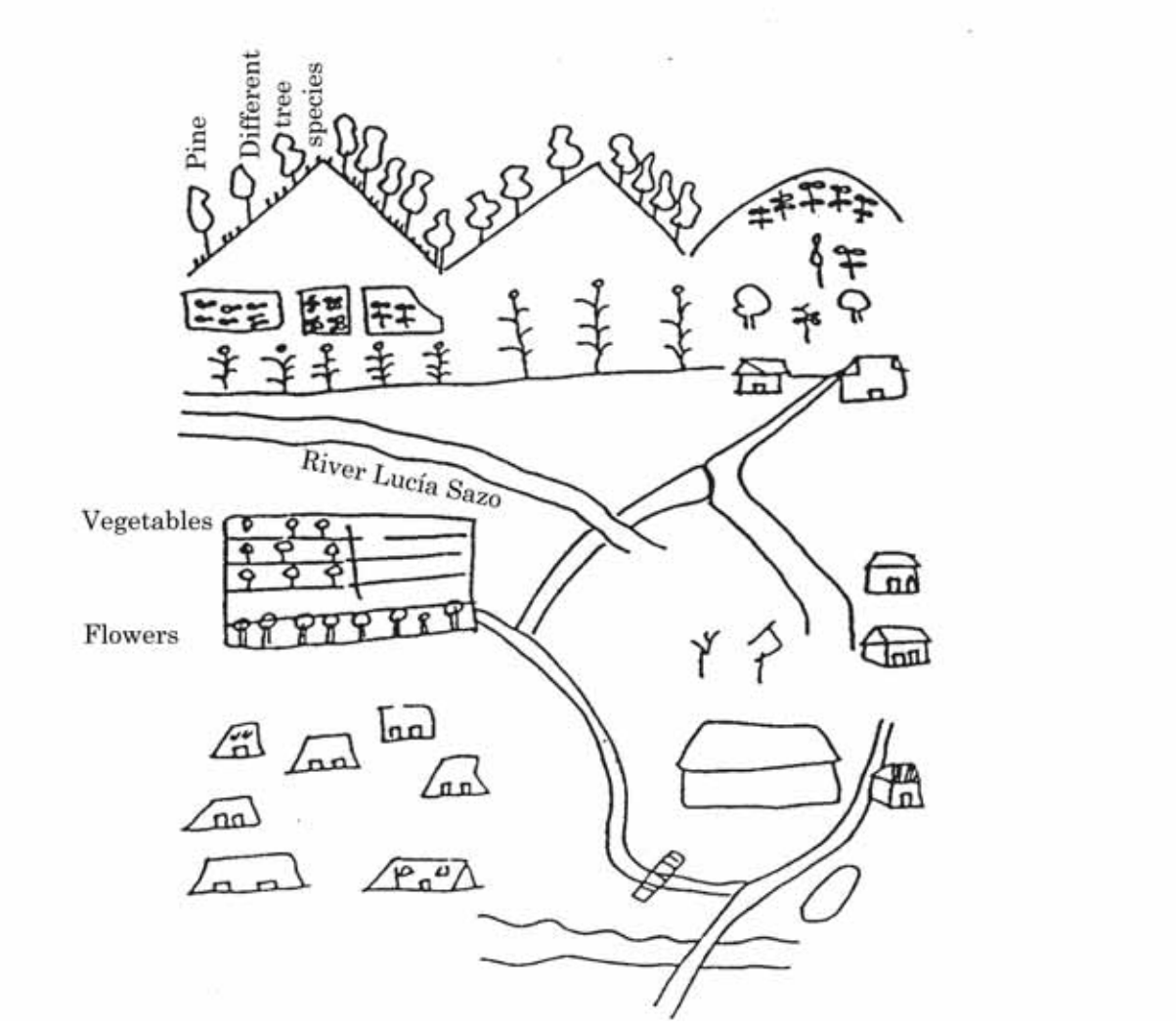
The idea is not to draw a perfect cartographer's map, but to use the map-drawing exercise as a chance to gain further understanding of the community and the context of the initiative.

The discussion part of the mapping is very important. After the map has been drawn, you can start asking questions relevant to the initiative, such as the following: "The community wants to build a well/school/clinic. Where would you put it on your map and why?" "Where is waste disposed of now? Where would the waste from the new food processing initiative be disposed of?" "You have mentioned that these roads are washed out in the rainy season. Where would you see putting a new road and why?" The discussion points can be recorded on the map or noted on a separate sheet.

Maps not drawn on paper should be copied onto paper. You should also ask the community members if they want to keep their original copy for themselves. The maps and the information from the discussion can then be used in a community meeting that brings together the findings for the next steps of planning the initiative.

Below is a map drawn by women in a village in Guatemala to identify land uses in the community for the purposes of planning a forestry initiative.

Community Map of Las Cebollas, Chiquimula
Drawn by women



Source: FAO. (1977). *Analísis de genero y desarrollo forestal. Manual de capacitación y applicación. Modulo 1.* Guatemala: FAO, p. 24-25.

TOOL SHEET: TRANSECT WALK

What is it?

The transect walk is a tool that can be used at various stages of an initiative. Community members walk through their community and the site of the initiative (or proposed site when used at the planning stage), and collect information on issues related to the community and the initiative through direct observation and discussion with others in the community.

Transects usually involve asking questions, and pointing out and mapping what is being seen: different land use and vegetation zones, local markets, community service centres, schools, and so on. A transect is usually a straight cut through the community, which aims to cover as many of the ecological, production, and social groups of the community as possible. Often, several transects are carried out to get a complete picture of a community.

Why do it?

Often planning takes place in the confines of a meeting place or room. The transect walk gives community members an opportunity, through direct observation and discussion, to take stock of the current physical, environmental, social, and economic situation in their community, as well as how a particular initiative may affect the community.

This exercise may reveal that there are differing visions in the community as to what people would like to see happen with a particular initiative. If so, it is useful to discuss what the common interests are, and how the community can achieve these through the initiative or through other means.

Issues raised in discussions during the transect walk, and when the group meets afterward to discuss their findings, can provide important input into the planning of an initiative. This information may be useful to include in the proposal/application document.

The same exercise can be carried out later on, when evaluating the activities. Community members walk through the community and the site of the initiative, observing, asking questions, and discussing how the initiative has affected the community — socially, environmentally, economically, and so on. They can then identify what helped the initiative to get where it is now, what obstacles remain, and how they are being overcome, as well as what the community still has to work on to achieve its vision.

Who does it?

A transect walk should be done by various members of the community in order for different perspectives and issues to be captured.

Women, men, and children may observe different things, identify different issues, and raise different questions about an initiative. Also, people of different social status and backgrounds may have differing perspectives, ideas, and issues.

How do you do it?

Identify the people who have an interest in or may be affected by the initiative (e.g. women from a certain neighbourhood, shopkeepers in the area, farmers from the same community, children who play in the proposed area, government officials).

Ask them if you can meet with them to obtain their input into the planning of the initiative, and to build an understanding of the benefits and problems an initiative may bring to the community. Depending on the size of the community, a mixed group of 12 to 15 people at a time works well.

Have the group brainstorm on what they might want to learn more about while on their transect walk — for example, potential environmental effects of the initiative, who might be personally affected both positively and negatively, where is the best site for the activities, and why.

The group should then be divided into smaller teams (e.g. four teams of three or four people) with as much diversity as possible on each team (e.g. a man, a woman, an elder, a youth) so that different perspectives are represented on each team.

Each team is then assigned to do their transect walk in a certain direction (e.g. north, south, east, west) so that each covers a different part of the community. Each team takes the questions from the brainstorming as their guide regarding what they are going to look out for and collect information about, through observation and talking to people along the way. The teams can take pens and paper with them in case they want to record information or make maps or drawings. Transect records can take a variety of forms, depending on the skills of the participants. For example, they may be just notes on specific locations, simple maps with notes on them, or more detailed "cross sections" with different kinds of information noted for each part of the transect (see the example on the following page). Depending on the size of the area to be covered, the teams agree to meet back at a certain time (e.g. two to three hours later).

The teams then meet as a group and share what they learned on their transect walks. This information can be mapped out on a large surface in order to get the full picture of the results of the transect walks. Some information can be grouped together if certain themes start to emerge.

The resulting information will give the community more knowledge to work with in planning the initiative. For example, it can help with choosing a site, identifying environmental concerns, raising waste disposal issues, and identifying other issues that the initiative should focus on. After discussing the results of the transect walks, the community may decide that they are ready to move on to another phase of planning. They may decide that an environmental action plan is necessary, or that they are now ready to do a "present and future" exercise to start to build a common vision for the initiative.

Example of a Transect Walk Through Mbusyani, Kenya

SOIL	LOOSE, DEEP RED SOIL	SANDY SOILS AND SMALL PATCHES OF RED SOILS	SHALLOW SANDY SOILS. ROCKY IN MOST PARTS.
WATER	ABOUT 3/4 OF HOUSEHOLDS HAVE SHALLOW WELLS, AREA ALSO HAS 5 DAMS & ONE SPRING	A RIVER INFESTED WITH BILHARZIA, 2 POORLY MAINTAINED DAMS.	WATER IN KILINDILONI RIVER SALTY. RIVER KATHANA HAS BILHARZIA, ROOF CATCHMENT IN PROGRESS.
VEGETATION	ALL NATURAL VEGETATION CLEARED TO GIVE WAY TO SETTLEMENT.	HIGH PROPORTION OF NATURAL VEGETATION, MAINLY ACACIA LANTANA, CANOLA GRASSES.	NATURAL VEGETATION CONSISTING OF ACACIA, SHRUBS AND GRASS.
SOCIAL-ECONOMIC INDICATORS	½ OF HOUSEHOLD HEADS IN WAGE EMPLOYMENT, MAJORITY HAVE MABATI ROOFS BRICK OR STONE WALLS.	½ OF HOUSEHOLD-CORRUGATED IRON ROOFS. ½ GRASS THATCHED, BRICK WALLS.	MAINLY GRASS THATCHED HOUSES.
FOOD CROPS	MAIZE, BEANS, PIGEON PEAS, BANANA'S.	MAIZE, BEANS, A LOT GORE. PIGEON MILLETS, FRUITS, BANANAS.	MAIZE, BEANS, PEAS, BANANAS, FRUITS.
CASH CROPS	COFFEE	COFFEE	COFFEE
ACHIEVEMENTS (LAST 6 YEARS)	SOIL CONSERVATION, TREE PLANTING, WATER DEVELOPMENT – WELLS, ROOF CATCHMENT.	SOIL CONSERVATION, WATER DEVELOPMENT – DAMS	SOME SOIL AND WATER CONSERVATION
FORESTRY / AGROFORESTRY	WIDESPREAD AGROFORESTRY WITH GREVILLEA, EUCALYPTUS, MANGOES, AND PAWPAWS.	MINIMAL TREE PLANTING, BUT MANGOES AND PAWPAWS PLANTED	VERY LITTLE TREE PLANTING
RESOURCES MANAGEMENT	A LOT TERRACING, EMBANKMENTS REINFORCED WITH MULTI-PURPOSE GRASSES	A LOT OF BENCH TERRACING	LIMITED SOIL CONSERVATION
PROBLEMS	INADEQUATE WATER, EDUCATION AND HEALTH FACILITIES, FAMINES AND LACK OF DIP FACILITIES	WATER, FAMINE, INADEQUATE EDUCATION AND HEALTH FACILITIES	WATER, TRANSPORT AND FOOD
OPPORTUNITIES	REHABILITATION 3 DAMS, 1 SPRING, EXTERNAL ASSISTANCE – TOOLS, MARKET	WATER DEVELOPMENT – DAM, WELL, ROOF CATCHMENT, GOVERNMENT ASSISTANCE	WATER DEVELOPMENT – DAMS, ROOF CATCHMENT, EXTERNAL ASSISTANCE.

Source: National Environment Secretariat. (1991). *Participatory Rural Appraisal Handbook: Conducting PRAs in Kenya.* National Environment Secretariat, p. 21.

TOOL SHEET: HISTORICAL TIME LINE

What is it?

A historical time line records and analyses important events that have taken place over time. It involves community members in identifying and recording significant events in the history of their community. These can be social, political, environmental — whatever may be significant to the individuals and community involved.

Why do it?

Constructing a historical time line can help establish a record of events. It gives insight into what has been important to the community, patterns in resource management, environmental changes over time, the involvement of government or other donors in the community, and so on. This can provide important background for understanding and analysing the current situation in the community.

The issues raised during the discussions when creating a historical time line can provide background and baseline information that is important for the planning of an initiative. This information, and the time line itself, can be included in the proposal/application document.

In the monitoring and evaluation of activities, community members can draw a time line of the initiative and look at what activities have taken place, when decisions were made, and what has happened in the community as a result of the various activities.

Who does it?

Historical time lines should be done by various members of the community in order for different perspectives on events and issues to be captured. Women, men, and children may identify different events as being important. Also, people of different social status and background may have other perspectives, ideas, and issues. Elders in the community can often bring an important, longer-term perspective to the environmental and social changes that have occurred.

Literacy is not a requirement to participate in a historical time line exercise. Symbols and simple drawings will do. In this case, the facilitator can write additional notes on the time line to ensure that the participants' meaning and interpretation of the symbols is accurately captured.

How do you do it?

Identify people who may have an interest in or may be affected by the initiative — for example, women from a certain neighbourhood, shopkeepers in the area, farmers from the same community, children who play in the proposed area. Ask them if you can meet with them to obtain their input into the planning of the initiative. Using markers or pens and paper, chalk or a stick on the ground, draw a line and mark the current year at one end and other marks at intervals of one or two years. Go back 20 years, or longer if desired (see the example on the following page). Ask them what events (social, political, economic, environmental, and so on) have taken place in the past that were significant to their community. When they start naming the events, ask them to mark on the time line what took place and when, in words or symbols.

Often this is done as a group so that people can build on each other's ideas. It is important that the marker/stick is circulated so that everyone has a chance to add their perspective. One single person or just a few individuals must not dominate the exercise. In some places, it may be appropriate

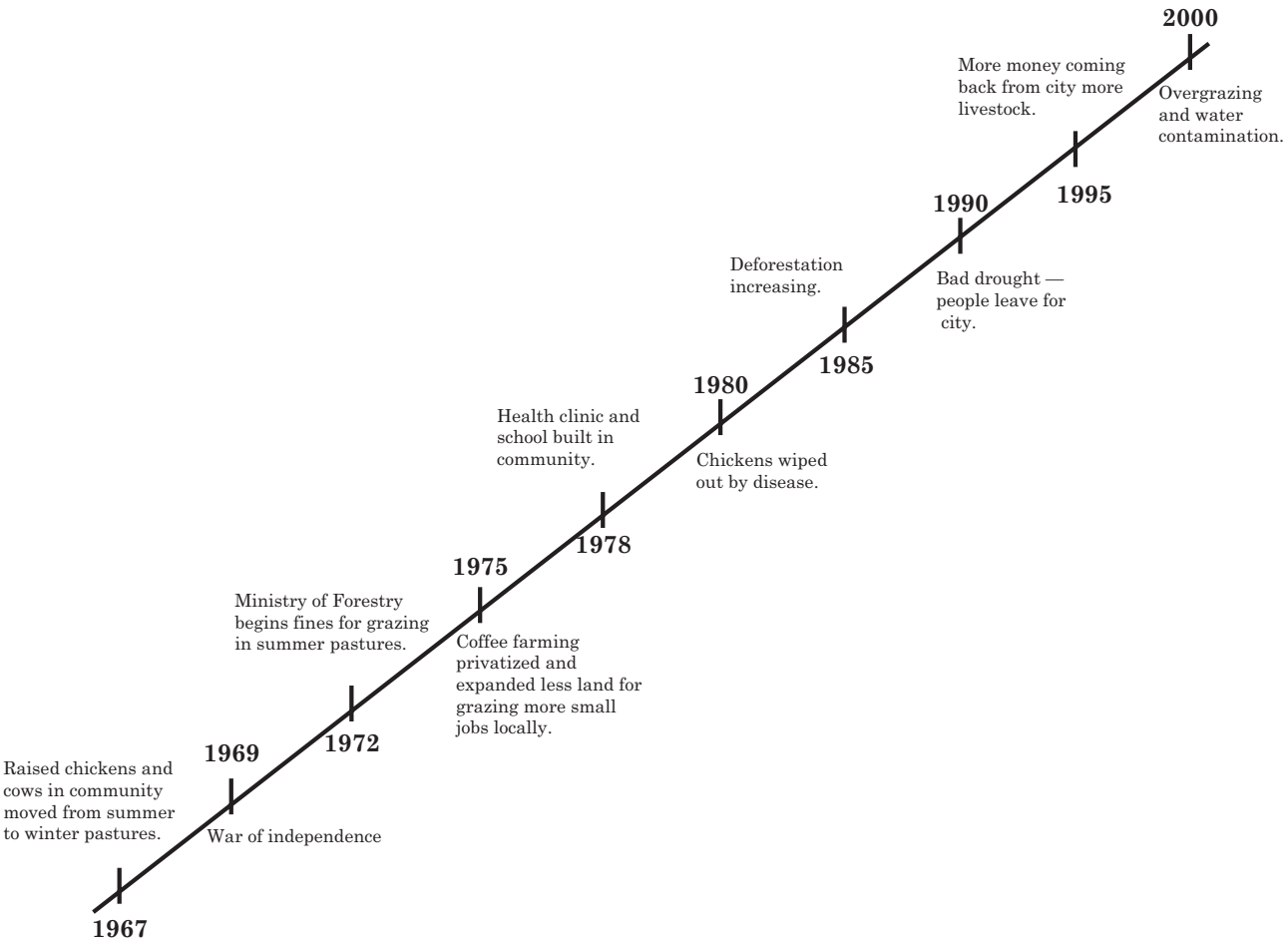
to have a group of women meet on their own to do their time line to ensure that their voices are heard.

The idea is not to develop a complete and perfect historical record. Use the time line creation exercise as an opportunity to gain further understanding of community perceptions and the context of the initiative. What is left off the time line can be an interesting comment on what the community sees as significant.

Discussions about the time line are very important. While the time line is being created, you can start asking questions relevant to the initiative, such as: "Do you see any patterns in how the community dealt with drought?" "Why was building the road such a significant event?" "When did other donors stop coming to the community and why?" The discussion points can be captured on the time line drawing or noted on a separate sheet.

Time lines that are not drawn on paper should be copied onto paper. You should also ask the community members if they want to keep their original copy for themselves. The time lines and information from the discussions can then be used in a community meeting that brings together the findings for the next steps of planning.

Example of a Historical Time Line



TOOL SHEET: PRESENT AND FUTURE

What is it?

The present and future exercise (also known as force-field analysis) involves community members in drawing what their current situation looks like and what they would like their future situation to look like, perhaps five years from now. They also identify what will help them get to their desired future situation, and what obstacles they will have to overcome.

Why do it?

The present and future exercise can help build or validate a common vision, and identify issues to be addressed as well as resources that can be drawn upon to realize that vision.

It may reveal that there are differing visions in the community in terms of what people would like to see happen with a particular initiative. It is useful to recognize these differing views, ascertain common interests, and discuss how the community can achieve these through an initiative.

The information in the drawings of the present can be used as baseline information for the initiative's proposal. The information in the drawings of the future can be used as the vision for the initiative, and help define the specific goals the initiative seeks to achieve. The information about what will help achieve the desired future, and what obstacles are to be overcome can be used in defining the initiative's strategy and activities.

Issues raised in the discussions during the exercise and when people are presenting their work can provide important input into the planning of the initiative. This information can be included in the proposal/application document, along with copies of the drawings.

The same exercise can be carried out when evaluating activities. Community members draw the situation at the beginning of the initiative and where they are at now (midway or at the end of an initiative), and identify and discuss the impact that the initiative has had on the community. They can then identify what helped the initiative to get where it is now, what some of the obstacles were and how they overcame them, and what the community still has to work on to achieve its vision.

Who does it?

The present and future exercise should be done by various members of the community in order for different perspectives and issues to be captured.

Women, men, and children may identify different issues in their current situation and their vision of the future. Also, people of different social status and background may have their own perspectives, ideas, and issues.

Literacy is not a requirement to participate in this exercise. Simple drawings and symbols can be used to illustrate the current situation and the desired future.

How do you do it?

Identify the people who have an interest in or may be affected by the initiative (e.g. women from a certain neighbourhood, shopkeepers in the area, farmers from the same community, and children who play in the proposed area).

Ask them if you can meet with them to obtain their input into the planning of the initiative. Using markers or pens and paper, chalk or a stick on the ground, ask them to draw a picture of what their community looks like now. They can work as a group or individually — whatever is most

appropriate. Ask them to think about how they would like their community to look in five years' time, or in whatever time period is appropriate. Have them draw this picture next to their picture of the present, leaving a large gap between the two pictures.

Once they are satisfied with how the future should look, ask them to start thinking about what would help them get there, what might hold them back, and what they would do about that. Ask them to note these in the gap between the two pictures.

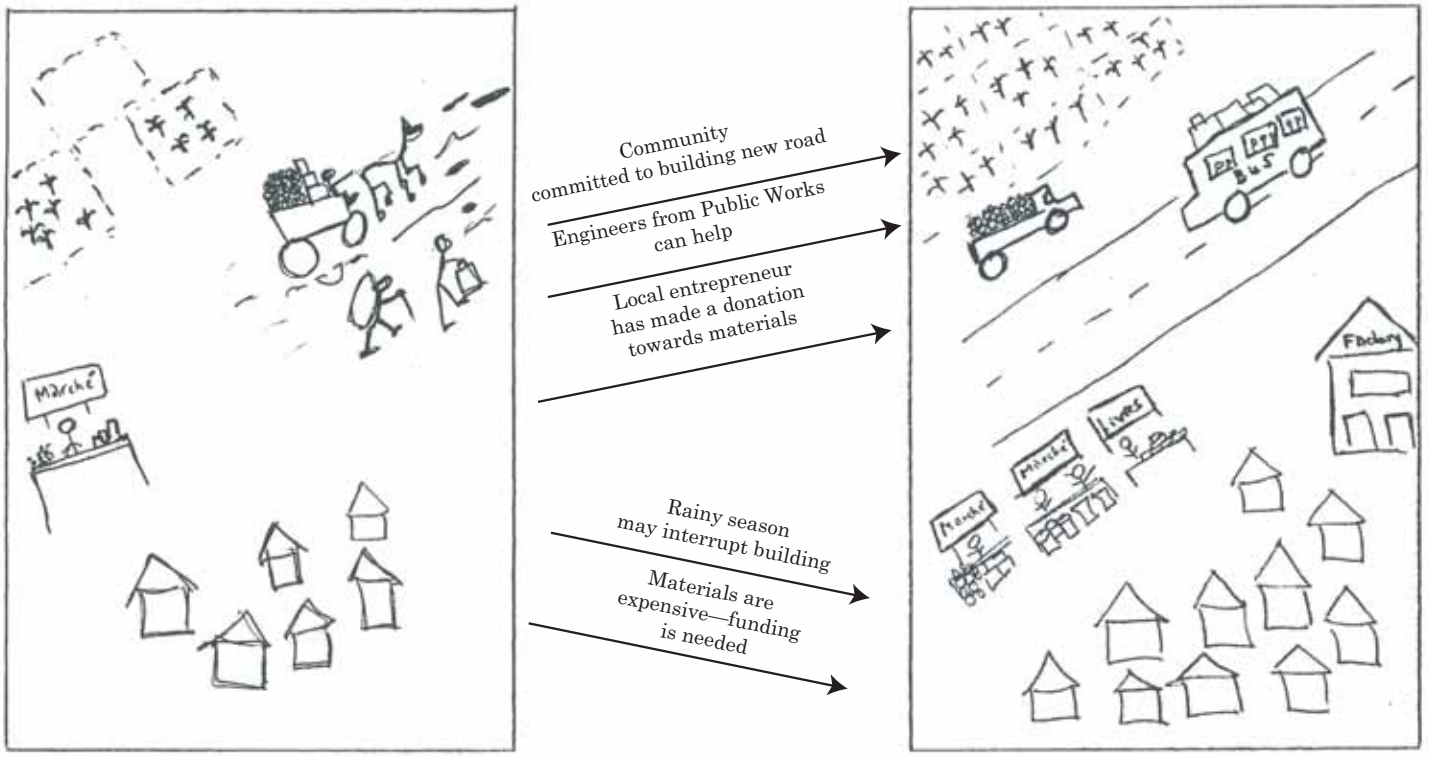
If they are drawing as a group, ensure that many markers/sticks are circulated so that everyone has a chance to add their perspective. The process should not be dominated by one person or just a few individuals.

The idea is not to draw a perfect picture, but to use the exercise as a chance to clarify and discuss the current and desired future of the community, and to talk about how to make that happen. The goal is for the group to clarify a common vision, and to begin to plan how to get from where they are to where they want to be.

The discussions that take place as the exercise is being carried out are very important. After the drawings have been made, you can start asking questions relevant to the initiative, for example: "From what you have drawn, what is the most important change you would like to see in your community and why?" "In your vision of the future, you have women raising chickens. Why did you choose that activity?" "In your vision of the future, you have a village tap for drinking water. Who would you envision looking after the operation and maintenance of this tap?" "For the road to the market that you drew in your future vision, what resources already exist in the community to build such a road?" The discussion points can also be captured on the map or noted on a separate sheet.

Drawings that are not made on paper should be copied onto paper. You should also ask the community members if they want to keep their original copy for themselves. The drawings and information from the discussions can then be used in a community meeting that brings together the findings for the next steps of planning.

Example of Present and Future Drawings



Now - 2002 **Future - 2007**

TOOL SHEET: ACTION PLANNING

What is it?

In planning an initiative, action planning can be used to develop and record the actions necessary to achieve specific results. It should be used in combination with the present and future exercise. The resulting plan can also be used for monitoring and evaluation.

Action planning has community members identify what they want to move from (the current situation), to (future situation), and the specific steps necessary to take them there. Where present and future helps with the overall vision and strategy for an initiative, action planning gives details of specific action steps required to achieve the future vision.

Why do it?

Action planning allows community members to reflect on, discuss, and record what the action steps are, who will do them, and when. It provides a common plan to clarify expectations for all as to "who will do what by when." Building an action plan together promotes accountability and transparency, and helps a community generate more ownership of the initiative.

The action plan becomes the common document that all stakeholders can work with. It can be used at meetings (i.e. weekly/monthly community meetings) to follow the progress of an initiative, keep track of what has been done, and identify what remains to be done. The action plan may need to be revised as the initiative evolves, new information becomes available, or new situations arise.

Who does it?

Action planning should be done by a group representing a cross section of the community — those likely to be directly involved in implementing the action plan, those who will directly benefit from the initiative, and others in the community who will be directly affected by the initiative.

Women, men, and children may identify different actions that need to be carried out. Also, people with different social status and backgrounds may have differing perspectives, ideas, and issues. They should all participate.

Literacy is useful in this exercise to best capture the details of the plan. However, simple drawings and symbols can be used to illustrate actions, and to note who will do them and by when. In this way, the plan is also accessible to non-literate community members.

How do you do it?

Action planning is best carried out after the community members have completed the present and future exercise. Then they will have thoroughly discussed the current situation and the desired future, and will have a common vision of what they are working toward. They also will have identified what will help them get there, and what obstacles they might need to overcome.

Ask members from the community if you can meet with them to obtain their input into the initiative's planning. The group should include those mentioned above (those directly affected by the initiative, those who will implement the action plan, those who took part in the present and future exercise, and so on).

Write the following headings of the action plan on different pieces of paper:

- From: (Current situation)
- Transition Actions: (What needs to be done to get to our desired future?)
- Who Will Do It?
- By When?
- To: (Desired future situation — what will be the result of the actions?)
- Progress: (What has happened with this activity? Notes on status/result).

These headings are then posted on a wall or laid out on the floor.

Going back to the present and future exercise, have the group come up with a statement that describes the present situation. The statement is written on another piece of paper and posted under the "From" column. The group then comes up with their statement describing what their future situation would look like, which goes under the "To" column.

Then ask the question: "To get from the present to the future, what are all the steps that must be taken?" The group discusses all the activities that need to take place. As the group comes up with each statement, it is written down on a slip of paper. Once the group is satisfied that they have all the actions necessary, they sort the actions in the order in which they should be taken. These now go in the "Transition Actions" column.

The next step is to identify who will be responsible for each step, as well as the date when each step should be completed. People can volunteer themselves from the group or make suggestions as to who would be appropriate. Suggestions must be confirmed with the individual suggested. This information is written on more pieces of paper and posted in the other two columns: "Who Will Do It?" and "By When?" The "Progress" column will be filled in as information about actions and their results becomes available.

When the exercise is complete, and the group is satisfied with the results, the information on the wall or floor is transcribed onto a sheet or series of sheets. This is the draft action plan.

To ensure that everyone is satisfied and committed to the action plan, it is important to consult with other community members who were not able to attend the initial meeting. Then another meeting should be held to finalize the action plan (see the sample on the following pages). This final plan can be prepared as a handout and distributed to everyone who took part.

It is likely that the action plan will change over time in response to changed circumstances, ideas, and other factors. Action plans usually must be adapted as experience is gained from the actual implementation of the initiative. Changing an action plan should always involve community members with an interest in the initiative. Though it may change, an action plan should always remain a guide as to how to proceed from where the community is now to where they want to be in the future.

The action plan can be used at community meetings to review and monitor the progress of an initiative. Someone should be designated to update the "Progress" column of the action plan, and enter any changes in actions, dates, and so on. Up-to-date copies of the action plan should always be available to any community members who want them.

Sample Action Plan for Community Water Harvesting Initiative

From: Food shortages in community due to lack of irrigation for crops		To: Water diversion scheme that brings water to the community, increases access to water for irrigation, and increases crop yields	
Transition Actions	**Who Will Do It?**	**By When?**	**Progress**
Meet as a community to discuss possibility of water diversion, identify who wants to be involved, and form community committee; identify community members with specific skills (i.e. engineers, etc.).	P.J. to invite community members.	February 1	Community Water Harvesting Committee formed (30 members); vote held for chair of committee (B.H.), secretary (P.J.), and treasurer (K.P.); volunteers with engineering experience identified.
Draw community map to identify where diversions could be built.	B.H. to invite members.	February 10	Maps completed and stored with P.J.; list of technical, environmental, and economic feasibility questions generated from discussions.
Meet with engineer from the Ministry of Public Works and agriculturalist from Conservation International to do a transect walk to obtain technical advice.	P.J. to invite engineer and agriculturalist and confirm date with members.	February 15 – planned March 1 – actual	Engineer and agriculturalist only available together on March 1. Meeting held, initial design sketched out, and erosion mitigation plans developed.
Carry out present and future exercise with community and Conservation International agriculturalist; identify main environmental concerns and goals; and then develop environmental action plan.	B.H. to coordinate with Conservation International; P.J. to invite committee and community members.	February 16 –planned March 2 – actual	Carried out present and future exercise. Created vision for environmentally sustainable irrigation. Main issues were erosion prevention and training in irrigated agriculture practices. Action plans were created for both issues; however, only 10 people attended (no women). Need to hold another general session (March 5), a session for women only (March 10), and final session to consolidate all input (March 15).
Get initial water diversion scheme plans drawn and develop budget for initiative.	B.H. and K.P. to work with engineer from Public Works and volunteer engineer from community.	February 28 – planned Revised to March 15	
Form four sub-committees to: i) identify various funding options for scheme; ii) oversee implementation; iii) develop an operation and maintenance plan; and iv) develop an environmental management plan.	P.J. to coordinate meeting of committee to review progress of action plan and establish sub-committees.	February 28 – planned Revised to March 15	

Transition Actions	Who Will Do It?	By When?	Progress
Bring plans and budget to committee for discussion and approval; decide on funding option; develop implementation plan; and develop operation and maintenance plan.	Sub-committees to coordinate meeting.	March 15 – planned Revised to March 21	
Begin implementation plan. Meet weekly as a committee to follow up on progress.	Sub-committees to report back.	March 21 – planned Revised to April 5	
Water diversion scheme operational. Community Water Harvesting Committee to host community celebration.	B.H., K.P., P.J. to coordinate celebration.	May 1	

TOOL SHEET: GENDER DIVISION OF LABOUR

What is it?

The gender division of labour exercise involves community members in collecting and analysing information about which work is done by women, and which work is done by men.

Why do it?

This exercise helps community members plan an initiative, through analysing the labour carried out by men, and that done by women. The exercise can reveal the different uses of time in the community, and help clarify expectations about who will take on specific roles in an initiative. It can also reveal land and income issues.

The exercise can also help identify who will be most concerned by a certain activity and, therefore, who should be more involved in the design and planning of that activity. For example, if the exercise reveals that only women are involved in water collection and storage, their input will be essential in designing a new community water system.

The gender division of labour exercise can also be useful in monitoring activities. After conducting the exercise during the planning of an initiative, it can then be used during the implementation and later to determine if and how the use of time by men and women has changed. If an undue increased burden is experienced by either men or women, this could be discussed during community meetings. Ways to address the problem can then be identified.

Issues raised in discussions during the exercise can be included in the proposal/application document, along with copies of the matrices or diagrams.

In the evaluation of activities, the same exercise can be carried out and compared with the original baseline exercise. For example, one of the goals may be to reduce the amount of time women spend collecting water. This exercise can be very valuable in helping to track that expected result over time.

Who does it?

The gender division of labour exercise should be done by various members of the community in order for different perspectives and issues to be captured. Women, men, girls, and boys can often have different roles and perspectives on how their time is spent. Also, people of different social status and background may have their own perspectives, ideas, and issues.

Literacy is not a requirement to participate in this exercise. Simple drawings and symbols can be used to illustrate the different tasks.

How do you do it?

Identify the people who have an interest in or may be affected by the initiative, such as women from a certain neighbourhood, or farmers from the same community.

Ask them if you can meet with them to obtain their help in the planning of the initiative. Depending on the nature of the initiative, have them list the tasks associated with the initiative's activities (e.g. collecting water for household use or taking animals for watering). Place two columns beside this list — one for women and one for men (see the example on the following page). Additional columns for girls and boys can be added if needed.

Ask each individual to think about how the work in their household is divided for each of these tasks. Give each participant the same number of pebbles per task (e.g. you can also use beans or short sticks — whatever is handy). Ask them to divide the pebbles according to how much time

men and women in their household spend on that task. Be sure that everyone is using the same number of pebbles per task. When everyone is finished, ask them what they noticed about the results. Other questions to ask are: "How does this breakdown of work between men and women affect the initiative?" "Will the initiative increase the workload for men or women?" "If so, how should this be addressed?"

Another way to look at the gender division of labour according to time use is to have each man and woman in the group draw a circle. Have them use the circle to create a "pie chart" of their day, dividing the circle according to the activities they take part in (see the sample on the following page). The whole group can then examine the collection of individual pie charts, and discuss the similarities, differences, and patterns they see in how men and women use their time. This method can also provide information about the time of the day that community members are available for community meetings or other activities.

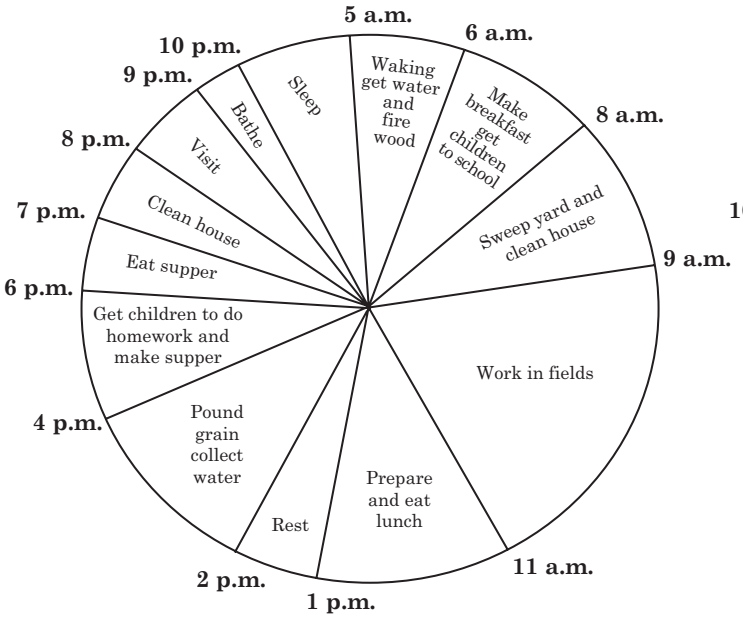
These exercises can work with men and women meeting in separate groups, or with an entire household meeting together. It can be very effective to have men and women discuss together how the gender division of labour will affect an initiative.

Drawings that are not made on paper should be copied onto paper. You should also ask the community members if they want to keep their original copy for themselves. The drawings and information from the discussions can then be used in a community meeting that brings together the findings for the next steps in terms of planning. It also provides a useful baseline in the evaluation of how the gender division of labour changes over the course of an initiative.

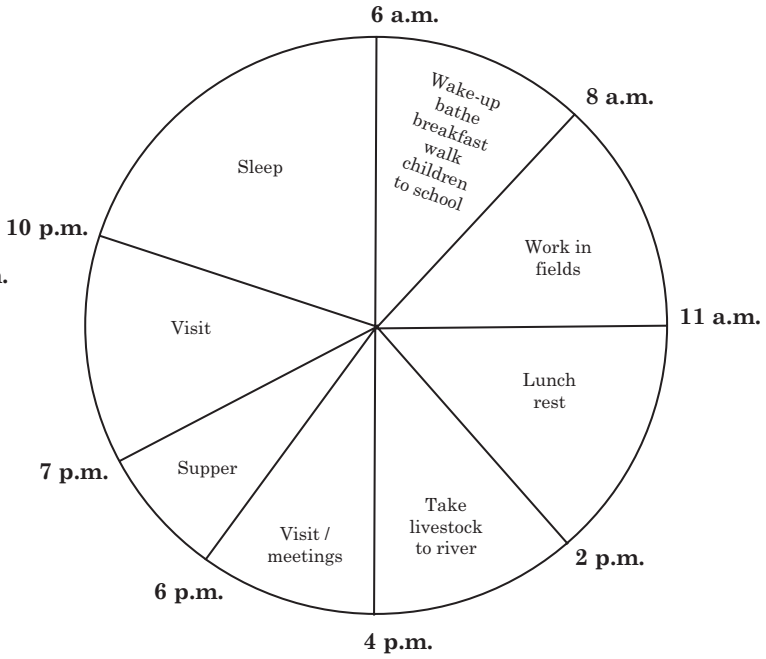
Example of a Gender Division of Labour Table

Nature of work	Division of work	
Tasks related to water	**Women**	**Men**
Collecting water in morning for cooking	● ● ● ●	
Storing water in house and taking to field for drinking	● ● ● ●	
Fetching water for animals	● ●	● ●
Fetching water for bathing	● ● ● ●	
Collecting water for cooking in afternoon	● ● ●	●
Taking animals to drink	●	● ● ●

Example of Daily Time Schedules



Mrs. B.



Mr. B.

TOOL SHEET: LEVEL OF SATISFACTION MATRIX

What is it?

The level of satisfaction matrix has community members rate their level of satisfaction with something in their community such as health centre services, water quality, roads, and so on. The community members build the matrix themselves. They establish the various criteria they want to use, and then vote on their level of satisfaction according to these criteria. This can be done as a group, individually, by men or women separately, and anonymously, if desired.

Why do it?

The level of satisfaction matrix is a tool that allows community members to express their views about a service, activity, or issue in the community. The information from this tool can be used for community discussions during the planning of an initiative. The criteria selected by the community for their matrix provide useful planning information about what is important to the community, and can identify planning issues that should be taken into account.

The level of satisfaction matrix can also contribute to evaluating the current situation in the community. For example, how satisfied are the community members with waste disposal? This tool can be used to examine potential options in the planning of an initiative. For example, what is the level of satisfaction with choices between different water supply systems?

The matrices can be used in a proposal/application document, and as a baseline record (e.g. community level of satisfaction with water quality) for checking on the progress of the initiative.

While an initiative is ongoing, a matrix can be used to evaluate activities and results, and as a discussion tool at community meetings to monitor and evaluate progress, and determine what is working well and what needs to be improved upon. This information can be fed directly into ongoing planning and improvement of the initiative.

Who does it?

The level of satisfaction matrix should be done by various members of the community in order for different perspectives and issues to be captured.

Women, men, and children may identify different criteria that they think are important to evaluate. Also, people of different social status and background may have their own perspectives, ideas, and issues to contribute.

Literacy is not required to participate in this exercise. Simple drawings and symbols can be used to identify the criteria and the levels of satisfaction. However, the drawings and symbols should be accompanied by an explanation so that everyone uses the same matrix consistently.

How do you do it?

Identify the people who have an interest in or may be affected by the initiative, and ask them if you can have their input into the planning of the initiative. Introduce the issue for which you would like their input (e.g. waste disposal) and explain why (i.e. to develop a community initiative). Draw an empty matrix (see the example on the following page). In the far left column, fill in the symbols for level of satisfaction — a happy face, neutral face and sad face. The matrix can be drawn on a large sheet of paper on the ground with a stick. The matrix will be completed with markers or stones, as appropriate. Use whatever materials are easily available.

Ask the participants to name their most important considerations about this topic or issue. For example, for waste disposal, they might come up

with some of the following: it should be far away from living quarters, well maintained, not near water sources, and should a have recycling system. These considerations become the criteria, which are listed at the top of each matrix column.

Once the participants are satisfied with the criteria they have chosen (usually four or five are enough), and are clear about the meaning of each one, ask them to rate their level of satisfaction for each criterion. This can be done by passing around a marker and having each person take their turn, or by each person getting as many stones as there are criteria and filling in the matrix with their stones. To determine if men and women have different opinions, they can be given different-coloured markers or stones for rating their level of satisfaction.

Always ask the group if they would prefer to do this exercise anonymously. If so, the matrix can be set up to the side away from the group, and they can take turns providing their ratings individually.

The discussions that take place during the exercise and afterward, as the group analyses the results together, are very important. After every member of the group has taken part in the exercise, you can start discussing the results together with questions such as: "What does this matrix tell you?" "Why do you think most people are satisfied with … ?" "Why do you think most people are dissatisfied with … ?" You can also ask questions about why these criteria where chosen and how they should be considered in planning the initiative.

If the level of satisfaction matrix is being used for evaluation, you can ask the group what improvements could be made, in cases where there is dissatisfaction, or you can ask what accounted for a high level of satisfaction, when this is the case.

Matrices that are not made on paper should be copied onto paper. You should also ask the community members if they want to keep their original copy for themselves. The drawings and information from the discussions can then be used in a community meeting that brings together the findings for the next steps in the planning.

Example of a Level of Satisfaction Matrix

Level of satisfaction	Waste disposal in the community			
	Convient to access	Away from living quarters	Away from water source	Adequate size for demand
☺		●●●●●●●●●●		
😐	●●		●●●●●●●●●●	
☹	●●●●●●●●●●		●	●●●●●●●●●●

TOOL SHEET: RANKING MATRIX

What is it?

The ranking matrix allows community members to decide on preferences, and make choices between various options, using criteria that they develop.

Why do it?

The ranking exercise can be useful when the community must make a choice together for something they will use in common (e.g. the choice among various water systems such as a hand pump, foot pump, or tap). A ranking matrix helps the community take into account the criteria that are important to them so that their choice reflects their various needs.

A ranking matrix can be used during the planning of an initiative to examine different options for activities, purchases, decisions, and so on. It can be used to conduct environmental assessments to determine which issues are important to address, and to compare different mitigation measures when they are necessary.

When the ranking exercise is carried out with members of the community, the criteria chosen and the results of the exercise provide important information for planning an initiative. Matrices and notes from the discussions can be included in a proposal/application document.

Who does it?

The ranking matrix should be completed by various members of the community in order for different perspectives and issues to be captured.

Women, men, and children may identify different criteria that they think are important to evaluate. Also, people of different social status and backgrounds may have differing perspectives, ideas, and issues.

Literacy is not a requirement to participate in this exercise. Simple drawings and symbols can be used to identify the criteria and the items or issues being ranked (see the example on the following page). However, the drawings and symbols should be accompanied by an explanation that is consistent for all who use the same matrix.

How do you do it?

A good time to use this exercise is when a community faces some choices or decisions regarding their initiative (e.g. the choice of different mitigation measures to be included in their environmental management plan).

Draw on the diverse group of community members that have an interest in or may be affected by the initiative. You may have already been working with them to identify the initiative, and perhaps they have already participated in a present and future exercise. Ask them if they can contribute to ranking some choices regarding the community initiative.

Introduce the issues for which you would like their input (e.g. choices regarding reforestation options). Ask them to brainstorm a list of various options that have been raised in community exercises and discussions. It may also be helpful to invite a resource person with some technical expertise in the subject to join in the exercise. Draw an empty matrix (see the example on the following page). In the far left column, fill in the various options that the group has come up with. The matrix can be made using a large sheet of paper and markers, or by tracing it on the ground and using stones to fill it in.

Now ask them to list all the considerations they need to take into account when choosing the best option (e.g. low cost, low maintenance, and so on). List these criteria across the top of the matrix columns.

Once the participants are satisfied with the criteria they have chosen (usually four or five are enough), and are clear about the meaning of each one, ask them to rate each option against the criteria. There are different ways of doing this. It can be done individually, with each person providing a rating from 1 to 5 for the criteria associated with each choice. Each individual provides his or her ratings, which are then added up to give an overall rating. It can also be done as a group, where the group discusses each option and comes up with a group opinion as to whether or not the option meets the criteria (see the example below). Markers, pebbles or whatever is available can be used. To determine if men and women have different opinions, they can be given different-coloured markers or stones when they do their ranking.

Always ask the group if they would prefer to do this exercise anonymously. If so, the matrix can be set up to the side away from the group and people can take turns providing their ratings individually.

The discussions that take place during the exercise and afterward, as the group analyses the results together, are very important. After every member of the group has taken part in the exercise, you can start discussing the results together with questions such as: "What does this matrix tell you?" "What is the choice that meets the most criteria?" You can also discuss why the criteria the group chose are so important, and how they should be considered when planning the initiative.

Matrices that are not made on paper should be copied onto paper. You should also ask the community members if they want to keep their original copy for themselves. The matrices and information from the discussions can then be used in a community meeting that brings together the findings for the next steps in the planning.

Example of a Ranking Matrix to Select Trees for a Community Watershed Management Initiative

Trees	Characteristics or Criteria				
	Gives shade	Doesn't need watering	Ability to hold soil	Bears fruit/medicinal properties	Matures quickly
Cashew	●			●	●
Ecalyptus		●	●	●	●
Pine		●			
Rosewood		●			
Mango	●			●	●

TOOL SHEET: STAKEHOLDER ANALYSIS DIAGRAM

What is it?

The stakeholder analysis diagram is a particularly useful at the beginning of an initiative to identify all potential stakeholders — the people who have an interest in and who may be affected by an initiative — and the relationships between them.

The exercise involves community members in creating a visual diagram that identifies all potential stakeholders. Using the diagram, they also indicate the relationships between these stakeholders. They discuss and analyse how these relationships should be taken into account in the initiative, and how all stakeholders can be included (e.g. consultation, decision-making, leadership, sponsorship).

Why do it?

Conducting a stakeholder analysis is an important early step in planning an initiative. It helps identify all potential stakeholders and allows them to voice their opinions. If only a few community members, representing only one or two groups, are involved in the planning phase, there is a risk that the initiative will not take into account the diverse opinions and ideas held in the community, and that community ownership of the initiative will be minimal.

When this exercise is done by a cross section of individuals and organizations, it is possible to develop a more complete idea of who the various stakeholders are and what relationships exist between them. The exercise may reveal that there are different views as to how strong or how important the relationships between the various stakeholders are. This will be important information to consider and discuss during the planning and implementation of the initiative.

The stakeholder diagrams, and the analysis of the information in them, can be used in initial planning meetings to clarify roles and relationships in the community.

In initiatives where improving relationships between stakeholders is important, initial stakeholder analysis diagrams provide useful baseline information. They can be repeated at later stages of the initiative to see if there have been any changes in the relationships between the stakeholders over the course of the initiative.

Who does it?

The stakeholder analysis exercise should be done by various members of the community to ensure that the whole range of potential stakeholders is included in the analysis, and that the different perspectives of their relationships are discussed.

Women, men, children, and representatives from different organizations may identify different ideas about who has an interest in or will be affected by the initiative, and about the relationships between these people or groups. Also, people of different social status and backgrounds may have differing perspectives, ideas, and issues.

Literacy is not a requirement to participate in this exercise. Simple drawings and symbols can be used to illustrate the various stakeholders.

How do you do it?

Identify an initial group of those who have an interest in or may be affected by the initiative (e.g. women from a certain neighbourhood, shopkeepers in the area, farmers from the same community, children who play in the proposed area, and local officials).

Ask if you can meet with them to obtain their input into the planning of the initiative. Ask the group:

- Who might be affected, positively or negatively, by the proposed initiative? Who are the representatives of those who are likely to be affected?
- Who are the "voiceless" for whom special effort may be needed to ensure they are included in planning the initiative?
- Who is likely to support the proposed initiative? Who is likely not to support it?

Using cut-out circles of various sizes, ask the group to choose a circle and mark down the names of these different groups, organizations, or individuals on the circles. Ask them to choose the size of circle according to the importance of that group, organization, or individual is in the community.

On a large piece of paper, put the proposed initiative in the centre (see the example on the following page). Ask the participants to arrange their circles with the different stakeholders according to the amount of contact each has had with the proposed initiative so far, and with each other. This may mean that circles will overlap. The advantage of not directly drawing the circles onto the paper is that with cut-out circles, participants can move the stakeholders around as they discuss the relationships. After the discussion, the circles can be glued or taped down to finalize the diagram.

The participants may have different perspectives of the importance of the various stakeholders and their amount of contact. The discussions can raise interesting points to be considered in planning the initiative. You can also ask the participants: "Who needs to be included in the planning phase of the initiative?"

The same exercise should be repeated with other groups in the community, including the ones that emerge on the diagrams as the initial exercise is carried out. This is to allow a more comprehensive analysis of the stakeholders, and their relationships to each other, the community, and the initiative.

The idea is not to come up with one perfect diagram, but to encourage the community to think about who should be involved. Use the diagrams as a guide to identify who should be included in planning the initiative.

Copies of the stakeholder analysis diagram can be included in the proposal/application document as a record of who will be involved in the initiative.

The stakeholder analysis can be a handy reference guide as to who should be invited to various planning activities. It may also be useful during action planning to look at all the various resource groups and people in the community who can assist with the initiative.

For evaluation purposes, the stakeholder diagrams can be reviewed by participants midway through or at the end of the initiative to see if the relationships between the different stakeholders have changed, or if new stakeholders are now involved in the initiative.

Example of a Stakeholder Analysis Diagram

3. Environmental Follow-Up and Monitoring

This section presents different tools that can be used to follow up and monitor the environmental aspects of an initiative. These tools are presented as examples and should be adapted to each specific context. They are not intended to provide an exhaustive account of approaches and situations. Follow-up and monitoring activities aim to assess the real effects of an initiative and identify effects that may not have been predicted at the planning stage. Proper follow-up and monitoring also ensures that mitigation measures have been implemented and are effective. If necessary, follow-up and monitoring activities identify additional measures to address previously unforeseen effects. Finally, these activities also help identify examples and lessons from the initiative to help improve the efficiency, quality, and sound budget management of future interventions. This section builds on the introduction to follow-up and monitoring presented in the handbook. As with general follow-up and monitoring, environmental follow-up and monitoring are essential to ensure the sustainability of an initiative. It is the organization's responsibility to ensure monitoring during the life of the initiative and it is also important to build local monitoring capacities.

This section includes the following:

- An environmental follow-up and monitoring sheet that can be used as a checklist to help take environmental considerations into account when conducting field missions.
- An example of a table that can be used to follow up / monitor specific environmental effects (which is similar to the summary table of an environmental management plan). This table is adapted from: Boyle, J. and Patterson, H. (Agrodev Canada Inc.). (June 2002). *Environmental Sourcebook for Small-Scale Community Development Projects*. Working Draft Prepared for CIDA, CIDA Internal Document.
- An example of a table that can be used to describe indicators, including environmental indicators, and their characteristics. This table is also adapted from the same source cited above.

ENVIRONMENTAL FOLLOW-UP AND MONITORING SHEET

This sheet can act as a checklist to help take environmental considerations into account when conducting follow-up and monitoring missions.

Initiative _____ **Evaluated by (name and position)** _____
Location _____ **Date** _____

Mitigation Strategies *What mitigation strategies were planned for this initiative? What mitigation measures were implemented? Did they fulfil their intended purpose? Did they adequately mitigate risks or effects?*	
Unforeseen Effects *Where there any unforeseen biophysical or social effects? If so, what were they? For negative unforeseen effects, how were they (or will they be) mitigated?*	
Changes to the Initiative *Describe any changes (and the reasons for such changes) to the initiative since the initial environmental assessment that could affect (may have affected) the environment.*	
Changes to the Environment *What environmental changes have occurred since the initial assessment that could affect (may have affected) the initiative (e.g. a change in level of infrastructure, pollution, and so on)? Are additional actions necessary in light of these changes? If so, explain.*	
Accidents/Mishaps *Describe any accidents or mishaps such as spills, contamination, or workplace hazards that occurred, as well as their effect. Indicate whether or not these risks were known/addressed before implementation. How were they dealt with?*	
Concerns/Changes *Outline any changes or concerns that should be addressed.*	
Recommendations *List any environmental lessons from this initiative that could be of use in the future, or any needs for further research that have been identified, and so on.*	
Environmental Objectives *Explain how environmental objectives that were previously integrated to the design of the initiative have been attained.*	

FOLLOWING UP AND MONITORING ENVIRONMENTAL EFFECTS — EXAMPLE FOR LIVESTOCK PRODUCTION IN FIADANANA

This type of table can be used to follow up / monitor specific environmental effects.

Anticipated effect	Mitigation measure(s)	Items to be monitored, follow-up metods and environmental indicators	Roles and responsibilities	Schedule	Cost and source of fund
Possible contamination of water sources from livestock manure	Fencing of water sources	Inspect fence construction	Monitoring committee	Construction period	Included in funding agreement
		Check condition of fencing at water points	Farmers and other community members	Ongoing	Nil
	Proper collection and use of manure	Check manure collection and storage procedures (away from water sources, slopes, and residential areas)	Farmers and other community members	Ongoing	Nil
		Evaluate manure uses	Farmers and other community members	Ongoing	Nil
	Early warning of reduced water quality	Check water quality at water sources (surveys on the quantity of water collected per household and per water source; number of diarrhea cases; perceptions). Analyse possible fecal contamination of water samples.	Monitoring committee	Every six months until effectiveness of mitigation measures is proven	$100 a year

INDICATORS — EXAMPLE FOR LIVESTOCK PRODUCTION IN FIADANANA

This type of table can be used to describe indicators, including environmental indicators, and their characteristics.

Results: *What will be achieved?*	**Indicators:** *What elements will help measure progress toward achieving each result?*	**Data sources and collection methods:** *Where to get the data for measuring the indicator, and what method will be used?*	**Frequency and responsibility:** *How often will the information be collected, and who is responsible for collecting it?*
Long-term impact: • A stronger and more diversified local economy • Fewer youth leaving for work in the city	• Family incomes • Number of youth finding employment in the county	• Statistics collected by local council for taxation purposes	• Beginning, middle, and end of the initiative by its committee
Medium-term outcomes: • Increased animal use of crop residue • Increased use of neighbouring fallow land for grazing purposes • Increased number of farmers raising livestock	• Number of farmers using crop residue for fodder • Number of hectares used for grazing • Number of head of livestock per farmer • Farmers' level of satisfaction with raising livestock	• Survey of farmers in area • Land-use survey using community mapping	• Annual survey by Ministry of Agriculture • Annual mapping facilitated by the initiative's committee
Short-term outputs: • New pumps at water sources • Expanded fencing to protect water sources • Communal livestock sheds • Training for farmers and youth	• Number of new water pumps • Number of water sources protected by fencing • Number of complaints about drinking water contamination • Level of satisfaction with drinking water quality • Level of satisfaction with training program	• Survey of local community • Community map	• Annual survey and community map by the initiative's committee
Activities: *What needs to be done to achieve the results?*		**Reach:** *What groups are affected by or benefit from the results?*	
• Farmer committees formed, needs identified, action plan developed and implemented • Youth committees formed, needs identified, action plan developed and implemented • Establish credit program for water pumps, fencing, and livestock • Establish training program on livestock and water management		• Farm families • Youth	

4. Tools for the Identification of Environmental Effects, Appropriate Mitigation Measures, and Guidelines for Specific Sectors of Activity

This section contains tools that can be adapted and used for the identification of environmental effects, appropriate mitigation measures, and guidelines for specific sectors of activity. Each tool is based on the checklists found in CIDA's first edition (1997) of the *Handbook on Environmental Assessment of Non-Governmental Organizations and Institutions Programs and Projects* (and its original references) and on the resource sheets found in Boyle, J. and Patterson, H. (Agrodev Canada Inc.). (June 2002). *Environmental Source-book for Small-Scale Community Development Projects*. Working Draft Prepared for CIDA, CIDA Internal Document.

These tools are not intended to provide an exhaustive account of all situations. Prior to using these tools, it is best to have clear indications as to an initiative's proposed activities. These tools can help identify the major environmental concerns and potential adverse environmental effects of specific sectors of activity. They can be used as field guides or as checklists of elements for discussion. They also present guiding principles on environmentally responsible siting, planning and design, as well as mitigation measures for the identified major environmental effects, and environmental indicators. These tools can thus be useful for the completion of environmental assessments.

The 10 sectoral tools are as follows:

1) Building construction
2) Rural roads
3) Water supply (including wells and other structures)
4) Sanitation systems
5) Forestry: nurseries, reforestation, and harvesting
6) Crop production
7) Animal husbandry
8) Irrigation
9) Fish farming
10) Solid waste management (including biomedical wastes).

BUILDING CONSTRUCTION AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for the construction of buildings, such as schools, health clinics, community centres, small businesses, and workshops (e.g. tannery, dyeing, handicraft, and so on). Please note that this document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over existing or planned land uses, activities, and infrastructures (both "legal" and "illegal") may arise.
- Induced population movements (migration, expropriation, resettlement) may occur.
- Nuisances (noise, foul odours, airborne dust, vibrations, traffic), health risks (transmission of diseases), and risks of accidents may arise during construction activities and depending on the building's operational activities.

How can these activities affect the natural environment?

- Soil degradation (affecting its stability, structure, drainage characteristics or through pollution by harmful products or wastes), erosion, and compaction may arise.
- Degradation of vegetation may occur, especially if soil denudation, erosion, filling/backfilling or vegetation clearing take place.
- Water quality may be degraded and the health of aquatic ecosystems may thus be negatively affected through increased sedimentation and the possible run-off of products and/or wastes.
- Air pollution (including dust) may arise, depending on the type of activities housed in the building.
- The quantity and quality of natural resources (e.g. water, wood, minerals, soils, energy sources, and so on) may be negatively affected if these resources cannot sustain an increase in demand resulting from an increase in population and/or increased extraction for the construction or operational activities of the building.

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

BUILDING CONSTRUCTION AND THE ENVIRONMENT (cont'd)

B. How can siting, planning, and design be environmentally responsible?

By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the population density, availability of local materials, availability of public services or resources (e.g. sanitation facilities, public transport, and so on), and the pattern and characteristics of land occupation (e.g. proximity of residences), as well as soil characteristics (i.e. stability, texture, drainage, and so on), proximity to water bodies, topography, climatic conditions, and intended building uses (including needs for maintenance), when selecting the construction site and the technical characteristics of the building.	
• Avoid siting in areas prone to natural disasters or hazards (e.g. flooding, heavy rain, intense storms, earthquakes, landslides, and so on).	
• Avoid infringing on vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. water bodies, waterways, slopes, wooded areas, coastal areas, arid and semi-arid areas, wetlands, biodiversity hotspots, habitats of endangered species, and so on).	
• Avoid unacceptable changes in ways of life and cultural characteristics (e.g. for indigenous populations, uncontrolled and unplanned human settlements and commercial development, and so on).	
• Avoid sites that would lead to unacceptable population displacements and/or loss of territory (e.g. migrations, expropriations, eviction of tenants or squatters, effects on Aboriginal peoples, and so on).	
• Avoid sites that would accentuate social inequalities (e.g. due to control by industrial entrepreneurs).	
• Avoid sites that would lead to incompatible uses of land and resources (e.g. between an industrial area and a residential area), unacceptable social conflicts (e.g. if the marketing system for traditional products is negatively affected), value conflicts and conflicts with respect to property rights and land tenure, as well as unacceptable changes in the visual quality (aesthetics) of the landscape (in relation to the local architectural style).	
• Integrate environmental conservation and restoration measures (e.g. erosion control and other soil stability measures, protective measures against flooding and heavy rainfall, tree planting, restoration of degraded sites, and so on).	
• Ensure that international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas, health and safety standards for the construction and use of the building, water effluents, waste management, and so on).	

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

BUILDING CONSTRUCTION AND THE ENVIRONMENT (cont'd)

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Ecosystem and soil degradation (e.g. erosion, compaction, changes in drainage, and so on) may occur as a result of construction activities. Soil degradation is a problem particularly where soils are fine or weak, or have complex drainage cycles. Heavy precipitation and steep slopes also present issues. In many cases, soil erosion can be associated with increased sedimentation in waters.	• Promote socially and environmentally responsible practices for building siting, planning, and design (see Section B). • Minimize vegetation clearing. • Avoid inappropriate use of heavy machinery. • Promote soil erosion control measures (e.g. balance cut and fill for minimum deposition of earth; minimize time when soil surfaces are exposed to rain and wind; stabilize soil for example with mulch on vulnerable surfaces; resurface and revegetate exposed areas; implement buffer zones of vegetation on slopes and surrounding bodies of water; implement soil stability structures; keep the mining of clay and limestone for brick making to a minimum, and ensure adequate drainage control and water recycling for this type of activity, and so on). • Ensure proper and timely management of construction materials and wastes (promote the re-use of products when possible). • Establish and enforce design and construction standards to ensure that the building is able to withstand extreme weather-related or geology-related events.
Nuisances (e.g. noise, airborne dust, vibrations, traffic), health risks, and risks of accidents may arise during construction activities.	• Plan construction activities according to a schedule that is compatible with the climatic conditions and the population's activities. • Promote the use of appropriate local materials and building techniques. • Promote the local labour force, and ensure proper health and safety training for the use of construction materials and equipment. • Ensure proper training for the management of possible construction wastes, as well as for soil degradation control. • If brick making takes place, promote measures to limit emissions of dust and combustion gases from the kilns (e.g. consider less damaging sources of energy, improved efficiency of kilns, re-use of generated ashes, and so on).

BUILDING CONSTRUCTION AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
Pollution (soil, water, air) and human health sensitivities may arise, depending on the building's operational activities (see the box below).	• Avoid creating stagnant water ponds which can be highly odorous and provide breeding grounds for mosquitoes. • Promote proper health and safety training, equipment (e.g. masks, ear plugs, gloves, boots, and so on), workspace layout, and work periods. • Implement proper cleanliness, maintenance, accident, spill, overheating, fire and/or explosion control measures. • Ensure proper training on environmental issues and waste management (see waste management sectoral tool if required). • Implement conservation and efficiency measures for energy, water and other natural resources / raw materials (e.g. dry cleaning methods before rinsing, closed-circuit water supply for its re-use, prevention of overflow by shut-offs to system, regulation of water flows with valves or high-pressure nozzles, biological and equitable certification, environmentally friendly packaging, and so on). • Implement pollution prevention or control devices to limit the harmful effects of pollutants (liquid, solid, or atmospheric), for example, biological wastewater treatment, drainage systems, air filters, proper ventilation, improved stoves, alternative energy sources (for example, solar energy), recycling of scraps, minimal use of dangerous products (e.g. chemicals, laboratory products, solvents, lubricants, oil, batteries, dyes, glue, acids, heavy metals, radioactive substances, and so on) and their appropriate manage-ment (e.g. secured storage areas away from vulnerable elements, storage of flammable products away from all sources of heat or ignition, labelled leakproof containers with covers that are understandable locally), and so on. • Ensure that sanitation facilities are located away from water sources, steep slopes, and vulnerable areas (see relevant sectoral tool, if needed). • Promote waste segregation practices to enable the re-use of certain products, recycling of other products, composting of biodegradable wastes, and appropriate storage, transportation, treatment and disposal of other wastes (see waste management sectoral tool).

Various Types of Building Operations and Their Major Environmental Issues

- *Health clinic:* Proper management of biomedical wastes (see waste management sectoral tool), wastewater and cleaning/disinfection products, as well as water availability.
- *Metalworking, automobile, and motor repair shops, and the textile and crafts industry:* Generation of hazardous wastes, such as heavy metals, oil, batteries, paints, solvents, and so on (the proper management of wastewater, wastes, chemical products, as well as health and safety guidelines are thus required), as well as natural resource availability and control of air pollutants, fumes, dust, noise, vibrations, and odours.
- *Small agro-processing or animal processing facility:* Proper management of wastewater, chemical products and wastes (through re-use when possible and appropriate handling of contaminated wastes), as well as water, energy, and natural resource availability, and control of odours, dust, noise, and vibrations. In

BUILDING CONSTRUCTION AND THE ENVIRONMENT (cont'd)

addition, leather processing activities tend to require large amounts of water. Wastewater treatment is thus essential and may include primary treatment with screens, grease traps, skim tanks and/or settling tanks; secondary biological treatment; tertiary treatment, such as lagooning or rapid sand filtration, or disinfection and treatment of the resulting sludge.

- *Forest products:* Please see the relevant sectoral tool.

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

BUILDING CONSTRUCTION AND THE ENVIRONMENT (cont'd)

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Surface water characteristics (suspended sediments, pH, transparency, chemicals); soil texture and composition characteristics; increase in vegetative cover; rate of water use; quantities of solid waste generated; quantities of re-used or recycled products; extent of energy use per type of energy source; and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease; frequency of accidents during the building's operational activities; and so on.*	

RURAL ROADS AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for initiatives involving the construction or upgrading of rural roads, trails, or tracks. Please note that this document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over existing or planned land uses, activities, and infrastructures (both "legal" and "illegal") may arise.
- Induced population movements (migration, resettlement) may occur.
- Nuisances (e.g. noise, foul odours, airborne dust, vibrations, air pollution), health risks (e.g. communicable diseases and water-borne diseases), and risks of accidents may arise due to (increased) traffic.

How can these activities affect the natural environment?

- Soil degradation (affecting its stability or structure), erosion, and compaction may arise.
- The health of terrestrial ecosystems may be negatively affected, especially if soil denudation, erosion, vegetation clearing, or displacement/reduction in wildlife occur.
- Water quality may be degraded and the health of aquatic ecosystems may thus be negatively affected through increased sedimentation, the possible run-off of products and alterations to hydrology.

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

B. How can siting, planning, and design be environmentally responsible?

By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

RURAL ROADS AND THE ENVIRONMENT (cont'd)

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the population density and the pattern and characteristics of land occupation, as well as soil characteristics (e.g. stability, texture, drainage, and so on), proximity to water bodies, topography, climatic conditions, intended road uses, and expected traffic characteristics when planning the road siting, its width, surfacing material, and structures (such as viaducts, tunnels, bridges, contour canals, ditches, culverts, cuts, embankments).	
• Avoid siting in areas prone to natural disasters or hazards (e.g. flooding, heavy rain, intense storms, earthquakes, landslides, and so on).	
• Avoid infringing on or giving unplanned access to vulnerable sites or sites of economic, ecological, cultural, archaeological or historical importance (e.g. water bodies, waterways, slopes, wooded areas, coastal areas, arid and semi-arid areas, wetlands, biodiversity hotspots, habitats of endangered species, and so on).	
• Avoid unacceptable changes in ways of life and cultural characteristics (e.g. for indigenous populations, uncontrolled and unplanned urbanization and commercial development, disruption in the organizational structure or means of subsistence, disruption of the marketing system for traditional products, and so on).	
• Avoid sites that would lead to unacceptable population displacements and/or loss of territory (e.g. migrations, expropriations, eviction of tenants or squatters, effects on Aboriginal peoples, population densification along the road, loss of agricultural lands, and so on).	
• Avoid sites that would accentuate social inequalities (e.g. depending on the means and availability of transportation for proposed users, for localities through which the road passes and their specific groups, if local sale prices would be negatively affected, and so on).	
• Avoid sites that would lead to incompatible uses of land and resources (e.g. demands for local public infrastructure and services or prospection activities that would be beyond existing capacities; road uses and transportation of products that would generate pollutants, and so on), unacceptable social conflicts, value conflicts, and conflicts with respect to property rights and land tenure, as well as unacceptable changes in the visual quality (aesthetics) of the landscape.	
• Integrate environmental conservation and restoration measures (e.g. erosion control, tree planting, restoration of degraded sites, and so on).	
• Ensure that international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas, water quality, health and safety standards for the construction and use of the road, and so on).	

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

RURAL ROADS AND THE ENVIRONMENT(cont'd)

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Health risks and risks of accidents for the population.	• Avoid creating stagnant water ponds in construction borrow pits and quarries, and on road sides (e.g. by ensuring proper drainage). • Promote education on avoiding communicable diseases (that may be associated with additional influx of workers and road users). • Ensure proper training for the regular maintenance of the road and its structures. • Avoid creating congested and unsafe road conditions at intersections, and in villages and towns (especially close to schools and dense neighbourhoods). • Ensure culturally pertinent warnings or signs are used alongside the road. • Implement proper accident, spill, fire, and explosion control measures. • Minimize the use of roadside herbicides and chemical maintenance materials.
Adverse effects on animals and wildlife due to disruption of their movements and increase in road kills.	• Avoid encroaching on and segmenting known animal and wildlife habitats and movement routes that are critical (e.g. those used for spawning, breeding, feeding, or migrations). • Promote the installation of animal/wildlife crossing warnings or signs, nighttime speed limits, and so on. • Rehabilitate degraded areas nearby as wildlife habitat.
Soil degradation (e.g. erosion, compaction, changes in drainage, gully formation, and so on) and degradation of vegetation and ecosystems. Soil degradation is particularly a problem where soils are fine or weak, or have complex drainage cycles. Heavy	• Promote socially and environmentally responsible practices for road siting, planning, and design (see Section B). • Limit vegetation clearing to a minimal pathway. • Keep a safe distance from water bodies and other vulnerable areas. • Avoid inappropriate use of heavy machinery. • Line receiving surfaces with stones or concrete.

RURAL ROADS AND THE ENVIRONMENT(cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
precipitation and activities on or around steep slopes also present issues. In many cases, soil erosion can be associated with increased sedimentation in waters (which degrades surface water quality and the health of aquatic ecosystems).	• Install culverts and bridges in dry season. • Ensure proper and timely design and maintenance of culverts and surface drainage structures or crossings to handle maximum anticipated water flows (which can vary in time and space and according to soil, climatic, and aquatic characteristics). • Ensure proper and timely maintenance of road surface, bridges, roadside slopes, roadside vegetation, and other road structures. • Promote soil erosion control measures (e.g. balance cut and fill for minimum deposition of earth, limit earth movement, minimize time when soil surfaces are exposed, site roads to follow hill contours, stabilize road surface with rocky surfacing material, stabilize soil for example with mulch on vulnerable surfaces, resurface and revegetate exposed areas, implement buffer zones of vegetation on slopes and surrounding bodies of water, promote windbreaks, and so on). • Collect and recycle used lubricants (e.g. during construction activities with equipment that requires the use of such products). • Establish measures to avoid accidental spills (e.g. oil, fuel, lubricant from construction equipment, and dangerous products or wastes that may be transported on the road), and properly contain them if they do happen. • Establish measures to avoid road accidents and fires, and properly contain them if they do occur. • Promote socially and environmentally responsible waste disposal practices (both during construction and road use) that would not lead to littering of the road and its vicinity.

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	

RURAL ROADS AND THE ENVIRONMENT(cont'd)

Planning follow-up and monitoring questions (cont'd)	Answers for the proposed initiative (cont'd)
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Concentrations of suspended sediments in surface waters and other characteristics (pH, transparency); productivity of ecosystems in the road's vicinity (e.g. number of breeding areas/species, number of plant shoots); quality of ecosystems in the road's vicinity (which can be evaluated through a qualitative scale); degree of biodiversity (number of species and an appreciation of their populations) in the road's vicinity; extent of critical or wildlife habitats (in hectares, for example); degree of wildlife habitat fragmentation (number of fragmented areas, for example); and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease; frequency of traffic accidents involving vehicles, pedestrians, fires, or product spills; incidence of commercial activity per groups involved; human population density in the road's vicinity; and so on.*	

WATER SUPPLY AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for the implementation of water supply systems designed to supply drinking water to the population (including groundwater as well as surface water extraction). Please note that specific sectoral tools exist for irrigation initiatives and sanitation initiatives (to ensure maximum benefits, it is pertinent to address both water supply needs and sanitation needs simultaneously). Please note also that this document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over land uses and surface or groundwater supplies (e.g. increased extraction in certain areas at the expense of others, incompatibility with activities that may pollute water sources) may arise.
- Activities may negatively affect existing community water management practices and relationships.
- Contamination of water sources and creation of stagnant water ponds may lead to the spread of illness and disease (water-borne diseases and infections).

How can these activities affect the natural environment?

- The quality and quantity of surface water / groundwater may be degraded.
- Soil degradation and erosion, as well as degradation of the watershed or wooded areas, may arise (e.g. deforestation, loss of biodiversity, wetland conversion, and so on).
- The health of aquatic and riverine ecosystems may be negatively affected (e.g. alterations to hydrology and flow and the presence of structures may have an adverse effect on the ecological regulatory functions of the aquatic ecosystem, including its capacity to dilute pollutants, and on the species that are part of that ecosystem).

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

B. How can siting, planning, and design be environmentally responsible?

By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

WATER SUPPLY AND THE ENVIRONMENT (cont'd)

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the population density in relation to available water supply, based on current and historical data (and which may vary between seasons), its quality, and sanitation practices, as well as the socio-economical and technical production capacities of the communities.	
• Avoid siting close to vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. slopes, wooded areas, wetlands, coastal areas, biodiversity hotspots, habitats of endangered species, and so on).	
• Avoid sites and activities that would lead to unacceptable population displacements and/or loss of territory and changes in ways of life and cultural characteristics (e.g. migrations, expropriations, eviction of tenants or squatters, effects on Aboriginal peoples, settling of nomads, induced uncontrolled urbanization, and so on).	
• Avoid sites and activities that would accentuate social inequalities (e.g. cases where specific groups of the population, such as women, farmers, livestock producers have not been consulted; where the number of beneficiaries is limited; where there would be an increase in women's workload, and so on).	
• Avoid sites and activities that would lead to incompatible uses of land and resources and/or unacceptable social conflicts (e.g. between common ownership of public or ancestral lands and "ownership" of water structures; between different types of water uses in the same area or different areas; between water users upstream and downstream from water source; between potentially pollutant activities and drinking water supply activities; between industrial uses and domestic uses, and so on). To ensure maximum benefits, such initiatives should take into account the improvement of human waste disposal systems and sanitation systems (see sanitation sectoral tool).	
• Choose water supply systems (e.g. wells, boreholes, reservoirs, tanks, pipes, aqueducts, treatment facilities, systems using gravity or pumps, and so on) in accordance with the characteristics of soils, topography, geology and climate (e.g. consider soil texture, stability, and composition; slope; seasonal water dynamics; if the area is prone to landslides, flooding, drought, or other hazards, and so on).	
• Integrate environmental conservation and restoration measures (e.g. water conservation, pollution prevention structures, erosion control, tree planting, rehabilitation of watershed, and so on).	
• Ensure international and national/local policies, standards, and regulations are respected (e.g. protected areas, surface and underground water quality and water extraction, and so on).	

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

WATER SUPPLY AND THE ENVIRONMENT (cont'd)

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Conflicts over land uses and surface or groundwater supplies, as well as negative effects on existing community water management practices and relationships.	• Consider water conservation measures instead of or in addition to a new water supply initiative, for example by upgrading or renovating existing systems (e.g. deepen and clean existing wells, reduce leakage, evaporation and seepage losses, and so on) and by promoting water recycling and re-use, where appropriate. • Ensure sufficient community participation and organization for effective planning and management of the water supply system, and for equitable water distribution (e.g. with a community management committee, including local representatives from different user groups and affected areas; community prioritization of intended uses; upstream/downstream user agreements; user fees, and so on). • Determine and maintain adequate water flow levels to ensure continued access to water of downstream populations (and ecosystem health). • Develop supply sources where water availability is adequate and the initiative will not conflict with existing human, livestock or wildlife water uses (especially during dry seasons) and so that withdrawals do not lead to major alterations of the surface water hydrology or exceed the groundwater recharge rate.
Human health sensitivities to water-borne diseases and infections (if creating habitats for disease carriers such as mosquitoes and snails, and increasing the likelihood of water-related diseases such as malaria, schistosomiasis (bilharzia), onchocerciasis (river blindness), or gastro-intestinal diseases).	• Ensure good drainage around water supply points and avoid creating stagnant water ponds (e.g. through the appropriate design, installation, use, and maintenance of drains and soak-away pits). • Construct a spigot or similar system that prevents people from touching impounded water with their hands or mouths. • Monitor disease occurrence and other public health indicators related to water-borne diseases and infections, and take corrective measures as needed (e.g. physical changes to water supply and sanitation systems, public education, medical intervention).

WATER SUPPLY AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	• Ensure water is fit for drinking, for example, based on World Health Organization (WHO) guidelines, and ensure regular ongoing water testing by the community (of the water source and at various points along the water supply system). • Ensure locally adapted water treatment where water potability may present issues. • Avoid the entry of contaminants into the water source / supply system (see next item on water quality).
Degradation of surface water or groundwater quality and quantity (see sanitation sectoral tool). In the case of groundwater extraction, it should be noted that areas where the water table is high (closer to the soil surface), where soils have a high clay or sand content, and coastal and insular areas present challenges.	• Promote water conservation practices (e.g. consider availability of water supplies, hydrology of surface waters or groundwater recharge rate, other uses, water recycling and re-use where appropriate, rationing during the dry season, use of control valves and reducer pipes, and so on). • Monitor water levels in wells or impoundment structures. • Limit diversion of surface waters and alterations to hydrology in fish migration and spawning areas. • Ensure that the water supply system is in line with silting patterns, flow rates, and flood cycles of the surface waters. • Avoid salinization from groundwater use that exceeds its recharge rate (consider spacing and number of wells). • Implement a community education, training, and capacity building program to properly operate and maintain the system, as well as to improve hygiene and sanitation practices (see sanitation sectoral tool). • Reduce possible leakage, evaporation, and seepage losses through appropriate design, installation, use, and maintenance of structures. • Avoid the entry of contaminants into the water source / supply system: – Ensure activities associated with chemical inputs (e.g. agriculture, certain handicrafts using dyes, mechanic workshops, and so on) are not taking place in the vicinity of the water source and supply system. – Locate latrines, septic systems (or other similar activities) and animal pens or areas of livestock concentration at least 30 m away from water source and supply system. – Locate water system well away from waste-generating activities or waste disposal areas. – Ensure that water extraction for crop production, bathing, laundering, and animal watering takes place in adequate predetermined areas, in order to avoid the possible entry of contaminants in the water source or supply system, and to avoid overextraction. – Protect the water source and supply system from run-off or seepage of contaminants by using lids or covers on wells, well casing above ground level, fences, lined distribution pipes and wells, covered drains, soak-away pits for domestic grey waters or spillage from wells, treatment systems, and so on.

WATER SUPPLY AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
Ecosystem/watershed degradation (e.g. deforestation, loss of biodiversity, increased sedimentation in waters, and so on) and soil degradation (e.g. erosion, compaction, changes in drainage, and so on). Soil degradation is a problem particularly where soils are fine or weak, or have complex drainage and fertility cycles. Heavy precipitation and activities on or around steep slopes also present issues.	• Minimize soil exposition (e.g. minimize vegetation clearing; minimize time when soil surfaces are exposed to rain and wind; resurface and revegetate exposed areas; implement buffer zones of vegetation; use proper bedding materials for pipes, and so on). • Implement soil protection measures and anti-erosion measures around the water source or the water supply system (such as avoiding improper use of heavy machinery, reforestation and revegetation, small-scale contouring or terracing, drainage structures with cobbled stone, gravel, or concrete, and so on). • Promote a watershed or river bank or water source improvement program to enhance retention capacities in soils (e.g. revegetation, reforestation).

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

WATER SUPPLY AND THE ENVIRONMENT (cont'd)

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Water quality (e.g. contaminants, salinity, transparency, suspended sediments, oxygen); rate of increase in vegetative cover of the watershed; variations in erosion of the watershed; surface water flows and groundwater table levels in area; rate of water use; number of persons trained in environmental issues (such as water conservation and water quality monitoring); and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease (associated with water-borne diseases); access to potable water; and so on.*	

SANITATION SYSTEMS AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for the implementation of sanitation systems (e.g. individual or community latrines, small-scale septic tanks and leach field systems, soak-away pits for household wastewater). Please note that a specific sectoral tool exists for water supply initiatives (to ensure maximum benefits, it is pertinent to address both water supply needs and sanitation needs simultaneously). Please note also that this document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over land uses and water uses may arise (e.g. sanitation systems may be incompatible with other types of activities since they may pollute water sources).
- Contamination of water sources and creation of stagnant water ponds may lead to the spread of illness and disease (e.g. water-borne diseases and gastro-intestinal diseases) and nuisances (e.g. foul odours and flies).

How can these activities affect the natural environment?

- The quality of surface water / groundwater may be degraded. For surface waters, such a degradation in quality may also negatively affect the health of aquatic and riverine ecosystems (contamination may cause nutrient enrichment and depletion of dissolved oxygen in water, and thus lead to negative effects on the species of these ecosystems).
- Soil degradation and erosion, as well as degradation of the watershed or wooded areas, may arise (e.g. deforestation, loss of biodiversity, wetland conversion, and so on).

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

B. How can siting, planning, and design be environmentally responsible?

By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

SANITATION SYSTEMS AND THE ENVIRONMENT (cont'd)

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the population density, demand, and preferences for sanitation; types of activities conducted; existing sanitation and hygiene practices/customs; the socio-economical and technical production capacities of the communities, when choosing a sanitation system and its location (including socio-cultural beliefs and possible taboos that may influence the selection of structures, their numbers, location, specificity of uses and/or users, and so on).	
• Avoid sites and activities that would accentuate social inequalities (e.g. cases where specific groups of the population, such as women, farmers, livestock producers, have not been consulted; where the number of beneficiaries is limited, and so on).	
• Avoid siting close to vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. steep slopes, wooded areas, wetlands, coastal areas, biodiversity hotspots, habitats of endangered species, and so on).	
• Avoid sites and activities that would lead to incompatible uses of land and resources, displacements and/or unacceptable social conflicts (latrines are possible sources of pollution and nuisances, they must be located at least 30 m from surface water sources, downhill from the water supply and well away from steep slopes that may enhance run-off and infiltration of polluting substances into underground waters). To ensure maximum benefits, sanitation initiatives should take into account the improvement of potable water supply systems (see water supply sectoral tool).	
• Choose sanitation systems [e.g. individual or community latrines, such as ventilated improved pit (VIP), composting, dry, and so on; small-scale septic tanks; and leach field systems] and their materials in accordance with the characteristics of soils, topography, geology, climate and the proximity of surface and underground water (e.g. consider soil permeability, texture, stability, and composition; slope; seasonal water dynamics; level of underground water; if area is prone to landslides, flooding, drought, or other hazards, and so on).	
• Integrate environmental conservation and restoration measures (e.g. water conservation, pollution prevention structures, erosion control, tree planting, and so on).	
• Ensure international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas, surface and underground water quality standards, and so on).	

Notes:

How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

SANITATION SYSTEMS AND THE ENVIRONMENT (cont'd)

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Soil degradation (e.g. erosion, compaction, changes in drainage, and so on). Soil degradation is a problem particularly where soils are fine or weak, or have complex drainage and fertility cycles. Heavy precipitation and activities on or around steep slopes also present issues.	• Minimize soil exposition during construction of structures (e.g. minimize vegetation clearing; minimize time when soil surfaces are exposed to rain and wind; resurface and revegetate exposed areas; implement buffer zones of vegetation; use proper bedding and lining materials, and so on). • If there are risks of soil instability, another choice of location or stability structures/lining are usually required. • Implement soil protection measures and anti-erosion structures around the sanitation systems (e.g. reforestation and revegetation; drainage structures with cobbled stone, gravel, or concrete, and so on).
Human health sensitivities to water-borne diseases and gastro-intestinal diseases (if creating habitats for disease carriers such as mosquitoes and snails, and increasing the likelihood of gastro-intestinal diseases such as infectious diarrhea, dysentery, cholera, typhoid) and other nuisances (such as foul odours and flies). ***Various* WASTEWATER TREATMENT *options exist for domestic grey waters, ranging from soak-away pits and other physical filtering drainage systems to wastewater stabilization ponds, controlled release lagoons, and engineered wetlands with native and adapted***	• Avoid creating stagnant water ponds to reduce risks of water-borne diseases. • Monitor disease occurrence and other public health indicators related to water-borne diseases and gastro-intestinal diseases, and take corrective measures as needed (e.g. physical changes to water supply and sanitation systems, public education, medical intervention). • Ensure existing water sources remain fit for drinking (e.g. based on WHO guidelines) and ensure regular ongoing water testing by the community (of the water source and at various points along the water supply system). • Ensure locally adapted water purification where water potability may present issues. • Ensure daily cleaning and adequate ventilation in latrines, for example the design of VIP (ventilated improved pit) latrines includes a ventilation pipe or air inlet (where the length and/or orientation will depend on the proximity of neighbours and predominating winds; it is generally recommended that an air inlet or pipe face the direction of prevailing winds to maximize air intake) and a mesh or flyscreen at its exterior extremity as a barrier for insects.

SANITATION SYSTEMS AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
species. Various sources of technical information are available; for example, see http://www.lifewater.org/wfw/wfwindex.htm	• Avoid defecation in open areas and disposal of excreta or wastewater directly on land or into water sources without adequate treatment. • Avoid seepage, infiltration and direct contact with contaminants from sanitation systems (see next item for details).
Degradation of surface water or groundwater quality. Measures to avoid such degradation are especially important where the water table is high (closer to the soil's surface) or where soils have a high clay or sand content. ***In the specific case of* COMPOSTING LATRINES: *maintain humidity of composting material above 60 percent and supplement excreta with generous quantities of dry leaves, dry grass, or straw—so that the pile remains aerobic (i.e. with oxygen), odour-free, and insect-free; if using a fixed-batch system, construct sealed vaults to hold composting material; if using a movable-batch system, check removable containers for leaks before installation; allow sufficient residence time in mature chamber (this may vary from six months in warm climates to 18 months in cooler climates); test samples from active chamber and mature chamber (after fallow period) for Ascaris eggs and fecal coliforms to assess level of pathogens.*** ***In the specific case of* DRY LATRINES: *maintain humidity of composting material above 20 percent and supplement excreta with alkaline material such as ashes or lime (so that the pile remains odour-free and insect-free and that the pathogens are destroyed); construct***	• Avoid defecation in open areas and disposal of excreta or wastewater directly on land or into water sources without adequate treatment. • Ensure that the sanitation systems are used specifically for biodegradable human wastes (these systems are not intended for toxic, hazardous, or non-biodegradable wastes). • Avoid locating sanitation systems where the water table is high (it is usually recommended that the bottom of the pit be separated from the water table by at least 2 m of unsaturated soil) or where soils have a high clay or sand content (which is typically a sign of permeability). • Ensure adequate spacing between latrines and soak-away pits. • Avoid the entry of contaminants from the sanitation system into the water source / supply system. – Locate latrines at least 30 m away from all surface waters and the water supply system, as well as downhill from the water supply. – Protect water source and supply system from run-off or seepage of contaminants by using lids or covers on wells, well casing above ground level, fences, lined distribution pipes and wells, covered drains, soak-away pits for domestic grey waters or spillage from wells, treatment systems, and so on. • Implement a community education, training, and capacity building program to properly use, operate, and maintain the sanitation systems (maintenance includes for example, monthly verifications of the integrity of the mesh or flyscreen of latrines, of the opening of ventilation pipes or air inlets of latrines; daily cleaning of the inside of latrines), as well as to improve hygiene attitudes and behaviour. • Ensure the use of a reliable and safe system for emptying latrines or septic tanks and transporting the collected material off-site for treatment (e.g. a mechanized vacuum pump, associated tank or container, use of stones to avoid collapse of the pit during emptying, and the use of protective clothing, long-sleeved shirts and pants, boots, rubber gloves, and masks / eye protectors, when needed, as well as access to adequate washing facilities with soap and warm water). • Ensure that maintenance workers are also trained in first-aid measures and relevant occupational health and security topics. • Ensure that the material collected from latrines or septic tanks is adequately treated, not directly applied on soils, and not disposed of improperly.

SANITATION SYSTEMS AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
sealed vaults to hold dehydrating and curing material; allow sufficient residence time in mature chamber (this may vary from six months in warm climates to 18 months in cooler climates); test samples from active chamber and mature chamber (after fallow period) for Ascaris eggs and fecal coliforms to assess level of sterilization.	• In the case of latrines not specifically designed for composting, it is usually recommended that latrines be used in alternation so that natural decomposition of the excreta and elimination of pathogens can occur (which can generally take up to two years, depending on the circumstances). • Ensure a proper resting period or decommissioning of latrines when they are filled to 0.5 m from the top (e.g. do not leave pits open, and fill in unused capacity with rocks or soil, in case of decommissioning).

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

SANITATION SYSTEMS AND THE ENVIRONMENT (cont'd)

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Water quality (e.g. fecal matter or coliforms, suspended sediments, oxygen, and so on); number of persons trained in environmental issues (such as hygiene, sanitation system maintenance, water quality monitoring); and so on.*	
• ***Human well-being indicators:*** *: Incidence of human illness or disease (associated with gastro-intestinal diseases); number of complaints of foul odours, and so on.*	

FORESTRY AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for nursery initiatives for the reforestation of trees and shrubs and subsequent forest harvesting activities. If the initiative involves the construction of a building to house the nursery, the construction or upgrading of access roads, or the construction of a water supply or irrigation structure, please see the relevant sectoral tools. Please note that this document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over existing or planned land uses, tenure, management practices, and extraction activities (both "legal" and "illegal", for both "private" and "communal" property or rights, related to firewood collection or multiple uses) may arise. Conflicts over socio-cultural behaviours, practices, or rules relating to forest heritage and historical or religious aspects may also arise.
- Conflicts over surface or groundwater supplies (e.g. increased withdrawal in certain areas at the expense of others) may arise.
- Forestry activities involving fertilizers, pesticides (such as herbicides, insecticides, and fungicides) or the use of chemical/dangerous products for extraction and post-harvest activities may lead to human health sensitivities.
- Nuisances (e.g. noise, airborne dust, air pollution, vibrations) and risks of accidents or to health and occupational safety may arise, depending on the characteristics of possible extraction activities.

How can these activities affect the natural environment?

- Areas supporting critical, valued, vulnerable, or protected species and habitats may be degraded, encroached upon, or destroyed.
- Biodiversity and endemic species of an area may be negatively affected.
- Soil degradation, erosion, loss of fertility, and pollution by chemical inputs may arise, depending on the characteristics of the planting activities and possible extraction activities.
- The quality and quantity of surface water and groundwater may thus be degraded.

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

FORESTRY AND THE ENVIRONMENT (cont'd)

B. How can siting, planning, and design be environmentally responsible?

> By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Avoid siting close to vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. water bodies, waterways, slopes, wooded areas, wetlands, coastal areas, desert areas, protected areas, biodiversity hotspots, habitats of endangered species, and so on), unless the intent is to protect or restore such sites if they are degraded (a proper analysis is nevertheless required).	
• Avoid unacceptable changes in ways of life and cultural characteristics (e.g. if subsistence practices are disrupted by the introduction of "modern" production techniques, and so on).	
• Avoid sites and activities that would accentuate social inequalities (e.g. cases where specific groups of the population, such as women, have not been consulted; where the number of beneficiaries is limited, and so on).	
• Avoid sites and activities that would lead to incompatible uses of land and resources, unacceptable social conflicts, value conflicts, and conflicts with respect to property rights (e.g. loss of subsistence territory and displacement; between common ownership of public or ancestral lands and private ownership of products; if the benefits are not equitably distributed; between various users of the forest; between nursery owners, owners of the reforested site, other members of the community, and people passing through the area).	
• Choose species and systems in accordance with the socio-economical and technical production capacities of the communities and the characteristics of soils, climate, and natural ecosystems (e.g. consider a variety of multi-purpose and fast-growing endemic, culturally significant and/or locally adapted species, water and nutrient requirements, space requirements, symbiotic species, vulnerability, maintenance requirements, origin, possibilities of invasion by exotic species, fires in the area, and so on).	
• Promote multiple uses of trees and shrubs, and the various functions of forests and woodlands (e.g. non-timber extraction activities — fodder, fruits, medicinal plants, and so on; timber extraction activities; eco-tourism and educational purposes; intercropping; companion plants; agroforestry; taking into account the need for fuelwood/charcoal and the workload of women, and so on).	
• Integrate environmental conservation and restoration measures (e.g. if there are extraction activities, ensure that an integrated, responsible, and long-term sustainable management plan, including regeneration aspects and silviculture practices, exists for the wooded area; promote biological and equitable certification of products based on recognized certification mechanisms or programs; promote partnerships and networking through model forest management; minimize the use of chemical inputs; promote the optimization of ligneous debris; restore already barren or degraded lands; ensure that storage and transportation include environmental considerations, and so on).	
• Ensure international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas and species, water quality, occupational health and safety, chemical inputs).	

FORESTRY AND THE ENVIRONMENT (cont'd)

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Biodiversity loss and soil degradation (e.g. erosion, compaction, changes in drainage, fertility, water-holding capacity). Soil degradation is a problem particularly where soils are fine or weak, or have complex drainage and fertility cycles. Heavy precipitation and activities on or around steep slopes also present issues. In many cases, soil erosion can be associated with increased sedimentation in waters.	• Promote sustainable forestry and silviculture based on land-use capacity and vocation, and choose species and their management/harvesting in accordance with the carrying capacity of ecosystems (i.e. what an ecosystem and its components can sustain without compromising their growth, regeneration, and roles in ecological regulatory functions). • Ensure the protection of natural forests and conserve vegetation on steep slopes and fragile soils. • Avoid inappropriate monoculture systems. • Promote multi-purpose systems and fast-growing endemic, culturally significant and/or locally adapted species. • Promote intercropping, companion planting, and agroforestry. • Rejuvenate soils through the use of compost (proper design, siting, training, fencing, and aeration are required to avoid pollution and nuisances). • Plan harvesting activities outside of extreme seasons. • Implement anti-erosion structures and use techniques such as bunding or mulch to control erosion and enhance water infiltration. • Promote selective, sustainable, and careful harvesting of trees in small, unconnected blocks to minimize exposed soils and enhance opportunities for natural regeneration from adjacent forest, and respect the mosaic and diversity of the wooded area.

FORESTRY AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	• Avoid soil salinization from groundwater use that exceeds its recharge rate and from improper irrigation practices (see irrigation, water supply, and sanitation sectoral tools). • Avoid improper use of heavy machinery and use low-impact equipment and methods for management and harvesting. • Minimize skid trail distances, construct tracks during the dry season, keep road gradients low but sufficient for natural drainage, locate access roads far away from vulnerable areas, leave vegetated strips along roadsides, and reseed or revegetate disturbed areas (see rural roads sectoral tool).
Degradation of surface water and groundwater quality and quantity (see irrigation, water supply, and sanitation sectoral tools, if relevant).	• Promote water conservation practices (e.g. consider availability and renewal of water, other uses, and so on). • Use species adapted to the local climatic, soil, and water characteristics. • Ensure chemical inputs, such as fertilizers, pesticides, and other dangerous products, are appropriately used (see next item for details).
Environmental degradation, as well as human health sensitivities, associated with chemical inputs such as fertilizers, pesticides (e.g. herbicides, insecticides, fungicides, and so on) and other chemical or dangerous products.	• Promote composting and use the adequate fertilizer for the species and the type of soil (excessive and long-term use of nitrogen fertilizers can lead to soil acidification, particularly in tropical regions). • Minimize pesticide input by using physical and biological alternatives to these dangerous products (e.g. traps, bait, weeding, crop rotation, companion planting, natural enemies, attractants or repellents, and so on). • Promote the study of pests, their abundance, habitats, life cycle and resistance to pesticides (resistance can be due to excessive, repeated application of broad-spectrum and other pesticides). • Promote efforts to manage pests, rather than eliminate them, and promote the principles of integrated pest management. • Avoid broad-spectrum pesticides (which can lead to pest resistance and the elimination of beneficial non-target organisms; species-specific pesticides with a short active period can offer alternatives) and pesticides that can lead to bioaccumulation of toxic products in the food chain (concentration in fats, particularly in carnivores). • Do not use banned or unauthorized pesticides. • Apply fertilizers and pesticides at the correct time, in correct amounts, and with appropriate equipment and measures (e.g. overalls, gloves, glasses, masks, ear plugs, and so on). • Do not apply any type of chemical product too close to steep slopes, streams, other water bodies, and drinking water sources. • Do not wash any type of chemical product container in water bodies or drinking water sources, and do not use any type of chemical product container for storing food or water.

FORESTRY AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	• Ensure that phytosanitary labels and chemical labels, on leakproof containers with covers in secured storage areas, are understood and contextually relevant. • Implement a training program in the safe and rational storage, handling, use, and disposal of all types of chemical products that may be used (e.g. fertilizers, pesticides, lubricants, oil, fossil fuels, glues, varnishes, preservation products, and so on).
Nuisances, environmental degradation, and risks of accidents or risks to health and occupational safety, depending on the possible extraction activities.	• Implement an environmental training program on the importance of integrated, responsible, and long-term management (including regeneration aspects) of forests and woodlands. • Ensure that the intensity and characteristics of harvesting respect the carrying capacity of local ecosystems, that is, what an ecosystem and its components can sustain without compromising their growth, regeneration, and roles in ecological regulatory functions.
For example, if a mobile sawmill is planned, proper siting (i.e. away from vulnerable or valued areas) is essential, as are environmentally friendly harvesting, erosion control, the optimization of ligneous debris, nuisance control, alternative energy sources, proper maintenance, and accident preparedness.	• Promote environmental awareness and training in the safe and appropriate maintenance and use of extraction equipment. • Implement pollution prevention or control devices to limit the harmful effects of pollutants (liquid, solid or atmospheric) and of nuisances (dust, noise, and vibrations). • Implement proper cleanliness, maintenance, accident, spill, overheating, fire and/or explosion control measures.

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	

FORESTRY AND THE ENVIRONMENT (cont'd)

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Liquid effluent and receiving water quality (e.g. nutrients, chemicals, suspended sediments, transparency); soil quality (e.g. fertility, texture, chemicals); surface water flows and groundwater table levels in area; rate of water use; rate of increase in mixed vegetative cover; net rate of increase in forest cover (through natural regeneration and/or tree planting); degree of biodiversity in the watershed (number of species and an appreciation of their populations); extent of critical habitats (in hectares, for example); number of persons trained in environmental issues and responsible forest management; and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease (associated with chemical inputs); incidence of accidents or fires, and so on.*	

CROP PRODUCTION AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for crop production or optimization initiatives. Please note that agro-processing activities are associated with other specific environmental concerns. This document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over existing or planned land uses, activities, and infrastructures (both "legal" and "illegal") may arise.
- Conflicts over surface or groundwater supplies (e.g. increased irrigation in certain areas at the expense of others; increased use of chemical inputs or manure that may pollute water sources) may arise.
- Activities may negatively affect community land use/management practices and relationships.
- Agricultural activities involving improved or new, more sophisticated technologies may also disrupt ways of life, social organization, and accentuate social inequalities. In fact, introduction of new technologies may not be afforded and adopted by the poorest households or communities, or may eliminate work opportunities.
- Activities involving the use of water through irrigation infrastructures may negatively affect community water management practices and relationships.
- Agricultural activities involving fertilizers, pesticides (such as herbicides, insecticides and fungicides) and the creation of stagnant water ponds may lead to human health sensitivities, as well as water-borne diseases and infections.

How can these activities affect the natural environment?

- Soil degradation, erosion, loss of fertility, and pollution by chemical inputs may arise.
- The quality and quantity of surface water and groundwater may be degraded.
- The health of aquatic and terrestrial ecosystems may be negatively affected (e.g. loss of biodiversity; deforestation; desertification; degradation of marginal lands, coastal areas, wetlands, and so on).

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

CROP PRODUCTION AND THE ENVIRONMENT (cont'd)

B. How can siting, planning, and design be environmentally responsible?

> By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the population density in relation to available arable lands and to the degraded soils.	
• Avoid siting close to vulnerable sites or sites of economic, ecological, cultural, archaeological or historical importance (e.g. water bodies, waterways, slopes, wooded areas, wetlands, coastal areas, desert areas, biodiversity hotspots, habitats of endangered species, and so on).	
• Avoid unacceptable changes in ways of life and cultural characteristics (e.g. where traditional practices would be disrupted by the introduction of "modern" production techniques, and so on).	
• Avoid sites and activities that would lead to unacceptable population displacements and/or loss of territory (e.g. migrations, expropriations, eviction of tenants or squatters, effects on Aboriginal peoples, and so on).	
• Avoid sites and activities that would accentuate social inequalities (e.g. cases where specific groups of the population have not been consulted; where the number of beneficiaries is limited; where there would be an increase in women's workload; where women are limited in their choice of arable land or are restricted to subsistence activities or low-income processing activities, and so on).	
• Avoid sites and activities that would lead to incompatible uses of land and resources, unacceptable social conflicts, value conflicts, and conflicts with respect to property rights (e.g. between industrial and agricultural areas, between common ownership of public or ancestral lands and private ownership of agricultural products, between producers and breeders, and so on).	
• Choose technologies and plant crops in accordance with aims of food security, the socio-economic and technical production capacities of the communities, and the characteristics of soils and natural ecosystems (e.g. consider water and nutrient requirements, growth rate, space and maintenance requirements, range and depth of root system, symbiotic species, vulnerability to climate and insects, accumulation and reaction to toxins, origin, seed treatment, and so on).	
• Promote land use optimization (e.g. land use for multiple purposes such as agro-silvi-pastoral or agroforestry systems; planting live fences; combining fruit trees, nitrogen-fixing plants, or medicinal plants and vegetable crops; reducing pressure and encouraging revegetation of degraded and marginal areas, and so on).	
• Integrate environmental conservation and restoration measures (e.g. pests study, erosion control, tree planting, water conservation, perennial crops along contour lines, green fertilizers and soil amendment, intercropping, rotations, windbreaks, integrated use of chemical inputs, and so on).	
• Ensure that international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas, agriculture, water quality, occupational health and safety, pesticides).	

CROP PRODUCTION AND THE ENVIRONMENT (cont'd)

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Human health sensitivities to water-borne diseases and infections.	• Avoid creating stagnant water ponds.
Ecosystem and soil degradation (e.g. erosion, compaction, changes in drainage, fertility, water-holding capacity, and so on). Soil degradation is a problem particularly where soils are fine or weak, or have complex drainage and fertility cycles. Heavy precipitation and activities on or around steep slopes also present issues. In many cases, soil erosion can be associated with increased sedimentation in waters.	• Minimize vegetation clearing. • Avoid overly frequent soil tillage, inappropriate burns, and improper clearing techniques. • Avoid improper use of heavy machinery. • Avoid monoculture systems and annual field crops on vast areas which expose soils to risks of erosion. • Avoid use of groundwater that exceeds its recharge rate and avoid improper irrigation practices (see irrigation, water supply, and sanitation sectoral tools). • Choose the quantity and spacing of species in accordance with the carrying capacity of soils. • Rejuvenate soils through the use of agricultural residues, compost, or green fertilizers; for composting activities, proper design, siting, training, fencing, and aeration are required to avoid pollution by run-off and to avoid nuisances (e.g. odours, vermin, and so on). • Create fallow lands, multiple purpose systems / locally adapted diverse crops, crop rotation, intercropping, and companion planting. • Plant live fences, windbreaks, fruit trees, nitrogen-fixing plants and implement anti-erosion structures (e.g. side hill ditches, diversion structures, gully plugs, small-scale contouring or terracing, and so on). • Plan harvesting activities outside of extreme seasons.

CROP PRODUCTION AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
Degradation of surface water and groundwater quality and quantity (see irrigation, water supply, and sanitation sectoral tools, if relevant).	• Promote water conservation practices and appropriate technologies that minimize water needs and reduce water loss (e.g. consider availability and source of water supplies, groundwater recharge rate, other uses by the community, and so on). • Use crops that are adapted to local climatic, soil, and water characteristics. • Ensure that chemical inputs, such as fertilizers and pesticides, and organic inputs are appropriately used (see next item for details).
Soil and water degradation, as well as human health sensitivities, associated with chemical inputs such as fertilizers and pesticides (including herbicides, fungicides, parasiticides, insecticides, and so on) and with organic inputs (such as manure).	• Promote and provide training in organic agriculture and the appropriate use of organic inputs. • Minimize chemical inputs by using physical and biological alternatives to these dangerous products (e.g. traps, bait, weeding, crop rotation, companion planting, natural enemies, attractants or repellents, and so on). • Promote the study of pests, their abundance, habitats, life cycle, and resistance to pesticides (resistance can be due to excessive, repeated application of broad-spectrum and other pesticides). • Promote efforts to manage pests rather than eliminate them, and promote the principles of integrated pest management. • Avoid broad-spectrum pesticides (which can lead to pest resistance and the elimination of beneficial non-target organisms; species-specific pesticides with a short active period can offer alternatives) and pesticides that can lead to bioaccumulation of toxic products in the food chain (concentration in fats, particularly in carnivores). • Do not use banned or unauthorized pesticides. • Use the appropriate fertilizer for the crops and in accordance with the type of soil (excessive and long-term application of nitrogen fertilizers can lead to soil acidification, particularly in tropical regions). • Apply organic inputs, fertilizers, and pesticides at the correct time (before field crops are planted for fertilizers, and when the study of pest abundance warrants it for pesticides; avoid windy conditions), in correct amounts, and with appropriate application measures. • Do not apply organic or chemical inputs too close to steep slopes, streams, ponds, other water bodies, and drinking water sources —besides health and pollution risks, this can also lead to the eutrophication of water bodies (i.e. when organic material accumulate and there is a proliferation of algae and/or other aquatic plants and bacteria at the water's surface, thus depleting oxygen in deeper waters), subsequent imbalances in aquatic ecosystems, and problems with the availability of quality water supplies. • Do not wash chemical product containers in water bodies or drinking water sources. • Do not use chemical product containers for storing food or water.

CROP PRODUCTION AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	• Promote the use of protective clothing (e.g. overalls, gloves, glasses, masks, and so on). • Ensure that phytosanitary labels are understood and contextually relevant. • Promote environmental awareness and training in the safe and rational storage, handling, use, and disposal of chemical products.

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

CROP PRODUCTION AND THE ENVIRONMENT (cont'd)

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Liquid effluent and receiving water quality (e.g. nutrients, chemicals, salinity, pH, transparency, and so on); soil quality (e.g. fertility, texture, chemicals, and so on); surface water flows and groundwater table levels in area; rate of water use; qualitative appreciation of the productivity of aquatic environments receiving liquid waste; rate of vegetation clearing or deforestation; rate of increase in mixed vegetative cover; number of farmers trained in environmental issues (such as pesticide use); ratio of surface areas where pesticides are used; number of farmers applying organic farming practices; and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease (associated with chemical inputs and water-borne diseases); improvements in balanced diets; and so on.*	

ANIMAL HUSBANDRY AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for animal production and management initiatives (involving cattle, poultry, goats, sheep, hogs, camels, wild animals, and so on), using confined, fixed, or transhumance systems. Please note that animal processing activities are associated with other specific environmental issues. This document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over existing or planned land uses, activities and infrastructures (both "legal" and "illegal") may arise.
- Conflicts over surface or groundwater supplies (e.g. increased water use for herds in certain areas at the expense of other areas or uses; pollution of soils and water sources with manure) may arise.
- Activities may negatively affect community land use/management practices and relationships.
- Activities involving the use of water may negatively affect community water management practices and relationships.
- Cultivating feed involving fertilizers, pesticides (such as herbicides, insecticides, and fungicides), and the creation of stagnant water ponds may lead to human health sensitivities, as well as water-borne diseases and infections.
- Animal pests (such as ticks) and diseases (e.g. trypanosomiasis, brucellosis, anthrax, fevers, and so on) may also lead to human health sensitivities.

How can these activities affect the natural environment?

- Soil degradation, erosion and compaction may arise.
- The health of terrestrial ecosystems and of wildlife may be negatively affected, especially if soil denudation, vegetation degradation and/or desertification occur as a result of overgrazing, or if activities lead to a displacement or reduction in wildlife and/or biodiversity. Inappropriate livestock species in fragile ecosystems also present risks of degradation (e.g. raising sheep in semi-arid areas of slow vegetation regeneration, since sheep pull grasses out by roots).
- The quality and quantity of surface water and groundwater may be degraded by organic wastes and liquid effluents; the health of aquatic ecosystems may also be negatively affected.

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

ANIMAL HUSBANDRY AND THE ENVIRONMENT (cont'd)

B. How can siting, planning, and design be environmentally responsible?

> By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the herd's population composition and density in relation to human population density, wildlife characteristics, available arable lands, and the land to be rehabilitated.	
• Avoid siting close to vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. water bodies, waterways, slopes, wooded areas, coastal areas, arid and semi-arid areas, wetlands, biodiversity hotspots, habitats of endangered species, and so on).	
• Avoid unacceptable changes in ways of life and cultural characteristics (e.g. the settling of nomad populations without considering the benefits and cultural values associated with the adaptive strategy of livestock transhumance, and so on).	
• Avoid sites and activities that would lead to unacceptable population displacements and/or loss of territory (e.g. migrations, expropriations, eviction of tenants or squatters, effects on Aboriginal peoples, and so on).	
• Avoid sites and activities that would accentuate social inequalities (e.g. cases where specific groups of the population have not been consulted; where the number of beneficiaries is limited; where women or the poorest families are restricted to remote, low-productivity pasture land, and so on).	
• Avoid sites and activities that would lead to incompatible uses of land and resources, unacceptable social conflicts, value conflicts, and conflicts with respect to property rights and land tenure (e.g. between users and owners of water sources and plants; between farmers and livestock breeders; between nomadic herders, sedentary breeders, and hunters; between the various uses of livestock; between common ownership of lands and private property, and so on).	
• Choose herd species, population, and production systems in accordance with the socio-economic and technical production capacities of the communities and the characteristics of lands, climate, and the carrying capacity of ecosystems (e.g. consider water and nutrient requirements in relation to seasonal availability; growth rate; reproduction rate; possible use of antibiotics, hormones and vaccines; soil and plant vulnerabilities to various types of browsers; spatial and temporal distribution of vegetation; competition and predation; the positive aspects of plant/herbivore relationships, such as seed dispersal and germination).	
• Promote land use optimization (e.g. land use for multiple purposes such as agro-silvi-pastoral systems that involve, for instance, using manure as fertilizer, combining forage crops and multi-purpose trees, using agricultural residues as livestock feed during the dry season, planting live fences, and so on).	
• Integrate environmental conservation and restoration measures (e.g. study and control of animal movements, erosion control, tree planting, water conservation, and so on).	
• Ensure international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas and species, water quality, and so on).	

ANIMAL HUSBANDRY AND THE ENVIRONMENT (cont'd)

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Human health hazards or nuisances (foul odours) by the introduction of diseases and the possible contamination of water supplies for human use by animal manure and urine.	• Keep manure and urine away from household areas and water bodies, and adequately collect and store manure for composting. • Consider using a biogas system (methane). • Avoid creating stagnant water ponds. • Implement disease control measures.
Ecosystem and soil degradation (e.g. erosion; compaction; changes in drainage, fertility, water-holding capacity, and so on) and loss of biodiversity associated with overpopulation, overgrazing, trampling, excess harvesting of fodder and forage, and removal of vegetation. Soil degradation is a problem particularly where soils are fine or weak, or have complex drainage and fertility cycles. Heavy precipitation and activities on or around steep slopes also present issues. In many cases, soil erosion can be associated with increased sedimentation in waters.	• When cultivating feed: minimize vegetation clearing; avoid overly frequent soil tillage, inappropriate burns and improper clearing techniques; avoid improper use of heavy machinery; avoid exposing soils to risks of erosion; choose the quantity and spacing of species in accordance with the carrying capacity of soils; rejuvenate soils through the use of agricultural residues, compost, or green fertilizers (for composting activities, proper design, training, fencing, and aeration are required to avoid pollution and nuisances); create fallow lands, multiple purpose systems / locally adapted diverse crops. • Use cut-and-carry feed from elsewhere. • Limit animal numbers, mix species to maximize use of forage potential and choose the size and the composition of herds according to the seasonal and temporal availability of water and plants. • Control the length of grazing time and succession of use in particular areas (rotational grazing to allow plant regrowth, use of dry-season grazing reserves, and so on).

ANIMAL HUSBANDRY AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	• Restrict animal access to unstable or fragile areas (e.g. steep slopes, degraded areas, where soils are fine or weak, or have complex drainage and fertility cycles, and so on) by defining and/or fencing off critical areas. • Promote soil erosion control measures (e.g. plant live fences or wind-breaks; promote reforestation and vegetated buffer strips; promote the reseeding of grasses; implement anti-erosion structures, such as terracing, and so on).
Degradation of surface water and groundwater quality and quantity (see irrigation, water supply, and sanitation sectoral tools, if relevant).	• Promote water conservation practices (e.g. consider availability, other uses by the community, and so on). • Develop many small-capacity water points, place them strategically to spread the effect, and control their use. • Fence off permanent water sources from animals, especially when temporary sources are available during the wet season. • Ensure that manure and chemical inputs, such as fertilizers and pesticides, are appropriately used (see next item for details).
Soil and water degradation, as well as human health sensitivities, associated with chemical inputs such as fertilizers and pesticides (e.g. herbicides, insecticides, fungicides, and so on) used to cultivate feed, or pollution by manure and organic wastes.	• Promote and provide protective clothing and equipment (e.g. overalls, gloves, glasses, masks, and so on) to minimize danger to field workers applying agro-chemicals. • Promote and provide training in organic agriculture and the appropriate use of manure. • Study pests, their abundance, habitats, life cycle, and resistance to pesticides (resistance can be due to excessive, repeated application of broad-spectrum and other pesticides). • Promote efforts to manage pests rather than eliminate them, and promote the principles of integrated pest management (e.g. by minimizing chemical inputs, when feasible). • Avoid broad-spectrum pesticides (that can lead to pest resistance and the elimination of beneficial non-target organisms; species-specific pesticides with a short active period can offer alternatives) and pesticides that can lead to bioaccumulation of toxic products in the food chain (concentration in fats, particularly in carnivores). • Do not use banned or unauthorized pesticides. • Use the appropriate fertilizer for the crops and in accordance with the type of soil (excessive and long-term application of nitrogen fertilizers can lead to soil acidification particularly in tropical regions). • Apply manure, fertilizers, and pesticides at the correct time (when the study of pest abundance warrants it for pesticides; avoid windy conditions), in correct amounts and with appropriate application measures. • Do not apply manure and chemical inputs too close to steep slopes, streams, water bodies, and drinking water sources – besides health and pollution risks, this can also lead to the eutrophication of water

ANIMAL HUSBANDRY AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	bodies (i.e. when organic material accumulates and there is a proliferation of algae and/or other aquatic plants and bacteria at the water's surface, thus depleting oxygen in deeper waters), subsequent imbalances in aquatic ecosystems, and problems with the availability of quality water supplies. • Do not wash chemical product containers in water bodies or drinking water sources, and do not use chemical product containers for storing food or water. • Ensure that phytosanitary labels are understood and contextually relevant. • Implement a training program in the safe and rational storage, handling, use, and disposal of chemical inputs.
Adverse effects on wildlife, such as loss of habitat, disruption of migratory stop-over points, competition, increased poaching and killing, and the introduction of diseases to wildlife.	• Plan and implement range management strategies (choice of species, animal numbers, grazing areas) that minimize adverse effects on wildlife and avoid excessive competition. • Rehabilitate degraded areas nearby as wildlife habitat. • Investigate and consider management of wildlife ranching in order to protect wildlife resources. • Consider wildlife ranching, tourism, and controlled hunting as alternatives to animal production.

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	

ANIMAL HUSBANDRY AND THE ENVIRONMENT (cont'd)

Planning follow-up and monitoring questions (cont'd)	Answers for the proposed initiative (cont'd)
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Liquid effluent and receiving water quality (e.g. nutrients, chemicals, salinity, pH, transparency, and so on); soil quality (e.g. fertility, texture, chemicals, and so on); surface water flows and groundwater table levels in area; rate of water use; qualitative appreciation of the productivity of aquatic environments receiving liquid waste; rate of vegetation clearing or desertification; rate of increase in mixed vegetative cover; incidence of wildlife habitats (for example, in hectares); rate of fodder use from cultivated areas and from "natural" ecosystems; ratio of surface areas where compost/manure is applied; number of breeders trained on environmental issues; and so on.*	
• ***Human well-being indicators:*** *Incidence of human and animal illness or disease (associated with chemical inputs, diseases, pests); improvements in balanced diets; and so on.*	

IRRIGATION AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for the implementation of irrigation initiatives that include diversion of surface water, spate systems (which rely on occasional flooding of a stream or river to collect water) and/or the use of groundwater, rain-fed systems, building canals or water distribution systems, pumping stations (lift systems), small reservoirs or water catchment areas, and so on. Please note that specific sectoral tools exist for crop production and forestry initiatives. This document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over land uses and management, land tenure system, and surface or groundwater supplies (e.g. increased extraction in certain areas at the expense of others) may arise.
- Contamination of water sources by agro-chemicals or other agricultural inputs and creation of stagnant water ponds in canals, ditches, or fields may lead to health problems and the spread of water-borne diseases and infections.

How can these activities affect the natural environment?

- Soil degradation and erosion (including compaction, negative changes in drainage, permeability and/or water-holding capacity), as well as losses of soil productivity may arise (e.g. in cases of over-irrigation, poor soil drainage, and so on) and may lead to waterlogging and salinization of the soils.
- The quality and quantity of surface water / groundwater may be degraded.
- The health of aquatic and riverine ecosystems may be negatively affected (alterations to hydrology and flow and the presence of structures may have an adverse effect on the ecological regulatory functions of the aquatic and wetland ecosystems, including their capacity to dilute pollutants, and on their species, biodiversity, and ecological productivity).

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

IRRIGATION AND THE ENVIRONMENT (cont'd)

B. How can siting, planning, and design be environmentally responsible?

> By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the population density, existing practices and crops, the socio-economic and technical production capacities of the communities, as well as irrigation demands in relation to available water supply (based on current and historical data, and which may vary between seasons) and its quality.	
• Avoid siting close to vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. slopes, wooded areas, wetlands, coastal areas, biodiversity hotspots, habitats of endangered species, and so on). In areas with acid sulphate soils (such as tropical coastal mangroves), irrigation removes certain elements (cations) from the soil, and reduces nutrient availability to plants.	
• Avoid sites and activities that would lead to unacceptable population displacements and/or loss of territory and changes in ways of life and cultural characteristics (e.g. migrations, expropriations, eviction of tenants or squatters, effects on Aboriginal peoples, settling of nomads, induced uncontrolled urbanization, and so on).	
• Avoid sites and activities that would accentuate social inequalities, for example, cases where specific groups of the population, such as women, farmers, livestock producers, landowners, tenants, communal owners, "tail-enders" (i.e. users whose fields are farthest from the water source) have not been consulted; where the number of beneficiaries is limited; where there would be an increase in women's workload, and so on.	
• Avoid sites and activities that would lead to incompatible uses of land and resources and/or unacceptable social conflicts (e.g. between common ownership of public or ancestral lands and "ownership" of irrigation structures; between different types of water uses in the same area or different areas; between farmers and livestock herders; between water users upstream and downstream from water source, and so on).	
• Choose irrigation systems in accordance with the characteristics of the water supply, soils, geology, topography, and climate (e.g. consider soil texture, stability, and composition; drainage; humidity and evaporation; slope; seasonal water dynamics; if area is prone to landslides, flooding, drought, or other hazards, and so on).	
• Integrate environmental conservation and restoration measures (e.g. water conservation, multiple-use irrigation, pollution prevention structures, erosion control, tree planting, rehabilitation of watershed, and so on).	
• Ensure that international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas, surface and underground water quality, water extraction, and so on).	

IRRIGATION AND THE ENVIRONMENT (cont'd)

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Conflicts over land uses and management, land tenure system, and surface or groundwater supplies.	• Consider water conservation measures instead of, or in addition to, a new irrigation initiative, for example, by upgrading or renovating existing systems (reduce evaporation, seepage losses, and so on) and by promoting water recycling and re-use, where appropriate. • Ensure community involvement for effective planning and management of the irrigation system, and for equitable water distribution (e.g. with a community management committee, including representatives from different user groups and affected areas; volume-based user fees; upstream/downstream user agreements, and so on). • Encourage crops with lower water demands. • Locate and size irrigation systems where water availability is adequate and the initiative will not conflict with existing human, livestock and wildlife water uses (especially during the dry season), and so that withdrawals do not lead to major alterations of the surface water hydrology or exceed the groundwater recharge rate.
Human health sensitivities to agrochemicals (e.g. pesticides and fertilizers), water-borne diseases, and infections (if creating habitats in canals and ditches for disease carriers such as mosquitoes and snails responsible for spreading diseases	• Avoid creating stagnant water ponds (e.g. site and orient water works, fields, and furrows to ensure adequate natural drainage of surface water; use spigots, lined canals, and pipes; avoid unsuitable gradients; construct straight or only slightly curved canals; install gates at canal ends to allow flushing; ensure adequate sub-surface drainage of fields; avoid over-irrigation; maintain water works, and clear sediments and weeds regularly; use intermittent drying-out periods, and so on).

IRRIGATION AND THE ENVIRONMENT (cont'd)

Major adverse effects	Associated mitigation measures
such as malaria and schistosomiasis/ bilharzia), and other infections or diseases associated with the inappropriate use of irrigation canals for drinking water supply, bathing, or human waste disposal.	• Ensure alternate facilities for drinking and domestic water supply, bathing, and wastewater disposal. • Monitor disease occurrence and other public health indicators related to water-borne diseases and infections, and take corrective measures as needed (e.g. modifications to water works, education, medical action). • Implement a training program for farmers and other community members in irrigation health risks; the efficient use of irrigation water; the maintenance of irrigation and drainage works; various agro-ecological methods; proper storage, handling, use, and disposal of agro-chemicals; and integrated pest management (see crop production sectoral tool). • Avoid nutrient loading of waters and the entry of agro-chemicals and other contaminants into the system (see crop production or forestry sectoral tools, and next item for details).
Degradation of surface water or groundwater quality and quantity and its potential negative effects on the health of aquatic and riverine ecosystems. ***The International Commission on Irrigation and Drainage (ICID) offers a range of technical resources on irrigation initiatives (http://www.icid.org).***	• Promote water conservation practices (e.g. consider water availability, water recycling and re-use where appropriate, rationing during the dry season, use of control valves and reducer pipes, drip or trickle irrigation, dawn/evening sprinkler irrigation, and so on). • Limit diversion of surface waters and alterations to hydrology, as well as blockage of fish migration and fish access to spawning areas (where there are reservoirs, water releases and/or habitat improvements may be required to sustain fish populations). • Ensure irrigation system (and its reservoirs and spillways) is in line with silting patterns, flow rates, and flood cycles of the surface waters. • Avoid deterioration of reservoir water by extracting and using vegetation from the reservoir area before flooding and by avoiding entry of eroded soils and agro-chemicals. • Avoid salinization from groundwater use that exceeds its recharge rate, or from saline intrusion at the mouth of a waterway or in coastal or island areas. • Reduce possible leakage, evaporation, and seepage losses through appropriate design, installation, use, and maintenance of structures. • Protect water source from run-off or seepage of contaminants (e.g. by using lined distribution pipes, covered drains, soak-away pits) and prevent surface drainage of fields into water bodies.
Soil degradation and erosion, as well as losses of soil productivity. Soil degradation is a problem particularly where soils are fine, thin or weak, or have complex drainage and fertility cycles. Heavy precipitation and activities on or around steep slopes also present issues.	• Minimize soil exposition (minimize vegetation clearing; minimize time when soil surfaces are exposed to rain and wind; resurface and revegetate exposed areas; implement buffer zones of vegetation; promote watershed and river bank restoration; use proper bedding materials for pipes, and so on). • Implement soil protection and anti-erosion measures around the water source and the irrigation system (e.g. avoiding improper use of heavy

IRRIGATION AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	machinery; avoiding unsuitable gradients and over-irrigation; appropriate design and layout of furrows; use of sediment traps in fields and canals to capture sediment for return to fields where appropriate; reforestation and revegetation; drainage structures with cobbled stone, gravel, or concrete; small-scale terracing and other agricultural / soil moisture conservation strategies). • Avoid waterlogging of soils through the implementation of water conservation practices, adequate surface and sub-surface drainage, and lined canals or pipes (waterlogging may be due to a rise in the groundwater table caused by improper irrigation that exceeds the crops' water needs and lacks appropriate drainage measures, or to the loss of water from canals that are not watertight, or if the soil is poorly drained – for example, in clay or lateritic soils). • Avoid salinization of soils through the implementation of water conservation practices, mulching of exposed soil surfaces to reduce evaporation and the regular flushing of irrigated land (especially in arid and semi-arid areas). • Implement an operation program that controls the two previous issues.

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	

IRRIGATION AND THE ENVIRONMENT (cont'd)

Planning follow-up and monitoring questions (cont'd)	Answers for the proposed initiative (cont'd)
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Water quality (e.g. nutrients, agrochemicals, salinity, suspended sediments, and so on) in water sources and irrigation canals; reservoir oxygen levels; physical and chemical properties of irrigated soils; variations in erosion of the watershed; surface water flows and groundwater table levels in area; rate of water use; degree of biodiversity; variations in fish populations or number of fish deaths; number of persons trained in environmental issues; and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease (associated with water-borne diseases); access to irrigation water and potable water; and so on.*	

FISH FARMING AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them?
This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for fish farming and aquaculture initiatives (raising and harvesting of fish and aquatic species, such as crustaceans or molluscs, under controlled circumstances) in fresh, brackish, or salt water, and in natural and/or artificial environments. If an initiative concerns capture fisheries (harvesting of wild fish and other aquatic species in their "natural" habitats), negative effects associated with over-harvesting, by-catches, harvesting, processing, storage, and transportation techniques (including the use of motorized vessels or other boats) should be addressed. This document does not constitute an environmental assessment, but rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over existing or planned land uses, tenure, and management practices (both "legal" and "illegal", for both "private" and "communal" property or rights) may arise.
- Conflicts over surface or groundwater supplies and their management practices (e.g. increased withdrawal in certain areas at the expense of others) may arise.
- Aquaculture activities involving artificially produced seed, specially made feed, or large quantities of fish meal, antibiotics, drugs, hormones, parasiticides, herbicides, and other chemical/dangerous products, anti-fouling agents, or pesticides may lead to human health sensitivities; human health sensitivities may also be associated with water-borne diseases and infections.

How can these activities affect the natural environment?

- The quality and quantity of surface water or groundwater may be degraded. Intensive and semi-intensive aquaculture systems often require large quantities of fresh water.
- Areas supporting critical, valued, vulnerable or protected species and habitats may be degraded, encroached or destroyed. Biodiversity and endemic species of an area may thus be negatively affected (e.g. deterioration of water quality from aquaculture discharges and large concentrations of exotic species, which can escape into wild populations that are important for local ecology and food supply, may lead to the decline of aquatic habitats and resident species, including fish, amphibians, and so on). Natural aquatic and riverine environments are especially at risk (such as mangrove forests, which play important ecological roles in stabilizing coastlines, reducing storm erosion, acting as spawning and nursery areas for many aquatic species, and supporting a diverse population of plants, birds, and other land-based and aquatic animals; they also offer renewable resources for local communities).

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

FISH FARMING AND THE ENVIRONMENT (cont'd)

B. How can siting, planning, and design be environmentally responsible?

> By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Site well away from vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. protected water bodies and waterways, protected wetlands and coastal areas, swamps, lagoons, marshes, mud flats, intertidal zones, sea grass meadows, mangrove forests, biodiversity hotspots, habitats of endangered species, coral reefs, shellfish beds, and so on).	
• Avoid unacceptable changes in ways of life and cultural characteristics (e.g. cases where artisanal fishing practices would be negatively affected by the introduction of "modern" techniques, or where the positive aspects of existing environmental management methods, such as selective fishing, are not taken into account).	
• Avoid sites and activities that would accentuate social inequalities and/or would lead to unacceptable population displacements (e.g. cases where all representative groups of the population have not been consulted; where the number of beneficiaries is limited, and so on).	
• Avoid sites and activities that would lead to incompatible uses of land and resources, unacceptable social conflicts, value conflicts, and conflicts with respect to property rights (e.g. loss of subsistence territory; between various users of water, aquatic ecosystems, and resources; navigational and industrial hazards, and so on).	
• Choose species and production system in accordance with the socio-economic and technical production capacities of the communities, the quality and quantity of water sources, the climate (e.g. tropical storms, hurricanes, and so on) as well as the characteristics of existing / "natural" ecosystems (e.g. consider the characteristics of existing indigenous and exotic fish species and other species, such as abundance, age classes, life cycle, habitats, vulnerability, and so on; consider the hydrographic characteristics such as flows, renewal rates, seasonal variations and floods, waves, tides, currents; consider culturally significant and/or locally adapted species; take into account their nutrient requirements, space requirements, life cycle, vulnerability, maintenance requirements, origin, possibilities of invasion, reproduction, competition, predation, and so on).	
• Promote multi-purpose systems and the optimization of resources (e.g. appropriate re-use of pond water for agricultural irrigation, aquaculture combined with rice production, using pond bottom sludge as agricultural fertilizer, if properly decomposed and non-toxic, and so on).	
• Integrate environmental conservation and restoration measures (e.g. ensure that an integrated, responsible, and long-term management plan exists for fisheries and/or aquaculture; that there is minimal use of chemical inputs, antibiotics, drugs, and growth hormones; that wastewater is adequately treated; that already degraded areas are protected or restored; that harvesting, processing, storage, and transportation include environmental considerations, and so on).	
• Ensure that international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas and species, water quality, health and safety, chemical inputs, and so on).	

FISH FARMING AND THE ENVIRONMENT (cont'd)

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Conflicts over existing or planned land uses, land tenure, and the associated management practices as well as conflicts over surface or groundwater supplies, and the associated management practices.	• Consider protection and restoration of natural habitats and fisheries instead of "artificial" means of production or the introduction of new species. • Encourage the use of existing cleared land, depressions, hollows, and ditches to create artificial ponds. • Limit areas converted to ponds, as well as surface area of ponds and enclosures. • Avoid premature abandonment and digging of new ponds by optimizing the design, construction, and maintenance of the planned production system. • Locate and size production systems where water availability is adequate (also keep in mind the possible effect of the environment on the initiative, such as climate, pollution, degradation, existing species) and the initiative will not conflict with existing various water uses (especially during the dry season and/or downstream), and so that water withdrawals do not lead to major alterations of the surface water hydrology or exceed the groundwater recharge rate (in coastal areas, excessive groundwater extraction can also lead to salinization of the aquifer and land subsidence). • Combine water uses and promote water conservation practices, recycling, and re-use, where appropriate (e.g. appropriately treated pond water used for irrigation of crops; consider the availability and source of water supplies, groundwater recharge rate, other uses, and so on). • Ensure community involvement for effective planning, operation, and management of the production system.

FISH FARMING AND THE ENVIRONMENT (cont'd)

Major adverse effects	Associated mitigation measures
Environmental degradation, as well as human health sensitivities, associated with artificially produced seed, large quantities of fish meal, antibiotics, drugs, hormones, parasiticides, herbicides and other chemical / dangerous products, anti-fouling agents or pesticides, as well as with water-borne diseases and infections.	• Assess ecology of water-borne disease vectors. • Ensure good drainage around water supply, ponds, and drainage works. • Promote the use of filter feeders and species that feed on disease vectors. • Monitor disease occurrence and other public health indicators related to water-borne diseases and infections, and take corrective measures as needed (e.g. physical changes to structures, education, medical action). • Ensure adequate water quality, e.g. ensure chemical inputs, antibiotics, drugs, growth hormones, and other dangerous products are appropriately chosen, used, and stored (see next item for details).
Degradation of surface water and groundwater quality and quantity. ***Keep in mind that molluscs are particularly vulnerable to biocides, leachates, metals, and pesticides.*** ***For saline brackish ponds, choose land with average elevation that can be watered by ordinary high tides and drained by ordinary***	• Promote water conservation practices. • Keep species densities in enclosures and ponds at moderate levels. • Line bottoms and sides of ponds, levees, and canals with impervious material; and design the structures to prevent overflow discharges, and storm and flood damage. • Avoid deterioration of pond water by extracting and using vegetation from pond area before flooding, where applicable. • Ensure training in the safe and rational storage, handling, use, and disposal of all types of chemical products that may be used (including fuel and oil for boats). • Do not use banned products, and minimize the use of chemical inputs, antibiotics, drugs, hormones, and so on (use such inputs only when required, for example, to control an outbreak rather than on a routine preventive basis, in correct amounts and with safe application measures; promote the integrated management of pests; dig ponds deep enough to control weed growth). • Avoid broad-spectrum pesticides (that can lead to pest resistance and the elimination of beneficial non-target organisms) and substances that can lead to bioaccumulation of toxic products in the food chain (concentration in fats, particularly in carnivores). • Ensure that chemical labels on leakproof containers with covers in secured storage areas are understood and contextually relevant. • Use quality feed with low waste generation; use feed of the appropriate size for the age of the stock; feed the right amounts at the right time; distribute feed evenly; and use feed pellets designed to float longer in the water column. • Maintain water quality firstly with aeration or other destratifying methods, sustainable stocking rates, controlled feeding rates and minimal chemical inputs, and secondly, with water exchanges. • Release pond water into water body with adequate dilution and dispersal capability and after adequate settling and/or treatment. • Time water releases with period of high water levels or flows (areas of high currents tend to minimize waste accumulation through dispersal; currents and tides also help replenish oxygen levels; in the case of saline ponds, discharges should take place in deep water with high currents,

FISH FARMING AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
low tides. Tidal fluctuation should be moderate, between 2 and 3 m. Areas with tidal fluctuations of 1 m or less, cannot be properly drained or filled. Sites with tidal fluctuations above 4 m require very large, expensive dikes to prevent flooding during high tide.	not in intertidal zones or freshwater) and use shorter retention time of water (to avoid high concentrations of residues, decreases in oxygen, and increases in water temperature). • Avoid an increase in sedimentation and/or eutrophication (including toxic algal blooms) caused by the high input of particles, wastes and changes in the nutrient cycle generated by high stock concentrations, longline cultures of crustaceans, and certain structures such as floats and piers (e.g. periodically move enclosures to different locations; manage stock wastes through bag systems, fallowing, vacuuming, or harrowing, where appropriate). • Alternate freshwater ponds, where appropriate, and allow ponds to dry out, lie fallow, or grow a crop to reduce the need for sludge and nutrient removal.
Degradation of natural environments and associated biodiversity loss.	• Ensure protection of natural habitats and species (e.g. enhance or protect other nearby habitats to offset possible losses at the site of the initiative; leave the most productive mangroves intact; site ponds on the landward side of mangroves; avoid disturbing water flows to and from wetlands; avoid inappropriate stake or longline cultures that slow water movements and cause a subsequent accumulation of sand; limit diversion of surface waters and alterations to hydrology as well as blockage of migration, feeding, spawning, and nursery areas with piers or floats; ensure that the production system is in line with silting patterns, flow rates, tidal movements, currents, and flood cycles of the surface waters; situate ponds away from tidal areas subject to flooding; avoid shallow waters and areas with aquatic vegetation; consider double nets or other techniques to avoid predation by birds and aquatic species; choose a size of net mesh that will prevent entanglement of wild species; use properly tensioned net pen lines, thick ropes or protective netting and weights to avoid entanglement of wild species; avoid abandoned lines, nets, cages, traps, and so on). • Avoid large-scale aquaculture systems. • Choose species and their management/harvesting in accordance with the carrying capacity of ecosystems (i.e. what an ecosystem and its components can sustain without compromising their growth, regeneration, and roles in ecological regulatory functions) and while respecting the mosaic and diversity of the area. • Use hatchery stock where possible. • Promote the use of locally adapted species, indigenous species and/or culturally significant species rather than introduced species as stock (use non-native species only where escape is impossible) and consider cultivating herbivorous species. • Avoid loss of ground cover and erosion (restrict area cleared; construct ponds during dry season; stabilize exposed soil with indigenous vegetation; avoid fragile, thin, or unstable soils and slopes; ensure good drainage

FISH FARMING AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
If local fuelwood is used to dry fish, ensure its integrated and sustainable management and consider a complementary community forestry initiative (see appropriate sectoral tool). If other sources of energy are used, implement air pollution control measures and consider renewable or alternative energy sources.	and erosion control around ponds; promote buffer zones near shores exposed to wave action; use low impact equipment and methods for management, harvesting and transportation; take into account climatic conditions, and so on). • Choose sites with soils that will retain water and be suitable for building dikes (clay-loam or sandy-clay soils, preferably); soils should be alkaline (acidic organic soils are not suitable). • Ensure stock is kept healthy (isolation of diseased individuals may be required) and confined (with screens at the entrances and exits of structures). • Ensure environmental training in the importance of integrated, responsible and long-term management as well as in safe and appropriate harvesting, processing, storage, and transportation methods (including proper cleanliness, waste management, maintenance, accident and spill prevention, and emergency response). • Implement pollution prevention or control measures to limit pollutants, nuisances, and risks of accidents or to health and occupational safety associated with cultivating, harvesting, processing, storage, and transportation.

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	

FISH FARMING AND THE ENVIRONMENT (cont'd)

Planning follow-up and monitoring questions (cont'd)	Answers for the proposed initiative (cont'd)
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Water quality in pond drainage and/or effluents (e.g. nutrients, chemicals, suspended solids, transparency, turbidity, salinity, oxygen, and so on); surface water flows and groundwater table levels in area; rate of water use; degree of biodiversity in the aquatic and riverine habitats (e.g. number of species and an appreciation of their populations); extent of critical habitats; number of persons trained on environmental issues and responsible aquaculture management; and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease (associated with chemical inputs and water-borne diseases and infections); and so on.*	

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT

How can possible environmental effects be identified? What measures can be used to deal with them? *This sectoral tool provides an outline that can be used to identify the major, potential, adverse environmental effects, associated mitigation measures, and guidelines, as well as environmental indicators, for small-scale or community-based solid waste management initiatives, including reduction of wastes at source, collection, sorting, storage, reclamation (re-use, composting, and recycling), and elimination or final disposal. In developing countries, approximately 70 percent of all solid wastes are organic in origin and can therefore be composted. This sectoral tool also includes information relevant to solid healthcare/biomedical wastes, which are dangerous and therefore entail more specific measures. Please note that this document does not constitute an environmental assessment but is rather a tool to assist you in completing such an assessment. Further, the aim is not to provide an exhaustive account of all situations. Before using this sectoral tool, it is best to have identified all the activities involved. Decision-making is based on a comparison of an initiative's possible benefits and negative effects.*

A. What are the major environmental concerns?

How can these activities affect the human environment?

- Conflicts over existing or planned land uses, activities, and infrastructures (both "legal" and "illegal") may arise.
- Nuisances (e.g. noise, foul odours, airborne dust, traffic), health risks (transmission of diseases), and risks of accidents may arise.

How can these activities affect the natural environment?

- Soil degradation (affecting its stability, structure, drainage characteristics, and so on) and erosion may arise.
- Degradation of ecosystems and habitats may occur, especially if soil denudation or vegetation clearing takes place.
- Water quality (both surface and underground waters) may be degraded and the health of aquatic ecosystems may thus be negatively affected through increased sedimentation, eutrophication, and the possible run-off of wastes.

Notes:
Using the points above as a guide, describe the major environmental sensitivities or areas of concern relating to the proposed initiative.

B. How can siting, planning, and design be environmentally responsible?

By addressing such concerns early in the initiative's cycle, they will have better chances of success and long-term sustainability, help to prevent negative outcomes, and avoid rehabilitation costs.

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT (cont'd)

The following guiding principles are useful to avoid adverse environmental effects associated with siting, planning, and design. *You can check the items that are relevant to the proposed initiative.*

• Take into account the population density, the characteristics of land occupation and uses (e.g. proximity of residences), the existing solid waste management practices (integrate informal reclamation/re-use and recycling/composting), the socio-economic and technical production capacities of the communities, as well as soil characteristics (stability, texture, drainage, permeability, and so on), proximity to water bodies, topography, climatic conditions when selecting the solid waste management site and designing the system.	
• Take into account the nature and quantities of the solid wastes to be managed (by category, such as organic and compostable, hazardous, recyclable, and so on) when designing the solid waste management system, and ensure separate collection, treatment, and disposal of hazardous wastes.	
• Avoid siting in areas prone to natural disasters or hazards (flooding, heavy rain, intense storms, earthquakes, landslides, and so on).	
• Avoid infringing on vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. water bodies, waterways, slopes, wooded areas, coastal areas, wetlands, biodiversity hotspots, habitats of endangered species, floodplains, and so on).	
• Avoid unacceptable changes in ways of life and cultural characteristics (e.g. for indigenous populations, uncontrolled and unplanned human settlements, and so on).	
• Avoid sites that would accentuate social inequalities (e.g. the selection of a solid waste elimination and/or reclamation site in poorer urban marginal areas without the prior consultation and involvement of residents) and/or would lead to unacceptable population displacements (e.g. as a result of the nuisances associated with a solid waste elimination site or the appropriation of this site, migrations, expropriations, eviction of tenants or squatters).	
• Avoid sites that would lead to incompatible uses of land and resources, unacceptable social conflicts, value conflicts, and conflicts with respect to property rights and land tenure, as well as unacceptable changes in the visual quality (aesthetics) of the landscape and in the value of neighbouring properties (interference with other services, residences, tourist attractions; related to odours, noise, and traffic; between land owners and tenants or squatters, and so on).	
• Integrate environmental conservation and restoration measures (e.g. erosion control; tree planting; restoration of degraded sites; creation of buffer zones; promotion of waste reduction, reclamation/re-use, recycling/composting, and so on).	
• Ensure that international and national/local policies, standards, and regulations are respected (e.g. siting, design, and operation of solid waste facilities; hazardous and toxic wastes; land use; protected areas; health and safety standards; water quality standards, and so on).	

Notes:
How will the checked items be taken into account? Are there other guiding principles or practices that apply to the proposed initiative?

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT (cont'd)

C. What are the major potential adverse environmental effects? What can be done to mitigate or avoid them?

Mitigation measures are measures that effectively control, eliminate, or significantly reduce an initiative's adverse environmental effects. Not all the measures identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen mitigation measures can be underlined in the following table. When documenting the chosen mitigation measures, it is pertinent to provide details about how they will be achieved (e.g. limit vegetation clearing to a minimal pathway).

Major adverse effects	Associated mitigation measures
Conflicts over existing or planned land uses, activities, and infrastructures.	• Ensure community involvement in locating and preparing the initiative's sites and access routes, as well as in developing responsibilities for managing the initiative's operations (including possible collection fees). • Design the initiative to provide alternatives for affected individuals (e.g. local employment, alternate livelihoods, and so on).
Nuisances (e.g. noise, foul odours, airborne dust, traffic), health risks (transmission of diseases), and risks of accidents. See appropriate sectoral tool (rural roads) for more details on access roads.	• Plan site preparation/construction activities and operations according to a schedule compatible with the climate and the population's activities. • Locate solid waste management site(s) well away from and downwind of human settlements and vulnerable areas. • Promote environmental training, health and safety training, as well as the use of adequate protective clothing and equipment (e.g. masks, overalls, resistant gloves, boots with thick soles, and so on). • Prevent access to solid waste management site(s) by unauthorized persons and wildlife (through vigilance, control of incoming and outgoing traffic, warning signs, and security fences). • Minimize the handling of waste and quantities of waste to be disposed of; ensure adequate solid waste segregation; and maximize containment. • Provide specific and regularly cleaned and maintained enclosed collection vehicles or carts (with tarpaulin covers), and ensure collection is sufficiently frequent (in line with quantities and climate). • Provide specific enclosed areas for vehicle unloading and refuse sorting (for recovery/re-use and recycling/composting); ensure good ventilation, dust suppression, ground impermeability, and worker protection, as well as accident and emergency preparedness; and avoid excessive traffic. • Ensure adequate composition, aeration, and maintenance of compost. • Study disease carriers and monitor disease occurrence and other public health indicators, and take corrective measures as needed. • For solid waste landfills: spread and compact adequately sorted incoming refuse, and cover with soil, daily; provide for safe ventilation,

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	recovery, and treatment of decomposition gases (such as methane, which is a product of decomposition and is explosive), and consider their possible use as an alternative energy source (biogas). • For solid waste incinerators: install appropriate, effective equipment for complete combustion and air pollution control (air filters or scrubbers), while ensuring that only wastes adequate for incineration are burnt (e.g. pressurized containers, halogenated plastics – PVCs, tires, and wastes containing heavy metals are not to be incinerated).
Ecosystem and soil degradation (e.g. erosion, compaction, changes in drainage, and so on) may occur. Soil degradation is particularly a problem where soils are fine or weak, or have complex drainage cycles. Heavy precipitation and steep slopes also present issues.	• Ensure training in soil degradation control and implement appropriate erosion control measures during site preparation (e.g. minimize time of exposure of areas cleared or excavated, especially during rainy and windy periods; stabilize and revegetate disturbed areas; when stockpiling soil, promote the creation of small mounds; implement buffer zones of vegetation; install adequate surface drainage control measures, and so on). • Maintain erosion and drainage control during operations. • Minimize vegetation clearing. • Avoid inappropriate use of heavy machinery.
Degradation of water quality.	• Ensure training in environmental issues, solid waste management, as well as health and safety topics (including site preparation/construction, operations, proper cleanliness and hygiene practices, first-aid measures, protective clothing and equipment, maintenance, waste segregation, collection, storage, transportation, treatment, disposal, accident and emergency response, reporting, as well as proper closure and restoration), and raise community awareness of the importance of waste reduction, recovery/re-use and recycling to reduce waste disposal requirements and extend the life of disposal sites. • Promote reduction of wastes at source as well as waste segregation to enable the re-use of certain products, recycling of other products, composting of biodegradable wastes (for example through vermiculture of vegetable food waste) and appropriate collection, storage, transportation, treatment, and disposal of other wastes. • Implement pollution prevention or control devices to limit the harmful effects of pollutants (for example, drainage and surface run-off systems), as well as leachate recovery and treatment systems (leachate is the soluble portion of decomposing solid wastes and may be treated through physical, chemical, or biological means, for example, with a sewage treatment facility, recirculation that sprays leachate from the bottom of the landfill onto its surface, evaporation of leachate through a series of open ponds or lagoons, and so on). • For solid waste landfills: siting where the underlying soils are relatively impermeable and have a high capability for containing contaminants (e.g. clays); siting well above the underground water table and where topography is relatively flat; use a landfill liner/sealer (e.g. clay or

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT (cont'd)

Major adverse effects (cont'd)	Associated mitigation measures (cont'd)
	geosynthetic) if leachate risks entering groundwater; siting well away and down gradient from surface waters and groundwater recharge areas or sources (according to the distance required to promote the receiving water's capability for dilution and dispersal of potential contamination); install test well(s) at landfill perimeter, and monitor water quality during operations, for early identification and mitigation of emerging adverse effects. • Ensure separate collection, storage, transportation, treatment, and disposal of hazardous wastes (e.g. biomedical, heavy metals, tires, oil, batteries, paint, solvents, acidic solutions, and so on).

Biomedical Wastes From Small-Scale Health Care Initiatives and Their Major Environmental Issues

- Biomedical wastes must be segregated first from "regular" wastes and then according to the following categories: 1) non-sharp infectious waste (such as laboratory cultures and objects contaminated by blood or body fluids); 2) pathological waste (such as human body parts, blood, and body fluids); 3) sharp infectious waste (such as needles, scalpels, and infusion equipment); 4) pharmaceutical waste (such as drugs, vaccines, and serums); 5) chemical waste (such as formaldehyde); 6) waste containing heavy metals (such as thermometers and blood pressure gauges); 7) radioactive waste (such as radionuclides); 8) genotoxic waste (such as cytotoxic products used in cancer therapies); and 9) health care wastewater (which is treated through physical or chemical means, biological purification, lagooning, or sand filtering).

- Biomedical wastes are associated with the same types of environmental effects as other types of wastes. However, in the case of biomedical waste the potential for disease transmission is greater. Biomedical wastes may lead to injuries (through sharp waste), short-term and long-term health problems (e.g. related to radioactive waste), as well as to the spread of diseases (e.g. hepatitis, HIV/AIDS, cholera, diphtheria, and other communicable respiratory, gastro-intestinal, ocular, and skin diseases). Environmental and health and safety training (including first aid measures, good hygiene practices, and the use of protective clothing and equipment) are essential, as is the assignment of specific tasks and responsibilities for the management of biomedical wastes (including its segregation, collection/handling, storage, transportation, treatment, and final disposal, as well as accident, spill, and emergency response).

- Source reduction of biomedical wastes is important. For example, to avoid generating pharmaceutical wastes in the form of expired medication, small amounts of the required products should be ordered in a centralized manner, and products should be used in the order of their expiration dates. Only products designed specifically for re-use are to be re-used after appropriate cleaning and sterilization (through an autoclave, for example).

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT (cont'd)

- The segregation of the different categories of biomedical wastes entails the use of specific containers in all areas where the wastes may be generated. Storage areas must have a restricted access, be able to withstand climatic conditions, be adequately ventilated, and be far away from food storage areas and water sources. The floor of the storage areas must also be impermeable, and cleaning and protective equipment must be available. Containers must be hermetic and leakproof (as well as puncture-proof in the case of sharp infectious waste). Containers are typically yellow and accompanied by the international symbol for infectious substances. They are typically sent to treatment and disposal when they are three-quarters full.

- For small-scale initiatives in developing countries, minimal requirements typically call for the incineration, encapsulation and/or safe burial of biomedical wastes, considering the context. Other more efficient and/or more sustainable methods of treatment and disposal of biomedical wastes exist (such as chemical disinfection, wet thermal treatment, microwave irradiation, authorized sanitary landfills and inertization). However, these tend to be more complex and more expensive. If on-site incineration is the preferred option of treatment, considering the context, it should take place preferably in a static-grate, single-chamber on-site incinerator. As a secondary option, on-site incineration may take place in a drum or brick on-site incinerator. Appropriately controlled incineration is generally adequate for non-sharp infectious wastes, pathological wastes, and sharp infectious wastes. The residues from burning (or ashes, which should contain less than 3 percent of unburned matter) are then buried using safe on-site burial methods or disposal in an authorized sanitary landfill. Incineration is generally not recommended for pharmaceutical wastes, chemical wastes, genotoxic wastes and radioactive wastes. Furthermore, pressurized containers, halogenated plastics (PVCs), and wastes containing heavy metals are not to be incinerated. On-site encapsulation is a method of treatment and disposal sometimes recommended for sharp infectious wastes and small amounts of pharmaceutical wastes. Encapsulation alone is not recommended for non-sharp infectious wastes, but may be used in combination with and after their incineration. Encapsulation is generally not recommended for pathological wastes, chemical wastes, genotoxic wastes, radioactive wastes, and wastes containing heavy metals. Safe on-site burial may be conducted for small amounts of non-sharp infectious wastes, small amounts of pathological wastes, small amounts of sharp infectious wastes (and ashes from the incineration of these three categories of biomedical wastes), and small amounts of pharmaceutical wastes (with the same protective and control measures as those proposed for landfills). Safe, on-site burial of prescribed wastes is practicable for only relatively limited periods of time (e.g. one to two years) and for relatively small quantities of such wastes (approximately up to 5 to 10 tonnes in total).

- For more information on the technical aspects of biomedical waste management, refer to: Prüss, A., Giroult, E. and Rushbrook, P. (1999). *Safe management of wastes from health-care activities.* Geneva: World Health Organization (http://www.who.int/water_sanitation_health/medicalwaste/en/).

SOLID WASTE MANAGEMENT AND THE ENVIRONMENT (cont'd)

D. How to plan follow-up and monitoring of environmental aspects

When planning the environmental follow-up and monitoring of an initiative, the following should be addressed.

Planning follow-up and monitoring questions	Answers for the proposed initiative
• Items to be monitored: *What items will be monitored? Potentially significant environmental effects, sensitive components of the environment, any uncertainties, and mitigation measures (their implementation and effectiveness) are generally monitored.*	
• Follow-up / monitoring methods: *How, where, and according to what schedule will follow-up / monitoring take place to help identify unforeseen effects and to assess the implementation and effectiveness of the chosen mitigation measures? Sufficient flexibility is required for additional measures when necessary.*	
• Follow-up / monitoring roles and responsibilities: *Who will be responsible for implementing these tasks and ensuring that the results are acted upon?*	
• Follow-up / monitoring reporting methods: *How and when will the results be reported to enable the analysis of lessons learned and their feedback into future initiatives? Who will be responsible for these aspects?*	

An indicator is a measurement, number, fact, standard, opinion or perception that helps measure progress toward achieving results. Not all the indicators identified in this table have to be used — only those that are relevant and contextually pertinent to the initiative and its setting. The chosen environmental indicators can be underlined in the following table. It is pertinent to provide details and specifications on how they will be used.

Useful environmental indicators	Answers for the proposed initiative
• ***Environmental indicators:*** *Concentrations of pollutants in air; concentrations of pollutants in surface and groundwaters; noise and dust levels; quantities of re-used or recycled products; increase in composting activities; number of persons trained on environmental issues; and so on.*	
• ***Human well-being indicators:*** *Incidence of human illness or disease; frequency of accidents; number of complaints; and so on.*	