INTER-AMERICAN DEVELOPMENT BANK

BRAZIL

CANA BRAVA HYDROELECTRIC POWER PLANT

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ENVIRONMENTAL AND SOCIAL IMPACT REPORT

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TABLE OF CONTENTS

ACRONYMS

TABLES

FIGURES

ANNEXES

ACRONYMS

ADI	Area of Direct Influence *(Área de Influencia Direta*)
AGMAR	Environmental Agency of the State of Goiás (*Agencia Goiana de Meio Ambiente e Recursos Naturais)*
AII	Area of Indirect Influence (*Área de Influencia Indireta*)
ANEEL	Regulatory Agency for the Energy Sector (*Agencia Nacional de Energia Elétrica)*
CELG	Electric Company of the State of Goiás *(Companhia de Energia Elétrica de Goiás)*
CEM	Companhia Energética Meridional
COMASE	Environmental Committee for the Electric Sector (*Comitê de Meio Ambiente do Setor Elétrico)*
CONAMA	National Environmental Council (*Conselho Nacional do Meio Ambiente)*
DNAEE	National Department of Water and Energy (*Departamento Nacional de Águas e Energia Elétrica)*
DNPM	National Department of Mineral Production *(Departamento Nacional de Produção Mineral)*
DRTs	State-based offices of the Ministry of Labor (*Delegacias Regionais do Trabalho*)
EIA	Environmental Impact Assessment (*Avaliação de Impacto Ambiental*)
ELETROBRAS	Centrais Elétricas Brasileiras S.A.
ESMP	Environmental and Social Management Plan (*Projeto Básico Ambiental – PBA*)
FEMAGO	Ex- State Environmental Agency (*Fundação de Meio Ambiente de Goiás)*
FURNAS	Furnas Centrais Elétricas S.A.
HPP	Hydropower Plant (*Planta hidroelétrica)*
IBGE	Brazilian Institute of Geography and Statistics *(Instituto Brasileiro de Geografia e Estatistica)*
IBAMA	Brazilian Institute for Environment and Renewable Resources (*Instituto Brasileiro de Meio Ambiente e Recursos Naturais Renováveis)*
IPHAN	National Institute for Historic Heritage (*Instituto do Patrimônio Histórico e Artístico Nacional)*
MT	Ministry of Labor (*Ministério do Trabalho*)
PNMA	National Environmental Policy (*Política Nacional do Meio Ambiente)*
RIMA	Environmental Impact Assessment Report (*Relatório de Impacto Ambiental*)
SANEAGO	Sanitation Company of the State of Goiás *(Companhia de Saneamento de Goiás)*
SIG	Integrated Management System (*Sistema Integrado de Gestão*)
SSTMA	Occupational Health and Safety and Environment (*Saúde, Segurança do Trabalho e Meio Ambiente*)
UFG	Federal University of Goiás (*Universidade Federal de Goiás*)

I. INTRODUCTION

1.1 The Cana Brava Hydroelectric Power Project (the "Cana Brava project" or the "Project") entails the construction and operation of a 450-MW hydroelectric power plant and the construction of a 50 km 230-kV transmission line. The Project is located on the Tocantins River, between the municipalities of Minaçu and Calvacante in the State of Goiás, approximately 250 km north of Brasilia, in the center-west region of Brazil. The Project is among the first private projects to be developed under the new institutional and regulatory framework established in 1995 and 1996, and is also one of the first Independent Power Producers (IPP) or self-generators to be financed under a project finance scheme in Brazil. The Project involves a private producer and a private off-taker, with tariffs set freely among private parties. Any excess production above the contracted level will be sold to the market. As such, the Project represents a key step towards the creation of a competitive electricity market in Brazil, an effort that has received continuous support from the Inter-American Development Bank (IDB).

1.2 Tractebel Brasil Limitada ("Tractebel") was awarded the Cana Brava Project Concession Contract, as a result of an international competitive tender, in March 1998 by *Agencia Nacional de Energia Elétrica (ANEEL)*, the Brazilian regulatory agency for the electric sector. The concession provides for the use of the river resources for a period of 35 years. Tractebel, through its subsidiary Centrais Geradoras do Sul do Brasil, S.A. ("Gerasul" or the "Sponsor") has created a special purpose company, Companhia Energética Meridional (CEM), to implement the project. The Project will be constructed under a turnkey fixed-price Engineering, Procurement and Construction ("EPC contract") contract by a consortium formed by four Brazilian companies: two civil works construction companies, Construtora Norberto Odebrecht S.A. and Construtora Andrade Gutierrez S.A.; and two equipment suppliers, Voith S/A Máquinas e Equipamentos and Siemens Ltda. CEM will enter into an Operation and Maintenance Agreement with Gerasul for the term of the Concession Contract.

1.3 Gerasul will finance the project using a combination of BNDES long-term financing and an IDB A/B loan. The Sponsor has requested IDB financing for the Cana Brava Project in the amount of US$160.2 million, consisting of an A-Loan in the amount of US$75 million and a B-Loan of US$85.2 million. BNDES financing will be in the amount of US$138 million. Total project costs are estimated at US$426 million, of which 30 percent will be contributed by the Sponsor with equity, and the remaining 70 percent will be funded with debt, as mentioned above.

II. PROJECT DESCRIPTION

A. Location

2.1 The Cana Brava Project will be located in the upper reach of the Tocantins River Basin, in the State of Goiás, approximately 250 km north of Brasilia, in the center-west region of Brazil (see Figures 2-1 and 2-2). The Tocantins River runs northward from the Brazilian heartland to the Atlantic Ocean, over a distance of 2,500 km, and in the Project area, the river separates the municipalities of Minaçu and Cavalcante. The Cana Brava Project dam site will be located approximately one km downstream from the Tocantins River's confluence with the Carmo River, approximately 46 km downstream from the São Felix River, and approximately 50 km downstream from the Serra da Mesa hydroelectric power plant. In the Tocantins River, below the Cana Brava Project, there is another hydroelectric power plant in operation (Tucuruí) and another presently under construction (Lageado). The Project transmission line will connect the Cana Brava dam site to the Serra da Mesa interconnection facility (at the Serra da Mesa dam site) and will run parallel to the existing road between Minaçu and the Serra da Mesa dam site,

B. Project Components

2.2 The Project consists of the construction and operation of a 450-MW hydroelectric power plant and the construction of a 50-km 230-kV transmission line. The Project will provide guaranteed average energy ("assured energy") equivalent to 273-MW or 2,396 Gwh/year. The water flow conditions of Cana Brava will be regulated by the reservoir of the Serra da Mesa dam, which will allow Cana Brava to operate in low flow conditions, with a small flooded area and with high power generation.

2.3 The Project entails the installation of three generating units of 150-MW each, and the construction of a Roller Compacted Concrete dam ("RCC") in the central section. The RCC will be built on the riverbed of the Tocantins River and will have a maximum height of 66 m and a total volume of approximately 325,000 m^3. On the left bank of the river, the dam will be earthen-fill with a length of 380 m and height of 50 m. All the main structures will be located on the right bank, including the spillway, the sluiceways for the river diversion, and the generation circuit (which comprises the power intake, the penstocks and the powerhouse). The RCC dam will continue to the right of the power intake, until it reaches the earthfill dam, which forms the right abutment. Two small dikes, one in each bank, will close the reservoir. The total crest length of the dam including the hydraulic structures is about 1,150 meters.

2.4 Reservoir: The Project will operate with a maximum upstream water level at elevation 333 meters above sea level (masl). A maximum depletion of 3 m may occur for daily regularization purposes, and hence the minimum water level of the reservoir will be at 330 masl. During the discharge of the Potential Maximum Flood (estimated as 17,802 m/s), the reservoir water level will reach 334 masl. The total reservoir surface area at the normal reservoir water level (333 masl) is approximately 139 km^2. The average reservoir water depth under operational conditions will be approximately 16.5 m, with a maximum depth of 55 m. The residence time of the reservoir is approximately 30 days. The total volume of the reservoir is 2.36×10^9 m^3. The estimated normal downstream water level with 3 units operating is 288 masl. The estimated time to fill the reservoir is approximately 60 days.

2.5 Embankments: The embankment dam sections will tie the concrete to each of the abutments and will be composed of zoned earth/rockfill. Impervious core materials will be alluvial materials found in the area. A downstream filter and drainage layer will be provided adjacent to the core.

2.6 Concrete Gravity Dam: The dam will be founded on hard rock and built of rolled compacted concrete (about 80 to 100 kg/m3 of cement and about 80 kg/m3 of fine material) with conventional concrete placed to encapsulate the RCC at the upstream and the downstream faces. The dam crest level will be 335 masl with a minimum crest width of 7.5 m. The dam is designed for earthquakes of magnitude less than 5 on the Richter scale.

2.7 Diversion structures: During the second phase of Project construction, the Tocantins River will be diverted via five concrete diversion which are designed to handle an inflow of 6,000 m^3/sec. During the filling of the dam, one diversion outlet will be kept open. The planned minimum downstream flow during the filling of Cana Brava reservoir is 100 m^3/s; however, if necessary, for practical or operational reasons, the minimum flow downstream will be allowed to drop to 84 m^3/s in a one-day event (this is the minimum daily flow registered in the river).

2.8 Spillway: A gated spillway will be constructed consisting of six gates/chutes (15.0 m wide x 20.0 m high) and crest at elevation 335 masl. Water from the spillway will be discharged into a wide channel downstream. The spillway is designed for a discharge of 17,800 m^3/s, corresponding to a 334 masl Probable Maximum Flow (PMF) reservoir level.

2.9 Intake: The intake for the powerhouse consists of three separate intakes. Each intake will house a gate

and a set of trashracks, and will be connected to the powerhouse with a short section of steel penstock. Three steel penstocks (diameter 9 m) will be installed on the downstream side of the concrete structure.

2.10 Powerhouse: The powerhouse will be located just below the intake structure and will house all the structures, facilities and associated equipment; including three turbine/generator units (3 x 150 MW), a powerhouse gantry and a bridge crane together with the upper loading bay, service bay, storage areas, and control room, bathrooms, offices, facilities areas, workshop, an elevator, an administration building, a guardhouse, and a secure area for storage of spare parts and consumables. Wastewater shall be collected and discharged to an on-site septic system.

2.11 Transmission Line: The 50 km 230-kV transmission line will be installed between the switchyard of the power plant and the switchyard of the Serra da Mesa power plant. The transmission line will be constructed near the existing transmission lines (500 kV of FURNAS, 138 kV of CELG and 138 kV between Minaçu and the work site) and will follow the right of ways of existing roads, service roads, or transmission lines.

2.12 Access Roads: An existing road is being repaired to support construction traffic and supply deliveries to the Project dam/construction site. Some minor access roads are being built within the construction site, to allow access to the intake structures, spillways, powerhouse area and switchyard.

2.13 Service Bridge: A bridge is being built 400 m downstream from the dam to be used during the construction and later as an access to the powerhouse and the hydraulic structures. This service bridge is designed to ensure the safe passage of a 100-year flood. After construction, the bridge will be used as an access to Minaçu.

2.14 Construction Site Facilities: The construction site installations comprise activities and facilities typical of such large scale construction, and include: carpentry shop, steel frame shop, uncovered storage site, offices, garage, gravel plant, conventional concrete plant, pneumatic garage, rolled concrete plant, fuel station, compressed air plant, tire repair garage, washing/lubrication area, water treatment plant, sewage septic tank, intake and water tank, test laboratory, and explosive storage room. When fully built and operational, the total constructed area of the work site will total approximately 13,400 m^2. The borrowing mineral areas around the work site will comprise 2.5 ha for rock, 40 ha for gravel, 58 ha for clay, and 75 ha for sand. The sewage system will be designed as a septic tank with biological filters. The disposal area for non-hazardous wastes will be built according to the good engineering practice (e.g., lining, drains and treatment for the leachates, 30cm earth cover when wastes deposit heights reach 1 meter and final cover with 60 cm of earth).

2.15 Construction Worker Facilities: On-site facilities for construction workers will include housing, dining facilities, recreation center, and an outpatient medical facility. During peak construction, 1,350 workers are expected to be living at the work site camping installations, with additional 550 workers living in the city of Minaçu.

C. Cost and Schedule

2.16 The total Project cost is estimated at US$ 426 million[1]. The total cost of environmental and social mitigation during construction and operation is estimated at approximately US$ 25,5 million (R$48,354 million) . This amount comprises the total cost of the ESMP for both the construction and the operation phase, including the specific environmental management measures for the campsite, the rehabilitation of

[1] All amounts in the base case financial projections and the project budget are in Brazilian Reais and have been converted to US dollars for better reference at an average exchange rate of R$1.9/ US$.

degraded areas (both included as responsibilities of the EPC and thus budgeted in the EPC contract), and the expropriation and resettlement costs. (see Section 6.3 for details).

2.17 Project construction commenced in May 1999 and all construction is expected to be completed in approximately 43.5 months (39.5 months for the first generating unit, 40.5 months for the second and 43.5 for the third). Operations are expected to begin in late 2002. The Tocantins River will be diverted approximately 23 months after the start of construction (approximately April 2001).

D. Project Alternatives

2.18 The development of electric power generation plants and electric transmission works in Brazil are established in the Brazilian Ten-year Expansion Plan 1998/2007, which provides the country's total installed capacity to grow from today's approximately 59,300 MW to 95,700 MW by the year 2007 to attend the growth rate in energy consumption projected by the Government of Brazil[2]. Projects are established based upon the need to guarantee the supply of electric power, the physical and economic viability of the individual project, and an evaluation of their social and environmental impact. The The Ten-year Expansion Plan, which is updated annually, is approved by the *Grupo Coordenador de Planejamento do Sistema ("GCPS*") coordinated by ELETROBRAS and integrated by all the Brazilian state utilities. The GCPS is responsible for all of the activities in connection with sector planning, mainly future investments in the sector.

2.19 The Cana Brava hydroelectric facility is included in the Ten-Year Expansion Plan and is considered an important component of the overall strategic energy generation plans for Brazil.

2.20 The development of the Cana Brava facility and project site alternatives were originally explored in 1979 by Furnas Centrais Elétricas S.A. ("FURNAS") who was granted permission to study the hydroelectric opportunities on the Tocantins River between the confluence of the Almas and Maranhão Rivers and Ribeirão São Felix falls. The location of the dam is the result of a six-site alternative analysis study. It presented the best conditions for the structure and for the river deviation as well as for foundations and overall arrangement. The proposed hydroelectric facility was originally to be called São Felix and incorporated both Serra da Mesa and Cana Brava. Due to financial and environmental considerations, it was subsequently decided to create two separate hydroelectric facilities, Serra da Mesa with 1,275 MW capacity and Cana Brava with 450 MW capacity. The option of two separate hydroelectric facilities allowed a more stable energy gain in the FURNAS system and in the interconnected national system, with a smaller flooded area and lower costs. The development of two separate power plants, when compared to the single embankment solution as first proposed, provides the following environmental and economic advantages: (i) an economy of around 30 millions m3 in embankment landfills; (ii) avoidance to flood important mineral reserves ("uranium") in the right margin of the Tocantins; (iii) reduction in the area to be flooded; (iv) increase of the installed energy capacity from 1,350 MW to 1,680 MW, with the same energy factor capacity; (v) economy of around US$ 80 million with the smaller Tocantins River diversion at Cana Brava, profiting from the large period of Serra da Mesa reservoir water filling time.

2.21 The welfare contribution of the *Cana Brava* Project to the Brazilian economy was estimated, as part of the IDB due-diligence, through an economic (cost-benefit) analysis, in order to confirm that the *Cana Brava* Project is economically justifiable. The methodology of analysis comprised the following: (a) measuring the economic benefits to the system associated with the Project coming into operation; (b) measuring the costs associated with the Project itself; and (c) on the basis of (a) and (b) above, deriving the net economic benefits of the Project, as measured by rate of return and net present value, all valued

[2] This growth rate of 5 percent per annum represents an expansion of 3,640 MW per year.

at economic (shadow) prices. The economic analysis was done under a system simulation "with" and "without" the Project (the "without" the project scenario refers to a thermal expanded system[3]), to define the (incremental) benefits and costs incurred by the Project under a set of assumptions about demand and supply during the period of analysis. The results produce an economic rate of return of 24.1 percent and a net present value of US$52 million and thus confirms that the *Cana Brava* project is an economically feasible Project.

III. INSTITUTIONAL AND LEGAL FRAMEWORK

A. Institutional

(a) Energy

3.1 The National Electrical Energy Agency (ANEEL), was instituted and regulated by Federal Laws 8.897/95 and 9.427/96 and its regulations, as the regulatory body responsible for implementing the federal government policies and procedures related to the potential for hydroelectric exploration and energy production, as well as for issuing the appropriate concessions, permits and other forms of authorizations. Two additional organizations are involved in the operation of the sector, GCPS and the National Electric System Operator (ONSE), a private institution integrated by entities operating under concessions or authorizations as well as final customers. Together they are responsible for the sector's operations planning and programming, and the activities of coordination, control and dispatch of the generation and transmission system. Other entities involved are Coordinating Group for Interconnected Operation (GCOI) and National System's Operation Center (CNOS), regarding the sector's operations planning and programming, and the activities of coordination and control of the generation and transmission system.

3.2 The Coordinating Committee of the Environmental Operations of the Power Sector ("*Comitê de Meio Ambiente do Setor Elétrico - COMASE")*, comprised of Eletrobrás and its regional concessionaires, established the environmental and social policies for the electric power sector based on the following guidelines: social and environmental feasibility of the project, environmental protection and socioeconomic development of the project area of influence, and public consultation and participation.

(b) Environment

3.3 The Ministry of the Environment, Water Resources and the Amazon Region (MMA) is responsible for the coordination of the National Environmental Policy ("*Politica Nacional de Meio Ambiente"*) at the federal level. The National Environment Council (CONAMA) is a consulting and deliberating body responsible for defining general environmental regulations and basic criteria and guidelines to implement the Policy, such as environmental and emission standards for ambient quality and pollutants, respectively, and also the general requirements for environmental licensing and for the environmental impact assessment process. The Brazilian Institute for Environment and Renewable Resources (IBAMA) is the federal agency responsible for executing and enforcing the environmental regulations and standards, at the federal jurisdiction, and to issue the environmental permit in the cases defined by law.

3.4 In terms of the Cana Brava Project, the environmental responsibility for the enforcement of environmental legislation, including the principal licenses, is primarily with the State of Goias environmental agency: Agencia Goiana de Meio Ambiente e Recursos Naturais ("AGMAR", previously

[3] The choice of natural gas plants is consistent with current trends in generation expansion plans and reflects GOB' policy towards increasing natural gas use in the overall energy supply.

FEMAGO). In May 1999, IBAMA confirmed that according to CONAMA Resolution 237/97 the State Environmental Agency would be responsible for issuing the environmental permits for the Cana Brava Project. IBAMA is only responsible for the authorizations related to reservoir clearing (e.g., tree cutting), flora and fauna rescue and cave protection. Archeological and historical resources are the responsibility of IPHAN (National Institute for Historic Heritage - Instituto do Patrimônio Histórico e Artístico Nacional).

(c) Health and Safety

3.5 The responsibility for developing and enforcing the health and safety regulations is assigned to the Ministry of Labor (MT) and its Regional State-based Offices (DRTs).

B. Legal

(a) Energy and power sector

3.6 The regulation of the public provision of electricity is mainly centered in articles 175 and 121 of the Federal Constitution which establish that the following are federal responsibilities: services and works of electric energy and exploration of hydroelectric potential of the water resources (together with the States where the hydroelectric resources are found), and rendering of public services, either directly or under regime of concession or permit, always by means of public bidding. The reform of the Brazilian power sector began in 1995 with the privatization of government-owned electricity utilities and with Constitutional amendments allowing private investment in the electricity sector. In 1996, the GOB undertook regulatory reform by setting rules of a new and competitive electricity market. The new market model opened generation and trading businesses to competition, while transmission and distribution continued as regulated activities.

3.7 Financial compensation (royalties) for the use of hydrological resources in the generation of electricity are regulated by Federal Laws 7.990/89 and 8.001/90, Federal Decrees 01/91 and 774/93, and Ordinance DNAEE 304/93. Compensatory payments are due to Federal government, States, and Municipalities where the areas to be flooded by hydroelectric reservoirs are located. The value of financial compensation is determined on a monthly basis, taking into account the amount of electric power effectively generated by the hydroelectric power plant. ANEEL is responsible for calculating the value of the financial compensation, based on information provided by the operator.

3.8 The expropriation process is regulated by the Federal Decree-Law 3.365/41 and Federal Law 2.786/56. This legislation constitutes the legal basis for the acquisition of private properties for public good/use. Article 5 (item XXIV) of the Federal Constitution defines the concept of fair payment. The expropriation process is to occur in two stages. In the declaration stage, ANEEL publishes a resolution determining that the area to be expropriated is of public utility. In the expropriation stage, the concessionaire is allowed to acquire and compensate the affected properties in the areas to be expropriated.

3.9 Other relevant pieces of legislation that regulate the provision of electricity are: Federal Law 8.987/95, which establishes the regime of concession and permit for public services, as established by article 175 of the Federal Constitution; Federal Decree 1.717/95, which establishes procedures for concessions of public services related to electric energy; Federal Decree 2.003/96, which regulates the electric energy production by independent producers; and Law 9.648, which included amendments to all the above legislation, as part of the government's reform to introduce greater competition and transparency in the generation of electricity.

(b) Environment

3.10 As granted by the 1988 Federal Constitution, environmental legislation and regulations in Brazil are enacted at the federal, state and municipal levels. The federal agency establishes general requirements of broad applicability, while specific standards of enforcement are left to the state agency, either by regulation or by administrative orders. The states and municipalities may also issue standards of equal or more stringent requirements than the federal ones. In addition, the Brazilian Technical Standards Association (ABNT) issues technical norms and standards dealing with specific environmental matters. The content of these standards is in general considered as best management practice; however, they can also be considered legal requirements when recommended by any piece of legislation.

Federal

3.11 The most relevant piece of environmental legislation is Federal Law 6.938/81, which created the National Environmental Policy (Politica Nacional do Meio Ambiente – PNMA). It established the basis for environmental protection in Brazil, by putting in place the appropriate institutional framework and defining the main instruments for environmental management. This policy and its regulations made provisions for the creation of the Brazilian Institute of Environment ("Instituto Brasileiro de Meio Ambiente, Recursos Naturais Renováveis e Amazonia Legal – IBAMA"), the National System of Environment ("Sistema Nacional de Meio Ambiente – SISNAMA"), and the National Council of Environment ("Conselho Nacional de Meio Ambiente – CONAMA"), as well as the establishment of the environmental permit system and the environmental impact assessment system (EIA system).

3.12 The Brazilian environmental permitting system requires that three licenses (permits) be obtained by all potentially pollutant activities: Preliminary License (Licença Prévia or "LP"), Installation License (Licença de Instalação of "LI"), and Operating License (Licença de Operação or "LO"). For projects listed in CONAMA 001/86 (includes HPPs with nominal capacity above 10 MW), an Environmental Impact Assessment (EIA) is required. The CONAMA Resolution 001/86 defines the basic content of the EIA and establishes the public participation requirements. CONAMA Resolution 09/87 regulates the public hearing process associated with the EIA process. The LP is granted based upon governmental approval of the project EIA and the RIMA ("Relatório de Impacto Ambiental", which is a summary of the EIA). The LI is granted based upon governmental approval of a project-specific Environmental and Social Management Plan ESMP ("Projeto Básico Ambiental" or "PBA")and represents the governmental authorization to start the construction of the proposed project. The LI also establishes specific requirements regarding the mitigation and monitoring or environmental and social impacts. The LO must be obtained prior to project operation.

3.13 The specific environmental licensing process for HPPs is regulated by CONAMA Resolution 006/87. The LP must be requested at the beginning of the feasibility study of the HPP and the granting depends on the approval of the EIA study and the RIMA . The governmental approval of the PBA is required for the issuance of the LI. The LO must be issued prior to the closing of the dam (i.e., beginning of reservoir filling/flooding), and is based upon verification of compliance with the environmental requirements established in the LI, in particular the implementation of the PBA.

3.14 CONAMA Resolution 002/96 determines that projects with significant environmental impact should include as mitigation measure the implementation of a Conservation Unit, preferably an Ecological Station, at the discretion of the environmental agency responsible for the permitting process (in this case, AGMAR). A minimum of 0.5% of the total project cost must be invested in a new area or existing conservation unit. Complementary funds (e.g., when areas cost less that the established percentage) can be used in infrastructure and monitoring activities within the area, also at the discretion of the state environmental regulatory agency.

3.15 Federal Laws 8.171/91 and 8.987/95 establish that electric utilities are obliged to recover the environmental conditions in the affected area. These laws also address requirements for forest clearing and other disinfecting activities within the reservoir area, as well as institutional arrangements with environmental agencies to promote pollution control in the reservoir watersheds, and monitoring and control of activities in the reservoir and protected areas. Federal Decree 95.733/88 establishes that large and medium scale projects, funded totally or partially by federal funds, must include in the project budget a minimum of 1% of this budget, to prevent or correct the project negative impacts.

3.16 Other federal legislation that may relate to the Project includes (see Annex for brief summary): (a) waste management; (b) water management, including water quality standards, and standards for wastewater and effluent discharges; (c) fauna and flora and forest management, including requirements for deforestation and clearing of reservoirs before filling and the minimum width of protected forests around reservoirs; (d) exploitation of mineral resources, including extraction of stones, clay , gravel and sand and other materials for construction works; (e) noise, including maximum limits for noise in industrial, commercial or leisure areas; (f) protection of historic and archeological sites and patrimony; (g) handling and transportation of explosives; and (h) the expropriation process required to acquire and compensate the affected properties in the areas to be expropriated for a public project or a project that is of public interest.

(c) Health and Safety

3.17 Health and safety regulations in Brazil are mainly established by the Ministry of Labor, at the federal level, through a set of laws, decrees and Regulatory Norms (NR's). However, complementary health and safety and industrial hygiene requirements are established through Technical Rules and Standards issued by the ABNT.

State of Goiás legislation

3.18 The main State legislation applicable to the Project are the State Law 8.544/78 and the Decree 1745/79 regarding prevention and control of environmental pollution.

Other

3.19 The Project Concession Contract (No. 185/98, dated August 7, 1998) between ANEEL and Companhia Energetica Meridional (CEM) establishes requirements for CEM's strict adherence to environmental legislation. For example, the Contract requires the Concessionaire to comply with the environmental legislation and will be held responsible for any environmental damage arisen from their performance. The Concession Contract also states that the Concessionaire is responsible for the expropriation of the land and properties, and resettlement or indemnification of the families in the affected area.

3.20 The Project EPC Contract requires the EPC Contractor to comply with all applicable legislation and establishes the obligations and responsibilities of each party, including all the environmental aspects that must be taken into consideration.

C. Compliance Status

3.21 The Contract between CEM and ANEEL (August 1998) regulates the rights of CEM to use the hydraulic energy potential in the Tocantins River by the Cana Brava HPP. The Cana Brava Project was originally to be undertaken by Furnas Centrais Elétricas S.A. ("FURNAS") who is the primary wholesale generator in the area, including the Southeast, the State of Goiás and the Federal District. FURNAS developed the

preliminary studies, which included an Environmental Impact Assessment (EIA) study that was submitted to the State Environmental Agency in Goiás (FEMAGO, at that time) in 1987. In 1990, FEMAGO issued the LP to FURNAS upon approval of the EIA study and the RIMA. The LP was subsequently renewed in 1995, and also in October 1997 after a Public Hearing was held in Minaçu on April 23 1997 (the public hearing complied with applicable Brazilian requirements, including the public availability of the Project EIA and RIMA at various locations and prior public notice of the public hearing). Further information on the public consultation process is presented in Section VII.

3.22 In August 1998, the Project Company (CEM), who had been granted by ANEEL the Concession to build and operate Cana Brava for 35 years, submitted an application to FEMAGO for the LI, which included some updated environmental and social information and the Project PBA. In September 1998, FEMAGO granted the LI. Other key environmental permits and authorizations include (see Table 3-1 for complete list): FEMAGO granted the LI for the Project campsite (dam work site) (May 1999); IBAMA issued authorizations for the implementation of the animal rescue program (May 1999) and for the clearing vegetation in the campsite area (June 1999); and IPHAN has issued the authorization for the implementation of the archeology program.

3.23 A formal census of families/persons directly affected by the flooding of the reservoir was performed during the months of March to September 1999. On November 29, 1999 the census was formally validated at a public meeting, at which some 300 people from the affected area were present, including the mayors (prefeitos) of Minaçu and Cavalcante and the Promotores de Justiça, who represent the Ministry of Public Affairs.

3.24 An environmental assessment for the transmission line was not specifically included as part of the Cana Brava EIA, especially given the limited impact associated with the development of the line. However, AGMAR is requiring that a project-specific Environmental Management Program be developed for the transmission line as a condition to the issuance of the LI to authorize the start of construction.

3.25 At the request of the IDB, CEM has performed the following: (a) modified and enhanced the PBA (see Section VI for summary); (b) developed a draft Resettlement Plan that complies with IDB Policy on Involuntary Resettlement (August 1998) (see Section VI for summary); and (c) implemented additional information disclosure activities (e.g., made the EIA and PBA available to the public again in late 1999 and early 2000) and public consultation activities (refer to Section VII for details).

IV. ENVIRONMENTAL AND SOCIAL CONDITIONS

A. Environmental

4.1 The Project will be located in the Tocantins River, approximately 50 km downstream Serra da Mesa reservoir, on the border between the municipalities of Minaçu and Cavalcante, in the State of Goiás (see Figure 2-1). The Area of Direct Influence (ADI) by the Project is defined as the areas to be flooded (138.7 km^2), the areas for the dam construction-related activities and the areas immediately downstream the dam (approximately until the confluence with Traira River); the Area of Indirect Influence (AII) of the Project is defined as the municipalities of Minaçu, Cavalcante and Colinas do Sul (see Figures 2-1 and 2-2).

4.2 Hydrology: The hydraulic basin of the Tocantins River is quite large, draining approximately 343,000 km^2. The Cana Brava Project is located in the upper portions of the basin, with the Serra da Mesa hydroelectric power plant located approximately 50 km upstream and two other hydroelectric power plants in operation and two others presently under construction located downstream. The Araguaia

River is located approximately 1,000 km downstream.

4.3 The Tocantins River between Serra da Mesa and Cana Brava dams is 87 kilometers long and has an average width of 160 m. The average surface area of water is approximately 13.9 km^2, which represents about 10% of the area that will be flooded to form the reservoir. The minimum flow registered in the Tocantins River is 84 m^3/s (02/20/1980); whereas the maximum flow registered is 13,368 m^3/s (10/12/1967). The average minimum monthly flow is 102 m^3/s and the long-term average flow is 820 m^3/s. The total area that drains directly to Cana Brava is approximately 57,777 $km^{2.}$ and the estimated flow contribution from this area is only 2 m^3/s (or 0.25% of the average flow of 820 m^3/s in the Tocantins River)(i.e., flows from the Serra da Mesa comprise the majority of flow into Cana Brava).

4.4 Water Quality: As part of the EIA and PBA, water quality monitoring has been performed at various locations (4 on the Tocantins River and 26 on its tributaries). Sampling was conducted during both the dry and rainy seasons for the following parameters: temperature, dissolved oxygen, pH, suspended solids, transparency (secchi disc) and alkalinity. The results, in both dry and rainy seasons, indicate that water quality meets the standards defined by CONAMA Resolution 20/86 for waters classified as Class II[4]. However, concentrations of suspended solids were high (for drinking water) in the Tocantins, Carmo and Bonito River (near Minaçu). Fecal coliform levels were observed in some samples as high as 10^5 nmp/100 ml (high for drinking water) due to the discharge into the rivers of raw sewage from the municipalities.

4.5 Geomorphology: The Area of Direct Influence (ADI) of Cana Brava comprises two different geomorphologic settings: the "Planalto Central Goiano" and the "*Depressão do Tocantins*". The first has altitudes ranging from 500 to 1,100 masl and is drained by the Tocantins River and its tributaries. The most outstanding features are the structural land surfaces formed by "*Serra da Mesa*", "*Serra Dourada*" and "*Serra da Mantiqueira*". The "*Depressão do Tocantins*" (Tocantins Depression) is observed only in the central-north part of the ADI, with altitudes that range from 300 to 360 masl. The "Serra da Cana Brava", though within the Tocantins Depression, is considered as a residual surface of the plateau. The results of erosion on rocks with different levels of susceptibility to erosion result in hills such as "*Serra da Moçambinha*", "*Serra da Bibiana*" and "*Serra do Retrato*".

4.6 Speleological features: As part of the PBA, a speleological survey was started in April 1999 and was completed one year later. Fifteen speleological occurrences were identified in or very near the ADI, including ten caverns, two small caverns, and three other karstic features such as *dolinas*. The most important cavern is the *Tamanduá Bandeira,* which has some potential for tourism.

4.7 Soils: The predominant types of soils in the region (AII) are considered to have high to moderate aptitude for agriculture: Lithosoils (low depth and associated with schists, granites and gneiss), Alluvial soils (deep soils, good aptitude for agriculture), Colluvial soils (moderately deep, good aptitude for agriculture), "Cambissolos" (moderate aptitude for agriculture), "Terra Roxa Estruturada" (good aptitude for agriculture, high susceptibility to erosion), Deep-red podzoil (high aptitude for agriculture, moderate susceptibility to erosion) and Red-yellow dystrophic podzoil (low fertility, high acidity and limited aptitude for agriculture). However, within the area that will be flooded (i.e., ADI), 75 percent of the land consists of soils with low agricultural potential, with physical impediments, low depths, over 5 months of water deficiency, and difficulties for irrigation. Only 25 percent of the ADI correspond to soils with good aptitude for agriculture.

[4] Intended for domestic supply after conventional treatment, protection of aquatic communities, primary contact recreation, irrigation of vegetables and fruit bearing plants and natural or intensive breeding of species intended for human consumption.

4.8 Climate: The prevailing climate in the region is classified as sub-humid. The region presents two very clear seasons, the dry season (in winter) from May to September and the rainy season (summer) from October to April. The wettest months are December and January, and the driest months are June and July. The annual average precipitation varies from 1,262 mm to 1,800 mm and annual evaporation varies from 1,000 mm to 1,500 mm. The average relative humidity is 74%. The average maximum and minimum temperatures are 33°C and 20°C, respectively. The long-term annual average temperature varies from 20 to 25°C.

4.9 Flora and fauna: The Project is located in the Brazilian savannah region ("Cerrado"). The principal types of vegetation in the ADI are dense and open savannah, grasslands and riverside woodlands. In the area between Porto do Garimpo and Serra da Mesa dam, the vegetation in the area that will be flooded is more preserved, including the riverside woodlands. Downstream Porto do Garimpo until Cana Brava, the landscape includes areas used for farming, Babaçu palm groves and secondary vegetation. The AII contains similar vegetation as in the ADI. Though within the AII, the National Park of Chapada dos Veadeiros, with an area of 60,000 ha of typical *cerrado* vegetation (latu sensu) is not likely to be subject to any relevant direct or indirect impacts from Cana Brava given the location of the park in relation to the reservoir. The park is within the Municipality of Cavalcante (60%) and includes part of the higher portions of the Preto River, one of the tributaries of Cana Brava reservoir.

4.10 The savannah region ("*Cerrado*") contains a relatively abundant number of animal species, although few endemic species. Endangered species have not been identified during the Project-related surveys. There are generally few migratory species of birds in the Project area. There are a wide variety of reptiles, amphibians and insects present (including insect species of phyto-sanitary interest as well as disease-vectors species). Regional fish species are found in the Tocantins River. The upper portion of the Tocantins River Basin has the natural characteristic of oligotrophic conditions, making the system less productive when compared with the middle and lower sections of the basin.

4.11 Mineral resources: A variety of mineral resources are found in the region (AII), such as asbestos, sand and gravel, gold, and granitic mineralizations, constituted by beryl, cassiterite, and tantalite. For example, asbestos is mined in the left margin of the Tocantins basin, sand in the Tocantins mainly near Porto de Buriti, and gravel near Minaçu. Small scale gold mining ("garimpo") is also present along the right margin of the Tocantins basin. However, specifically in the ADI, the gold reserves that existed in the Carmo River were depleted in 1996 thus leading to the abandon of the mining activities. Other mineral resources such as quartz, marble, thermal water and copper also occur in the basin.

4.12 Seismology: Although Brazil is considered a country of low seismic activity, data surveyed of the "Seismtectonic Province" that includes the AII shows that, especially in Porangatu, Palmeirópolis and Minaçu there are significant and complex structural features including folds, normal and reverse faults that lead to the occurrence of natural seismic events in this area. Reports (dating to 1826, though the systematic observation started in the 1970's) indicate twenty-five seismic events were registered inside a 300 kilometer circle centered in the Cana Brava dam axis, with the maximum magnitude registered for a single event being 4.0 (Richter Scale).

B. Socio-economic aspects

4.13 The area to be directly flooded by the Cana Brava Project (i.e., ADI) is located primarily in the municipalities of Minaçu and Cavalcante, with a smaller portion in the municipality of Colinas do Sul (see Table 4-1). The nearest city is Minaçu, situated about 15 kilometers from the dam site. Minaçu is linked to the Federal road BR-153 by the State road GO-241 from the city of Santa Teresa de Goiás. BR-153 links Goiania (the capital city of Goiás) to the State of Tocantins. The city of Goiania has a major airport, and is linked by road to the main Brazilian cities. The city of Cavalcante (capital of the

Municipality of Cavalcante) is located over 100 km from the reservoir. The mountain chains Bibiana and Serra da Mesa separate both and represent a major constraint to any road connection between the city and the reservoir.

4.14 The economy of northern Goiás is based on cattle ranching, agriculture (corn, rice and sugar cane) and some mining. Historically, the settlement of the region was encouraged by the development of Brasilia, and construction of the South-North roads BR-153 and BR-010/118, which stimulated the development of new urban areas. The origins of Minaçu are linked to SAMA (*S.A. Mineração de Amianto*), an asbestos mining company, belonging to the French-owned Saint Gobain group, that began production in 1965. The Minaçu economy was subsequently enhanced with the construction of the Serra da Mesa HPP (construction initiated in 1986, operation started in 1998). In 1976, Minaçu was given the status of a municipality, breaking away from Uruaçu. The municipality of Cavalcante was founded in 1831, while the municipality of Colinas do Sul was created in 1988.

4.15 Population: The Municipality of Minaçu has the largest population in the region, a total of 36,663 (1996), the majority living in the urban area (31,896). The main sources of employment in Minaçu are SAMA and, until recently, the Serra da Mesa construction site. The municipality of Cavalcante is the sixth largest in Goiás in terms of area (close to 7,000 km²), but has a population of only 9,510 (1996), of whom 75 percent reside in the rural areas. The population of Colinas do Sul is 3,469 (1996). The rural population of Minaçu has decreased by approximately 30 percent between 1985 and 1998. A survey by IBGE for the State of Goiás showed a decrease in the rural population of approximately 47 percent between 1980 and 1991.

4.16 Based upon the Project census of families directly affected by the Cana Brava Project (performed during March to September 1999), the following is a summary of the socio-economical conditions of these families (see Section V for further description of impacts). There are 258 families (875 people) living in the area that will directly affected by the project: 226 families (726 people) live in the rural area and 32 families (149 people) in the urban area of Minaçu. The density of population in the directly affected area (ADI) is low, with 3.2 inhabitants per km². In terms of families directly affected, 46 percent have not completed primary education.

4.17 One of the poorest and most vulnerable populations is Limoeiro, comprising 7 families who live in a small community situated on the Rio San Antonio in the Municipality of Cavalcante. The settlement has a small rural school and an evangelist church, and receives some support from North American evangelist missionaries.

4.18 The rural population that do not have land title or occupancy rights (*posse*), live and work in the area under a variety of different arrangements. They are sharecroppers (*meeiros*), usufruct (*usufrutuários),* tenants *(arrendatarios),* family labor *(mao de obra familiar),* residents *(comodatarios),* non-family residents *(ocupantes),* and employees *(agregados).*[5]

[5] Sharecroppers are allowed to cultivate land belonging to others on condition that they give part – not always half, of the crop to the landowners, or they plant part of the area in pasture. Usufruct refers to people, generally the sons or sons-in-law of landowners, who work independently on land given by their parents, but where the sub-division is not formally documented. Tenants pay for the land they work and/or for the house they reside in. Family labor includes people who work on the land of relatives without making any payments in cash or kind. Residents live and work on the land without making payment, but the arrangement is temporary, and they are obliged to return it to the owner when he or she requires. Non-farming residents simply live on the property, without engaging in any productive activities. Employees live and work on the property, and are paid in cash and/or kind. This category includes long-term employees, who have lived and worked on a particular landowner's property for many years, often with their families, and have nowhere else to go. The category would also cover any employees who were engaged for a shorter term, but who were included in the census that was carried out between March and September 1999.

4.19 Infra-structure: Most of the available infrastructure in the region is concentrated in Minaçu, which has a hospital, schools, airport, business activities and a water treatment plant, built for the Serra da Mesa construction camp and offices. In the City of Minaçu, approximately 94 percent of households are linked to the piped water supply system provided by SANEAGO (water concession company); while the sewage collection system reaches only 2 percent of households, and 79 percent use septic tanks or pit latrines. The health services' capacity in Minaçu is 3,5 hospital beds per 1000 inhabitants and 5 doctors per 1000 inhabitants. There are four private ambulatory and four hospitals. One of the hospitals is localized in the Villa FURNAS and offers 40 percent of its capacity to local people.

4.20 The condition of the access roads is poor in the ADI, especially during the wet season. The primary mode of crossing the Tocantins is in small boats or ferries (in limited locations) which carry vehicles across the river.

4.21 Economic activities: The main economic activities in the rural areas are ranching and small scale agriculture (sugar cane, manioc, corn and rice). In much of the area soils are poor, and the potential of agriculture is limited by the lack of transport infrastructure and markets. Ranching has also suffered from restrictions of the sale of cattle intended to prevent the spread of foot-and-mouth disease. Until recently alluvial gold was mined in Rio do Carmo and São Felix, but the workings have been abandoned as the deposits have been exhausted. There are two sand dredges that supply sand for construction in Minaçu. SAMA is the principal source of employment in Minaçu. There are also two brickworks, only one of which is in operation. Some 44 percent of the economically active population (EAP) of Minaçu are employed in trade and services.

4.22 The rural area directly affected by the reservoir is characterized by a mixture of relatively large landholdings, which are typically ranches devoted to extensive cattle raising, and small agricultural holdings, most of which are limited to subsistence agriculture. Some 55 holdings represent over 80 percent of the land in the area of the reservoir. The ranches to the west of the Tocantins, in Minaçu, are more accessible and tend to be more highly capitalized, with better infrastructure and larger areas planted in pasture whereas the ranches in Cavalcante and Colinas do Sul are more remote. The smaller holdings typically combine subsistence agriculture with cattle raising.

4.23 Income levels are generally low in the three municipalities: in Minaçu 62 percent of the EAP receive two minimum salaries (1 minimum salary equals R$ 130,00) or less, and in Cavalcante and Colinas do the percentage is 87%. Once construction came to and end at Serra da Mesa HPP, unemployment in Minaçu rose above the national average. In terms of families directly affected, in general, the standard of living and educational level of the affected population is low, for example 72 percent of the affected families receive two minimum salaries or less.

4.24 Archaeological heritage: The region's archeological sites include the ruins of historical value of São Felix and Carmo.

4.25 Indigenous People: There are no indigenous people in the Direct Area of Influence (ADI) of Cana Brava. Upstream of the Cana Brava ADI, and immediately below the Serra da Mesa dam, are located the remaining six surviving members of the Avá-Canoeiro people (an adult couple, their children, and two women who are currently maintained in the Avá-Canoeiro Indigenous Reserve). The Avá-Canoeiro Indigenous Reserve was originally established by the National Indian Foundation (FUNAI) in 1985. When the Serra da Mesa HPP was built, around 10 percent of this original area was affected by the reservoir. As a result, a specific mitigation measure required FURNAS, who was responsible for the construction and operation of Serra da Mesa, to acquire a new area and transfer the six Avá-Canoeiro people. This new area covers 38,000 hectares and is located in the municipalities of Minaçu and Colinas

do Sul, upstream of Cana Brava's directly affected area.The indigenous village is located in a remote area in the interior of the Reserve, approximately at 345 masl, on the border of Pirapitinga Creek, which runs into the Lageado River, an affluent of the Tocantins River. . As part of the due-diligence, the IDB visited the area and consulted with the group of indigenous people to confirm that Cana Brava will not represent any incremental impact to the impacts of the relocation originated by Serra da Mesa. For the last 8 years, FURNAS has supported FUNAI's attempts to locate and contact any remaining groups of Avá-Canoeiro. However, given that to date none have been encountered, these attempts have been suspended since 1999.

4.26 Another indigenous community, the Kalunga, is located approximately 120 km downstream from the Cana Brava Project and is not located in either the area of direct or indirect influence of the Project.

V. ENVIRONMENTAL AND SOCIAL IMPACTS

A. Construction Impacts

5.1 The principal environmental and social impacts associated with the construction of Cana Brava HPP are those typical of large-scale hydroelectric works. These include the following principal impacts which are mainly temporary and mitigable: soil erosion; dust and air contamination from vehicle traffic and cement plant; noise emissions from construction and blasting activities; wastes and spills from petroleum products and other chemicals; waste rock disposal; sewage disposal and storm water runoff; temporary changes in river flows due to diversions and hence impacts on aquatic flora and fauna; and social issues associated with construction camps, such as increased local traffic, increased demand on local infrastructure and services (including social services), worker accidents, cultural conflicts and possible increase in sexually transmitted diseases. Other impacts are permanent, though mitigable, mainly those related to the filling of the reservoir, such as loss of land use, involuntary resettlements, changes in flora and fauna ecosystems, loss of mineral resources, and loss of archeological sites, and loss of infrastructure (e.g., roads, etc.).

5.2 The environmental and social impacts of the Transmission Line (TL) are limited and relatively minor due to its limited extension (50 km) and to the fact that it will be constructed along the existing lines and the existing road between Cana Brava and Serra da Mesa. The impact primarily on the flora and fauna (due to deforestation), air quality (due to dust emissions), and possible soil erosion will be minimum. Land use, archeological sites and speleological occurrences will not be affected, since the right of way already exists and has been used for other lines and a road.

(a) Environmental

5.3 Loss of land: The Cana Brava reservoir will result in the loss of approximately 124.47 km^2 (based upon total area affected (139 km^2) minus area of existing Tocantins River (14.53 km^2). The rural area directly affected by the reservoir (ADI) is characterized by a mixture of relatively large landholdings, which are typically ranches devoted to extensive cattle raising, and small agricultural holdings, most of which are limited to subsistence agriculture. Approximately 25 percent of the area to be flooded correspond to soils of high aptitude for agriculture, and 75 percent of poor soils. The principal types of vegetation in the ADI are dense and open savannah, grasslands and riverside woodlands.

5.4 Erosion and soil losses: Given many of the local soils are considered to have high erosion potential, the

[6] Nevertheless, an ESMP for the TL will be required by AGMAR, the state environmental agency, to issue the Installation License (LI).

construction at the Project site may result increased soil erosion due to superficial soil removal, exploitation of borrowing areas, opening of access roads and others factors. In addition, some areas will have the soil exposed during vegetation clearing (deforestation) which may enhance soil erosion and small scale slope failures.

5.5 Contamination of Air, Soil and Water: Construction site activities (such as excavation, earth filling, vehicle cleaning and maintenance, truck movements, drilling and blasting, worker housing and support facilities, etc.) will result in temporary increases in noise, dust, air emissions, wastewater (sewage, storm water runoff), and waste disposal.

5.6 Flora and fauna: The reservoir clearing and filling will result in the loss of some flora and fauna. They may be some habitat fragmentation and/or changes to flora and fauna in the reservoir edge areas. The decrease of habitats is more important for some species, mainly big carnivores, which need large territories and do not migrate from one fragment to another. The submersion of *cerrado latu sensu*, the main vegetal physiognomy in the flooded area, may cause the loss of some species. Some species of fauna may temporarily disappear from the area (especially those with the most specific requirements for feeding and reproduction and that live in forest core areas) whereas generalist species may have an increase in their populations. However, these impacts will be of moderate significance, given that the majority of the ADI is being used for agriculture. The diversion of the river and the filling of the reservoir may lead to a change in ichtyofauna diversity. Some fish species use the riverine conditions to feed and reproduce. Thus, the loss of this habitat may cause a decrease in those species' populations.

5.7 Loss of mineral resources: As of April 1999, there are approximately 180 requests to the DNPM for mineral surveys in the directly affected area. Some of these areas will be partially flooded. The vast majority of them are related to sand, gravel and construction materials. The filling of the reservoir will result in a loss of the exploitation of alluvial deposits in the Tocantins River.

(b) Socioeconomic

5.8 Expropriation and resettlement: A total of 258 families (875 persons) will have to be moved from the reservoir area, and compensated and/or resettled. Of these families, 226 families (726 persons) live in rural areas distributed between the three municipalities (see Table 5-1). The remaining 32 families (149 persons) live in the town of Minaçu (see Table 5-2). In general, the standard of living and educational level of the affected population is low, for example 72 percent of the affected families receive two minimum salaries or less.

5.9 In terms of properties, a total of 252 holdings will be affected by the reservoir. The properties are distributed among 236 owners, as some owners hold more than one property. The distribution of the affected property owners and properties is shown in Table 5-3. The rural area directly affected by the reservoir is characterized by a mixture of relatively large landholdings, which are typically ranches devoted to extensive cattle raising, and small agricultural holdings, most of which are limited to subsistence agriculture. Some 55 holdings represent over 80 percent of the land in the area of the reservoir (see Table 5-4). The smaller holdings typically combine subsistence agriculture with cattle raising.

5.10 The rural population that do not have land title or occupancy rights (*posse*), live and work in the area under a variety of different arrangements. They are sharecroppers (*meeiros*), usufruct (*usufrutuários)*, tenants *(arrendatarios)*, family labor *(mao de obra familiar)*, residents *(comodatarios)*, non-family residents *(ocupantes)*, and employees *(agregados)*(see Table 5-5).

5.11 Within the urban area of Minaçu, there are 32 affected families which include all the families whose

houses and/or house plots fall within the limit of affectation, defined as 30 meters from the 333 masl contour line (i.e., the reservoir area plus the 30 meter "security area" (*área de segurança*)). There are three areas of the town that are affected: an area along both banks of the Rio Bonito (25 houses) most of which have been occupied for at least 10 years, an area near the municipal slaughterhouse, comprising three brick houses, and four houses in the Vila Manchester. These houses form part of a small squatter settlement in an area that the Municipality had defined as unsuitable for urban development. Of the 32 families, 25 can be considered owners of the houses they occupy. Seven families have title deeds to the houses and the others have some form of occupancy rights (*posse*). The remaining seven families include one family who rent their house and six that live in the houses – usually of close relatives, without paying any rent.

5.12 The Avá-Canoeiro Indigenous Community is not directly affected by the Cana Brava Project.

5.13 Pressure on local infrastructure and social services: Approximately 1,350 direct and 550 indirect jobs will be created during the construction of Cana Brava HPP. The increase in Minaçu's population, due to the incoming workers and their families, may put additional pressure on local urban planning and availability of housing, social services (education, health, public safety, transportation) and infrastructure. This should be of small magnitude, given that a large portion of the work force will be recruited among Minaçu residents (thus reducing the potential for social and cultural conflicts), the majority of the workforce will be housed on the campsite (with some of the technical and professional staff being housed in the existing Villa FURNAS, originally built for the Serra da Mesa HPP) and that the required workforce is not relevant compared with the population of Minaçu. Therefore, impacts from Cana Brava should be relatively minor given the previous activities related to the construction of Serra da Mesa HPP, with FURNAS providing additional services in areas such as health and transport. ,

5.14 Loss of infrastructure and productive activities: The urban infrastructure that will be affected in Minaçu includes a bridge across the Rio Bonito, the electricity supply system, and the bridge across the Rio Bonito, east of Minaçu on the way to the airport and to the locality of Buriti, and the municipal slaughterhouse. In the rural directly affected area, 15 kilometers of State secondary and local roads will be affected (parts of GO-241 and GO-132), portion of the local road that is the alternative connection between Minaçu and Palmeiropolis, part of the local connection between Buriti and the landholdings at the right bank of the Tocantins River, and some electric transmission lines.

5.15 The main productive activities that will be affected by the reservoir are agriculture and cattle ranching. The non-agricultural economic activities affected by the reservoir are relatively limited. They include two sand-dredging operations in the Tocantins, near to Minaçu, and a large brick works in Minaçu that will lose access to its present source of clay. No other non-farming commercial activities will be affected. There is no commercial fishing in the Tocantins or its tributaries. Fishing does however provide an additional source of subsistence for people in rural areas – as in Limoeiro. The fishery in the main river has already been affected by the change in water quality resulting from Serra da Mesa. There is no evidence of current mining activity in the area (the alluvial gold deposits that were explored until 1996 in the Rio do Carmo, have been exhausted).

5.16 Total or partial destruction of archaeological sites: During the filling of the reservoir, archaeological sites located in the ADI will be affected. There have been 13 archeological sites identified and 22 lito-ceramic occurrences identified.

B. Operation Impacts

(a) Environmental

5.17 Change in Limestone and Speleological Resources: Of the fifteen speleological occurrences that have been identified in the ADI, one cavern (Três Bocas) and two karstic features, a small cavern (Rainha do Norte II) and a doline (Rainha do Norte I) will be entirely flooded. Three other caverns (Senhor do Bonfim, Três Pontes and Bibiana III) will become accessible along the margins of the reservoir. The others will likely be partially flooded due to the increase in groundwater level elevation that will occur after the formation of the reservoir.

5.18 Erosion of Reservoir Margins: Reservoir water level changes/oscillations of up to 3 m within a short period may cause localized soil erosion and/or slope failures, and thus increase in suspended solids in the reservoir. This impact may be increased, if areas along the reservoir's margin are used more intensively.

5.19 Change in Groundwater: The filling of the reservoir will likely cause changes in the groundwater levels. Once the reservoir and groundwater become stabilized, the groundwater level at the reservoir margin should coincide with the elevation of the reservoir water surface. The subsurface water level prior to creation of the reservoir established by the Tocantins river is located at 293 masl, and with reservoir water level will be 330 masl. In addition, there may be some localized change in groundwater quality.

5.20 Increase in Aquatic Flora: The creation of the reservoir may result in increased habitats and growth of aquatic macrophytes and algae.

5.21 Increase in population of disease carrying vectors: The creation of the reservoir may result in increased habitats for insect larvae, and in particular the order Culicidae (which are responsible for the transmission of many endemic diseases, such as malaria and *dengue)* and the genus *Biomphalaria* (which host the ethiological agent of schistosomosis). This could lead to an outbreak of these diseases in the urban areas.

5.22 Changes in the Landscape: As a result of the reservoir, an island (with approximately 150 ha) will be formed approximately 6.5 km from the dam site. In addition, there will be a visual change from riverine to reservoir environment.

5.23 Potential Change in Seismicity: The creation of the reservoir may induce minor localized seismic activities.

5.24 Potential Change in Micro-Climate: The relative humidity in the air tends to increase due to the evaporation of reservoir water to the atmosphere, and thus, there may be minor micro-climate changes (e.g., increased fog) especially in the areas nearest to the reservoir. In addition, there may be slightly increased winds due to the large surface area of the reservoir.

5.25 Changes in Water Quality: The reservoir will result in changes to the hydraulic and quality characteristics of the Tocantins river in area to be flooded, especially in the downstream areas near the dam. However, due to the relatively short residence time (60 days), some portions of the reservoir will maintain some riverine characteristics. Water quality is anticipated to be good to very good given that the majority of reservoir inflows will be from Serra da Mesa reservoir releases which should be good given the reservoir design. Cana Brava reservoir water quality maybe impacted in the future due to uncontrolled releases/discharges into the reservoir (e.g., from Minaçu or immediately surrounding reservoir land uses).

5.26 The Cana Brava Project is not likely to reduce significantly the long-term average flow in the Tocantins River, since the average reservoir release/flow of 800 m^3/s is anticipated during the operational phase. The reservoir releases are not likely to affect the downstream river conditions (e.g., hydraulics, water

quality and biological resources) given the expected reservoir water quality and the fact that the reservoir is a "run of river type". During the reservoir filling, a release of 100 m^3/s is planned (the average monthly minimal flow registered in the river).

(b) Socioeconomic

5.27 Risks to Public Health: The presence of the reservoir may result in increased disease carrying vectors and thus increased risks to public health (e.g., endemic diseases, such as malaria and *dengue*, or schistosomosis). In addition, in the urban areas of Minaçu there may be increased impacts to human exposure to contaminated water due to lack of adequate wastewater collection and treatment.

C. Positive Impacts/benefits

5.28 At a national scale, Cana Brava is one of the first private projects to be developed under the new institutional and regulatory framework of 1996 for the electricity sector and one of the first Independent Power Producers of self-generators to be financed under a project finance scheme in Brazil. The project also mobilizes the private sector financing with tenors not available in the commercial bank market and will contribute to support the creation of a competitive electricity market in Brazil.

5.29 At a regional scale, the principal positive impacts of the implementation of Cana Brava HPP are: (a) improvement in the electric energy offer to the regional system, via the CELG system, thus fostering regional economic development ; (b) revitalization of commercial and services activities in Minaçu, due to the increased market represented by the new population attracted by the Project; (c) employment during construction and operation phases (approximately 1,350 direct jobs and 550 indirect during construction); (d) regularization of the Tocantins River flow, enabling a stable water flow regimen downstream, reducing inundation (flooding) risks so that land uses may be better planned; (e) increased environmental education in the region; and (f) investment in preservation of natural resources (approximately R$ 2,640,000 will be invested in the implementation of a Conservation Unit).

5.30 Another important positive impact, at a local scale, is the increase in the Municipal tax incomes in the Municipalities of Minaçu, Cavalcante and Colinas do Sul, mainly: (a) ISS payment (Tax on services) to the municipal government's during the 43 months of construction, estimated at 6,5 million[7] *reais*; (b) ICMS (Tax on commercialization of goods), due to the Municipality of Cavalcante (where the powerhouse is placed and the concession owner has its headquarter), during the entire useful life of Cana Brava reservoir (estimated at 6,6 million *reais*)[8]; (c) financial compensation (royalties) for the use of water resources, to be paid to Minaçu, Cavalcante and Colinas do Sul (estimated at 2.8 million *reais* per year to be shared by the three municipalities).

VI. ENVIRONMENTAL, SOCIAL, AND HEALTH AND SAFETY MANAGEMENT

6.1 The environmental, social, and health and safety management for the project is based upon the following Project plans/procedures:

- Project Environmental and Social Management Plan (ESMP or PBA), which presents the environmental and social mitigation measures and monitoring programs (see Sections 6.A and 6.B

[7] ISS : R$ 6,5 million (currency exchange rate on 01/04/98 – Base-date of the EPC).
[8] ICM-S : R$ 6,6 million (currency exchange rate on 01/04/98 – Base-date of the EPC), calculated with the interstate rates of 7%, since there in an exemption until April 2001in the difference of 10% in the rates charged internally by the State of Goais (17%) .

for description);

- Project draft Resettlement Plan, which presents the proposed requirements, options and procedures for Project-related expropriation and resettlement of affected families and properties (see Section 6.A for details);
- Project specific environmental, health and safety procedures developed by the EPC contractor to deal with the environmental, health and safety impacts and risks associated with the HPP construction activities (see parts of Section 6.A, and Sections 6.D and 6.E).

6.2 The Cana Brava mitigation and monitoring measures benefits from the experience gained with the implementation of the ESMP for the Serra da Mesa HPP. The responsibilities and costs associated with the environmental and social mitigation and monitoring measures are presented in Section 6.C. Section 6.E presents a summary of the proposed environmental, health and safety management systems proposed for the project.

A. Mitigation Measures

(a) Construction phase

Environmental mitigation measures

6.3 Environmental Management of the Construction Site: The Program comprises a detailed set of mitigation and monitoring measures aimed at controlling the impacts of the construction activities on the air, water, soil, flora and fauna. It includes the implementation of detailed procedures regarding prevention of erosion and sedimentation, clearing of vegetation, implementation of service roads, protection of the surrounding vegetation, protection of the fauna surrounding the campsite, disposal of effluents and solid wastes, including hazardous wastes. The liquid effluents are treated in a system of two lagoons. In order to prevent air pollution the service roads in the campsite are frequently water-sprayed. Domestic solid wastes are disposed in the municipal landfill in Minaçu[9]. Oils are collected in oil/water separators and re-used. Tires and leftovers are being either recycled or sent to the landfill. Some waste materials are burned on-site. Wastes from the health unit are incinerated at Minaçu Hospital Incinerator (approved by FEMAGO). The EPC is presently designing a new landfill to be implemented at the construction site. The landfill will be approved by FEMAGO and will be based upon good practice procedures for designing and operating municipal waste landfills. The Program also contains a set of environmental indicators that must be evaluated periodically. The program is developed and implemented by the EPC (*Consórcio Cana Brava)* under the overall responsibility of the Environmental, Health and Safety Unit of Cana Brava. The Program includes detailed designation of responsibilities at the middle management level for specific mitigation measures.

6.4 Rehabilitation of Degraded Areas Program: Though considered as a separate program in the ESMP (PBA), this program is part of the EPC responsibility to mitigate the impacts of the construction activities. The program is designed at recovering the areas disturbed by the construction of Cana Brava HPP, including the rehabilitation of the campsite, the borrow areas for building materials such as gravel, clay and sand, the disposal areas for construction materials, and the reservoir margins. The program includes the identification and characterization of the vegetal cover, soils, land use patterns and definition of a management plan for the disturbed areas. As part of the program, the EPC is stocking the upper layer of the soil and for use in rehabilitating areas. In coordination with the Flora Conservation Program, rescued species will be used to recover disturbed areas. The same will be done at the end of

[9] The Municipal landfill in Minaçu has an environmental permit from FEMAGO and operates according to good environmental practices, such as burying and covering the wastes, treating the leachate before disposal, preventing the entrance of non-authorized personnel, ensuring a vegetation belt around the landfill and other appropriate measures.

the construction phase to all the degraded areas. Each borrow area has a separate environmental permit (Operation License or LO) issued by FEMAGO and are obliged to follow the rehabilitation plan which was approved as part of the LO application.

6.5 Program of Speleological Survey on the Reservoir Area: This program consists of non-systematic observations on caverns' biota ecology and biology, the registration and report of the speleologic occurrences, caverns exploitation, topographic survey, map production, and non-systematic observations on caverns biota ecology and biology. The program also contributed to the National Speleologic Heritage study, registration and report of the speleologic occurrences in the region. The Instituto Geabrasil implemented the program, with a team of eight geographers, six speleologists and two guides. The final report was issued in April 2000 and the conclusions of the study indicate that the Speleological patrimony of the Cana Brava HPP area of influence "offers little contribution to the patrimony of the State of Goiás". The caverns in the region of Cana Brava are not considered to be relevant to the study of the speleological development of the region, nor to the tourism activities in a large and economically feasible scale". The study also concluded "the Tamandua Bandeira Cavern will not be affected by the project" and "the negative impacts of the Cana Brava project on the national speleological patrimony are likely to be minimum". Of the three caverns to be directly affected, only Tres Bocas will be completely submersed. The others (Bibiana I and II) might have part of the lower areas submersed.

6.6 Mineral Exploitation Survey Program: The program consists of the review of mineral survey requests in the reservoir directly affected area, including construction areas and borrow areas. The program is developed by CGR and has identified approximately 180 requests for mineral exploitation in the affected area. Once ANEEL issues a Decree stating that the area is of public interest, the program will proceed requesting the renunciation of rights. The program is being implemented by one geologist and one mining technician.

6.7 Flora Conservation Program: The program will mitigate the impacts of the reservoir in the Cerrado vegetation, enabling the conservation of the genetic resources of the affected species for future use and research, since the Cerrado vegetation is endemic to Brazil and the eastern part of Bolivia. Though characteristic of low-fertility soils, the Cerrado presents several species that are important for their many different uses such as medicine, fiber, oil and tannin production among others. The Program involves floral survey in the directly affected reservoir area, evaluation of flora relationships in the *cerrado* areas within the area of direct Project influence, and estimation of the diversity and dominance index. The methodology includes eight main criteria to determine the level of priority for collection and transfer of the genetic material. The genetic material will be collected from seeds, fruits and in other forms from a large number of individuals pertaining to each species. After collection the material will be conserved "ex situ", "in vivo" or used in the recuperation of degraded areas, in coordination with the Rehabilitation of Degraded Areas program. The Catholic University of Goiás is implementing the Flora Conservation Program with a team of four biologists, five forest engineers, and fifteen trainees.

6.8 Wild Fauna Program: The Program is designed to mitigate and monitor terrestrial fauna before and after the reservoir filling to identify fauna displacement and distribution patterns. The methodology involves a new concept that minimizes rescue of fauna (will be restricted to the filling period) based on recent studies and results from the Serra da Mesa rescue program. For Cana Brava, emphasis will be placed in the follow-up of the existent fauna and their adaptation to the new conditions. The Program is being developed under the coordination of the Catholic University of Goiás. It involves the survey, identification and marking, capture and release of fauna before the installation of the construction site, during the construction, and before and after the filling of the reservoir. During May to December 1999, four bi-monthly campaigns were conducted (total of eight months) at four permanent collection stations and ten temporary stations. A team of 20 people including professionals, technicians and support staff was involved. Results show that the fauna present in the construction site area easily adapted to the

displacement into the new surroundings. The next monitoring will de developed in two stages, one until June 2002 when the reservoir will be filled, and the second after the rescue of the fauna. The program also involves the rescue of the fauna during clearing and filling of the reservoir. This activity will require a team of 34 people, including eight biologists, two veterinarians and other support staff, and will develop from May to July 2002. After which, monitoring will continue.

6.9 Ichtyofauna Program: The objective of the Program is to minimize the impacts on local ichtyofauna due to the new reservoir. The program is being developed under the coordination of the Catholic University of Goiás and was structured with four main phases. Phase I involves complementary studies to establish the baseline information regarding the biological characteristics of the ichtyofauna and the changes originated by the dams which already exist on the Tocantins River. Phase II involves the study of the feeding, reproduction, eggs and larvae biology as well as population and community ecology. Phase III will be developed during the filling of the reservoir and will focus on species behavior. Phase IV will be implemented during the operation of the reservoir and will continue the studies previously done and define monitoring requirements and programs.

6.10 Archeological Rescue Program: The objective of the Program is to identify, rescue and analyze the archaeological occurrences (pre-historical and historical) within the area of direct influence (until elevation 335 masl) and in the area of indirect influence (until elevation 350 masl). The Program was approved by the the National Institute of Historical and Artistic Heritage (IPHAN) and will be implemented by the Museum of Anthropology of the Federal University of Goiás (UFG) as part of a university research program. The methodology that will be used is the *Multistage fieldwork and analytical techniques*, which has been tested, in several other similar projects. It combines four stages (general reconnaissance, intensive survey, controlled surface collection and excavations). As part of the Program, UFG wil prepare a communication program addressed at the three municipalities to ensure that the information is disclosed and that the materials are available. Currently, a total of 139 occurrences and 13 archeological sites have been found and are in the process of collection and laboratory analysis. An interdisciplinary team composed of six researchers (archeology, history, engineer, biologist, and geography) and five support personnel (for the fieldwork) is responsible for implementing the Program according to the terms and conditions as authorized by IPHAN.

6.11 Clearing of the Vegetation in the Reservoir Area: The program aims to minimize the impacts of eutrophication in the reservoir. The Catholic University of Goiás is responsible for developing the mathematical model that will orient the identification of areas and amount of vegetation to be cleared and the Federal University of Goiás will be responsible for the implementation of this program. The initial results of the mathematical model are expected by December 2000.

Socio-economic mitigation measures

6.12 Social Communication Program: The objective of the program is to keep both the directly and indirectly affected population informed about the construction activities and the environmental and social impacts and correspondent mitigation and monitoring measures of the Cana Brava HPP. The social communication activities relating to expropriation and resettlement are also presented as part of the Project Resettlement Plan). The program also involves establishing partnerships with the municipal authorities in Minaçu and Cavalcante and the State Secretaries of Culture, Environment and Education to develop activities aiming at raising environmental awareness in the population. The program will engage in three main activities: (a) identification of the demands and expectations of the affected population, (b) provision of information, particularly in regard to the options and procedures for compensation and resettlement, and (c) negotiation and inter-institutional coordination. CEM has the responsibility for implementing this program and has contracted CGR environmental consultants to manage it. CEM has installed an office and an Information Center, in Minaçu. A team, headed by a sociologist, is available

to provide information to the affected population and to develop other communication activities, as planned (public meetings, newsletter, institutional agreements, radio and TV interviews, among others). The first issue of the Project Newsletter was issued on the 5th of May 2000 (300 copies were distributed at schools, churches, supermarkets and at the Rural Fair held in Minaçu, on the 6th of May 2000). Nevertheless, the most effective communication midia in the rural area is the radio and a radio program is being negotiated with the local radio station (*Radio Serra da Mesa*) to start in June 2000, on a weekly basis.

6.12 Relocation of infrastructures and compensation: The Program aims at mitigating the loss of local infrastructures. The following infrastructure will be subject to mitigation: (a) part of the state roads GO-241 (8.720 m) and GO-132 (two bridges over the *Corregos Lageado* and *Ginho)*; (b) part of the secondary road access to the campsite (alternative connection Minaçu-Palmeirópolis, with an extension of 7.740 m); (c) part of the road between Buriti and some farms in the right banks of the Tocantins River, with an extension of approximately 20 km; (d) the bridge over the Bonito River, at the exit of Minaçu; and (e) approximately 15 km of CELG high power transmission line. The compensation measures for the Municipality of Cavalcante will include the relocation of the Evangelist Church and the Municipal School as well as the construction of a new Police Station and Public Jail (120,92 m2 and 157,36m2, respectively)[10], though the existing facilities will not be affected by the Project. The EPC contractor is responsible for the implementation of this Program and is currently developing the required engineering projects before submitting them to AGMAR for the necessary environmental permits. Many of these projects are being developed in close coordination with the Social Communication Program, since it involves the discussion of alternative routes and land expropriation. The relocation of the affected infrastructures in the urban area of Minaçu is considered in a separate program, the Environmental Management Program for Minaçu.

6.13 Environmental Education Program: The objective of the program is to improve the local/regional knowledge about the environment and about the interaction between the land use and activities of the Cana Brava HPP. The program is specifically designed assist in the development of activities in the areas surrounding the reservoir that will not have negative effects on reservoir water quality. The program will target the informal environmental education, whereas the Education and Culture Program will target the formal environmental education (through the educational system). The campaign will address mainly environmental management practices with regard to waste and effluent disposal, good practices in agriculture, protection of the reservoir's margins and strategies to develop ecological tourism in the reservoir. Educational campaigns will be realized using folders, books, videotapes and posters. Institutional partnerships are also envisaged. The technical team responsible for this program consists of six people, two sociologists, two geographers and two biologists, under the responsibility of CGR. Currently the team is developing the detailed schedule for the activities to be carried out in coordination with the Social Communication Program and the Education and Culture Program.

6.14 Education and Culture Program: This Program has two main objectives: (a) to develop formal environmental education, and (b) to follow up the environmental and cultural impacts of the Project. The following main impact indicators will be monitored: demand for formal education in the municipal system, number of students and teachers, changes in cultural patterns, and the number and type of religious and civic celebrations. The program will be implemented in three stages: (a) field studies to identify the baseline indicators; (b) meetings and workshop with the local community to discuss the likely social and cultural impacts of the project; and (c) the development of alternative actions to optimize positive impacts and mitigate negative impacts, under a participatory process involving the community and formal institutions in the three municipalities. The program is under the responsibility

[10] As assumed by CEM in the Public Agreement signed on April 18, 2000.

of CEM (through CGR and involves a team of two sociologists and a few support trainees.

6.15 Compensation and Resettlement Plan: The Sponsor has prepared a draft Resettlement Plan, which complies with the IDB Policy on Involuntary Resettlement (OP-710, August 1998), related to the compensation and/or resettlement of affected families and properties. The objective of the plan is to minimize the impact of the project on the rural and urban populations that are affected, and to ensure that they can improve, or at least recover their standard of living, and levels of income. The plan contemplates compensation for people whose properties and houses will be affected, ensuring that they are offered at the very least replacement cost. The more vulnerable groups from the rural areas, including small landowners and the families of non-landowners will be offered the option of resettlement, including at the minimum a viable agricultural plot with basic housing, services and infrastructure. The urban families affected by the project will be offered the option of compensation or resettlement in an urban plot, with basic housing and services.

6.16 The main characteristics of the draft Resettlement Plan are presented as follows (see Annex 2 for additional details):

(a) Eligibility Criteria: The families eligible for resettlement include all the small landowners whose total property is 50 hectares or less and all rural non-landowners, including sharecroppers (*meeiros*), families with usufruct rights (*usufrutuários*), tenants (*arrendatários*), independent family labor (*mão de obra familiar*), other residents (*comodatários* and *ocupantes*), and employees (*agregados*). In total, approximately 277 families will be entitled to participate in the resettlement program (115 landless families and 162 small landowners with holdings of 50 hectares or less).

(b) "Compensation": Three options will be offered to rural landowners with more than 50 hectares: (i) cash compensation, (ii) exchange, and (iii) letter of credit. The non-landowners in rural areas will be compensated for their housing, improvements, crops and other improvements or offered the option of resettlement. The methodology for land valuation has been discussed and in principle accepted by the Commission of Representatives of the Affected Population (*Comissão de Representantes* – which represents many of the larger landowners).

(c) Resettlement: Rural resettlements will comprise a minimum of 10 hectares of agricultural land per household. In urban areas most affected families will be offered three options: (i) cash compensation for their houses and house plots; (ii) compensation for their houses and improvements, and provision of an alternative house plot, of the same size or larger than the plot they occupy, connected to the municipal water supply system and to the municipal sewerage system that will be constructed as part of the ESMP; and (iii) provision of a plot of at least 200 M², with a basic housing unit connected to the municipal drinking water and sewerage systems, and with electricity.

(d) Tranport costs: All families will receive a fixed amount to cover transportation costs to new location

(e) Assistance: Assistance will be provided for various areas, including titling, property search and assistance to vulnerable families.

(f) Social Communication: A formal communication program is being implemented to better inform the affected population about compensation procedures and resettlement options. At the Information Center, in Minaçu, a team of two is permanently available to assist the affected population.

(g) Monitoring: The affected population will be monitored during resettlement process and after completion (see Section VI.B for more details).

(h) Timetable: The draft resettlement plan includes an indicative timetable up to December 2001, with July 2002 being the start date for the filling of the reservoir.

6.17 A final Resettlement Plan is presently being developed and will be completed prior to the presentation of the Project to the IDB Board of Executive Directors.

(b) Operation phase

Environmental mitigation measures

6.18 Consolidation of Conservation Units Program: The objective of this program is to develop the necessary actions to comply with the legal requirements of CONAMA Resolution 002/96[11]. In relation to the resolution, IBAMA also accepts the concept of application of the designated resources into existing conservation units. In April 2000, CEM discussed with AGMAR the alternative of investing 0.5% (R$$ 2,640,000.00) of the total project cost (as required by CONAMA Resolution) in the implementation of Parque Terra Ronca, in the State of Goiás. CEM also discussed investing 15% of that amount to support AGMAR's supervision, enforcement and training activities. A formal agreement, however, is not yet signed.

Socio-economic mitigation measures

6.19 Public Health/Disease Carrying Vector Control Program: The program aims at mitigating the impacts due to the increase of water-born diseases and disease-carrying vectors, mainly in the Municipalities of Minaçu and Cavalcante, which are areas of principal impact due to endemic diseases such as malaria, dengue, and yellow fever. The Program will be developed under institutional agreements with the Federal, State and Municipal Health Secretariats.

6.20 Environmental Management for Minaçu:: The Program aims at mitigating the impacts that are specific to the urban area of Minaçu. The program involves supporting the development of a new sewage system to Minaçu, the construction of a new slaughterhouse, and providing technical support to develop an urban development plan that takes into account the changes in the land use structure and potential and the new revenues generated by the Project. The new sanitation system for Minaçu will be implemented to collect and treat wastewater from approximately 80% of the urban population. An agreement between CEM, the Sanitation Company of the State of Goiás ("SANEAGO") and the Minaçu municipal government is already signed[12]. For the new slaughterhouse, a separate agreement between the CEM and the municipality of Minaçu will be signed. The municipality has already selected the new site (based on a public consultation held by the Municipal Council) and CEM is already developing the engineering designs according to the relevant National, State and Municipal legislation regarding the treatment of effluents, and other requirements for this type of activity. CEM will also obtain the necessary environmental permit for the new facility. CEM will also implement a sanitary cleaning of the area to be flooded to ensure sanitary conditions and avoid health problems during the filling of the reservoir.

6.21 Implementation of the Preservation and Safety Zone (surrounding the reservoir): The safety zone is defined by a strip of 30 meters from elevation 333.00, surrounding the perimeter of the reservoir. This area must be maintained in such conditions as to avoid erosion, sedimentation and pollution of the reservoir. The Program involves the control of erosion, the implementation of vegetated areas and recreation areas and landscapes. It will be implemented in close coordination with the Flora

[11] CONAMA Resolution 002/96 establishes that projects that cause significant impacts must spend a minimum of 0.5% of its budget on the implementation of a conservation unit. It also defines that 15% of this amount can be invested in institutional strengthening of the State Environmental Agency, according to a formal agreement to be signed between the Agency and the Project Sponsor.

[12] According to this agreement, the system will be operational by May 2002, thus before the filling of the reservoir (anticipated for July 2002).

Conservation Program, and will be particularly focused in the urban area of Minaçu (coordination with the Environmental Management of Minaçu).

6.22 Master Plan for the Reservoir Drainage Area: This Program aims at establishing new land use plans and regulations in the three municipalities that take into consideration the new potentialities created by the reservoir and the restrictions required to ensure adequate water quality. The Master Plan will be based upon the results of a mathematical modeling of the reservoir and outflow water quality, and will include measures to protect the reservoir and to support the economic development of the region. Due to the specific institutional framework in Brazil, land use planning is the responsibility of the municipal governments. The Master Plan will be developed in close coordination with the municipal governments, whom are ultimately responsible for the implementation of land use regulations. It will also be developed in a participatory basis, including consultation with the local population with the objective of identifying opportunities for development of new economic activities related to the reservoir (tourism, fishery and irrigated agriculture, among others).

B. Monitoring programs

(a) Construction phase

Environmental monitoring programs

6.23 Geology Monitoring Program: The activities to be developed under the program include: (a) description of the evolutionary process of regional formation and the litostructural conditions of the area where the power plant will be built, (b) preparation of a 1:50.000 geologic map (detailing the specific areas of interest (dam axis, shearing zones, and limestone areas) in 1:25.000 scale), and (c) identification of the geologic environment in the area of influence, tectonic disturbances and discontinuities, percolation tests in different litologic areas, and rock fissure mapping ("Roseta Sinóptica de Fraturas"). The geological mapping will identify the following elements: fractures system, regional fails, *estruturas litoestrutural dobradas, ambientes calcareos,* and definition of the lithologic units (*Grupo Paranoá, Bambuí, Araí* and *Cana Brava*). The technical team of CGR that will be responsible for developing the geological monitoring will be composed of one geologist, one technician in mining and one specialized designer for the maps.

6.24 Seismicity Monitoring Program: This Program aims at monitoring the seismological data before and after the formation of the reservoir. The objective of this monitoring is to identify the possibilities of seismic activities that could either affect the dam or disturb the communities in the region, taking into account that the region has registers of extremely low seismic events everyday (perceptible only by instruments). For the implementation of the program, an agreement with the University Foundation of Brasília (*Fundação Universitária de Brasília – FUBRA*) was signed. The program will provide the installation of a Seismological Station at Cana-Brava HPP . The technical staff of the Seismological Observatory of the University of Brasília will be responsible for the implementation of the program and the maintenance of the equipment.). The Program will be implemented until year 2003.

6.25 Climate Monitoring Program: The objective of this program is to evaluate the micro-climatic modifications that may result from higher levels of evaporation and lower evapo-transpiration in the area of influence of Cana Brava HPP. The activities to de performed under the program include monitoring of climatic parameters at one hydrometeorological station in Cana Brava, one in Serra da Mesa, and other four pluviometric and four fluviometric stations[13]. Information will be collected hourly and daily

[13] ANEEL Resolution 396/98 establishes that the number of stations is defined according to the incremental drainage area. In the case of Cana Brava the incremental drainage area is 7,000 km2.

and monthly values will be calculated and registered into a computer system in the Cana Brava hydrometereological station. The Program started in December 1999. The technical team of CGR responsible for the implementation of this program is composed of one geologist, one meteorologist and two trainees.

6.26 Hydrological Monitoring Program: This program aims at monitoring the flow in the Tocantins River. The Program will include the development of a hydrologic study using models in spillway areas, powerhouse and areas of direct and indirect influence and the monitoring of flow and sediment load. The program will also conduct percolation tests and groundwater level monitoring. CGR is responsible for the implementation of the program and includes one geologist, one hydrology engineer and three trainees.

6.27 Limnology and Water Quality Monitoring Program: The objectives of the Program are: (a) to characterize the Tocantins River limnology; (b) to compare changes in water quality prior to, during and after reservoir filling; (c) to evaluate the pollutant capacity of the rivers Preto, São Félix, Carmo and Bonito; (d) to assess compliance with the water quality standards determined by CONAMA Resolution 020/86 for Class II waters[14]; (e) to evaluate potential impacts due to mining activities; and (f) to support the other environmental programs, mainly Ichtiofauna. The Program is under the responsibility of the Catholic University of Goiás and involves a team of four (one limnology specialist, one biochemist and two biologist). The program will comprise three phases. Phase I monitoring (prior to the filling of the reservoir) was initiated in April 2000 with the realization of four campaigns that will be repeated every three months, until approximately August 2002. A minimum of thirteen sample points were determined in the rivers Tocantins, Carmo, Bonito and Preto, upstream and downstream the reservoir and samples were analyzed for chemical parameters (in compliance with CONAMA Resolution 020/86), phyto and zooplankton (each three months), sediments and zoobenthos (each six months). Phase II monitoring (during the filling of the reservoir and until the start of operation) will consist of monthly monitoring during the filling period and every three months subsequently. The sample points will be the same as in Phase I and in the reservoirs samples will be taken at three levels (superficial, mid-depth, and bottom). The same parameters analyzed in Phase I will be maintained for Phase II, with the exception of zoobenthos and the inclusion of total organic carbon and chlorophyll A. Phase III monitoring (operation of the reservoir) will involve the same monitoring parameters and sample points in Phase II, but the frequency will be reduced to every four months

(b) Operation phase

Environmental monitoring programs

6.28 The majority of the monitoring programs initiated during the construction phase, will continue during the operation of the reservoir as follows: Seismology (until September 2003), Hydrology (continuous), Climate (continuous), Limnology and Water Quality (continuous), Wild Fauna (until September 2003) and Ichtyofauna (until December 2002).

Socio-economic monitoring programs

6.29 Education and Culture (monitoring of cultural and educational indicators until September 2002): The

[14] In CONAMA Resolution 020/86, "Class II waters" are related to waters that can be used for water supply after conventional treatment, protection of aquatic communities, recreation (swimming, diving, etc), irrigation and "aquaculture".

following main impact indicators will be monitored: demand for formal education in the municipal system, number of students and teachers, changes in cultural patterns, and the number and type of religious and civic celebrations.

6.30 Resettlement: As part of the Resettlement Plan, monitoring of the affected families will be performed. For example, the program will select a sub-set of the affected families and will monitor their living conditions using specifically developed indicators, such as land use and occupation in rural area, production and in income distribution (particularly in the urban areas).

C. Responsibilities and Cost

6.31 Table 6-1 presents a summary of the responsibility and costs for the principal environmental and social mitigation measures and monitoring programs. The ESMP for Cana Brava HPP comprises 19 mitigation and monitoring programs that account for a total of approximately 36 million *reais* (approximately USD 20 million[15]). The draft Resettlement Plan includes an estimate of total costs. These include 7 million *reais* (around US$ 4.1 million) for land acquisition, and 3 million *reais* (around US$ 1.75 million) for the resettlement program.

6.32 To ensure the technical quality of the environmental and social programs, CEM has contracted experienced and well-known research centers in the main Universities of the region to develop and implement the ESMP programs; for example, the Anthropology Museum of the University of Goiás, the Catholic University of Goiás, the National University of Brasilia, and the Brazilian Institute for Agriculture Research (*EMBRAPA)*. Other programs are being implemented by the EPC contractor (Norberto Odebrecht and Andrade Gutierrez) or CGR– *Meio Ambiente,* a consultant firm hired by CEM.

6.33 The CEM Project Manager is responsible for the overall supervision of the environmental and social programs. CEM is currently hiring an environmental specialist to assist the Project Manager in the supervision of the ESPM. This specialist will be based in Minaçu and will also be responsible for supervising the implementation of the ESMP for the construction site. The compensation and resettlement activities are presently being managed by one engineer and one sociologist that are both based in Minaçu.

6.34 The ESMP for the construction site is implemented by the EPC (*Consórcio Cana Brava*) and supervised by the Environmental, Health and Safety Unit of Odebrecht (the leader of the *Consórcio*). Odebrecht supervision system includes quarterly audits at Cana Brava construction site and is part of the Integrated Management System (*SIG)* that the company is implementing based on the principles of ISO 14001(last audit was in February 2000).

6.35 The State Environmental Agency AGMAR will perform periodically monitoring of the project to ensure compliance with the requirements of the Environmental Permit. However, given the current limited resources of AGMAR, the IDB will hire an independent environmental and social consultant to assist in supervision of the Project environmental, social, and health and safety aspects of both the construction and the operation phases.

D. Contingency Plan and Procedures

6.36 Regarding accidents due to natural or man made causes, the *Consórcio Cana Brava's* Integrated Management System (SIG) includes a Corporate Procedure (SIG-PCR-01) that: (a) classifies workers tasks; (b) identifies issues and hazards; (c) identifies risks and impacts, (d) defines the acceptable level

[15] 1 USD= R$1,75

of risk and impacts; (e) establishes an action plan to control risks and impacts; and (f) requires a critical analysis of the action plan adequacy. The implementation of this process is the responsibility of both the Civil Works Manager and the Environment, Health and Safety Manager (*Gerente de Saúde, Segurança do Trabalho e Meio Ambiente - SSTMA)* at Cana Brava.

6.37 The Emergency Preparation and Assistance Plan (SIG-PCR-09) defines project-related emergencies and provides procedures to deal with these emergencies; for example, fire and explosions, transportation of and storage of hazardous materials; spill control, and flooding.

E. Health and Safety Plan

6.38 A Health and Safety Plan has been developed and implemented for the Cana Brava to control risks and to implement preventive safety systems during construction. The Health and Safety Plan (HSP) comprises the following components:

(a) *Risk Control:* procedures to deal with the labor safety by eliminating risks and preserving health and physical integrity of all workers;
(b) *Risk Analysis*: includes classification of workers tasks, identification of risks, determination of risks and impacts, definition of the acceptable risks, establishment of an action plan to control risks/impacts, performance of critical analysis of the action plan adequacy, and designation of responsibilities;
(c) *Individual Protection Equipment:* provided as necessary based upon site risks (e.g., hard-hats, mask, coat, safety belt, gloves, etc.);
(d) *Educational Program*: aimed at informing workers about procedures and programs to prevent accidents and detect and eliminate risks; and
(e) *Performance Quantification*: periodical monitoring of the work conditions, proactive actions (e.g., safety inspections and quality control), and reactive actions (accident investigation and statistic indicators).

6.39 *Consórcio Cana Brava* also implements an Occupational Health Control Program, which involves all the necessary medical examinations required by Brazilian regulations for construction workers. This includes one at admission, periodically (according to the type of work, as established in the regulations), after absence from work for more than 30 days, when changing functions or type of work, and at the end of contract. The Consórcio also performs all the complementary medical examination required, according to the type of work performed by the worker. As part of this Plan, the *Consórcio* maintains a Health Center with permanent and qualified staff including a full time medical doctor specialized in occupational health. At *Consórcio Cana Brava* each worker is protected by an All Risk Insurance Contract, and by the Brazilian Social Security System (*INSS*).

F. Environmental, Health and Safety Management

6.40 The *Consórcio Cana Brava* developed an Environmental, Health and Safety Management Plan as part of the Integrated Management System (SIG). Although there is no formal policy statement, the following commitments are presented: (a) to improve processes, activities, products and services; (b) to act preventively, minimizing impacts to people's health and safety and to the environment, with special attention to pollution prevention; (c) to promote workers' development through education; and (d) to establish communication channels with the community. This program was based on ISO 14.000 and BS 8.800 guidelines.

6.41 An important part of the EHS Management system is the training program. *Consórcio Cana Brava* implements four type of training programs: (a) initial training for new workers; (b) continuous training

encompassing civil and criminal responsibilities, preliminary risk and impact analysis, accident prevention (for Internal Commission for the Prevention of Accidents - *CIPA* members), accident prevention (for electricity workers), safety inspections, first-aid, fire prevention and combat dangerous charges and sexually transmitted diseases among others; (c) specific training; and (d) Integrated Management System and Environment, Health and Safety Awareness Training. Evaluation of the training is performed periodically and after the end of each training program and/or emergency.

6.42 Documentation is another important part of the SIG system. Environmental reports, environmental audits, training events, and all accidents and incidents are reported according to standard formats and procedures by the responsible officer to the EHS manager, who keeps the records and determines the investigation (in case of accidents and incidents, also according to standard procedures). The CIPA members conduct periodic inspections (last report is from 29 April 2000) and report results to the EHS Manager and the General Manager of the construction site.

6.43 The *Consórcio Cana Brava* also implements a Social Integration Program, which involves literacy classes for workers and the realization of two religious services per month (one Catholic and the other Evangelist, the two predominant religions among workers at Cana Brava).

6.44 The Participation in the Results Program (*Programa de Participação de Resultados – PPR)* is implemented by Odebrecht among various construction sites. Results include not only construction indicators, but also environment, health and safety indicators (such as frequency indicator and severity indicator, both per million men-hour worked).

VII. PUBLIC CONSULTATION

7.1 A Public Hearing was arranged for and held by FEMAGO, FURNAS and DNAEE (ANEEL's antecessor) on April 23, 1997, in Minaçu. The Project EIA and RIMA were made available to the affected population of Minaçu and Cavalcante, the public in general, and institutions (IBAMA and FEMAGO) for a minimum of 30 days prior to the public hearing. At the hearing, a description of the project (construction and operation phases) and the environmental and social aspects, impacts and mitigation measures were discussed. The hearing included representatives from IBAMA, Federal and State Public Ministry, DNPM, representatives of the municipalities of Minaçu and Cavalcante, representatives of different entities, communities, students, and university professors. After the hearing and at the request of FEMAGO, CEM contracted the development of a Social Communication Program and proposed that a Center of Information be installed in Minaçu to keep the population informed about the status of the Cana Brava project, environmental impacts and programs.

7.2 The Information Center in Minaçu was inaugurated in November 1999 to provide information, particularly about the compensation and resettlement programs. The Company is carrying out meetings with the affected people and coordination with non-governmental organizations with strong leadership in the area such as the Catholic and Evangelist Churches. A staff of two (one sociologist and one engineer) are permanently available to assist and take into consideration, in an effective and satisfactory manner, the concerns of the affected people regarding indemnification and resettlement and any other impact-related issue.

7.3 On November 29, 1999 a public meeting was held to discuss the expropriation and resettlement issues associated with the Project. Approximately 300 people from the affected area were present, including the mayors (prefeitos) of Minaçu and Cavalcante and the *Promotores de Justiça,* who represent the Ministry of Public Affairs at the municipal level.

7.4 At the request of the IDB, CEM has recently again made the updated EIA and PBA available to the local public.

7.5 On April 18, 2000, CEM held another public hearing in the Municipality of Cavalcante to discuss the relocation of the community of Limoeiro and of the public buildings affected (a Church and a municipal school). Attendants included CEM representatives, the Mayor of the Municipality of Cavalcante, the Judge of the local representation of the Department of Justice, the Public Attorney, and members of the Municipal Council, including the President. As a result, an agreement was signed by CEM regarding the construction of two new public buildings for the Municipality (the Police Station and Public Jail), even though these existing buildings will not be affected by the Project.

7.6 At the request of the IDB, another public meeting will be held in Minaçu to present the ESMP programs and in particular the Environmental Management Plan for Minaçu. Though the date has not yet been defined, CEM is organizing the information and preparing the documentation that will be made available prior to the Hearing. In addition, as part of the ESMP, CEM is implementing a Social Communication Program, which will continue until December 2002 (see Section VI.A, Social Communication Program).

VIII. RECOMMENDATIONS

8.1 The Bank (IDB) will require as part of the Loan Agreement that CEM and the parties involved in the Project shall, at all times during the life of the Loan Agreement, comply with each of the following:

(a) All applicable environmental, health and safety Brazilian regulatory requirements;
(b) All requirements associated with any environmental, health and safety related permits, authorizations, or licenses that apply to the Project or the Company;
(c) All environmental, health and safety requirements of the Project contracts, and any subsequent modifications;
(d) All mitigation and monitoring programs and actions of the Project's Environmental and Social Management Plan - ESMP *(Projeto Básico Ambiental – PBA)*, for both the construction (including the Environmental Management Plan for the Campsite) and the operation phase.All the procedures in Consórcio Cana Brava' s Integrated Management System (SIG);
(e) All actions and requirements established in the Project Resettlement Plan;
(f) Implement ongoing information disclosure and consultation activities related to environmental, social, and health and safety aspects of the project, and, particularly, related to the indemnification and resettlement plan.
(g) Implement an environmental, health and safety management system
(h) Ensure that all companies contracted for construction or operation activities comply with the applicable environmental and social requirements of the loan agreement;
(i) Consult with the Bank before implementing any action not covered by the Project environmental, social, or health and safety plan, which will have a material environmental or social impact.
(j) Notify the Bank of any and all noncompliance with any environmental requirement of the loan agreement and any significant environmental, social, or health and safety accident, impact, event or environmental claim;

8.2 Prior to the presentation of the Project to the Bank Board of Executive Directors, the Company must submit a Final Project Resettlement Plan, in form and content acceptable to the IDB, and which complies with the IDB Policy on Involuntary Resettlement (OP-710, August 1998).

8.3 Prior to the date of Financial Closure, the Company must fulfill the following conditions:

(a) Submit evidence of compliance with the environmental permitting requirements (Installation License) for the installation of the campsite, for the exploration of quarries and other construction materials, and for the clearing of the vegetation at the campsite.
(b) Submit the final version of the Project's Environmental and Social Management Plan (ESMP or PBA),
(c) Submit the complete version of *Consórcio Cana Brava* Integrated Management System (*SIG)*, including without limitation the Corporate Procedure (SIG-PCR-01) and the Emergency Preparation and Assistance Procedures (SIG-PCR-09).
(d) Submit the finalized version of the construction Health and Safety Plan.

8.4 Prior to First Disbursement of the Loan, the Company shall fulfill the following conditions:

(a) Submit a report on the status of the implementation of the ESMP, including without limitation the Environmental Management Plan of the Campsite and the Public Disclosure and Communication Program, including the records of the Public Hearing being held in Minaçu at the Bank's request.
(b) Submit a report on the status of the implementation of the Resettlement Plan, including without limitation, the social and communication activities implemented as part of the Plan as well as evidences of the indemnification paid.

8.4 Prior to each disbursement, the Company must certify compliance with all environmental and social requirements in the loan agreement and, as applicable, provide a description of any significant environmental, social, or health and safety accident, impact, event, claim, liability, material complaint, or unforeseen environmental, health or safety impact or risk.

8.5 As a condition for the Technical Completion of the Project the Company shall:

(a) Submit, in form and substance satisfactory to IDB, a Final Report prepared by an Independent Consultant certifying that the ESMP (in particular the Environmental and Social Mitigation and Monitoring measures for the construction phase) was fully and adequately implemented.
(b) Submit, in form and substance satisfactory to IDB, a Final Report prepared by an Independent Consultant certifying that the Resettlement Plan was fully and adequately implemented.
(c) Submit, in form and substance satisfactory to IDB, a final Environmental and Social Management Plan for the Project's operational phase, including without limitation the Master Plan for the Reservoir' s drainage area .
(d) Submit, in form and substance satisfactory to IDB, the Contingency Plan (e.g., SPCC, Emergency) for the Project's operational phase.
(e) Submit, in form and substance satisfactory to IDB, the Health and Safety Plan for the Project's operational phase.
(f) Submit an Environmental Management System for Gerasul/CEM

8.6 During the life of the Loan Agreement, the Company must prepare and submit an Environmental and Social Compliance Report, in form, content and frequency acceptable to IDB.

8.7 The Bank will monitor the project's environmental, social, and health and safety aspects via internal Bank supervision actions (e.g., site visits, review of documentation, etc.) and will contract an external independent environmental and social consultant to perform more detailed supervision/monitoring actions during project construction and initial operation. In addition, the Bank will have the right, as part of the Loan Agreement, to contract for the performance of an independent environmental, health, and safety audit, if needed.

Table 3-1. Project Environmental Permits Status (as of April 2000)

Undertaking	Licensing Institution	Type and Number of the License	Period of Validity
UHE - Cana Brava	FEMAGO	LI nº 063/98 issued 9/29/1998	Not established
UHE - Cana Brava	IBAMA	060/99 05/15/1999 License for Capturing / Collecting Animals	06/30/2000
Consorcio Cana Brava	FEMAGO	Authorization nº 013272, issued on 06/16/99 Clearing of vegetation in the campsite areas	Not limited
UHE – Cana Brava	IPHAN	Authorization nº 54/99 Archaeological Uplifting and prospecting in the Influence Area	1 year
Consorcio Cana Brava	FEMAGO	LI nº 015/99 (05/13/1999)	Not limited
Consorcio Cana Brava	FEMAGO	Authorization of Vegetation Suppression nº 001/99 (06/11/1999)	1 year
Consorcio Cana Brava	FEMAGO	Authorization for Forest Exploration (06/16/1999)	Time Period for execution of services
Consorcio Cana Brava	AGMAR (ex-FEMAGO)	LI nº 059/2000 issued on 03/21/2000 Extraction of sand via drainage of the Tocantins River	Without Date
Consorcio Cana Brava	AGMAR (ex-FEMAGO)	LF nº 108/2000 issued 3/21/2000 Extraction of sand via drainage of the Tocantins River	2 years
Consorcio Cana Brava	AGMAR (ex-FEMAGO)	LI Nº 061/2000 issued on 3/21/2000 Extraction of Clay	Without Date
Consorcio Cana Brava	AGMAR (ex-FEMAGO)	LF nº 110/2000 issued on 3/2/2000 Extraction of Clay	2 years
Consorcio Cana Brava	AGMAR (ex-FEMAGO)	LI nº 060/2000 issued on 3/21/2000 Extraction of gravel in open areas	Without Date
Consorcio Cana Brava	AGMAR (ex-FEMAGO)	LF nº 109/2000 issued on 3/21/2000 Extraction of gravel in open areas	2 years
Consorcio Cana Brava	AGMAR	LO nº 117/2000 issued on 03/21/00	Not limited
Consorcio Cana Brava	AGMAR	LO 118/2000 issued on 03/21/00	Not limited
Transmission Line*	AGMAR	-	-

* Gerasul has not yet defined who will be responsible for the application for the permit.

Table 4-1. Distribution of Areas to be Flooded by Municipality

Municipality	% of flooded Area	% of each Municipality's Area that will be Flooded
Minaçu	48,5%	2,1%
Cavalcante	33,6%	0,6%
Colinas do Sul	17,9% (1)	1,3%
TOTAL	**138,7 km²**	**-**

(1) Estimate Share
Source: Companhia Energética Meridional

Table 5-1. Rural Families in the Reservoir Area

Municipality	Landowners*	Non-owners**	Total
Minaçu	46	73	119
Cavalcante	65	38	93
Colinas do Sul	-	4	4
Total	**111**	**115**	**226**

* Includes people with possession rights (*posse*) or legal title
** Includes employees, tenants, sharecroppers, usufruct and family labor

Table 5-2. Urban Families (Minaçu) in the Reservoir Area

House Owners*	Non-Owners**	Total
25	7	32

* Includes people with possession rights (*posse*) or legal title
** One tenant, six living free of charge in relatives' houses (*cessionários*)

Table 5-3. Affected Property Owners and Properties

Municipality	Resident Owners*	Non-Resident Owners	Total Property Owners	Total Number of Properties
Minaçu	71 (46 rural) (25 urban)	65 (60 rural) (5 urban)**	136	152
Cavalcante	65	33	98	98
Colinas do Sul	-	2	2	2
Total	136	100	236	252

* Some ranch owners were classified as "resident" in the census, although they also have houses in Minaçu or Goiania.
** House plots. There are seven houses on the five plots

Table 5-4. Rural Landholding in the Reservoir Area

Size of Holding	Number of Holdings	Percentage of Holdings	Total Area in Hectares	Percentage of Affected Area
1 hectare or less	21	10%	9	< 1%
1–10 hectares	53	24%	244	< 2%
10–50 hectares	88	41%	2,378	17%
50-500 hectares	50	23%	6,406	47%
500 + hectares	5	2%	4,628	34%
Total	**217**	**100%**	**13,665**	**100%**

Table 5-5. Rural Population without Title or Occupancy Rights

Situation	Minaçu	Cavalcante	Colinas do Sul	Total
Sharecropper	7	1	-	8
Usufruct	7	5	-	12
Tenant	3	1	-	4
Family labor	4	6	-	10
Resident	8	6	1	15
Non-farming resident	5	2	-	7
Employee	39	17	3	59
Total	**73**	**38**	**4**	**115**

Table 6-1. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR CANA BRAVA

IMPACTS	MITIGATION PROGRAMS	MONITORING PROGRAMS	RESPONSIBILITY
Total cost of environment and social mitigation (construction and operation phase)			
CONSTRUCTION PHASE			
A- Campsite/ worker's village			
Impacts on air, water, erosion, wastes, etc.	**1. ESMP for the construction site and worker's village**	**Effluent monitoring program;**	**EPC (Consorcio Cana Brava)**
B- Degraded areas			
Impacts on borrow/ disposal areas, and campsite areas	**2. Rehabilitation of degraded areas (borrow /disposal areas, campsite areas**		**EPC (Consorcio Cana Brava)**
C- Area of Direct Influence (ADI)	**ESMP for the ADI**		
Archeology	1. Archeological Rescue		**CEM (PBA)***
Speleology	2. Speleological Survey		**CEM (PBA)**
Flora	**3. Conservation of Flora**		**CEM (PBA)**
	4. Implementation of the Conservation Unit		**CEM (PBA)**
Fauna	**5. Conservation of wild fauna**	**Includes monitoring component**	**CEM (PBA)**
Icthiofauna	**6. Survey and monitoring of the Icthiofauna**	**Includes the monitoring component**	**CEM (PBA)**
Seismology		**12. Seismic Monitoring**	**CEM (PBA)**
Climate		**13. Climate Monitoring**	**CEM (PBA)**
Geology		**14. Geological Monitoring**	
Eutrophication	**15. Suppression of vegetation in the reservoir's area**		**CEM (PBA)**
Water quality		**16. Monitoring of limnology and water quality**	**CEM (PBA)**

D. Social impacts			
Loss of infrastructure	**7. Relocation of infrastructure**		**EPC (Consorcio Cana Brava)**
Impacts on society, culture and education	**8. Social communication**		**CEM (PBA)**
	9. Environmental Education		**CEM (PBA)**
	10. Education and culture	**Includes monitoring component**	**CEM (PBA)**
Involuntary displacement	**11. Resettlement and Compensation Plan**	**Includes monitoring component for the affected population**	**CEM (PBA)**
E. Others			
Compliance with legal permitting system	**Licenses and permits**		**CEM**
Operational support to all programs	**Logistics**		**CEM**
Others	**Others**		**CEM**

*** All the PBA programs will be implemented in all the areas around the reservoir (rural areas of the Municipalities of Mi do Sul)**

(CONT.)

IMPACTS	MITIGATION PROGRAMS	MONITORING PROGRAMS	RESPONSIBILITY
OPERATION PHASE			
F. Natural environment			
Fauna		**Cont. of fauna monitoring**	**CEM (PBA)**
Icthiofauna		**Cont. of Icthiofauna monitoring**	**CEM (PBA)**
Seismology		**Cont. of seismic monitoring**	**CEM (PBA)**
Geology		**Cont. of geological monitoring**	**CEM (PBA)**
Water quality		**Cont. of limnology and water quality monitoring**	**CEM (PBA)**
Climate		**Cont. of climate monitoring**	**CEM (PBA)**
G. Social environment			
Land use impacts in the area surrounding the reservoir	**17. Master Plan of the Reservoir's Drainage Area**		**CEM**
Erosion in the marginal areas of the reservoir	**18. Implementation of the preservation area around the reservoir**		**CEM**
Impacts on society, education and culture	**Cont. of the Social Communication Program**		**CEM (PBA)**
	Cont. of the Env. Education Program		**CEM (PBA)**
	Cont. of the Education and Culture Program		**CEM (PBA)**
Impacts on resettled families	**Cont. of the resettlement plan**	**Monitoring of the affected population during operation phase**	**CEM (PBA)**
Impacts in the urban area of Minaçu	**19. ESMP for the urban area of Minaçu**		**CEM**
	Sanitation program		
	Municipal slaughterhouse		
	Cleaning of wastes/sanitary		
	Implementation of a 30m safety zone		

	Control of Disease-carrying vectors			
	Land use plan			

FIGURE 2-1. SITE LOCATION OF CANA BRAVA HYDROELECTRIC POWER PLANT

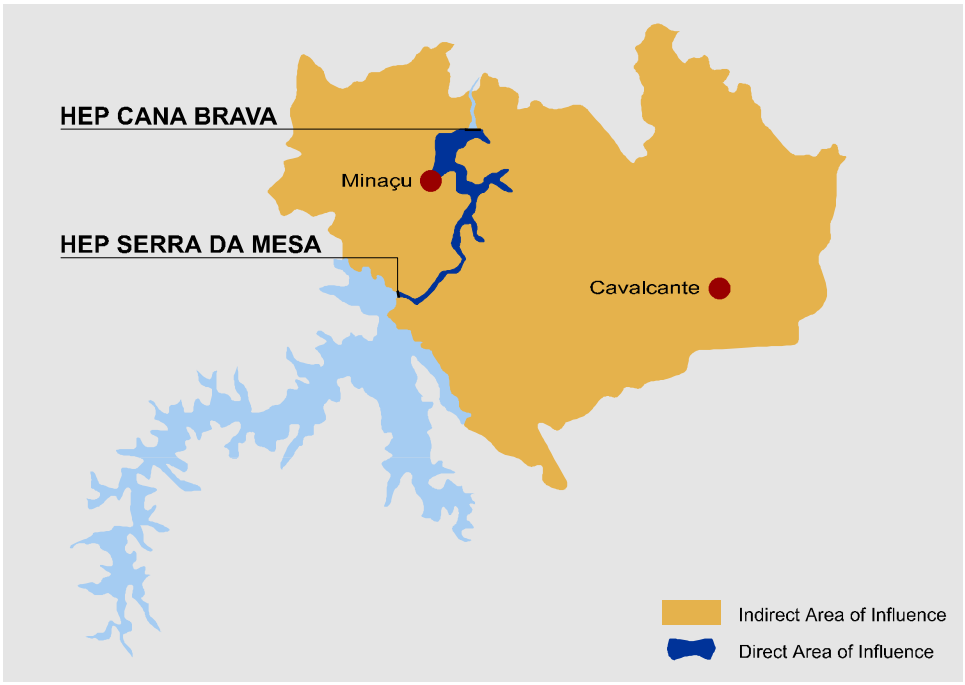
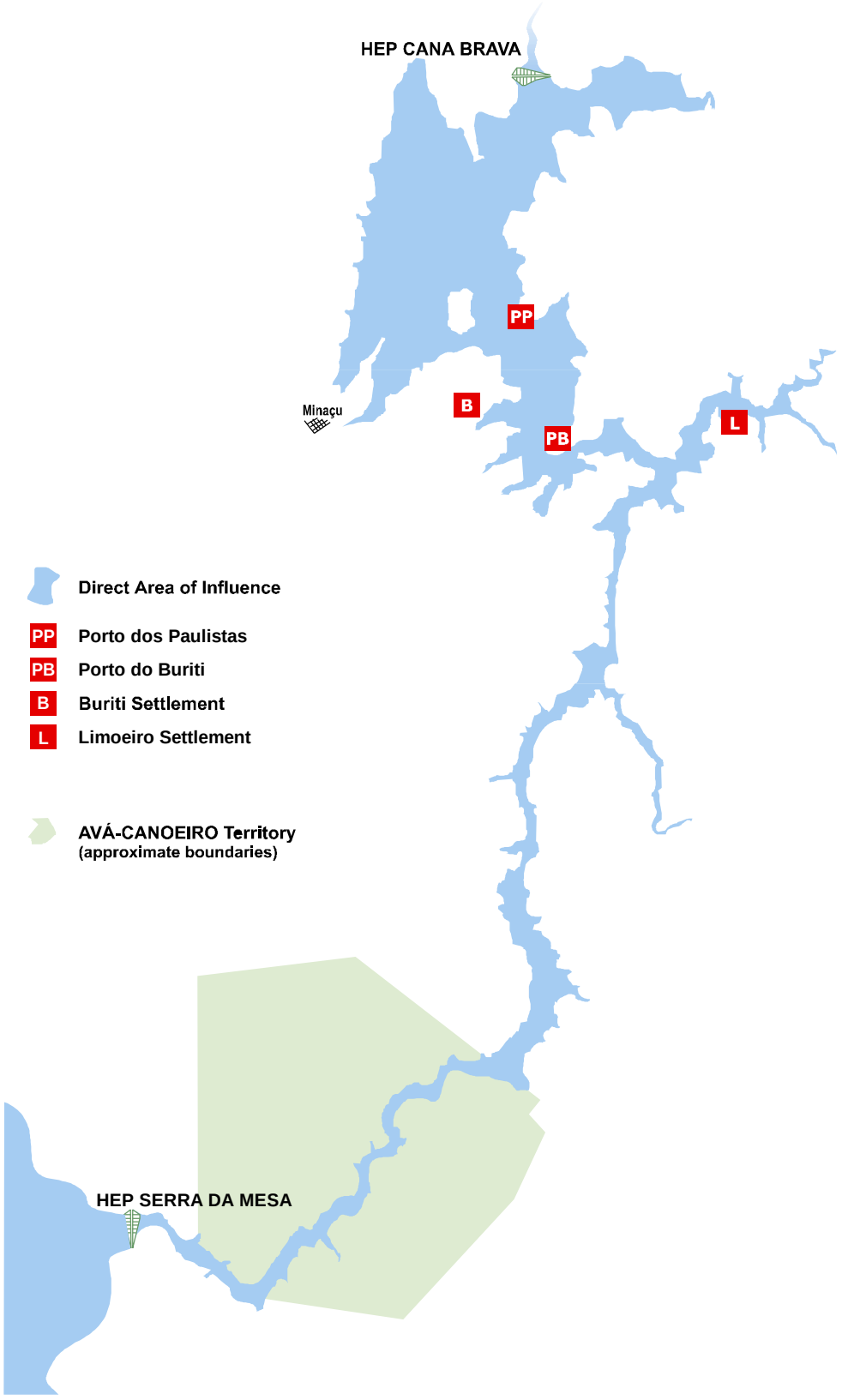


FIGURE 2-2. SITE LOCATION OF CANA BRAVA HYDROELECTRIC POWER PLANT



ANNEX 1

SUMMARY OF SELECT POTENTIALLY APPLICABLE PROJECT ENVIRONMENTAL LEGISLATION

Waste Management: several CONAMA Resolutions deal with waste management and regulate requirements for a complete waste inventory (including storage, transportation and final disposal methods), submittal of inventory forms to the state environmental agency, classification of used lubricant oil as hazardous waste, and procedures for its storage, treatment and disposal. The ABNT has also issued a number of standards that relate to waste management, such as waste classification and characterization. There are also standards addressing the final disposal of wastes. Criteria for design, construction and operation of a hazardous waste (Class 1) landfill are defined under NBR's 8418 and 10157. The option of disposal through incineration is becoming more widely available and performance criteria for hazardous waste incinerators are established under NBR 11175 (former NB 1265). CONAMA Resolution 006/88 requires the submission of an inventory of any PCB (Polychlorinated Biphenils) and/or PCB-containing materials to the state environmental regulatory agency. Federal legislation also establishes procedures for handling, storage and transportation of PCB or PCB-containing materials (and reference ABNT NBR 8371 for technical aspects).

Water Management: the most important piece of legislation is CONAMA Resolution 20/86, which establishes standards for quality of superficial water bodies and requirements and limits for wastewater and/or effluent discharges. Most recently, Federal Law 9.433/97 establishes the Water Resources National Policy and creates the National System of Water Resources Management. Ordinance 36/90, by the Ministry of Health, establishes standards for drinking water use.

Fauna and Flora and Forest Management: the most relevant legislation, at the federal level, is Federal Law 4.771/65 (Forestry Code), which defines as permanent preservation areas forests and other forms of natural vegetation along the rivers and around lakes and other natural or artificial reservoirs. It sets provisions to authorize the clearing of these forests if previously authorized or when absolutely necessary for the implementation of public interest projects. Procedures to manage native forests and requirements to cutting and transporting forest resources are defined at the state level. Further regulation at the federal level defined the minimum width of "ciliary belts" – in the case of artificial reservoirs and rivers wider than 50 meter "ciliary belts" should have a minimum width of 100 meters. CONAMA Resolution 04/85 also requires the establishment of a permanent preservation area of 100 meter around the reservoir of a HPP.

Federal Law 3.824/60, establishes the requirements for deforestation and clearing of the areas to be flooded.

Mineral resources: under the Brazilian Mining Code, established by Federal Law 227/67, the extraction of stones and slate (quarry) (Class II mineral resources) to serve as raw material for the construction of dams require an specific authorization from the local administration authority and from the National Department of Mineral Production (DNPM). CONAMA Resolution 010/90 determines that the quarry to serve at class II mineral resources is subject to the environmental permitting procedures.

Environmental education: Federal Law 9.795, of April 27, 1999, creates the National Policy for Environmental Education.

Noise: CONAMA Resolution 001/90 establishes criteria for noise emissions from any industrial, commercial, social or leisure activities. It also addresses the contents of NBR 10151 as the suitable noise evaluation method and NBR 10152 as the applicable noise levels for areas of different use (residential, commercial, and industrial).

Historic and Archeological Heritage: the main regulation addressing the issues related to the protection of the

historic, artistic, aesthetic, cultural and archeological heritage/patrimony is Federal Law 3924/61 that determines that any site in which positive vestiges of occupation by paleoamerindians or of temporary settlements of the ceramic period, is defined as historic or archeological monuments. The legislation also establishes the general requirements for the excavation procedures.

Health and Safety: health and safety regulations in Brazil are mainly established by the Ministry of Labor, at the federal level. The federal legislation establishes the set of general requirements and details the federal health and safety requirements through Regulatory Norms (NR's). However, complementary health and safety and industrial hygiene requirements are established through Technical Rules and Standards issued by the ABNT. As for the transportation, handling and temporary storage of explosives for mineral extraction purposes Federal Decree 2998/99 requires that a specific authorization ("Certificado de Registro") be granted by the Ministry of Army for each activity. Technical requirements for the storage facilities are also established by the Decree.

Expropriation: The expropriation process, regulated by the Law-Decree No. 3.365, of June 21, 1941, occurs in two stages. In the declaratory stage, ANEEL, the organization responsible for the regulation of the electricity concessionaires, publishes a Resolution determining the area to be expropriated for public utility. In the expropriation stage, the concessionaire is allowed to acquire and compensate the affected properties in the areas to be expropriated.

Environmental crimes: recent Federal Law 9.605/98, regulated by Federal Decree 3,179/99 establishes punishments for environmental crimes, which include among other, environmental damages provoked by human actions.

ANNEX 2

SUMMARY OF DRAFT RESETTLEMENT PLAN

The Sponsor has prepared a draft Resettlement Plan that outlines the objectives, definitions, programs and responsibilities of the company in regard to the population that will lose their land, housing or livelihood as a result of the project. The objective of this plan is to minimize the impact of the project on the rural and urban populations that are affected, and to ensure that they can improve, or at least to recover their standard of living and levels of income. The plan contemplates compensation for people whose properties and houses will be affected, ensuring that they are offered at the very least replacement cost. The more vulnerable groups from the rural areas, including small landowners and the families of non-landowners will be offered the option of resettlement, including at the minimum a viable agricultural plot with basic housing, services and infrastructure. The urban families affected by the project will be offered the option of compensation or resettlement in an urban plot, with basic housing and services.

1. DEFINITIONS

The Sponsor is responsible for the preparation, implementation and finance of all aspects the resettlement plan, with the exception of the rural roads, electric power lines and bridges covered under the EPC contract. The Sponsor has contracted a GIS/land use specialist to carry out the valuation and negotiation for the compensation program, and to support the resettlement program, particularly in regard to identification and acquisition of the resettlement sites. The Sponsor has extended the contract of the sociologist who carried out the baseline surveys so that she can begin the social communication program. At present she is engaged in discussion of the resettlement plan for non-landowners with the affected families. Additional staff will be hired for the resettlement program as necessary. Where possible the Sponsor will contract local professionals, such as surveyors and lawyers for specific activities. This will offer the advantage of having people that are familiar with the area and its inhabitants.

Eligibility Criteria. The families eligible for resettlement include all the small landowners whose total property is 50 hectares or less and all the rural non-landowners, including sharecroppers (*meeiros*), families with usufruct rights (*usufrutuários*), tenants (*arrendatários*), independent family labor (*mão de obra familiar*), other residents (*comodatários* and *ocupantes*), and employees (*agregados*). The "family" is defined as "one or more individuals who live under the same roof and are economically dependent on the head of the family." Few cases of multiple occupancy were identified in the census, but the definition implies that any "economically independent" group living in the same house – for instance a married son or daughter, who worked the land independently, would be considered a separate family, and would be eligible for a separate resettlement plot and house. In total some 277 families will be entitled to participate in the resettlement program (115 landless families and 162 small landowners with holdings of 50 hectares or less).

The Sponsor has agreed that any landowners with more than 50 hectares, who deserve to be considered as special cases of hardship, could be included in the resettlement program. Cases would be considered on their individual merits, and would probably be few in number, corresponding to a few small ranchers with very poor land in the most remote areas.

"Cut-off Dates". The cut-off dates – ie. the date after which new entrants are not entitled to resettlement benefits, corresponds to the census, which was carried out between March and September 1999. On 29 November 1999 the census was formally validated at a public meeting, at which some 300 people from the affected area were present, as well as local authorities, including the mayors (*prefeitos*) of Minaçu and Cavalcante and the *Promotores de Justiça*, who represent the Ministry of Public Affairs (*Ministerio Público*) at

municipal level.

Landowners. The category of "landowners" includes people who have registered legal titles, purchase documents or who have "rights of occupancy" (*posse*). The Sponsor will be responsible for the legal costs needed to regularize occupancy rights. The adult children of landowners who live and work on their parents' land will be compensated for their improvements (houses, barns, fences, pastures, etc), provided that their parents are in agreement. If they accept compensation, and their parents' property is larger than 50 hectares, they would not be eligible for resettlement.

Affected Areas. The Sponsor will acquire all the land that is directly affected by the reservoir – up to 333 masl plus the 30 meter security zone (*zona de segurança*). In addition the Sponsor will idemnify rural landowners for the restrictions placed on the use of the remaining 70 meters of the 100 meter conservation area (*faixa ciliar*). The level of indemnification will be equivalent to the price paid for the land that is acquired, but the ownership of the land – and the onus to comply with the regulations controlling land use on the margins of the reservoir, will remain with the original landowner. The Sponsor will also offer to acquire the remaining areas of any property that will no longer remain economically viable. In principle, this is defined as any property – whatever the size, that is more than 70 percent affected. The option of selling the whole property will also apply to any property that has a remaining area of less than 10 hectares. Other cases, including properties affected by loss of access, would be decided on their merits, although the landowner would have to demonstrate that the remaining area is no longer economically viable.

2. INSTITUTIONAL RESPONSIBILITIES

Under the concession agreement CEM is responsible for compensation and resettlement of the population directly affected by the project. The company has prepared a Draft Resettlement Plan and has hired consultants to finalize and implement the plan. The reconstruction of some of the infrastructure affected by the reservoir – basically roads and bridges, will be carried out as part of the EPC contract. The Sponsor will coordinate closely with the Municipalities, the Ministry of Public Affairs (*Ministerio Público*) and the Commission of Representatives of the Affected Population (*Comissão de Representantes*).

3. COMPENSATION

Rural landowners with more than 50 hectares will be offered the options of cash compensation or exchange of their land for an area of similar size and productive capacity. In addition, the Draft Resettlement Plan mentions the alternative option of a letter of credit. Non-landowners in rural areas will be compensated for their housing, improvements, crops and other improvements or offered the option of resettlement (see below). Urban land or house owners will be offered the option of compensation or resettlement.

Cash Compensation. It is expected that most of the larger landowners will opt for cash compensation. Compensation will be given on the basis of a detailed assessment of the affected land, housing and improvements. The value of the land will be assessed as *terra nua* – that is to say, independently of any crops, houses, buildings, fences or other improvements. The procedure for land valuation – approved by the Federal University of Rio de Janeiro (UFRJ) – is based on a detailed system of geo-processing, that has already been set up by the GIS-land use specialist. It takes data from the aerial survey carried out by Aeroconsult, to identify the soil types, slope and altitude of the land in the affected properties. The system of valuation, particularly the relative weighting given to the different factors that are taken into account, has been discussed and in principle accepted by the Commission of Representatives of the Affected Population (*Comissão de Representates* – which represents many of the larger landowners). The valuation system assigns the following weighting to the different factors that should affect the value of *terra nua*: soil type – 60 percent, slope – 20 percent, altitude – 5 percent, distance from Minaçu – 10 percent, distance from rivers – 3 percent, and distance from roads – 2 percent.

All the houses, buildings, fences, drinking ponds, pastures, crops and other improvements, are assessed from a table of values that has been prepared taking into account the local prices for building materials, labor, fuel and hire of equipment. The valuation procedures follow the norms established by Brazilian Association for Technical Norms (ABNT) for the valuation of rural (NBR-8799) and for urban properties (NBR-5676). Valuation is usually fairly easy in the rural areas as most ranches have few improvements: usually limited to a house, simple outbuildings, fences, drinking ponds and areas planted in pasture.

Once the price has been agreed with a landowner, a purchase agreement will be drawn up. If the title is in order, and there are no outstanding taxes or other demands on the property, a single payment will be made within 30 days. The owner will be allowed to remain on the property as a tenant, making a symbolic payment of one *real* per annum, until given final notification to vacate, shortly before the reservoir is to be flooded. The landowner can cultivate or use the natural resources of the property and can take the building materials from the houses and outbuildings. The Sponsor is presently negotiating with IBAMA and the State authorities for permission to cut the timber from below 333 masl. Once this has been authorized, the landowners will be allowed to cut the timber and firewood from the directly affected areas of the property.

The Sponsor will provide landowners and legal occupants (*posseiros*) with legal support to regularize the titles to their land, hiring local lawyers from Minaçu and Cavalcante. This service will be provided free of charge, but will not be used to resolve disputes between landowners and occupants, boundary disputes, disputes over inheritance or other litigation.

Exchange. This option will be offered to those landowners that would prefer to acquire other properties in the region rather than receive cash payment. The alternative is designed to satisfy the demands of landowners that feel that their property has been undervalued, and should provide a means of ensuring that compensation is set at full replacement value. The option involves the same valuation procedures as cash compensation, with the affected landowner being allowed to acquire a property with a value of up to 5 percent more than the one affected by the project. If the cost of the new property is more than 5 percent above the one being exchanged, the landowner can pay the difference, provided the technical evaluation of the new area shows that it is more productive or advantageous than the property that is ceded. If the cost of the new property is less, the Sponsor will pay the difference in cash, following the same procedures as for compensation. The GIS-land use specialist will try to identify suitable areas in the region that are being offered for sale.

Letter of Credit. Under this option the Sponsor will provide affected landowners with a letter of credit up to the agreed value of the affected property. The landowner will be responsible for identifying a suitable area for resettlement.

4. RURAL RESETTLEMENT

The option of resettlement is open to small landowners, with 50 hectares or less, and to landless families. It is envisaged that much of the rural resettlement will use the "remaining areas" – the areas acquired by the Sponsor that remain above 333 masl and outside the 30 meter security zone. Rural resettlements will comprise a minimum of 10 hectares of agricultural land per household. Each household will be provided with a basic housing unit comprising a kitchen-living room, and at least one bedroom, potable drinking water, a latrine, an access road and, where possible, electricity. The household will also receive basic productive infrastructure, comprising fences, a corral and/or a barn, depending on the productive activities that the resettled families intend to engage in.

Small landowners and landless households will have the option of receiving compensation or of participating in the resettlement program. If they choose the resettlement program they will only receive cash compensation if the value of their property and/or their improvements is greater than the cost of the compensation program. Small landowners will be allowed to remove their building materials from the original site and, once

authorization is given, will be allowed to take the timber and firewood. Landless families can only take the building materials if the landowner is in agreement, as under the law the house belongs to the landowner.

Titling. The beneficiaries of the rural resettlement program will receive full title to the plots and houses as soon as they transfer their existing land and/or houses to the Sponsor or accept the terms of the resettlement program. Once they receive title they will be fully responsible for paying any taxes or charges for water or electricity. Legally married couples will be given joint title to the property, in accordance with Brazilian law. In the case of couples living in common-law unions, the title will be given in the name of both partners.

Selection of Resettlement Sites. The resettlement sites have to be identified. The urban sites will be selected in coordination with the municipal authorities and the Commission of Representatives. One potential site for rural resettlement is the *Fazenda Coriolano*, a property that was originally acquired by FURNAS for the construction site, but which was never used as the power plant was redesigned, and moved to the other side of the river.

One of the Sponsor's first priorities is the resettlement program for the seven families of Limoeiro. Some consultations have been carried out, but no formal agreement has been reached. Three elderly people with "rural pensions" (*aposentados rurais*) would prefer to move to Minaçu, where some of their children or other close relatives are living. They feel they are too old to develop a new farm. Most of the younger people would prefer to be resettled together in a rural resettlement site, although one or two have mentioned that they would move to Mato Grosso. The details of plot size, layout, productive activities, housing and services still need to be discussed.

Transitional Costs. In the rural areas, the Sponsor will be directly responsible for transporting the families that opt for resettlement, with their goods and animals, to the resettlement site. The timing of the move will be agreed with these families, taking the school year and agricultural calendar into account. The large property owners that opt for compensation, exchange or letter of credit will be responsible for their own transport costs.

5. URBAN RESETTLEMENT

Options. In urban areas most affected families will be offered three options. The first is cash compensation for their houses and house plots. The second is compensation for their houses and improvements, and provision of an alternative house plot, of the same size or larger than the plot they occupy, connected to the municipal water supply system and to the municipal sewerage system that will be constructed as part of the ESMP. The final option is provision of a plot of at least 200 M², with a basic housing unit, comprising a minimum of a living room, two bedrooms, a kitchen and a bathroom. The house will be connected to the municipal drinking water system and to the sewerage system, and will be provided with electricity. Given the size and condition of most of the affected houses, it can be expected that most property owners and legal occupants will choose the option of a plot with basic housing. The house owners that choose this option will only receive compensation if the value of their house is greater than the cost of the house and house plot at the resettlement site.

Titling. The beneficiaries of the urban resettlement program will also receive full title to the new plots and houses as soon as they transfer their existing plots and houses to the Sponsor. As soon as they receive the titles they will be responsible for all taxes and service charges for water, sewerage or electricity. Married couples will be given joint title to the property, while couples living in common-law unions will be given the titles in the names of both partners.

Transitional costs. In the urban area of Minaçu, the Sponsor has proposed that the municipality will be responsible for moving the affected households to the new resettlement site, and for demolition and removal of the old building materials. The Sponsor will sign an agreement with the municipality, defining the timetable, activities, and responsibilities of each side.

6. THE SOCIAL COMMUNICATION PROGRAM

The objective of the Social Communication Program is to keep both the directly and indirectly affected population informed about the construction activities and the environmental impacts and correspondent mitigation and monitoring measures of the Cana Brava HPP. It also aims at establishing partnerships with the municipal authorities in Minaçu and Cavalcante and the State Secretaries of Culture, Environment and Education to develop activities aiming at raising environmental awareness in the population. As part of the program, the Company established an Information Center in Minaçu in November 1999 to provide information, particularly about the compensation and resettlement programs.

The social communication program will engage in three main activities: i) identification of the demands and expectations of the affected population, ii) provision of information, particularly in regard to the options and procedures for compensation and resettlement, and iii) negotiation and inter-institutional coordination. The sociologist is presently engaged in discussions of the details of the resettlement program with the directly affected population that is eligible for the program. Once the program is finalized, the information will be disseminated, using various media, particularly the radio and very simple printed bulletins, of a kind suitable for populations with a low level of functional literacy. The program will also provide a broader range of information through the media (television, radio, newspaper, loudspeakers and speeches), including general information about the Project and environmental issues. The social communication program will also be responsible for identifying and resolving outstanding issues as they arise. This would cover issues related to compensation, resettlement, relations between local communities and contractors, and so on. The program will coordinate closely with the municipal authorities of Minaçu and Cavalcante, periodically holding meetings to inform them of the latest developments. The program was started in January 2000 and will continue to December 2002.

7. ENVIRONMENTAL IMPACTS OF THE RESETTLEMENT PROGRAM

The two most important potential impacts of the resettlement program relate to the rebuilding of the municipal slaughterhouse in Minaçu, and the resettlement of small landowners and landless families in the "remaining areas". In regard to the slaughterhouse, the Sponsor will ensure that this project complies with all the relevant environmental legislation.

The resettlement sites have not yet been chosen, and detailed productive plans have not yet been developed. However, the Sponsor has determined that, wherever possible, the sites will be developed in areas that are already used for agriculture or grazing, avoiding any unnecessary forest clearance. Any clearance that does take place will only be carried out after consultation with the relevant environmental authorities, and will respect the environmental legislation in regard to the maintenance of the legal forest reserves and protection areas. Particular attention will be given to ensuring that no unauthorized activities are allowed in the 100 meter remaining areas around the edge of the reservoir.

8. TIMING AND COSTS

The draft Resettlement Plan includes an indicative timetable up to December 2001. During this period the Sponsor has to complete all valuations, reach agreements and compensate all the landowners that are willing to negotiate a solution. The Sponsor also has to implement the resettlement of the small landowners and landless families affected by the project. Between January and March 2002 the Sponsor will identify all those cases that have not been resolved via negotiation and from April 2002 these cases will be passed to the courts for arbitration. The reservoir is due to start filling in July 2002.

The draft Resettlement Plan includes an estimate of total costs. These include 7 million *reais* (around US$ 4.1 million) for land acquisition, and 3 million *reais* (around US$ 1.75 million) for the resettlement

program. Land acquisition will involve the purchase of between 13,900 and 26,900 hectares (the minimum corresponds to the area below 333 masl, the maximum to the proposed public utility decree, including the "remaining areas" of properties that will no longer be economically viable). This would give an average price of somewhere between 260 and 500 *reais* (US$ 150-295) per hectare. Most of the small landowners that opt for resettlement will not be compensated, but will receive the benefits of the resettlement program. However, it is important to remember that the land of all the small landowners (< 50 hectares) taken together represents less than 20 percent of the total area affected.

9. MONITORING

According to the draft Resettlement Plan, the monitoring of the resettlement program will be carried out by the sociologists responsible for the baseline census. The monitoring program will cover different moments in the resettlement program: after receipt of compensation, after the move, and after the first harvest. The monitoring will consider the situation of all affected groups: landowners receiving compensation, those that have opted for exchange or letter of credit, households that opt for resettlement, and the urban population resettled in Minaçu.