from which their cooperation is expected, it can be mentioned Ministry of Development (MINDES), Ministerial Department of Highways (DGC) of the Ministry of Communications, Transport, and Public Works (MCTOP), Executing Unit of the Program of Rural Aqueducts (UNEPAR).

As a consequence, it is proposed the creation of the "General Office of the Integrated Rural and Agricultural and Livestock Development Project in Jutiapa" under the jurisdiction of the Sectorial Unit of Agricultural and Livestock and Nutrition Planning (USPADA) from which the offices of the respective projects will depend on.

Considering the fact that it is necessary to coordinate with other ministries and institutes as well as with international organizations, the general office will be installed in USPADA in Guatemala City. The respective offices of the project will be installed in the site of the project within the Department of Jutiapa.

6.5.2 Operation and Maintenance Program

(1) High public interest projects

The operation and maintenance task of the high public interest projects (research, extension, education and public works) whose main objective is to supply new facilities, equipments and materials within the existing areas, will be in charge of the public organizations. With the exception of the Breeding and Reproduction Centers, which are expected to generate an income coming from reproduction fees, the operation and maintenance expenditures will be financed within the government's budget. The projects covered in this item are as follows:

	Project	Executing agency	Related Organization
1.	Strengthening of agricultural production, extension and education	ICTA in Jutiapa	DIGESA DIGESEPE DIGEBOS
2.	Strengthening of animal health	Office of DIGESEPE, Region IV/Cattle disease diagnosis center	DIGESEPE
3.	Breeding and reproduction improvement	Office of DIGESEPE, Region IV	DIGESEPE
4.	Soils conservation	Office of DIGESEPE, Region IV	DIGESEPE DIGEBOS
5.	Forestal fires prevention	Office of DIGEBOS, Region IV	ICTA

(2) Irrigation projects

One part of the operation and maintenance expenditures of the state operated irrigation unit is at present financed by the government; DIGESA is the institution responsible for operation and maintenance of the state operated irrigation facilities and the water users pay as water charge one part of those expenditures. It is a government's policy that the tasks related to the operation and maintenance of the state operated irrigation units are to be performed by the water users in the future and, in accordance with this, it is proposed in the present Master Plan that the operation and maintenance of the irrigation projects are to be carried out by the water users under the technical assistance and supervision of DIRYA and DIGESA.

(3) Integrated rural development projects

The integrated rural development projects include sub-projects whose beneficiaries are clearly specified (irrigation, vegetables commercialization center, water supply, community center, etc.); within these projects, different governmental organizations will participate. In order to carry out the projects in an efficient and timely way, a general office for the project within the community center will be contemplated as a component of the sub-project. In this office the staff in charge of each project will be assigned. The organization chart of the general office of the project is shown in Chapter 7.

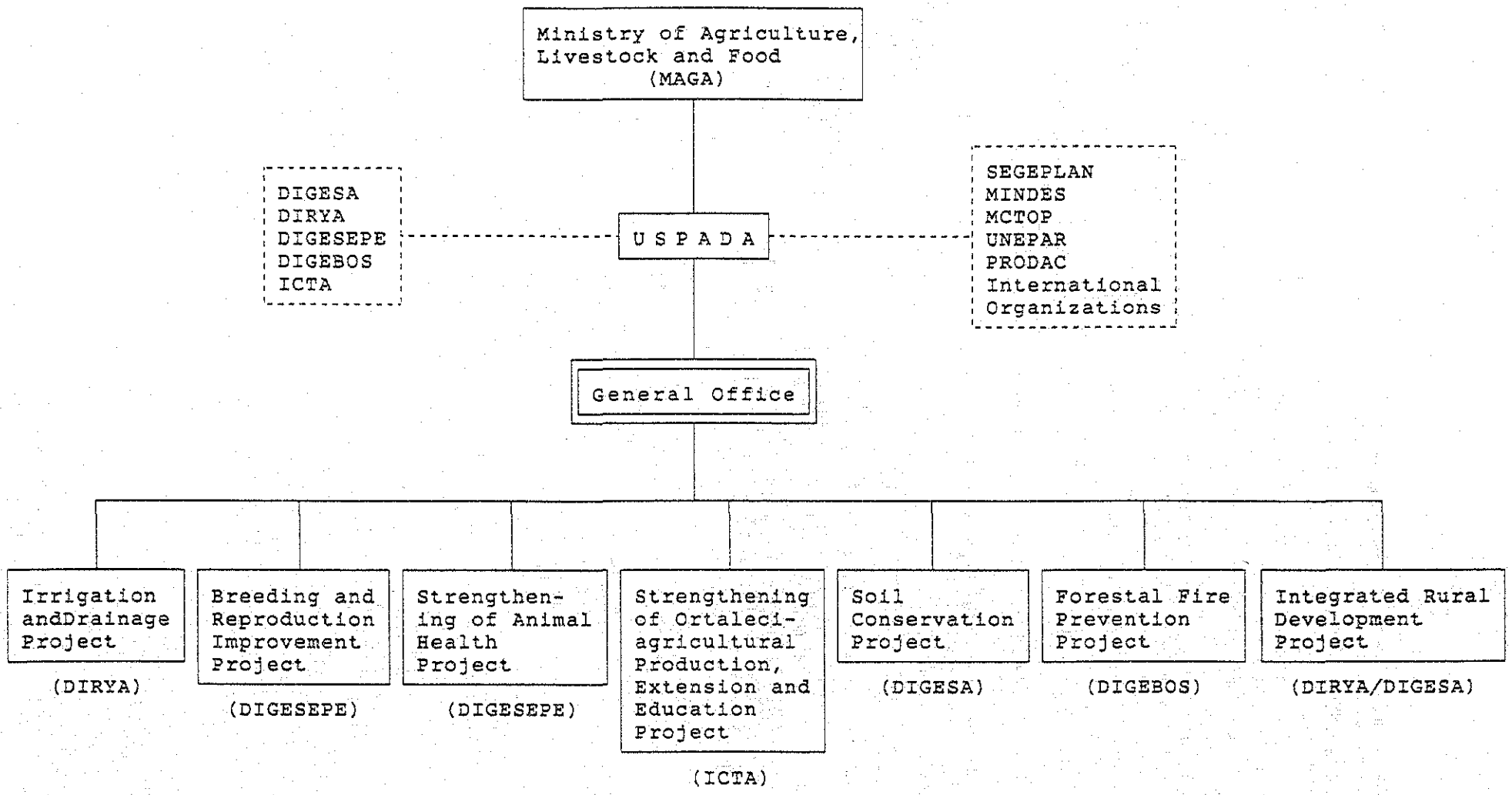


FIGURE 6.5.1 ORGANIZATION CHART FOR THE EXECUTION OF THE MASTER PLAN PROJECT

6.6 PROJECT EVALUATION

Due to disadvantageous physical conditions, the agricultural and livestock activities have been carried out in an extensive way with the exception of cattle raising activities of the big scale farmers in the coastal plains and coffee cultivation in the mountainous zone. Under these circumstances, the present Master Plan has as an objective improve the agricultural and livestock productivity of the small and medium scale farmers who cultivate less productive lands, and raise their life conditions.

In order to fulfill the goal above mentioned, within the components of the projects of the Master Plan the following items.

The industrial sector of the Department of Jutiapa is underdeveloped with the exception of the rice industry. The success of crops diversification and the increase in exports will contribute to the industrialization of the country and, at the same time, to the correction of the income gap existing between the big scale farmers and small and medium scale farmers.

6.6.1 Methodology of the Quantitative Evaluation

The evaluation of the present Master Plan was carried out according to the methodology used by the world Bank and the parameters used by DIRYA. The monetary unit utilized was the quetzales.

6.6.2 Economic and Financial Evaluation

The present Master Plan contemplates 12 projects of 7 sub-sectors. Total requested investment was estimated and the expected benefits coming from the increment in the agricultural and livestock production was calculated for 6 projects of 2 sub-sectors. Based on these data, the financial internal rate of return (FIRR) obtained by the Master Plan is 12.3%. The investment for the projects will be disbursed in 10 years from the beginning of the Master Plan and the benefits will be generated in a 26-years period from the 5th until the 30th year. Due to the fact that:

1. Economic prices for the producer are higher than the market prices; and

2. Economic costs for operation and maintenance are higher than the market costs,

the Economic Internal Rate of Return (EIRR) is always higher than the FIRR.,

The FIRR obtained based on the direct benefits to be obtained by the increase of the agricultural and livestock production corresponding to 70.1% of total investment for the

projects is almost equal to the opportunity cost of capital in Guatemala (12%), it can be said that the projects of the present Master Plan are highly profitable. In fact, it is shown that with the benefits of 4 projects of the irrigation and drainage sub-sector and 2 projects of the integrated rural development sub-sector, all projects of the Master Plan can be implemented achieving a financial feasibility. Financially, one portion of the benefits are distributed to the executing agencies under the form of water fees and to the central government as a tax on income coming from the agricultural and livestock production.

6.6.3 Social Evaluation

The projects whose benefits are not quantitatively calculated, are justified according to their social impact. For this reason, four irrigation and drainage projects and two integrated rural development projects are not dealt with hereon as their benefits have been already quantitatively estimated.

The remaining total investment (total investment minus the investment for the six projects above mentioned) is distributed in the following way:

1) Strengthening of agricultural production, extension, and education project (5.7%)

2) Strengthening of animal health (3.0%)

3) *Breeding and reproduction improvement project* (9.9%)

4) Comapa integrated rural development project (4.9%)

5) Soils conservation project (3.6%)

6) Forestal fire prevention project (2.7%)

The scope of the coverage of the projects except numeral 4) covers the whole surface of the Department. Numeral 2) is profitable expecting revenues coming from the beneficiaries and the operation and maintenance expenditures will be covered by those revenues. Also, contemplating the introduction of other type of cattle besides the bovine one (meaning swine and goats), the project will contribute to raising the income level of the small and medium scale farmers, as well as improving the nutritional situation of the family members of the farmers households.

The project of numeral 1) aims to strengthen the required human resources for the achievement of the agricultural and livestock development and also becomes an indispensable component of the present Master Plan, while the project of numeral 4) aims to correct the socioeconomic disparity among the subregions of the Department through the equipment of the social infrastructures and the conditioning of the agriculture for self-

consumption production purposes.

The project of soils conservation is closely related to the agricultural and livestock production concerning recovery and conservation of the productive capability of the soils. It is also related to the reforestation for production of firewood. In this sense, the execution of the present project will engage the improvement of the production and rural life conditions environment of the small scale farmers, and this improvement, at the same time, will mean an improvement of the welfare of women and children.

The active participation of women in the socioeconomic activity will not be possible without the execution of the above mentioned projects.

6.6.4 Environmental Impacts

(1) Environmental considerations

When considering a self-sustained development, it is important to pay an adequate attention to the environment when executing the projects. The existing relationship among the execution stages of the projects and the considerations on environmental impacts are as follows:

a. Identification (search and formulation) of the project
b. Preparatory Study
   - Environmental preliminary study
c. Study for the Master Plan
   - Study on the initial environmental assessment
d. Feasibility Study
   - Study on the estimation of the environmental impact
e. Elaboration of the Implementation Plan of the Project (including the detailed design)
   - Detailed plan for environmental conservation measures
f. Execution of the Project
   - Implementation of the measures for environmental conservation and preparation of the environmental operative plan
g. Operation of the Project
h. Monitoring and Evaluation of the Project
   - Environmental monitoring

(2) Point of View of the Environmental Impact Evaluation

The evaluation of the environmental impact helps to prognosticate and evaluate the environmental and socioeconomic impacts caused by the execution of the development projects. The impacts on the environment caused by the execution of the project are divided in two parts. One is the negative impact in the short term which is perceived at the moment of the execution of the project. In this case, it is important to consider the environment

in such a way to compatibilize the development activities and the conservation of the environment. Another is an irreversible positive or negative impact in the long run which is perceived after finishing the project. This directly contributes to the conservation and improvement of the environment, or may exert a dangerous influence on the environment.

The agricultural and livestock development, from multiple aspects, in its execution, has an effect on the improvement of the environment, in general; it can be said that its effect is to preserve and improve the actual condition of the environment, and there are few elements which degrade the environment. Specially, this Integrated Rural and Agricultural and Livestock Development Project does not have activities which would mean a great modification of the lands, like a dam construction, and it is forecasted that it will have a slight effect on the environment. On the other hand, this Integrated Project has project for the conservation and improvement of the environment such as project for strengthening animal health, soils conservation, forestal fire prevention, etc., and it is prognosticated that the surrounding environment will be even more improved with the execution of the project.

(3) Actual Situation of Environmental Problems

The natural environment of the Department of Jutiapa is already destroyed in most of its territory, and the slight and valuable environment subsists only in small limited areas. The main environmental problems in the Department area as follows: a) deforestation; b) erosion; and c) diverse contaminations; specially the first two ones are exerting a great influence on the agricultural and livestock production.

(4) Environmental Impacts Caused by the Execution of the Project

The prevention of the environmental impacts caused by the execution of the project is shown in a qualitative matrix from the point of view of the initial assessment of the environment.

Summaries of the environmental components considered as the most important are shown below:

Flora:
The vegetation carpet in the Department is very small and the flora is poor. With the execution of the project the existing forests will be preserved. Specially, the mountainous and mangrove wet forests which are important from the point of view of the biodiversity, will be protected as reserve forests, and the growth condition of

the natural vegetation will be improved.

Forests:
With the execution of the forestal fire prevention project, the frequency of the forestal fires will decrease, the burned surface will be reduced and the deforestation process will be slowed. Also, due to the promotion of the reforestation of water resources, energy-source forests, agroforests, etc., the forestal surface will be recovered and increased.

Fauna:
The fauna of the Department is already destroyed and is very poor, and valuable species can not ne found anymore. Because the forestal surface will be increased with the execution of the project, the life conditions for the wildlife will be suitable and improved.

Land Utilization and Soils Erosion:
The development projects with large extensions within the Master Plan are the irrigation and drainage projects which aim to improve the existing agricultural lands due to the improvement and introduction of new irrigation and drainage infrastructures. In the actual lands utilization, the area being used for agricultural and livestock purposes is greater than the suitable lands; with the execution of the project, due to the improvement and incorporation of lands which were formerly unsuitable for agricultural and livestock purposes, the suitable land extension will be improved. Also, with the execution of the project for soils conservation, the erosion of the soils and sedimentation of the rivers will be decreased.

Contamination:
The contamination of the soils, water, and agricultural and livestock products due to the use of agrochemicals will be slowed or improved with the implementation of the projects for strengthening od the agricultural and livestock technological transfer and environmental education. Also, with the execution of the integrated rural development projects, due to the stable supply of water with the improvement of water supply infrastructure, the diseases caused by drinking contaminated water will be decreased.

(5) Environmental Conservation Measures

As mentioned before, due to the execution of the present Integrated Rural and Agricultural and Livestock Development Project in Jutiapa, the environment of the Department will be greatly improved. However, when implementing the projects, the possible impacts on the project areas are taken into account, together with the natural conditions surrounding the projects and the socioeconomic environment, When each project is executed, a more detailed study must

be carried out. It is necessary to assess beforehand as best as possible, the possible effects of the implementation of the projects and to find possible countermeasures.

Specially, as the irrigation and drainage projects mean a lot of civil engineering works, in the design of the main infrastructures must be considered in such a way as not to affect as much as possible the characteristics and distribution of the soils; also, the construction method should not allow the apparition of water and soil contamination, noise and vibrations. When executing the projects, the works must be managed in an adequate way and it will be necessary to establish a monitoring system for any possible environmental mutation.

MATRIX OF ENVIRONMENTAL IMPACTS
(Impacts caused to the environment by the projects)

Development Projects lo	A	B	C	D	E	F	G
I. Natural Environment							
1. Soils							
a. Topography and Geology	*	*	*	-	+	+	-
b. Soil	*	*	*	+	++	+	+
c. Erosion and Sedimentation	*	*	*	+	++	++	+
2. Waters							
a. Rivers and Lakes	*	*	*	-	+	++	-
b. Underground Waters	*	*	*	*	+	+	-
c. Coast and Sea	*	*	*	*	+	+	*
3. Micro-climate	*	*	*	+	+	++	+
4. Ecosystem							
a. Flora							
- Natural Vegetation	*	*	*	+	+	++	+
- Crops	++	*	*	++	++	+	++
b. Fauna							
- Mammals and Birds	*	+	+	-	+	++	-
- Fish and Aquatic Insects	*	*	*	-	++	+	-
c. Biodiversity	*	*	*	-	+	++	-
5. Landscape	*	*	*	-	-	++	-
II. Socioeconomic Environment							
1. Land Utilization	+	+	+	++	++	+	++
2. Productive Activities							
a. Agriculture	++	*	*	++	++	+	++
b. Livestock	*	++	++	+	+	+	++
c. Fisheries	*	*	*	-	+	+	++
d. Agroindustry	+	+	+	+	*	*	+
e. Marketing and Commerce	+	++	+	+	+	*	++
3. Life and Culture							
a. Health and Sanity	*	+	+	+	+	*	++
b. Facility	*	*	*	+	*	*	++
c. Employment	*	*	*	++	+	*	++
d. Poverty	*	*	+	++	+	*	++
e. Transport	*	*	*	-	*	+	-
f. Energy	+	*	*	*	*	++	+
g. Tourism	*	*	+	+	*	*	+
h. Rural Society and Culture	*	*	*	*	*	+	++
i. History and Archeology	*	*	*	*	*	*	*
j. Tourism	*	*	*	*	*	+	*
III. Environmental Problems							
1. Air contamination	*	*	*	*	*	++	*
2. Water contamination	*	*	*	-	++	+	-
3. Soils contamination	*	*	*	-	*	*	-
4. Noise and vibration	*	-	*	--	*	*	—
5. Land sinking	*	*	*	*	*	*	*
6. Bad odor	*	+	+	*	*	+	*

Note: ++ Big positive impact, + Small negative impact
* No influence
- Small negative impact, -- Big negative impact

Development projects:
A: Strengthening of Agricultural Production, Extension and Education
B: Strengthening of Animal Health
C: Cattle Breeding and Improvement Center
D: Irrigation and Drainage
E: Soils Conservation
F: Prevention of Forestal Fires
G: Integrated Rural Development

CHAPTER 7

PRIORITIZED PROJECTS

CHAPTER 7 PRIORITIZED PROJECTS

7.1 SELECTION OF PRIORITIZED PROJECTS

The projects belonging to the Master Plan for the Integrated Rural and Agricultural and Livestock Development Project consist of the sectorial projects formulated within each subsector and the projects integrating the subprojects of each subsector in each municipality (district). It is possible that the sectorial projects independently executed may have a huge impact on the agricultural and livestock development of the Department of Jutiapa, but in order to improve the socioeconomic conditions of a zone it would be better to execute those projects at the same time as the projects of other subsectors as benefits would be greater. On the other hand, integrated rural development projects have been formulated in such a way as to satisfy the objectives of each subsector and assure that the global impact of the Project will be the highest.

The integrated rural development projects included in the Master Plan are located in Santa Catarina Mita and Montúfar (projects focusing the development of the agricultural and livestock infrastructure) and Comapa (project focusing the improvement of the rural socioeconomic conditions). These three communities represent the physical and socioeconomic characteristics of the Department. The first projects cover the equipment of the irrigation and drainage system as the center of its components (sub-projects), and also the expansion of the production of basic grains, increment of the vegetables production and improvement of the commercialization infrastructure, and arrangement of the social infrastructure (farm roads and drinkable water supply); on the other hand, the second type of project, carried out in Comapa which is considered one of the most underdeveloped zones in the Department of Jutiapa from the socioeconomic point of view and where there are not water facilities for irrigation, aims mainly towards arrangement of farm roads and water supply to the rural zone and the construction of a pond for complementary water supply for irrigation and cattle watering.

Taking into account the problems faced by the agricultural and livestock sector, it is advisable to recommend the granting of the highest execution priority to those projects which generate benefits as soon as possible. In accordance with this criteria the integrated rural development projects of Santa Catarina Mita and Montúfar have been identified as projects with the highest priority . These project generate benefits coming from the increment of the agricultural and livestock production and its collateral effects on exports expansion, food supply stability, raising of the income level of the farmers, etc., and at the same time contribute to the improvement of the rural life.

On the other hand, when selecting the projects with the highest priority, not only their economic feasibility was taken into consideration but also the fact of an harmonious development of the Department as a whole. The two zones of the selected projects represent the two specific topographies of the Department -the mountainous zone and the plains and are located within the two hydrographic basins. Thus, implementation of these two projects will become a development model for zones with similar conditions.

7.2 SANTA CATARINA MITA INTEGRATED RURAL DEVELOPMENT PROJECT

7.2.1 Project Background

The Santa Catarina Mita zone is located on the northeastern part of the Suchitán Mount and is the agricultural center of the northern section of the Department and, at the same time, is the main leather industry center. Within the Project zone there is a state operated irrigation unit which captures the waters from the Ostúa river through pumps, but there is the danger that those pumps will deteriorate due to the occurrence avalanches as they are located in the river bed. At the state operated irrigation unit vegetables are grown during the dry season, but outside this zones, agricultural activities become stagnant due to their dependence on traditional practices. Also, in the dwellings of the highlands located on the departmental highway which joins the head municipalities of El Progreso and Santa Catarina Mita, the arrangement of the rural water canal is quite inadequate and water for human consumption depends on public wells located in Horcones; those waters are contaminated and the hygienic conditions of the zone are not good.

7.2.2 Project Profile

The present Project tries to improve the agricultural productivity and achieve better life conditions for the farmers by the integrated rural development project which combines rural roads works and supply of drinkable water besides its connection with the irrigation system. In Fig. 7.2.1 the general plan for the Project is shown.

(1) Land utilization

Land utilization is shown how is being carried out at present and how it would be carried out in the case of implementation of the Project.

(Unit: ha)

Utilization	Actual	With Project
Lands with transitory crops (with irrigation)	50	190
Lands with transitory crops (without irrigation)	110	0
Fruit trees	0	10
Pastures (with irrigation)	0	40
Pastures (without irrigation)	60	0
Bushes and without use	40	0
Others (urban zone, roads, canals, etc.)	40	60
Total	300	300

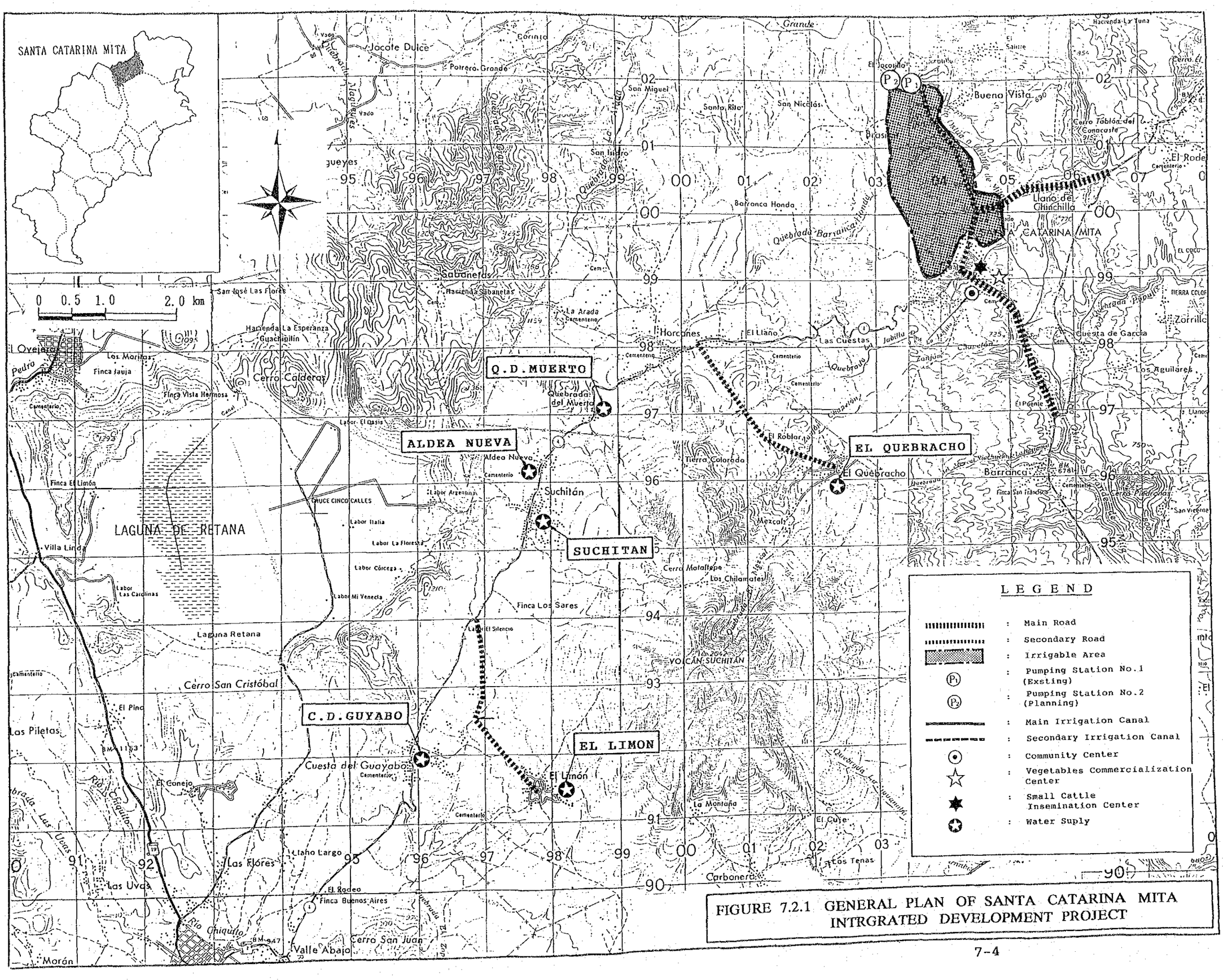


FIGURE 7.2.1 GENERAL PLAN OF SANTA CATARINA MITA INTRGRATED DEVELOPMENT PROJECT

(2) Agricultural production

With irrigation, the cultivated surface during the dry season will be increased and the production of tomato and onion during the dry season will be also increased.

Crops	Actual			With Project		
	Area (ha)	Yield (t/ha)	Produc. (t)	Area (ha)	Yield (t/ha)	Produc. (t)
Corn	110	2.0	220	110	3.9	429
Corn (for seeds)	-	-	-	20	3.0	60
Sorghum	50	1.8	90	-	-	-
Kidney beans	50	0.7	35	50	1.9	95
Tomato	25	15.0	375	140	20.0	2,800
Onion	25	10.2	255	80	17.0	1,360
Mango	-	-	-	10	30.0	300
Pasture	60	-	-	40	6.5	260
Total	320		975	450		5,304

(3) Irrigation system

The irrigable area will be 300 ha on the right bank of the Ostúa river, including the existing state operated irrigation unit. Based on the existing facilities, planning has been done in the following way:

1) Pumping station No.1 (existing)

The existing state operated pumping station will be denominated as Pumping Station No.1 in the present Master Plan. Except for the head race where a section will be enlarged, the existing facilities will be used. Also, because the installation position of the existing pump is low, a monitoring system will be established in order to prevent damages by dismounting the engine in case of a landslide.

Irrigable area:	100 ha
Benefitted families:	36 farms
Designed pumping flow:	0.100 m^3/sec
Pumping charge:	20 m
Pump type:	Double-suction centrifugal pump
Number of pumps:	2 units

2) Pumping station No.2 (new facility)

Pumping Station No.2 will be a new facility installed on the right bank of the Ostúa river, 250 m upstream from Pumping Station No.1. To achieve a higher efficiency when operating the pumps and to try to coordinate the operations of Pumping Stations No.1 and 2, the 2-stages pumping system will be adopted to feed the discharge tank of Pumping Station No.1.

Irrigable area:	200 ha
Benefitted families:	75 farms
Designed pumping flow:	0.207 m^3/sec
Pumping charge:	25 m
Pump type:	Submersible airlift pump
Number of pumps:	4 units

Second-stage pump

Designed pumping flow:	0.130 m^3/sec
Pumping charge:	25 m
Pump type:	Simple-suction centrifugal pump
Number of pumps:	1 unit
Branched canal length:	3,000 m
Side canal length:	2,000 m

(4) Farm roads

The following farm roads will be improved in order to facilitate transportation and distribution of agricultural products and inputs, avoid damage of the products during their transport and promote construction of the drinkable water supply sub-project.

Stretch	Length (km)	Width (m)	Remarks
S. Catarina Mita - El Puente	2.8	6.0	Trunk farm road
S. Catarina Mita - Río Ostúa	3.0	4.0	Lateral farm road
Río Ostúa - Carr. Depart. 4	1.8	4.0	"
Horcones - El Quebracho	3.0	4.0	"
El Silencio - El Limón	3.0	4.0	"
Total	13.6		

(5) Drinkable water supply

Simple facilities for pumping underground waters is being planned for the following 6 dwellings where domestic water supply is very difficult during the dry season.

Towns or villages	Projected population (year 2003)	Projected flow (m^3/day)	Distribution tank (m^3)	Public faucets (places)
Suchitán	2,483	200	80	40
C.D. Guayabo	1,811	150	60	30
El Quebracho	1,803	150	60	30
El Limón	1,531	130	50	25
Aldea Nueva	460	40	15	10
Q.D. Muerto	235	20	8	10
Total	8,323	690	273	145

(6) Vegetables Commercialization Center

With irrigation it is expected an increase in the production of vegetables (3,600 ton of tomato, 1,400 ton of onion). In Santa Catarina Mita a Vegetables Commercialization Center will be installed for an efficient handling and dispatch of vegetables to the consumption centers.

Management of the facilities will be in charge of the producers cooperative.

Plot surface:	70 m	x 100 m	=	7,000 m2
Reception and classification of products:	200 m^2	x 2	=	400 m^2
Storage:	450 m^2	x 2	=	900 m^2

(7) **Small Cattle Insemination Center**

With the purpose of achieving a joint exploitation of small and medium farmers, a insemination center for swine and goats will be installed in Santa Catarina Mita. The quantity of cattle to be raised will be 5 heads of male breeder swine and 10 heads of goats and at the same time the breeding place will be built.

(8) **Community Center**

The Community Center for social intercourse of the regional population and as a place for the education of the population will be constituted by the offices of the Agricultural Producers Association, leather Goods Producers Association, Drinkable Water Supply Commission, and by the meeting saloons for the education of the population. The location will be the municipality head of Santa Catarina Mita, During the execution of the Project, the center will be used as the Project Office and after finishing the construction works, it will be used as an administrative office. The dimensions of the facilities will be as follows:

Plot surface:	720 m^2
Constructed surface:	200 m^2 for offices, 100 m^2 for meeting saloons, 50 m^2 for warehouse

7.2.3 Execution Program of the Project

The execution program is detailed in Fig.7.2.2.

7.2.4 Project Cost

Total cost of the Project including physical contingencies will be 24,292,000 quetzales (US$ 4,699 thousand). Cost breakdown and disbursement program is detailed in Table 7.2.1. Annual operation and maintenance cost of the Project is estimated to be around 1,026,000 quetzales (US$ 198 thousand).

7.2.5 Executing Agencies of the Project and Operation and Maintenance Program

(1) **Executing agencies of the Project**

The executing agencies of the Project will be DIRYA and DIGESA who will receive the collaboration of related organizations like MINDES, UNEPAR, etc. To facilitate a smooth and efficient execution of the Project, it is necessary to

install the Project Office with the participation of the related organizations.

The organization chart of the Project Office is shown in Fig. 7.2.3 and the staff will be selected among the staff of DIRYA, DIGESA, etc.

(2) Operation and maintenance plan

Operation and maintenance of the respective facilities of the Project will be carried out at the general office to be installed in the Community Center. Operation and maintenance expenses for the irrigation unit, drinkable water and the Small Cattle Insemination Center will be responsibility of the users and operation and maintenance of the facilities will be in charge of the autonomous organization of the users' association under the jurisdiction of the joint commission integrated by members of the public and private sectors. Operation and maintenance of farm roads will be transferred to the DGC. The organization chart of the Project Office is shown in Fig. 7.2.4.

Concepts	Item	1st Year	2nd Year	3rd Year	4th Year	5th Year
1. Design and Tender		■■■■■				
2. Civil Works						
2.1 Irrigation	Pump		■■■■■			
	Conduction Canal		■■■			
	Irrigation Canal & Others		■■■■■■■■			
	Improvement		■■■■■■■■■			
2.3 Rural Water	Civil		■■■■■■■■			
2.4 Vegetables Commercialization Center	Buildings			■■■		
2.5 Animals Insemination Center	Corral			■■■		
2.6 Communications Center	Buildings		■■■	■■■		
3. Rural Education and Organization			■■■■■■■■■■■■■■■■■■■■			
4. Operation and Maintenance				■■■■■■■■■■■■■■■■■■■■		

FIGURE 7.2.2 EXECUTION SCHEDULE OF SANTA CATARINA MITA PROJECT

TABLE 7.2.1 DISBURSEMENT SCHEDULE
(Santa Catarina Mita Zone)

(Unit: Q1000)

	Quantities	1st Year	2nd Year	3rd Year	Total
1. CONSTRUCTION COST					
1.1 Irrigation					
Pumping	1 G	0	4,000	0	4,000
Irrigation Canal	1 G	0	876	1,000	1,876
Others	1 G	0	200	254	454
Sub-total		0	5,076	1,254	6,330
1.2 Rural Road					
S. CATARINA M-EL PUENTE	2.8km	0	280	0	280
S. CATARINA M-OSTUA RIVER	3.0km	0	0	180	180
OSTUA RIVER-ROUTE D.4	1.8km	0	0	108	108
HORCONES-EL GUEBRACHO	3.0km	0	0	180	180
EL SILENCIO-EL LIMON	3.0km	0	0	180	180
Sub-total		0	280	648	928
1.3 Rural Water					
SUCHITAN	1 G	0	1,920	0	1,920
C.D.GUAYABO	1 G	0	1,410	0	1,410
EL QUEBRACHO	1 G	0	0	1,400	1,400
EL LIMON	1 G	0	0	1,190	1,190
ALDEA NUEVA	1 G	0	0	360	360
Q.D.MUERTO	1 G	0	0	180	180
Sub-total		0	3,330	3,130	6,460
1.4 Vegetables Commercialization Center	1 G	0	0	1,034	1,034
1.5 Animals Insemination Center	1 G	0	0	624	624
1.6 Communication Center					
Office	200m2	0	710	0	710
Warehouse	50m2	0	80	0	80
Meeting Hall	100m2	0	0	310	310
Sub-total		0	790	310	1,100
1.7 Total		0	9,476	7,000	16,476
2. INDIRECT COST					
2.1 Administration		2,000	500	500	3,000
2.2 Supervision (1x10%)		0	948	700	1,648
2.3 Total		2,000	1,448	1,200	4,648
3. TOTAL(1+2)		2,000	10,924	8,200	21,124
4. PHYSICAL CONTINGENCIES (3x15%)		300	1,639	1,230	3,169
5. TOTAL COST (3+4)		2,300	12,562	9,430	24,292

FIGURE 7.2.3 ORGANIZATION CHART OF THE OFFICE OF THE SANTA CATARINA MITA

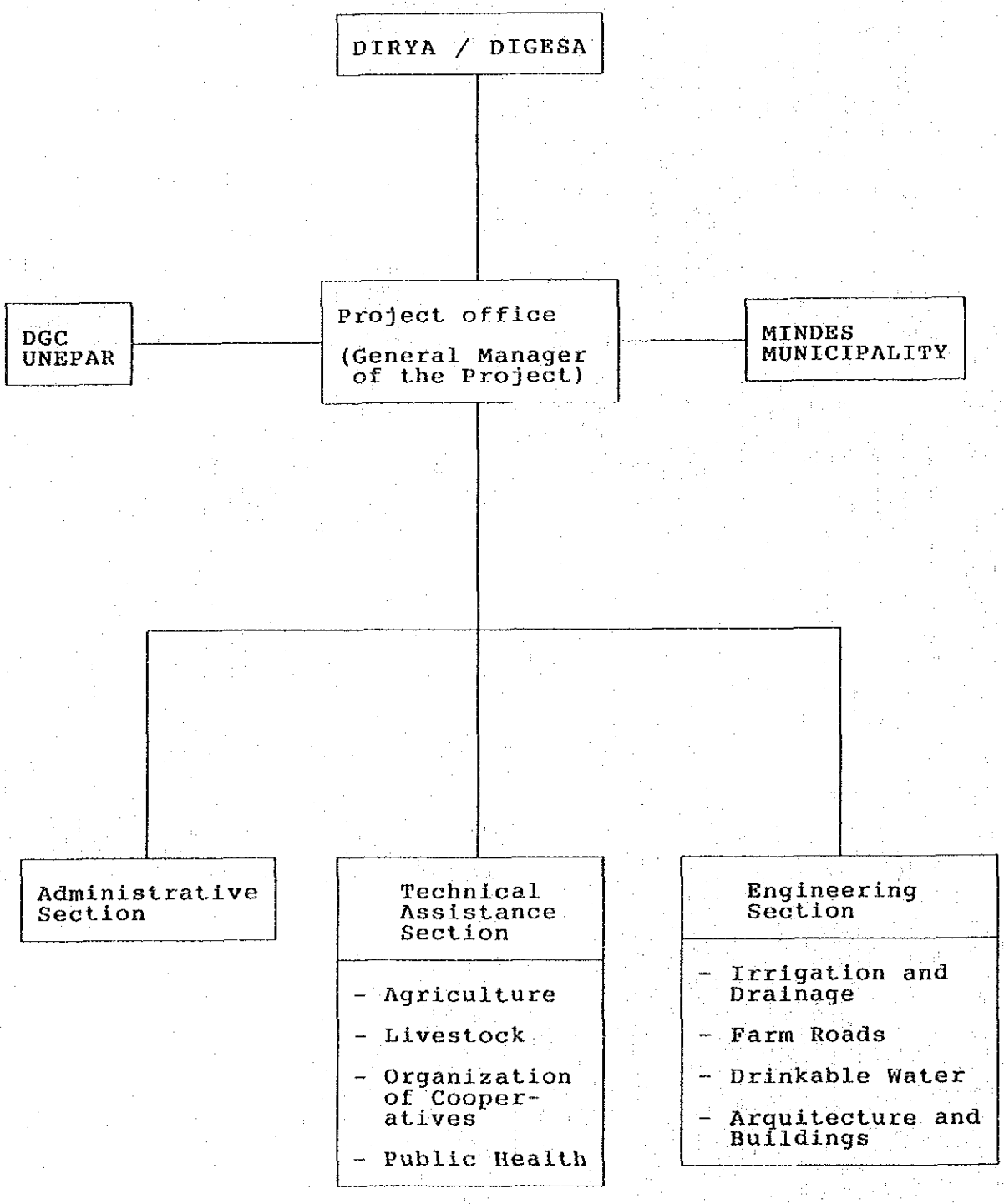
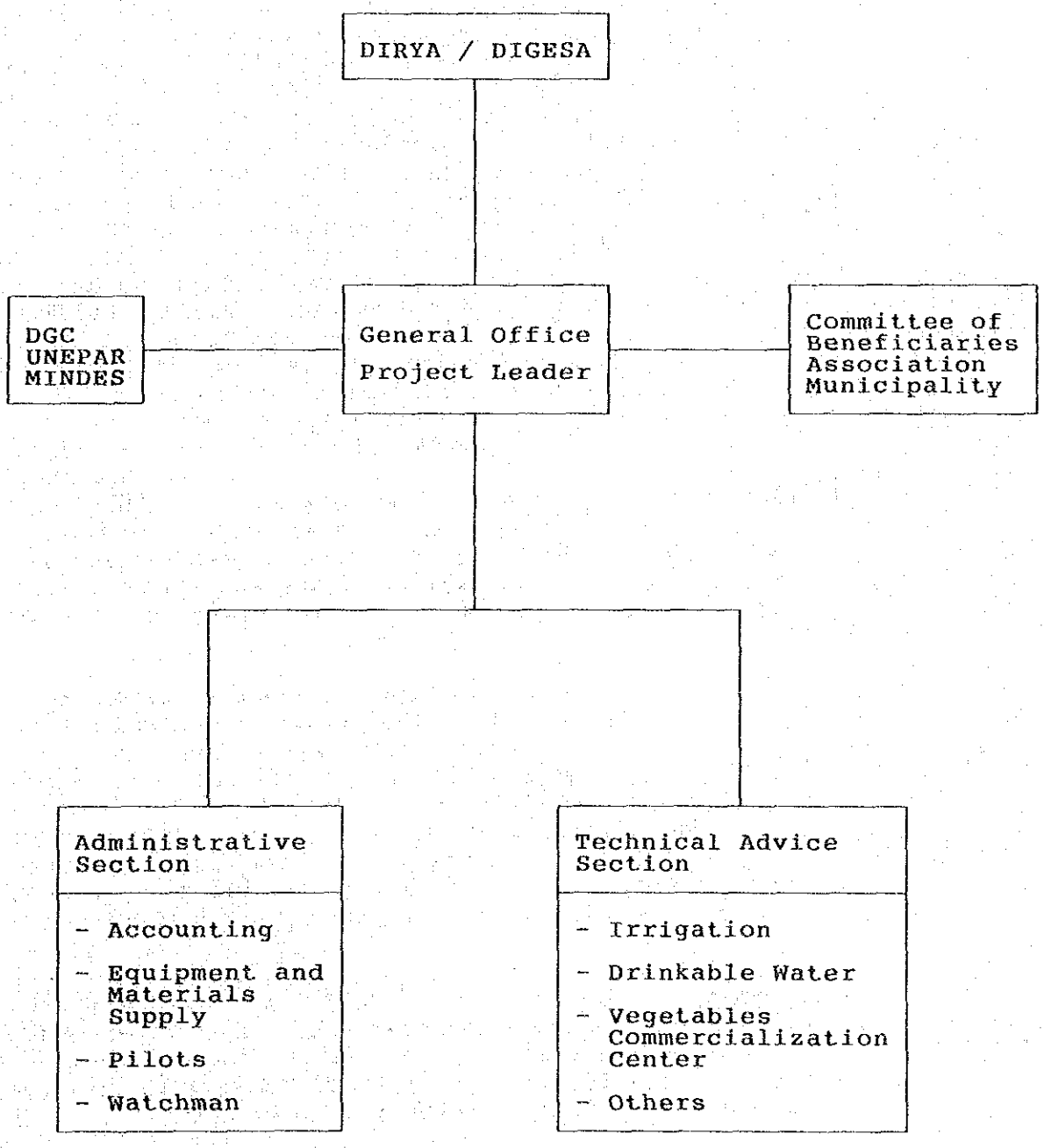


FIGURE 7.2.4 ORGANIZATION CHART OF THE GENERAL OFFICE OF THE OPERATION AND MAINTENANCE OF THE SANTA CATARINA MITA PROJECT



7.2.6 Project Evaluation

(1) Methodology of the evaluation

The evaluation of the present Project was made according to the methodology adopted by the World Bank and the adopted parameters were those related to the DIRYA. Currency used was quetzales.

(2) Financial evaluation

Financial evaluation was carried out based on the incremental benefits expected from the increased production and on the costs incurred in a period of 25 years - the period of useful life of the Project. Engineering works will be finished in three years and the operation and maintenance works for the Project will start in the third year; in the third year 50% of the annual standard cost will be disbursed. The benefits will become stable on the sixth year and remain constant in the following years, while the proportion of the decreased benefits until the sixth year is 40% on the third year, 80% on the fourth year, and 90% on the fifth year. The financial internal rate of return (FIRR) reached in that way is 9.9% and the Financial Net Present Worth (FNPW) calculated with a discount rate of 12% (the opportunity cost of capital in Guatemala evaluated according to the banking market conditions) was Q.2,632,000.

In this evaluation no sensitivity analysis was carried out because the FIRR value is lower than the opportunity cost. As at present the preferential line of credit assigned to the agricultural an livestock sector has been eliminated, it is necessary for the Project to be executed with external financial aid.

Assuming that the operation and maintenance expenses of the irrigation unit are compensated by the water fee, this fee is calculated as Q.762.1/ha in the year when the Project is stabilized; this amount is equivalent to 9% of the average incremental benefits of the Project (Q.8,486.5/ha). It is suggested that in the operational stage of the Project, around 15% of the water fee could be deposited in the bank account id the water users' association or producers cooperative in order to invest it in machineries and equipment replacement in the future.

According to the population projection for the year 2003, the operation and maintenance expenses of the water supply facilities will be Q.54/habitant, It is advisable that the water users' committee asks to the beneficiaries Q.10 per month in order to expend them in facilities repairs, etc.

(3) Economic evaluation

Based on the incremental benefits and initial investment

costs and operation and maintenance of the Project, both are converted into economic prices and the Economic Internal Rate of Return (EIRR) was calculated. The EIRR is 15.7% and the Economic Net Present Worth (ENPW) calculated with a discount rate of 12% is Q.4,070,000.

(4) Social evaluation

The number of direct beneficiaries of the Project will be 111 families and the average surface of their farms is 2.9 ha. This surface extension can be classified as sub-familiar within the farms classification in Guatemala. The income of the beneficiaries is Q.8,729.2/year as an average. Because all beneficiaries of the Project belong to the low income bracket. all the benefits of the Project will be distributed to low income farmers. In general, with the execution of the Project the income of the farmers before deducting the water fees will be increased five times compared with the level obtained when the Project is not implemented.

(5) Global evaluation

The FIRR of the Project is lower than the opportunity cost, therefore it can be judged that it is a project that can be implemented so easily when the available financial resources for development projects are limited. However, since the proposed beneficiaries are all low income farmers, a high priority can be assigned to the present Project. Judging from the required investment amount, it is suggested that the Project may be implemented with a low interest loan to be granted by international banking institutions or through a non-reimbursable financial cooperation.

7.3 MONTUFAR INTEGRATED RURAL DEVELOPMENT PROJECT

7.3.1 Project Background

The zone of Montúfar is located on the pacific coastal zone, in the municipality of Moyuta and shows a plain and undulated physiography. The coverage area of the Project is around 4,000 ha and most of it belongs to the INTA.

Soils classified as S2-S3 and N1(W) are widely distributed presenting a high potentiality for agricultural development. However, due to the lack of water during the dry season and flood damages during the rainy season agricultural and livestock productivity is low and the life conditions of farmers are not optimal. Also, diseases caused by contaminated water proliferate and living standards are inferior.

7.3.2 Project Profile

The present Project covers, besides irrigation and drainage sub-projects, farm road works and water supply, and its objective is to raise the agricultural productivity and living standards in the rural sector. The details of the components are described below and in Fig. 7.3.1 the general plan of the Project is shown.

(1) Lands utilization

In the following table information about lands utilization with and without-project situation is shown.

(Unit: ha)

Use	Actual	Project
Lands with transitory crops (with irrigation)	0	1,069
Lands with transitory crops (without irrigation)	881	103
Fruit trees	12	12
Pastures (with irrigation)	0	1,331
Pastures (without irrigation)	3,005	993
Bushes and without use	41	0
Others (urban zone, roads, canals, etc.)	83	574
Total	4,022	4,022

Source: Montúfar Irrigation and Drainage Project (DIRYA)

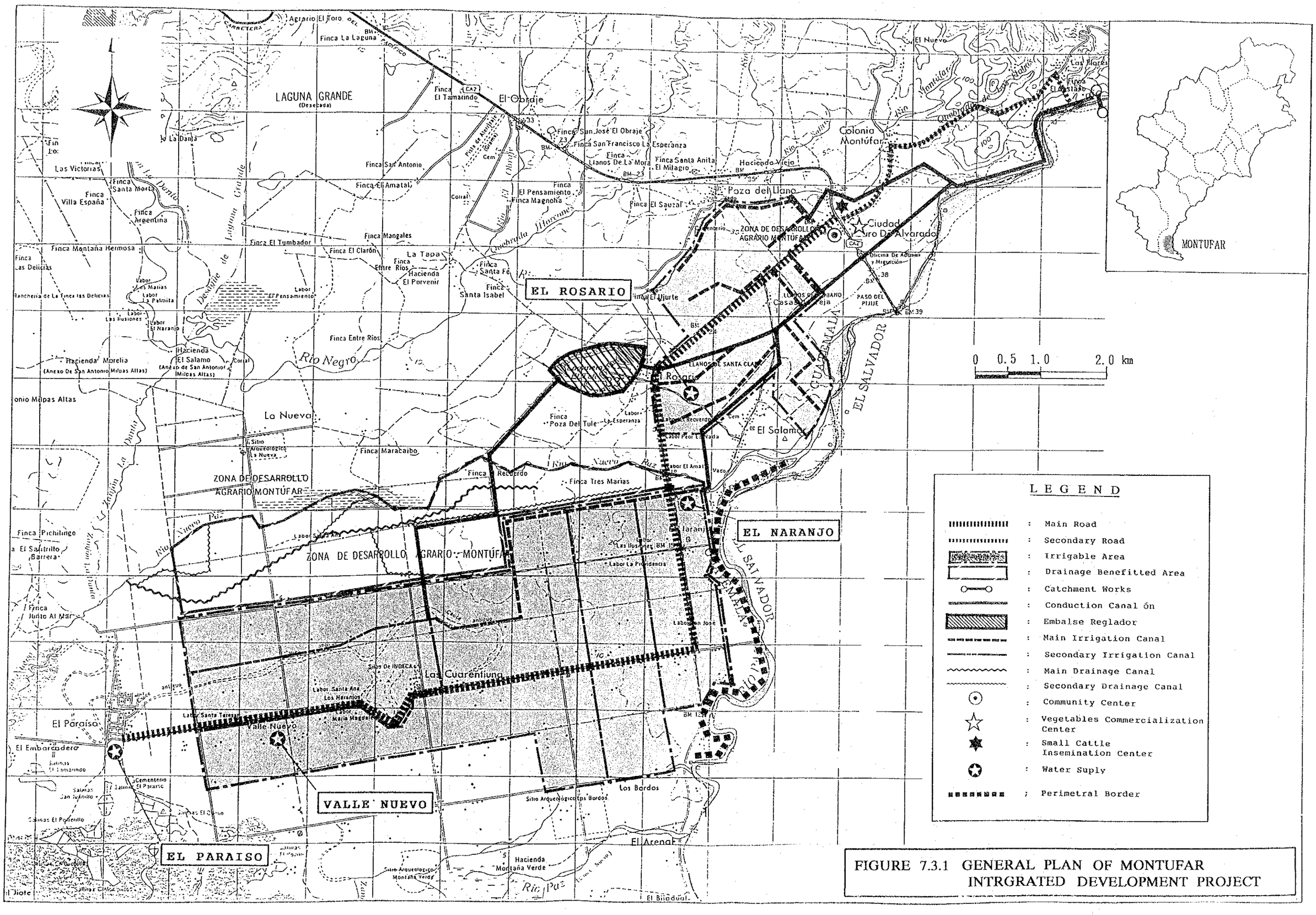


FIGURE 7.3.1 GENERAL PLAN OF MONTUFAR INTRGRATED DEVELOPMENT PROJECT

(2) Agricultural production

With irrigation, cultivation of products like onion, okra, melon, etc., can be done during the dry season. As follows, the agricultural production situation with and without-project is shown.

Crops	Actual			With project		
	Area (ha)	Yield (t/ha)	Produc. (t)	Area (ha)	Yield (t/ha)	Produc. (t)
Corn	753.51	2.68	2,019.41	1,171.42	4.00	4,685.68
Sorghum (Joint)	559.04	1.84	1,028.63	634.00	3.00	1,902.00
Sorghum (alone)	17.68	2.03	35.89	-	-	-
Rice	11.03	1.28	14.12	-	-	-
Okra	-	-	-	45.22	10.00	452.20
Onion	-	-	-	118.28	17.50	2,069.90
Sesame	18.06	0.43	7.77	537.42	1.00	537.42
Peanuts	-	-	-	120.56	3.32	400.26
Melon	-	-	-	684.40	16.40	11,224.16
Pasture	3,005.33	1.41	4,238.52	2,264.09	6.69	15,146.76
Banana	6.25	4.18	26.13	12.00	4.18	50.16
Total	4,370.90		7,369.46	5,587.39		36,466.54

Source: Montúfar irrigation and drainage project (DIRYA)

(3) Irrigation and drainage

1) Irrigable area will be 2,400 ha divided in the southern zone of 1,820 ha and northern zone of 580 ha. Source of water used for irrigation of the 2,400 ha is the Paz river from which water will be derived at a rate of 3.45 m^3/sec. for irrigation of the northern zone.

   The irrigation time will be 16 hours daily, but to avoid waste in the discharge of the remaining 8 hours, this flow will be stored in the El Tule lake, which will serve as reservoir with the adjustment of the design of the contention wall which consists in a compacted embankment of 2,675 m of length of contour, with a trapezoidal form, with a crown width or lower base of 0.6 m and a maximum height of 1.82 m. This regulating reservoir will have a capacity of storage of 99,219 m^3 daily. The irrigation network covers 17.6 Km of conduction canals, and 16 Km of main canals.

2) Drainage

Drainage will be divided in surface and sub-surface drainage. Surface drainage network will be developed in a zone of impermeable soils with low seeping velocities of 8 mm/hour, with an extension of 1,065 ha. Subsurface drainage network is integrated by parcel drainage and collectors forming a rectangular system.

3) Levee

To protect the beneficiaries of floods of the Paz river, a levee will be constructed on the right bank of the Paz river which will bear a maximum flow of 2,000 m^3/sec with return period of 10 years.

(4) Farm roads

Rehabilitation and arrangement of the following existing farm roads will be conducted:

Stretch	Length (km)	Width (m)	Remark
Río Paz - Alvarado	2.5	4.0	
Alvarado - El Paraíso	17.0	6.0	Includes rehabilitation of the Paz river bridge
Total	19.5		

(5) Water supply for rural zones

The following simple facilities will be installed using the underground waters in the following dwellings.

Towns or villages	Projected population (year 2003)	Projected flow (m^3/day)	Distribution tank (m^3)	Public faucets (places)
El Rosario	3,317	270	110	55
El Paraíso	2,450	200	80	40
El Naranjo	1,306	110	40	20
Valle Nuevo	942	80	30	15
Total	8,015	660	260	130

(6) Vegetables Commercialization Center

With the introduction of irrigation systems, the production of vegetables (melon, onion, okra, etc.) will be increased and in order to improve their commercialization, a marketing center will be installed in C.P.D Alvarado; efficient handling and delivery will be carried out from there to the consumption centers. management of the facilities will be responsibility od the users cooperatives.

Plot surface:	70 m	x 100 m	=	7,000 m2
Reception and classification of products:	200 m^2	x 2	=	400 m^2
Storage:	450 m^2	x 2	=	900 m^2

(7) Small Cattle Insemination Center

With the purpose of achieving a joint exploitation of small and medium farmers, a insemination center for swine and goats will be installed in Alvarado. The quantity of cattle to be raised will be 5 heads of male breeder swine and 10 heads of goats and at the same time the breeding place will be built.

(8) Pisciculture

Cultivation of the mojarra fish will be carried out using the El Tule Lake which will also play a regulating reservoir. Management will be in charge of the producers cooperative. The scale of cultivation will be 4,000 pieces per hectare and release of the fish will take place twice a year, It is projected a catch of 0.5 ton/ha annually in order to maintain the normal reproduction rate.

Because El Tule Lake has a surface if 50 ha, it is estimated an annual production of 25 ton.

(9) Community Center

The Community Center for social intercourse of the regional population and as a place for the education of the population will be installed in Alvarado. During the construction, the center will be used as the Project Office and after the civil works have finished, as a administrative office. Facilities will be constructed in a lot of 720 m^2 with a constructed surface of 350 m^2.

7.3.3 Execution Program of the Project

The execution program is detailed in Fig.7.3.2 and it is estimated that it will take four years with one year for detailed design and tender and 3 years for the execution of the civil works. Due to the fact that there are many unforseen aspects, the project dealing with the levee and water supply, etc., will be executed after carrying out a feasibility study previous to the actual implementation.

7.3.4 Project Cost

Total cost of the Project including physical contingencies will be 112,000,000 quetzales. Operation and maintenance costs breakdown and disbursement program are detailed in Table 7.3.1. Annual cost is estimated to be around 1,865,000 quetzales.

7.3.5 Executing Agencies of the Project and Operation and Maintenance Program

(1) Executing agencies of the Project

The executing agencies of the Project will be DIRYA and DIGESA who will receive the collaboration of related organizations like MINDES, etc. To facilitate a smooth and efficient execution of the Project, it is necessary to install the Project Office with the participation of the related organizations.

The organization chart of the Project Office is shown in Fig. 7.3.3 and the staff will be selected among the staff of DIRYA, DIGESA, MINDES, etc.

(2) Operation and maintenance plan

Operation and maintenance of the respective facilities of the Project will be carried out at the general office to be installed in the Community Center. Operation and maintenance expenses for the irrigation unit, drinkable water and mojarra fish pisciculture will be responsibility of the users and operation and maintenance of the facilities will be in charge of the autonomous organization of the users' association under the jurisdiction of the joint commission integrated by members of the public and private sectors. Operation and maintenance of farm roads will be transferred to the DGC. The organization chart of the Project Office is shown in Fig. 7.3.4.

Concepts	Item	1st Year	2nd Year	3rd Year	4th Year	5th Year
1. Design and Tender		■■■■■■				
2. Civil Works						
2.1 Irrigation and Drainage	Catchment		■■■■■■			
	Conduction Canal		■■■	■■■		
	Irrigation Canal		■■■■■■	■■■■■■	■■■■■■	
	El Tule Lake System		■■■	■■■■■■	■■■■■■	
	Drainage Canal		■■■■■■	■■■		
	Paz River Border			■■■	■■■■■■	
2.2 Rural road	Improvement		■■■■■■	■■■■■■		
2.3 Rural Water	Civil		■■■	■■■■■■	■■■■■■	
2.4 Vegetables Commerc-ialization Center	Buildings				■■■	
2.5 Animals Insemination Center	Corral		■■■■■■			
2.6 Sweet Water Piscicul-ture	Tilapia				■■■	
2.7 Communications Center	Buildings		■■■			
3. Rural Education and Organization			■■■■■■	■■■■■■	■■■■■■	■■■■■■
4. Operation and Maintenance				■■■■■■	■■■■■■	■■■■■■

FIGURE 7.3.2 EXECUTION SCHEDULE OF MONTUFAR PROJECT

TABLE 7.3.1 DISBURSEMENT SCHEDULE
(Montúfar Zone)

(Unit: Q1000)

	Quantities	1st Year	2nd Year	3rd Year	4th Year	Total
1. CONSTRUCTION COST						
1.1 Irrigation and Drainage						
Catchment	1 G	0	11,231	0	0	11,231
Conduction Canal	1 G	0	3,893	6,000	0	9,893
Irrigation Canal	1 G	0	3,594	7,186	7,186	17,966
El Tule Lake System	1 G	0	1,906	3,813	3,813	9,532
Drainage Canal	1 G	0	3,623	3,623	0	7,246
Paz River Border	1 G	0	0	6,313	10,000	16,313
Sub-total		0	24,247	26,935	20,999	72,181
1.2 Rural Road						
PAZ RIVER-A;VARADO	2.5km	0	150	0	0	150
ALVARADO-EL PARAISO	17.0km	0	800	900	0	1,700
Nueva Paz River Bridge	1 G	0	0	2,000	0	2,000
Sub-total		0	950	2,900	0	3,850
1.3 Rural Water						
EL ROSARIO	1 G	0	1,720	0	0	1,720
EL PARAISO	1 G	0	0	1,270	0	1,270
EL NARANJO	1 G	0	0	0	680	680
VALLE NUEVO	1 G	0	0	0	490	490
Sub-total		0	1,720	1,270	1,170	4,160
1.4 Vegetables Commercialization Center	1 G	0	0	0	1,034	1,034
1.5 Animals Insemination Center	1 G	0	0	0	644	644
1.6 Sweet Water Pisciculture	1 G	0	0	0	100	100
1.7 Communication Center						
Office	200m2	0	710	0	0	710
Warehouse	50m2	0	80	0	0	80
Meeting Hall	100m2	0	0	0	310	310
Sub-total		0	790	0	310	1,100
1.8 Total		0	27,707	31,105	24,257	83,069
2. INDIRECT COST						
2.1 Administration		3,000	1,000	1,000	1,000	6,000
2.2 Supervision(1x10%)		0	2,771	3,111	2,426	8,307
2.3 Total		3,000	3,771	4,111	3,426	14,307
3. TOTAL(1+2)		3,000	31,478	35,216	27,683	97,376
4. PHYSICAL CONTINGENCIES (3x15%)		450	4,722	5,282	4,152	14,606
5. TOTAL COST (3+4)		3,450	36,199	40,498	31,835	111,982

FIGURE 7.3.3 ORGANIZATION CHART OF THE OFFICE OF THE MONTUFAR PROJECT

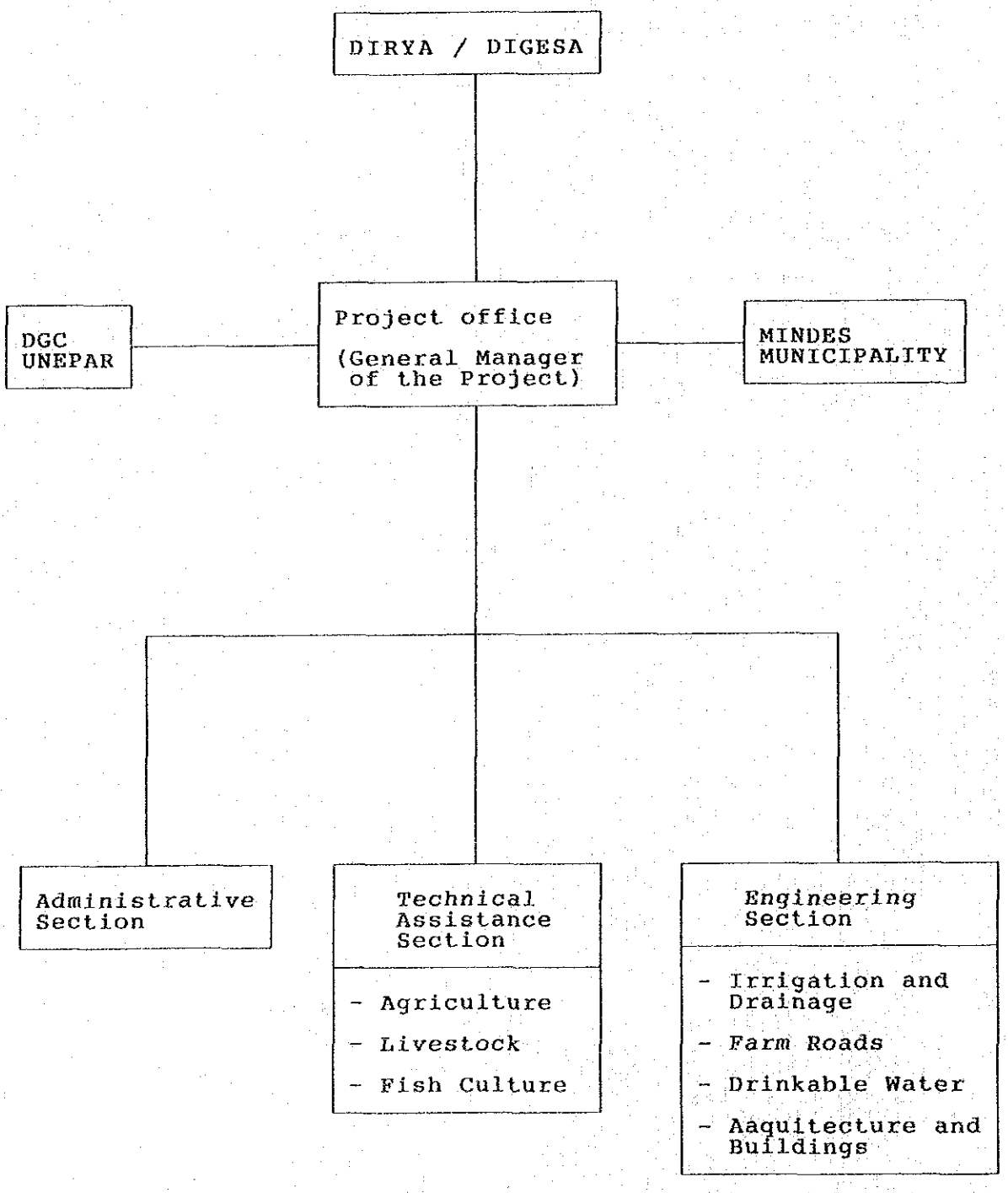
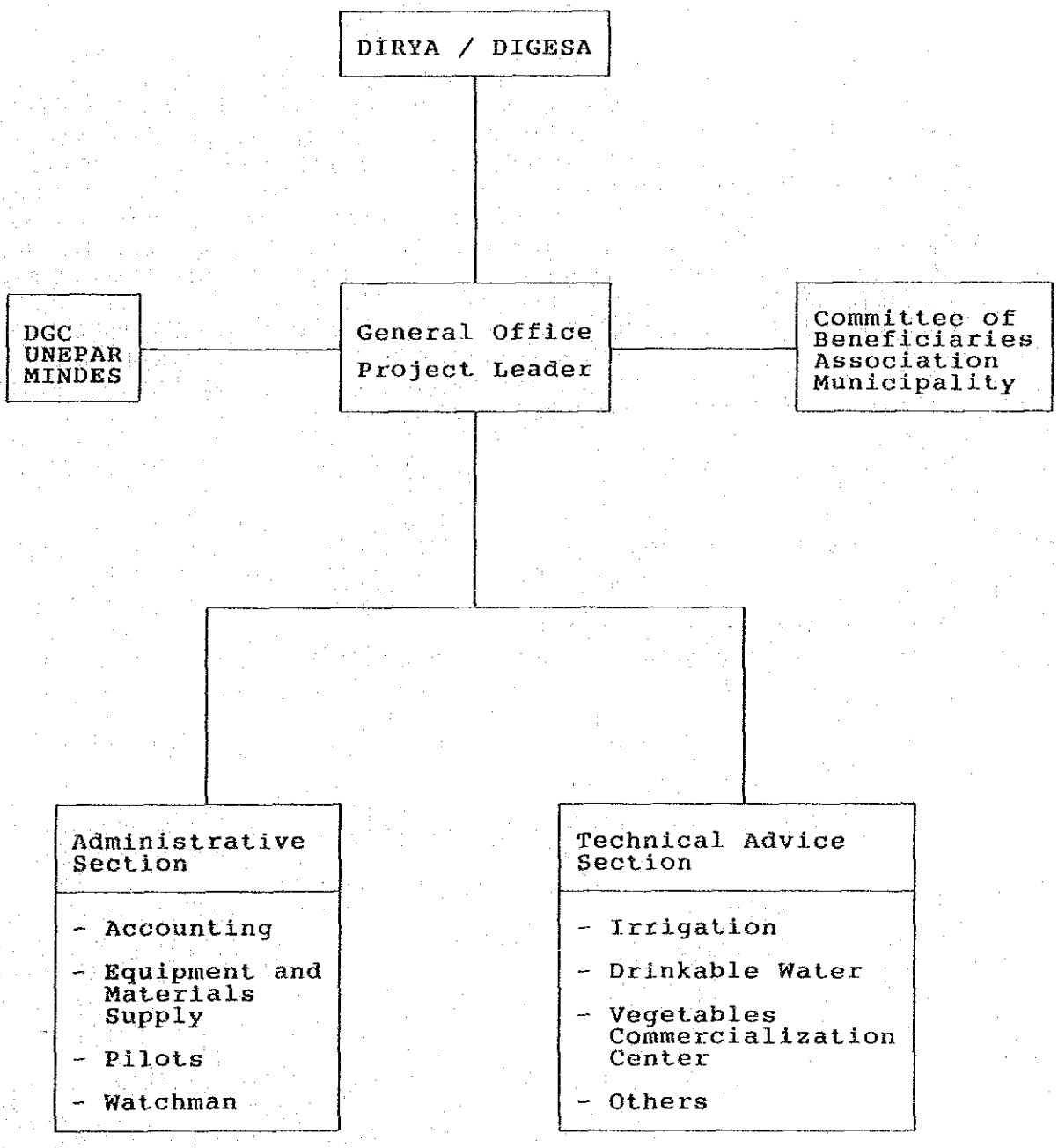


FIGURE 7.3.4 ORGANIZATION CHART OF THE GENERAL OFFICE OF THE OPERATION AND MAINTENANCE OF THE MONTUFAR PROJECT



7.3.6 Project Evaluation

(1) Methodology of the evaluation

The evaluation of the present Project was made according to the methodology adopted by the World Bank and the adopted parameters were those related to the DIRYA. Currency used was quetzales.

(2) Financial evaluation

Financial evaluation was carried out based on the incremental benefits expected from the increased production and on the costs incurred in a period of 25 years - the period of useful life of the Project. Construction works will be finished in four years and the operation and maintenance works for the Project will start in the third year; full maintenance costs will be generated from the fifth year, while in the third year 25% of the cost and in the fourth year 50%. The benefits will become stable in the seventh year and remain constant in the following years, while the proportion of the decreased benefits until the seventh year is 20% in the third year, 40% in the fourth year, 80% in the fifth year, and 90% in the sixth year.

The FIRR for the present Project is 19.2% and the FNPW was Q.44,837,000.

Sensitivity analysis was performed modifying the normal values of the following variables:

- 10% investment increase
- 10% "with-project" benefit decrease
- 1 year extension of the construction period

The results obtained are given below:

SENSITIVITY HYPOTHESIS	FIRR(%)
- Normal hypothesis	19.2
- 10% investment increase	17.1
- 10% "with-project" benefit decrease	17.4
- 1 year extension of the construction period	9.4

Assuming that the operation and maintenance expenses of the irrigation unit are compensated by the water fee, this fee is calculated as Q.333.6/ha in the year when the Project is stabilized; this amount is equivalent to 7% of the average incremental benefits of the Project (Q.4,791.5/ha). In the same way, the maximum value of interest payments for the loan is equal to 6% of the incremental benefits and the annual amortization quota corresponds to 10% of them. In the case the beneficiaries take care of the total investment value of the Project, the proportion of the quota value against the annual incremental benefits will be 23% in the year when interest payments are the highest and 7% from the 40th year. The most sensible proposal would be to deposit an approximate portion of between 15-20% of the incremental benefits in the account of the users association and used those funds for repairs and replacement of equipments and machineries.

(3) Economic evaluation

Based on the incremental benefits and initial investment costs and operation and maintenance of the Project, both are converted into economic prices and the EIRR was calculated. The EIRR is 27.8% and the ENPW calculated with a discount rate of 12% is Q.76,690,000.

(4) Social evaluation

Total surface of the cultivated area of low income farmers (farm size is below 20 ha) represents 58% of total cultivated area of the Project. Subject to the condition of improvement of the agricultural and livestock productivity of these farmers in such a way that they reach the level of the high income farmers and that they will try their best to increase cultivable area , the average income of the low income farmers will be increased a little it less than 9 times the level of the "without-project" situation.

The distributive analysis of the incremental benefits achieved by the Project shows that 70% of the net benefits of the Project will be channeled to the low income farmers. Also, it can be concluded that the Project shows a strong distributive impact, having a social internal rate of return of 95.2% and a social net present value of Q.20,838,000 calculated with a discount rate of 12%.

(5) Global evaluation

The feasibility analysis of the Project which has been carried out taking into consideration economic, financial and social factors, justify the execution of the Project. Taking into account its high profitability together with its size, it is recommended that a high priority should be given to the present Project within the context of the national development program.

Even though it is a small scale hydraulic development project, its economic profitability is high with the increment of the agricultural and livestock production in a quite broad area ; also, with its high profitability, one part of the investment could be allocated to the sub-projects which aim to improve the rural living conditions.

Additionally, it is worth to mention that the Montúfar project has different characteristics from the Santa Catarina Mita projects related to the required investment, financing sources, etc. However, both projects could be implemented at the same time subject to the condition that they are justified within the budgetary distribution program of the central government related to the development projects for each department.

APPENDIX:

LIST OF SURVEY TEAM AND COUNTERPARTS

LIST OF SURVEY TEAM AND COUNTERPARTS

ASSIGNMENT	N A M E	NAME OF COUNTERPART
Team Leader / Irrigation & Drainage	Dr. Shoji KANATSU	Mr.Roberto Matheu Mc Mr.Luis Fernando Peña Mr.Carlos Mazariegos Mr.Armando Pineda
Meteology & Hydrology	Mr. Keiichi SAKAEBARA	Mr.Abelardo Mejía
Soil & Remote Sensing	Mr. Hisashi KOBAYASHI	Mr.Leeroy Gillespie Mr.Leonardo Contreras
Farming,Cultivation & land Use	Mr. Satoru KIDO	Mr.Bayron Méndez Mr.Leeroy Gillespie Mr.Misael Ruiz
Rural Infrastructure	Mr. Shinichiro MATSUMOTO	Mr.Iván Galvez A. Mr.Jorge A. Galvez
Animal Husbandry	Dr. Toshikazu NAGAMITSU	Mr.Juan M. Orellana Mr.Martín A. Martínez
Agricultural Economic	Mr. Tamio OTA	Mr.Mario A. Salazar Mr.Maynor Sandoval Mr.Celestino Polanco
Environment and Soil Conservation	Mr. Yutaka NOZAKI	Mr.Luis A. Olivares Mr.Jorge H. García Mrs.Velkis Donis
Structure Design & Estimate	Mr. Shin ONODA	Mr.Armando Pineda
Project Evaluation	Mr. Fumiakira ONODA	Mr.Mario A. Salazar