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**ORGANISATION POUR LA MISE EN VALEUR DU
FLEUVE SENEGAL (O.M.V.S.)**

HAUT COMMISSARIAT

**ENVIRONMENTAL IMPACT ASSESSMENT OF THE
FÉLOU PROJECT**

EIA Report



EXECUTIVE SUMMARY

Context of the study

This project falls within the framework of the development of the hydroelectric potential of the states of the OMVS (*Organisation pour la Mise en Valeur du Fleuve Sénégal*,) grouping Mali, Mauritania and Senegal, and of the integration of their networks to distribute electrical energy. The OMVS has already developed two dams in the Senegal River basin (Manantali and Diama) and is now focusing on the hydropower project of Felou, which is the subject of the present study.

The OMVS has commissioned feasibility studies of the so-called second generation projects, which are at Felou and Gouina in the upper basin of the Senegal River. This report completes the technical feasibility studies of these second generation projects (Felou and Gouina), which form part of the Energy Program of Manantali.

This document addresses the evaluation of environmental impacts of the "rehabilitation" of the hydro-electric generating capacity at the Felou falls. A preliminary environmental evaluation was carried out as part of the technical feasibility report by Coyne and Bellier (2004). This study extends and elaborates that assessment in greater detail, in the local (Malian) and regional (Senegal R basin and the states it passes through) contexts..

Description of the project

- The present situation

The Felou falls are situated on the Senegal River, about 200 km downstream of the Manantali dam, and about 15 km upstream of the town of Kayes.

A small hydropower station was built in the early 1920's, and was rehabilitated in 1992.

The present capacity of the station is 600 kW, obtained by means of a flow through the turbines of 5 m³/s, or about 1% of the flow of the river.

The existing weir comprises a low wall, made of concrete and masonry, across the width of the river on the lip of the falls, at water level 40 m. From this, a diversion channel, with a width of about ten meters, runs on the left bank for about 0,5 km to a powerhouse situated at the lower end of the rapids (with a head of about 14 m), equipped with a Francis turbine. The diverted flow re-enters the river at the base of the falls. The diversion to the powerhouse hardly affects the flow over the falls at all, since Manantali releases at least 100 m³/s even in the driest months.

The villages of Lontou and Bangassi lie on the south (left) bank of the river close to the weir. They use the existing canal extensively for collecting water, washing, bathing and watering stock.

- The proposed project

The goal of the new project is to optimally exploit the full capacity of the site for the production of electrical energy, by utilizing both the height of the natural falls and the strong, perennial flow of the Senegal River at this point, partially regulated by the reservoir at Manantali.

The Felou project has been described in several reports produced during the feasibility studies, and especially in the documents Coyne & Bellier, 2001 and Coyne & Bellier, 2003.

The project consists of the construction of a new hydropower station, with a vastly increased output of 59 MW, the rehabilitation of the existing weir (without modification of elevation of the sill), the excavation of a new, enlarged canal to carry the turbine capacity of 500 m³/s, the connection of the power station with the HT network interconnected at the existing sub-station of Medina, about 10 km to the south-east of the village of Kayes, and of an access road to the site which passes by the railway siding near Medina. The railway siding, which will be used for unloading bulk construction equipment and supplies, has to be rehabilitated. This arrangement will require the re-alignment of the road past Medina.

A summary of the principal characteristics of the project is given below:

Reservoir	Normal reservoir (m) Population displaced by the reservoir	40,0 0
Sill (to be rehabilitated)	Max. Height on the T.N (m) Length	2 945 m
Power house	Number of turbines Type Head Maximal power output (3 turbines in action at max. processable flow)	3 Bulb 13,8 m 59 MW
Transmission line to sub-station Kayes	Voltage Distance	225 kV about 3 km
Access road	Distance	7 km

Source: Coyne and Bellier, 2003, table 1.1 (page 5) and section 3.42. (page 57).

Methodology

The principles which have guided the realization of this EIA are based on (not given in order of importance): i) World Bank environmental and social safeguard policies and guidelines; ii) the guidelines of the CEDEAO, the guidelines stated in the PASIE, and regulations promulgated in terms of the laws of Mali.

- Limits of the study

In accordance with the terms of reference, the study zone extends from the weir at Felou to the village of Kayes 15 km downstream, and takes as baseline the current conditions at Felou (incorporating modifications due to the operation of Manantali dam).

However, the team decided to investigate the possible major impacts due to the actual presence of the installations, as well as the possible repercussions at a regional scale.

- **Baseline data collection and impact assessment:**

The EIA-team, formed by nine consultants, gathered and reviewed relevant documents, and met in Bamako to clarify terms of reference and scope of work. Thereafter, a site visit was conducted and consultants spent up to a week in the project area gathering data and information and interviewing affected communities. At Kayes a technical workshop was held with the regional authorities and technical services and representatives of the public. The consultants also identified impacts, assessed their significance and identified principles of mitigation and compensation in team workshops held during the course of the mission.

- **Participation of the public and capacity building:**

A public meeting was held in Bamako early in the mission to present the project and the study's terms of reference to relevant authorities and other interested parties, such as major NGOs, and to hear their issues of concern.. This meeting was followed by a feedback meeting with the same participants at the end of the mission, to inform them of the principal conclusions. A technical workshop with the relevant regional authorities and institutions was held at Kayes.

- **Field visit**

The team spent 7 days on the field to visit the different sites concerned by the project and meet the local populations.

The results of the study

In the broadest context

The hydroelectric project of Felou is coherent in its concept and in its finality. It will contribute to a reduction of greenhouse gasses in the sense that the *hydro*-production of electricity will replace thermal power generation.

The different investigations realized by the consultants confirm the principal conclusions of the preliminary environmental evaluation done by Coyne and Bellier in their report of 2003.

- **Present impacts on the environment**

The current hydropower scheme at Felou has very modest impacts on the local environment.

The flow regime of the Senegal R has been modified in a major way by the development and operation of Manantali dam upstream, and by the operating objectives agreed between the countries for the river system. Nevertheless, the aquatic ecosystems remain productive and host a diverse array of species.

The current state of the environment does not imply reconsideration of any aspect of the project.

- **Anticipated impacts of the proposed project**

The main impacts are common to all hydropower schemes. Essentially they concern changes in river flow patterns in a limited part of the river, the health sector as regards water related diseases, and the local economy. The major component of the impacts is associated with the construction of the project and the presence of the construction camp and workforce. This project will not generate impacts which will affect the physical, biological and human environments in irreversible and unacceptable ways. The majority of impacts identified can be mitigated and/or compensated by appropriate measures. The initial observations of the mission scoped the detailed investigations more accurately.

- **Involuntary resettlement and compensation**

Not a single inhabitant will have to be moved. The different installations (canal, new powerhouse, transformer station, railway siding, transmission line and access road) as well as the telecommunications network that will be installed do not pass through inhabited zones.

A small part of the vegetable gardens as well as some old fruiting trees belonging to inhabitants of Bangassi and Lontou, all situated within public ground (in the floodplain of the Senegal R which is public domain), will have to be destroyed to make way for the new intake structure and canal. These losses will be compensated in accordance with Malian legislation, the World Bank Operational Procedures 4.12 and the procedures described in the Resettlement Action Plan (RAP). In addition measures to help with the intensification of agricultural production will ensure that the owners do not lose their livelihood.

The « rehabilitation Félou » project will, within the framework of the accompanying measures associated with the impact mitigation plan, as detailed in the environmental and social management plan (ESMP), contribute to the fight against poverty, and will reinforce the sensitization and environmental management capacity of the territorial authorities. These actions integrate perfectly into the program (which started mid-2004) to fight poverty and build institutional capacity and the IEC of the OMVS, a program financed by GEF and UNDP.

Synthesis in relation to the Safeguard Policies of the World Bank Group

OP/PB 4.01 Environmental Evaluation

This procedure requires an **Impact Study** being carried out by certified experts as well as a **Social and Environmental Management Plan**. The results generated by this policy may change depending on the project. Moreover, this policy recommends that all projects are assessed by contractors assisted by environmental and social consultants in order to make sure that they have followed the requested procedure.

Within the context of the present project, the Operational Policy 4.01 has generated the production of an Environmental Impact Assessment together with a Social and Environmental Management Plan. The project must now ensure that its activities remain in accordance with the Malian environmental regulations and with the Operational Policies and Bank Procedures of the World Bank regarding these aspects.

OP/BP 4.04 Natural habitats

Within the zone of the project, there are no terrestrial or aquatic natural habitats which have not been disturbed by human activities. Also, there are no ecosystems containing endogenous or protected animal or plant species which merit specific attention.

Given the low population density in this zone, natural habitats are not in an advanced stage of degradation which might necessitate restoration, and the project will have minimal effect on the existing equilibrium.

The project will not induce significant and permanent modification or degradation of critical natural habitats.

The environmental and social management plan proposes measures to avoid or ameliorate impacts, in order to minimize the potential negative effects on plant and animal resources due to the arrival of the construction workforce during the construction phase.

OP 4.11 Cultural heritage

Within the zone of influence of the project there is an internationally important historical site: the site of Medina.

The project will not contribute to the direct or indirect disappearance or degradation of this cultural heritage. On the contrary, improvements are likely to result directly or indirectly due to the project.

The access road will by-pass Medina in order to eliminate the possibility of any deleterious impacts due to traffic in Medina..

Archaeological or historic resources discovered during the construction of the bypass will fall within the ambit of Malian legislation. The Works Contract will specify that machine operators and construction personnel are to be sensitized in the identification of archaeological and historic artifacts/remnants, and trained in the appropriate procedures to follow should any such resources be uncovered.

There are no other known cultural or religious sites vulnerable to being affected.

Concerning natural heritage, there are no exceptional features meriting protection. The view of the Felou falls will be partially affected by the presence of the new power station, but there are no other feasible alternatives. These falls, without negating their attractive character, do not have sufficient tourism importance on a regional or international scale to counterbalance the social and economic benefits generated by the project.

It will be a contract specification that the powerhouse buildings be integrated into the landscape to the greatest extent possible.

OP/BP 4.12 on involuntary resettlement

The project will not cause any loss of habitation.

None of the infrastructure that will be constructed (powerhouse, transformer yard, canal, access road, transmission line), will pass through sites which are temporarily or permanently inhabited.

The works on the new canal will cause the loss of a small swamp zone, smaller than 1 ha, and of a zone of fruiting trees of a similar area.

The users of these zones (they do not own the ground), will be compensated for crop loss, not only according to Malian regulations, the WB OP 4.12 and the procedures described in the Resettlement Action Plan (RAP), but also by measures to help them with agricultural intensification and by rejuvenating fruiting trees. This will be detailed in the environmental and social management plan.

These measures will permit the augmentation of productivity and thus income, and will largely compensate for losses due to the works on the new canal.

The planned route for the transmission line, over a distance of 3 km, will not pass through fertile zones and thus will not affect the incomes of people.

No vulnerable group will be affected.

OP/BP 4.10 Indigenous people

The villages which are directly affected by the project, especially during the working phase, are multicultural and multi-ethnic and are of relatively recent origin (established in the 1960s)

There are no Peuls or ethnic minorities vulnerable to be affected by the project.

OP/BP 4.36 Forests

There are no large, indigenous forests in the zone of the project.

The zone is covered by an open savannah, which is much degraded by human activities. The classified forest of Papara lies between the project area and the village of Kayes, but it is much degraded and will not be affected by the project in any way.

The project will not generally cause a degradation of vegetation cover. However, it is possible that during the works, the arrival of about 50 laborers will cause a higher demand for firewood. This supplementary need could result in more cutting of the woody species.

The impact of this demand can be minimized by specifying that the Contractor makes available, at cost price and on site, more efficient stoves to laborers, or cooking devices that use derivatives of petrol. The Contractor can also be required to aid the AMADER, responsible management of the renewable natural resources and especially biomass energy, to organize locally a rational cutting of woody species (where this is unavoidable) and a reforestation project.

OP/BP 4.37 On the safety of the dams

The present water level represents no danger of submersion of zones of human settlement in the event of the weir's breaching, which has a height of only 2 m.

In the event of a breach, the resulting flood surge would merely be equivalent to the floods which took place seasonally before the presence of Manantali dam, which has regulated the flow of the Senegal River year round since 2001.

The only significant danger comes from the dam of Manantali 80 km upstream, which, although it is well guarded, does not have an operational emergency plan.

OP/BP 7.50 On the projects related to international water courses

The riverine states of the Senegal River made the agreement decades ago to create the *Organisation pour la Mise en Valeur du fleuve Sénégal* (OMVS), not only to decide on the different usages of the river, but also to combine their efforts in creating the legal and financial framework for optimizing the river basin's potential.

By mediation amongst the different entities of the OMVS, especially thanks to the recently edited charter, the different usages of the Senegal River have been defined in a mutual agreement between the member states, which are also the riverine states.

The project will not impede any other usages of the river, nor the river's navigability, which is naturally interrupted by the configuration of the topography at the falls.

The project will function within the framework of the decision by the states to intensify hydroelectric production and is a continuation of the program from which the dams at Manantali and Diama originate.

Social and Environmental Management Plan costs

The budget required for the implementation of the mitigation measures included in the Social and Environmental Management Plan are summarized as follows :

Compensation/mitigation measures for Economy, Soil development	214.710.000 F Cfa
Compensation/mitigation measures for Health	33.000.000 F Cfa
Compensation/mitigation measures for natural and physical Environment	95.200.000 F Cfa
Compensation/mitigation measures capacities strengthening	136.000.000 F Cfa
GRAND TOTAL	478.910.000 F CFA

Specific results of the impact study

A synthesis of the key findings of the mission are presented below, by taking as an entry point the current state of the receiving environments, and imposing the predicted impacts of the project thereon.

1. SOCIAL ENVIRONMENT

1.1 Health

1.1.1. Reference state

Malaria, bilharzia and gastro-intestinal disorders (infectious diarrhoea) are the prevalent diseases in the project zone, in the villages of Bangassi and Lontou. These disorders are the result of the socio-sanitary conditions of the inhabitants, and the water-related diseases are linked to the presence of the Senegal River and its water level.

The prevalence rate of these disorders is not unusual, the percentages encountered being the same as for the region as a whole.

1.1.2. Impacts:

The health impacts of the project are linked to the potential to create favorable conditions for the development of sexually transmitted diseases (STDs), including HIV-AIDS. During the three years of the construction phase especially, the social dynamics engendered by influx of outsiders (laborers) are expected to result in a rise in the prevalence rate of STDs.

The number of people exposed to bilharzia and to diarrhoea could rise, because construction of the new canal will force the communities to use the main river directly, in the slow-moving pool above the falls..

The population of Bangassi is less affected by bilharzia than that of Lontou, because the former use the present canal, which has a faster velocity and is therefore less suitable for the growth of the bilharzia host.

The new canal could also present safety risks to the riverine villages, due to the very high volumes of water which will pass down it.

The extent of the impacts is primarily local, but will indirectly have regional repercussions, because distant workers will leave the site after completion of the works to return home. They are thus potential vectors of water-related diseases, STDs and HIV-AIDS contracted in the project zone.

Following the contracted diseases the impacts are reversible (bilharzia, STD) or irreversible (AIDS).

1.1.3. Measures for mitigation

The measures for mitigation of the health-related problems consist in combining, i) sanitary information and education of people (IEC) among other HIV/AIDS information campaigns and free availability of condoms for workers, ii) the construction of infrastructure for village water supply and sanitation, for hygiene and ablutions, the construction of zones for swimming and washing alongside the pool, upstream of the village. On the other hand, the planned canal for water supply will have to be made safe by means of appropriate protection measures.

Bilharzias occurrence will be monitored and if necessary mass treatment with Praziquantel will be carried out to reduce the wormload of the Shistosoma worms, the cause of bilharzia, to improve the health situation of the local population.

1.2 Socio-economic

1.2.1. Reference state

Agriculture, comprising cropping and fishing, is the main activity in the study zone. Agricultural exploitation remains traditional, oriented towards food-producing rain-fed agriculture (millet, sorghum, maize, and peanuts), familial extensive breeding and fishing in the Senegal River. These activities are completed with vegetable gardens and fruit trees on the banks of the Senegal River and its tributaries.

The study area is traversed by the road Kayes-Diamou-Bafoulabé, which is in a very bad condition over the entire distance. This road is presently the only access road to the site. This road network becomes impassable during the raining season.

The railway line Dakar-Bamako, which traverses the range of Kayes (administrative division), passes about 4 km south of Felou, without connection to the nearby villages. Currently the state of the railway line, the stations and siding and the rolling stock are old and are almost uncompetitive.

River transport along the Senegal River occupies an important niche in the region's transport network and economy, but the rapids of Felou form an impassable obstacle.

The villages of Lontou, Bangassy and Medina have been supplied with electricity since 2002 from the mini-hydropower station of Felou, installed in the early 1920's and rehabilitated by 1992.

Until the start of the services at Manantali, the plant at Felou exclusively supplied the town of Kayes.

1.2.2. Impacts:

A. Positive impacts

- A.1.** Increase of the hydro-electrical production to on average 325 GWh/year, which totally substitutes for thermal generation, which has a higher cost and a higher production of greenhouse gasses (gain of 200.00 equivalent Tons CO₂/year)
- A.2.** Reduction of the dependency of the OMVS-countries on the supply of petroleum products for the generation of electrical energy.
- A.3.** National economies: reduction in the demand for foreign exchange, since thermal generation necessitates the continuous import of oil payable in foreign currency.

The impacts A1, A2 and A3 are of an **international, regional** scale (3 countries of the OMVS).

- A.4.** Local economy: (region of Kayes & Felou): contribution of the project to the socio-economic development of the villages close to the site (especially Lontou, Bangassy and Medina) and the town of Kayes, in the creation of jobs, the increase in demand for consumer products, the development of activities adjunct to the construction site: accommodation, restaurants, business and transport.

B. Negative impacts

B.1. Loss of agricultural terrain

- i) Vegetable gardens due to the works on the new canal (very small area); ii) orchards (mangos and bananas) and small vegetable gardens, established on the banks in the zone of excavation of the canal intake structure (area of a few ha).

Compensation measures

- Compensation of the owners for crop losses following the Malian regulations and the World Bank OP/BP 4.12 and the procedures described in the RAP
- Assistance with the establishment of new orchards if the terrain is available (supply of plants and subsidiary input locations).

B.2. Rupture of the energy supply

of the villages of Lontou, Bangassy and Medina, by disassembly of the mini-power plant currently generating electricity at Felou.

Mitigation measures

The supply of energy for covering the basic needs of the villages implies action to be taken by the OMVS:

- Either the primary integration of these villages in the program of rural electrification foreseen by the GEF project,
- Or the connection with the Félou power plant, which will provide a reserve electrical supply to the affected villages.

B.3. Inaccessibility of the old canal for water supply and domestic use

The dimensions of the new canal for water supply (width 28m, depth 10m), and the flow and the speed of the water in the canal will not be compatible with the present uses of the existing canal (bodily care,

washing, drinking). For the safety of all current users, the new canal will have to be kept out of reach of people and animals.

Mitigation measures

Installation of a well for water supply at Lontou/Bangassy

Installation of washing and swimming facilities by putting concrete near the new piers to be constructed.

B.4. Aggravation of the cereal deficit of the project zone/region of Kayes

The establishment of workers on the construction site and the probable arrival of immigrants, attracted by jobs and income generating opportunities in the project area, will increase the demand for basic foodstuffs, which will in turn aggravate the chronic cereal deficit of the sub-region.

Mitigation measures

Support for agricultural activities in the zone of Felou. The Contractor should bring food from further away to the site and sell the goods to the workforce in a cooperative. The food scarcity for local people should also be monitored.

B.5. Increase of the price of the food and of primary products

The additional demand for food products, in a situation of chronic deficit, will cause a significant increase in the price of staple foodstuffs, which may become unaffordable for local inhabitants.

Mitigation measures

Assistance in agricultural intensification in the project area (diffusion of improved agricultural practices). Price increases for basic items will be monitored.

B.6. Social nuisances

The arrival of paid workers from elsewhere in the rural zone of Lontou-Bangassy could provoke social conflict with the local population (land, community, and cultural conflicts).

Mitigation measures

- Maximize recruitment of local manpower (contractual clause of the selected contractor).
- IEC targeted at local populations.
- Develop a code of good conduct for the personnel as part of the conditions of contract.
- Updating the plans for the development of the villages of Lontou/Bangassy, Medina etc., with an infrastructure development plan for these villages.

B.7. Loss of harvest

The access of trucks and construction plant to the excavation zone for the canal intake structure near to Lontou will cause the destruction of orchards and vegetable gardens presently occupying the land between the road and the bank of the river.

Compensation measures

- Compensation of the owners for lost crops, according to Malian regulations and World Bank OP/BP 4.12 and the procedures described in the RAP (cf. higher).
- Help with replanting and/or rejuvenating the orchards (supply of plants and subsidiary input locations).

B.8. Restriction of access to the river for the people of Bangassi and Lontou during a part of the working phase

Compensation measures

- Installation of provisional access (during the working phase), situated upstream of the village.
- Installation of infrastructure to accommodate the three major uses of the old canal, namely a pier, wash-house, and drinking troughs for animals.

2. NATURAL ENVIRONMENT

2.1 Physical environment

2.1.1. Water

Reference state

As for all watercourses of the region, the hydrology of the Senegal River at Felou is dependent on the seasonal character of the rains (strong floods during the rainy season and dramatically reduced flows during the dry season).

The start of dam operations at Manantali in 2001 has permitted a notable regulation of flow and the levels of water in downstream reaches of the Senegal River. The volume and duration of floods are reduced, while the dry season minimum flow has increased by orders of magnitude.

Water quality is generally good, and is on the one hand affected by flooding periods when the suspended solid loads are elevated, and on the other hand (but to a lesser extent) by the transport and deposition of erosion products from the fields, and by household garbage in the village of Lontou adjacent the river immediately above the falls.

The hydrogeology of the area around Lontou indicates that the ground water is of relatively good quality. Infiltration on the site is almost zero. The permeability is weak due to the plateau of sandstone. The contamination of ground water by infiltration is also minimal.

Impacts:

There will be no impact on the overall flow of the Senegal river (the water volume which arrives in the reach upstream is returned to the reach downstream of the power station), but there will be seasonal impacts on the flow over the short stretch of river (the falls) between the canal intake and outlet structures (about 0.5 km of river).

The upstream and downstream water levels will not be affected by the project.

- Construction phase

- Water quality will be reduced due to increased turbidity associated with the entraining of sediments during construction within the river channel. This impact is reversible, moderate and local.
- Operational phase
- Reduction of the flow over the falls during the dry season (March, April, May, June and maybe July), due to the large proportion of river flow which would be diverted through the turbines;
- The coincidence of this impact with the tourist season in March and July.
The scenic and thus tourist appeal of the falls could be affected.

Mitigation measures

The mitigation actions and measures essentially focus on:

- Construction phase
- Regular control of the water quality downstream of the falls
- Operational phase
- Detailed modeling of operating conditions and optimization of energy generation against ecological and scenic imperatives for the Felou falls (a 5 cm depth of flow over the weir's sill has been proposed in this report, but this needs to be tested rigorously)
- Secure the population and the animals against falling into and drowning in the new canal;
- the preservation of the water quality in the stream and in the new canal (actions and measures against erosion, of decontamination and of hygiene in the village of Lontou);

2.1.2. Soil, topography, and geology

Reference state

The topography is almost flat in the zone of the site. There is very little soil due to an outcrop of the mother rock which occurs as a rocky massif.

The construction of the powerhouse and excavation of the canal will take place on the rocky massif.

The routes of the road and pylons are situated partially on the rocky massif and, where not, will pass through hills with low slopes as well as through the bottom of shallow valleys.

Impacts

No significant impacts on the soils by the works, apart from the alluvial sands in the stream bottoms which are susceptible to erosion.

Visual impacts due to the construction of the powerhouse and the canal, notably during the operational period.

Mitigation measures

- Control of the erosion in the valleys.

2.1.3. Air quality

Reference state

Excellent air quality, no sources of pollution, except for some fires.

Impacts:

During the construction phase, temporal and local change of the air quality due to dust.

Mitigation measures

Sprinkling the zones where the dust is produced.

Selection of a batching plant site which takes account of wind direction and the location of the villages.

2.2 The biological environment

2.2.1. Fauna

Reference state

No terrestrial fauna species which have protected status were found on site.

Fish are concentrated in the Senegal River downstream of the falls.

The releases of Manantali maintain a water level which makes it harder to catch fish, but which offers a larger habitat area.

Impacts:

No major impacts.

Possibility of more hunting by the laborers, or resulting in a much higher demand for meat.

Possibility of more fishing pressure if professional fishers migrate into the area to exploit the increased demand, causing a diminution of fish resources.

Mitigation measures

Prohibition of laborers from hunting or possessing weapons, or trapping (contract specification)

Stocking with fingerlings if a decline of certain species is noted.

Quarterly follow-up of species by means of surveys in the village fish market.

2.2.2. Flora

Reference state

No particular protected or rare species. The vegetation is generally degraded by human activities.

Along the access road some mature *Sterculia setigera* and *Acacia nilotica* occur.

Impacts:

No major impacts.

The construction of the connection road could cause the destruction of some *Sterculia setigera* and *Acacia nilotica*.

The turbulence caused by the discharge of the return water could generate a current that could cause erosion of the bank and hence affect gallery forest on the opposite bank of the river.

Mitigation measures

Installing energy dissipaters or stilling basin at the return water outlet.

Aligning the access road to avoid *Sterculia setigera* and *Acacia nilotica* where possible.

2.2.3. Forest

Reference state

The only noteworthy forest patch is the gallery forest situated on the right bank of the Senegal River. This gallery forest includes some specimens of *Borassus aethiopum* which are protected.

Impacts:

No major impacts.

Possible bank erosion due to turbulence linked to return water discharge into the river channel (cf. above).

More pressure on woody resources for firewood due to the presence of the construction workforce.

Cutting of trees along the route of the transmission line and the access road

Mitigation measures

Subsidizing efficient woodstoves.

Provision by the contractor of petroleum products or gas to the laborers.

RESSETLEMENT ACTION PLAN SUMMARY

The option for the Félou weir project proposed by the feasibility study and confirmed by the present environmental impact assessment does not modify the elevation of the existing weir (40,0 m), nor consequently the reservoir surface. It is therefore the most economical option, the one having the least environmental impact, and requiring **no mass resettlement of local populations**. The impacts are restricted to the construction works and will require the destruction of 0,35 ha of vegetable gardens and of 0,9 ha of orchards.

Within this RAP we will develop the impacts resulting from the loss of housing, land used for economic purposes, loss of financial resources, goods or means of subsistence, limitation of access to public goods and services following the World Bank Operational Policy OP 4.12 and the Malian law. The other social impacts generated by this project not related to these aspects are developed in the main report on EIA.

The impacts requiring a RAP are twofold: those related to the loss of agricultural land (0.35 ha of agricultural land and 0,9 ha of orchards) concerning individuals and those related directly or indirectly to the loss of public services (access to the channel for drinking water and washing, loss of the landing stage, loss of electrification) affecting local communities of Lontou, Bengassi and to a lesser extent Médine.

The compensations foreseen follow the WB Operational Policy OP 4.12 and the Malian law.

They consist of compensating on one hand, agricultural and orchards land users for i) the loss of these areas, ii) the loss of crops over 20 years and iii) the cost of fruit trees, and on the other hand, foreseeing new cultivation areas and supporting measures for agricultural intensification in favor of affected individuals as well as the whole communities of the neighboring villages of Lontou and Bengassi.

Regarding public services, access to water will be rebuilt upstream from Lontou village in a cleaned up and secure area in order to avoid the propagation of water-borne diseases. This place will also be used as new landing stage and fit out in order to improve it.

The use of the channel for drinking water will be compensated through a drinking water supply program, foreseeing not only the necessary physical infrastructures (water tower, piping, etc.) but a IEC program (Information, Education and Communication) facilitating the organization of water management in the villages of Lontou and Bengassi (Médine village outside the affected area is not concerned by these measures), the conservation of the equipment and the education of population to hygiene rules.

Continuity of electricity supply will be realized through the connection to the generator building site during the works and also through the measures adopted by the OMVS following the decision taken by the last Ministry Council, that is either the connection to the international network with the allocated energy principle, or the inscription of Médine, Lontou and Bengassi villages to the OMVS priority rural electrification program.

The total costs of these measures is estimated at 194.710.000 F CFA

The measures developed in the RAP do not generate any negative environmental impacts but rather contribute to improving the environment management.

Monitoring of the measures conveyed through the RAP will be done by local authorities in close relationship with state representatives and the Ministry responsible for this project.

FINAL CONSIDERATIONS

- The contractor will particularly pay attention to the health and security of the workers, including securing the work site
- This EA report should be part of the bidding documents, so that the contractor can prepare his own EMP (Contractor EMP)
- The contractor will employ its own Environmental Site Officer.
- The supervising engineer will have a staff responsible for supervising the adequate implementation of the Environmental and Social Management Plan (ESMP)
- The Felou Operator will establish its own Safety Health and Environment Department (SHE Department), which will be responsible for environmental and social management during operation.

**ORGANISATION POUR LA MISE EN VALEUR DU
FLEUVE SENEGAL (O.M.V.S.)**

HAUT COMMISSARIAT

**ENVIRONMENTAL IMPACT ANALYSIS OF THE
FELOU PROJECT**

«*RESETTLEMENT ACTION PLAN*»



February 2006

Executive Summary

The option for the Félou weir project proposed by the feasibility study and confirmed by the present environmental impact assessment does not modify the elevation of the existing weir (40,0 m), nor consequently the reservoir surface. It is therefore the most economical option, the one having the least environmental impact, and requiring **no physical displacement**. The impacts are restricted to the construction works and will require the destruction of 0,35 ha of vegetable gardens and of 0,9 ha of orchards.

Within this RAP we will develop the impacts resulting from the loss of housing, land used for economic purposes, loss of financial resources, goods or means of subsistence, limitation of access to public goods and services following the WB directives and the Malian law. The other social impacts generated by this project not related to these aspects are developed in the main report on EIA.

The impacts requiring a RAP are twofold: those related to the loss of agricultural land (0.35 ha of agricultural land and 0,9 ha of orchards) concerning individuals and those related directly or indirectly to the loss of public services (access to the channel for drinking water and washing, loss of the landing stage, loss of electrification) affecting local communities of Lontou, Bengassi and to a lesser extend Médine.

The compensations foreseen follow the WB OP/BP 4.12 on Involuntary resettlement and the Malian law on land tenure is the Enactment order No.027/P-RM du 22 Mars 2000, related to Code Domaniat et Foncier.

They consist of compensating on one hand, agricultural and orchards land users for i) the loss of these areas, ii) the loss of crops over 20 years and iii) the cost of fruit trees, and on the other hand, foreseeing new cultivation areas and supporting measures for agricultural intensification in favor of affected individuals as well as the whole communities of the neighboring villages of Lontou and Bengassi.

Regarding public services, access to water will be rebuilt upstream from Lontou village in a cleaned up and secure area in order to avoid the propagation of water-borne diseases. This place will also be used as new landing stage and fit out in order to improve it.

The use of the channel for drinking water will be compensated through a drinking water supply program, foreseeing not only the necessary physical infrastructures (water tower, piping, etc.) but a IEC program (Information, Education and Communication) facilitating the organization of water management in the villages of Lontou and Bengassi (Médine village outside

the affected area is not concerned by these measures), the conservation of the equipment and the education of population to hygiene rules.

Continuity of electricity supply will be realized through the connection to the generator building site during the works and on the other hand through the measures adopted by the OMVS following the decision taken by the last Ministry Council, that is either the connection to the international network with the allocated energy principle, or the inscription of Médine, Lontou and Bengassi villages to the OMVS priority rural electrification program.

The total costs of these measures is estimated at **194.710.000 FCFA**

The measures developed in the RAP don't generate any negative environmental impacts but rather contribute to improving the environment management.

OMVS is responsible for implementing the RAP in collaboration with its coordinating unit at the national and local level (CNC and CLC) in close relationship with state representatives and the Ministry responsible for this project.