

INTER-AMERICAN DEVELOPMENT BANK



BRAZIL

CAMPOS NOVOS HYDROELECTRIC POWER PROJECT

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**ENVIRONMENTAL AND SOCIAL MANAGEMENT REPORT
(ESMR)**

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ACRONYMS AND INITIALS

ABNT	Associação Brasileira de Normas Técnicas (Brazilian Association for Technical Standardization)
ANA	Agência Nacional da Águas (National Water Agency)
ANEEL	Agência Nacional de Águas e Energia Elétrica (National Electrical Energy Agency)
CAM	Centro de Atendimento ao Migrante (Center for the attention of migrant workers)
CBA	Companhia Brasileira de Alumínio (Aluminum Brazilian Company)
CCCC	Construções e Comércio Camargo Corrêa S.A.
CEEE	Companhia Estadual de Energia Elétrica (Electric Energy State Company)
CELESC	Centrais Elétricas de Santa Catarina (Electric Companies of Santa Catarina)
CFCN	Consórcio Fornecedor de Campos Novos (Campos Novos Consortium)
CIPA	Comissão Interna de Prevenção de Acidentes (Internal Accident Prevention Commission)
CLT	Consolidação das Leis do Trabalho (Consolidated Labor Legislation)
CNEC	CNEC Engenharia Ltda.
CNT	Companhia Níquel Tocantins
COMASE	Comitê de Meio Ambiente do Setor Elétrico (Coordinating Committee for the Environmental Operations of the Power Sector)
CONAMA	Conselho Nacional do Meio Ambiente (National Environmental Council)
CONSEMA	Conselho Estadual de Meio Ambiente (Santa Catarina State Secretariat of Health)
COPEL	Companhia Paranaense de Energia (Energy Paranaese Company)
CPFL	Geração de Energia S.A.
DNAEE	Divisão Nacional de Águas e Energia Elétrica (National Department of Waters and Electrical Energy)
DNPM	Departamento Nacional de Produção Mineral (National Department of Mineral Production)
ECSA	Engenharia Sócio-Ambiental S/C Ltda
EIA	Estudo de Impacto Ambiental (Environmental Impact Assessment)
ELETROSUL	Empresa de Transmissão do Sul do Brasil S.A.
ENERCAN	Campos Novos Energia S.A.
ENGEVIX	Engenix Engenharia Ltda.
EPAGRI	Estudos de Pesquisa de Agropecuária (SC State Agricultural Research Agency)
EPC	Engineering, procurement, and construction
ESMP	Environmental and Social Management Plan
FATMA	Fundação do Meio Ambiente (Environmental Protection Agency)
IBAMA	Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis (Institute for Environment and Renewable Resources)
IBPA	Instituto Brasileiro de Pesquisa Alternativa (Brazilian Institute for Alternative Investigation)
IDB	Inter-American Development Bank
ILO	International Labor Organization
IPHAN	Instituto do Patrimônio Histórico e Artístico Nacional (National Institute for Historic Heritage)
IPP	Independent power producer
IPT/SP	Institute of Technological Research of the State of São Paulo
ISS	Imposto Sobre Serviços (Tax on Services)
km	Kilometers
km ²	square kilometers
KV	Kilovolt

LAI	Licença Ambiental de Instalação (Environmental Installation License)
LAP	Licença Ambiental Prévia (Preliminary Environmental License)
LO	Licença de Operação (Operating License)
m ³	cubic meters
m ³ /s	cubic meters per second
masl	meters above sea level
MAB	Movimento dos Atingidos por Barragens (The Movement of Dam Affected People)
MME	Ministério de Minas e Energia (Ministry of Mines and Energy)
MPE	Ministério Público Estadual (State Attorney General Office)
MPF	Ministério Público Federal (Federal Attorney General Office)
MT	Ministério do Trabalho e Emprego (Ministry of Labor and Social Security)
MW	Megawatts
NBs	Normas Brasileiras (Brazilian Norms)
NRs	Normas Regulamentadoras (Regulated Norms)
PBAs	Programas Básicos Ambientais (Basic Environmental Programs)
PCB	Polychlorinated biphenyls
PCMAT	Programa de Condições e Meio Ambiente de Trabalho (Occupational Health and Safety Conditions at the Workplace Environment Program)
PCMSO	Programa de Controle Médico e Saúde Ocupacional (Workers Health and Medical Program)
Project	Campos Novos Hydroelectric Power Plant Project
PMF	Probable maximum flood
PPE	Personal protective equipment
PPRA	Programa de Prevenção de Riscos Ambientais (Environmental Risks Prevention Program)
PRI	Private Sector Department (of the Inter-American Development Bank)
RAS	Relatório Ambiental Simplificado (Simplified Environmental Report)
RIMA	Relatório de Impacto Ambiental (Environmental Impact Statement)
ROW	Right-of-way
SEBRAE	Serviço Brasileiro de Apoio às Micro e Pequenas Empresas (Brazilian Service for the Support of Micro and Small Business)
SISNAMA	Sistema Nacional do Meio Ambiente (National Environmental System)
SPC	Special-purpose company

I. INTRODUCTION

- 1.1 The Campos Novos Hydroelectric Power Project (the “Project”) entails the construction and operation of a 880 Megawatt (MW) hydroelectric power plant and an 11-kilometer (km) 230 kV transmission line. The Project is situated on the Canoas River, in the State of Santa Catarina, Southern Brazil. The dam is located in a steep-sided narrow valley and will be the highest concrete faced rock-fill dam in Brazil, with a maximum height of 202 meters (m). Construction started on August 1, 2001, and filling of the reservoir is planned for September 30, 2005. When filled, the reservoir will cover an area of 35 square kilometers (km²) and will flood areas in four municipalities.
- 1.2 The Project will be developed by Enercan, a special-purpose company that has been granted a 35-year concession to develop the Campos Novos Project to produce and sell up to 3,310,404 MWh of energy per year. The concession was assigned by the National Electrical Energy Agency (“*Agência Nacional de Energia Elétrica*” [ANEEL]) to Enercan on September 30, 1999 and the concession contract was executed on May 29, 2000. Enercan is owned by CPFL-G *Geração de Energia S.A.* with 48.73 percent of the shares, *Companhia Brasileira de Alumínio* (CBA) with 22.69 percent, *Companhia Níquel Tocantins* (CNT) with 20.04 percent, *Companhia Estadual de Energia Elétrica* (CEEE) – the State Electricity Company of Rio Grande do Sul, with 6.51 percent, and *Centrais Elétricas de Santa Catarina* (CELESC) – the State Electricity Company of Santa Catarina, with 2.03 percent.
- 1.3 Enercan has contracted the *Consórcio Fornecedor de Campos Novos* (CFCN) as the EPC contractor to construct the Project. The CFCN consortium is led by *Construções e Comércio Camargo Corrêa S.A.* (CCCC), and includes *Engevix*, *CNEC Engenharia* and *GE-Hydro Inepar do Brasil S.A.* CCCC is about the fourth largest contractor in Brazil.
- 1.4 The total Project costs are estimated at US\$523.9 million, including finance costs, interests, insurance premiums, reserve accounts and the strengthening of a fund for the development of communities. The EPC contract is worth US\$343.7 million and does not include provision for land acquisition, resettlement or the rebuilding or replacement of affected infrastructure. The Sponsors are developing the Project using equity and a combination of financing from the Brazilian National Bank for Economic and Social Development (*Banco Nacional de Desenvolvimento Econômico e Social* [BNDES]) and an “A” Loan from the Inter-American Development Bank (IDB). BNDES is providing long-term financing of US\$267.5 million in local currency. The IDB “A” Loan is expected to be approximately US\$75.0 million.

II. PROJECT DESCRIPTION

A. Location

- 2.1 The Campos Novos Hydroelectric Power Plant is located on the Canoas River, in the State of Santa Catarina, Southern Brazil. The Project is located 390 km to the southwest of Florianópolis, the capital of Santa Catarina, and 28 km from the center of Campos Novos, the nearest and most important town in the vicinity (Figure 2.1). The dam axis will be located between the municipalities of Campos Novos and Celso Ramos, 21 km upstream from the confluence of the Canoas and Pelotas Rivers. The dam and the lower reaches of the reservoir are sited within a

deep river canyon, with steep slopes ranging from 35 to 40 degrees. The reservoir will flood areas of the municipalities of Campos Novos, Celso Ramos, Abdon Batista and Anita Garibaldi.

- 2.2 There are other existing and proposed hydroelectric power projects in the Canoas hydrographic basin, as well as other dams in the basins downstream of the Project (the Canoas River is tributary to the Pelotas River, which in turn becomes a tributary to the Uruguai River). In the Canoas River, the Peri hydroelectric power plant is located 142 km upstream of the Campos Novos Project. Closer to the Project, there are plans to develop a 200 MW hydropower project (the Garibaldi hydroelectric power project) approximately 60 km upstream of the Campos Novos Project. The Garibaldi project is currently in the early stages of feasibility studies. Two hydroelectric power plants are in operation downstream of the Campos Novos Project; the Machadinho hydropower project is located in the Pelotas River, 24 km downstream of the Project dam. The Machadinho reservoir extends to the location of the Project dam. The Ita hydroelectric power plant is located further downstream of the Machadinho dam. Although not directly downstream of the Project, the Barra Grande hydroelectric power projects is being constructed in the Pelotas River, upstream from the confluence of the Canoas and Pelotas Rivers. Other hydroelectric power project that is at the design stage is Foz de Chapecó. Foz de Chapecó will be located in the Uruguai River, downstream of the existing Ita hydroelectric power project. Figure 2.2 depicts the elongated form of the Campos Novos reservoir and its location within other hydropower projects in the basin.

B. Project Components and Facilities

- 2.3 The Project will have a total nominal capacity of 880 MW, provided by three Francis-type generating units of 293 MW each. The overall construction site is steep and hilly. All temporary and concrete structures such as spillway, powerhouse, diversion tunnels, concrete plant, camps etc. are located in the right (north) margin of the canyon (See Figure 2.3).
- 2.4 Diversion scheme. The diversion scheme required during construction consists of two cofferdams and two diversion tunnels. The tunnels are 16 m high and 14 m wide and have lengths of 860.9 m and 915.8 m respectively. When the diversion works are no longer needed, the tunnels will be sealed permanently with concrete.
- 2.5 Power Intake, Penstocks and Spillway. The design of the Project is for withdrawals of the top 35 m of the reservoir for either power generation or spillway discharge. The hydraulic circuit will consist of one 790 m approach channel, one intake structure and three adduction tunnels. The intake structure located near the end of the approach channel will divert water into the powerhouse through three separate 6.2 m-diameter concrete-lined tunnels. Three penstocks connect the intake to the powerhouse and are comprised of a 160 m shaft and a 202 m long horizontal tunnel. The horizontal section has a concrete-line segment and 91 m steel-lined segment. The controlled spillway with four gates (17.4 m wide and 20.0 m high) was designed to accommodate the Probable Maximum Flood (PMF) of 18,240 m³/s.
- 2.6 Powerhouse. The powerhouse is located between the dam and the spillway plunge pool energy dissipator and will house the three Francis type turbine/generators units, a powerhouse bridge crane, service bay and other facilities. Each of the three turbines will have a nominal rated output of 300 MW at a 175.6 m rated head. The generator will be provided with surface water/air coolers and will be housed in a concrete structure.
- 2.7 Transmission Lines and Switchyards. A 10.75-km-long, 230 kilovolt (kV) double-circuit lattice-tower transmission line will connect the Project to the national grid through the existing *Empresa*

de Transmissão do Sul do Brasil S.A. (ELETROSUL) Campos Novos Substation. The Project Substation will be located on the north side of the Canoas River, near the Project powerhouse. The right-of-way (ROW) will run northwestern for a short distance, turning westward to eventually join the ROW of the Barra Grande transmission line. The transmission line will be mounted in 56 towers with a height of 27 m located at a distance of 2.5 km between towers. By positioning the Project transmission line ROW adjacent to the Barra Grande transmission line ROW, the developers minimize the impact on property owners. Figure 2.4 illustrates the old ROW presented in the Project Environmental Impact Assessment (EIA) and the most recently proposed trajectory.

- 2.8 Dam. The Campos Novos embankment dam will consist of a rockfill dam with an upstream concrete face. The dam crest will be 592m long with a maximum height of 202m above the foundations. The volume of compacted filling is 11,818.600 cubic meters (m³). The dam will be filled with rocks and debris that result from the excavation of the water intake structures as well as from one onsite rock quarry.
- 2.9 Reservoir. When the reservoir is filled, the maximum operating level will be 660 meters above sea level (masl) and the minimum 655 masl. The reservoir is 53km in length, but is very narrow, except where tributary streams, such as the Rio Ibicuí, flow into the main river. The valley is steepest in the 15-20 km nearest the dam while shallower and more open valleys are found in the upper reaches of the reservoir. At 660 masl the reservoir will cover an area of approximately 35 km², of which 9 km² correspond to the existing bed of the river, giving an area to be affected by flooding of just over 26 km². The total volume of the reservoir is 1,471 x 10⁹ m³. The depth of the reservoir at the dam will be of 145 m. The 35 km² reservoir is relatively small in size compared to the size of reservoirs of hydroelectric projects with similar generating capacity. Although the reservoir is deep, its surface area is only 35 km² and provides minimal usage storage (approximately 129.7 x 10⁹ m³) for flow regulations between elevations of 660 and 655 masl. Consequently, the Project is primarily a run-of-river type hydro facility with daily to weekly flow regulating capacity. The average long-term flow is 298.5 m³/s and the hydraulic residence time is 5 days. The estimated time to fill the reservoir is approximately 40 days. During the filling of the reservoir, a low-level outlet will maintain the minimum flow requirements downstream of 18.3 m³/s, corresponding to 80 percent of the minimum monthly flow of 22.9 m³/s downstream of the dam. This will be consistent with Brazilian best practices regarding ecological flow¹. This low-level outlet will remain operational after construction in the event the powerhouse is shut down and minimum conservation flows are needed. Due to the topography, the reservoir will have an elongated shape, reaching as far as 53 km from the Dam. The area to be flooded includes land in the municipalities of Campos Novos, Abdon Batista, Celso Ramos and Anita Garibaldi.
- 2.10 Clearing of Vegetation. Approximately 30% of the vegetation of the area to be flooded will be cleared prior to the filling of the reservoir. The forestry cover to be removed will account for approximately 325,000 m³ of wood, principally trees and bushes with dense coverage, as the degradation of this type of vegetation is responsible for greater impacts on water quality (see discussion in Section 5). Clearing activities will be limited at the very steep slopes with more than 45° of inclination.

¹ While there are no specific standards regulating ecological flows, the Project has adopted a standard from the former Department of Water and Electric Energy (Norma DNAEE N°03) for hydroelectric projects for generation of electricity to private companies, which requires the release of a minimum flow comprised of no less than 80% of the minimum monthly flow registered in at least a 10-years period.

- 2.11 Conservation Areas. An area of at minimum 30 m wide along the perimeter of the reservoir will be established as a conservation area (*Area de Preservação Permanente*) to help protect the water quality of the reservoir. The conservation area will be expanded to 100 m in areas with forestall cover. The variable conservation area accounts for 1,718.2 ha and represents 80% of land when compared to a fixed 100 m conservation area. The variable conservation area affects less of the fertile *várzea* soils used for agricultural activities in the upper reaches of the reservoir.
- 2.12 Conservation Unit. Enercan has acquired an area of 1,067.8 ha for environmental conservation (the “Conservation Unit”) in the Municipality of Campos Novos, along the right margin of the Canoas River. Currently Enercan is the owner of the property designed for the Conservation Unit and the area has been notarized by deed. FATMA has to define the category of the Conservation Unit and issue a State Decree formalizing the creation of the unit. Upon classifying the Conservation Unit, this land ownership will be transferred to the Santa Catarina State Government. Depending on the classification, either FATMA or other division from the environmental agency will be responsible for managing the area. The area selected for the establishment of the Conservation Unit presents the largest continuous area along the future reservoir with secondary vegetative cover and the presence of endemic vegetation including some endangered species such as the Brazilian pine, owls, deer and wild cats.. The dense vegetation in the Conservation Unit will allow for the preservation of species that require more complex biological process.
- 2.13 Project Roads. The site is easily accessible through a new 18.5 km access road over relatively flat terrain, linking the site to the BR-470 highway, some 10 km southwest of the town of Campos Novos. Upon completion of the Project, this new road along with a road across the dam, will be used to link the town of Celso Ramos with the National Highway system. No additional roads will be built or new routes created to access the Project. The Project required the construction of 12.5 km of internal roads (i.e. roads at the construction site). The internal roads are subdivided into two classes: (1) 7.5 km of definitive roads (switchyard included), and (2) 5.0 km of secondary roads to the powerhouse and various structures which will be flooded upon filling of the reservoir. Temporary site roads presently give access to the work areas, stockpile areas, equipment storage areas and site buildings.
- 2.14 Construction Materials. The construction of the Project requires approximately 13,000,000 m³ of rock material principally for the construction of the dam. The rock material is being quarried from the quarry at the right margin, located where the spillway approach channel and the powerhouse structures are being constructed. The elevation of the spillway approach channel was lowered by 15 m to 620 masl so that approximately 1,000,000 m³ could be obtained from this source rather than from the authorized quarry in the left margin of the river. Additional rock material was obtained during the excavation of the 860.9 m and 915.8 m diversion tunnels. The EPC contractor is producing concrete on-site. Concrete aggregates are being obtained from crushed rock coming from the excavations and quarry. The sand is being produced from local rocks because there is no natural sand near the Project site. Most of the construction equipment and other materials are being shipped by truck to the site.
- 2.15 Construction Activities. At the early stage of the construction phase, considerable amount of excavations works were necessary for the construction of internal roads and the initial works at spillway and power intake approach channel. Subsequently, two diversion tunnels were excavated to by-pass the river flow to allow construction of the dam (the spillway and powerhouse did not require river diversion). The river was deviated on October 17, 2003 and a cofferdam was constructed to allow the foundation treatment for the dam in the river channel. Once the spillway is complete and the dam nearly finished, impoundment of the reservoir will

take place when the bulkhead gates in the diversion tunnels are lowered to seal the water passageways.

- 2.16 Water supply system. The Canoas River is being used to supply water for the construction activities. The water is treated before its use in the cafeteria, lavatories, and office buildings. The water treatment plant is a conventional physico-chemical plant with flocculation, settling, and filtration processes, followed by disinfecting with sodium hypochloride. The plant has the capacity to produce 55 cubic meters per hour (m^3/h) but currently treats $30 \text{ m}^3/\text{h}$ ($0.0083 \text{ m}^3/\text{s}$). Raw water from the Canoas River is used in the construction site for dust control, washing of equipment, watering green areas, etc. Drinking water is trucked to the site in large containers.
- 2.17 Wastewater treatment plant. The sanitary effluents from the cafeteria, office, and lodging facilities are sent to the onsite wastewater treatment plant, which consists of the following units in this sequence: screening boxes, aeration tank, settling tank, and anaerobic treatment.
- 2.18 Electric energy and fuel storage. The Project is supplied with electric energy from the state electricity distributor (*Centrais Elétricas de Santa Catarina* [CELESC]). There is no need for onsite generation of electricity, except in the event of a power disruption. Five fuel storage tanks are present onsite for fueling heavy equipment and vehicles, including three diesel tanks (two 30,000 liter tanks and one 15,000 liter tank), and two gasoline tanks (30,000 and 15,000 liters). All of the tanks are aboveground structures constructed on impermeable ground with secondary containment.
- 2.19 Operation. Campos Novos will make use of five meters of reservoir draft to meet system dispatch demands. Because there are no storage dams immediately upstream that could regulate flows, power production is expected to be irregular due to run-off river-conditions, which will result in changing conditions in reservoir levels. The Project will operate under a system of central dispatch, on a merit-order basis, as per instruction of the Brazilian Independent System Operator (*Operador Nacional do Sistema Elétrico* [ONS]).

C. Schedule, Project Workforce and Cost

- 2.20 Construction of the civil works started on August 1, 2001 and the river was deviated on October 17, 2003. Clearing of the reservoir will be conducted gradually during the second semester of 2004. The contractual schedule sets forth a 54-month construction period, with filling of the reservoir planned to start on September 30, 2005 to be completed by January 30, 2006. The three turbines are due to begin generating on January 31, April 30 and July 31, 2006. As of January 31, 2004, civil construction works were approximately 65% completed.
- 2.21 As of January 2004, about 1,780 workers have been employed: 1,500 by Camargo Corrêa, and 280 by the subcontractors responsible for the maintenance of trucks, management of explosives, security and transport. Workforce is composed of local and non-local workers. Over 600 non-local workers are living on site, in lodging facilities within the construction site. Approximately 150 skilled workers, technicians and engineers are living in the town of Campos Novos. The others workers are local people and are brought in by bus from towns within a radius of 50 km, including 300 workers from the town of Campos Novos and other small towns including Capinzal, Celso Ramos, Joaçaba, Piratuba, and Barracão. A record high number of workers, 2,335, was reached in February of 2003. An average number of 1,800 workers for construction and electro-mechanical works will be maintained during 2004. This number will be reduced to 1,000 during 2005 and 350 for 2006. Most of the workers are male; Camargo Corrêa has a policy

of employing women wherever possible, but they constitute only 3-4 percent of the workforce and are mainly employed in skilled or professional areas.

- 2.22 The Project will employ approximately 60 people during the operations phase for Plant operation and maintenance activities. Enercan will be responsible for the operation and maintenance (“O&M”) of the Plant with the technical support from CPFL Geração, a solid operational utility from the State of São Paulo.
- 2.23 Total cost of the Campos Novos Project is estimated at US\$523.9 million, which includes all Project-related expenses. The EPC contract is approximately US\$321 million and includes payments for civil works and equipment. Additional costs include construction insurance premiums, administrative, area acquisition and resettlement of the affected population, environmental programs, a social fund and bank fees. Enercan has been financing the construction of the Project with equity and a US\$267.5 million long-term loan in local currency from BNDES, which is currently being disbursed. The IDB will provide a loan for approximately US\$75 million that will be divided over a 15-year tenure.

D. Project Alternative Analysis

- 2.24 Location. In the 70's and 80's the federal state-owned energy company Eletrosul developed a series of hydrological studies in the Uruguai basin and its tributaries for the development of hydroelectric power projects. Several locations and potential hydroelectric projects were identified at that time in the Uruguai, Pelotas and Canoas rivers. The severe financial restriction faced by the public Brazilian electric sector in the 90's prevented Eletrosul from developing the identified hydroelectric projects. The growth of the energy demands forced the federal government to modify the legislation concerning the concession of public services to allow private participation in the generation of energy, which resulted in the development of the current hydroelectric projects in this area.
- 2.25 The hydrological studies for the Campos Novos Project were also initiated by Eletrosul. During the 70s and 80s, more than 20 alternatives were analyzed, which varied in scope, the site axis location, height of the dam, the total area to be flooded, and the total nominal capacity. A total of 12 different locations were studied along 5 km of the Canoas River. Of these, three locations were selected for more detailed analysis. The analysis resulted in the identification of the two best location alternatives, from which the current Project design was selected. The selection was based on several factors including energy efficiency, technology, and environmental, social, and economic benefits. The Campos Novos Project will have a relatively small size and deep reservoir, which results in the affectation of less land when compared Projects with a similar generating capacity.
- 2.26 Generating Technology. Enercan carried out a thorough review of the generating technology upon winning the concession and was able to reduce the number of turbines from four to three.
- 2.27 Transmission Lines. The initial siting and design studies proposed that the Project Substation be located on the southern side of the Canoas River and anticipated that the transmission line would cross the river a short distance from the Project substation. The siting was revised during 2003 and the Project substation will now be constructed in the north side of the Canoas River, from where the transmission line will go westward to join the right of way (ROW) of the Barra Grande transmission line ROW without the need for the transmission line for crossing the Canoas River. In addition, the route of the transmission line was modified to mitigate environmental impacts on secondary vegetation. The revised ROW will be 812 m longer, but will affect less patches of

secondary vegetation currently present within the original proposed ROW as shown in the proposed and revised routes illustrated over the aerial photograph included in Figure 2.4. Finally, the decision for locating the transmission lines from the Campos Novos and the Barra Grande projects adjacent to one another will minimize the total area of land directly impacted by the restrictions in 40 m along 3.75 km along the ROW.

III. INSTITUTIONAL AND LEGAL FRAMEWORK

A. Institutional

Energy Sector

- 3.1 The National Electrical Energy Agency (*Agência Nacional de Energia Elétrica* [ANEEL]) is the federal electricity regulator responsible for implementing the federal government policies related to hydroelectric exploration and energy production. ANEEL is also responsible for issuing concessions, related permits and approving the technical and engineering aspects of power projects. The agency also issues the public utility declaration (*Declaração de Utilidade Pública*) for the expropriation of land related to a reservoir area and the right-of-way for the transmission lines associated with a power Project. ANEL was established through Federal Laws 8.897/1995 and 9.427/1996.
- 3.2 The Coordinating Committee for the Environmental Operations of the Power Sector (*Comitê de Meio Ambiente do Setor Elétrico* [COMASE]) was created by the Ministry of Mines and Energy (*Ministério de Minas e Energia*) to establish environmental policies within the power industry. Comprised of Eletrobrás and its regional concessionaires, COMASE has established the environmental and social policies for the electric power sector based on social and environmental feasibility of the project, environmental protection and socioeconomic development of the project area of influence, and public consultation and participation.
- 3.3 Brazil's National Water Agency (*Agência Nacional da Águas* [ANA]) is the autonomous regulatory authority responsible for implementing the Brazilian Water Resources Policy established by Federal Law 9.433/1997. ANA was instituted by Federal Law 9.984/2000 and regulates the uses of water resources, including water used for hydropower plants. In Santa Catarina, the State Secretariat of Technology, Energy, and Environment is the principal agency responsible for the management of water resources. The Canoas River Basin Committee (*Comite da Bacia*) has been recently constituted to define policies and guidelines for the management of the Canoas River. The Canoas River Basin Committee shall coordinate efforts to identify polluting sources discharging into the river basin, propose measures for wastewater minimization and treatment and enhance the development potential of hydroelectric projects. ENERCAN, together with other energy companies active in the area are required to participate in the River Basin Committee and as such Enercan participates regularly in the Basin Committee. Given the importance of the basin in the region, FATMA has assumed just recently the presidency of the Committee.
- 3.4 An Inter-Ministerial Working Group to review the demands of the people affected by hydropower projects was created by the Federal Government in October 10, 2003. The Working Group will conduct a study of the demands and a report with some recommendations is expected by mid March 2004. It should be noted that Projects located in the same region, such as Campos Novos and Barra Grande, apply different criteria (i.e. to determine rights to resettlement or the viability

of remaining areas) have different procedures and provide different levels of compensation and benefits.

Environmental Sector

- 3.5 Brazil's National Environment Council (*Conselho Nacional do Meio Ambiente* [CONAMA]) is a consulting and deliberating body responsible for defining general environmental regulations and basic criteria and guidelines to implement the National Environmental Policy. In the case of the Campos Novos Project, authorization for vegetation clearing and use of forestry resources must be granted by IBAMA. The Brazilian Institute for Environment and Renewable Resources (*Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis* [IBAMA]) is the federal agency responsible for executing and enforcing the environmental regulations and standards at the national level, and for issuing the environmental permit in the cases defined by law. IBAMA also provides administrative and technical support to CONAMA.
- 3.6 Brazil's Federal and State Public Ministry (*Ministério Público Federal* [MPF] and *Ministério Público Estadual* [MPE], respectively) serve an "ombudsman" function, overseeing the environmental practices of government agencies and the private sector. The two offices have investigative and prosecutory powers, and may bring civil and criminal actions against polluters and those who violate federal environmental laws. The Public Ministry provides an arbitration and conciliation service that is cheaper and quicker than recourse to the courts. The State-level offices of the Public Ministry operate independently of the district offices, which are located in the *comarcas* of Campos Novos and Anita Garibaldi, and the decisions of the State and district-level promoters (*promotores de justiça*) are not legally binding. If either party refuses to accept their decisions they would still have recourse to the formal legal system.
- 3.7 In the case of the Campos Novos Project, enforcement of environmental legislation and issuance of the major licenses is the responsibility of the State of Santa Catarina's environmental protection agency (*Fundação do Meio Ambiente* [FATMA]), which has a department solely dedicated to the issuance of environmental permits. The National Institute for Historic Heritage (*Instituto do Patrimônio Histórico e Artístico Nacional* [IPHAN]) also participates in the permitting process, in coordination with FATMA. Additionally, the Ministry of Mines and Energy (*Ministério de Minas e Energia* [MME]) also participates through its National Department of Mineral Production (*Departamento Nacional de Produção Mineral* [DNPM]), which has the authority to halt or prevent mining activities in a reservoir area upon official request of the project owner.
- 3.8 At the local level, the municipalities of Campos Novos, Celso Ramos, Anita Garibaldi, and Abdon Batista are responsible for verifying that the Project is in compliance with applicable industrial, land use, and occupational health and safety regulations, as well as other related requirements.
- 3.9 The Brazilian Association for Technical Standardization (*Associação Brasileira de Normas Técnicas* [ABNT]) issues, when not covered by existing legislation, additional standards and procedures. The technical specifications issued by ABNT are referred to as *Normas Brasileiras* (NBs or NBRs).

Health and Safety

- 3.10 The Ministry of Labor and Social Security (*Ministério do Trabalho e Emprego* [MT]) is responsible for developing health and safety regulations and its enforcement is assigned to the

regional state-based offices. Severe penalties, including a construction embargo, may be imposed if the Project is found to be non-compliant.

- 3.11 The Ministry of Health (*Ministério da Saúde*) has legislative jurisdiction over health-related issues. In the case of Campos Novos, health issues fall under the authority of the Santa Catarina State Secretariat of Health, which is a member of the Santa Catarina State Secretariat of Health (*Conselho Estadual de Meio Ambiente* [CONSEMA]).

B. Legal

Energy Sector

- 3.12 At the regulatory level, ANEEL resolutions are the primary legal documents governing power generating project operations. Of particular relevance are: 1) the resolution which empowers the property owner to become an independent power producer, and 2) the resolution that allows ANEEL to issue a declaration confirming that the reservoir area becomes a restricted area (*Área de Interesse Público*).
- 3.13 Federal Decree 2.003/1996 regulates the electric energy production by independent power producers. Other significant legislation includes Federal Law 8.987/1995, which establishes the system of concessions and permits for public services; Federal Decree 1.717/1995, which establishes procedures for concessions of public services related to electric energy; Federal Law 9.648/1998, which includes amendments to the legislation to introduce greater competition in the generation of electricity; and Federal Decree 2.003/1996, which regulates electric energy production by independent producers.

Environmental Sector

- 3.14 At the federal level, the most relevant environmental legislation is Federal Law 6.938/1981, enacted in August 1981, which created the National Environmental Policy. It establishes the basis for environmental protection in Brazil by putting in place the appropriate institutional framework and defining the main instruments for environmental management. Federal Law 6.938/1981 and its regulations made provisions for the creation of IBAMA, the National System of Environment and CONAMA. It also establishes a system of fines, financial restrictions, and provisions for the suspension of activities for non-compliance with federal, state, or municipal regulations.
- 3.15 The National Environmental Policy also created the environmental permitting system and the environmental impact assessment process. The Brazilian environmental permitting process requires that three licenses (permits) be obtained by all proposed projects that have the potential to cause environmental pollution: Preliminary License (*Licença Prévia* or LAP), Installation License (*Licença de Instalação* or LAI), and Operating License (*Licença de Operação* or LAO). This process applies to projects listed in CONAMA 001/1986. This Resolution defines the basic content of an Environmental Impact Assessment (EIA) and establishes the public participation requirements. CONAMA Resolution 09/1987 regulates the public hearing process associated with the EIA process.
- 3.16 The environmental permitting process begins with the review of an EIA. Upon review and approval of the EIA and Environmental Impact Statement (*Relatório de Impacto Ambiental* [RIMA]), the LAP is issued. A public hearing may be required prior to the issuance of the LAP. The LAI is granted based upon agency review and approval of the project-specific Environmental

Management Plan (*Projeto Básico Ambiental* [PBA]) and provides the legal authorization for the developer to start construction of the proposed project. The LAI also establishes specific requirements regarding the mitigation and monitoring of environmental and social impacts. An LAO must be obtained prior to beginning project operation. The LAO is granted only after all the plans and programs defined in the PBA are implemented. Once issued, the LAO is valid from 4 to 10 years (CONAMA Resolution 237/1997). The operating permit is issued for the entire facility. If expansions, changes in major equipment, or changes in process are planned for the facility, then new applications for the LAI and LAO are required by law. As part of the permitting process, CONAMA Resolution No. 001/1986 establishes that a study must be conducted in an area to be impacted by a project to assess the presence of archeological, historical, and cultural sites as well natural places of unique beauty.

- 3.17 CONAMA Resolution 002/1996 determines that projects with significant environmental impact, such as a hydroelectric power plant, shall establish an area for environmental conservation (a “Conservation Unit”), and that a minimum of 0.5 percent of the total project cost be spent exclusively for the acquisition of the necessary areas. Excess funds (e.g., when areas cost less than the established percentage) can be used on infrastructure and monitoring activities within the area, at the discretion of the state environmental regulatory agency, which is FATMA for the proposed Project.
- 3.18 Federal Law 4.771/1965 (Forestry Code) defines as permanent preservation areas forests and other forms of natural vegetation along the rivers and around lakes and other natural or artificial reservoirs. Further regulation at the federal level defined the minimum width of conservation areas.” In the case of artificial reservoirs and rivers wider than 50 meters, conservation areas must have a minimum width of 100 meters. CONAMA Resolution 04/1985 requires the establishment of a permanent conservation area (*Área de Preservação Permanente*) of 100 meters around the reservoir of a hydroelectric power plant. CONAMA Resolution 302/2002 allows the conservation area to be reduced to 30m in accordance with the characteristics of the affected area. Subsequently, IBAMA issued regulations (*Instrução Normativa IBAMA/SUPES -SP 3/97*) that govern the use of part of the ecological conservation area around the reservoirs for public or private uses. According to the regulations, 30 meters of this area has to be fully expropriated; owners of the properties within the remaining 70 meters will be compensated by the limitations of use (that will be imposed on the properties by the Reservoir’s Master Plan).
- 3.19 CONAMA Resolution 279/2001 established simplified procedures for the environmental permit process for electric utilities of small potential impacts, including power plants (thermal, hydro, and wind), transmission and distribution lines, and any associated facility. According to this resolution, public utilities must present a Simplified Environmental Report (*Relatório Ambiental Simplificado* [RAS]) when applying for the Preliminary License. Based on the RAS, the environmental agency, within a period not exceeding 10 days, will define whether the Project falls under the simplified procedure or requires the full EIA procedure. According to the simplified procedures, the agency will issue the environmental permit within a maximum period of 60 days.
- 3.20 Federal Laws 8.171/1991 and 8.987/1995 establish that electric utilities are required to restore the environmental conditions in the impacted area. Federal Decree 95.733/1988 establishes that large and medium scale projects funded totally or partially by federal monies must allocate a minimum of 1 percent of the total Project budget to mitigate the Project’s negative environmental impacts.

- 3.21 State Law 5793, passed October 15, 1980, and Decree 14250, enacted June 5, 1981, regulate all environmental protection and environmental quality issues in the State of Santa Catarina. Other regulations applicable to the Project are summarized in Table 3.1.

Health and Safety

- 3.22 The 1988 Federal Constitution provided for the reduction of labor risks through health, hygiene, and safety measures (Article 7, XXII). Chapter V of the Brazilian Consolidated Labor Legislation (*Consolidação das Leis do Trabalho* [CLT]) contains numerous sections and provisions to guarantee health and safety, including the use of personal protective equipment (PPE).
- 3.23 Federal Law 6.514/1977 is the primary instrument governing occupational health and safety standards. The Ministry of Labor also issued Administrative Norm 3.214/1978, which included detailed provisions (*Normas Regulamentadoras* [NRs]) governing health and safety standards. Programs for medical control of occupational health (Administrative Rule 8/1996) must take the NR provisions under consideration. Complementary health and safety and industrial hygiene requirements are established through Technical Norms and Standards issued by the ABNT.
- 3.24 The principal legislation regarding occupational health and safety are: a) Workers Code (CLT) and its regulations (NRs); and b) International Conventions of the International Labor Organization (ILO). NR 05 and Article 163 of the CLT define that every company must create and operate an Internal Accident Prevention Commission (*Comissão Interna de Prevenção de Acidentes* [CIPA]). NR 07 and 09, respectively, define requirements for the Workers Health and Medical Program (*Programa de Controle Médico e Saúde Ocupacional* [PCMSO]) and the Environmental Risks Prevention Program (*Programa de Prevenção de Riscos Ambientais* [PPRA]).

C. Project Compliance Status

- 3.25 The initial licensing took place before Enercan was awarded the concession. The EIA and the RIMA were completed for Eletrosul by Magna in 1990. At that time the RIMA estimated a population to be affected by the flooding of the reservoir of 135 families. On December 5, 1995 Eletrosul and Magna organized a public hearing at the city of Campos Novos to discuss the EIA and RIMA (See Section 7). In March 1996, FATMA issued the preliminary environmental license (License Number LAP 028/1996). The LAP was renewed by FATMA in March 1997 (LAP 021/97).
- 3.26 In August 1998, Enercan won the bid conducted by ANEEL for the Campos Novos Project. One of the conditions imposed by ANEEL was for Enercan to obtain the installation license (LAI) prior to signing the concession contract. As part of the requirements to obtain the LAI, Enercan prepared the PBA and updated a socioeconomic register of affected people conducted in 1997. The socioeconomic census was carried out by the firm COPEL and ETS (*Energia, Transporte e Saneamento S/C Ltda.*), consultants contracted by COPEL between September and December 1998, before the aerial survey of the affected area had taken place. This meant the team, led by COPEL, was working without accurate maps of the affected area or on-the-ground demarcation of the 660masl contour. COPEL provided Enercan with the completed questionnaires, and a list of the affected properties and families in the reservoir area. The 1998 census identified 486 families totalizing 1,706 inhabitants living in 335 properties in the area to be affected by the flooding of the reservoir. The date the 1998 census was finalized (December 31, 1998), has been used as the “cut-off date” for eligibility for resettlement. In early 1999, Enercan prepared the

PBA based on the results of the socioeconomic census finalized in 1998, the concepts and objectives presented in the EIA and the recommendations contained in the LAP of March 1997.

- 3.27 The PBA, including a preliminary resettlement plan was submitted to FATMA in March 1999. In November 1999, Enercan forwarded the PBA and technical report and studies on vegetation in the area of influence of the reservoir to IBAMA. FATMA and IBAMA reviewed the PBA in 2000 and requested complementary information. FATMA approved the PBA in March 2000 and issued the LAI (License Number LAI 019/00) after reviewing supplementary information submitted by the developer and following consultation with IBAMA (Letter 157/2000). The LAI was renewed for two years on May 25, 2001, and again on August 27, 2003 (LAI 015/2003). The present LAI is valid until August 27, 2005.
- 3.28 The Concession Agreement was signed on May 29, 2000. Article 5 of the concession decree, makes Enercan responsible for all environmental and social mitigation programs. ANEEL issued three public utility decrees for the Project after the Concession Agreement was signed. The first, for the area of the construction site on the right margin of the river, in the Municipality of Campos Novos (Resolution N°. 463), was obtained on November 29, 2000. The decree for the construction site on the left margin of the river, in the Municipality of Celso Ramos, (Resolution N°. 435) on August 20, 2002, and the decree for the reservoir area – up to 660 masl plus a 100m conservation area (Resolution N°. 533), was obtained on October 15, 2002.
- 3.29 Upon obtaining the LAI and signing of the concession contract, Enercan disclosed the approved PBA at the four Municipalities and organized several meetings and seminars to inform the affected population about the Project. In June 2000, approximately 1,200 people attended a public hearing held by Enercan in the City of Campos Novos to discuss the PBA programs. During the ensuing months, similar hearings were held in the other three affected municipalities (See Section 7).
- 3.30 In 2000 an aerial survey of the affected area was conducted, which was used to validate the 1998 census and to conduct the physical demarcation of the 660masl contour. The validation of the 1998 census was carried out through surveys on each of the affected properties and confirmation of legal boundaries and ownership using municipal land records. The validation of the 1998 census was completed in September 2001. The surveys identified 354 properties in the area to be flooded by the reservoir; 25 additional properties compared to the 1998 census. The difference between the number of properties results from 25 subdivisions that have occurred since 1998 as a way to take advantage of the resettlement options. Since the 1998 census, the number of affected non-owners has increased from 200 to 466, as a result of adults that were not living in the area at the time of the census as well as outsiders making claims to resettlement benefits (See Section 6).
- 3.31 In March 2001, Enercan assumed responsibility for the negotiation process and conducted several meetings with the affected communities. The first documented meeting addressing the resettlement of the affected population was held on October 18, 2001, involving representatives from each affected municipality, Enercan, and the Project construction company. Community representatives were chosen directly by the affected people in each municipality and constituted the Negotiation Council. The Negotiation Council comprises 6 members and 6 alternatives from each of the four Municipal Commissions of affected people. The Municipal Commissions were elected by the directly affected population in each municipality and are mainly composed of landowners, where the only non-owners are sons of landowners. The Municipal Commissions are responsible for reviewing the case studies carried out to determine whether individuals have a right to resettlement benefits and the Negotiating Council has taken an active role in the surveys

of land prices in the project area. The Council is independent of the municipal administrations and represents a range of political positions.

- 3.32 As required by IPHAN Ruling 07/1988, the Project obtained authorization from IPHAN to conduct archaeological studies in areas that were previously identified as having archaeological potential.
- 3.33 In July 2001, FATMA issued the authorization (CPS/035/2001) for site preparation, which involves clearing of vegetation at the construction site and access roads.
- 3.34 As per the request of the IDB, the RIMA and the PBA, including the preliminary version of the Resettlement Plan, were made available in the four affected municipalities on January 11, 2002. A social communication program was agreed upon with the Municipal Councils and the Negotiating Council to ensure that all the affected families understood the criteria, procedures and options for compensation and resettlement. The Resettlement Plan satisfied the IDB Policy on Involuntary Resettlement (OP-710) for a Preliminary Resettlement Plan. Please refer to Section 6 for a summary on the resettlement and compensation initiatives and to Annex 1 for a summary of the Resettlement Plan. Section 7 elaborates on the public consultation and information disclosure activities.
- 3.35 On August 29, 2002, IBAMA issued the permit for the Project program for the rescue and relocation of animals that may be trapped during the filling of the reservoir.
- 3.36 In March and October 2003, the Brazilian organization Movement of Dam Affected People (*Movimento dos Atingidos por Barragens* [MAB]), a group that works to defend the rights of dam-affected populations invaded the construction site demanding compensation of the indirectly affected families living in the general Project area. After the first occupation of the construction site, Enercan agreed to use R\$ 600,000 of a proposed R\$ 1 million rural development fund to provide agricultural inputs for people living in the affected Municipalities. See Section 6 for details on the use of the R\$ 600,000. However, after the second occupation of the construction site, Enercan initiated a legal lawsuit against supporters of MAB for damages occurred on vehicles and office equipment. It should be noted that MAB has not disputed the accuracy of the socio-economic census as MAB has done in other hydroelectric projects. Rather than disputing the census, MAB has tried to discredit the Negotiating Council, the body representing the affected population within the four Municipalities Council and at some point demanded that people from the surrounding area (i.e. not directly affected area) be allowed to elect the representatives of the Negotiating Council. As a result the Negotiating Council is unwilling to coordinate with MAB.
- 3.37 Late in 2003, affected families that had opted for rural resettlement rejected MAB's proposal to implement the collective rural resettlement schemes. However, even though MAB does not have the sympathy of the direct and indirect affected families in the Project area, it is likely that due to the movement's political strategies, they will continue to organize protests and occupations of Enercan's offices and/or the construction site. Section 6 describes the various initiatives to mitigate the indirect impacts of the Project, in particular actions oriented to increase the productivity in the region.
- 3.38 In December 12, 2003 FATMA confirmed the acceptance of the area proposed by Enercan for the creation of the Conservation Unit. The Conservation Unit will be created in the *Espigao Branco* ranch and will have an extension of 1,067.8 ha (excluding the 100 m conservation area along the area to be flooded) and might be expanded to include an area to be defined of a contiguous ranch.

FATMA has to define the category of the Conservation Unit and issue a State Decree formalizing the creation of the unit.

- 3.39 In January 2004 Enercan submitted to FATMA a Simplified Environmental Report (*Relatório Ambiental Simplificado* [RAS]), presenting the characteristics of the 230 kV transmission line and the potential environmental impacts associated with the proposed line. On February 6, 2004, FATMA issued the LAP N°108/2004, which exempts Enercan from obtaining a LAI for the transmission line. The LAP is valid for 36 months.
- 3.40 On February 19, 2004 FATMA authorized the clearing of vegetation along with Enercan's proposal for a variable conservation area instead of the fixed 100 m conservation area along the perimeter of the reservoir required in the State's environmental regulation and assessed in the EIA. The variable conservation area accounts for 1,718.2 ha and considers the acquisition of 30 m along the edge of the reservoir, plus a further 70 m in areas with forest cover. The variable conservation area represents 80% of land when compared to a fixed 100 m conservation area. The variable conservation area affects less of the fertile *várzea* soils in the upper reaches of the reservoir, and consequently reduces the number of families that are affected. The concept of a variable conservation area is based on CONAMA Resolution 302/2002. The 30 m conservation area is consistent with the requirements for Itá and Machadinho, two hydroelectric projects in the region. In both cases, the width was determined by IBAMA through federal licensing, since the projects affected two States (Santa Catarina and Rio Grande do Sul).
- 3.41 The implementation of the mitigation measures and monitoring programs are detailed in several documents or plans, the most relevant being the Construction Environmental Management Plan (EMP) prepared by Camargo Corrêa (the EPC contractor) and the PBA prepared by Enercan based on the review of the EIA requirement for the construction license. The PBA includes the more spatially broad and long-term mitigation measures and sixteen specific monitoring programs.
- 3.42 The IDB has conducted three due diligence missions (August 2002, September 2003, February 2004). As part of each due diligence, the IDB and its consultants have been providing recommendations to Enercan in order to enhance the environmental and social aspects of the Project.

IV. ENVIRONMENTAL AND SOCIAL CONDITIONS

- 4.1 The Campos Novos hydroelectric Project is located in the south-central portion of the State of Santa Catarina. The Project is situated on the Canoas River, where the dam is being constructed in a very steep canyon between the Municipalities of Campos Novos and Celso Ramos. When filled, the reservoir will flood portions of Campos Novos and Celso Ramos and two other municipalities; Anita Garibaldi and Abdon Batista. The general land surrounding the Project has been altered by anthropogenic activities, especially those associated with farming and ranching. The EIA completed for Eletrosul by Magna in 1990 defines the Project Directly Affected Area as those areas affected by the flooding, the quarries, access road, construction and lodging facilities and all other construction areas that are not included in the locations to be flooded. The term "directly affected" is also used to refer to the people (owners and non-owners) and properties affected by the reservoir, construction site, and loss of access and/or which no longer remain socially or economically viable. The viability of a property is based on Enercan's guidelines and involves calculations that take into account the area of the property and labor force. The

minimum viable area for each family of up to three adults is equivalent to 17 ha, of which at least 10 have to be suitable for agriculture. Properties of less than 17 ha (i.e. properties that would not be classified as viable even before being affected) are regarded as fully affected if the reservoir or conservation zone affects any part of the cultivated area. If the cultivated area is not affected the properties are regarded as partially affected. If the owner uses the remaining area for non-farming activities that provide a viable income, such as barns for chicken or pig production, the remaining area would be regarded as economically viable. The Indirectly Affected Area comprises the total area of the four affected municipalities that will have portions of their territories flooded by the reservoir. The Indirectly Affected Area also includes portion of the river basin between the Garibaldi Hydroelectric Power Project (upstream of the Project) and the confluence of the Canoas and Pelotas Rivers (downstream of the Project). The Project Affected Area is the sum of both the directly and the indirectly affected areas. The following section presents information from the various monitoring programs underway and included in the PBA, as well as some references to information on the 1990 EIA.

A. Environmental

- 4.2 Hydrology. The Canoas River is a mountain river, which extends 514 km from its origin in the Serra Geral at an altitude of 1,800 m to its confluence with the Pelotas River at an altitude of 430m. The area of the watershed is 14,690 km², with an average long-term mean flow of 298.5 m³/s and a perimeter of 645 km (see Figure 4.1). Approximately 6,415 km of perennial rivers drain to watershed. The average declivity is 44.9m/km and the drainage density is 0.45. The area presents steep canyons and areas with few vegetation, which contributes to elevated runoffs during rainy episodes. The watershed presents an elongated form (east-westerly) and prevents the concentration of these runoffs. . The minimum monthly mean flow reported since January 1931 is 22.9 m³/s, while the maximum monthly mean flow was 3,243 m³/s occurring in July 1983. The Canoas River originates in the Municipality of Urubici and crosses 12 municipalities before merging with the Pelotas River to form the Uruguai River. There are no dams directly upstream to the Project; the closest dam is the Peri hydroelectric power plant located 142 km upstream of the Campos Novos dam. The Machadinho hydropower project is located 24 km downstream of the Project dam in the Pelotas River. The Machadinho reservoir extends to the location of the Campos Novos Project dam. The Ita Project is located further downstream to the Machadinho dam in the Uruguai River. Both the Canoas and the Pelotas are tributaries to the Uruguai River (See Figure 2.2).
- 4.3 Hydrogeology. The local hydrodynamic conditions are characterized by the structure of the Serra Geral Formation (Formação Serra Geral) and by the unconfined aquifer that follows the topographic surface and fills interstitial spaces of the upper portion of the soil profile, which receives recharge waters. The estimated values of permeability on the contacts and horizontal discontinuities range from 10⁻³ to 10⁻⁵ m/s, while the vertical discontinuities present lower permeability values of 10⁻⁸ m/s. Many groundwater springs were found on the slopes around the area chosen for the reservoir. The presence of the springs is particularly predominant along the contact zones of different basalt formations.
- 4.4 Water Quality. More comprehensive water quality baseline information has been collected as part of the monitoring activities included in the PBA. The surface water monitoring program started in June 2000 with the monthly collection and analysis of water samples taken at 10 stations, all of them upstream of the the dam; 6 located in the Canoas River and 4 of its tributaries (confluence of Inferno Grande River and Ibicuí River, Marombas River, and Caveiras River) (See Figure 4.1). During the first year, samples were collected and analyzed monthly. From then on, samples have been monitored on a quarterly basis. . Average water temperatures range from 17 to 20°C but can

reach 6°C at night during the winter. Dissolved oxygen levels are high (above 90 percent saturation), with an average of 9.0 milligrams per liter (mg/l) most likely due to the high water turbulence (aeration) and low temperatures. The presence of low levels of Biologic Oxygen Demand and high levels of Chemical Oxygen Demand at the upper reaches of the Canoas River indicate industrial water contamination. This could be the result of polluting loads from industries such as cellulose producers that are known to be active in the area around Lages, more than 80 km upstream the Project reservoir. Fecal coliform levels are normally high, with maximum values above 1,000 MPN/100 ml probably due to the elevated contribution of non-treated sewage from the City of Lages, but also, in a lesser extent, due to the contributions of sewage from Anita Garibaldi, Abdon Batista, and Marombas.

- 4.5 High levels of phenol ranging from 0.05 to 0.35 mg/l were detected in all of the 10 sampling locations. Ammonia concentrations are also high, with concentrations from 1.2 to 1.6 mg/l. The high phenol and ammonia concentrations may be due to the use of fertilizers and pesticides required for the harvesting of pine, garlic and onion crops, as suggested by the group that conducts the monitoring program for Enercan. Total phosphorus concentrations were also high, with average values ranging from 2.0 to 6.0 mg/l. The average values of Ortho-PO₄ vary from 0.1 to 1.4 mg/l. This is indicative of nutrient enrichment that likely results from sewage discharge and agricultural runoff into the river. By contrast, calcium and magnesium concentrations are extremely low, with maximum levels of 2 and 1 mg/l, respectively. Low specific conductivity (76 uS/cm) suggests the presence of small quantities of dissolved ionic materials. The pH is usually above 6.0, which is a normal value for river water. Total dissolved solids vary from 30 to 300 mg/l, with an average value of 100 mg/l. The high values of turbidity, with concentrations ranging from 25 to 40 nephelometric turbidity units (NTU), and maximum concentrations reaching 100 NTU, may be indicative of the erosion caused by agricultural activities in surface soil. This may accelerate sedimentation of reservoirs.
- 4.6 Geology and Geomorphology. The four affected municipalities are located on the Southern Plateau of Santa Catarina, a region of undulating basalt hills, situated at between 700-1000masl. The Canoas River, in the area of the construction of the dam, runs through a narrow valley that forms a canyon hundreds of meters deep. The directly affected area is characterized by unique topography consisting of deeply-carved valleys with steep slopes that result from the local geological structures. The area of the reservoir is located within the Paraná Intra-Cratonic Basin (*Bacia Intracratônica do Paraná*), which is characterized by volcanic rocks, primarily basalt, of the Mesozoic Serra Geral Formation. The wide range of basaltic formations in the study area, along with alignment of linear structures, favor the formation of linear surface drainage systems. Two distinct morphologies affect the topography in the regional geology; downstream from the central point of the reservoir, near the dam, the surface topography is characterized by deep and steep valleys that form canyons while shallower and more open valleys are found upstream of the dam.
- 4.7 Seismicity. Historically, the Project area of influence has not been susceptible to natural seismic events. The resistance of the rocks to fractures is far higher than the estimated Project hydraulic pressure of 20 kgs/m², but there is a potential for water to penetrate the rock along fracture zones and may induce minor seismic episodes.
- 4.8 Soil and Subsurface Lithology. In the area of the Project, the thickness of the soil cap is relatively thin due to the presence of steep slopes along the canyon walls where bedrock outcrops are abundant. Given the accentuated topography where steep slopes predominate (70 percent of the area to be affected by the implementation of the Project contains slopes with angles between than 30 to 45 degrees), the predominant soil types in the area are cambissols, which are soils that are

shallow and of poor quality and therefore limited for agricultural use. Because of the steep slopes, the area is highly susceptible to erosion and landslides. The eastern and western margins of the Canoas River canyon present dystrophic soils, which are generally acidic soils not suitable for crops. As such, the majority of the land to be affected by the flooding of the reservoir near the dam is unsuitable for agriculture. More agriculturally suitable soils are present in the lower reaches of the valley at the flat alluvial areas located approximately 25 km upstream of the dam.

- 4.9 Flora. The flora of this area is typical of this region in Brazil. The vegetation in the area directly affected by the Project includes reminiscences of the two predominant types of native vegetation: mixed ombrophilous forest (forests tolerant to a large amount of rainfall) and the seasonal deciduous forest. The mixed ombrophilous forest is located along the margins of the Canoas River above elevations of 500 to 600 masl and is nearly extinct in the general area of the Project. The main characteristic of this type of forest is the presence of Brazilian Pine (*Araucaria angustifolia*). The few remaining stands are strongly altered by the exploitation of the *Araucaria* for timber. The seasonal deciduous forest is found at elevations below 500 masl and is characterized by the presence of species such as the angico-vermelho (*Parapitadenia rigida*), açoita-cavalo (*Luehea divaricata*), maria-preta (*Diatenopterix sorbifolia*), and the tarumã (*Vitex megapota*). This forest is restricted to a few narrow areas on the steeper canyon walls along the Canoas River, beginning downstream from the Machadinho Dam and moving upstream past the mouth of the Ibicuí River. The land of the upper reaches of the canyon has been deforested to allow for agricultural use. The 1990 EIA lists three species of macrophytes: *Eichhornia azurea*, *Heteranthera keniformis*, and *Pontederia lanceolata*. These are fast reproducers, which represent a potential concern for the future reservoir.
- 4.10 Conservation Unit. Enercan has acquired an area of 1,067,86 ha for the creation of the Conservation Unit. The area for the Conservation Unit is located in the Municipality of Campos Novos, along the right margin of the Canoas River. The 1,067,86 ha site presents the largest continuous area with secondary vegetative cover and the presence of preserved endemic vegetation. The Conservation Unit is being created at a property known as “Fazenda Espigão Branco”. In the 1960s native vegetation was removed from areas surrounding the Conservation Unit by a sawmill operation. In fact, the area is currently named “Fita Amarela” after the sawmill located near the land proposed for the Conservation Unit. However, the area of the Conservation Unit presents a good level of conservation with dense secondary vegetation that will allow for the preservation of species that require more complex biological process. In the southern edge of the land proposed for the Conservation Unit, there is a grove of large *Araucária* trees. Studies are currently underway by FATMA to characterize this important *Araucária* grove better and evaluate its inclusion to the Conservation Unit.
- 4.11 Terrestrial Fauna. The original fauna of the area has been significantly altered by human interference due to the historic exploitation of natural resources in the area. Due to the limited availability of natural native vegetated habitats, the overall terrestrial fauna is confined to the steeper slopes of the Canoas River valley where the secondary and partially native vegetation thrives. The EIA provided non-quantitative information from a survey, which listed 48 species of mammals, 178 species of birds, 29 species of reptiles, and 20 amphibian species. Wildlife field studies to be conducted prior to the filling of the reservoir will complement the information contained in the 1990 EIA.
- 4.12 Aquatic Fauna. A total of 53 species of fish were identified in the EIA. The most abundant species encountered at that time were *Hypostomus* sp. (catfish cascudo), *Astyanax* sp. “B”(lambari), *Steindachnerina brevipinna* (traíra), and *Steindachnerina stigmosa*. According to information from the 1990 EIA, eight of the sampled species were thought to be endemic to the

upper Uruguay River. These species included *Hypostomus luteus* (cascudo), *Diapoma aff. speculiferum* (lambari), two species of *Crenicichla* (joaninhas), *Hopliius aff. lacerdae* sp. (trairão), and *Steindachnerina* sp. (biru). The information reported in the EIA is consistent with the ichthyofauna monitoring program initiated in June 2002. As of January 2004, six surveys confirm that the ichthyofauna is characterized by species found in the upper Uruguay River.

- 4.13 Commercial fishing is not feasible in the area, since average catches are considered too low for commercial purposes. The area has undergone strong anthropogenic changes in the last 20 years. The pollution generated by the industries (mainly cellulose and paper) and livestock (especially swine breeding) along the regional basin has played an important role in the presence and abundance of aquatic species.
- 4.14 Threatened and Endangered Species. Endangered species have been only recorded in the indirectly affected area. Endangered flora species include the Brazilian pine (*Araucaria angustifolia*), imbuia (*Ocotea porosa*) and xaxim (*Dicksonia sellowiana*). Endangered fauna species include the owl (*Alouata guariba*), wolf-guará (*Chrysocyon brachyurus*); lontra (*Lutra longicaudis*); irara (Eira Barbara), cotiara (*Bothrops cotiara*), deers (*Mazama spp*) and wild cats (*Puma concolor* e *Leopardo spp*).
- 4.15 Climate. The overall Project area is located in the South Subtropical Zone of Brazil and is characterized as humid tempered or humid subtropical. Cool summers (22.3 to 25.8°C) and extremely mild winters (10.8 to 12.9°C) typify the region. Normal annual precipitation ranges from 1,460 to 1,820 mm, with rain occurring 129 to 144 days per year on average. Relative humidity varies from 76.3 to 77.7 percent. Wind is predominately from the northeast with an average wind velocity of 3 meters per second (m/s). There are indications that El Niño events have become more frequent in recent years. The Project is located in a region that can be unusually wet during El Niño events.
- 4.16 Cultural Resources. The cultural resource survey prepared as part of the 1990 EIA suggested the presence of archeological sites. More detailed archaeological investigations have identified 214 archaeological sites at and near the area being affected directly by the Project. Six sites were located within the area near or at the construction site and were given priority for description and rescue. Figure 4.2 illustrates the general distribution of the archaeological sites at or near the construction area. The more relevant archeological findings include bonfires, ceramic and stone artifacts, and a secondary burial site. The sites have been classified into five types: stone-ceramic (78 sites), stone (71 sites), ceramic (17), subsurface structures (45 sites and 145 units), and circular elevated structures (3 sites). The sites have been signed to restrict activities while excavations retrieve the artifacts. The sites that have been studied and rescued have yielded valuable findings that will add to the overall knowledge of ancient history of southern Brazil.
- 4.17 Noise and Air Quality. Noise levels and ambient air quality before the start of the construction of the Project were typical of sparsely inhabited rural areas. Noise levels have increased and ambient air quality is being impacted as a result of construction related activities but both impacts are confined to a small area.

B. Socio-economic

- 4.18 The four Municipalities of Campos Novos, Abdon Batista, Celso Ramos and Anita Garibaldi affected by the Project are located in the State of Santa Catarina, one of the most economically developed states in Brazil. The State's economy is evenly distributed among the industrial, mining, and agricultural sectors. In the vicinity of the Project, agriculture activities (crops and

livestock) are the primary economic driver in the region. Farmers range from small property owners who live from the land to a few large land owners (properties >100 ha) with more lucrative businesses and modern practices (heavy farming equipment as opposed to manual labor), located principally in the Municipality of Campos Novos. The Municipality of Campos Novos reports a higher proportion of farmland (Campos Novos prides itself as the cereal growing center of Santa Catarina), while there is a higher proportion of pasture and unused land in the other municipalities.

- 4.19 Land Use. The area to be affected by the flooding of the reservoir is over 26 km² (2,592 ha excluding the 873 ha of the existing riverbed) and 1,753 ha for the variable conservation area. The 1990 RIMA refers that of a total of the 2,592 ha to be flooded, only 80 ha (3 percent) were planted with annual crops, while 510 ha (21 percent) were pasture. This comprised 385 ha of natural pasture and 125 ha of improved pasture. The rest of the area was either forest 1,235 ha (50 percent) or forestall areas of more recent re-growth (*capoeira*) 650 ha (26 percent).
- 4.20 Demography. The Municipality of Campos Novos is the oldest, the larger and the most developed of the four municipalities directly affected by the Project. The 2000 Census reports a population in the municipality of Campos Novos of 28,707 inhabitants, followed by Anita Garibaldi with 10,232, while Abdon Batista and Celso Ramos report 2,776 and 2,843 inhabitants, respectively. Over half the total population of the area lives in the town of Campos Novos; the rest of the towns are small and much of the population lives in rural areas. Collectively, the population of this region has decreased significantly due to migration from these rural districts to nearby cities outside the four Municipalities, reflecting the continued search among rural communities for better living conditions in urban centers. There are no indigenous reserves or groups within the area to be impacted by the implementation of the Project. The population in Campos Novos is mostly descendents from immigrants of diverse nationalities – Poles, Russians, Syrians, Lebanese, Greeks and French, as well as people from other areas of Brazil, particularly Rio Grande do Sul, which moved into the region in the first decades of the 20th century. Until 1919 the area of Abdon Batista was mainly inhabited by mixed race *caboclo* families who lived from hunting and subsistence agriculture. From 1919 onwards, colonists of Italian and later German origin, moved into the area from Rio Grande do Sul. Celso Ramos was colonized during the 1930s by immigrants from the south of Santa Catarina. Table 4.1 summarizes area and population of the affected Municipalities.
- 4.21 Land Tenure. The large majority of farmers are the owners or legal occupants of their holdings in the four municipalities. Only eight percent are tenants, paying rent, and five percent are sharecroppers (Table 4.2). Most tenant farmers are found in Campos Novos. Sharecropping appears to be an option for landless small farmers, who are often the sons of smallholders. Celso Ramos reports the highest concentration of sharecroppers– 25% of farmers, which may reflect the lack of economic opportunities or the shortage of affordable agricultural land in the municipality. Landholding is characterized by small properties (i.e. <10 ha) in the four municipalities. Just over half the properties are in the 10-100 ha range and there are few medium or large properties. The size of the holding by itself gives little indication of its productivity as some small holdings are situated in areas of alluvial *várzea* soils, and are potentially very productive, while many of the larger holdings in steep areas have little agricultural potential and are used for pasture. In recent years the prices of corn and soy – the principal commercial crops, have doubled and there is evidence that medium and large-scale farmers are buying up land, particularly in Campos Novos, where there is more land suitable for mechanized agriculture. The increasing concentration of landholding is another factor that explains the depopulation of the rural areas.

- 4.22 Mining resources. The area of the Project presents a limited mining potential for the supply of construction materials (sand, gravel, and rocks). The mining areas of economic interest are limited to rock quarries and non-homogeneous sands in a few small and illegally exploited deposits in the Canoas River bed. According to the National Department of Mineral Production (*Departamento Nacional de Produção Mineral*), there are no claimed areas for mining within the area to be flooded. However, there is a private miner exploiting sand and gravel in the Canoas River alluvial deposits, in the Municipality of Anita Garibaldi. This individual has no authorization from the National Department of Mineral Production to exploit any materials from the Canoas River.
- 4.23 Rural Workforce. Most holdings in the four municipalities are worked exclusively with family labor (i.e. the owner, occupant, tenant or shareholder and his or her immediate family). Overall, only 5 percent of the workforce is not part of the family working the land. Most employees are found in Campos Novos, where they constitute 16 percent of the workforce. It is only in the larger mechanized holdings and a few properties devoted to commercial forestry that permanently employees are non-family. In Celso Ramos and Anita Garibaldi, agricultural activities are of small-scale subsistence, where the land is worked by family members using simple, labor intensive methods of cultivation (See Table 4.3).
- 4.24 Economic Activities. In addition to the corn, soy and beans, in the four municipalities there are also small areas of tea (*yerba maté*), dry rice, peaches, garlic and sugar cane. Cattle, and to a lesser extent pigs, are part of a smallholder economy that combines subsistence farming, small areas of cash crops, and livestock. There are various farmers in Anita Garibaldi and Abdon Batista also have ponds for small-scale fish farming and bees. Campos Novos is the only municipality within the Project area that has experienced a limited industrial development. The Municipality of Campos Novos also has other types of industry such as lumber, civil construction, paper, and metal. Campos Novos is the most developed among the four municipalities to be affected by the Project, with a per capita income of R\$382 per month, or approximately R\$4,580 per year. The gross domestic product (GDP) for the municipality was R\$137,182,161 in 2000.
- 4.25 Education. The local school system is composed of rural and urban schools, with public elementary and secondary schools. There is only one university in the area of the Project, a private institution located in Campos Novos. Campos Novos has 52 isolated schools in the rural area and eight other schools in the city. Anita Garibaldi has 17 elementary schools and 42 elementary and middle schools, one of which is a state school. There is also one school for disabled children in Anita Garibaldi. In the Municipality of Celso Ramos, there are 17 elementary schools and one elementary and middle school. Abdon Batista has 21 elementary schools and one elementary and middle state school.
- 4.26 Health Infrastructure. The public health infrastructure is deficient in all four municipalities. In Campos Novos, there are only two hospitals and six public health clinics, which, combined, offer 135 beds for the more than 34,000 inhabitants. In Anita Garibaldi, there is only one public hospital, and patients frequently have to travel 110 km to Lajes for better medical services. Both Celso Ramos and Abdon Batista have no public hospitals, although each municipality has a health clinic where a doctor is available once a week. Celso Ramos has been given a medical clinic as part of the Project social compensation program.
- 4.27 Water supply and Electricity. More than 80 percent of the territories of the four municipalities have water supply and electricity. Access to drinking water and electricity is correlated with

urbanization, although increasingly houses in the more accessible rural areas are being provided with water and electricity.

- 4.28 Roads. The transportation network includes national railroads; interstate, state and municipal roads; and waterways. There are no airports in the immediate area of the Project. Two barges transport people across the Canoas River between Bom Jesus Menegasso in Abdon Batista and Santa Ana in Anita Garibaldi, but neither is used for transporting agricultural goods.
- 4.29 Affected Population. The Project directly affects 378 properties (27 properties at the construction site and 354 properties in the reservoir area). Of the 354 properties affected by the reservoir, only 15 are completely affected by the reservoir and conservation zone. Of the other 339 properties, 84 have remaining areas classified as no longer viable, giving a total of 99 properties (15 + 84) to be fully acquired. The other 255 affected properties are classified as having viable remaining areas; which areas within the property are to be acquired by Enercan. In regards to non-owners, since the 1998 census, the number of affected non-owners has increased from 200 to 466, as a result of adults that were not living in the area at the time of the census as well as outsiders making claims to resettlement benefits (See Section 6).
- 4.30 The standard of living of the directly affected population is generally low. Approximately 60 percent of the economically active population is involved in subsistence agriculture, while only 10 percent of the properties employ heavy agricultural equipment (given the association of type of soil and topography). In general, poultry, cattle, and pigs are raised for subsistence and are not bred commercially. In terms of education, 14.8 percent have not completed elementary school, and 6.3 percent are still under the age of seven and without pre-school education. The illiteracy rate is approximately 3.34 percent among the registered population. According to the 1998 census, approximately 40 percent of the population has lived in the area for more than 10 years.

V. ENVIRONMENTAL AND SOCIAL IMPACTS

A. Construction Impacts

- 5.1 The principal environmental and social impacts associated with the construction of the Campos Novos Project are those typically generated at similar large-scale hydroelectric projects. Localized short-term impacts such as earth movement, clearing of vegetation, generation of waste, emission of air pollutants from vehicles and machinery and noise are being generated as a result of the large-scale construction activities and are mostly contained within the construction site. There are no inhabitants living in the immediate vicinity of the construction site. On a broader scale, additional significant impacts such as the permanent loss of land and the resettlement of population will be experienced. These impacts will be experienced principally in the upper reaches of the reservoir as the 20 km of the lower reach are sited in a deep gorge where population is dispersed. In the upper reaches where the valley widens the reservoir will affect areas of farmland and grazing, as well as five small settlements: two in the Municipality of Anita Garibaldi and three in the Municipality of Abdon Batista (see Figure 2.2).
- 5.2 The Project EIA defines the Project Directly Affected Area as those areas affected by the flooding, the quarries, access road, construction and on-site lodging facilities and all other construction areas that are not included in the locations to be flooded. The term “directly affected” is also used to refer to the people (owners and non-owners) and properties affected by

the reservoir, construction site, and loss of access and/or which no longer remain socially or economically viable, this is everyone eligible for compensation or resettlement. The Indirectly Affected Area comprises the total area of the four affected municipalities that will have portions of their territories flooded by the reservoir. The Indirectly Affected Area also includes portion of the river basin between the Garibaldi Hydroelectric Power Project (upstream of the Project) and the confluence of the Canoas and Pelotas Rivers (downstream of the Project). The Project Affected Area is the sum of both the directly and the indirectly affected areas.

Environmental Impacts

Construction Site

- 5.3 The principal environmental impacts that are being generated at the construction site are a result of the extraction of materials from quarries and excavations, the civil construction activities associated with the built-out of the structure of the dam and access roads, the deviation of the river and the generation of industrial, construction and household waste. Following is a description of the principal and potential environmental impacts associated with the construction of the Campos Novos Project. A description of additional impacts is summarized in Table 5.1.
- 5.4 Soils. Soil erosion has occurred principally as a result of rock quarry and borrow area mining, access road opening and superficial soil removal required for construction infrastructure, offices, lodging facilities, assembling patios, etc. The quarrying of soil has resulted in the modification of the natural relief and in some erosion. Soils are exposed in some areas, which create the potential for triggering small-scale landslides or falling rocks.
- 5.5 Aquatic Fauna and Flora. During the construction of the Project, the natural flow of the river is being deviated through two tunnels. The deviation of the river has not lead to any increase or decrease in the river level. During the deviation, 5,600 kg of fish were rescued, while only approximately 30 kg died. The diversion will have minimal impacts on the water quality, since it is not very extensive and the water flows directly into the Machadinho reservoir.
- 5.6 Water quality. The sewage produced on site is discharged to the Canoas River after its treatment in the wastewater treatment plant. The wastewater treatment plant operates with an efficiency of 85% for biological oxygen demand removal in accordance with federal regulations. The approximately 10 tons per month of lubricants and waste oil, the high volumes of fuel used at the site and oil/water separators at the construction site (vehicle washing, maintenance and fuel storage areas) pose the potential for spills and discharge of untreated oily streams that could possibly impact groundwater quality at the Project construction site and on the Canoas River.
- 5.7 Waste. Construction activities are generating a wide range of waste, including construction and household solid waste. Approximately 10 tons per month of lubricants and waste oil as a result of the in-house maintenance activities, sludge from grease collectors from maintenance areas, fuel storage facilities and vehicles cleaning areas, generation of used solvents and paint residues, metal scraps and containers impregnated with oil are generated on-site and sent for its reuse and/or final disposal through authorized companies. Household solid waste, such as general office and domestic refuse, cafeteria waste and sludge from the wastewater treatment plant are also produced at the site. The water treatment plant and the waste water treatment plant generate 75 kg per month of sludge. With the exception of the sludge from the water treatment plant, waste is adequately stored and disposed of, but still poses a potential source of contamination to soil and groundwater in the event of a spill, leak or improper storage or disposal.

- 5.8 Air Quality. There are defined sources within the construction site generating fine particulate material: the concrete aggregate crushing plant and stockpile area, excavations, quarrying of material and the concrete plant. In addition, within all the construction area, site grading, stockpiling and the circulation of vehicles on unpaved roads generate dust and particulate matter. Blasting activities also contribute to the generation of fine particulate matter, although blasting is not conducted on a continuous basis. Occasionally, strong winds will disperse dust and other particulates. Combustion processes, principally vehicles, machinery, heavy equipment and emergency generators, are generating other air pollutants, principally carbon monoxide, sulfur dioxide and particulate matter less than 10 microns. The short-term ambient air quality impacts are contained to the construction areas. There are no receptors living in the immediate vicinity of the Project.
- 5.9 The 11 km transmission line will cross approximately 1.8 km of privately-owned land used for agriculture before joining the ROW of the Barra Grande transmission line. No areas of native or secondary vegetation are reported in the proposed trajectory.

Filling of the Reservoir

- 5.10 Loss of Land, Flora and Fauna. The filling of the reservoir will result in the loss of over 26 km² of land (2,592 ha excluding the 873 ha of the existing riverbed) and 1.7 km² for the variable conservation area. This area is composed by *capoeira* and forest in more than 75% and will experience the loss of vegetation cover that will be eradicated by clearing and/or by the filling of the reservoir. Clearing of the reservoir will be conducted gradually during the second semester of 2004. The forest cover to be cleared and/or filled presents highly segmented areas. This loss of land will diminish available habitat for the fauna. The clearing of the vegetation could, in turn impact upon the fauna living in the cleared area – loss of habitat as well as stranding during the clearing process itself. However, if the clearing of vegetation along the river banks is conducted systematically from lower to higher elevations, animals in the area will voluntarily move in that direction and should not be stranded. The anticipated impacts on the local wildlife that currently survive in the area will be of minor significance. However, the potential exists that the animal density in the upper forest strips may become too high and exceed the forest's carrying capacity. Populations forced to move to the remaining forest will inevitably become scarcer, since there is no alternative area for them to occupy. In view of the geometry and topography of the area, as well as the location of the remaining forests along extremely deep valley walls, incidents of animal drowning/rescue are not anticipated. This conclusion is supported by data from the construction phase of the Machadinho Power Project, where only three mammals required rescue during filling of the Machadinho reservoir.
- 5.11 Surface Water. Impacts to surface water could result from the reservoir filling operations and during operation due to the changes in river dynamics caused by the presence and operation of the reservoir and the power generation activities. Potential impacts to the river water quality during the filling of the reservoir include changes in water quality (i.e. an increase in biological oxygen demand concentrations and a decrease in dissolved oxygen levels in the reservoir) and a decrease or temporary suppression of the flow rate downstream of the dam. Given that the reservoir will be relatively deep and that there is no intake withdrawal from the lower 145 m of reservoir deep at the dam, stratification is anticipated within the water column. In addition, a decrease in the levels of oxygen will occur as a result of the decay of organic material. During this period, death of fish and other aquatic organisms could potentially occur due to the change in the physico-chemical characteristics of the original ecosystem. In addition, a change in the ichthyofauna can be expected in the area of the reservoir. Fish that thrive in the river system will be replaced by those that prefer the lake-like conditions of the reservoir.

- 5.12 The mathematical model CE-QUAL-W2 was used to assess expected changes in water quality resulting from different scenarios for filling of the reservoir and different levels of clearing of vegetation at the areas to be flooded. The CE-QUAL-W2 is a two-dimensional model (longitudinal and vertical) developed by the US Army Corps of Engineers and is widely used in hydropower projects. Based on geographic, hydrologic, meteorological and water quality data, the model can simulate temperature, salinity and up to 19 additional water quality variables. Given its extension and depth, the Campos Novos reservoir was divided into 26 horizontal 2 km cells and 37 vertical 5 m cells. Overall, the effect on water quality during filling of the reservoir is proportional to the amount of biomass and the organic matter fixed in the vegetation. The mass of organic carbon was estimated based on the amount and type of vegetation reported in the vegetation survey conducted in 2003. Filling of the reservoir is scheduled to start on September 30, 2005, at the outset of the dry season, when the estimated flow on the Canoas River would be on average 300 m³/s during the approximately 3.5-month period² required to create the reservoir. This scenario was modeled assuming an average temperature in the water of 20°C, which would promote degradation of organic matter. The results of the model suggest that adequate variations in the biological oxygen demand concentrations would be achieved removing 40% of the vegetation. The target vegetation would be trees and bushes with dense coverage, as this type of vegetation is responsible for greater variations in the biological oxygen demand.
- 5.13 Ichthyofauna. Impacts on the ichthyofauna could be experienced as a result of the reduction of flow downstream of the dam. Upon filling of the reservoir, the flow of the river will be suppressed for approximately two days, during which the level of water at the dam will reach a low-level outlet located at the foundation of the dam. The low-level outlet will provide flow upon the water level reaching an elevation of 525 masl at the dam (49 meters depth). The low-level outlet will provide an average flow of 18.3 m³/s, corresponding to 80 percent of the minimum monthly flow of 22.9 m³/s downstream of the dam, which is in compliance with Brazilian best practices. Based on the historical flow data for the Canoas River, the probability of providing flow before the first two days after suppressing flow downstream has been estimated in 61%. This probability increases to 92% after four days. The flow will increase proportionally up to 30 m³/s as the reservoir is being filled (the estimated time to fill the reservoir is approximately 40 days), at which time (elevation 640 masl) the water will flow through the spillway. Normal operating levels at the Machadinho reservoir dam will prevent the creation of dry stretches below the Project dam. Section 6 presents the analysis of worst-case scenarios of flow during the filling of the reservoir and proposed measures to mitigate impacts on the ichthyofauna.
- 5.14 Geology and Geomorphology. The creation of the reservoir and the flooding of surrounding areas will have a major impact on the local topography, primarily the flooding of the local canyons. The flooding of the reservoir will result in erosion and could trigger localized landslides.
- 5.15 Seismicity. Seismic activity during or after the creation of reservoirs is expected to be, at a worst-case scenario, similar as natural seismic events that could occur in the Project area. Since the area is not subject to natural seismic activities, it is anticipated that any seismic event associated with the filling of the Campos Novos reservoir would be of low-to-medium intensity and magnitude, spatially restricted and would last just a few seconds. The potential impact associated with these types of seismic events would result in no damages to the Project structures. Cracks in walls of poorly constructed buildings in the surrounding areas could be experienced but no significant damages would be expected. The seismic events normally occur only during the

² Based on the hydrological studies, there is a 90% probability that the filling of the reservoir can be achieved in 107 days and a 50% probability that the reservoir can be filled in 44 days.

filling of the reservoir and for one to three years following the filling of the reservoir. After this time, subsurface structures are expected to stabilize and become stable under the newly created conditions; i.e., the weight of the water column and other effects on the geology eventually reach an equilibrium soon after the creation of the reservoir.

- 5.16 Groundwater. Groundwater levels will rise around the area of the reservoir and the natural flow of groundwater will be modified. The significance and influence of the water saturation caused by the rising groundwater level will decrease upstream from the dam and perpendicular to the lake. As such, the impacts on the exploitation of groundwater and the occurrence of highly saturated soils are expected to be minor, as the settlements and agricultural areas are located in the far upstream reaches of the reservoir. In some areas, new springs may surface in the areas surrounding the reservoir.
- 5.17 Soil and Subsurface Lithology. The capillary fringe causes higher water saturation of previously dried soils and impacts those land uses that may not be compatible with the more highly saturated soils. Areas that are currently dry and adequate for harvesting will have more soil moisture or may even become very saturated near the surface after the reservoir is filled what may lead to a decrease in the overall availability of suitable agricultural land in the land located near the reservoir.
- 5.18 Cultural resources. The principal impacts on cultural resources during the construction phase are the permanent loss of the six archaeological sites located in the construction site and historic landmarks such as the churches and the cemeteries in the settlements of Rosário and Santa Ana that represent the heritage of the areas to be flooded.

Social impacts

- 5.19 The principal social impacts during construction are land acquisition for the construction site, reservoir, and conservation area, and the typical short-term impacts associated with large-scale construction projects, including the presence of a large, mainly male workforce, increased pressure on local services (health, education, police) and increased traffic. In addition, when the reservoir is flooded social infrastructure will be lost and some areas will be left without access.
- 5.20 Loss of Land. The directly affected area is estimated at 5,008 ha, comprising 663 ha for the construction site, 2,592 ha for the reservoir (excluding the 873 ha of the existing riverbed), and 1,753 ha for the variable conservation area. Over 75% of the directly affected area includes forest and *capoeira*, most of it in steep slopes, used mainly for forestry and in a minor degree for shifting cultivation or pasture. The rural area directly affected by the reservoir consists mainly of undeveloped land where secondary vegetation thrives among several large private properties dedicated to cattle raising and a number of small farms restricted chiefly to subsistence agriculture. The loss in agricultural production caused by the reservoir is not considered significant, impacting 1.35 percent of the total agricultural land in the four affected municipalities.
- 5.21 Land Acquisition. The Project will affect 378 properties; the reservoir and the variable conservation area will affect 354 properties while the construction site has already affected 24 properties. Of the 354 properties affected by the reservoir and conservation area, 15 are totally affected and 339 are partially affected (i.e. a given area of the property is affected by the filling of the reservoir). Of this latter group, 84 have been classified as having non-viable remaining areas, and will be fully acquired; the remaining 225 are deemed to have viable remaining areas, and compensation will be granted to the owners of the areas affected by the reservoir and

conservation area. Table 5.2 shows the distribution of the original 353 properties directly affected by the construction site, reservoir and the variable conservation area. Enercan is also acquiring the remaining areas of properties that no longer remain economically viable. In addition, some properties will lose access or will no longer remain viable if the rest of the population leaves the area; so far three indirectly affected properties have been identified, all situated on the right margin.

- 5.22 Affected Families. The information on the 1998 census identified 499 families that would be directly affected by land acquisition for the construction site, reservoir and conservation area. They included 308 property owners and 191 non-owners, including tenants, sharecroppers, and adult children or other relatives who were living and working on the affected properties. Table 5.3 shows how the identified families are distributed between the reservoir area and the construction site. It is important to note two points in relation to the non-owners. First, not all are automatically regarded as directly affected. If the remaining area of the affected property is left economically viable the non-owners are not entitled to resettlement benefits since they can continue cultivating on the same areas they cultivated before. Second, the definition of who should be considered an economically independent adult, for instance, adult sons or daughters of landowners, is determined from the date the property is acquired, and not from the date of the 1998 census.
- 5.23 Infrastructure. Infrastructure that will be lost by the reservoir and conservation area includes 33 km of roads, telephone and electricity lines, and drinking water wells. The churches, community centers, and cemeteries in the settlements of Rosário and Santa Ana (in Anita Garibaldi) and a church and community center in Barra do Arroio (Abdon Batista) will be relocated to higher areas. A school in Rosário has already been closed. The bridge across the Canoas River, on State Highway Santa Catarina-456 (SC-456), linking Abdon Batista and Anita Garibaldi, will also be affected during periods of flooding when the reservoir reaches its highest levels. Two manually operated cable ferries cross the Canoas River will have to be replaced with motor ferries, as the reservoir will be much wider than the present river crossing.
- 5.24 Viability of Settlements. One of the access roads to Santa Catarina (Abdon Batista) will be affected by the reservoir, and two other small settlements, Bom Jesus in Abdon Batista and Caçadorzinho in Anita Garibaldi, may lose a significant part of their population, leaving the families that remain without viable infrastructure. There may no longer be enough pupils to justify the existence of the schools or sufficient people to keep the churches open, which could result in people having to cover longer distances to reach the schools and the churches.
- 5.25 Impacts on basic services. An increase in crime in Campos Novos was registered between 2000 and 2001, which has been followed by a reverse trend. An increased in the disease rates pressure on the local health services. Epidemiological figures have increased, especially sexually transmitted diseases. The information on education shows a marked increase in the number of pupils in Campos Novos and Anita Garibaldi, and only a small increase in Abdon Batista and Celso Ramos. In Campos Novos most of the increase was absorbed by private schools, which increased their enrollment by 751 pupils (57 percent) from 2001-2003. In Anita Garibaldi the number of pupils increased by 887 (34 percent) from 2000-2002; most of the pupils were absorbed by the municipal school system. This increase is more likely due to Barra Grande hydroelectric power project, which is located in Anita Garibaldi, rather than the Campos Novos project.
- 5.26 Traffic and blasting. Heavy traffic to the construction site does not pass through any towns in the Project area. Traffic coming from the North or South will use National Highways BR-116, BR-

282, and BR-477, and will then turn on to the specially constructed 18 km access road to the site. No public access roads cross the site and few people who are not associated with the Project live in the immediate vicinity.

- 5.27 Workforce. Most of the approximately 600 non-local workers are living on site, in lodging facilities provided by the EPC. Minor social impacts from the presence of non-local workers have been experienced in the towns surrounding the construction site. There are no communities in the immediate surroundings of the construction site and the non-local workers living at the on-site lodging facilities do not commute to Campos Novos (Campos Novos is the closest town located 28 km from the construction site). The specialized labor such as civil, mechanical, electrical and occupational health and safety engineers, doctors, nurses as well as welders and electricians come from other regions of Brazil. The majority of the non-specialized labor was recruited locally from cities and communities within the local municipalities, primarily from the cities of Campos Novos and Capinzal/Ouro. To date, the highest number of workers was approximately 2,300 in February 2003, with approximately 600 living within the construction site.
- 5.28 Aesthetics. During construction, removal of vegetation, diversion of the river, and the large-scale rock mining activities have scarred the landscape. The permanent visual impacts associated with the quarrying of materials will be reduced as the spillway and power-house will be located at the quarrying area. Other sections of the quarry and areas modified by the construction of roads will be covered by water once the reservoir is filled and the surrounding land is flooded. The flooding of the reservoir will permanently change the natural characteristics of the area, as the creation of the reservoir will result in a permanent aesthetic change.

Health and Safety and Project Risks

- 5.29 Health and Safety. Given the magnitude of the civil works and associated activities, the construction of the Project involves considerable health and safety risks. Permanent heavy traffic in very steep roads poses a risk of vehicles overturning. Past tunneling work has involved the use of explosives, excavators, lift trucks and dumpers. Blasting is required in the authorized quarry used to supply construction material. The construction of the powerhouse and hydraulic circuit requires the erection of very tall scaffolds, the operation of cranes and the continuous use of energized tools. However, overall, the safety record is better than similar Projects in Brazil. The Project reported an average frequency index of 1.17 for 2003, which supersedes the 5.31 index reported internationally for similar projects. The 2003 rainy season resulted in a slight increase in the number of accidents. One fatality has occurred to date, when a worker was hit by a rock that fell from a steep slope. No cases of dengue or malaria have been reported at the construction site, while three cases of dengue and two of malaria have been reported by the health service in the area of Campos Novos.
- 5.30 Risk of Construction flooding. Currently the risk of construction flooding is negligible given that the dam has reached the elevation of 570 m, which provides protection against floods of 500 years of recurrence. The Power House is being constructed quickly, protected by a rocky cofferdam. The spillway and intake structures are out of the influence of the risk of flooding.

B. Operation

Environmental Impacts

- 5.31 Hydrology and Water Quality. Some of the anticipated changes within the future reservoir include: thermal stratification, potential increased mineral salt content from interaction of groundwater with native rocks, increased sedimentation within the reservoir, reduction of oxygen concentrations in the water at lower depths along the water column, potential generation of gases due to the decomposition of organic matter, and eutrophication due to pollution loads in the watershed. The changes in the quality and thermal stratification of the reservoir water can also have a significant affect on the aquatic communities, especially on the diversity and density of the benthic communities and the assemblage of fish.
- 5.32 Geology and Geomorphology. During filling of the reservoir the surface water level rises and when it reaches less resistant rock formations the instability of the canyon walls increases, which creates a potential for increased erosion and landslides along the canyon walls. At the same time, the materials that constitute the slopes and the talus deposits will undergo progressive saturation. As a result of the impounding, the stability conditions of some materials may change. For example, when the rocks are submerged below water, their weight decreases to the submerged weight, but their loading above the water level remains unchanged. Concurrently, the cohesion of fine-grained soils may be appreciably reduced. This will generate a decrease in the shear resistance of the rocks due to the hydrostatic pressure on the submersed portion of the slopes, which may cause the marginal slopes to slip and lead to landslides or rock-falls along the reservoir slopes into the lake. In addition, once the Campos Novos Project is operational, the wave action may cause erosion of the reservoir margins at the surface water level, which could also lead to landslides and rock-falls.
- 5.33 Aquatic Fauna and Flora. The major expected impact is the change in the aquatic communities, with river species being replaced by those that prefer lake conditions. With the filling of the reservoir, the water quality will change from a moving and constant current regime to a nonmoving regime, which will cause changes to the assemblage of the ichthyofauna. The aquatic fauna and flora will reach an ecological equilibrium after the reservoir is completely filled and has been operational for several years. The magnitude of the impact of this change can only be evaluated through monitoring of the ecologic conditions of the future lake and the re-established communities.
- 5.34 Terrestrial Fauna and Flora. The operation of the reservoir is not expected to adversely impact the local terrestrial flora and fauna.
- 5.35 Climate and Air Quality. The potential increase in relative humidity associated with construction of the reservoir may cause minor impacts to the meso- and microclimate in areas around the Project. While higher relative humidity can diminish the effect of cold weather on crops, it can also lead to new diseases in crops in the areas affected by the microclimatic changes. The increase in relative humidity may also lead to an increase in the occurrence of fog in the area. Changes in the meso and microclimate may be more noticeable downgradient of the dam along the Canoas River Valley.
- 5.36 Solid Waste. Solid waste produced onsite during the operational phase of the Project will be that generated in conjunction with the plant operation, such as domestic and waste from maintenance activities, such as used oil, spent solvents, and other chemicals. There are no plans for onsite disposal of solid waste and therefore no significant impacts that could result from the inappropriate disposal of waste are expected. Domestic waste will be separated onsite and sold for recycling in order to minimize the quantities to be disposed of at local municipal landfills.

Social Impacts

- 5.37 Land Use. Operation of the Project will have a limited impact on land use in 1,718.2 ha surrounding the reservoir as a result of the implementation of the 30 to 100 m conservation area. A minimum of 30 m will be established as a conservation area between the reservoir and agricultural areas to help protect the water quality of the reservoir. This conservation area will be reforested with native species. The conservation area will be expanded to 100 m in areas with forestall cover. Within the properties crossed by the transmission line corridor, agricultural activities will have restrictions.
- 5.38 Socioeconomics. The principal socioeconomic impacts from the operation of the Project will be the loss of productive areas of farmland and grazing in the upper reaches of the reservoir where the valley broadens and inclination diminishes significantly. The impact on agricultural production from the loss of 80 ha that were harvested with annual crops in the 2,592 ha area to be affected by the reservoir is not considered significant, as this loss is approximately 1.35 percent of the total agricultural land in the four affected municipalities. Social impacts will be experienced with more significance on Rosário and Santa Ana in the Municipality of Anita Garibaldi and Barra do Arroio in the Municipality of Abdon Batista. Santa Ana may lose a significant part of their population, leaving the remaining families without enough pupils to justify the existence of the schools or sufficient people to keep the churches open. In the long term the Project could accentuate the economic decline of the rural areas in the affected municipalities.
- 5.39 Aesthetics. The landscape will be permanently altered through the introduction of the dam and the reservoir causing the flooding of the canyon. This impact is of moderate significance given that the present landscape is not used for tourism.

C. Indirect and Cumulative Impacts

- 5.40 The indirect impacts of the Project are more complex, since the Itá and Machadinho hydropower projects have recently been concluded in the region, the Barra Grande hydropower project is being constructed, and the Foz de Chapecó and the Garibaldi are in the design stage (see Figure 2.2). One of the affected municipalities, Anita Garibaldi, is affected by three hydropower projects: Campos Novos, Barra Grande and Machadinho, while Campos Novos and Celso Ramos have also been directly affected by Machadinho. The cumulative impact of these projects makes it difficult to determine each company's respective responsibilities for the wider socio-economic impacts on the region.
- 5.41 The population of the region has declined over the last decade, and this process is likely to continue unless there is a significant shift in the prospects for the smallholder farmers, tenants, and sharecroppers living in the region. In this respect, compensation and letters of credit allow the affected families, or the vendors in the case of letters of credit, the opportunity to liquidate their assets and abandon farming. This in turn may lead to the further decline of small rural settlements, loss of services and business, pressure on the remaining families and/or loss of employment in small towns, such as Abdon Batista and Celos Ramos. The direct loss of population is partly offset by the collective resettlement programs that have been carried out in the area. At least two collective resettlements from Machadinho and Itá are located in Campos Novos. An area in Anita Garibaldi has been acquired for the collective resettlement of families from Barra Grande and another area, in Campo Belo, was acquired for collective resettlement of families affected by Machadinho, but has not yet been occupied.

E. Positive Impacts

- 5.42 The most notable positive impact associated with the implementation of the Campos Novos Project is the improvement in the electric energy supply both regionally and throughout southern Brazil. Other positive impacts include the increase in municipal tax revenue, primarily ISS payment (tax on services) to the municipal governments of Campos Novos and Celso Ramos during the construction period; financial compensation (royalties) for the use of water resources to be shared by the four affected municipalities; value-added tax on electricity sales (*Imposto sobre circulação de mercadorias e services [ICMS]*) paid by Enercan to the four affected municipalities and to the State of Santa Catarina. The royalties the affected municipalities will be received from 2006 onwards, when the Project begins generating. This represents a significant increase in the revenues of the affected municipalities. These royalties could be used to finance agricultural development programs, improvements to the road network and other essential infrastructure. Table 5.4 shows the current average monthly budget of the municipalities and the proportion used to pay salaries; it demonstrates the importance of ISS payments and royalties for small municipalities like Celso Ramos.
- 5.43 At the local level, positive impacts include increased commercial and services activities in the four affected municipalities to meet the market demands of the construction of the Project and the workforce attracted to the area, employment opportunities during construction and operation phases, and new infrastructure such as 33 km of new access roads, one bridge, additional electrical energy network along the new roads. The urban center of Celso Ramos will benefit from a new access to the National Highway system across the dam. Enercan has contracted engineering designs for a 3 km access road linking the dam to the urban center of Celso Ramos. This will represent a significant improvement in access to the town, halving the distance to Campos Novos and the National Highway network.
- 5.44 Enercan and the Santa Catarina state agency for the development of small and medium enterprises (SEBRAE) have allocated R\$1.45 million (Enercan has committed R\$600,000 for the development of a study and the financing of proposed projects while SEBRAE will provide R\$842,350 in kind for technical assessment and training) to initiate an innovative program to aid small-businesses in the area. Potential goods produced in the area will be identified along with their local and regional marketability. Once products are identified, SEBRAE will assist the small producers in the market and distribution of their goods. If the program is successful, it will become sustainable and other products may be identified and producers will be helped to market and distribute their goods.

VI. ENVIRONMENTAL, SOCIAL AND HEALTH AND SAFETY MANAGEMENT

- 6.1 As per the Concession Agreement, Enercan is responsible for all environmental and social mitigation programs defined in the EIA and PBA, as well as the conditions established in the various environmental authorizations. Enercan is managing the environmental, social and health and safety aspects at three different levels: at the construction site, where the EPC contractor is responsible for implementing all control, mitigation and monitoring activities under direct supervision of Enercan; outside the construction site area where long-term mitigation and monitoring activities are being implemented directly by Enercan through academic institutions or specialized consulting firms; and the mitigation and compensation of social impacts, which are also being conducted by Enercan with the support of a specialized consulting firm. The implementation of the mitigation measures and monitoring programs are detailed in several

documents or plans, the most relevant being the Construction Environmental Management Plan (EMP) prepared by Camargo Corrêa, the EPC contractor and the PBA prepared by Enercan based on the review of the EIA requirement for the construction license. The PBA includes the more spatially broad and long-term mitigation measures and sixteen specific monitoring programs.

A. Environmental and Social Mitigation Measures

(a) Construction Phase

Environmental Mitigation Measures

Construction Site

- 6.2 The EPC contractor is mitigating the adverse short-term environmental impacts associated with construction activities through the implementation of good practice and Project specific procedures. The environmental procedures are consolidated in a comprehensive EMP (*Plano de Gestao Ambiental UT 453 UHE Campos Novos*). The content and structure of the EMP is consistent with industry practice and includes a detailed description of the mitigation measures and monitoring activities, training, auditing, necessary resources and reporting activities. The EMP includes the specific environmental provisions that are to be followed by subcontractors as well as the requirement to include the provisions in the contracts. It is also part of the EPC responsibility to restore the areas disturbed/degraded by the construction of the Project, 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 following sections summarize the most relevant construction related mitigation measures implemented by the EPC contractor. Other mitigation measures that are being implemented are described in Table 5.1 along with the corresponding construction related impacts.
- 6.3 Soils. The elevation of the spillway approach channel was lowered by 15 m to 620 masl so that approximately 1,000,000 m³ could be obtained from this source. The optimization of material from the quarry at the right margin and the use of material from the excavations of the deviation tunnels, spillway and powerhouse lead to canceling the use of the quarry that was authorized on the left margin of the river. In addition, soil impacts were reduced by siting and constructing patios, warehouses, offices, lodging facilities, areas for disposal of construction waste and roads considering the topographic characteristics of the site with the aim of reducing the excavation of soil and the need for leveling. A specific erosion control program has been implemented, which limits the clearing of vegetation, requires drainage systems in all the construction areas, dissipation lagoons at areas with considerable topographic relief, and other mitigation measures. In order to prevent erosion, landslides and the falling of rocks, concrete is injected in the walls throughout the canyon at construction areas and roads. The waste rocks generated by the blasting activities are stored in a designated area inside the campsite to prevent storing debris all over the construction site. This storage area will be flooded by the future reservoir.
- 6.4 Waste. *Lwart Lubrificantes Ltda* and *Industria Petroquimica do Sul Ltda*, companies authorized to collect, transport and treat oil for its reuse, collect the approximately 10 tons of lubricants and waste oil that are generated every month. Used solvents and paint residues, metal scraps and containers impregnated with oil are also collected for disposal at authorized landfills. Solid and hazardous waste storage areas are designed according to current Brazilian environmental regulations. Domestic waste such as paper, cardboard, aluminum cans, plastic bottles, and bags are separated at an onsite solid waste storage facility and sold for recycling in order to minimize the quantities to be disposed of at local municipal landfills. Organic waste is composted on-site.

- 6.5 Water Quality. The wastewater treatment plant treats all sewage produced on site prior to its discharge to the Canoas River. The wastewater treatment plant operates with an efficiency of 85% for biological oxygen demand. Collection sumps and oil/ water separators located at critical areas (vehicles washing and maintenance areas, maintenance patio, fuel farm, etc.) prevent untreated discharges from reaching the Canoas River and groundwater. Diesel, gasoline, and waste oil are stored in aboveground storage tanks that include secondary containment and impermeable floors. A basin at the concrete plant recovers concrete run-off from the washing of the trucks.
- 6.6 Air Quality. Dust from the sand and rock quarry areas is suppressed by spraying water near the conveyor belt and crushing areas. Other mitigation measures include the watering of roads, covering the cargo trucks to prevent the dispersion of the material while being transported, and adequate stockpiling to reduce dispersion of dust by wind.
- 6.7 Construction Workers. Camargo Corrêa makes a serious effort to ensure its workers do not have negative social or environmental impacts on local communities. The company has adopted a code of conduct, the “Environmental Ten Commandments”, which is presented to workers at induction and reiterated almost daily as part of their environmental and safety training. The code of conduct demands that workers respect neighboring communities, and prohibits them from carrying knives or firearms, or from carrying, consuming or storing any alcoholic drinks or drugs. Serious or repeated infractions of the code of conduct leads to automatic dismissal. Approximately 30% of the workers live in lodging facilities at the construction site, while local workers are mostly transported to the site by bus. Lodging facilities on-site include 18 type C facilities with 22 rooms each of approximately 16 m² which can accommodate up to four workers per room (a maximum of 88 workers per unit) and 6 type B units with 16 rooms each of 12.5 m², which accommodate two workers per room (a maximum of 32 workers per unit). All units include restrooms, showers with hot water and areas for washing clothes. There is telephone service and recreational facilities as basketball courts and a football field. On-site lodging facilities have been under use for most of the construction period, having capacity to house approximately 1,800 workers. The on-site lodging facilities were designed for an accelerated construction schedule, which was not implemented. Local workers are transported to the construction site by bus from towns within a radius of 50 km, mostly from the town of Campos Novos and as other small towns including Capinzal, Celso Ramos, Joaçaba, Piratuba, and Barracão.

Project Direct Area

- 6.8 The PBA describes the broader and long-term environmental and social mitigation and monitoring programs. The PBA includes a few activities associated with the construction site (i.e. rescue of fish during the deviation of the river and recuperation of the natural landscape at the construction area) and is more oriented on the overall Project Affected Area. The PBA also includes a Resettlement Plan (*Plano de Remanejamento da População Rural*) and a Social Infrastructure Program (*Programa de Recomposição Físico Territorial*). The actions included in the PBA consider a wider timeframe, with most of the activities covering both the construction and the operational phase. Table 6.1 identifies the timeframe of implementation of the different programs that encompass the PBA (i.e. construction and operation), summarizes the elements of the different programs, and the status of its timeframe scheduled for their implementation. Following is a more detailed description on the principal mitigation actions and programs included in the PBA.

- 6.9 Fauna and Flora. The principal actions in the PBA to mitigate adverse impacts on the flora and fauna are: (i) establishing a Conservation Unit, (ii) the Forestry Nursery Project, (iii) vegetation of the conservation area along the reservoir, and (iv) programs to conserve and use the native flora and fauna. In December 2003 FATMA authorized the creation of the Conservation Unit in a 1,067,86ha area at a property known as “Fazenda Espigão Branco”. The proposed location is one of the most preserved areas in the surroundings of the Project. FATMA is evaluating extending the eastern boundaries of the Conservation Unit to include a grove of large Araucária trees. The Conservation Unit must be implemented before the filling of the reservoir. From June 2002 to June 2003 the nursery produced approximately 210,000 trees. The native species produced at the nursery will be used to reforest the variable conservation area along the perimeter of the reservoir and other areas in the Municipalities, such as public parks and schools. A wildlife rescue and relocation program will be implemented during the filling of the reservoir. If endangered species of flora and/or fauna are identified in the directly affected area, they will be rescued and relocated to other areas, such as the conservation area.
- 6.10 Aquatic Fauna. The ichthyofauna monitoring and rescue program is already being implemented in portions of the Canoas River. Bi-monthly collection campaigns have been conducted during November and December 2003 and January and February 2004 and will be conducted in January and February 2005. The objective is to identify migratory species and the overall conditions of the ichthyofauna to better define strategies for future rescue activities. The most relevant rescue effort was conducted in October and November 2002 during the deviation of the river, when more than 5,000 kilos of live fish were successfully rescued and relocated both upstream or downstream of the Project site. Only approximately 30 kg of that fish was dead. The species collected during the rescue and relocation effort included: Lambaris (*Astynax*), Bagres (*Pimelodus*, *Rhamdia*), Cascudos (*Rhineloricaria*, *Loricaria*, *Rhinelpis*, *Plecostomos*), Espada (*Eigenmannia*), Voga (*Schizodon*), Traíra (*Hoplias*), Surubim (*Steindachneridion*), Piranha (*Serrasalmus*), Carpa (*Cyprinus carpio*), Saiganga (*Acestrashamphus*), Joaninha (*Crenicichla*), and Peixe Cadela (*nototamus*).
- 6.11 The impact on the ichthyofauna as a result of suppressing the flow downstream from the Campos Novos dam from two to four days during the start of the filling of the reservoir will be mitigated through operating the Machadinho reservoir at its maximum normal level of 480 masl. The area of the Machadinho reservoir extends to the point of discharge of the Campos Novos Project. Operating the Machadinho reservoir at its maximum normal operation level will elevate the height of the river downstream the Campos Novos dam by 4 m, which will prevent the formation of dry sections in the Canoas River when suppressing the flow. In the case that the Machadinho reservoir cannot be operated at its maximum normal level, a medium operating level of 473 masl could create some dry sections in the Canoas River. Fish would be rescued from the few expected stretches and translocated to the section of river with water. Under a worst-case scenario on which the Machadinho reservoir would operate at 465 masl (minimum operating level), sections of the Canoas river would be isolated in a 1,300 m section downstream of the dam. To mitigate this impact, the Project would use the eight pumps available at the construction site to pump 650 l/s from areas downstream with good water quality to the stretches of the river with loss of water flow. The pumping of fresh water will increase oxygen levels in isolated stretches of the river and will prevent fishes from dying. This measure, along with the rescue of fish would be conducted for a maximum of four days while the Project reservoir reaches the 525 masl level (49 meters depth) and provides the ecological flow. The specific provisions are included in the Plan for the Rescue of Ichthyofauna, May 2003 prepared by the University of Santa Catarina. To mitigate these scenarios further, Enercan has requested to the ONS to maintain the Machadinho reservoir between normal to medium operating conditions during the first days of the filling of

the reservoir. Enercan and ONS are developing a study to characterize the levels of operation of Machadinho and assess interferences to evaluate the required scenario.

- 6.12 Geology and Geomorphology. As per the PBA, a slope stability study is being developed. The three-phase study will identify the areas prone to erosion, landslides, and rock falls in the approximately 207 km perimeter of the reservoir. Areas prone to erosion will be modeled using slope stability software such as Reinforced Slope Stability, Bishop Circular Surface, Fellenius or Rankine. A general geomorphological risk map at a scale of 1:5,000 will identify areas, which will require further analysis, field studies and modeling. Based on the detailed analysis, specific mitigation measures such as drainage, contention and slope stability will be implemented at critical areas.
- 6.13 Water Quality. A partial clearing in the area to be flooded will be conducted based on the results of the model as discussed in section 5. The type of vegetation and steepness of the canyon will determine the amount of vegetation to be cleared. The vegetation will be removed to prevent and mitigate potential adverse impacts associated with the decay of vegetation that occurs once the area is flooded such as eutrophication and the generation of methane and other greenhouse gases in the reservoir. Clearing of vegetation will start ten months before the filling of the reservoir.
- 6.14 Cultural Resources. The archaeological study is being conducted in accordance and schedule proposed in the Archaeological Plan, as authorized by IPHAN. The six sites located within the area impacted by the construction activities were studied in January and February 2002 and artifacts have been collected and classified. All archeological sites affected by the reservoir have been identified. Since August of 2002, the recovered artifacts have been sent for further study at the Unisul Archeological Laboratory that belongs to the Environmental Engineering Department of the Unisul Campus in Florianópolis. As per the PBA, by July 2005 recovered artifacts should be exhibited in museums. Cultural exhibits, videos and other actions are being developed to preserve the cultural values of the area.
- 6.15 Landscape. Upon concluding the construction of the Project, the EPC contractor must be responsible for mitigating to the extent possible, the visual impacts of decommissioning the construction site and recovering as much as possible the original conditions of the area.

Socio-economic mitigation measures

- 6.16 The Resettlement Plan includes the principal measures and details associated with the mitigation of the impacts on the population directly affected by the Project. The Resettlement Plan provides the eligibility criteria for the compensation and resettlement programs, including cut-off dates and a methodology to determine the eligibility of people missed by the census; an estimate of the numbers of people and properties affected by the Project; a description of the compensation and resettlement options; figures for the resettlement and infrastructure budgets, and a chapter on the legal and institutional aspects. The Resettlement Plan was developed in accordance with the IDB Policy on Involuntary Resettlement, August 1998 (OP-710) for a Resettlement Plan. Please refer to Annex 1 for a summary of the Resettlement Plan. In October 2001 Enercan contracted *Engenharia Sócio-Ambiental S/C Ltda (ECSA)* to implement the compensation, resettlement and social infrastructure programs under Enercan's management. The contract covers negotiation with the affected population, the study of land values used to determine the reference price for land, the surveying, valuation, and negotiation of the affected properties, provision of advice to owners and non-owners in regard to resettlement options, and implementation of the resettlement program. Presently the compensation and resettlement program are progressing rapidly, the appraisal of all affected properties has been completed, 58% of the properties have been

negotiated and the first families are being resettled. Each of the case studies has been carefully documented, using evidence from local tax records, school registers, birth certificates, etc.

- 6.17 Compensation for Land Owners and *Posseiros*. Compensation for landowners, including the few people with occupancy rights who lack full legal title (*posseiros*), is based on a detailed assessment of the value of their affected property and assets. The assessment has been conducted by ECSA based on a reference price of land, the estimated commercial value of the standing timber; the estimated cost of improvements to the land, including clearance and de-stumping for mechanized farming, pasture and permanent crops; and the estimated cost of dismantling, moving, and reconstructing all the houses, barns, fences and other buildings on the property. The methodology is based on accepted Brazilian national standards and was agreed to by the Negotiating Council. The Negotiating Council represent 95 percent of affected families as the members were elected from the directly affected families. The Negotiating Council has accepted the methodology, but believes the reference prices for land are undervalued, as prices have increased dramatically in the affected municipalities due to demand generated by the Campos Novos and Barra Grande projects. Enercan reviewed land prices on four occasions (March 2002, October 2002, May 2003 and November 2003) and reports that the last study is final and that no further increases will be contemplated. Houses and other buildings are assessed at the cost of moving the buildings to a new site (*remocão*) rather than replacement cost (*reposição*); however, the affected families regard the prices paid for improvements, permanent crops and timber as fair, if not generous. For all owners and *posseiros*, Enercan is willing to acquire the whole of the partially-affected properties that no longer remain economically viable as per specific guidelines, provided the owner does not have other, viable holdings outside the area. Owners have the option of receiving the amount of compensation assessed for their property or benefit from the resettlement program but only if their plot is smaller than 40 ha and the property is no longer economically viable. It is important to note that not all of the non-owners are automatically regarded as directly affected. If the remaining area of the affected property is left economically viable the non-owners are not entitled to resettlement benefits since they can continue cultivating on the same areas they cultivated before.
- 6.18 As of 31 January 2004, ECSA had surveyed and prepared detailed valuations (*laudos*) for all 354 properties in the reservoir area and the valuations were approved by Enercan. As of March 31, 2004, a total of 206 properties (58 percent) had been negotiated: in 188 of these cases the owners have received payment, and in 79 cases the properties have been vacated; the owners are continuing to farm the other 109 properties, since the purchase agreement allows the landowners 8 months to harvest their annual crops. A total of 148 cases (42 percent) were still being negotiated. The survey and valuation started from the dam site and moved upriver; some of the landowners in Celso Ramos, situated nearest the dam, received valuations for their properties at the end of December 2002 but had not yet accepted the offers made by Enercan. In January 2004 the company advised the first 15 families that their cases would be passed to the courts on February 20, and a further 8 families were given until 27 February to conclude negotiations. This tactic has persuaded some landowners to negotiate; however, it is not always the valuation that is in dispute. In many cases, the main issue is the eligibility of sons or daughters for resettlement benefits, especially letters of credit, since the landowners intend to continue working with their sons or sons-in-law, and want to combine their compensation with the son or daughter's letter(s) of credit. In other cases the dispute is over the viability of the remaining area. There are also situations, as in Santa Ana (Anita Garibaldi), where landowners have hired lawyers to represent them and have been told they will have to pay the lawyers 10 to 25 percent of their compensation if they come to a negotiated agreement. By the time the first deadline was reached, 9 of the 15 families had come to an agreement with Enercan and the remaining 6 have been taken to court. In 4 of these cases the owners have refused to accept Enercan's valuation, while in the other 2 the

disputes are over the boundaries, ownership or inheritance of the properties. As of March 31, 2004 there is no resolution on these 6 cases.

- 6.19 Compensation for Small Landowners and Non-owners. The following people are entitled to the benefits of the Resettlement Program: landowners identified in the 1998 census with less than 40 ha of land whose properties are non-viable; non-owners such as tenants, sharecroppers, farm hands, and other people who were living and working on an affected property at the time of the 1998 census; married children of landowners who were living and working on an affected property at the time of the 1998 census; economically independent unmarried children of landowners over 18 years of age enumerated in the 1998 census and children of landowners who were temporarily absent at the time of the 1998 census but who came back to live with their parents before September 30, 1999.
- 6.20 As of March 31, 2004, a total of 560 people had claimed rights to resettlement benefits; 466 non-owners and 94 small landowners. The situation of 459 of the non-owners had been reviewed: 188 were classified as eligible for resettlement, 271 were classified as not eligible and a further 7 cases are under review by Enercan and the municipal-level negotiating commissions. In regards to small landowners, 42 families were automatically given the right to resettlement benefits and 52 were denied because they acquired their plots after the 1998 census. A total of 7 cases, all non-owners are being reviewed and have not been accepted by Enercan, but have not been rejected by the Municipal Commissions. The number of people eligible for resettlement will change in accordance to the results of the review of the pending cases.
- 6.21 Resettlement. The resettlement program comprises three options: (1) a letter of credit, presently valued at R\$ 87,800 (approximately US\$29,260 dollars at April 2004 prices³) for a family of up to 3 adults, (2) collective resettlement, and (3) resettlement in remaining areas. It also contemplates modified options for independent unmarried children over 18, and for people classified as “special cases”, that is vulnerable groups, such as the elderly, handicapped, chronically ill, or widows with young children.
- 6.22 The R\$ 87,800 letter of credit is based on the survey of land prices carried out in November 2003, which represents a 44 percent increase on the amount estimated in March 2002 (R\$ 61,036). The value represents the amount needed to acquire a viable holding of at least 17 hectares, with the necessary basic infrastructure, within a 100km radius of the affected municipalities. As described earlier, a viable holding is considered to have 10 hectares suitable for mechanized agriculture, 0.5 hectares of land of the same quality for the house plot, barn, vegetable garden and access road, 3 hectares of pasture and 3.5 hectares of legal reserve. The value of the infrastructure is based on the cost of building a 54m² house with two bedrooms, and a 96m² barn, incorporating a hen house, pigsty, stables and storage space. It also includes the cost of digging and lining a well, and purchasing a motor pump. A family of 6-7 people is entitled to R\$ 90,355 to cover the cost of a 63m² house with 3 bedrooms, and a family of 8 or more to R\$ 93,004 to cover the cost of a 72m² house with 3 or 4 bedrooms. People that choose this option will have to repay the value of the letter of credit. Non-owners who are not eligible for compensation technically will have to repay the full value. Owners have the value of their compensation for land and other assets discounted from the total, and must repay the amount outstanding. The beneficiaries have 3 years grace, and then have to pay 10 annual installments, calculated as 20 percent of their estimated net annual income, indexed to the market value of maize. If over 25 percent of the harvest is lost, the year's repayment will be condoned. If they wish they can repay in a shorter period, the minimum being 5 years, and will receive full title as soon as the debt is paid off. The value of the letter of

³ 3 reais = 1 US dollar

credit for those people classified as “special cases”, that is the elderly, widows with small children, the chronically sick and the handicapped is less, but does not have to be repaid.

- 6.23 Collective rural resettlement is an option for groups of 10 or more families. The sites should be located less than 30km from a municipal center, in one of the four affected municipalities or within 120km of the affected municipalities. They must comprise at least 60 percent agricultural land, no more than 40 percent, including the legal reserve having forest cover. The criteria for land and housing is identical as for the letter of credit. Enercan has acquired six areas for collective resettlement, with capacity for 60 families. The land in the collective resettlements is suitable for mechanized farming. Small-scale collective resettlement is an option for groups of 4-9 families. Enercan is also offering incentives for the exchange of remaining areas (*permuta*), since this allows affected families to reconstitute economically viable properties in the remaining areas, and will help reduce migration from the area. Refer to Table 6.2 for a summary of the resettlement options and to Annex 1 for additional information on the Resettlement Plan.
- 6.24 As of March 31, 2004, 203 families or individuals had chosen resettlement options: 119 opted for letters of credit, 63 for collective or small-scale collective resettlement, 10 for remaining areas, and another 11 were classified as “special cases”. Regarding letters of credit, 54 people had already moved to areas acquired with this option. In most cases the letters of credit are used to acquire established properties, with housing, barns and other productive infrastructure. Enercan had acquired seven areas for collective resettlement (San Pedro I, Curitibanos, Cerro Negro 1, Sao Pedro 2, Campos Novos, Cerro negro 2 and Anita Garibaldi) with a total capacity for 65 families; three areas for small-scale collective resettlement (4-9 families) and three larger areas, with capacity for 13-18 families. In regards to the third option, 10 families have opted for resettlement in remaining areas.
- 6.25 Viability of Settlements. In Santa Ana, 24 families or individuals will leave the community – many are the sons of affected landowners who have opted for letters of credit or collective resettlement, and 9-10 families will remain. At present, the community is divided over the future. The families that have received compensation for their partially affected properties would prefer to stay in the settlement, while those that are unaffected would prefer resettlement or compensation. In Rosário and Barra do Arroio fewer properties are fully affected, and the inhabitants of the settlements have already agreed to relocate the community infrastructure to nearby areas.
- 6.26 Technical Assistance. Families of smallholders and non-owners are the least able to cope with resettlement and require consistent social and technical assistance. Enercan will directly provide social and technical assistance to the families classified as “special cases”. For all other affected families, Enercan will request assistance from the local public agencies. Please refer to Table 6.2 for a summary of the resettlement options
- 6.27 Status of the Resettlement Programs. In regards to resettlement, as of March 31, 2004, a total of 560 people had requested resettlement. They included 94 landowners and 466 non-owners. All of landowners have had their cases reviewed. A total of 42 have been accepted as eligible and 52 have been rejected, some because they acquired their plots after the 1998 census. The 466 non-owners had been reviewed. A total of 181 were classified as eligible for resettlement and 278 were classified as not eligible.
- 6.28 Infrastructure. The PBA includes nine specific programs to mitigate and compensate for the impacts due to the loss or deterioration infrastructure. The infrastructure program involves the reconstruction of 33 km of access roads in Abdón Batista, the construction of a new bridge over

the Canoas River at State Road SC-456 (between Abdon Batista and Anita Garibaldi), the replacement of electricity supply lines, phone lines and water pipes, and negotiating the relocation or rebuilding of community infrastructure for settlements that no longer remain viable. Enercan will also replace the two barge services lost to the filling of the reservoir with new and improved transportation infrastructure. Campos Novos will have a new access to the National Highway system across the dam.

- 6.29 Influx from non-local workers. In October 2001 Enercan set up a reception center for migrants (*Centro de Atendimento ao Migrante* [CAM]) that arrive in Campos Novos in search of work. The program is financed by Enercan, and carried out in collaboration with the Municipality of Campos Novos and a local parish priest. It is intended to reduce the influx of unemployed migrants and avert the growth of squatter settlements on the outskirts of the town. The program has an office in the Campos Novos bus station, staffed by a professional psychologist and her assistant. They provide new arrivals with information on where they should apply for work, and can direct them to a dormitory managed by the parish priest – where they can stay without charge for 2-3 days while looking for work. If they fail to find work, the center can provide them with the bus fare to return to the city they came from. From October 2001 to the end of January 2004 the center dealt with 1,158 cases. Of these, 364 received lodging and meals in the dormitory, and 753 were given return tickets at a total cost of nearly R\$ 32,000. Most migrants come from the States of Santa Catarina, Rio Grande do Sul, Paraná and São Paulo, although some have come from as far away as Goiás and Pará.
- 6.30 Support to Health Education and Recreational Program. On August 26, 2002 Enercan signed a formal agreement to support the Municipalities of Abdon Batista, Campos Novos, and Celso Ramos to compensate for the indirect impacts of the Project, particularly the social impacts generated from the influx of workers. The agreement was signed in the presence of the State-level Public Ministry and defines the obligations of Enercan and the municipalities. In Campos Novos, Enercan is supporting the education and health departments. From 2003-2006 the company will provide R\$ 12,000 a year for books and materials for pupils from poor families. The company will pay a total of R\$ 750,000 to the Municipal Health Department in various monthly installments until February 2006. The financial aide will help repair the pediatric ward of the municipal hospital and the additional costs incurred because of the influx of people coming to work on the Project. In Abdon Batista, Enercan provided R\$ 8,762 for a radio managed by a community association. The company has also provided R\$ 30,000 for the maintenance of roads, R\$ 15,000 for educational materials for pupils from poor families (R\$ 5,000 a year from 2003-2006), and R\$ 9,500 for 50 public litter bins.
- 6.31 Enercan has provided the Municipality of Celso Ramos with R\$ 45,000 to acquire a vehicle for the Municipal Health Service, R\$ 15,000 to extend the Municipal Health Post, and has agreed to request additional medicine supplies from the State Secretary for Health. The company will also pay the municipality R\$ 9,500 to provide 50 public litter bins. Most importantly, Enercan has confirmed that once the Project is completed, vehicles of up to 45 tons will be allowed to cross the dam. This will represent a significant improvement in access to the town of Celso Ramos, halving the distance to Campos Novos and the National Highway network. Enercan has contracted engineering designs for a 3 km access road linking the dam to the urban center of Celso Ramos. Enercan has put up half the financing needed for the Master Plan for Anita Garibaldi. Enercan has also agreed to build a Cultural Center in Anita Garibaldi. The Cultural Center will become a museum and will be used to exhibit the items collected by the program to document the existing landscape, history, and cultural heritage of the region. The domestic waste recycling facility will be donated to the City of Abdon Batista.

- 6.32 Other programs that are being implemented during the construction phase to improve community relations include the Environmental Communication Program and the Environmental Education Program.

(b) Operational Phase

Environmental and social mitigation measures

- 6.33 As referred to in Table 6.1, most of the mitigation measures that are being implemented during the construction phase and the filling of the reservoir will continue into the initial phase of the Project's operation. The creation of the Conservation Unit and the permanent conservation area around the margins of the reservoir are the most significant mitigation measures, both of which will start during the construction phase and continue for the life of the Project. After the filling of the reservoir, the operation of the hydropower facilities will have reduced impacts. Solid waste will be sorted and stored for proper disposal, including recycling or final disposal at local municipal landfills. For sanitary waste, it is anticipated that the onsite wastewater treatment plant currently in operation at the construction site will remain onsite for use during the Project's operational phase.
- 6.34 The most relevant management measures associated with the operation of the reservoir are being developed as part of the Reservoir Management Plan (*Plano Diretor para o Reservatório e Entorno*). The drafting of the Reservoir Management Plan started in July 2002 and its disclosure and consultation activities have begun and a public hearing is scheduled for May 2004. The Plan will be submitted to FATMA for its review and comments in mid-2004. The Plan also requires approval from the Canoas River Basin Committee. The Plan includes the following elements:
- Characterization of the affected area
 - Multiple Uses
 - Municipal Finances
 - Potential for Tourism
 - PBA subsidies for the Reservoir Management Plan
 - Analysis of the Management Policies on hydrological resources in Brazil
 - Legal Framework and responsibilities
 - Environmental Education
 - Analysis of Emergent Scenario
 - Land use mapping
 - Cartography
- 6.35 As part of the characterization of the affected area, a detailed survey of the domestic, agricultural, municipal and industrial sources discharging into the reservoir will be conducted to define the measures required to control pollutant-loading discharges and mitigate its adverse impacts on the reservoir's water quality.

Mitigation of Indirect Impacts

- 6.36 The Canoas River Basin Committee (*Comite da Bacia*) has been recently constituted to define policies and guidelines for the management of the Canoas River. The Canoas River Basin Committee shall coordinate efforts to identify polluting sources discharging into the river basin, propose measures for wastewater minimization and treatment and enhance the development potential of hydroelectric projects. ENERCAN, together with other energy companies active in the area are required to participate in the River Basin Committee.

- 6.37 The Agricultural Development Fund to support small farmers living in the indirectly affected area. In 2003 Enercan agreed to MAB's demand to set up a non-reimbursable fund of R\$ 600,000 to support indirectly affected small farmers living in the area around the reservoir. In total, 574 farmers have received R\$ 1,087 for agricultural inputs, paid through the agencies of the Bank of Brazil in Anita Garibaldi and Campos Novos. MAB does not have direct control over the funds; however, MAB has been charging users a commission of R\$ 60, and has made bulk purchases of inputs, including lime for soil correction and fertilizers.
- 6.38 Fund for directly affected small landowners. Since the Agricultural Development Fund is exclusively for the use of indirectly affected families, Enercan also decided to provide non-reimbursable funding of R\$2,000 for small landowners (less than 100 ha) that receive compensation and for people choosing exchange or resettlement in remaining areas, R\$1,500 for people choosing letters of credit, and R\$1,000 for people choosing collective resettlement.
- 6.39 Economical Study. In December 2000 Enercan contracted IBPA (*Instituto Brasileiro de Pesquisa Alternativa*) to carry out a study of the economy and opportunities for investment in the four municipalities. The study, which was completed in February 2002, included a detailed census of the businesses in each municipality, with recommendations for potential areas of growth.
- 6.40 The Fund for Development of Communities of the Future Campos Novos Reservoir (*Fundo de Desenvolvimento das Comunidade Lindeiras ao Futuro Reservatório de Campos Novos*). On September 24, 2003 Enercan signed an agreement with SEBRAE (*Serviço Brasileiro de Apoio às Micro e Pequenas Empresas*), a Santa Catarina State agency, to set up a fund for the development of micro-enterprise and small agribusinesses in the municipalities affected by the Project. Enercan will contribute with R\$ 600,000 to the fund, including funds to support small agro-industries while SEBRAE-Santa Catarina is providing R\$ 842,350 in kind for agricultural development projects, technical support, and the promotion of small enterprises, administrative training, market studies, marketing and product certification. The fund is jointly managed by Enercan, SEBRAE-Santa Catarina, EPAGRI (the Santa Catarina State agricultural research agency) and the municipalities. SEBRAE-Santa Catarina has organized 14 meetings in various settlements in the affected municipalities to explain the program, and 160 representatives from the affected municipalities have visited the Municipality of Santa Rosa de Lima to get a first-hand view of a series of pilot projects undertaken with support from SEBRAE. The project is organized at the level of local catchment areas (*micro-bacias*), and priority is given to projects that involve 10 or more small holdings. The beneficiaries have to provide at least 50 percent of the financing, and the maximum amount available is R\$ 50,000. The operating procedures for the fund still have to be developed, but it is envisaged that it will operate as a revolving fund, with specific projects repaying at least part of the funding received.
- 6.41 As per the request of the IDB, Enercan will allocate additional resources of the Bank's Loan to complement the R\$ 1.4 million available at the fund with SEBRAE. The fund for the development support to Municipalities is oriented to encourage the diversification and increase in productivity of the smallholders in the affected area. The economic decline of the rural areas could be mitigated through investment in infrastructure and services for small farmers and by providing incentives for affected families to remain in the region. This means actively promoting the exchange of remaining areas, and wherever possible locating collective resettlements in the affected municipalities. Table 6.3 summarizes the characteristics of the Project related funds.

B. Environmental and Social Monitoring Programs

- 6.42 The monitoring programs currently in place for construction will extend their timeframe beyond the start of operation of the Project, with the exception of the monitoring activities conducted by the EPC at the construction site. Following is a description of the most relevant monitoring programs. Please refer to Table 6.1 for the timeframe of each of the 16 monitoring programs including in the PBA.

Environmental Monitoring Programs

- 6.43 Hydrology and Water Quality. The surface water monitoring program started in 2000 and will continue until June 2006 in order to develop baseline information on the limnology and establish the physical, chemical, and biological characteristics of the waters of the Canoas River and its tributaries as well as the future reservoir. The monitoring program started with monthly analysis for the first year and quarterly thereafter. Twenty-one monitoring campaigns have been conducted as of January 2004. The surface water monitoring program will continue for the entire life of the Project. The results and location of the stations are summarized in Section 3. The groundwater monitoring program will be implemented from May 2004 through May 2007 and is designed to end as the stability of groundwater level and quality is reached. The groundwater monitoring program will establish the baseline groundwater conditions prior to implementation of the reservoir, which will allow the evaluation of the impacts caused by the rise of the potentiometric surface on the quality of the local shallow aquifers. Groundwater samples will be collected at 10 locations and analyzed for the following parameters: Ambient and water temperature, color, turbidity, acidity, alkalinity, hardness and conductivity, suspended solids, total suspended solids, total dissolved solids, aluminum, iron, manganese, chromium, copper, lead, pH, silica, boron, cyanides, chlorides, total phosphate, total nitrogen, ammonia nitrogen, nitrite, nitrate, sulfide and sulfate, oil and grease, surfactants, UV-254 nm, chlorophyll, organochlorinated (pesticides), herbicides fenoxiacetics, anti-cholinesterase activity, total coliforms, thermal-tolerant coliforms and *Thiobacillus* sp.
- 6.44 Geology and Geomorphology. The Geological Conditions Monitoring Program focuses on the monitoring of slope stability and seismic conditions of the reservoir banks and surrounding areas during the filling of the reservoir and operation of the Project. The slope stability program will identify areas prone to landslides, erosion, and rock falls in order to develop measures to control the unstable conditions on the slopes of the reservoir and prevent major landslide or rock-fall occurrences.
- 6.45 The seismic program includes studies on induced seismic events to assess the potential risk of seismic activity in the area. A monitoring network consisting of 10 seismic stations in the region of the Project can be used to monitor seismic activity in the area. An existing seismic station has been relocated and four more will be installed to closely monitor any potential seismic activity associated with the filling of the reservoir. Enercan will form a partnership with the Institute of Technological Research of the State of São Paulo (IPT/SP) to conduct this seismic program. IPT/SP will also conduct the seismic program for the Barra Grande hydroelectric Project and will position four seismic monitoring stations to better monitor seismicity associated with Campos Novos, Machadinho, Barra Grande and Itá plants.
- 6.46 Fauna and Flora. As part of the implementation of the Conservation Unit and preservation of the conservation area, various surveys will be conducted to identify existing terrestrial animal and plant species to establish a baseline for the Project area. The surveys of various animal and plant species will be conducted before and after the implementation of the reservoir. Information presented in the Project PBA indicates that the monitoring programs are scheduled to start in

2002 and will focus on the following groups: insects, spiders, amphibians, reptiles, birds and mammals.

- 6.47 Climate. A total of four meteorological stations will be used to monitor meso and microclimatic conditions including hydrometeorology in the four municipalities impacted by the filling of the reservoir. The climate monitoring program started in mid-2002 and will continue until mid 2006. The stations will be completely automated and will provide data for ambient temperature, wind direction and speed, atmospheric pressure, relative humidity, precipitation and solar radiation.

Social Monitoring Programs

- 6.48 Enercan is setting up a monitoring system to track the situation of each of the three sub-programs in the resettlement plan. This will allow the company to assess progress, plan disbursements, identify problems as they arise and generate the quantitative information required for reporting to the Bank. The starting-point is a database that combines the information from the 1998 socio-economic survey with the inventory of affected properties and the surveys and valuations carried out by ECSA. This defines the universe of affected families and properties, and can be updated to include any additional families or properties eligible for compensation or resettlement, for instance, families affected by loss of access or isolation.
- 6.49 Enercan is negotiating the contract for a study to monitor the population resettled (*Monitorização da População Rural Relocada*) with Batistello Consultoria. The proposed study is based on similar studies carried out in Itá and Cana Brava, that are periodic evaluations rather than an on-going monitoring system. The study will help Enercan assess the impact of the compensation and resettlement programs. A comprehensive survey of all affected households will complement Enercan's database of affected families (owners and non-owners). This will provide a baseline against which the results of the mid-term and final survey can be compared. The objective of the evaluation is to ensure that the affected families have been able to improve or at least recover their standard of living within a reasonable period of time. It will follow the use of compensation, distinguishing different categories of affected landowners: those that received compensation for the whole of their properties, those that chose a resettlement option, and those that were only compensated for the directly affected areas of their properties. It will also follow the families that have chosen the different resettlement options.

C. Health and Safety

- 6.50 Given the type of works involved in the construction of the Campos Novos Project, the EPC Consortium and Enercan have placed special attention on the control and mitigation of the Project specific health and safety impacts and risks. The EPC provides mandatory, periodic and adequate training to all workers and requires this practice of all its subcontractors. Before the commencing of a shift, a 10-minute health and safety talk is provided to all employees at the different work fronts. The EPC contractor has developed a Health and Safety Plan for the construction phase of the Project that contains the health and safety policy to be followed by the EPC contractor and all subcontractors, procedures to deal with labor safety by eliminating risks and preserving health and physical integrity of all workers; guidance on the type of personal protection equipment (e.g., hard-hats, masks, coats, safety belts, gloves, etc.) to be used on the various works; a training program to prevent accidents, detect and eliminate risks; performance indicators through periodical monitoring of the work conditions, proactive actions (e.g., safety inspections and quality control), and reactive actions (accident investigations and statistic indicators) and a medical control program indicating all necessary medical examinations required by Brazilian regulations for construction workers.

- 6.51 In addition, an assessment of the environmental and physical conditions report (*Programa de Condições e Meio Ambiente de Trabalho - PCMAT*) has identified the most common risks of the various construction areas and works, the associated basic health and safety procedures, personnel protective equipment and collective protection measures required to mitigate the referred risks. The PCMAT complements the Health and Safety Plan developed for the construction of the Project. The Health and Safety Plan follows good industry practices and Brazilian regulations. Health issues are further assessed in the plan for the control of occupational health aspects (*Programa de Controle Médico de Saúde Ocupacional*). For example, air quality within the deviation tunnels was monitored and ventilation systems were used to remove air pollutants from within the tunnels that may have accumulated there from vehicles and heavy equipment emissions and from particulate matter from heavy traffic.
- 6.52 All the workers at the construction site have to undergo health checks before they can be employed, and are closely monitored for the presence of directly or indirectly transmissible diseases at the onsite medical facilities. The health and safety program continually emphasizes the need to eliminate potential breeding grounds for mosquitoes to avoid dengue.

D. Contingency Plans and Procedures

- 6.53 The EPC contractor has developed a comprehensive contingency plan (*Plano de Contingências Ambientais* or PCA) for the construction of the Campos Novos Project. The PCA identifies 25 project specific events that would lead to a contingency or risk at the construction site. Each of the events has a description of the contingency, corrective actions, procedures, responsibilities, resources, training, regulations (if applicable) and timeframe for the implementation of corrective actions. The PCA was developed based on an assessment of the likelihood of potential risks based on the characteristics of the works and the construction site. Among the most relevant contingency events that are included in the PCA are explosions, fires and different events from spills such as from tank farm, maintenance areas, concrete plant, water and wastewater treatment plant, among others. An outline of the PCA is included as Annex 3.

E. Environmental, Health and Safety Management

- 6.54 Enercan manages the Project's environmental, health, and safety aspects at various levels. Enercan has developed an Environmental Management Program (*Diretrizes Ambientais para a Prevenção e Controle Ambiental nas Atividades de Implantação da UHCN*) that establishes measures to prevent impacts to air, water, soil, flora, and fauna during construction activities. Such measures must be followed by the EPC, which has developed and implemented an Environmental Control Program (*Plano de Controle Ambiental* [PCA]). As part of the contract, the EPC Contractor has developed and implemented an Environmental Management System that is consistent with the requirements of the ISO 14001 Standard. According to the environmental supervisor, the Environmental Management System ISO 14000 is expected to be certified in a near future. The EMS is being implemented by the EPC Contractor and supervised by Enercan. Other relevant requirements of the EPC Contract are training, documentation, recordkeeping, supervision, and audits in line with the principles of ISO 14001.
- 6.55 Camargo Correa as the EPC Contractor is fully engaged in the control and mitigation of the environmental, social and health and safety aspects and risks of the Campos Novos Project. Camargo Correa has been awarded for the construction of the Campos Novos Project with multiple industry related environmental awards and recognitions since the beginning of construction activities. The last awards include the Ecology Award 2003 for the actions

implemented to control soil and water pollution on the implementation of a hydroelectric project and the 11th Award on Expressions on Ecology for awareness actions associated with the construction of hydroelectric projects. As a group, Camargo Correa has been recognized for increasing significantly safety in their projects. Two years ago as part of a corporate social responsibility (CSR) effort, Camargo Correa created the Camargo Correa Institute through which CCCC supports education, health and cultural projects. Additional information on Camargo Correa CSR efforts is described at the Institute web site at: www.camargocorrea.com.br/instituto/.

- 6.56 As part of the requirements of the LAI issued by FATMA, Enercan has been issuing quarterly monitoring reports on the status of the implementation of the PBA.

F. Cost, Schedule and Responsibilities

- 6.57 Table 6.1 summarizes the schedule and cost of the implementation of the 16 Programs included in the PBA. The mitigation and monitoring programs account for a total of approximately 79 million *reais*. An additional 10 million *reais* has been allocated for the management of the resettlement and compensation program, Enercan's supervision, the aerial surveillance and the studies for the transmission line. One of the principal environmental mitigation measures is the creation of the Conservation Unit. The cost of the Conservation Unit and equipment for FATMA (i.e. vehicles, computers, GPS, etc) to manage the Conservation Unit accounts for R\$3'187, 068. This amount represents 0.56 percent of the total cost of the Project, complying with CONAMA regulation 02/96, which requires hydroelectric projects to allocate 0.5 percent of the Project cost to the acquisition of conservation areas.

- 6.58 The total budget for resettlement, compensation, and the replacement of infrastructure is approximately US\$18 million at February 2004 prices. This includes over US\$ 6 million for compensation, and over US\$ 7 million for resettlement, US\$ 3.5 million for the replacement of infrastructure, and just over US\$ 40,000 for mitigating the indirect impacts on the affected municipalities. The budget does not include the R\$ 600,000 for the productive activities in the indirectly affected areas, arising from the agreement with MAB or the R\$ 600,000 committed for the rural development fund with SEBRAE.

G. Supervision and Control of Project Mitigation and Monitoring

- 6.59 Enercan has a head office in Florianópolis, an office on site responsible for supervision of the engineering and the construction related environmental and health and safety aspects, and an office in the town of Campos Novos, with six full-time professional staff, responsible for supervising the environmental and social mitigation programs included in the PBA. Enercan also has representatives in Celso Ramos, Abdon Batista and Anita Garibaldi, contracted to help affected families with their documentation. ECSA has an office in Campos Novos, with six full-time technical staff, supported by eight specialist staff from ECSA's head office in Florianópolis.
- 6.60 As part of the PBA, Enercan would implement the Environmental Supervision Program by the Environmental Monitoring Group (*Grupo de Monitorização Ambiental* - GMA). FATMA will have consultant appointed for the supervision of the Project and implementation of the PBA programs.

VII INFORMATION DISCLOSURE AND PUBLIC PARTICIPATION

- 7.1 A public hearing for the Project was held on December 5, 1995, in the City of Campos Novos as a requirement for the issuance of the LAP 028. Representatives of FATMA, ELETROSUL (then the owners of the Project), ANEEL, Magna Engenharia (the consultant that performed the EIA and RIMA), the governments of the affected municipalities, the Comissão Regional dos Atingidos por Barragens (CRAB [Regional Commission of People Affected by Dams], now known as MAB, and representatives of the local communities and NGOs were present at the hearing. The EIA and RIMA were presented and discussed with the participants in the meeting. The principal issues raised were the criteria for indemnification and resettlement, the impacts on the area to be flooded, the number of affected families and the topographic survey.
- 7.2 In June 2000, approximately 1,200 people attended a public hearing held by Enercan (which had been granted the concession in May 2000) in the City of Campos Novos to discuss the environmental and social programs included in the PBA. During the ensuing months, similar seminars were held in the other three affected municipalities, each of which drew attendance of more than 500 people. In addition, other meetings were held through March 2001, which were attended by representatives from local communities, Enercan, and ELETROSUL.
- 7.3 In March 2001, Enercan assumed responsibility for the negotiation process associated with compensation and resettlement of the population to be affected by the reservoir. Enercan conducted several meetings with the affected communities, during which the concept of the Negotiating Council was conceived. The first documented meeting addressing the resettlement of the affected population was held on October 18, 2001, involving representatives from each affected municipality, Enercan, and CFCN, the Project construction company. During this meeting, the community representatives were chosen directly by the affected people in each municipality, and constituted the Negotiation Council.
- 7.4 As per the request of the IDB, the RIMA and the PBA, including a preliminary Resettlement Plan, were made available in the four affected municipalities on January 11, 2002. and brochure with an overview of the environmental and social mitigation programs was distributed widely in schools, libraries, public buildings and government offices in the four affected municipalities.
- 7.5 A social communication program was agreed upon with the Municipal Councils and the Negotiating Council to ensure that all the affected families understood the criteria, procedures and options for compensation and resettlement. After the first site visit conducted in August 2002, IDB social consultants provided recommendation to enhance the communication program, to include house visits to explain the compensation and resettlement programs, specially to the more vulnerable families in order to help them examine the advantages and disadvantages of the different options of the resettlement program.
- 7.6 The social communication program includes radio community programs, newspaper advertisements, and the formation of two information centers, one in Campos Novos and the other in Celso Ramos. Additional information centers will also be installed in the near future in Anita Garibaldi and Abdon Batista. The radio programs have adopted a more interactive format, and give the affected population the opportunity to ask questions about the compensation and resettlement programs. Local newspapers in Campos Novos and Anita Garibaldi have covered discussions with the municipalities and the Negotiating Council, perhaps concentrating more on the indirect impacts of the Project than on the details of the compensation and resettlement programs. Enercan has produced a brochure, which provides an overview of the environmental

and social mitigation programs. A brief description of the Project and the programs in the PBA is can be found at <http://www.enercan.com.br/>.

VIII. RECOMMENDATIONS

- 8.1 The IDB proposes to require as part of the Loan Agreement that Enercan, all portions of the Project, and all environmental parties related to 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, including all environmental, health and safety requirements of the Project contracts, and any subsequent modifications, and all requirements associated with any environmental, health and safety related permits, authorizations, or licenses that apply to the Project, the Company or any environmental party in relation to the Project.
 - (b) All aspects and components of the various Project-related environmental, health and safety plans/documents, including all mitigation and monitoring programs and actions of the Project's Environmental Management Plan (*Plano Básico Ambiental [PBA]*), Enercan's Environmental Management Guidelines for construction of the Campos Novos Project (*Diretrizes Ambientais para a Prevenção e Controle Ambiental nas Atividades de Implantação da UHCN*, Construction Environmental Management Plan (*Plano de Gestão Ambiental UT 453 UHE Campos Novos*), Construction Health and Safety Plan and Assessment of Construction Activities (*Programa de Condições e Meio Ambiente de Trabalho - PCMAT*), Health Plan (*Programa de Controle Médico de Saúde Ocupacional*), Construction Contingency Plan (*Plano de Contingências Ambientais* or PCA) and Special Action Plan (*Plan Acciones Specias*)
 - (c) All aspects, actions and requirements established in the Project Resettlement Plan;
 - (d) Implement an environmental, health and safety management system that is consistent with ISO 14001 and BS 8800 (for environment and health and safety, respectively), for the construction and the operation phases.
 - (e) Ensure that all companies contracted for construction and operation activities comply with the applicable environmental and social requirements of the Loan Agreement;
 - (f) Consult with IDB before approving or implementing any and all substantive changes to the Project or its timetable, which could potentially have negative environmental, social, or health and safety effects.
 - (g) Send written notice 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.
 - (h) Ensure that all companies contracted for construction or operation activities comply with the applicable environmental and social requirements of the Loan Agreement.
 - (i) Implement ongoing information disclosure and consultation activities related to environmental, social, and health and safety aspects of the project, and in particular related to the indemnification and resettlement plan.
- 8.2 The Bank will continue monitoring the Project, including site visits and the submittal of the following environmental and social compliance reports in the frequency referred to below:
- (a) Environmental, Social and Health and Safety Compliance Report associated with the construction activities being conducted by the EPC contractor. The report shall be

submitted quarterly during all the construction and final commissioning period until the Technical Completion Date.

- (b) An Environmental and Social Compliance Report on the status of the implementation of each of the programs and subprograms included in the PBA, including without limitations the specific products such as studies, final reports and records of the Public Hearing being held with the development of the Reservoir Management Plan (*Plano Diretor para o Reservatório e Entorno*) and the environmental and social related aspects associated with the operation of the Project. The report shall be submitted quarterly until one-year after the start of operation of the third turbine and annually thereafter during the life of the Loan.
- (c) An Environmental and Social Compliance Report on the status of the Resettlement Plan. A summary report must be submitted monthly and detailed reports must be submitted on a quarterly basis until one-year after the start of operation of the third turbine. Thereafter, information will be submitted as per the reporting requirements for the operation of the Project (i.e. Environmental and Social Management Plan for the operational Phase).

8.3 Prior to the presentation of the Project to the Bank Board of Executive Directors, the final Resettlement Plan must be in form and content acceptable to the IDB and to comply with the IDB Policy on Involuntary Resettlement (OP-710, August 1998), including:

- (a) Ensure an appropriate level of technical/social assistance for all households and all individuals receiving resettlement (2 years) and collective resettlement (5 years).
- (b) Provide an appropriate level of maintenance payments for all individuals receiving resettlement benefits and collective resettlement.
- (c) Detailed monitoring activities to be conducted by Enercan to evaluate effectiveness of the social and technical assistance and the strategy to complement such assistance.
- (d) Specific and effective actions to enhance communication activities, in particular with families and individuals that have opted or are likely to opt for letters of credit or collective resettlement, and terms and conditions for the repayment of the letter for credit. The enhancement of the program should include at a minimum the development of written material such as leaflets, brochures, etc and direct visits to families and individuals to reinforce Resettlement related information (i.e. information on letters of credit, collective resettlement, terms and conditions for payments of letters of credit, etc). Communication activities should include visits and meeting with individual living in other Collective Resettlements in the area to help the affected families take a more informed decision.
- (e) The alternative provisions at all the resettlement related areas, including a detailed timetable, for an earlier than anticipated filling of the reservoir scenario.

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

- (a) Related to Enercan's proposal to provide additional contribution to the Fund for Development of Communities of the Future Campos Novos Reservoir (*Fundo de Desenvolvimento das Comunidade Lindeiras ao Futuro Reservatório de Campos Novos*), ensure that the additional contribution will be available to a more broader group of persons (e.g., small land holders, non-owners, women's groups, etc) either by modifying the rules of the Fund or creating a mechanism/fund.
- (b) Provide complementary information to assess the adequacy of the technical study "*Modelagem do reservatório da UHE Campos Novos - Efeito da biomassa inundada na qualidade da água do reservatório da UHE Campo Novos através de aplicação modelo CE-QUAL-W2, EPAGRI, August 2003*" to assess the proposed amount and location of vegetation to be cleared prior to the filling of the reservoir.

- (c) Provide the Reservoir Management Plan (*Plano Diretor para o Reservatório e Entorno*) to the IDB for its review and comment.
- (d) Submit evidence of compliance with all Project related environmental permitting requirements.
- (e) Establish a resettlement reserve account using funds from the disbursements of the Loan to cover all potential costs to fully resolve any and all pending resettlement issues.

8.5 At the earliest of December 1, 2004 or three months before the filling of the reservoir:

- (a) Provide the Slope Stability Study and Erosion Control program.
- (b) Provide a detailed study for the assessment of the variations in water quality during and after the filling of the reservoir.
- (c) Provide the study to characterize the levels of operation of the Machadinho hydroelectric project and assess interferences to evaluate the required maximum to normal operating scenario for the filling of the Campos Novos Reservoir.

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

- (a) Provide evidence that the Machadinho hydroelectric project will operate at its maximum to normal operating conditions to mitigate the suppression of flow during the filling of the reservoir or a detailed contingency plan if the referred operational conditions at Machadinho are not implemented.
- (b) Implement measures to ensure that the following settlements are being fully and adequately mitigated/compensated to the satisfaction of the IDB: Rosario, Santa Ana and Barra do Arroio.

8.7 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.

8.8 As a condition prior to the start of operations (first turbine) of the Project and as a requirement for Technical Completion, Enercan shall:

- (a) Submit, in form and substance satisfactory to IDB, a report on the construction phase and a letter certifying that the environmental plans were fully and adequately implemented.
- (b) Submit, in form and substance satisfactory to IDB, a final report on the implementation of the Resettlement Plan and a letter 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.
- (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, in form and substance satisfactory to IDB, the Environmental Management System for the operation of the Project compatible with the principles of ISO 14001.

In addition, the Bank will require from its consultant's:

- (g) A certificate from the environmental consultant certifying compliance with all environmental and social requirements in the loan agreement.

- (h) A certificate from the social consultants certifying compliance with all social requirements in the loan agreement.

8.9 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 through the external independent environmental and the external independent social consultants throughout the validity of the Loan Agreement. 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
Regulations applicable to the Project

Subject	Legislation and standards
Fauna and Flora and Forest Management	<ul style="list-style-type: none"> • Federal Law 4.771/1965 (Forestry Code) 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 granted or when absolutely necessary for the implementation of public interest projects. Procedures to manage native forests and requirements for cutting and transporting forest resources are defined at the state level. Further regulation at the federal level defined the minimum width of permanent conservation areas “ciliary belts.” In the case of artificial reservoirs and rivers wider than 50 meters, conservation areas must have a minimum width of 100 meters. CONAMA Resolution 04/1985 also requires the establishment of a permanent preservation area of 100 meters around the reservoir of a hydroelectric power plant. Subsequently, IBAMA issued regulations (<i>Instrução Normativa IBAMA/SUPES -SP 3/97</i>) that govern the use of part of the ecological conservation area around the reservoirs for public or private uses. According to the regulations, 30 meters of this area has to be fully expropriated; owners of the properties within the remaining 70 meters will be compensated by the limitations of use (that will be imposed on the properties by the Reservoir’s Master Plan). • CONAMA Resolution 302/2002, issued on March 20, 2002, establishes the definition, parameters, and limits of the Permanent Conservation Areas in reservoirs, and determines the use of the areas surrounding the reservoir. Paragraph 2 of Article III establishes the need for the development of a Master Plan to characterize the use of the surrounding areas in order to define and protect the conservation area. • Federal Law 3.824/1960 establishes the requirements for deforestation and clearing of the areas to be flooded. • The protection of the Atlantic Rainforest is defined by Federal Decree 750/1993 and regulated in each state by CONAMA, which prohibits the felling, suppression, and exploration of primary vegetation or formations that are at an advanced or medium level of succession. Exceptions can be approved in the event such actions are required for projects considered to be of public utility or social interest, such as energy production, roads, and mass transportation. • CONAMA Resolution 02/1996 determines the obligation on the part of the owner of a large project, such as a hydroelectric power plant, to implement at the developer’s own expense what is known as the “Conservation Units of Public Domain and Indirect Use.” The required total expenditures for such conservation units should be no less than 0.5 percent of the total project investment value. Such requirement must be part of the environmental compensation plans for the project and approved as part of the environmental permit by the state environmental agency (FATMA in Santa Catarina). The conservation unit may be planned and projected for many different uses such as a park, a plant nursery, a preservation area, etc. The various uses of a conservation unit shall be established by the state environmental agency (FATMA in Santa Catarina).
Mineral Resources	<ul style="list-style-type: none"> • Under the Brazilian Mining Code, established by Federal Law 227/1967, the extraction of gravel and sand (Class II mineral resources) to serve as raw material for construction requires authorization from the local administration authority and the DNPM. CONAMA Resolution 010/1990 determines that the quarry to serve at Class II mineral resources is subject to the environmental permitting procedures.

Table 3.1 (continuation)

Subject	Legislation and standards
Water and Wastewater Management Water Supply.	<ul style="list-style-type: none"> • Federal Law 9.433/1997 establishes the National Policy for Water Resources. This law determines that projects that utilize water from rivers, lakes, coastal areas, and aquifers must obtain a specific authorization, concession, or license from the competent state authority representing the National Department of Waters and Electrical Energy (Divisão Nacional de Águas e Energia Elétrica [DNAEE]). The statute also determines that management of any hydrological resource must ensure the multiple uses of the water. • CONAMA Resolution 20/1986 establishes standards for the quality of superficial water bodies as well as the requirements and limits for wastewater and/or effluent discharges. This resolution also classifies all fresh, brackish, and saline waters at the national level into nine classes according to their prevailing uses and physical characteristics. • Federal Law 9.433/1997 establishes the Water Resources National Policy and creates the National System of Water Resources Management. Ordinance 36/90, imposed by the Ministry of Health, establishes standards for drinking water use. The waters of the Canoas River at the area of the Project are classified as a Class 4 body of water. • State of Santa Catarina Decree 14.250/1981 determines that discharge of treated industrial effluents and/or treated sanitary sewage shall be subject to specific permitting procedures by the state, and shall comply with discharge limits and environmental quality standards. • State Decree 3515, issued November 19, 2001, establishes the formation of the Canoas River Basin Committee.
Waste Management	<ul style="list-style-type: none"> • Article III of Portaria MINTER 53, issued on March 1, 1979, determines that wastes containing toxic, caustic, flammable, explosive, or radioactive substances must be properly stored and treated and must also be disposed of in accordance with standards to be determined by state regulations. Item X establishes that solid and hazardous waste should not be stored in open areas or incinerated, except in areas previously approved and/or in emergency situations. • CONAMA Resolution 6, issued on June 15, 1988, requires inventories of industrial wastes to be submitted to the state environmental agency. The waste inventory should contain the following information: waste classification; waste quantity; transportation data; storage and handling procedures; and final treatment and disposal procedures. • NBR 10004 establishes the Brazilian Solid Waste Classification Standards. Storage and handling procedures as well as final treatment and disposal depend on the waste classification. Solid wastes are classified as Class I, II, and III. <ul style="list-style-type: none"> ○ Class I – Wastes classified as hazardous and should be stored according to NBR 12235 (formerly NB 1183). Storage facilities should be covered and include secondary containment with impermeable ground. Hazardous wastes must be kept in closed containers with visible labels that indicate the characteristics and nature of the contents. Class I wastes must be stored segregated from non-hazardous wastes. ○ Class II – Classified as non-inert. Class II wastes should be stored according to NBR 11174 (formerly NB 1264). Storage areas need to be clearly posted and access-restricted. Non-inert wastes should be stored in covered areas, with secondary containment and impermeable ground. Class II wastes must be kept in closed containers with visible labels that indicate the characteristics and nature of the content. Access by unauthorized personnel is restricted or prohibited. ○ Class III – Class III wastes are those classified as inert and apply to domestic and related wastes. These are normally collected and disposed of at a municipal landfill.

Table 3.1 (continuation)

Subject	Legislation and standards
Hazardous Chemicals and Materials	<ul style="list-style-type: none"> Portaria MINTER 124 requires structures that contain substances which may cause water pollution to be located at a minimum distance of 200 meters from any water body. Article II determines that any aboveground storage area must be protected by secondary containment or other containing device to prevent soil, water or groundwater contamination. NB 98 establishes procedures for the handling and storage of flammable liquids. NR 20, issued by the Labor Ministry, establishes procedures for the safe storage of hazardous materials. Article 2 of CONAMA Resolution 01A, passed January 23, 1986, establishes that the environmental agency must be notified 72 hours in advance of the transportation of hazardous materials in order to take the proper precautions. CONAMA Resolution 9, passed August 31, 1993, establishes definitions and criteria for the final destination of spent lubricating oil, including potential recycling of used oil. It prohibits any discharges of spent oil to the soil, surface water, groundwater, or sewers as well as onsite incineration of the spent oil. It dictates that all spent oil be recycled through re-refining.
Explosives	<ul style="list-style-type: none"> Federal Decree 2.998/1999 requires that a specific authorization (<i>Certificado de Registro</i>) be granted by the Army for the transportation, handling, and temporary storage of explosives for mineral extraction purposes. Technical requirements for the storage facilities are also established by the decree.
Environmental Education	<ul style="list-style-type: none"> Federal Law 9.795/1999, enacted April 27, 1999, creates the National Policy for Environmental Education.
Historic and Archeological Heritage	<ul style="list-style-type: none"> The primary regulation addressing issues related to the protection of the historic, artistic, aesthetic, cultural, and archeological heritage/patrimony is Federal Law 3.924/1961. This legislation determines that any site in which there is evidence of occupation by paleoamerindians or temporary settlements of the ceramic period is defined as an historic or archeological monument. The legislation also establishes the general requirements for the excavation procedures of archaeological sites. IPHAN Ruling (Regulamento) 07/1988 establishes the conditions for requesting authorization from the institute for conducting archaeological research in the area to be affected by the projects).
Expropriation	<ul style="list-style-type: none"> The expropriation process is regulated by the Federal Decree-Law 3.365/1941 and Federal Law 2.786/1956. This legislation constitutes the legal basis for the acquisition of private properties for public use. Article 5 (Item XXIV) of the Federal Constitution defines the concept of the fair payment. The expropriation process is to occur in two stages. In the first stage (declaration stage), ANEEL publishes a resolution determining that the area to be expropriated is of public utility. In second stage (the expropriation stage), the concessionaire/developer is allowed to acquire and compensate the affected properties and property owners in the areas to be expropriated. Given that the energy generation is of public interest, its negotiation is subject to the rules and regulations set forth in Federal Decree-Law 3.365/1941, which regulates land expropriation and compensation for public utility. In addition, this process is regulated by Federal Law 8.987/1995, which covers the concession system and permission for rendering public services.
Environmental Crimes	<ul style="list-style-type: none"> Recent Federal Law 9.605/1998, regulated by Federal Decree 3.179/1999, establishes punishments for environmental crimes, including environmental damages caused by human actions.

Table 4.1
Area and Population of the Affected Municipalities (Indirectly Affected Area)

Municipality	Area Square Km²	Urban Population	Rural Population	Total Population
Campos Novos	1,632	22,532	6,175	28,707
Abdon Batista	198	715	2,061	2,776
Celso Ramos	190	637	2,206	2,843
Anita Garibaldi	605	4,163	6,069	10,232
Total	2,625	28,047	16,511	44,558

Figures taken from the Census of 2000 (IBGE) and cited in Projeto Canoas Século XXI (IBPA).

Table 4.2
Land Tenure in the Affected Municipalities (Indirectly Affected Area)

Municipality	Owner	Occupant	Tenant	Sharecropper	Total
Campos Novos	2,084	362	327	37	2,810
Abdon Batista	393	134	3	57	587
Celso Ramos	420	-	30	150	600
Anita Garibaldi	1,089	229	84	33	1,435
Total	3,986	725	444	277	5,432

Source: IBGE Census 1995/6

Table 4.3
Rural Workforce in the Affected Municipalities (Indirectly Affected Area)

Municipality	Owner and/or Family Labor	Permanent Employees	Total
Campos Novos	2,442	450	2,892
Abdon Batista	1,422	7	1,429
Celso Ramos	1,633	6	1,639
Anita Garibaldi	3,470	50	3,520
Total	8,967	513	9,480

Source: IBGE Census 1995/6

Table 5.1
Environmental Impacts at the Construction Site

Activities (Source of impacts)	Potential Environmental Impacts	Preventive and Mitigation Measures
Fuel storage	Transfer of fuel to storage tanks	<ul style="list-style-type: none"> • Secondary containment at tank farms with drainage coupled to an oil water separator unit. • Conduct a continuous inspection program on facilities and equipment.
Fuel supply	Fuel spills	<ul style="list-style-type: none"> • Use of trays to contain spills.
Car and equipment washing	Discharge of oily water with suspended solids and detergents.	<ul style="list-style-type: none"> • Install oil/water separators. • Use of suspended solids separators. • Remove manually the excess of solids and oil before washing activities, which minimizes the use of water, detergents and soaps. • Use only biodegradable detergents and soaps. • Conduct periodic cleaning and removal of sediments in the oil/water and sediments separators. • Conduct periodic analysis of the water discharge to confirm efficiency of the separators.
Maintenance, oil change and lubrication of equipment	Oil spills which potentially could contaminate water bodies	<ul style="list-style-type: none"> • Construct impervious surfaces at maintenance areas and locations where oil change activities are conducted. • Install oil/water separators. • Use trays to contain possible spills. • Conduct periodic cleaning and removal of sediments in the oil/water and sediments separators.
Management of contaminated materials from accidental spills	Inadequate disposal of hazardous, materials (oily rags, oil and fuel containers, oily metal scraps, etc)	<ul style="list-style-type: none"> • Use of absorbent material to contain and collect spills. • Restrict mixing hazardous waste with domestic waste. • Implementation of procedures to label, separate and store temporarily hazardous waste in adequate facilities in accordance with hazardous waste regulations. • Collect used oil, batteries and oil filters for recycling and/or its return to the manufacturer of the provider. • Use of authorized companies to dispose of hazardous materials.
Generation of household waste	Inadequate disposal of paper, wood, packing material, etc.	<ul style="list-style-type: none"> • Implement minimization practices to reduce the generation of household waste • Implement a selective collection program • Recycle and commercialize

Table 5.1 (continuation)

Activities (Source of impacts)	Potential Environmental Impacts	Preventive and Mitigation Measures
Generation of construction debris	Inadequate disposal of construction material such as rocks, gravel, concrete, wood, etc.	<ul style="list-style-type: none"> • Implement an awareness program to minimize the generation of waste. • Selective collection • Dispose of at the selected areas at the construction site (i.e. <i>bota-fora</i>). • Recycle and commercialize as much feasible.
Generation of infectious material	Inadequate disposal of infectious material generated in the medical post.	<ul style="list-style-type: none"> • Restrict mixing with any other waste. • Classify, identify and label type of waste and possible risks from mishandling. • Use of authorized companies to dispose of hazardous materials.
Cement plant	Generation of dust and water discharge with concentrations of cement to water bodies	<ul style="list-style-type: none"> • Design drainage and settling devices to separate rest of cement from water • Store product and cement waste in adequate locations to avoid runoff to water bodies.
Concrete plant	Generation of dust and water discharge with concentrations of concrete to water bodies and spills of additives	<ul style="list-style-type: none"> • Design drainage and settling devices to separate rest of cement from water. • Store product and cement waste in adequate locations to avoid runoff to water bodies. • Use inert additives.
Rock and gravel plant	Generation of dust during crushing of rocks	<ul style="list-style-type: none"> • Spray water system at conveyor belts and crushing areas. • Covering cargo trucks to prevent the dispersion of the material while being transported. • Conduct adequate stockpiling to reduce dispersion of dust by wind.
Asphalt plant	Air pollution and spillage of asphalt on soil	<ul style="list-style-type: none"> • Minimize suspended material and emissions through the use of filters in the asphalt plant. • Collect and dispose of residues of asphalt while washing vehicles and plant.
Clearing of vegetation	Excessive clearing, inadequate disposal of cleared material, interferences with flora and fauna	<ul style="list-style-type: none"> • Prohibit the clearing of vegetation from unauthorized areas. • Prohibit burning practices. • Prohibit the collection of flora and fauna.
Preparation of the site and construction of roads	Erosion and interference with natural drainage patterns	<ul style="list-style-type: none"> • Implement erosion control procedures, water dissipation basins, etc. • Minimize the clearing of vegetation and revegetate the areas as soon as possible.

Table 5.2
Number of Properties Directly Affected by the Project

	Right Bank	Left Bank	Total
Construction site	10 (+1)*	14 (+1)*	24 (+2)*
Reservoir and conservation area	184 (including 2 islands)	145	329
Total	194 (+1)	159 (+1)	353 (+2)

*Properties rented or exchanged for the duration of the construction camp

Source: COPEL 1998. The figures for the construction site include all the properties that were initially acquired or rented. This is slightly more than the 20 properties originally identified by COPEL in 1998 (7 on the Right Bank and 13 on the Left Bank).

Table 5.3
Number of Families Directly Affected by the Project

Families/Area	Reservoir	Construction Site	Total
Landowners	281	27	308
Non-Owners	185	6	191
Total	466	33	499

Source: COPEL 1998

Table 5.4
Royalties and Service Tax (ISS *Imposto Sobre Serviços*)

Municipality	Monthly ISS Payments	Monthly Royalties due 2006 (% of total)	Average Monthly Municipal Budget (% Salaries)
Campos Novos	98,493*	99,567 (34%)	1,260,000 (35%)
Celso Ramos	42,211	58,269 (20%)	300,000 (27%)
Abdon Batista	-	64,096 (22%)	226,000 (32%)
Anita Garibaldi	78,569**	69,922 (24%)	450,000 (48%)

* This was increased by the Municipality from 3 to 5 percent, and represents a total increase of R\$ 2,440,879

**From BAESA (Barra Grande)

Table 6.1
Projeto Basico Ambiental (PBA) - Environmental Mitigation and Monitoring Programs

PROGRAMS AND ACTIONS	Start	Ends	Cost/ Status
Mitigation measures			
1. Flora and Fauna Conservation Program			14,257,740.00
<ul style="list-style-type: none"> Implementation of the Conservation Unit Project Implementation of the Forestry Nursery Project Recuperation and preservation of the conservation area Conservation, Management and Scientific Use of Native Flora Conservation, Management and Scientific Use of Native Fauna 	Dec 02 June 02 June 02 June 02 June 02	Dec 05 May 05 May 05 May 05 May 05	Area acquired, FATMA to classify the Unit Nursery producing trees Belt has been demarcated. On-going On-going
2. Cleaning of the Reservoir Program			2,071,120.00
<ul style="list-style-type: none"> Clearing Final cleaning Disinfection/demolition 	Feb 04 Feb 05 March 04	Dec 04 Jun 05 Dec 04	To be contracted To be contracted To be contracted
3. Historic Heritage and Archeological Rescue and Preservation Program			2,689,300.00
<ul style="list-style-type: none"> Historic Heritage Archeological Heritage 	July 02 Nov 01	Feb 05 June 05	On-going All sites have been identified
4. Recuperation of the Natural Landscape at the Construction Area Program	Dec 04	June 06	Included in the EPC contract
5. Special Actions Program			41,560.00
<ul style="list-style-type: none"> Construction Contingency Plan 			Concluded
6. Rural Population Relocation Program			41,346,400.00
<ul style="list-style-type: none"> Compensation to land owners (flooded and conservation area) Letter of Credit Rural Collective Resettlement Technical Assistance 	July 02 Dec 02 May 03 June 04	April 04 June 04 March 04 Dec 09	On-going On-going Areas purchased To be contracted

Table 6.1 (continuation)

PROGRAMS AND ACTIONS		Cost	
Mitigation measures			
7. Physical and Territorial Program			9,880,100.00
• Federal highway (3.4 km)	Nov 03	Dec 04	Project contracted, construction starts April
• Municipal roads and bridges	March 04	Sept 04	Projects under development
• Access to Properties	Sept 03	Dec 04	On-going
• Raising of the Canoas River Bridge	March 04	Sept 04	Projects under development
• Electric Distribution Lines	Oct 03	Dec 04	On-going
• Water supply	Nov 03	Dec 04	On-going
• Barra do Arroio Community	July 03	Dec 04	Areas purchased
• Rosario Community	July 03	Dec 04	Areas purchased
• Santa Ana Community	Feb 04		Identify area for relocation
8. Support to the Health, Educational and Recreational Program			1,106,300.00
• Agreement with the Municipality of Campos Novos	Aug 02	Feb 06	On-going
• Agreement with the Municipality of Celso Ramos	July 02	Feb 06	On-going
• Agreement with the Municipality of Addon Batista	Aug 02	Feb 05	On-going
• Agreement with the Municipality of Anita Garibaldi	Aug 02	Feb 05	On-going
• Agreement with the Safety Secretariat			
9. Support for the Development of the Municipalities			2,350,450.00
• Diagnosis for Actions Project			Concluded
• Support to Municipalities	June 02	July 05	
• Support to Commercial and Industrial Activities with SEBRAE	Oct 03	Oct 04	
• Migrant population project	Nov 01	Dec 05	
10. Environmental Communication Program	Oct 01	Dec 05	880,260.00
11. Environmental Education Program	Concluded		229,190.00
12. Reservoir Management Program	July 02	June 04	274,290.00

Table 6.1 (continuation)

PROGRAMS AND ACTIONS		Cost	
Monitoring Programs			
13. Environmental Supervision Program	June 03	Dec 06	105,320.00
14. Hydrology and Water Quality Program			982,950.00
• Surface Water Quality	June 00	June 06	On-going
• Ground Water Quality	May 04	May 07	On-going
15. Geologic Monitoring Program			1,105,820.00
• Seismic Conditions Monitoring Project	Dec 03	May 05	
• Reservoir Slope Stability Project	Oct 03	Oct 04	
16. Climate Monitoring Program			1,699.48.00
• Climate Monitoring	Feb 02	Jan 06	
• Hydrometeorology Monitoring	July 02	April 06	
()* Monitoring of Flora and Fauna Conservation Program			
• Monitoring of Ictofauna	June 02	Dec 05	Six surveys, including tunnels rescue
()** Rural Population Relocation Program			
• Monitoring of the Relocation of Rural Population	March04		
		TOTAL	79,020,300.00

* Included as part of the Flora and Fauna Conservation Program

** Included as part of the Rural Population Relocation Program

Table 6.2
Summary of the Resettlement Options⁴

OPTION	PLOT SIZE ⁵	HOUSING	BUILDINGS & UTILITIES	TECHNICAL ASSISTANCE	MAINTENANCE PAYMENTS	REPAYMENT	NOTES
Letter of credit	17 ha, or smaller area if authorized by Enercan. (12 ha for singles) Any difference in value can be invested in the plot.	Where housing does not already exist: Type 1 = 54m ² Type 2 = 63m ² Type 3 = 72m ² Type determined by the size of the family.	Standard barn of 96m ² . Soil correction, according to size of cultivable area (first year only).	None. Enercan will request 2 years technical assistance from local public agencies.	Decided on a case by case basis. Payments will be until the first harvest (for up to 9 months). All transport costs will be paid.	3 years grace, followed by 10 annual payments, equivalent to 20% of annual profit, defined in terms of bags of maize (at lowest prevailing prices).	Housing and barn provided where they do not already exist. This is only for people who did not have housing or barns on the affected property. Landowners will be paid an amount equivalent to the cost of relocating their houses.
Resettlement in remaining areas	17 ha or smaller (according to criteria used by INCRA) (12 ha for singles)	Type 1 = 54m ² Type 2 = 63m ² Type 3 = 72m ² Type determined by the size of the family.	Standard barn of 96m ² plus road access, electricity, potable water, water for livestock, soil correction and preparation of soil for cultivation.	None. Enercan will request 2 years TA from local public agencies.	To be decided on a case by case basis. If approved, payments will be until the first harvest (for up to 9 months). All transport costs will be paid.	3 years grace, followed by 10 annual payments, equivalent to 20% of annual profit, defined in terms of bags of maize (at lowest prevailing prices).	No criteria exist to determine what constitutes a viable remaining area.
Collective resettlement	Minimum of 17 ha. Larger areas determined according to family size. (12 ha for singles)	Type 1 = 54m ² Type 2 = 63m ² Type 3 = 72m ² Type determined by the size of the family.	Standard barn of 96m ² plus road access, electricity, potable water, water for livestock, soil correction and preparation of soil for cultivation.	5 years TA. May be provided through public agencies.	Until the first harvest (for up to 9 months). All transport costs will be paid.	3 years grace, followed by 10 annual payments, equivalent to 20% of the annual profit, defined in terms of bags of maize (at lowest prevailing prices). It will include the cost of soil correction and	The collective resettlement must comprise at least 10 families. They will be provided with community equipment, including a community hall, a bowling court, barbecue, church hall, soccer field, and community silo or other

⁴ Summary options based in the existing Resettlement Plan; content might vary upon final Resettlement Plan acceptable to IDB.

⁵ Unmarried adult children of affected landowners, who are 18 or over at the time the property is acquired, who are economically independent, and who were enumerated in the 1998 census or returned to live with their parents before 30 September 1999, are entitled to a 12 ha plot (the minimum plot considered viable by INCRA) of which 60 percent must be agricultural land.

OPTION	PLOT SIZE ⁵	HOUSING	BUILDINGS & UTILITIES	TECHNICAL ASSISTANCE	MAINTENANCE PAYMENTS	REPAYMENT	NOTES
						the maintenance payments.	building to support productive activities.

Table 6.3
Summary of the Project Funds

FUND	PURPOSE AND TYPE	RESOURCES AND STATUS	POPULATION BENEFITED	COMMENTS
The Agricultural Development Fund	<ul style="list-style-type: none"> Support indirectly affected small farmers living in the area around the reservoir Non-reimbursable funding 	<p>Payment were made through the agencies of the Bank of Brazil in Anita Garibaldi and Campos Novos upon authorization of Enercan.</p> <p>All funds have been distributed.</p>	<p>R\$600,000</p> <p>574 farmers received R\$ 1,087 for agricultural inputs</p>	Although MAB had not direct control over the funds, MAB charged users a commission of R\$ 60, and made bulk purchases of inputs, including lime for soil correction and fertilizers.
Fund for directly affected small landowners.	<ul style="list-style-type: none"> Support directly affected small owners Non-reimbursable funding 	<p>Enercan makes payments directly.</p> <p>Funds have been provided to small owners who have decided on any of the alternatives.</p>	<p>R\$2,000 for small landowners (<100 ha) that receive compensation and people choosing exchange or resettlement in remaining areas,</p> <p>R\$1,500 for people choosing letters of credit, and</p> <p>R\$1,000 for people choosing collective resettlement</p>	
The Fund for Development of Communities of the Future Campos Novos Reservoir	<ul style="list-style-type: none"> All small farmers (either directly or indirectly) living in the four affected Municipalities Revolving fund 	<p>Enercan has agreed to contribute with R\$ 600,000 and SEBRAE-Santa Catarina is providing R\$ 842,350 for technical support, promotion, training, marketing and product certification.</p> <p>As per the request of the IDB,</p>	<p>All the population of four Municipalities.</p> <p>SEBRAE-Santa Catarina has organized 14 meetings in various settlements and 160 representatives have visited a series of pilot projects undertaken with support from</p>	The project is organized at the level of local catchment areas (<i>micro-bacias</i>), and priority is given to projects that involve 10 or more small holdings. The beneficiaries have to provide at least 50 percent of the financing, and the maximum amount available is R\$ 50,000.

		Enercan will contribute with additional resources	SEBRAE.	
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Annex 1

Summary of the Resettlement Plan

The Resettlement Plan (*Plano de Remanejamento da População Rural*) is included as one of the programs of the PBA. The Resettlement Plan provides definitions of eligibility criteria for the compensation and resettlement programs, including “cut-off dates” and a methodology to determine the eligibility of people missed by the census; an estimate of the numbers of people and properties affected by the project; a description of the compensation and resettlement options; figures for the resettlement and infrastructure budgets and a chapter on the legal and institutional aspects.

I. DEFINITIONS

Affected Areas. The affected areas include the approximately 26 km² of land to be flooded by the reservoir when filled to the maximum operating level (660 masl) and a variable conservation area (*Area de Preservação Permanente*) along the reservoir of 30 m, which will increase to 100 m in areas with forest cover. The properties affected by the reservoir comprise the 329 properties identified by COPEL in 1998, and 25 that are the result of subdivisions that have occurred since 1998. Enercan is also acquiring the remaining areas of properties that no longer remain economically viable and has acquired an area of nearly 7 km² in Campos Novos and Celso Ramos for the construction site.

Affected Population. The directly affected population includes owners and non-owners which are living, working or depending on the affected areas including properties with loss of access and/or which no longer remain socially or economically viable. The socio-economic census carried out in 1998 by COPEL identified 499 families that would be directly affected by land acquisition for the construction site, reservoir and conservation zone. They included 308 property owners and 191 non-owners, including tenants, sharecroppers, and adult children or other relatives who were living and working on the affected properties.

“Cut off Dates”. The formal date after which new entrants are not entitled to resettlement benefits (cut-off date) is December 31, 1998, based on the original socio-economic survey carried out that year by COPEL and ETS (*Energia, Transporte e Saneamento S/C Ltda.*). Further confirmed the information of the 1998 survey.

Eligibility. Landowners and *posseiros* are eligible for compensation and in some case for resettlement. Affected non-owners are eligible for resettlement.

Eligibility for Compensation. All landowners and *posseiros* are eligible for compensation, including people that acquired the land after the 1998 socio-economic census. However, people that acquired properties after the 1998 census are not eligible for any of the resettlement options for owners of 40 ha or less whose properties are no longer left economically viable. Enercan is willing to acquire the whole of those partially-affected properties that no longer remain economically viable, provided the owner does not have other, viable holdings outside the area. The viability of the remaining areas is decided on a case by case basis, since the size or proportion of the remaining area gives little indication of its potential productivity. Enercan has developed guidelines to determine which remaining areas remain viable. For areas remaining viable, Enercan will compensate owners for the area affected by the reservoir and conservation zone.

Eligibility for Resettlement. The following people are eligible for resettlement.

- Landowners enumerated in the 1998 census, whose total holdings – including land held outside the affected area – are less than 40 ha, and whose properties are fully acquired by Enercan (i.e. the remaining areas are no longer economically viable).
- Non-owners who were living and working on an affected property at the time of the 1998 census. This includes tenants, sharecroppers, farm hands, and other people who were working on the land, which, in the case of partially affected properties, are left without an economically viable remaining area. The tenants, sharecroppers or farm hands must not have viable plots of their own outside the affected area or be engaged in other activities that provide their main source of income.
- Married children of landowners who were living and working on an affected property at the time of the 1998 census. The partially affected properties must not be left with an economically viable remaining area, and the married sons cannot have other viable plots outside the affected area. Marital status – including common-law marriages – is determined from the date the affected property is acquired.
- Economically independent unmarried children of landowners, over 18 years of age, enumerated in the 1998 census, will be given the option of a smaller house and plot in a collective resettlement. Economic independence and age is determined from the date the affected property is acquired.
- In addition, an addendum to the January 2002 agreement makes provision for the children of landowners who were temporarily absent at the time of the 1998 census but who came back to live with their parents before 30 September 1999 (the date the concession was signed)

Loss of Access and Isolated Properties. Enercan will acquire any properties that lose access. So far, only 3 properties have been identified as affected by loss of access; they are all located on the Right Bank of the Canoas River. As of 31 January 2004, none of these properties had been valued or negotiated. If no other alternative is feasible, the company will also acquire any unaffected properties that are left isolated or no longer remain socially viable – i.e. where most families in a settlement are directly affected and those that remain would no longer be able to manage on their own. In Santa Ana, 24 families or individuals will leave the community – many are the sons of affected landowners who have opted for letters of credit or collective resettlement, and 9-10 families will remain. At present, the community is divided over the future. The families that have received compensation for their partially affected properties would prefer to stay in the settlement, while those that are unaffected would prefer resettlement or compensation. In Rosário and Barra do Arroio fewer properties are fully affected, and the inhabitants of the settlements have already agreed to relocate the community infrastructure to nearby areas.

Viability of Affected Areas. The minimum economically viable area for each family up to three adults is equivalent to 17 ha, of which at least 10 ha have to be suitable for mechanized agriculture, 0.5 ha of land of the same quality for the house plot, barn, vegetable garden and access road, 3 ha of pasture and 3.5 ha of legal reserve. Properties of less than 17 ha are regarded as fully affected if the reservoir or conservation zone affects any part of the cultivated area. If the cultivated area is not affected the properties are regarded as partially affected. If the owner uses the remaining area for non-farming activities that provide a viable income, such as barns for chicken or pig production, the remaining area would be regarded as economically viable. Of the 354 properties affected by the reservoir, only 15 are completely affected by the reservoir and conservation zone. Of the other 339 properties, 84 have remaining areas classified as no longer viable, giving a total of 99 properties (15 + 84) to be fully acquired; as of 31 January 2004, 55 of these properties had been acquired. The other 255 affected properties as classified as having viable remaining areas; as of 31 January 2004, Enercan had acquired the affected areas of 111 of these properties.

The Negotiating Council. The Negotiating Council (*Conselho de Negociação*) represents the people directly affected by the project. It was formally constituted on 18 October 2001, and comprises 6

members and 6 alternatives from each of the four Municipal Commissions of Affected People. The Municipal Commissions were elected by the directly affected population in each municipality and are mainly composed of landowners. The Municipal Commissions are responsible for reviewing the case studies carried out to determine whether individuals have a right to resettlement benefits and the Negotiating Council has taken an active role in the surveys of land prices in the project area. The Council is independent of the municipal administrations and represents a range of political positions. The Resettlement Plan was formally agreed with the Negotiating Council on 18 January 2002.

2. INSTITUTIONAL RESPONSIBILITIES

Enercan is fully responsible for implementing the resettlement plan. In October 2001 Enercan contracted ECSA (*Engenharia Sócio-Ambiental S/C Ltda*) under a 49-month contract to implement the compensation, resettlement and social infrastructure programs under Enercan's management. The contract covers negotiation with the affected population, the study of land values – used to determine the reference price for land, the surveying, valuation, and negotiation of the affected properties, provision of advice to owners and non-owners in regard to resettlement options, and implementation of the resettlement program. The infrastructure program involves planning the reconstruction of 33 km of access roads, the replacement of electricity supply lines, phone lines and water pipes, and negotiating the relocation or rebuilding of community infrastructure for settlements that no longer remain viable.

3. COMPENSATION

Compensation for landowners, including the few people with occupancy rights who lack full legal title (*posseiros*), is based on a detailed assessment of the value of their affected property and assets. In accordance with the agreement between Enercan and Negotiating Council, signed on 18 January 2002, the valuation is based on the following:

- the intrinsic or unimproved value of the land (*terra nua*)
- the estimated commercial value of the standing timber
- the estimated cost of all improvements to the land, including clearance and de-stumping for mechanized farming, pasture and permanent crops
- the estimated cost of dismantling, moving, and reconstructing all the houses, barns, fences and other buildings on the property

Each of these items is calculated separately, on the basis of the valuations carried out by ECSA, and supervised by Enercan, using a methodology based on accepted Brazilian national standards.

Valuation of Land. The intrinsic value of unimproved land (*terra nua*) is based on 4 categories, determined on the basis of potential or actual use. They are:

- Category A. Suitable for mechanized agriculture (100 percent of the reference value)
- Category B. Suitable for plowing with oxen (70 percent of the reference value)
- Category C. Suitable for planting by hand (40 percent of the reference value)
- Category D. Land unsuitable for agriculture (30 percent of the reference value)

Within each category the valuation is the same regardless of whether the land is legally titled or is occupied (*posse*), and whether it is in the reservoir, conservation zone, or is the remaining area of a property that has to be fully acquired. Where the property owner is willing to negotiate, Enercan will value all Category D land as if it were Category C. ECSA was responsible for valuation of the affected

properties. The properties were verified in the field, the technical staff being accompanied by at least one member of the affected family.

ECSA, with the participation of representatives from the Negotiating Council, has carried out detailed studies of land prices in a 100 km radius of the project, considering actual transactions and the prices asked by real estate agents. The January 2002 agreement with the Negotiating Council states that the studies should be updated every six months. Four studies have been carried out, in March 2002, October 2002, May 2003, and November 2003; Enercan is insisting that this last study is final and that no further increases will be contemplated as all the families have now received valuations for their property. On the basis of the most recent study, carried out in November 2003, ECSA has calculated the reference price for land in Category A at R\$ 2,622 per hectare; this represents a 41 percent price increase since April 2002, when the reference price was set at R\$ 1,865, a figure that itself was 42 percent above the R\$ 1,310 paid by Machadinho HPP. The evidence suggests that prices for agricultural land have risen sharply in the areas nearest the reservoir, but less in other parts of Campos Novos and in neighboring municipalities. The increase in land prices reflects the demand generated by the compensation and letters of credit provided by Barra Grande, Itá and Machadinho as well as Campos Novos; it is also partly due to the high prices of soy and corn, which until recently reflected the relative strength of the dollar against the real.

Standing Timber. Enercan is compensating landowners for timber and secondary forest. If they accept the compensation they will not be allowed to harvest the timber, which becomes the property of Enercan. If they are unwilling to accept compensation, Enercan will help them acquire licenses to harvest from the areas situated below 660masl, and they will be responsible for extracting, transporting and selling the timber. Standing timber is divided into four categories: primary forest, secondary forest, areas of old re-growth (*capoeirão*), and areas of more recent re-growth (*capoeira*). Each category is assigned a standard value, based on average yields of timber in each type of forest and prices paid by local sawmills or buyers of firewood. The categories are then subdivided, according to ease of access, into easy, regular, difficult, and very difficult. This generates the following table of values.

Permanent Crops and Improvements. The value of plantations of pine and eucalyptus, fruit trees, ornamental plants, sugar cane, and pastures are standardized. The value of standing timber and fruit trees is based on a calculation of the investment cost, except for large commercial plantations, which are calculated on the basis of the commercial value of the timber. Plantations of pine and eucalyptus are classified according to the age of the trees, and fruit trees according to whether they are improved varieties and whether or not they are producing. Sugar cane is valued according to variety and age, and pastures by whether they are natural or improved. Finally, an additional payment of R\$ 1,346 per hectare is given to areas that have been cleared and de-stumped for mechanized farming. An additional payment of R\$ 262.20/hectare for Class A, R\$ 275.30/hectare for Class B and R\$ 209.75/hectare for Class C land has been agreed for land that has been cleared for agriculture, but not fully mechanized. No compensation is paid for annual crops, since it is envisaged that farmers will harvest their annual crops before they move.

Buildings and Other Structures. Compensation for housing and all other structures, such as toilets, barns, pigsties, garages, and fencing, is based on the removal cost, i.e. the cost of dismantling, transporting, and reconstructing the structure, including damage to materials. The values are taken from standardized tables that assign a value per square meter, according to the type and condition of the structure. In practice, the removal values represent between 70 and 90 percent of the replacement cost, according to the condition of the building. This methodology gives values that are only slightly lower than replacement cost.

4. RESETTLEMENT

Case studies have been carried out to determine who has a right to resettlement benefits. The studies have been undertaken by a social worker from ECSA, who presents her findings to Enercan for review and approval. The results of the study are then reviewed by the relevant Municipal Commission of affected people. The Municipal Commissions have a first-hand knowledge of the affected families and can ask for a case to be reconsidered.

The options and criteria for the resettlement program were defined in the agreement of 18 January 2002. The resettlement program comprises the following options:

- Letter of credit, presently valued at R\$ 87,800 for a family of up to 3 adults
- Collective rural resettlement
- Resettlement in remaining areas

In addition, the agreement contemplates modified options for independent unmarried children over 18, and for people classified as “special cases” – that is vulnerable groups, such as the elderly, handicapped, chronically ill, or widows with young children.

Letter of Credit Enercan is presently providing a letter of credit of up to R\$ 87,800 for a family of up to 3 adults. This is a 44 percent increase on the amount estimated in March 2002 (R\$ 61,036), and is based on the survey of land prices carried out in November 2003. It represents the amount needed to acquire a viable holding of at least 17 ha, with the necessary basic infrastructure, within a 100 km radius of the affected municipalities. The value of the infrastructure is based on the cost of building a 54 m² house with two bedrooms and a 96 m² barn. It also includes the cost of digging and lining a well, and purchasing a motor pump. Larger families would be entitled to a higher value letter of credit to cover the cost of a larger house. A family of 6-7 people is entitled to R\$ 90,355 to cover the cost of a 63 m² house with 3 bedrooms while a family of 8 or more is entitled to R\$ 93,004 to cover the cost of a 72 m² house with 3 or 4 bedrooms.

In most cases the letters of credit are used to acquire established properties, with housing, barns and other productive infrastructure. The property owners who choose this option are paid an amount equivalent to the cost of moving their houses to the new site, and this is deducted from the value of the letter of credit. However, if this is less than the value of a standard 54m² house the letter of credit will include the full cost of the standard house. If a beneficiary acquires a plot without a house and barn – and does not have a house that can be moved to the site – he or she can use part of the letter of credit to build a new house.

Once an eligible owner or non-owner chooses this option, Enercan provides the letter of credit and the beneficiary has 60 days – which can be extended for a further 30 days, to find a suitable property within a maximum radius of 120 km. When the beneficiary finds a property, Enercan reviews it within 30 days to ensure it is economically viable, has no legal impediments, and is offered at an acceptable price. If the purchase is approved, Enercan or a party contracted by Enercan arranges transfer of the title deeds, pays for the property, and ensures it is inscribed in the property register.

If the beneficiary acquires an area without buildings, the letter of credit is issued for the value of the land, and the funds for construction of the house and other buildings are disbursed in three installments, with the beneficiary taking full responsibility for contracting and supervising the work. Before the first crops are planted, a single payment is made for lime for soil improvement. Enercan can also provide monthly maintenance payments to support the beneficiary and his or her family from the time of moving until the first harvest (up to 9 months). If the beneficiary acquires a suitable property for less than the full value of the letter of credit, Enercan may allow him or her to invest the outstanding amount in productive activities, such as the purchase of livestock or agricultural equipment. Finally, the addendum to the January 2002 agreement envisages that all beneficiaries of letters of credit will receive an additional

R\$ 1,500 from a fund for agricultural production, since they are not eligible for the agricultural development fund managed by MAB.

No provision is made for the construction of access roads or connection to the electricity supply. Families opting for a letter of credit are fully responsible for the choice of a new property and will have to make sure these services are available or negotiate installation of these services with the municipality.

People that choose this option will have to repay the value of the letter of credit. Non-owners who are not eligible for compensation technically will have to repay the full value. Owners have the value of their compensation for land and other assets discounted from the total, and must repay the amount outstanding. The beneficiaries have 3 years grace, and then have to pay 10 annual installments, calculated as 20 percent of their estimated net annual income, indexed to the market value of maize. If over 25 percent of the harvest is lost, the year's repayment will be condoned. If they wish they can repay in a shorter period, the minimum being 5 years, and will receive full title as soon as the debt is paid off.

Letter of Credit for "Special Cases." The procedures for obtaining a letter of credit are similar for those people classified as "special cases" – that is the elderly, widows with small children, the chronically sick and the handicapped. However, the letter of credit for "special cases" is less, but does not have to be repaid. At present a letter of credit for "special cases" is from R\$ 30,104 to R\$ 71,292 according to the size of the family and the amount of land required. This varies from a minimum holding of 3 ha, for elderly or handicapped people with little capacity to work the land, to 12 ha, which is the minimum viable holding for the region defined by INCRA. Although the letter of credit does not have to be repaid, property owners forgo compensation for their land, houses and other assets. The letter of credit for "special cases" can be used to acquire a house in town. The plot should be of at least the minimum size defined by local and State legislation, situated in an area classified as Zone C. The letter of credit can be used either for an existing house, or for a plot and construction of a house of the size described above. "Special cases" will receive one year's social assistance – preferably from a social worker attached to the municipality, since this is more likely to provide continuity.

Collective Rural Resettlement Collective rural resettlement is an option for groups of 10 or more families. The sites should be located less than 30 km from a municipal center, in one of the four affected municipalities or within 120 km of the affected municipalities. They must comprise at least 60 percent agricultural land, no more than 40 percent – including the legal reserve – having forest cover. The minimum plot size is 17 ha for a family of two adults and should be a viable holding. Larger families are entitled to larger plots, the size of which is determined by the family's labor force.

Families will be provided with housing: a house of 54 m² with 2 bedrooms for a family of up to 5 members, a house of 63 m² with 3 bedrooms for a family of 6-7, and a house of 72 m² with 3 or 4 bedrooms for families with 8 or more members. They will also receive a barn of 96 m², incorporating a hen house, pigsty, stables and storage space. Each plot will have road access, electricity, drinking water supply, and water for livestock. Enercan will ensure the collective resettlement site is connected to the electricity grid and the road network, with access all year round. Each collective resettlement will be provided with a community hall, a bowling court (*cancha de bocha*), a community barbecue, a church or church hall, a football field and a community warehouse, silo or productive facilities of similar value. Wherever possible, existing local schools will be extended and/or upgraded to take pupils from the collective resettlement. If this is not possible Enercan will provide a school at the site.

Unmarried adult children of affected landowners, who are 18 or over at the time the property is acquired, who are economically independent, and who were enumerated in the 1998 census or returned to live with their parents before 30 September 1999, are entitled to the minimum plot considered viable by INCRA. This is equivalent to 12 ha, of which 60 percent must be agricultural land. They are also entitled to a

house of 40m² with a single bedroom, and a barn of between 40 m² and 96 m². Unmarried adult children who choose this option are subject to a case study to ensure they are economically independent.

The families will receive monthly maintenance payments for up to 9 months, calculated as the maximum time they would have to wait between moving and their first harvest. Before planting they will receive lime for soil correction, and technical and social assistance for a period of 5 years. In addition, the addendum to the January 2002 agreement contemplates a payment of R\$ 1,000 for investment in agricultural inputs.

The repayment conditions for collective resettlement are the same as for the letter of credit, with 3 years grace and repayment over 10 years, at a level equivalent to 20 percent of the family's net income, indexed to the market value of maize. Landowners have the value of the compensation for their land, houses, and other assets discounted, and only have to repay the amount outstanding.

Enercan has acquired three areas for collective rural resettlement. The two largest collective rural resettlements are situated in the Municipality of Cerro Negro, some 25 km from Anita Garibaldi. The areas were approved by MAB, as the movement was to have been responsible for implementing the collective rural resettlement program. However, because of MAB's mismanagement of Campo Belo, a collective resettlement site for families affected by Machadinho in Anita Garibaldi, the families that will move to Cerro Negro I have formed their own association and have contracted an ex-member of MAB to help them organize the construction of the houses and community infrastructure. The Campos Novos site is situated close to the reservoir area and will be used to settle non-owners from the surrounding area.

Small-scale Collective Resettlement. This is an option for groups of 4-9 families. The size of the plots and houses are the same as in the other collective resettlements, and each plot will have road access, electricity, drinking water supply, and water for livestock. Enercan will ensure the site is connected to the electricity grid and road network – with access guaranteed throughout the year. The families will receive maintenance payments until the first harvest, and technical assistance for 2 years. However, they will not be entitled to any community infrastructure and will have to use the facilities that exist in the locality. This is an interesting option as it allows extended families to stay together. There is also greater availability of properties in the 100-200 ha range suitable for this type of resettlement. Enercan has acquired three areas for small-scale collective rural resettlement.

Enercan has acquired three areas for small-scale collective resettlement. The first, in Curitibanos, was acquired for two single men and two families, plus an elderly man, regarded as a “special case” who will continue to live with his son. San Pedro I, in Celso Ramos, comprises three plots: one of 62 ha, one of 4 ha and a remaining area of 1.8 ha. The area will be occupied by 2 single men, 3 other families, and the daughter of one of the beneficiaries, who is considered a “special case”. The access roads have been built and 4 houses have nearly been completed; another beneficiary will continue living in his present house in Celso Ramos and the last will stay in his original house, which will be repaired, but his barn will be moved to the new plot. The negotiations for San Pedro II were completed in February 2004.

Resettlement in Remaining Areas. There are two ways in which the remaining area of properties acquired by Enercan can be used for resettlement: exchange and reorganized to create viable new units.

Exchange Exchange is the direct exchange of the affected area of one property for the remaining area of another (*permuta*), normally situated next to, or near the first property. This is an appropriate option for partially-affected landowners whose properties are either not fully affected, or who have forgone the right to resettlement or compensation for the whole of their property. They would be given first priority, since the objective is to reorganize an affected property as an economically viable unit. The exchange is based on equivalence of values, which will be assessed using the same valuation methodology applied to all

other properties acquired by Enercan. If the affected area of the first property is worth more than the remaining area that replaces it, Enercan will pay the difference. Enercan has agreed that if the affected area is worth less than the remaining area, the neighbor that acquires the property will be able to repay the difference on the same terms as a letter of credit. This would be repayment over 10 years, with 3 years grace, repayments being indexed to the market price of maize. Enercan will pay the transfer and registration fees.

Reorganized Remaining Areas. The remaining areas of affected properties can also be reorganized to create viable new units. These will be used first for the resettlement of families classified as “special cases” and secondly for resettlement of other eligible families. Valuation, the size of plots and houses and terms and conditions for payment are the same as with a letter of credit, including the considerations for special cases. During the first year the families will receive help with soil preparation – if necessary including the removal of vegetation and tree stumps, and will be given lime for soil correction. They can also receive maintenance payments to help them manage until the first harvest. Enercan will not provide technical assistance, but will solicit two years’ agricultural extension from the agencies working in the area. “Special cases” will be entitled to one year’s social assistance.

As of 31 January 2004, a total of 560 people had requested resettlement. They included 94 landowners and 466 non-owners. All of landowners have had their cases reviewed: 42 have been accepted as eligible and 52 have been rejected – some because they acquired their plots after the 1998 census. A total of 466 non-owners have had their cases reviewed: 141 have been accepted as eligible and 271 have been rejected. A total of 56 cases (6 landowners and 50 non-owners) are being reviewed; they have not been accepted by Enercan, but have not been rejected by the Municipal Commissions. A further 12 case studies still have to be carried out. Each of the case studies has been carefully documented, using evidence from local tax records, school registers, birth certificates, and so on.

5. SOCIAL COMMUNICATION PROGRAM

It was initially assumed that the discussions with the Municipal Councils and the Negotiating Council would ensure that all the affected families understood the criteria, procedures and options for compensation and resettlement. However, at the time of the original due-diligence it was apparent that many affected families had little or no idea of what they were entitled to, how benefits were assessed or what options were available to them. In many cases – and this was particularly true of the elderly, and more vulnerable families – they also needed help to think through the implications of the various options.

On the advice of the Consultants, Enercan agreed to establish a social communication program, with additional staff based in the field office in Campos Novos. An agronomist, who had previously worked in Itá, was contracted in December 2002 and has been carrying out house visits to explain the compensation and resettlement programs. This activity needs to continue, in close coordination with ECSA and the rest of Enercan’s field team, and should be supported by the social assistant contracted to manage the monitoring system.

6. TIMING AND COSTS

Enercan is paying the legal costs relating to the transfer, and if necessary the regularization of the title deeds to the affected properties, plus an additional 4 percent of the value of the land and improvements to cover the legal expenses of acquiring a new property. The January 2002 agreement states that Enercan will negotiate directly with the affected landowners, and not through intermediaries, (i.e. lawyers, real estate agents, or local politicians). All owners that negotiate amicably, without recourse to the courts or

to intermediaries, are entitled to an additional payment, equivalent to 5 percent of the value of their unimproved land (*terra nua*). Compensation is paid within 30 days of concluding negotiations. Once payment has been made, the landowner has 8 months to harvest the annual crops, remove his or her property – including personal effects, livestock and buildings – and to fell and transport any timber that has not been transferred to Enercan. Payment is made to the legal owner of the property, as shown in the title documents. If the owner is married or living in a common-law union, payment is made in the presence of the owner's spouse.

The total budget for resettlement, compensation, and the replacement of infrastructure is now just under US\$ 18 million at February 2004 prices. This includes over US\$ 6 million for compensation, and over US\$ 7 million for resettlement, US\$ 3.5 million for the replacement of infrastructure, and just over US\$ 40,000 for mitigating the indirect impacts on the affected municipalities.

7. MONITORING

Enercan is setting up a monitoring system to track the situation of each sub-program in the resettlement plan. In January 2004 the company contracted a social assistant, who will be responsible for managing the system, which should generate the quantitative information required for reporting to the Bank. The monitoring system comes under the responsibility of the Manager of the environmental and resettlement programs, and is shared between Enercan and ECSA. The starting-point is a database that combines the information from the 1998 socio-economic survey with the cadaster of affected properties prepared by Engefoto and the surveys and valuations carried out by ECSA. This defines the universe of affected families and properties, and can be updated to include any additional families or properties eligible for compensation or resettlement – for instance, families affected by loss of access or isolation.

8. EVALUATION

Enercan is negotiating the contract for a study called *Monitorização da População Rural Relocada* with Batistello Consultoria. The Terms of Reference are based on similar studies carried out in Itá and Cana Brava, the study being a periodic evaluation rather than an on-going monitoring system. The study will help Enercan assess the impact of the compensation and resettlement programs. It will start with information from Enercan's database of affected families (owners and non-owners), along with additional information from a comprehensive survey that will cover all affected households. This will provide a baseline against which the results of the mid-term and final survey can be compared.

The objective of the evaluation is to ensure that the affected families have been able to improve or at least recover their standard of living within a reasonable period of time. It will follow the use of compensation, distinguishing different categories of affected landowners: those that received compensation for the whole of their properties, those that chose a resettlement option, and those that were only compensated for the directly affected areas of their properties. It will also follow the families that have chosen the different resettlement options.

Figure 4.1.
Location of Water Quality Monitoring Stations in the Hydrographic Basin of the Campos Novos Project

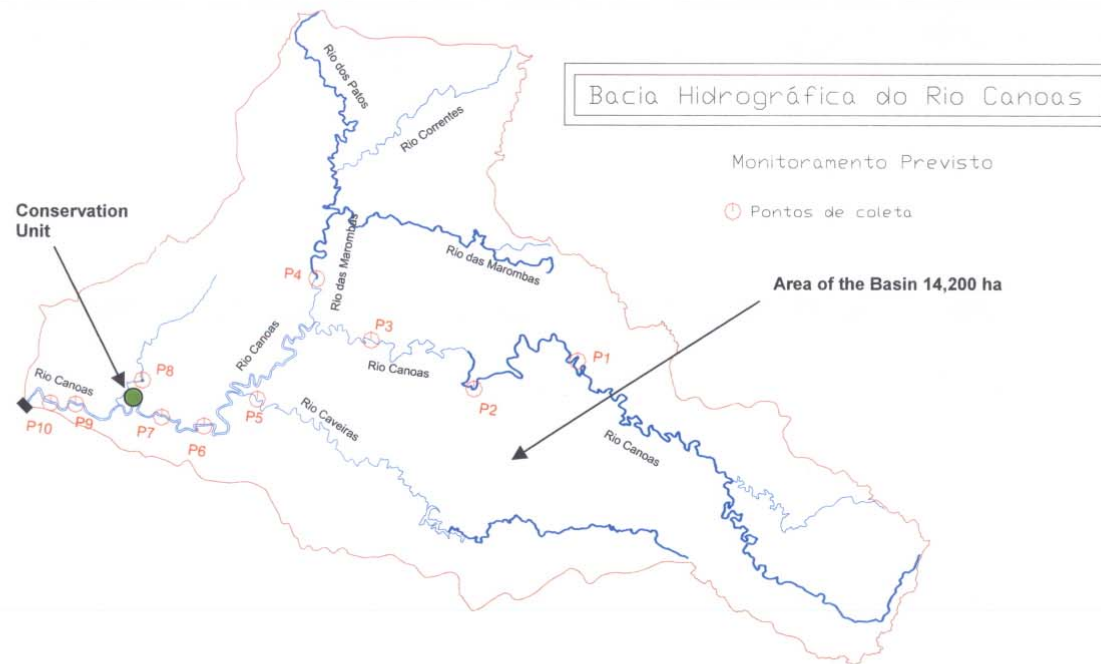
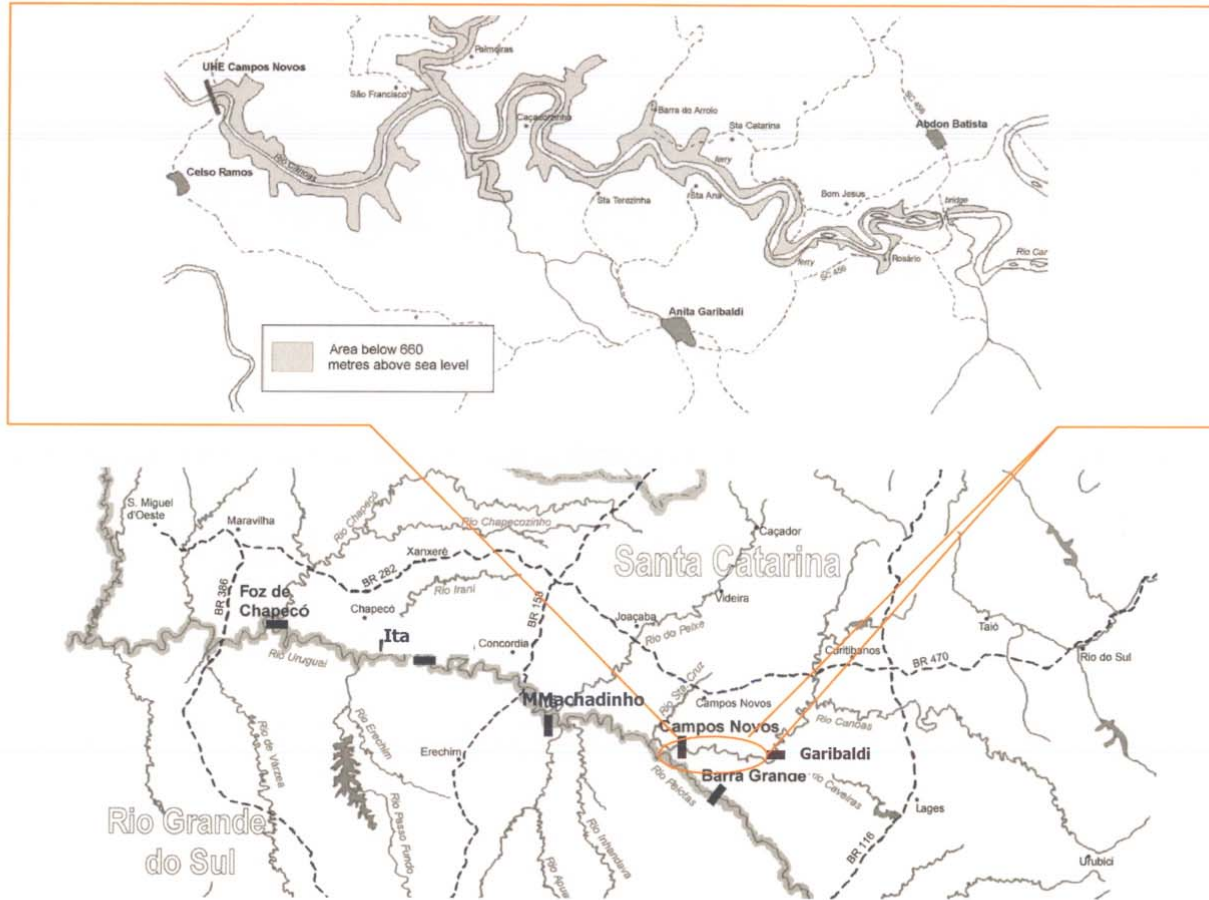
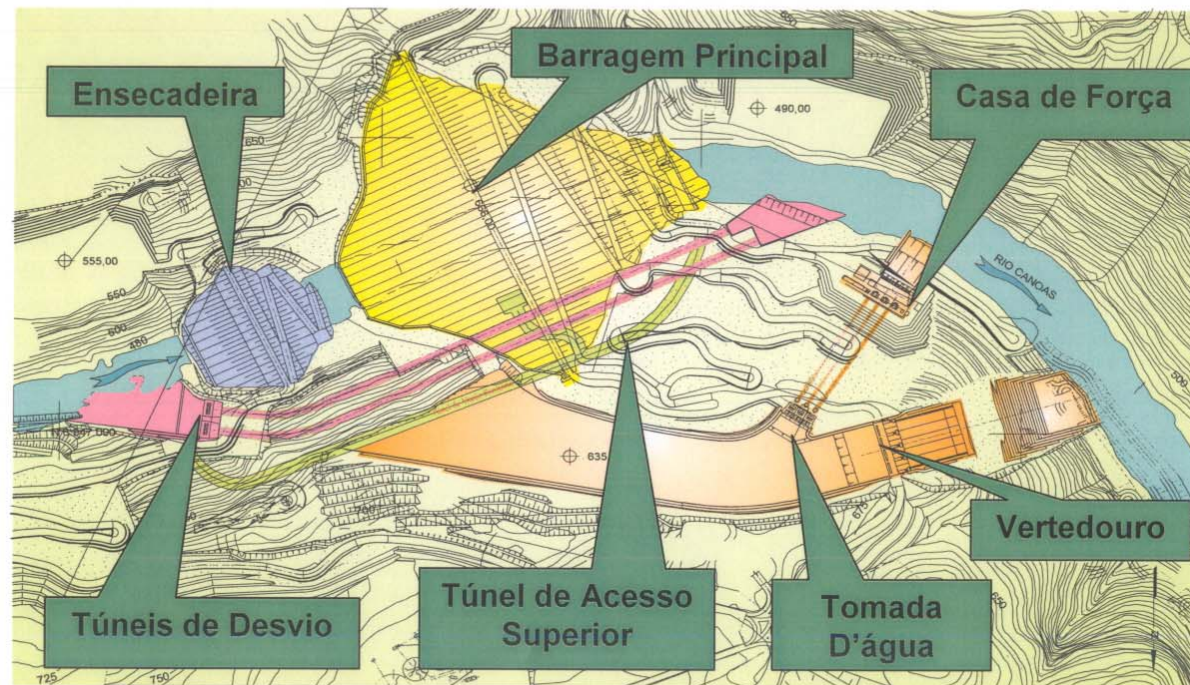


Figure 2.2
Area of the Campos Novos Reservoir and its location within other hydropower projects in the region



Campos Novos Hydropower Project General Layout

Figure 2.3



Usina Hidrelétrica
CAMPOS NOVOS

Figure 2.4
Project Transmission Line Right-of-Way



Figure 4.1.
Location of Water Quality Monitoring Stations in the Hydrographic Basin of the Campos Novos Project

