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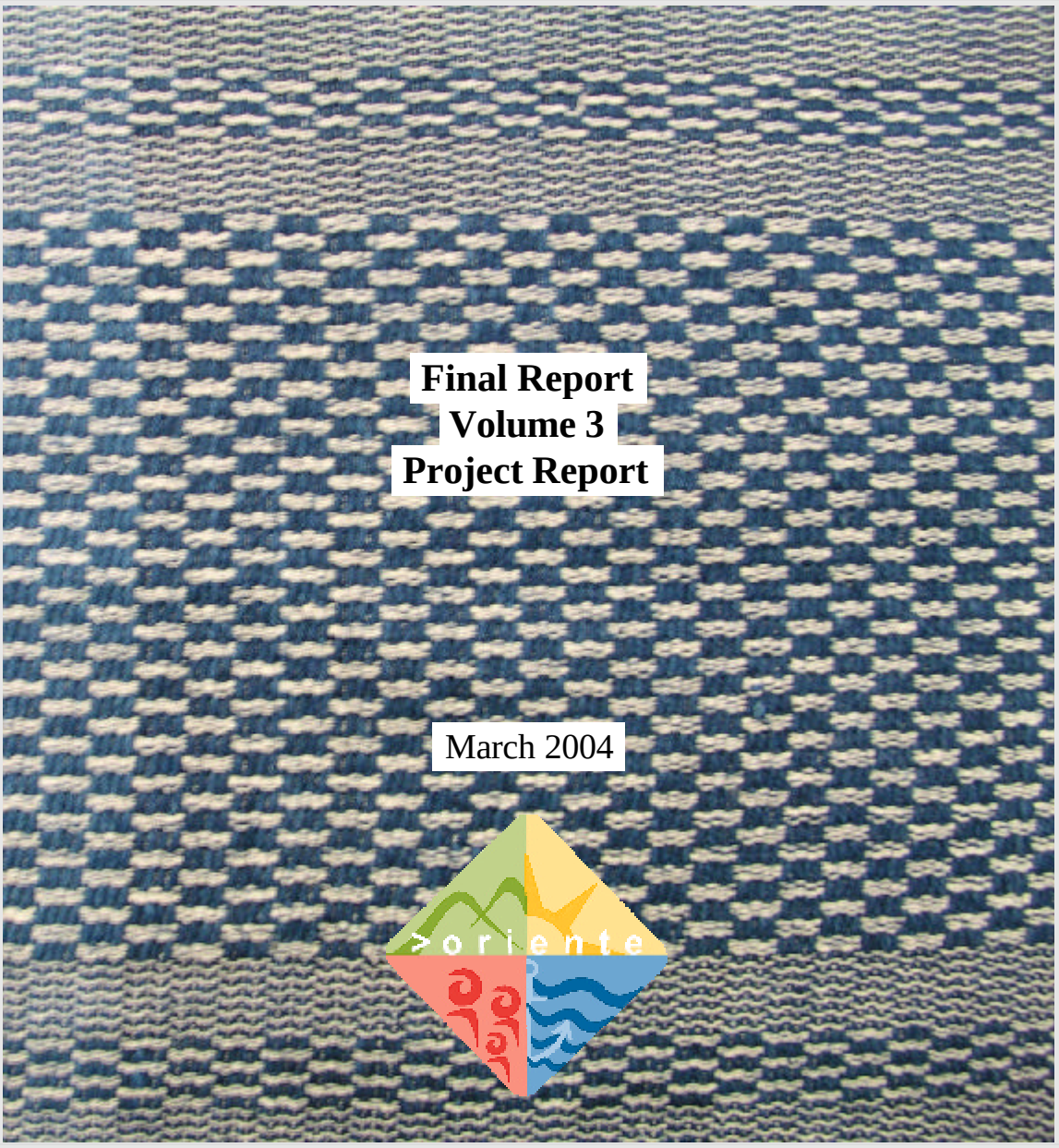
Japan International Cooperation Agency (JICA)

Comisión Nacional de Desarrollo
The Republic of El Salvador

The Study on Economic Development, Focusing on the Eastern Region, of the Republic of El Salvador



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The Republic of El Salvador

The Study on Economic Development, Focusing on the Eastern Region, of the Republic of El Salvador

Final Report
Volume 3
Project Report

March 2004

RECS International Inc.
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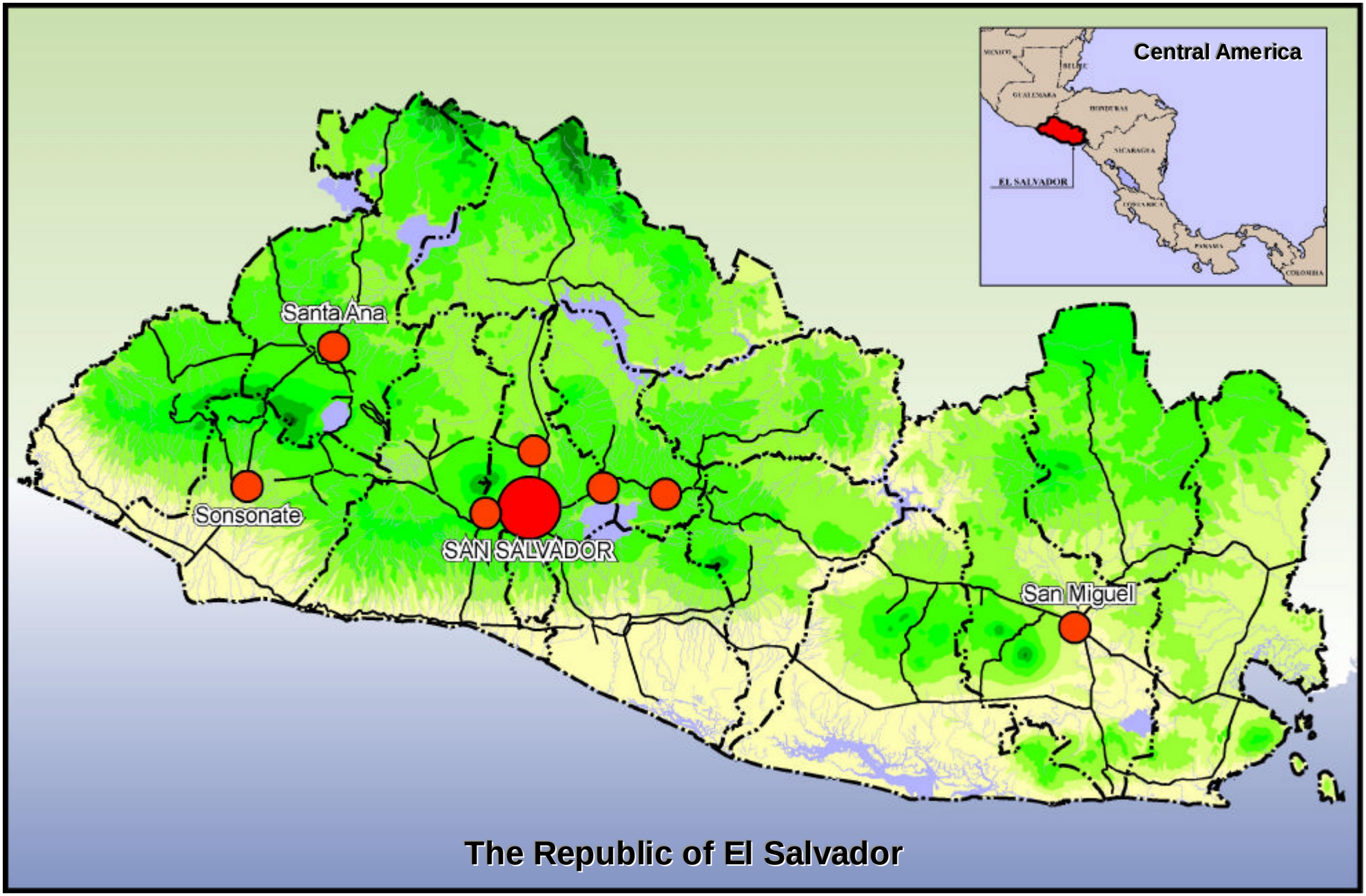
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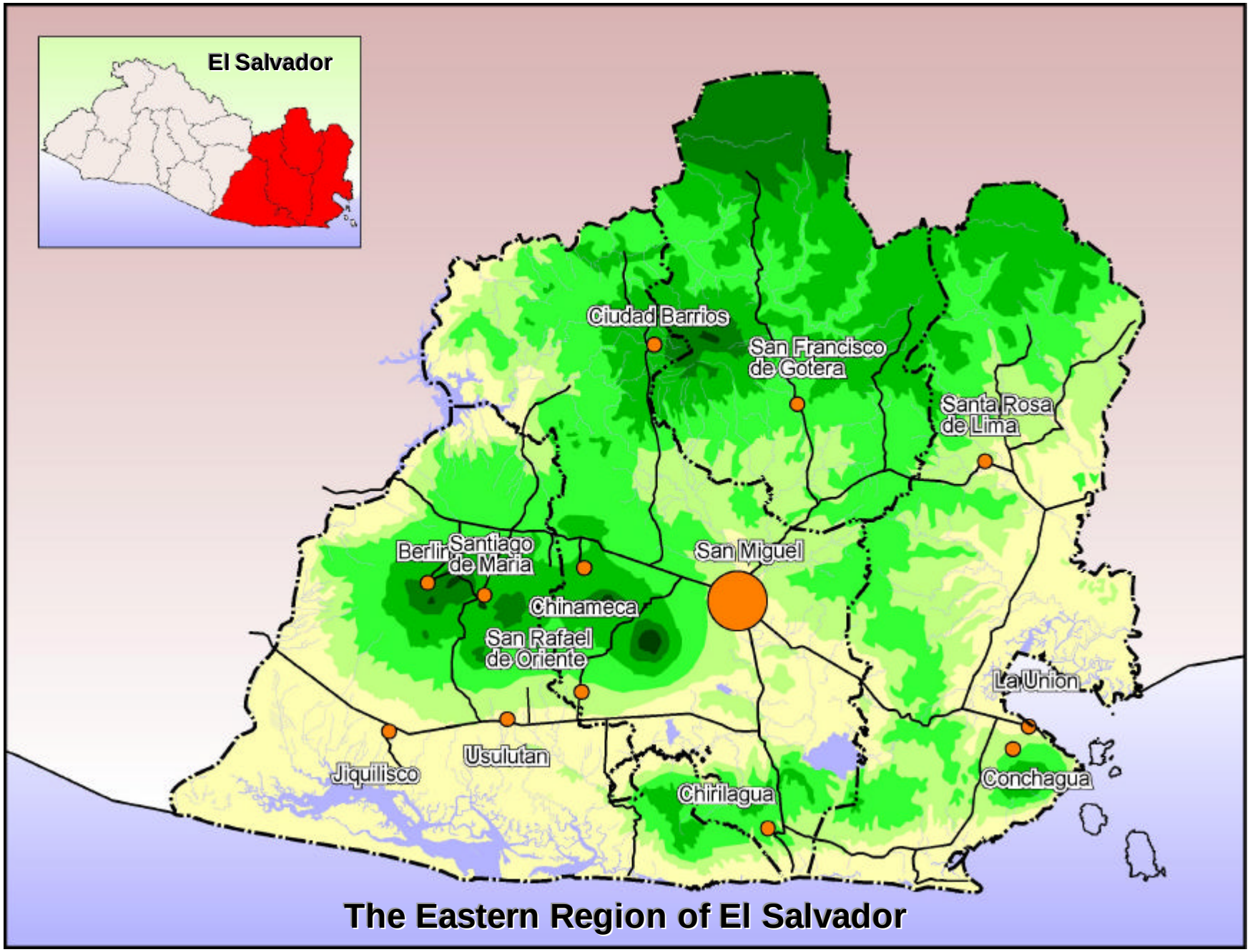

The Eastern Region of El Salvador

The Study on Economic Development, Focusing on the Eastern Region, of the Republic of El Salvador

Final Report
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Contents

Abbreviations

AADT	Average annual daily traffic
ACOTENO	Cooperative Association of Dyers in the East
AIDS	Acquired immune deficiency syndrome
AITC	Agro-industrial technology center
ANDA	National Water Supply and Wastewater Administration
APE	Export Promotion Agency
APREMAT	Technical Medium Education Reform Process Assistance
ASI	Association of Industries in El Salvador (Asociación de Industriales de El Salvador)
BMI	Multi-sector Investment Bank (Banco Multisectorial de Inversiones)
BOD	Biological oxygen demand
BPO	Business process outsourcing
CAMAGRO	Chamber of Agriculture, Fishery and Agro-industry of El Salvador (Cámara Agropecuaria y Agroindustrial de El Salvador)
CBD	Central business district
CDA	Departmental Council of Mayors
CEL	Executive Commission of Lempa River Hydropower
CENDEPESCA	Fishery and Aquaculture Development Center
CENTA	National Center for Agriculture, Livestock and Forestry Technology
CEPA	Executive Commission for Autonomous Ports
CLUSA	Cooperative League of the USA
CND	National Development Commission
COD	Chemical oxygen demand
CODECA	Association for Coordination of Communities for the Development of Cacahuatique (Asociación Coordinación de Comunidades para el Desarrollo de Cacahuatique)
COEN	National Emergency Committee (Comité de Emergencia Nacional)
COMURES	Corporation of Municipalities of the Republic of El Salvador (Corporación de Municipalidades de la República de El Salvador)
COMUS	United Communities from Usulutan (Comunidades Unidas de Usulután)
CONACYT	National Council for Science and Technology
CONAMYPE	National Commission for Micro and Small Enterprises
CONCULTURA	National Committee for Culture and Heritage
CORSATUR	Salvadoran Tourism Corporation
CRS	Catholic Relief Services
CSC	Salvadoran Council for Coffee (Consejo Salvadoreño del Café)
DANIDA	Danish International Development Assistance
DD	Detailed design
EEO	Eastern Electric Company (Empresa Eléctrica de Oriente)
EIA	Environmental impact assessment
EIRR	Economic internal rate of return
ENA	National School of Agriculture
ETESAL	El Salvador Electricity Transmission Company
FAT	Technical Assistance Fund (Fondo de Asistencia Técnica)
FEDISAL	Foundation for Integrated Education in El Salvador

	(Fundación para la Educación Integral de El Salvador)
FESACORA	Salvadoran Federation of Agrarian Reform Cooperatives
FIAGRO	Foundation for Technological Innovation in Agriculture and Fishery (Fundación para la Innovación Tecnológica Agropecuaria)
FLO	Fairtrade Labelling Organizations
FOEX	Export Promotion Fund
FPEZ	Free port and economic zone
FS	Feasibility study
FTZ	Free trade zone
FUNDE	National Foundation for the Development (Fundación Nacional para el Desarrollo)
FUSADES	Economic and Social Development Foundation
GDP	Gross domestic product
GIS	Geographic information system
ICT	Information and communication technology
IDB	Interamerican Development Bank
INSAFOCOOP	Salvadoran Institute for Promotion of Cooperatives
INSAFORP	Salvadoran Institute of Professional Formation
IP	Internet protocol
ISDEM	Salvadoran Institute for the Development of Women (Instituto Salvadoreno para el Desarrollo de la Mujer)
ISO	International Organization for Standardization
IT	Information technology
ITC	Industrial technology center
ITCA	Inter-American Institute for Cooperation of Agriculture
ITUS	Technological Institute of Usulutan (Instituto Tecnológico de Usulután)
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JOCV	Japan Overseas Cooperation Volunteers
LGU	Local government unit
LMU	Local management unit
LWR	Lutheran World Relief
MAG	Ministry of Agriculture and Livestock
MARN	Ministry of Environment and Natural Resources
MINED	Ministry of Education
MISPAS	Ministry of Public Health and Social Assistance
MOE	Ministry of Economy
MOL	Ministry of Labor
MOP	Ministry of Public Works
MRS	Market regulating system (Mercado regulador del sistema)
NGO	Non-governmental organization
OCIA	Organic Crop Improvement Association
PNODT	National Plan for Regional Arrangement
PROARCA	Regional Environmental Program for Central America (Programa Ambiental Regional para Centroamerica)
PROCAFE	Coffee Producers Association
PRODERNOR	Rural Development Project for the North-Eastern Region (Proyecto de

	Desarrollo Rural del Nororiente)
PROGOLFO	Project for Conservation of the Coastal Ecosystems in the Gulf of Fonseca
PVC	Polyvinyl chloride
QC(C)	Quality control (circle)
R&D	Research and development
SALT	Sloping agricultural land technology
SME	Small and micro enterprise
SNET	National Service for Territorial Studies
SRMU	Sub-regional management unit
TiE	The IndUS Entrepreneurs
UCRAPROBEX	Union of Agrarian Reform Cooperatives of Producers, Processors and Exporters of Coffee
UES	University of El Salvador (Universidad de El Salvador)
UGB	Universidad Gerardo Barrios
UNIVO	University of the East
UPREX	Usulutan Producers and Exporters Union (Unión de Productores y Exportadores de Usulután)
USAID	United States Agency for International Development
USGS	United States Geological Survey
VMVDU	Vice Ministry of Housing and Urban Development (Viceministerio de Vivienda y Desarrollo Urbano)
VOC	Vehicle operating costs
VoIP	Voice over Internet protocol
WebCam	Web camera

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Part 1

Project Profiles

Project No. 1.1

1. Project Title	AIC Support Program
2. Location	Eastern Region
3. Implementing Agencies	MAG, CND
4. Objectives	(1) To establish an agro-based complex of economic activities that would drive the Eastern Region development; and (2) To increase income levels of the majority of local people and enterprises
5. Expected Effects	(1) Generation of over 50,000 lucrative employment opportunities and inducement of additional services employment; and (2) Sense of solidarity among the majority of local people
6. Project Costs	US$12.8 million
7. Implementation Schedule	Phase 1-Phase 2

8. Project Description

The program provides a comprehensive package of support measures for most promising industries/commodity groups identified in the Eastern Region. For apiculture and sugar-related industries, the program provides guidance to facilitate producers in the Eastern Region to associate with the existing cluster/complex. For poultry industry, the program supports small farmers to organize themselves for poultry farming in combination with vegetables growing, and to prepare them to link up with large-scale commercial poultry operators expected to establish in the Eastern Region as the La Union port becomes operational. For indigo and kenaf industries, the program supports technical and marketing aspects of respective industrialization.

Support components for dairy and cashew industries are as follows.

Dairy industry

1) expansion/strengthening of existing dairy farmers/organizations including small farmers,
2) technical extension for high input-high yield dairy farming in areas with improved water availability,
3) joint procurement of import feed grains and supplements,
4) associations with maize and sorghum producers for silage production,
5) school milk program, and
6) establishment of a dairy plant.

Cashew industry

i) cashew producers' organizing (expansion of existing organizations),
ii) provision of saplings,
iii) technical extension for grafting and organic fertilization,

iv) products development with R&D,
v) establishment of processing plants, and
vi) association with exporters, confectionery industry, etc.(for a cluster).

The program utilizes a pilot project approach. Several pilot projects will be initiated representing different industries, implemented mainly by MAG in cooperation with related public and private institutes and NGOs as necessary. CND will coordinate activities of different actors involved. To deal with the marketing aspect of each industry particularly for export, mobilization of foreign experts on the short and the long-term basis is expected. Support of donor agencies and NGOs is to be sought for financial and technical cooperation, depending on the different pilot projects.

Project No. 1.2

1. PROJECT TITLE	One Village-One Product Model
2. LOCATION	Rural areas in the northern San Miguel and La Union, and Morazan
3. IMPLEMENTING AGENCIES	Municipal governments supported by MAG and NGOs
4. OBJECTIVES	(1) To develop specialty products through "coopetition" or cooperative competition among municipalities; and
	(2) To develop entrepreneurial base in rural areas
5. EXPECTED EFFECTS	(1) Development of 20-30 specialty products including some export products; and
	(2) Establishment of entrepreneurial base for corporate development in the subsequent stage
6. PROJECT COSTS	US$3.0 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

The model project applies the world-famous one village-one product approach to rural development in the Eastern Region. Municipalities are invited to submit proposals to create their own specialty products using indigenous resources in respective municipalities. Joint proposals combining resources of multiple municipalities should be allowed. Selected proposals will be implemented with the support of MAG and NGOs as necessary.

Selected municipalities will compete for successful implementation of their projects, respectively. Each municipality will have to report the progress of its project together with related activities and developments in a local broadcasting program on TV or radio. This will provide incentive for municipalities to successfully implement their own projects. Some municipalities may establish a web site to report the progress and to advertise their activities. Computer systems to be established by Project No. 6.2d may be utilized for the purpose.

Preparation of initial proposals may be guided by CND in cooperation with technical staff of MAG or foreign experts. CND may also facilitate the procurement of cooperating NGOs by municipalities. Once the implementation starts, technical advisors will be dispatched to help municipalities to prepare TV/radio programs and to develop web sites.

The preparation and selection of proposals and the implementation of selected proposals may be undertaken for a few rounds with different municipalities at each time. Some of implementing municipalities may form a municipal association to manage the project implementation and further develop individual projects. They may undertake joint marketing of various products, and invite investors from outside to expand their operation. Eventually, a local shareholding company may be established by capital contributions from both municipalities and the private sector.

Project No. 1.3

1. PROJECT TITLE	Agro-Business Center Establishment
2. LOCATION	San Salvador and La Union (branch)
3. IMPLEMENTING AGENCIES	MAG-Agronegocios
4. OBJECTIVES	(1) To provide local business information on business opportunities and resources; (2) To strengthen business linkages through information exchanges between various actors; and (3) To promote entrepreneurial culture in the Eastern Region.
5. EXPECTED EFFECTS	(1) Active business development through investments by both local entrepreneurs and investors from outside; and (2) Cultivated entrepreneurial culture
6. PROJECT COSTS	US$0.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

The project will provide a database for business information and consulting services to support the business development by local entrepreneurs. For this purpose, the existing Agronegocios of MAG will be strengthened for its functions in the Eastern Region.

Agronegocios was established by MAG in 1999 utilizing the FANTEL fund. It provides information to support the agro-industry. It has nine branches in the Country: two in the northeast; two in the Eastern Region, one each in Usulutan and San Francisco Gotera; and five in the other regions. The project will support the establishment of another branch in La Union.

The agro-business center will have three sections: database, consulting services and administration. A permanent exhibition hall will also be constructed. The database section collects macro level information on production technology and products in the Eastern Region. It will be linked to existing networks of related organizations, both international and domestic.

The consulting section will provide the following services to create business opportunities and to facilitate business development:

1) introduction of regional products,
2) adaptation of production technology,
3) market research for regional products,
4) research on potentials of local businesses,
5) arrangement of business partnership, associations, joint ventures, etc,
6) introduction of buyers, dealers, distributors, etc., and
7) support for participation in business fairs.

Initially, FIAGRO, a newly established NGO for the provision of information on agricultural technology, farmers' training, consulting, and rural credit, may provide some services.

Project No. 1.4

1. PROJECT TITLE	Organic Fertilizer R&D and Production
2. LOCATION	To be determined through competition
3. IMPLEMENTING AGENCIES	Technical institutes to be designated, NGOs and private enterprises
4. OBJECTIVES	(1) To develop appropriate organic fertilizer applicable to various crops; and (2) To contribute to the establishment of organic agriculture and products in the Eastern Region
5. EXPECTED EFFECTS	(1) Establishment of the Eastern Region reputation for organic products; and (2) Higher value-added and smaller wastes as a result of livestock/poultry-fishery-crops integration
6. PROJECT COSTS	US$0.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

The project supports the development of organic fertilizer of various kinds applicable to different crops promoted in the Eastern Region for organic agriculture, including vegetables, coffee and cashew. Raw materials for organic fertilizer are those locally available, including cattle and chicken manure, plant and fruit residues, fish wastes, and even sludge from wastewater treatment.

The project will establish small-scale organic fertilizer plants of various types, and support R&D for development of appropriate organic fertilizer for various crops. They may include composting plants, biogas digesters and fishmeal plants. Technical institutions may be accredited by the Government to undertake a basic study to examine existing technologies and select those that are more appropriate in the Eastern Region. Private enterprises and NGOs are invited to submit proposals to establish pilot or small-scale plants. The technical institutions evaluate the proposals, and provide technical assistance to successful applicants for the implementation.

Project No. 1.5

1. PROJECT TITLE	San Miguel Sugar Mill Power Generation
2. LOCATION	San Miguel.
3. IMPLEMENTING AGENCIES	Ingenio Chaparrastique sugar mill.
4. OBJECTIVES	(1) To develop renewable power generation using bio mass readily available in the Eastern Region; and
	(2) To increase value-added of the sugar industry
5. EXPECTED EFFECTS	(1) Additional 5-8MW power generating capacity; and
	(2) More viable sugar industry
6. PROJECT COSTS	US$4.8 million
7. IMPLEMENTATION SCHEDULE	Phase 2

8. PROJECT DESCRIPTION

The Chaparrastique sugar mill operates four months a year, consuming about 650,000ton of sugarcane every year. Currently the plant has two units for a total of 3.5MW power generating capacity, which is more than enough for plant consumption. The project intends to increase the capacity to around 8MW, and replace a 2MW unit. The new addition of 6MW would cost about US$4.8 million, using new units at around US$1,000 per kW of installation cost.

This addition will provide an incremental generation of 15GWh per year, and therefore excess energy for sales to the grid at a rate of US$0.054 per kWh, and will dramatically improve the sugar mill's financial situations. The average incremental cost is US$0.039 per kWh.

Since the sugar mill may not have enough money to invest in the project, a credit would be guaranteed by the Government to provide incentives to the sugar mill to sell power to the grid. Although the initial investment cost is large for the mill, its benefits far surpass the cost. The project has an EIRR of 17% since the fuel is basically free.

Project No. 1.6

1. PROJECT TITLE	Fishery Support Program
2. LOCATION	Eastern Region (coastal areas)
3. IMPLEMENTING AGENCIES	MAG, CENDEPESCA, private sector
4. OBJECTIVES	(1) To increase income levels of small fishermen; and (2) To contribute to the establishment of sustainable fishery activities
5. EXPECTED EFFECTS	(1) Viable fishery sector contributing to the regional economy; and (2) Conservation of marine, coastal and fishery resources for sustainable regional development
6. PROJECT COSTS	US$2.2 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

The program will extend the ongoing efforts by CENDEPESCA and related institutes to support small fishermen particularly in the Eastern Region, generally in line with the artisan fishery development master plan prepared in 2002 with the technical cooperation of JICA. The program aims to bring up livelihood activities by small fishermen into viable economic activities in order to raise their income levels and also to contribute to development and diversification of regional economy in the Eastern Region. The program, therefore, takes a more focused approach to support more promising activities identified in the Region. These activities include the following:

(1) aquaculture of shrimps, oysters and other shellfish in the Jiquilisco and the La Union bays,
(2) integrated farming combining irrigated agriculture and tilapia aquaculture by pond, poultry and fish wastes processing into fishmeal, and possibly others,
(3) innovative small-scale marine fishery using floating cages and artificial reefs, and
(4) value-added fish processing such as fish pastes manufacturing.

In addition to the ongoing cooperation by JICA, NGOs and others for aquaculture, artificial reefs and fish pastes manufacturing, the program will provide support facilities and services. They include (i) further strengthening of fishermen's organizations, installation of ice plant and/or cold storage to be owned by the fishermen's organizations, and technical cooperation for establishing viable integrated farming practices and fishmeal plant.

The program will also support the re-establishment of fishery training facilities and a database for marine fishery. This component will contribute to sustainable marine fishery activities through more effective fishery resources management and regulations, improved fishing and navigation technologies, and better storage and processing.

The estimated project cost is only indicative, representing rough estimates of costs for major components. It covers the fishery training facilities (roughly US$0.8 million), ice plant (US$0.4 million), feasibility studies (US$0.3 million), and a dispatch of foreign experts (US$0.7 million).

Project No. 2.1

1. PROJECT TITLE	Rio Grande de San Miguel Water Resources Development and Management
2. LOCATION	Rio Grande de San Miguel river basin (Morazan, San Miguel, Usulutan)
3. IMPLEMENTING AGENCIES	MAG, CENTA, MARN-SNET, COEN, MOP, municipalities
4. OBJECTIVES	(1) To increase agricultural production by irrigation; (2) To mitigate flood damages and enhance development potentials; and (3) To enhance water and land environment through watershed management
5. EXPECTED EFFECTS	(1) Much enhanced productivity in the Rio Grande de San Miguel river basin; and (2) Sound watershed with high soil and water retention capacity to support sustainable development
6. PROJECT COSTS	US$291.8 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

The project will change the water and land regime of the Rio Grande de San Miguel, the second largest river in El Salvador, in a fundamental way. It will control floods by a combination of a storage reservoir, river improvement with dykes, and reforestation and improved farming practices. It will contribute to the reduction of flood damages through the physical measures of flood control, flood plain management, and early flood warning system. For the latter, recent efforts by SNET would be strengthened. Also hazard maps prepared by SNET would be used to prepare a detailed land use plan for flood plan management.

The following components are included.

1) El Guayabal multipurpose dam (Project No. 2.1a);
2) Irrigation and drainage (Project No. 2.1b):
   - Rio Grande de San Miguel irrigation (9,000ha),
   - Jocotal irrigation (3,000ha), and
   - San Dionisio irrigation (2,300ha); and
3) Flood control:
   - Rio Grande midstream river improvement (Project No. 2.1c),
   - Olomega diversion, and
   - Flood plain management.

Project No. 2.1a

1. PROJECT TITLE	El Guayabal Multipurpose Dam
2. LOCATION	El Guayabal river, a tributary of Rio Grande
3. IMPLEMENTING AGENCIES	MAG, MARN-SNET, COEN, municipalities
4. OBJECTIVES	(1) To construct the first sizable multipurpose dam in El Salvador; and (2) To contribute to increase in agricultural production, reduction in flood damages, and enhancement of water and land environment in the Río Grande de San Miguel basin
5. EXPECTED EFFECTS	(1) Fundamental change in the water and land regime of the Rio Grande de San Miguel, providing a model for multi-objective water resources development and management; and (2) Dynamic regional economy supported by enhanced water and land resources capacity
6. PROJECT COSTS	US$65.8 million
7. IMPLEMENTATION SCHEDULE	FS, DD and preparatory works in Phase 1; construction in Phase 2

8. PROJECT DESCRIPTION

Through the evaluation of alternative dam sites, a site on the El Guayabal river, a tributary of the Rio Grande de San Miguel, has been found most promising. A dam with the maximum height of 42m at this site will create a storage volume of 280 million m^3 (MCM). This storage volume corresponds to 68% of the storage to be provided by the San Esteban dam proposed earlier. The embankment volume for the El Guayabal dam would be much smaller than that for the San Esteban dam due to more favorable topographic conditions of the site for the former. Consequently, project costs will be much smaller.

The El Guayabal dam would allow regulation of the Rio Grande flow by storing floodwater to be use for irrigation purposes. Combined with the river improvement along the middle reaches through channel excavation and dike construction as proposed by the 1997 JICA study to cope with floods of 2-year return period, the dam would provide protection against floods of 20-year return period. With the water to be released from the dam, the entire irrigable area of 9,000ha along the middle reach of Rio Grande can be irrigated. Additional areas further downstream can also be irrigated for a total area of 14,300ha.

The El Guayabal dam would inundate about 19km^2 by its reservoir. This corresponds to 64% of the reservoir area of the proposed San Esteban dam. Therefore, the number of households to be relocated will be much smaller, estimated preliminarily at 342. The El Guayabal reservoir would inundate a portion of the trunk road CA7 linking San Miguel and Santa Rosa de Lima, and some 7km would have to be realigned.

A pre-feasibility study has been conducted as part of the Study to plan for the project in more details. The economic internal rate of return (EIRR) has been calculated at 29.0% for the case without hydropower development, including irrigation for 14,300ha, river improvement and flood plain management as recommended by the 1997 JICA study, and water supply to San Miguel city. Thus, this multipurpose dam project is highly viable. The data used for the pre FS, however, are not sufficient. More detailed analyses and cost estimate should be undertaken through a feasibility study, also including an environmental impact assessment (EIA). Moreover, a strategic resettlement plan should be prepared by the participatory approach. Further project development should be carried out involving all the stakeholders from the beginning with all the related information made open and shared by them.

Project No. 2.1b

1. PROJECT TITLE	Rio Grande de San Miguel Irrigation and Drainage
2. LOCATION	Along the middle and lower reaches of Rio Grande de San Miguel
3. IMPLEMENTING AGENCIES	MAG, municipalities
4. OBJECTIVES	(1) To increase production of vegetables and other high-value crops under irrigation; and (2) To contribute to mainstreaming small farmers into much higher income levels
5. EXPECTED EFFECTS	(1) Production of diversified crops including export crops; and (2) Supply of various raw materials to processing industries
6. PROJECT COSTS	US$70 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

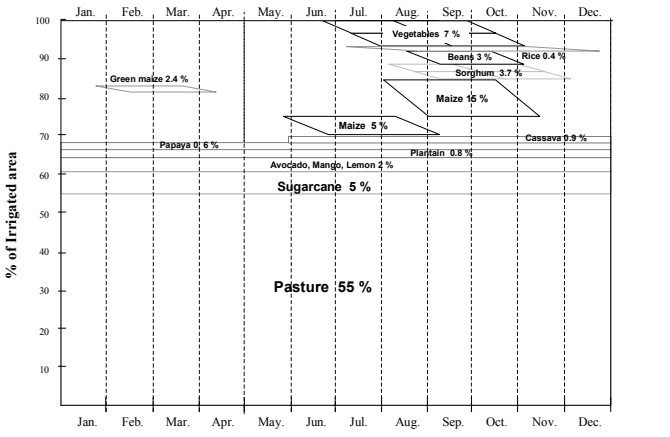
Previous studies have identified potential irrigation area of 14,300ha along the middle and lower reaches of Rio Grande de San Miguel. This area can be protected from medium floods of 10 to 20-year return period by the El Guayabal dam in combination with the river improvement along the middle reaches of Rio Grande. The water to be stored in the El Guayabal dam can be used to irrigate the entire 14,300ha of the San Miguel, Jocotal and San Dionisio irrigation.

The proposed irrigation and drainage by surface water comprises the following:

- San Miguel irrigation (9,000ha)
- Jocotal irrigation (3,000ha)
- San Dionisio Irrigation (2,300 ha)

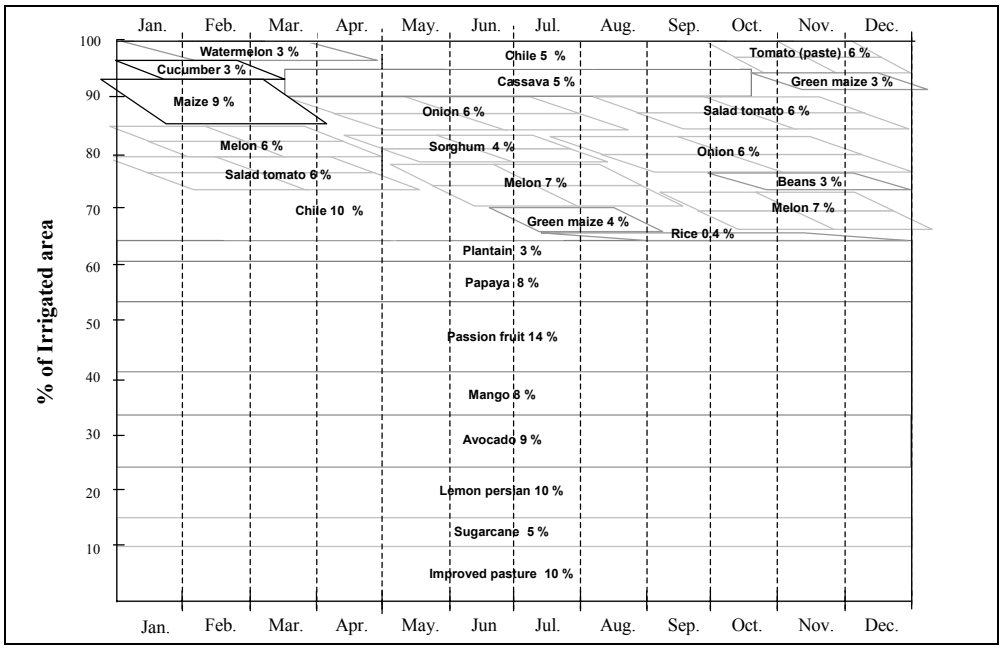
The present land use in the flood plain along the middle and lower reaches of Rio Grande de San Miguel is mostly pasture (55%) and sugarcane (5%) as shown in the figure on the right.

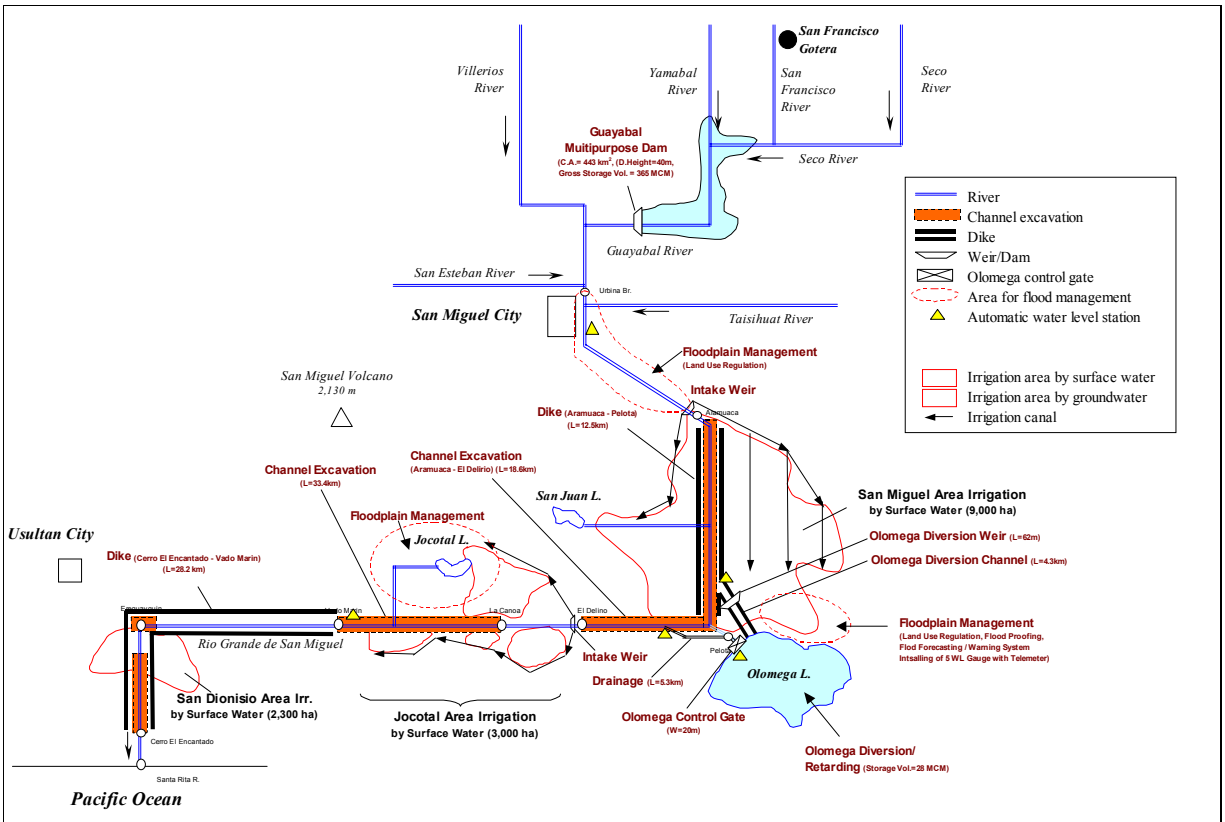
A more promising cropping pattern under irrigation has been worked out in view of new marketing opportunities, which is illustrated below. Under such cropping patterns, the El Guayabal dam with this irrigation scheme is preliminarily assessed to yield an EIRR at 29%.



Present Cropping Pattern in Sam Miguel-Ologema Area

Proposed Cropping Pattern for San Miguel Irrigation Areas





(Source: JICA Study Team.)

Proposed Rio Grande de San Miguel Water Resource Development and Manegement

Estimated Annual Benefits of San Miguel Irrigation Project (9,000ha)

Project Area: 1 **San Miguel-Olomega**
Irrigation Area (ha) = 9,000

Crop	1. Present/Without Irrigation Project				2. With Irrigation Project				Annual Project Benefit
	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	(US$/year)
1 Beans	500	3.4%	306	153,000	600	3.4%	306	183,600	30,600
2 Cassava (yucca)	1,110	0.9%	81	89,910	1,590	5.0%	450	715,500	625,590
3 Chile, sweet	11,800	0.6%	54	637,200	12,690	15.0%	1,350	17,131,500	16,494,300
4 Maize	490	20.4%	1,836	899,640	680	9.3%	837	569,160	-330,480
5 Green maize (elote)	785	2.4%	216	169,560	990	7.0%	630	623,700	454,140
6 Sorghum	460	3.7%	333	153,180	575	3.7%	333	191,475	38,295
7 Cucumber	1,240	0.3%	27	33,480	1,630	3.0%	270	440,100	406,620
8 Onion	7,400	0.4%	36	266,400	8,590	12.0%	1,080	9,277,200	9,010,800
9 Rice	740	0.4%	36	26,640	970	0.4%	36	34,920	8,280
10 Sugarcane	862	5.0%	450	387,900	959	5.0%	450	431,550	43,650
11 Tomato, salad	9,300	0.5%	45	418,500	10,560	12.0%	1,080	11,404,800	10,986,300
12 Tomato, paste	3,170	0.8%	72	228,240	3,890	6.0%	540	2,100,600	1,872,360
13 Zuchinni, (pipian)	350	0.4%	36	12,600	510	1.0%	90	45,900	33,300
14 Melon	6,830	0.6%	54	368,820	8,180	20.0%	1,800	14,724,000	14,355,180
15 Mango	2,900	0.8%	72	208,800	3,830	8.0%	720	2,757,600	2,548,800
16 Watermelon	690	0.7%	63	43,470	960	3.0%	270	259,200	215,730
17 Avocado	3,500	0.6%	54	189,000	4,430	9.0%	810	3,588,300	3,399,300
18 Lemon persian	4,865	0.8%	72	350,280	5,950	10.0%	900	5,355,000	5,004,720
19 Papaya	15,220	0.7%	63	958,860	16,740	8.0%	720	12,052,800	11,093,940
20 Passion fruit	7,970	0.4%	36	286,920	9,620	14.0%	1,260	12,121,200	11,834,280
21 Plantain	700	0.7%	63	44,100	1,030	3.0%	270	278,100	234,000
22 Pasture	650	55.5%	4,995	3,246,750	850	10.0%	900	765,000	-2,481,750
TOTAL		**100.0%**	**9,000**	**9,173,250**		**167.8%**	**15,102**	**95,051,205**	**85,878,000**

Source: JICA Study Team.

Estimated Annual Benefits of Jocotal Irrigation Project (3,000ha)

Project Area: 2 **Jocotal**
Irrigation Area (ha) = 3,000

Crop	1. Present/Without Irrigation Project				2. With Irrigation Project				Annual Project Benefit
	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	(US$/year)
1 Beans	500	3.4%	102	51,000	600	3.4%	102	61,200	10,200
2 Cassava (yucca)	1,110	0.9%	27	29,970	1,590	5.0%	150	238,500	208,530
3 Chile, sweet	11,800	0.6%	18	212,400	12,690	15.0%	450	5,710,500	5,498,100
4 Maize	490	20.4%	612	299,880	680	9.3%	279	189,720	-110,160
5 Green maize (elote)	785	2.4%	72	56,520	990	7.0%	210	207,900	151,380
6 Sorghum	460	3.7%	111	51,060	575	3.7%	111	63,825	12,765
7 Cucumber	1,240	0.3%	9	11,160	1,630	3.0%	90	146,700	135,540
8 Onion	7,400	0.4%	12	88,800	8,590	12.0%	360	3,092,400	3,003,600
9 Rice	740	0.4%	12	8,880	970	0.4%	12	11,640	2,760
10 Sugarcane	862	5.0%	150	129,300	959	5.0%	150	143,850	14,550
11 Tomato, salad	9,300	0.5%	15	139,500	10,560	12.0%	360	3,801,600	3,662,100
12 Tomato, paste	3,170	0.8%	24	76,080	3,890	6.0%	180	700,200	624,120
13 Zuchinni, (pipian)	350	0.4%	12	4,200	510	1.0%	30	15,300	11,100
14 Melon	6,830	0.6%	18	122,940	8,180	20.0%	600	4,908,000	4,785,060
15 Mango	2,900	0.8%	24	69,600	3,830	8.0%	240	919,200	849,600
16 Watermelon	690	0.7%	21	14,490	960	3.0%	90	86,400	71,910
17 Avocado	3,500	0.6%	18	63,000	4,430	9.0%	270	1,196,100	1,133,100
18 Lemon persian	4,865	0.8%	24	116,760	5,950	10.0%	300	1,785,000	1,668,240
19 Papaya	15,220	0.7%	21	319,620	16,740	8.0%	240	4,017,600	3,697,980
20 Passion fruit	7,970	0.4%	12	95,640	9,620	14.0%	420	4,040,400	3,944,760
21 Plantain	700	0.7%	21	14,700	1,030	3.0%	90	92,700	78,000
22 Pasture	650	55.5%	1,665	1,082,250	850	10.0%	300	255,000	-827,250
TOTAL		**100.0%**	**3,000**	**3,057,750**		**167.8%**	**5,034**	**31,683,735**	**28,626,000**

Source: JICA Study Team.

Estimated Annual Benefits of San Dionisio Irrigation Project (2,300ha)

Project Area: 4 **San Dioniso**
Irrigation Area (ha) = 2,300

Crop	1. Present/Without Irrigation Project				2. With Irrigation Project				Annual Project Benefit
	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	(US$/year)
1 Beans	500	3.4%	78	39,100	600	3.4%	78	46,920	7,820
2 Cassava (yucca)	1,110	0.9%	21	22,977	1,590	5.0%	115	182,850	159,873
3 Chile, sweet	11,800	0.6%	14	162,840	12,690	15.0%	345	4,378,050	4,215,210
4 Maize	490	20.4%	469	229,908	680	9.3%	214	145,452	-84,456
5 Green maize (elote)	785	2.4%	55	43,332	990	7.0%	161	159,390	116,058
6 Sorghum	460	3.7%	85	39,146	575	3.7%	85	48,933	9,787
7 Cucumber	1,240	0.3%	7	8,556	1,630	3.0%	69	112,470	103,914
8 Onion	7,400	0.4%	9	68,080	8,590	12.0%	276	2,370,840	2,302,760
9 Rice	740	0.4%	9	6,808	970	0.4%	9	8,924	2,116
10 Sugarcane	862	5.0%	115	99,130	959	5.0%	115	110,285	11,155
11 Tomato, salad	9,300	0.5%	12	106,950	10,560	12.0%	276	2,914,560	2,807,610
12 Tomato, paste	3,170	0.8%	18	58,328	3,890	6.0%	138	536,820	478,492
13 Zuchinni, (pipian)	350	0.4%	9	3,220	510	1.0%	23	11,730	8,510
14 Melon	6,830	0.6%	14	94,254	8,180	20.0%	460	3,762,800	3,668,546
15 Mango	2,900	0.8%	18	53,360	3,830	8.0%	184	704,720	651,360
16 Watermelon	690	0.7%	16	11,109	960	3.0%	69	66,240	55,131
17 Avocado	3,500	0.6%	14	48,300	4,430	9.0%	207	917,010	868,710
18 Lemon persian	4,865	0.8%	18	89,516	5,950	10.0%	230	1,368,500	1,278,984
19 Papaya	15,220	0.7%	16	245,042	16,740	8.0%	184	3,080,160	2,835,118
20 Passion fruit	7,970	0.4%	9	73,324	9,620	14.0%	322	3,097,640	3,024,316
21 Plantain	700	0.7%	16	11,270	1,030	3.0%	69	71,070	59,800
22 Pasture	650	55.5%	1,277	829,725	850	10.0%	230	195,500	-634,225
TOTAL		**100.0%**	**2,300**	**2,344,275**		**167.8%**	**3,859**	**24,290,864**	**21,947,000**

Source: JICA Study Team.

Results of Economic Analysis
(El Guayabal Dam + All Rio Grande de San Miguel Midstream Irrigation Projects)

Cost of Irr. (Economic Cost)	88.82	
Cost of Dam (Economic Cost)	57.61	
Study (F/S+D/D)	5%	7.32 for Dam & Irr.Project
O&M Cost (every year)	2.0%	for Dam & Irr.Project
Replacement Cost (10-yr)	5.0%	for Dam & Irr.Project

Project Area (Sector)	Irr. Area (ha)	Irr.Cost (US$106) Pjt. Cost	Econo. C.	Irr.Benefit (US$106/yr)
San Miguel-Olomega	9,000	63.54	59.40	85.88
Jocotal	3,000	20.22	18.90	28.63
San Dionisio	2,300	11.25	10.51	21.95
TOTAL	**14,300**	**95.01**	**88.82**	**136.45**

Discout Rate: 12.0%

(Unit : US$ 10^6)

Year After Pjt.	Disc. Year	Year		Economic Cost: Study F/S&D/D	Dam: Invest.	Dam: O&M	River Imp.(M/P): Invest.	River Imp.(M/P): O&M	Irrigation (Investment): (San Miguel)	Irrigation (Investment): (Jocotal)	Irrigation (Investment): (S.Diosisio)	Irr. O&M	Replace-ment	Total Cost	NPV (Cost)	Economic Benefit: Irrigation Benefit	Lost *1) Benefit	HEP (Fuel)	Flood Control	Total Benefit	NPV (Benefit)	Net Cash Flow (B - C)
	1	2005		1.83			3.01							**4.84**	4.32	0.00	0.00			**0.00**	0.00	-4.84
	2	2006	Phase-1	1.83			1.40							**3.23**	2.58	0.00	0.00		0.00	**0.00**	0.00	-3.23
	3	2007					14.51							**14.51**	10.33	0.00	0.00		0.00	**0.00**	0.00	-14.51
	4	2008		1.83			14.51	0.06						**16.40**	10.42	0.00	0.00		0.00	**0.00**	0.00	-16.40
	5	2009		1.83			14.51	0.12						**16.46**	9.34	0.00	0.00		2.35	**2.35**	1.33	-14.11
	6	2010			5.76		16.44	0.18	5.94					**28.32**	14.35	0.00	0.00		4.69	**4.69**	2.38	-23.63
	7	2011	Phase-2		11.52		14.87	0.24	11.88			0.36		**38.87**	17.58	0.00	-0.76		7.04	**6.28**	2.84	-32.59
	8	2012			20.16		12.38	0.30	20.79			0.77		**54.41**	21.97	21.47	-1.51		9.39	**29.34**	11.85	-25.06
	9	2013			11.52		12.09	0.35	11.88			1.01		**36.86**	13.29	42.94	-1.51		11.74	**53.16**	19.17	16.30
	10	2014			8.64		12.09	0.41	8.91			1.19		**31.24**	10.06	64.41	-1.51		13.81	**76.70**	24.70	45.47
1	11	2015				1.15	12.09	0.46		1.89	1.05	1.25		**17.89**	5.14	85.88	-1.51	0.00	15.83	**100.19**	28.80	82.30
2	12	2016	Phase-3			1.15	12.09	0.51		3.78	2.10	1.36		**21.01**	5.39	85.88	-1.51	0.00	19.98	**104.34**	26.78	83.33
3	13	2017				1.15		0.57		6.62	3.68	1.57		**13.58**	3.11	98.52	-1.51	0.00	22.79	**119.80**	27.45	106.21
4	14	2018				1.15		0.57		3.78	2.10	1.69		**9.29**	1.90	111.16	-1.51	0.00	22.79	**132.44**	27.10	123.15
5	15	2019				1.15		0.57		2.84	1.58	1.78		**7.91**	1.44	123.81	-1.51	0.00	22.79	**145.08**	26.51	137.18
6	16	2020				1.15		0.57				1.78		**3.49**	0.57	136.45	-1.51	0.00	22.79	**157.73**	25.73	154.23
7	17	2021				1.15		0.57				1.78		**3.49**	0.51	136.45	-1.51	0.00	22.79	**157.73**	22.97	154.23
8	18	2022				1.15		0.57				1.78		**3.49**	0.45	136.45	-1.51	0.00	22.79	**157.73**	20.51	154.23
9	19	2023				1.15		0.57				1.78		**3.49**	0.41	136.45	-1.51	0.00	22.79	**157.73**	18.31	154.23
10	20	2024				1.15		0.57				1.78	5.85	**9.34**	0.97	136.45	-1.51	0.00	22.79	**157.73**	16.35	148.38
11	21	2025				1.15		0.57				1.78		**3.49**	0.32	136.45	-1.51	0.00	22.79	**157.73**	14.60	154.23
12	22	2026				1.15		0.57				1.78		**3.49**	0.29	136.45	-1.51	0.00	22.79	**157.73**	13.03	154.23
13	23	2027				1.15		0.57				1.78		**3.49**	0.26	136.45	-1.51	0.00	22.79	**157.73**	11.64	154.23
14	24	2028				1.15		0.57				1.78		**3.49**	0.23	136.45	-1.51	0.00	22.79	**157.73**	10.39	154.23
15	25	2029				1.15		0.57				1.78		**3.49**	0.21	136.45	-1.51	0.00	22.79	**157.73**	9.28	154.23
16	26	2030				1.15		0.57				1.78		**3.49**	0.18	136.45	-1.51	0.00	22.79	**157.73**	8.28	154.23
17	27	2031				1.15		0.57				1.78		**3.49**	0.16	136.45	-1.51	0.00	22.79	**157.73**	7.40	154.23
18	28	2032				1.15		0.57				1.78		**3.49**	0.15	136.45	-1.51	0.00	22.79	**157.73**	6.60	154.23
19	29	2033				1.15		0.57				1.78		**3.49**	0.13	136.45	-1.51	0.00	22.79	**157.73**	5.90	154.23
20	30	2034				1.15		0.57				1.78	7.32	**10.82**	0.36	136.45	-1.51	0.00	22.79	**157.73**	5.26	146.91
21	31	2035				1.15		0.57				1.78		**3.49**	0.10	136.45	-1.51	0.00	22.79	**157.73**	4.70	154.23
22	32	2036				1.15		0.57				1.78		**3.49**	0.09	136.45	-1.51	0.00	22.79	**157.73**	4.20	154.23
23	33	2037				1.15		0.57				1.78		**3.49**	0.08	136.45	-1.51	0.00	22.79	**157.73**	3.75	154.23
24	34	2038				1.15		0.57				1.78		**3.49**	0.07	136.45	-1.51	0.00	22.79	**157.73**	3.35	154.23
25	35	2039				1.15		0.57				1.78		**3.49**	0.07	136.45	-1.51	0.00	22.79	**157.73**	2.99	154.23
26	36	2040				1.15		0.57				1.78		**3.49**	0.06	136.45	-1.51	0.00	22.79	**157.73**	2.67	154.23
27	37	2041				1.15		0.57				1.78		**3.49**	0.05	136.45	-1.51	0.00	22.79	**157.73**	2.38	154.23
28	38	2042				1.15		0.57				1.78		**3.49**	0.05	136.45	-1.51	0.00	22.79	**157.73**	2.13	154.23
29	39	2043				1.15		0.57				1.78	7.32	**10.82**	0.13	136.45	-1.51	0.00	22.79	**157.73**	1.90	146.91
30	40	2044				1.15		0.57				1.78		**3.49**	0.04	136.45	-1.51	0.00	22.79	**157.73**	1.70	154.23
31	41	2045				1.15		0.57				1.78		**3.49**	0.03	136.45	-1.51	0.00	22.79	**157.73**	1.51	154.23
32	42	2046				1.15		0.57				1.78		**3.49**	0.03	136.45	-1.51	0.00	22.79	**157.73**	1.35	154.23
33	43	2047				1.15		0.57				1.78		**3.49**	0.03	136.45	-1.51	0.00	22.79	**157.73**	1.21	154.23
34	44	2048				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	1.08	154.23
35	45	2049				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.96	154.23
36	46	2050				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.86	154.23
37	47	2051				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.77	154.23
38	48	2052				1.15		0.57				1.78	7.32	**10.82**	0.05	136.45	-1.51	0.00	22.79	**157.73**	0.68	146.91
39	49	2053				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.61	154.23
40	50	2054				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.55	154.23
41	51	2055				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.49	154.23
42	52	2056				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.44	154.23
43	53	2057				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.39	154.23
44	54	2058				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.35	154.23
45	55	2059				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.31	154.23
46	56	2060				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.28	154.23
47	57	2061				1.15		0.57				1.78	7.32	**10.82**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.25	146.91
48	58	2062				1.15		0.57				1.78		**3.49**	0.00	136.45	-1.51	0.00	22.79	**157.73**	0.22	154.23
49	59	2063				1.15		0.57				1.78		**3.49**	0.00	136.45	-1.51	0.00	22.79	**157.73**	0.20	154.23
50	60	2064				1.15		0.57				1.78		**3.49**	0.00	136.45	-1.51	0.00	22.79	**157.73**	0.18	154.23
				7.32	57.61	57.61	139.98	29.76	59.40	18.90	10.51	90.91	35.14	**507**	137.50	6,774.34	-81.00	0.00	1,178.74	**7,872**	437.58	7,365
											88.82											

B-C :	300.09
B / C :	3.18
EIRR :	**29.0%**

Source: JICA Study Team.

Note: Lost benefit indicates estimated crop benefit that would have been gained at the area inundated by the dam project.

"R.Imp.": Flood control benefit by river improvement project that was proposed by JICA 1997 study (flood control project master plan for 10-year flood).

Project No. 2.1c

1. PROJECT TITLE	Rio Grande Midstream River Improvement
2. LOCATION	Middle reaches of the Rio Grande de San Miguel
3. IMPLEMENTING AGENCIES	MAG, MOP, MARN-SNET, COEN, municipalities
4. OBJECTIVES	(1) To protect the productive land along the middle reaches of Rio Grande from habitual floods; and (2) To promote flood plain management and lifestyles adopted to flooding
5. EXPECTED EFFECTS	(1) More rational land use in the flood plain; and (2) Reduced flood damages
6. PROJECT COSTS	US$80 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

The 1997 JICA Study identified priority schemes for flood control of the Rio Grande de San Miguel, including the river improvement along the middle reaches. The project consists of channel excavation and dike construction to allow the containment and discharge of floods with the 10-year return period.

Implementation of the project should be combined with better flood plain management (another component of Project No. 2.1) for more rational land use in the flood plain. The project should be encourage also such lifestyles of the people that would adapt to inevitable flooding. They include the construction of houses with elevated floods, and the provision of flood shelters and high grounds to protect property including cattle in case of floods. To reduce flood damages effectively, the early flood warning system should be strengthened extending the ongoing initiative by SNET, supported by USAID and USGS.

Project No. 2.2

1. PROJECT TITLE	Small and Micro Irrigation
2. LOCATION	La Union, Morazan, San Miguel, Usulutan
3. IMPLEMENTING AGENCIES	MAG, CENTA, municipalities, NGOs
4. OBJECTIVES	(1) To increase income levels of small farmers; (2) To diversify crop production under irrigation; and (3) To contribute to more robust regional economy with reduced vulnerability to floods and droughts
5. EXPECTED EFFECTS	(1) Improved livelihood of small farmers; and (2) Accumulated experiences in irrigated agriculture and promising crops
6. PROJECT COSTS	US$22.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

The project supports small farmers to enhance farm productivity by providing irrigation by various means and from various sources. Small-scale irrigation schemes consist of the following four types, depending on the source of irrigation water:

1) surface water irrigation in southern part of San Miguel, Usulutan and La Union,
2) small reservoir irrigation in upstream and midstream areas of small tributaries in the northern La Union, Morazan, and middle part of San Miguel,
3) spring water irrigation at the foot hills of the San Miguel volcano, and
4) groundwater irrigation in the northern La Union, Morazan and Usulutan.

Small-scale irrigation by small reservoirs and ponds would contribute also to enhancing water retention capacity of land and soil conservation. Some of them may be inter-connected horizontally through contour canals and vertically in cascades to enhance overall water use and soil conservation efficiency. The project will plan for such an interconnected system particularly for upper and middle catchment areas of river basins, while priority schemes are implemented.

Micro irrigation may combine a simple weir possibly made of gabions or sand bags, PVC channels to convey water, small ponds (or tanks) waterproofed with rubber sheets, and drip irrigation. The same channel may feed a few or more ponds. Maize during the rainy season may be combined with vegetables during the dry season under drip irrigation.

Project No. 2.2b

1. PROJECT TITLE	Micro-Scale Irrigation by Tank Irrigation System
2. LOCATION	Morazan, San Miguel and La Union
3. IMPLEMENTING AGENCIES	MAG, CENTA, municipalities and communities, NGOs, the private sector
4. OBJECTIVES	To reduce poverty of small farmers affected by severe droughts in the northern part of Morazan, San Miguel and La Union through development of drip irrigation systems and technical training
5. EXPECTED EFFECTS	(1) Farmers' groups motivated for large-scale irrigation development; (2) Accumulated experiences in irrigated agriculture and promising crops for marketing; and (3) Higher income of small farmers
6. PROJECT COSTS	US$3.5 million in Phase 1
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

Both floods and droughts are more severe in the Eastern Region, and the extensive area suffering from dry spells during the rainy season is unfortunately a unique characteristic of the Region. The departments of San Miguel, Morazan, and La Union experience severe drought damages for agricultural crops and livestock by the *El Niño* phenomena. Especially the drought in 2001 damaged 44 cantons, and the total damage in the agriculture sector was estimated at US$3,300 million with about 410,000 people affected. Most affected families were small-scale farmers for self-sufficiency cultivating mainly maize, sorghum and frijole bean at steep slopes in the mountainous region. The income levels of these farmers are very low, and the rural areas in the Eastern Region are most poverty stricken in the Country. The Region also suffers problems with water resources and erosion due to the degraded upper basins.

Given these conditions in the Eastern Region, the watershed management is of utmost importance for the development of the Region. A key to successful watershed management is to enhance the water retention capacity of river basins, particularly in upper and middle basins through reforestation and forest management, adoption of better farming practices such as sloping agricultural land technology (SALT), and large and small-scale water storage.

It may be effective to link small ponds by contour canals for a tank system. This system may be particularly relevant in the Region for the purpose of supplemental irrigation to bridge dry spells during the rainy season and extend cropping season by a few months at most. The proposed project of micro irrigation with a small reservoir will use neighboring small rivers or springs as a water source.

The reservoirs will be linked by contour canals for a tank system. Simple weirs may be constructed across small rivers to raise the level of water, which would be introduces into contour canals and gravity irrigation (Figure 1). One possibility is to utilize gabions or sandbags produced by utilizing gravels and stones or sands widely available in the Region and skillfulness of local people. Local communities should be involved in the identification of sites for weirs and suitable agricultural areas as well as construction works. The proposed canal is by PVC pipe for reduction of water loss. A reservoir tank will be excavated at the ground surface and the bottom and side of the reservoir will be covered by rubber-sheets (e.g., geo-textile, etc.) to reduce water losses. A drip or sprinkler irrigation method should be selected for saving water.

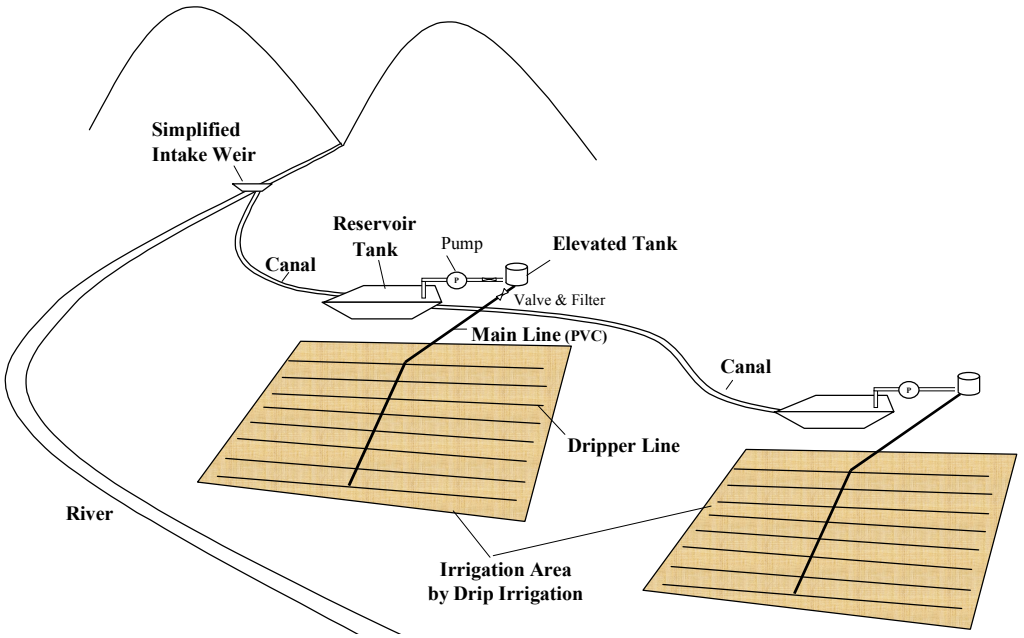


Figure 1. Micro Scale Irrigation by Small Reservoir Tank System

According to a rough estimate using available hydrological data (river discharges) and climate data, semiannual (double) cropping is possible in a year by the proposed micro scale irrigation by small reservoir tank system, even in the mountainous area of northern part of La Union, Morazan or San Miguel departments (at present only single cropping of maize, sorghum or frijol). The proposed cropping pattern is shown in Figure 2.

Required reservoir volumes in the northern part La Union, the southern part of La Union, Morazan and San Miguel for the irrigation area of 1.0ha are estimated at 1,250m^3, 3,130m^3, 3,500m^3 and 2050m^3, respectively. The river flows are estimated using specific discharge of once-in-five-year probable drought discharge, referring to similar conditions of hydrological observation station, and the catchment area at the intake site is assumed 1.0km^2. Estimated unit costs are around US$31,000-44,000 per ha. The costs include a simplified intake weir, PVC pipe canal of 300m, reservoir tank, pump, generator, elevated tank, and a drip irrigation

system (1.0ha). The annual average benefit is estimated at around US$5,500 and the EIRR will be 9.1-15.2%. In other zones where sufficient river flow is available, the reservoir will not be required (only intake weir, canal and drip irrigation system required). Assuming the unit cost of US$35,000 per ha at each site, 100 sites to be covered by the project during Phase 1 will cost US$3.5 million.

The project will greatly contribute to reduction of poverty in rural areas of the Eastern Region. At the same time, technical training and guidance in organizing farmers' associations, crop production and commercialization for the beneficiaries should be conducted. Careful hydrological investigations, social and environmental impact studies for downstream will also be required.

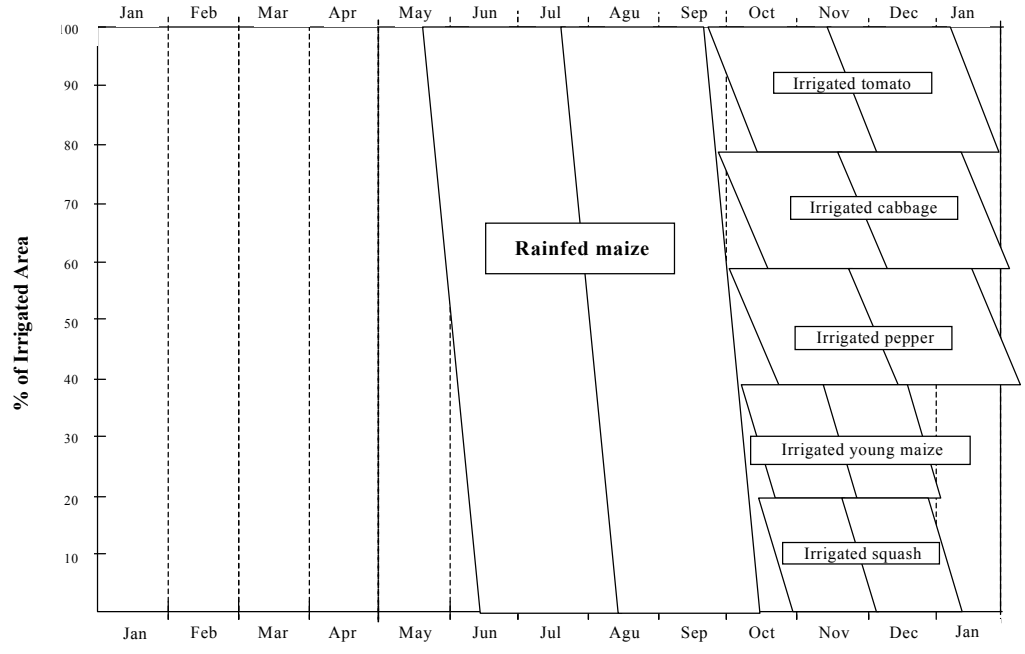


Figure 2. Proposed Cropping Pattern

Project No. 2.3

1. PROJECT TITLE	High Elevation Coffee Improvement Program
2. LOCATION	Coffee areas in the Eastern Region
3. IMPLEMENTING AGENCIES	PROCAFE, MOE-Tradepoint and NGOs coordinated by CND
4. OBJECTIVES	(1) To improve coffee production and processing for quality products; (2) To increase income levels of small coffee producers; and (3) To protect and enhance the upper watershed by promoting coffee production under shade trees system
5. EXPECTED EFFECTS	(1) Mainstreamed small coffee growers; (2) International reputation for quality coffee; and (3) Improved watershed
6. PROJECT COSTS	US$0.3 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

The program supports the improvement of coffee production and processing with emphasis on high elevation coffee produced by small coffee farmers. It consists of the following four main components:

1) expansion of high elevation coffee with shade trees as part of reforestation program,
2) promotion of organic coffee,
3) establishment of small processing facilities to produce high quality coffee by organized coffee growers, and
4) development of original coffee brands.

A pilot program has been formulated with the following components:

1) Formation of coffee producers organizations,
2) Installation of two units of coffee pulping machines,
3) Market survey and preliminary marketing,
4) Technical extension for coffee production, harvesting, pulping and other treatment,
5) Development of trade name and logo for export coffee, and
6) Processing of organic coffee certification.

Project No. 2.4

1. PROJECT TITLE	Lower Lempa Re-regulating Dam and Irrigation
2. LOCATION	Usulutan
3. IMPLEMENTING AGENCIES	CEL, MAG, MARN, MOP
4. OBJECTIVES	(1) To utilize the water released from the September 15 dam for irrigation, hydropower, fishery and tourism; and (2) To contribute to the long-term socioeconomic development in the Eastern Region
5. EXPECTED EFFECTS	Creation of a rich agro-environment-tourism zone in the lower Lempa area
6. PROJECT COSTS	US$487 million (US$226 million in Phase 3)
7. IMPLEMENTATION SCHEDULE	Phase 3-

8. PROJECT DESCRIPTION

The project serves as a model multipurpose water resources development project for the new era, in which efficient use of limited water resources as well as environmentally sound development is regarded as increasingly important. The project will change limited and sometimes abusive use of water resources in the lower Lempa to most efficient use for multiple purposes.

A dam would be constructed at San Marcos Lempa to re-regulate the water released from the September 15 dam. The water should be used to irrigate some 23,000ha along the lower Lempa. Additional hydropower would be generated, and the reservoir would be used for fishery and tourism.

The project also includes the construction of a Lempa riverside road, which would be used as an access road to the dam site, to improve access to the tourism area. This 15km-long road would command a magnificent view of the river and the volcano from the riverside.

Project No. 2.5

1. PROJECT TITLE	Urban and Rural Water Supply Program
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	ANDA, municipalities
4. OBJECTIVES	(1) To expand the service coverage of water supply at least to the level comparable to the national average; and
	(2) To improve the quality of water supply to attract investors and visitors to the Eastern Region
5. EXPECTED EFFECTS	(1) Expanded population coverage by piped water supply in urban areas;
	(2) Improved sanitation in urban and rural areas; and
	(3) High quality water supply to attract investors and visitors, including tourists to rural areas
6. PROJECT COSTS	US$104.7 million
7. IMPLEMENTATION SCHEDULE	Continuous implementation for Phase 1-Phase 3

8. PROJECT DESCRIPTION

The project has two separate components: (1) urban water supply improvement in major cities and (2) rural water supply and sanitation. The first component expands water supply capacity and improves the quality of urban water supply in major cities as an essential condition to attract investors and visitors. The second component improves the rural water supply and sanitation consistently to fulfill the basic human needs.

Community involvement would be essential for effective implementation and management particularly of rural water supply facilities. Local communities are expected to participate not only in planning but also in construction works such as well drilling, materials transportation, installation of equipment and pipes, etc. This would ensure effective use of local sources of water and selection of more adequate materials and appropriate methods of construction. Local people would be motivated to manage and operate the facilities they have planned and implemented.

Project No. 2.5a

1. PROJECT TITLE	Urban Water Supply Improvement
2. LOCATION	(1) La Union-Conchagua, (2) San Miguel, (3) Usulutan, (4) Santa Rasa de Lima, (5) San Francisco Gotera, (6) El Triunfo cities
3. IMPLEMENTING AGENCIES	ANDA, municipalities
4. OBJECTIVES	(1) To meet increasing water demand through rehabilitation of existing system and expansion of service area; and (2) To improve the quality of city water supply
5. EXPECTED EFFECTS	(1) Expanded population coverage by piped water supply; reduced risk of waterborne diseases; and (2) High quality water supply to attract investors and visitors
6. PROJECT COSTS	US$72 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

The service coverage for water supply by ANDA in the Eastern Region is below the national average (88% in 2001). In terms of the population coverage in urban areas, the coverage by ANDA is 85% in Usulutan, 64.5% in San Miguel, 62.5% in Morazan, and 72% in La Union at the department level. In the major cities with over 10,000 urban population, the population coverage is 86.3% in Usulutan city, 84.5% in Santiago de Maria, 71.6% in San Miguel, 62.5% in San Francisco Gotera, 86.1% in La Union, 100% in Santa Rosa de Lima, as shown in the table below.

Current Situation of Urban Water Supply by ANDA in Eastern Region (Dec. 2001)

Department	Municiparity	No. of Connection (Household)	Supply *1) Population (people)	Urban Population (people)	Population Coverage (%)	Monthly Consumption (m3/month)	Unit Consumption (liter/c/d)
Usulután	Usulután	7,666	38,330	44,407	86.3	325,500	283
Usulután	Santiago de María	2,141	10,705	12,668	84.5		
San Miguel	San Miguel	22,332	111,660	156,036	71.6	1,048,000	313
Morazan	San Francisco Gotera	1,711	8,555	13,691	62.5	83,000	323
La Unión	La Unión	4,002	20,010	23,246	86.1	202,300	337
La Unión	Santa Rosa de Lima	2,426	11,719	11,719	100.0	96,600	275

Source: Boletín Estadístico No.23, 2001, ANDA.

Note *1) Assumed 5 person/houshold (average number of urban family) for urban area.

The coverage ratio appears to be high but it does not guarantee full access, due to the following problems:

a) the average supply time that fluctuates between 16 and 18 hours per day;
b) the precarious water quality that can be hazardous to the consumers' health (hence, increased demand for bottled water); and

c) the existence of areas with difficult access, which has resulted from haphazard urbanization.

The existing conditions of water supply in the three largest cities of San Miguel, Usulutan and La Union cities are shown in the table below.

Existing Conditions of Urban Water Supply Systems in the Eastern Region

Name of City		San Miguel City	Usulután City	La Union City
Administration of Water Supply System		ANDA	ANDA	ANDA
Water Source		GW (95%) + Spring (5%)	GW (41%) + Spring (59%)	GW (mainly)
No. of W.Source (Groundwater Wells)	(wells)	13	3	5
Depth of Wells	(m)	120 ~ 180 m	20 m	100 m
No. of W.Source (Surface water)	(sites)	1 spring (Moncagua)	1 spring (La Ceiba)	(1: Bella Vista)
No. of receptions (intake)	(nos.)	5	2	(1)
Current Total Daily Production Capacity	(m^3/day)	31,135	11,750	6,500
Current Water Demand (Dec. 2001)				
No. of Connection Households	(HH)	22,332	7,666	4,036
Estimated Supplied Population (HH x 5 pers.)	(people)	111,660	38,330	20,180
Service Coverage Ratio in Servoce Area	(%)	71.6%	86.3%	86.1%
Population coverage in Municipality	(%)	47%	56%	50%
Mean Monthly Consumption	(m^3/month)	1,048,000	325,500	202,300
Daily Mean Consumption (Demand)	(m^3/day)	34,930	10,850	6,740
Unit Daily Mean Consumption	(liter/p/d)	313	283	334
Deficit (Production Capacity - Demand)	(m^3/day)	-3,795	900	-240
Operattion Years	(years)	> 60 Years	> 40 years (since 1962)	> 40 years
Illigal Connection Rate	(%)	35%	> 1.3%	> 2.5%
Water Loss Rate	(%)	30%	(unknown)	(unknown)
Service of Supply 24 hours a day	-	YES	NO	NO

Source: ANDA (2002)

The production and supply capacity is not enough to meet the water demand in San Miguel and La Union cities. The water supply capacity needs to be expanded continuously in most municipalities to meet growing demands from accelerating urbanization. Moreover, those systems were established over 40 or 60 years ago and the rate of water losses will be high. Improvement and/or rehabilitation of the existing supply systems are also required.

At present, only San Miguel city has an expansion plan for a larger water supply system to cover several communities. The project aims to extend such an approach to other municipalities and neighboring villages. Implementation of the water supply systems in San Miguel, La Union and San Francisco Gotera is prioritized.

The population in the Eastern Region may increase at the average rate of 1.6% per annum. The urban population in San Miguel, Usulutan, La Union, San Francisco Gotera, Santiago de Maria, and Santa Rosa de Lima may increase to some 204,400, 58,200, 72,000, 17,900, 16,600, and 15,300 by 2018, respectively. The water demand and the additional number of wells required by 2018 are shown in the following table. To meet the future water demand in these cities, projects for rehabilitation and new expansion will be required. The total cost of the water supply system improvement projects for the six cities is estimated at US$72 million.

Future Demand Projecttions and Estimated Project Cost in 2008 and 2018

NAME OF CITY		San Miguel	Usulután	La Union	San Francisco Gotera	Santiago de María	Santa Rosa de Lima
Department		San Miguel	Usulután	La Union	Marazan	Usulutan	La Union
Average Annual Population Growth Rate *1)		1.6%	1.6%		1.6%	1.6%	1.6%
Population in Urban Area	2001	156,036	44,407	23,246	13,691	12,668	11,719
	2008	174,374	49,626	43,000	15,300	14,157	13,096
	2018	204,400	58,200	72,000	17,900	16,600	15,300
Unit Water Cunsumption (ANDA Plan) *2)	liter/c/d	250	250	250	200	200	200
Popuration Coverage (Plan) (%)	2001	71.6%	86.3%	86.1%	62.5%	84.5%	100%
	2008	100%	100%	100%	100%	100%	100%
	2018	100%	100%	100%	100%	100%	100%
Domestic Water Demand (m^3/d)	2001	27,930	9,581	5,004	1,711	2,141	2,344
	2008	43,593	12,406	10,750	3,060	2,831	2,619
	2018	51,100	14,550	18,000	3,580	3,320	3,060
Industrial and Commercial Water Demand (m^3/d) *3)	2001	2,793	958	500	171	214	234
	2008	4,359	1,241	1,075	306	283	262
	2018	5,110	1,455	1,800	358	332	306
Total Water Demand (m^3/d)	2001	30,723	10,539	5,504	1,883	2,355	2,578
	2008	47,953	13,647	11,825	3,366	3,114	2,881
	2018	56,210	16,005	19,800	3,938	3,652	3,366
Current Production Capacity (m3/d)	2001	31,135	11,750	6,500	*1,177*	*1,990*	*2,578*
Required New Production Water (m^3/d)	2008	16,818	1,897	5,325	2,189	1,125	303
	2018	25,075	4,255	13,300	2,761	1,662	788
Average Well Yied *4)	liter/sec	26.3	18.7	19.6	*14.6*	3.0	*6.5*
Average Well Depth *4)	(m)	150	20	100	63	136	42
Required No. of Aditional Wells	2008	8	2	4	2	5	1
	2018	12	3	8	3	7	2
Cost							
Unit Cost of Deep Well (Drill+Casing)	US$/m	570	570	570	570	570	570
Cost of Well (US$)	2018	1,026,000	34,200	456,000	108,409	542,640	47,950
Unit Cost of Pump	US$/unit	31,000	31,000	31,000	31,000	31,000	31,000
Cost of Pump (US$)	2018	372,000	93,000	248,000	93,000	217,000	62,000
Cost of Connecting Pipe Line (US$)	2018	242,400	60,600	161,600	60,600	141,400	40,400
Cost of Electric Power Supply for Pumps (US$)	2018	132,000	33,000	88,000	33,000	77,000	22,000
Cost of Disinfection, Reservoir Tank and Pump St. (US$)	2018	4,413,000	749,000	2,341,000	486,000	293,000	139,000
Cost of Distribution Pipeline (US$)	2018	12,768,000	3,641,000	12,871,000	1,111,000	1,038,000	945,000
Cost of New Expantion System (million US$)	2018	18.95	4.61	16.17	1.89	2.31	1.26
Cost of F/S, D/D, S/V, Contingency, etc. (30%) (US$10^6)	2018	5.69	1.38	4.85	0.57	0.69	0.38
Cost of Rehabilitation of Existing System (30%) (US$10^6)	2018	5.69	1.38	4.85	0.57	0.69	0.38
TOTAL COST (US$10^6)	2018	30.32	7.38	25.87	3.03	3.69	2.01

Source: JICA Study Team

Note *1) Assumed as 1.6% based on the average annual grouth rate of 1.59% during 1992 - 2000 in Eastern Region.

*2) Generally used unit consumption for plan of ANDA, 250 l/c/d for the large urban area, and 200 l/c/d for midium urban area.

*3) Assumed 10% of domestic water demand.

*4) San Miguel, Usultan and La Union: (source: average well yield of existing well by ANDA.)

Project No. 3.1

1. PROJECT TITLE	Cooperative Tourism Promotion Program
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	CND, CORSATUR
4. OBJECTIVES	(1) To develop various tourism products through cooperative efforts of local promotion groups; and
	(2) To conduct joint marketing of the tourism products in alliance with San Salvador-based tour conductors
5. EXPECTED EFFECTS	(1) The Eastern Region as an established market for domestic tourism; and
	(2) Stable and robust operation of the local tourism industry
6. PROJECT COSTS	US$7.8 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

The project supports and extends the ongoing initiative for local tourism promotion in the Eastern Region assisted by CND. It has the following components:

1) tourism circuits formation,
2) tourism products development,
3) local tour operators training, and
4) strategic alliance promotion.

A pilot project has been formulated as part of the JICA Study to support a local tourism group in developing some tourism products such as local food recipes and tour circuits. The pilot project should be implemented in the immediate future.

Training of local tour operators should be undertaken using the existing facilities such as INSAFORP. The new La Union technological institute, once established in 2006, should start to offer training courses to generate qualified managers and operators for tourism.

A strategic alliance should be sought with San Salvador-based tour conductors to promote the Eastern Region brand of tourism and to accommodate tourists right from the beginning. Proactive promotion campaigns should be conducted when the La Union port is commissioned both in the Eastern Region and in San Salvador as a first step to form their strategic alliance.

Project No. 3.1a

1. PROJECT TITLE	Tourism Circuits Formation
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	CND, CORSATUR, local communities
4. OBJECTIVES	(1) To identify tourist routes and activities in three major destination areas in the Eastern Region; (2) To formulate a concrete plan of tourism development in each area, with components achievable within a year; and (3) To form up strategic alliance with San Salvador based tour conductors
5. EXPECTED EFFECTS	(1) Accelerated tourism development based on a realistic and concrete development plan formulated through participatory process (2) Effective preparation for a tourism promotion campaign at the start of the operation of the La Union port
6. PROJECT COSTS	US$0.8 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

Through the participatory efforts made among local tourism promotion groups assisted by CND, three tourist routes were identified as the most promising and urgent to promote, namely:

(1) "*La Ruta del Golfo*" or the route of the gulf consisting of Conchagua and La Union municipalities,

(2) "*La Ruta de la Paz*" or the route of peace running through municipalities of Perquin, Arambala, Jocoaitique and Villa El Rosario in Morazan Department, and

(3) "*La Ruta de la Bahía de Jiquilisco y la Sierra Tecapa Chinameca*" or the route of the Jiquilisco Bay and hinterland, covering the municipailies of Jucuarán, Puerto el Triunfo, and Alegría in Usulutan Department.

In order to put the momentum on the track and further activate promotion efforts to generate the main driving force of the entire tourism development in the Region, it is desirable to formulate detailed development plans for each tourist route, and identify concrete projects which can be materialized in a fairly short period of time. In this light, a pilot project has been formulated in the course of the JICA Study and will be materialized afterwards by the hands of local initiative with proper assistance and/or funding by relevant government agencies.

The main activities and output of the pilot project are as follows:

1) building a consensus among the participants on the composition of the planning process,
2) setting up a tourist development committee in each area and providing necessary training to the leaders,

3) conducting planning workshops (including visits to precedent successful projects) aiming to identify tour routes and activities to offer in each of the three areas, and
4) promoting the plan including identification of fund sources for key projects and realization of strategic alliance with San Salvador-based tour conductors.

Project No. 3.1b

1. PROJECT TITLE	Tourist Attractions Creation Program
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	CND, CORSATUR
4. OBJECTIVES	To establish a platform and movement to develop new tourist attractions in the Eastern Region
5. EXPECTED EFFECTS	(1) Promotion of tourism in the Eastern Region by new tourist attractions; and (2) Contribution to stable operation of local tourism industries
6. PROJECT COSTS	US$7.0 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

At present, the main tourist attractions in the Eastern Region are areas for long-stay activities such as campsites, agro-tourism sites and lakeside resorts. These attractions, however, are not particularly unique compared to those available in other parts of the Country. In order to overcome the disadvantage in transport access to the Region, it is necessary to expand the range of tourist attractions, extending to the development of some artificial attractions.

The program aims to establish a platform for creating man-made tourist attractions within the Region, based on the existing local initiatives for tourism, coordinated by CND. First steps may include the following.

(1) Development of regional health food recipes

Local materials readily available in the Eastern Region, such as agricultural, forestry, and/or marine products, will be used to create new local delicacies. These materials should be developed as health-food ingredients and new dishes should be promoted as lighter and healthier food to appeal to both domestic as well as foreign visitors.

(2) Development of local industry participation and experience-oriented tourism

As the Eastern Region develops a variety of agricultural and agro-processed products, opportunities for visitors to experience cultivation and processing works may be created to develop some participatory tourism. The tour menus should include local industries, both existing and new, such as apiculture and indigo works.

Project No. 3.2

1. PROJECT TITLE	Fonseca Gulf Joint Environmental and Tourism Development Program
2. LOCATION	La Union
3. IMPLEMENTING AGENCIES	CEPA, CORSATUR, MARN, CND, Fonseca gulf municipal association (liaison with PROARCA)
4. OBJECTIVES	(1) To establish three-country joint environmental monitoring system; and (2) To establish three-country joint tourism development system
5. EXPECTED EFFECTS	(1) Better promotion to invite cruise ships by new tourist attractions; (2) Realization of three-country joint tourism; (3) Improvement in the livelihood of coastal communities along the Fonseca gulf; and (4) Promotion of ongoing environmental management efforts
6. PROJECT COSTS	US$6.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

The Fonseca gulf with its rich natural environment constitutes important part of the Central American environmental corridor. The governments of three countries sharing the coast of the Fonseca gulf, El Salvador, Honduras and Nicaragua, have agreed to further extend the PROGOLFO initiative pursued with support from Denmark (DANIDA). The communities along the gulf coast are the poorest ones in the respective countries. Improvement of the livelihood of these communities is one of the main aims of the continued PROGOLFO efforts.

The gulf area with many islands and diverse and attractive landscapes is promising in tourism. If the three-country joint tourism is realized, it will be a great advantage to invite cruise ships. Community based environmental management is an important component of the three-country joint program.

The program aims to establish a joint platform to carry out the following:

1) designing of boat tour routes in the gulf;
2) adjustment of the immigrations management procedure system;
3) physical development planning of piers and waterfront areas (e.g., plaza, cafes and restaurants, tourist information offices, kiosks, and an environmental monitoring center), planning and preparation for optional excursions;
4) training of tour guides; and
5) preparation for environmental monitoring and database development.

Project No. 3.2a

1. PROJECT TITLE	Fonseca Gulf Participatory Management Planning
2. LOCATION	La Union
3. IMPLEMENTING AGENCIES	CEPA, CORSATUR, MARN, municipalities, CND (supported by PROARCA)
4. OBJECTIVES	(1) To promote the sustainable tourism development in the Fonseca gulf area by joint efforts of local communities and municipalities in the three countries; and (2) To protect and enhance the environmental quality of the gulf
5. EXPECTED EFFECTS	(1) Model international cooperation for environment and tourism development in international water; and (2) Improved livelihood of coastal communities
6. PROJECT COSTS	US$2.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

The program seeks mutually supportive tourism development and environmental management in the Fonseca gulf. Active participation of coastal communities is essential. As a first step, a management plan for the Fonseca gulf and coastal areas should be prepared by the participation of local communities through respective municipalities coordinated by CND. This process would allow local people to realize opportunities for tourism and other livelihood activities and needs for environmental management to sustain these activities.

The plan on the Salvadoran side should be presented to the three-country meeting to clarify common concerns and to resolve possible conflicts. Similar plans are expected to be prepared on the Honduran and Nicaraguan sides. The program should liaise with the ongoing PROARCA initiative, particularly in training for environmental management system planning.

The improvement of the joint environmental monitory system should be worked out in view of possible environmental problems associated with the construction and operation of La Union port such as dredging and cleanup of oil spills. Opportunities for joint tourism development should also be clarified.

Project No. 3.2b

1. PROJECT TITLE	La Union Tourist Core Development
2. LOCATION	Hinterland of the La Union port
3. IMPLEMENTING AGENCIES	CEPA, CND
4. OBJECTIVES	To develop a tourist core area targeting the cruise ship visitors
5. EXPECTED EFFECTS	More cruise ships attracted by meeting ship operators' requirement for calling at the port
6. PROJECT COSTS	US$4.0 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

Although a passenger berth construction is included in the La Union port revitalization program, promotion activities are necessary to persuade cruise ship operators to call at the La Union port. The following are identified as necessary conditions for attracting cruise ships to call at the port: i) provision of necessary ship maintenance services, ii) supply of fuel, water, etc., iii) dining facilities to accommodate a large number of passengers, and iv) preparation of at least four routes of excursion activities.

The project is to establish a designated host function zone for cruise ship visitors since La Union is insufficiently equipped to accommodate a large number of tourists. In the development, a synergistic effect will be pursued taking advantage of the location near the industrial park area and fishery port, while the activities of tourists and industries are to be effectively separated. The main components of the project are as follows:

1) immigration office;
2) facilities for activities outside the customs office including an information center, restaurants, a fisherman's wharf and boardwalks, open factory shops, tour conductors' offices, rest areas and open space (e.g., parks), etc.; and
3) facilities inside or attached to the customs office including a bus terminal, boardwalks, souvenir shops, etc.

Project No. 3.3

1. PROJECT TITLE	Environmental Awareness Program
2. LOCATION	Municipalities of la Union and Conchagua
3. IMPLEMENTING AGENCIES	Promoter group of La Union port city, municipalities of La Union and Conchagua, CND, MARN
4. OBJECTIVES	To raise people's awareness about proper waste management and the importance of their role in reducing wastes and recycling
5. EXPECTED EFFECTS	Cities of La Union and Conchagua as models for waste disposal and environmental management
6. PROJECT COSTS	US$0.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

Environmental awareness programs have been implemented in San Salvador and several municipalities in the Eastern Region, but only a few have been held in La Union. It is necessary to raise people's environmental awareness to promote proper waste management.

There is an active citizens' group called "the promoter group of La Union port city" that deals with various environmental issues in the cities of La Union and Conchagua. This group may be designated as the party in charge for all the educational activities.

The project consists of the following components.

Workshops

Workshops will be held at schools, community groups, offices and others. A staff member from a San Salvador-based NGO/recycling company will facilitate each workshop. Audio-visual teaching materials such as textbooks, videos and flipcharts will be prepared to help participants' learning. The workshop may cover the following contents.

1) What are natural resources? (Everyday we consume natural resources and throw them away after using as garbage. Some resources of forestry, agriculture and fishery are restorable if managed properly.)
2) How garbage can be separated (recyclable and non-recyclable, organic and non-organic)?
3) How much garbage is produced?
4) Where does garbage go? (Wastes may contaminate soil and water without proper handling.)
5) What is a landfill? How it is built? How much does it cost?
6) How is recycling undertaken?
7) What does Regulation /ordinance on soil waste management say?
8) What should we do?
   a. Do not throw garbage away to rivers or open spaces.

b. Pay attention to the priority order for the use of resource: 'Reduce, Reuse, Recycle', which means recycling is not the only or the best solution.
c. Make effort to reduce garbage.
d. Separate garbage properly from recycling (if recycling service is available).
e. Make compost from organic garbage (if there is enough space).
f. Cooperate to disseminate the idea to keep environment clean.

Site visit to a landfill

The participants will visit a landfill with an instructor to understand the present condition, and discuss how it should be improved.

Cleanup activities

The participants will clean up beaches, rivers or streets to learn the importance of keeping the natural environment beautiful and think of what citizens should or should not do.

Training of facilitators to expand the activities

The above activities will be organized and facilitated by staff members of NGOs/recycling companies who will be dispatched from San Salvador. It is also necessary to train new facilitators in La Union and Conchagua to expand and continue those educational programs. Schoolteachers, the citizens' group members, and municipality office workers can be candidates for trainees.

Project No. 3.4

1. PROJECT TITLE	Solid Waste Management Program
2. LOCATION	Municipalities constituting the Fonseca gulf municipal association (supported by PROARCA)
3. IMPLEMENTING AGENCIES	Fonseca gulf municipal association, CND, MARN
4. OBJECTIVES	(1) To promote sound solid waste management and (2) To contribute to creating better living environment in La Union-Conchagua area and the Fonseca gulf area
5. EXPECTED EFFECTS	Establishment of the best practice for solid waste management in the Eastern Region
6. PROJECT COSTS	US$27 million
7. IMPLEMENTATION SCHEDULE	Phase 1- Phase 2

8. PROJECT DESCRIPTION

The program will establish and promote effective and efficient solid waste management in the Eastern Region under the integrated solid waste management plan currently prepared for the Fonseca gulf municipal association. The plan includes waste reduction measures such as recycling, waste collection, transport, and final disposal by sanitary landfill.

The program should take advantage of the ongoing PROARCA initiative for training of municipal personnel in solid waste management practices and planning. The program, in turn, would contribute to establishing practical and sound solid waste management practices that may be replicated in other parts of Central America through the PROARCA-SICA system.

Following the implementation of the environmental awareness program (Project No. 3.3), a wastes recycling program should be implemented. San Salvador-based NGOs/recycling companies should be invited to establish operations in the Eastern Region. Municipalities and local chambers should support them to facilitate collection and make initial operations financially viable. It may help to give the operators franchises to ensure their long-term commitment and sustainable operations with increasingly more lucrative waste materials.

Project No. 3.4a

1. PROJECT TITLE	Wastes Recycling Program
2. LOCATION	Cities of La Union and Conchagua
3. IMPLEMENTING AGENCIES	Promoter group of La Union port city, municipalities of La Union and Conchagua, CND
4. OBJECTIVES	(1) To help people gain knowledge, skill and attitude on environmentally sustainable lifestyle through material recycling; and (2) To promote recycling and reduce wastes to be brought to the proposed sanitary landfill
5. EXPECTED EFFECTS	(1) Reduction of solid wastes to be disposed at the proposed sanitary landfill; and (2) Awareness for resources conservation among local people
6. PROJECT COSTS	US$0.5 million
7. IMPLEMENTATION SCHEDULE	Phase 2

8. PROJECT DESCRIPTION

A solid waste management plan has been prepared, which covers all the municipalities of the Fonseca gulf municipal association, consisting of 11 municipalities in La Union and one municipality in San Miguel located around the gulf. Proposed in the plan are the construction of a sanitary landfill and the reduction of wastes through recycling and composting to ensure that the landfill may be used as long as possible.

According to an estimate, of the solid wastes generated in the La Union city, 66% were organic matters, followed by paper (9%), glass (7%), plastic (6%), non-ferrous (5%), ferrous metal (3%), etc. Therefore, the priority should be given to the reduction of organic wastes.

Rural areas are not covered by municipal waste collection services in both La Union and Conchagua cities. Thus, in the rural areas of La Union, wastes tend to be thrown away at vacant lands or ravines, causing serious environmental problems.

The following five programs are proposed, from which priority projects for implementation are to be selected.

(1) Small-scale composting program

Since it is generally difficult to collect and transport a large amount of organic wastes, they may be made into compost at each household or community. Facilitator will instruct local residents on how to make compost from organic wastes and how to apply it as fertilizer or soil improver.

(2) Large-scale composting program

The promoter group members and/or volunteer community members collect organic wastes from local markets and agro-industries and take them to a composting plant. They may use a

portion of collected organic wastes to raise earthworms, which they may sell as soil improver. The program should be advertised via radio, newspapers and other media to promote wider participation.

(3) Promotion of paper, metals and plastic recycling

A community and a recycling company are selected for pilot implementation, and target materials for recycling are determined along with the schedule and places of collection, required conditions and redemption value. Then, the program will be announced and advertised community-wide and pilot implemented. At the end of the pilot implementation, community members' participation and the amount of wastes recycled will be assessed.

(4) Concrete container program (in combination with the small-scale composting program)

A concrete container for wastes will be constructed in a rural community. A facilitator will instruct the residents to separate their wastes to organic and non-organic wastes and deposit the latter in the container, for which arrangements are made for scheduled collection by a municipal garbage collection vehicle. The organic wastes will be composted through the small-scale composting program.

(5) Cloth scraps reuse program

The promotion group members buy cloth scraps from maquila and make dresses and other clothing products from the pieces for sale. Large pieces can be made into children's clothes and small pieces may be sewn together for patchworks and quilts for bed/furniture covers, mops, etc.

Of the above, (2), (3) and (5) can be lucrative. An option may be to form a cooperative (with 10-20 members) to collectively engage in those activities in a coordinated manner. Low-income people should be involved in these recycling activities through cooperatives to supplement their income.

At present, there are people collecting recyclable wastes at landfills for part of their livelihood. However, this can be extremely hazardous to their health. These people should be encouraged to participate in the recycling activities and programs in the future.

Project No. 4.1

1. PROJECT TITLE	Logistics Circuits Strengthening
2. LOCATION	Parts of San Miguel, La Union and Usulutan
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To strength links between major urban centers and border areas in the Eastern region; and (2) To induce locations of various logistic facilities and functions within the circuits
5. EXPECTED EFFECTS	(1) Establishment of more viable logistic facilities and functions to serve the Eastern Region development (2) Integration of remote rural areas in the main economy of the Eastern Region.
6. PROJECT COSTS	US$78.6 million
7. IMPLEMENTATION SCHEDULE	Stepwise implementation of roads construction and upgrading projects over Phase1-Phase 3

8. PROJECT DESCRIPTION

The project will consolidate the proposed logistics circuit of the Eastern Region linking San Miguel, La Union, Usulutan, Santa Rosa de Lima, El Amatillo, and other towns along artery roads. The logistics circuits are defined in such a way that practically all the areas in the Eastern Region will be within easy reach from/to the circuits once some access roads are improved. Even the remotest areas in Morazan, therefore, can be integrated into the main economy of the Region centering around the cities of San Miguel and La Union.

The project will strengthen physical links between cities and towns within the logistics circuits. In addition to the upgrading of the trunk roads, CA1 and CA2, the following component projects will be implemented:

a. Bypass road construction,
b. San Alejo-El Divisadero radial road development, and
c. CA1-CA2 link road construction.

Project No. 4.1a

1. PROJECT TITLE	Bypass Road Construction
2. LOCATION	Department of Usulutan, San Miguel and La Union
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To alleviate traffic congestion in major urban centers; and
	(2) To improve the living environment in major cities
5. EXPECTED EFFECTS	(1) Reduction of noises and exhaust gas; and
	(2) Savings of travel time and fuel costs (VOC)
6. PROJECT COSTS	US$35.2 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

Usulutan, San Miguel and La Union are largest cities in the Eastern Region, whose economic activities are brisk. Each city has a relatively large population. With the expansion of the cities, traffic congestion is becoming serious.

It takes about 14 minutes to pass through the city of Usulutan at the peak traffic hours, while it takes only eight minutes without congestion. As noises and exhaust gas increase with the traffic congestion, the living environment of the local residents becomes worse. Increase in vehicle operating costs (VOC) and long traveling time cause economic losses.

The Usulutan bypass is 10km long, located south of the city center. The San Miguel bypass, 12km long, runs north and east of the city center. The La Union bypass, 7km long and running through south of the city center, is connected with the La Union port.

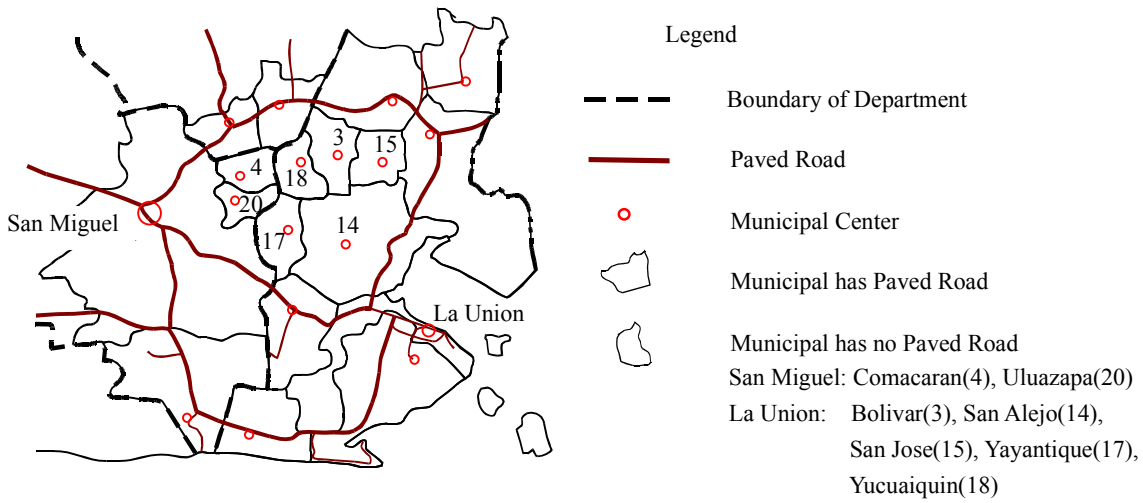
Project No. 4.1b

1. PROJECT TITLE	El Divisadero-Comacaran-San Alejo Radial Road Development
2. LOCATION	Department of San Miguel
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To facilitate transport activities between north and south of the Region; and (2) To promote agricultural development
5. EXPECTED EFFECTS	(1) More efficient economic development; and (2) Savings in travel time and fuel costs.
6. PROJECT COSTS	US$28.1 million
7. IMPLEMENTATION SCHEDULE	Phase 2-Phase 3

8. PROJECT DESCRIPTION

The project is to construct a new road in the area encircled by CA1 including El Amatillo, San Miguel and La Union and CA12 linking San Miguel and Santa Rosa de Lima. The road runs north and south to offer a short cut to the La Union port. The local topography is relatively gentle, and the dominant land use is for grazing. The road length will be 33km.

The project will contribute to facilitating marketing of agro-products of Morazan in the urban market of La Union. The traveling distance from San Francisco Gotera to the La Union port will be reduced by 22km. At present, Comacaran and Uluazapa of San Miguel and Bolivar, San Alejo, San Jose, Yayantique and Yucuaiquin of La Union have no paved road in the Project area as shown below. The project road will also induce economic development in and around the area by allowing bus services for those local residents.



Project No. 4.1c

1. PROJECT TITLE	CA1-CA2 Link Road Construction
2. LOCATION	Department of San Miguel
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To enhance the reliability of road transportation serving the La Union port; and
	(2) To promote agricultural development
5. EXPECTED EFFECTS	(1) Savings in travel time and fuel costs
	(2) Increase in agricultural production
6. PROJECT COSTS	US$15.3 million
7. IMPLEMENTATION SCHEDULE	Phase 2-Phase 3

8. PROJECT DESCRIPTION

At present, most traffic traveling from Usulutan to La Union passes through San Miguel and CA1, rather than CA2 along the coast. The project will construct a new road running through the north of the Olomega lagoon linking CA2 to CA1 with the shortest distance. With the construction of this 18km long road, the traveling distance will be reduced by 20km.

The project will also contribute to the development of areas along the route. In constructing the road, flood protection works around the Olomega lagoon should be considered.

Project No. 4.2

1. PROJECT TITLE	Logistic Facilities Location Planning and Guidance
2. LOCATION	Area of logistic circuits
3. IMPLEMENTING AGENCIES	Municipalities in the area, CND, SNET
4. OBJECTIVES	(1) To prepare a detailed land use plan as a tool to guide the location of various logistic facilities; and (2) To promote rational land use that would maximize the economic benefit and minimize flood damages
5. EXPECTED EFFECTS	(1) Best locations for various logistic facilities to serve the entire Eastern Region (2) Rational land use avoiding flood prone areas for highly productive activities and also providing areas for evacuation from floods
6. PROJECT COSTS	US$0.5 million
7. IMPLEMENTATION SCHEDULE	Plan preparation in Phase 1; continual guidance thereafter

8. PROJECT DESCRIPTION

The project supports the municipalities in the area of logistic circuits to prepare a detailed land use plan to guide the location of various logistic facilities and the provision of areas for evacuation from floods as well as development for intensive agriculture. Foreign experts should be procured through CND to provide technical support. Hazard maps prepared by SNET would be utilized to guide the planning. Planning for evacuation areas should be coordinated with the early flood warning system of SNET to be strengthened under Project No. 2.1.

Logistic facilities to locate in the circuits may include inland container depots, truck yards and industrial/commercial estates. Sites suitable for these and other facilities and uses would be designated. Areas suitable for establishing various agro-processing facilities would be indicated without pinpointing. Location guidelines would be prepared as part of the planning for use by the municipalities to control the development by the private sector.

Project No. 4.3

1. PROJECT TITLE	El Amatillo Border Facilities Improvement
2. LOCATION	Department of La Union
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To improve the international traffic of the Pan-American Highway; and (2) To contribute to the realization of the commercial treaties undersigned between the Central American countries and Mexico
5. EXPECTED EFFECTS	More economic interaction between Central American countries and Mexico
6. PROJECT COSTS	US$11 million (new bridge)-US$5.5 million each for El Salvador and Honduras, US$5 million (customs office and access road)-US$2.1 million for El Salvador and US$2.9 million for Honduras
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 2

8. PROJECT DESCRIPTION

The existing border facilities at El Amatillo do not work fully due to the complexity of the customs procedures and the narrow access road. It is difficult for large cargo trucks to pass because the alignment of the access road is improper.

The existing bridge was constructed in 1932 for traffics of the HS-15 cargo type. Now it must handle more volume of heavier traffics of the HS 20-44 cargo type, including new container traffics to and from the La Union port. Although the bridge is still usable, it does not comply with the minimum traffic safety requirements. El Salvador and Honduras will jointly build and own the new bridge.

The proposed new El Amatillo crossing is 150m long. Relocation of the customs office, the access road and facilities is necessary on both sides. According to the interview survey at the Amatillo border, it takes more than one hour to clear customs procedures at present. If this is reduced by one hour, time cost savings are estimated to total US$3.2 million based on the through traffic at the border of 803 vehicles per day in 2003. The traffic increase will induce service industries in the border areas to increase the benefit further.

Project costs are estimated as follows.

	El Salvador	Honduras	Total (US$10^6)
Bridge (US$10^6)	5.5	5.5	11.0
Customs office			
Area (m^2)	2,000	2,000	
Unit cost (US$)	450	450	
Cost (US$10^6)	0.9	0.9	
Equipment (US$10^6)	0.9	0.9	
Total (US$10^6)	1.8	1.8	3.6
Access road			
Length (km)	0.3	1.1	
Unit cost (US$10^6/km)	1.0	1.0	
Cost (US$10^6)	0.3	1.1	1.4

Project No. 4.4

1. PROJECT TITLE	Northern Artery System Establishment
2. LOCATION	Morazan, San Miguel, La Union
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To establish artery roads serving the northern part of the Eastern Region; and (2) To contribute to the physical and socioeconomic integration of the entire Eastern Region
5. EXPECTED EFFECTS	(1) Improved access by agro-producers in the north to the core economic areas; and (2) Inter-linked tourism objects in the north for more viable circuits
6. PROJECT COSTS	US$176.4 million
7. IMPLEMENTATION SCHEDULE	Phase1-Phase 3

8. PROJECT DESCRIPTION

The northern longitudinal road has been proposed as one of anchor projects in the National Plan, which will serve the northern mountainous areas bordering Honduras. The road is expected to contribute to the physical and socioeconomic integration of the Country as a whole. The project aims at stage-wise development of the northern longitudinal road and its alternative to establish the artery roads system serving the northern part of the Eastern Region. The stage-wise development is in line with the phased development of the Eastern Region according to its development scenario.

Project No. 4.4a

1. PROJECT TITLE	Northern Longitudinal Road Development
2. LOCATION	Department of Morazan and San Miguel
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To promote integrated regional development; and (2) To facilitate transport activities between north and south of the Region
5. EXPECTED EFFECTS	More efficient economic development in the northern part of the Region as well as the southern part of Honduras
6. PROJECT COSTS	US$74.4 million
7. IMPLEMENTATION SCHEDULE	Stage-wise implementation through Phase 1-Phase 3

8. PROJECT DESCRIPTION

The proposed northern longitudinal road starts from Nuevo Eden de San Juan to San Carlos via Sesori, Chapeltique. The total length of the road is 57km. It crosses the Lempa river with a long bridge in Nuevo Eden de San Juan, and it is connected to Metapan through Sensuntepeque, Charatenango and Nueva Concepcion. A detailed study on the width of the Lempa river is necessary to determine the length of the bridge because it changes from 200m to 300m depending on the season.

The northern part of the Eastern Region is mountainous, and there are many municipalities. The agricultural productivity is low with limited marketing opportunities as the road conditions are generally bad. There are many municipalities not served by any trunk road. If a new road is constructed, it is expected that the productivity of agricultural sector will be much improved. The road will also serve for tourism development as the northern part is rich in natural environment. The road will greatly affect not only other regions in El Salvador but also the least developed southern part of Honduras.

Project No. 4.4b

1. PROJECT TITLE	Alternative Northern Road Establishment
2. LOCATION	Department of Morazan, San Miguel and La Union
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	(1) To promote integrated regional development; and (2) To facilitate transport activities between the northern and the southern parts of the Region
5. EXPECTED EFFECTS	More efficient economic development in the northern part of the region as well as the southern part of Honduras
6. PROJECT COSTS	US$102.0 million
7. IMPLEMENTATION SCHEDULE	Stage-wise implementation through Phase 2-Phase 3

8. PROJECT DESCRIPTION

The northern longitudinal road alternative starts from Nuevo Eden de San Juan to Concepcion de Oriente via Carolina, Ocicala, Corinto Nueva Esparta. The total length is 85km. For the road passes through mountainous areas, prevention measures for landslides and other potential hazards should be reflected in the selection of alignment and construction methods.

There are many municipalities without paved roads in the northern part of San Miguel, the eastern part of Morazan, and the northern part of La Union. The beneficiary municipalities by this road for improved access have the combined land area of 1,163km^2 and the total population of 110,227 as shown below.

Department	Municipal	Population	Area (km^2)
San Miguel	Carolina	9,122	52.92
	Nueva Eden de San Juan	2,961	63.13
	San Antonio	7,657	16.91
	San Gerardo	6,284	82.84
	San Luis de La Reina	7,352	168.18
	Sesori	12,389	203.30
	Sub-Total	45,765	587.28
Morazan	El Rosario	1,282	19.12
	Gualococti	3,278	18.62
	Guatajiagua	10,815	70.77
	San Fernando	1,025	26.93
	San Isidro	3,275	11.51
	San Simon	9,190	39.14
	Sensembra	3,325	22.02
	Torola	1,504	58.26
	Yamabal	3,845	84.08
	Sub-Total	37,539	350.45
La Union	Lislique	16,759	98.82
	Poloros	10,164	126.60
	Sub-Total	26,923	225.42
	Total	110,227	1,163.15

Project No. 4.5

1. PROJECT TITLE	Rural Road Program
2. LOCATION	Region-wide
3. IMPLEMENTING AGENCIES	MOP
4. OBJECTIVES	To maintain and repair rural roads in the Eastern Region by supporting self-help efforts of people in rural areas.
5. EXPECTED EFFECTS	(1) Better access by rural people to social services and markets; (2) A sense of solidarity among villagers; and (3) Better communication with neighboring communities
6. PROJECT COSTS	US$37 million
7. IMPLEMENTATION SCHEDULE	Phase1-Phase 3

8. PROJECT DESCRIPTION

The program supports self-help efforts of people in rural communities to maintain and improve rural roads. It will provide (1) simple machinery and tools for road works, (2) training of community leaders for people organizing, and (3) technical guidance and training for stabilization, repair and maintenance, drainage improvement, and surfacing of rural roads.

Project No. 5.1

1. PROJECT TITLE	Free Port and Economic Zone (FPEZ) Establishment Program
2. LOCATION	Municipalities of La Union and Conchagua
3. IMPLEMENTING AGENCIES	Member ministries of the ministerial task force for the La Union port, local management unit (LMU), CND, CEPA
4. OBJECTIVES	(1) To designate a large area in the hinterland of the La Union port and develop a free trade zone, core facilities for distribution and tourism, and other related facilities in the area; and (2) To establish a special zone with high grade infrastructure and management to attract investments and effect the Eastern Region development drive
5. EXPECTED EFFECTS	(1) Most attractive, international class special zone with viable economic activities; and (2) High-grade living environment for local and foreign residents
6. PROJECT COSTS	US$41.4 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

The program has both hard components in construction of facilities and soft components in institutional and organizational development. Facilities to locate in the FPEZ include a free trade zone, core facilities for distribution and tourism, infrastructure, and utilities. Some amenity facilities would also be provided, such as an indigo museum, waterfront development, picnic areas, and a tourist orchard. A step-wise approach will be taken to institutional and organizational development to meet planning and management needs that would evolve as the FPEZ is developed.

Development of infrastructure and utilities for the FPEZ would be supported by other projects: Project No. 2.5a for water supply, Project No. 5.4 for power supply, and Project No. 3.4 for solid waste management. For wastewater treatment, the existing ANDA plan needs to be updated to accommodate the envisioned development of the La Union port city as well as the FPEZ. Establishment of core facilities for tourism would be supported by Project No. 3.2b

Project No. 5.1a

1. PROJECT TITLE	La Union Free Trade Zone
2. LOCATION	La Union
3. IMPLEMENTING AGENCIES	CEPA, private sector, CND
4. OBJECTIVES	(1) To establish a free trade zone in the La Union port area; and (2) To experiment special incentives to attract investments
5. EXPECTED EFFECTS	Fully operational FTZ immediately following the commissioning of the La Union port
6. PROJECT COSTS	US$38.2 million
7. IMPLEMENTATION SCHEDULE	Phase 1 (details below)

8. PROJECT DESCRIPTION

A free trade zone (FTZ) will be established in the industrial-logistic zone designated behind the port area with the maximum area of 50ha. The area includes part of future expansion area of CEPA. Additional land may be acquired by CEPA, and the development may be entrusted to a third party jointly with CEPA under the initial institutional arrangements for the FPEZ area.

Competitive utility tariffs should be applied to attract investors. Special incentives may also be introduced as a trial case at the beginning and extended to other areas in the Eastern Region at a later stage.

Provision should be made to establish open factory areas at a later stage, where people will have access to purchasing goods produced at factories established in the FTZ. Some other shops, supermarkets, banks, and hotels should also be planned for both workers at the FTZ as well as visitors and local residents.

Future industrial land demand in El Salvador in 2019 is projected as:

El Salvador:	1,429ha
Eastern Region:	713ha
La Unon-Conchagua area:	50ha

The LUFTZ will be located in industrial and logistic zone designated at an area right behind the port area with a total area of 50 hectares by the year 2019.

La Union Development Corporation in cooperation with the Ministry of Economy and the La Union Municipality will be responsible for a feasibility study, implementation and operation at an early stage. Operation will be handed over to private companies as the project gains momentum in attracting factories. Companies locating in the LU FTZ will enjoy a number of advantages in terms of tax incentives special to LUFTZ, competitive utility tariffs and consorted support by LUDC and other central and regional governmental organizations.

Detailed schedule of the initial implementation is given below.

	Land area (ha)	Completed by	FTZ filled by
Feasibility Study	50	2005	--
Construction, Phase I	25	2006	2010
Construction, Phase II	25	2010	2019

Project No. 5.1b

1. PROJECT TITLE	La Union Distribution Core Development Program
2. LOCATION	Hinterland of the La Union port
3. IMPLEMENTING AGENCIES	CEPA, private sector, CND
4. OBJECTIVES	(1) To develop a physical distribution complex connected to the port area; and (2) To establish a high-grade physical distribution information system
5. EXPECTED EFFECTS	(1) Strengthened competitiveness of the La Union port through increased efficiency of freight handling and established credibility; (2) Better promotion of FDI and BPO of physical distribution industry through increased attractiveness of the La Union port; and (3) Vitalized local distribution industry
6. PROJECT COSTS	US$0.7 million (for information systems development)
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

Strengthening of the port oriented physical distribution system is critically important from several viewpoints. First, the physical distribution industry is the most important industry especially at the earlier stage of the economic development of El Salvador and the Eastern Region in particular. The port-oriented cargo handling is the base for the development of the industry. Second, the competitiveness of the La Union port depends largely on the efficiency of the supporting distribution system including cargo works in the port area.

The freight handling system of the La Union port will be complex, for it connects the Central American countries and domestic transportation with Pacific marine transport. To meet the requirements, it is necessary to develop a distribution park with full infrastructure including a high-grade information technology systems network directly connected to the port area.

Distribution park development

As there are only two berths planned for cargo handling at the La Union port, the berth areas are likely to be for the public use. Therefore, shipping and transport companies will need to have container freight terminal in a port hinterland for exclusive use of the yard. Furthermore, in order to promote the use of the La Union port by foreign shipping companies, it is expected that warehouse space will be readily provided by leasing or other forms of contract.

To meet the aforementioned conditions, a distribution park will be developed in the hinterland of the La Union port, physically and functionally connecting it to the planned port area. The main components of the project are:

1) transport and utilities infrastructures,
2) land lots for sale and/or rent,
3) administration office equipped with information center facilities,
4) refrigerated warehouse for rent, and
5) bonded warehouse for rent.

Physical distribution information system

Any port is in fierce competition in the contemporary business world; only ports that offer outstanding services can survive. The performance of a port largely relies on how it can respond to various needs of cargo owners/forwarders by fully commanding its information technology base.

Furthermore, effective use of cargo ordering information, which will eventually be concentrated at the port, is vital for strengthening business marketing in the Country. It constitutes one of the wheels of the envisioned status of El Salvador's economic development: "the trade center of Central America". Since imported finished goods will dominate the cargo in El Salvador for the time being, securing the traceability of goods will be the most effective way in gaining credibility by cargo owner companies.

To meet the requirements, the project aims to develop and establish a high-grade information network connecting at least the following information systems:

1) cargo identification system such as RFID (radio frequency identification) to ensure the traceability of goods,
2) cargo ordering information system connected to the port EDI (electronic data interchange) system,
3) truck location determination system using mobile phones, and
4) port reservation information system.

Project No. 5.1c

1. PROJECT TITLE	FPEZ Institutional Development
2. LOCATION	La Union
3. IMPLEMENTING AGENCIES	Ministerial task force for the La Union port area, municipalities of La Union and Conchagua, management group for La Union city, CND
4. OBJECTIVES	(1) To institute initial arrangements for planning, coordination and management of key facilities to be located in the FPEZ; and (2) To establish a development cooperation to take change of the FPEZ
5. EXPECTED EFFECTS	(1) Key facilities in place when the La Union port becomes operational; and (2) Coordinated implementation and efficient management of all the facilities and functions thereafter
6. PROJECT COSTS	US$2.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

To make the La Union port operation viable and to establish a growth center around the port, a large area shall be designated in the port hinterland for the FPEZ to accommodate various functions and facilities related directly and indirectly to the port. To ensure key functions and facilities in place when the La Union port is commissioned, initial arrangements should be instituted immediately to plan and coordinate the implementation and management of those facilities.

First, the existing ministerial task force for the La Union port area should be expanded for both membership and jurisdiction. Its membership should be expanded to include all the ministries and institutes related to those facilities to locate initially in the FPEZ as well as CND representing local interests. Its jurisdiction should be expanded to cover the entire FPEZ area. This is the institution to authorize developments in the FPEZ, resolving possible conflicts between ministries and between central and local interests.

Second, a local management unit (LMU) should be established, building on the existing management group of La Union city, including also representatives of citizens and business communities in the municipalities of La Union and Conchagua as well as the municipal governments. CND should assume the chairmanship of LMU and act as its representative to any central institutions, including the ministerial task force.

LMU would be responsible for the planning, management and operation of facilities within the FPEZ in cooperation with relevant public and private entities, respectively. Any decision by LMU could be brought to the ministerial task force for authorization if such were considered

necessary by LMU. Any possible conflicts between ministries and other institutes regarding the development and management of any facilities in the FPEZ would also be brought to the ministerial task force for intermediation and prompt resolution.

In the subsequent stage of the development of the FPEZ, a development corporation should be established by public-private partnership. It is expected that LMU will be developed substantively into this corporation authorized by the ministerial task force.

CND should prepare legislative documents necessary for the establishment of the corporation, the nomination of the Chief Executive, and the public subscription for shareholders based on relevant laws. Legislative actions necessary for land acquisition may also be initiated by CND on behalf of the ministerial task force. The supervisory control of the Government may also be effected by the ministerial task force, which may be renamed the FPEZ steering committee.

First, the chief Executive Director should be nominated by the Government, and the public will be notified how to subscribe to the corporation's shares and other related matters. At the first meeting of shareholders, a few directors will be elected from the private sector. Together with additional directors to be appointed by the Government, the Board of Directors would be formed. The Board would prepare the articles of associations for the corporation.

Project No. 5.2

1. PROJECT TITLE	La Union Port City Development Program
2. LOCATION	La Union and Conchagua
3. IMPLEMENTING AGENCIES	Municipalities of La Union and Conchagua, MOP, ANDA, CEPA, CND
4. OBJECTIVES	(1) To develop La Union as multi-function growth center for the Eastern Region development drive; and (2) To provide high-grade urban facilities and services to visitors and local and foreign residents
5. EXPECTED EFFECTS	(1) La Union port city as tourist attraction by itself; and (2) Strong urban core of the Eastern Region together with San Miguel
6. PROJECT COSTS	US$150.6 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

The program has the following components:

- infrastructure and utilities including bypasses, water supply, sewerage and drainage, solid waste management, power supply, telecommunications, and urban roads;
- residential development;
- social and cultural facilities such as hospital, schools, technological institute, sporting facilities, urban parks, etc.;
- a municipal market and a slaughterhouse; and
- development of a new central business district (CBD).

Development of infrastructure and utilities would be supported by other projects: Project No. 2.5 for water supply, Project No. 5.4 for power supply, and Project No. 3.4 for solid waste management. For sewage and drainage, an existing ANDA plan needs to be updated in line with the macrozoning by the Master Plan.

The La Union residential development will cover 360ha, of which 50% is allocated to housings, 25% to urban parks and greenery, and the rest for roads and other infrastructures, commercial areas, social and cultural facilities, administrative functions and others. A new central business district (CBD) will be established within this area.

Project No. 5.2a

1. PROJECT TITLE	La Union-Conchagua New Urban Development	
2. LOCATION	La Union and Conchagua	
3. IMPLEMENTING AGENCIES	La Union Development Corporation (LUDC), MOP, municipalities of La Union and Conchagua	
4. OBJECTIVES	(1) To prepare a new urban development plan;	
	(2) To legalize planned land uses; and	
	(3) To purchase land and construct public facilities	
5. EXPECTED EFFECTS	(1) Creation of a functional and attractive urban environment;	
	(2) Enhancement of foreign direct investment; and	
	(3) Higher utilization of La Union Port	
6. PROJECT COSTS	($496 million for residential development by the private sector)	
7. IMPLEMENTATION SCHEDULE	Development plan preparation	by 2004
	Legalization	by 2005
	Land purchase for public facilities	by 2006
	Construction of public facilities	by 2007
	Promotion of private investors for commercial and residential development	2006-

8. PROJECT DESCRIPTION

The opening of the La Union port and the Free Trade Zone in the direct hinterland of the port would create employment at about 28,000 in the industrial, service and port sectors. The total population is estimated to reach 72,000 in 2019. Assuming a half of this population comes from the existing urban area in La Union and Conchagua, the remaining half of the population needs to be accommodated properly in order to avoid unplanned urban sprawl. An area of about 360ha is designated for a new urban area at a location surrounded by the existing La Union urban area, the main road currently connecting La Union with San Miguel, the bypass under construction and Route CA-2. This area was designated as the new residential area in consideration of the availability of flat land, minimizing cost for developing water supply facilities by allocating the area in lower altitude part and avoiding the bypass running through new residential area. Assuming a population density at 100 per ha, an area of 360ha should be developed avoiding the built-up area and sloping land. Development of 150ha is planned as the first stage by the year 2009, followed by 210ha development by 2019. The following land use classification is broadly assumed: 166ha (46%) for residential area, 72ha (20%) for roads, 68ha (19%) for park/green area, 36ha (10%) for educational facilities and 18ha (5%) for other areas.

The project should start with preparation of a detailed land use allocation within the area and be followed by legalization of the designated land uses and purchase of land for the construction of

public facilities such as parks, green belt and administrative service facilities. An analysis on the existing land use regulations and its effectiveness should precede legalization procedure. Since residential development itself will be mostly undertaken by the private sector, promotion of investment and guidance should be provided according to the land use regulation and the design guideline to be established.

Project No. 5.2b

1. PROJECT TITLE	La Union-Conchagua Urban Renewal Project	
2. LOCATION	La Union and Conchagua	
3. IMPLEMENTING AGENCIES	LUDC, MOP, municipalities of La Union and Conchagua	
4. OBJECTIVES	(1) To prepare an urban renewal plan; (2) To take necessary legalization steps and architectural agreement; and (3) Implementation of public/private cooperation projects and guidance of private projects	
5. EXPECTED EFFECTS	(1) Creation of a functional, attractive and competitive urban environment; and (2) Increase in private investment in service sector	
6. PROJECT COSTS		
7. IMPLEMENTATION SCHEDULE	Preparation of urban renewal plan	by 2004
	Legalization	by 2005
	Implementation of public/private cooperation project	2005-
	Promotion and guidance of private investment	2005-

8. PROJECT DESCRIPTION

The existing urban area in La Union provides an excellent opportunity for service development taking its locational advantage facing the sea. Waterfront development could significantly enhance its touristic value. For creating an urban environment at such a level as to be able to attract tourists from other part of El Salvador, neighboring countries and cruise passengers, some part of the existing La Union town would need to be upgraded. Provision of public space in combination with new touristic facilities such as restaurants and shops would enhance attractiveness of an area. In the event that individual renovation or construction projects are to be implemented by the private sector, they should be properly guided so that their designs and appearance fit into the planned urban renewal concept. The whole process should start from working out a common concept and preparation of an urban renewal plan with involvement of the municipality, landlords, service and commercial business and related parties. The same process needs to be undertaken in the Conchagua municipality, which is suited more to recreational activities taking advantage of its climatic and natural aesthetic merits.

Project No. 5.2c

1. PROJECT TITLE	La Union-Conchagua Waterfront Development Program
2. LOCATION	La Union and Conchagua
3. IMPLEMENTING AGENCIES	LUDC, municipalities of La Union and Conchagua
4. OBJECTIVES	To upgrade urban, recreational and living environment of the waterfront area
5. EXPECTED EFFECTS	(1) Upgrading of urban environment; and (2) Attraction of investment and tourists
6. PROJECT COSTS	$10.1 million (1st stage by year 2007)

7. IMPLEMENTATION SCHEDULE

	No. of components	Target year
First stage	7	2007 completed by 2005
Second stage	5	2009

8. PROJECT DESCRIPTION

CND has been working out a La Union-Conchagua waterfront development program in consultation with the two municipalities and various local groups with the following components.

a. 1st stage (up to 2007)

1.1 Reconstruction and expansion of pier
1.2 Construction of sea-wall
1.3 Expansion of urban recreation area
1.4 Development of restaurant and complementary area
1.5 Construction of sports complex
1.6 Road expansion project
1.7 Sewerage stem development project for the urban area

b. 2nd stage (up to 2009)

2.1 Residential environment improvement for 458 fishermen houses
2.2 Conservation of mangrove area and touristic development
2.3 Construction of a national Aquarium
2.4 Construction of artificial beach with hotel development
2.5 Construction of sea-wall walkway

Project No. 5.3

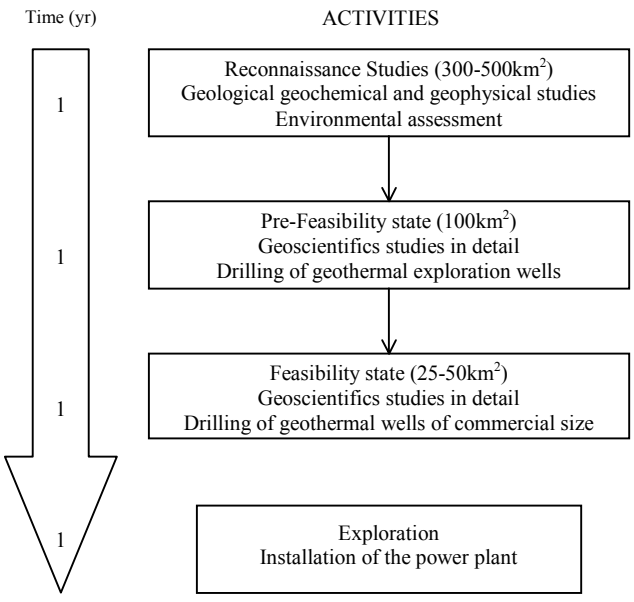
1. PROJECT TITLE	Geothermal Prospecting
2. LOCATION	La Union (Conchagua)
3. IMPLEMENTING AGENCIES	GESAL
4. OBJECTIVES	To develop a renewable power generation base using indigenous resources
5. EXPECTED EFFECTS	Confirmed geothermal potential in the Region for subsequent development
6. PROJECT COSTS	US$0.2 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

GESAL plans to study several promising sites for geothermal energy production in addition to the continued development and/or expansion of the areas already developed. The Conchagua site of La Union is located near the on-building port, which is expecting an increase of power demand in the Region after 2007. The Conchagua site of possibly 10MW, if proved and developed, could contribute to the local development with clean, renewable energy. The Geologists at GESAL are undertaking a reconnaissance study of the area. The process would take several years before a potential site can be developed.

GESAL plans to dispatch a reconnaissance team to make a geological, agrochemical, and geophysical environmental assessment. The project will support GESAL's effort to find a new renewable energy source in the Eastern Region.

GENERAL GEOTHERMAL PROJECT PROCESS



Project No. 5.4

1. PROJECT TITLE	La Union Power Transmission
2. LOCATION	La Union.
3. IMPLEMENTING AGENCIES	CEPA
4. OBJECTIVES	To insure sufficient power delivery to the La Union port.
5. EXPECTED EFFECTS	Expanded and stable supply of power from the main grid
6. PROJECT COSTS	US$13.6 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

The La Union port is scheduled to be operational in 2007. With the port and its related socioeconomic activities, the demand for energy in the La Union and Conchagua area will increase considerably. Currently, there is no high voltage transmission line to the area.

The Eastern Electric Company (EEO) serves the area with 2x46kV line (50 km) from San Miguel, which is sufficient for its 70,000 residents at the moment. EEO has promised CEPA that it will be able to serve the port construction and operation, estimated at 4 MVA level.

ETESAL, only recently released from its legal restriction to build new transmission lines, now proposes a five-year expansion plan, which, at the moment, does not consider the La Union area's long-term needs. ETESAL, however, will be flexible in adjusting its development plan.

A simple demand projection in the La Union area shows that the demand might reach 62MW in the long-term as shown below.

Power Demand in 2019 in La Union Metropolitan Area

Country/ Region	Population	GDP US$10^6	Total energy demand (GWh)	Demand (MW)	kWh per Capita	kW per Capita	GDP per kWh
USA*	282,000,000	9,237,000	3,910,160		13,866	3.48	2.36
Japan*	127,000,000	4,499,557	1,056,969		8,323	1.81	4.26
National	8,533,700	27,700	9,821	2,956	1,151	0.35	2.82
La Union	180,344	585	208	62	1,151	0.35	2.82

*U.S. and Japan in 2000, except kW per capita for U.S. in 2002 and Japanese in 2001.
Sources: IEA, SIGET, and estimate by JICA Study Team.

The preliminary estimate of the transmission line and substations required is 50km of 115kV line and a substation. The cost would be US$5 million at US$75,000 per km of the transmission line with the substation at US$1.25 million. The project calls for a bid to supply energy to the La Union port. The supplier, whether a generating company or a distributing company, is responsible for the building of the transmission line. Instead of charging to construction cost consumers, the builder will offer a long-term tariff.

The port authority does not have to pay upfront the construction cost. Since the port would be a huge consumer, it has the leverage to tender for the lowest energy cost possible. The beneficiaries of the project will be the local consumers and enterprises.

Project No. 6.1

1. PROJECT TITLE	Secondary and Higher Education Strengthening Program
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	MINED, NGOs
4. OBJECTIVES	To improve quality of secondary and higher education
5. EXPECTED EFFECTS	(1) Increase in students' participation rate in secondary and tertiary education; and (2) Decrease in regional disparity in secondary education participation rate
6. PROJECT COSTS	US$43.1 million
7. IMPLEMENTATION SCHEDULE	Continuous implementation of various components in Phase 1-Phase 3

8. PROJECT DESCRIPTION

Secondary and higher education in El Salvador is characterized by high concentration of students and schools in San Salvador and its vicinities. Also, currently in the Eastern Region, there is no tertiary educational institute in La Union and Morazan. Another issue for secondary and higher education is low enrollment. Secondary school enrollment in El Salvador is lower than many other countries in Central America. Further, in tertiary education, private institutes operate without any public subsidies, resulting in high tuitions and fees.

The program aims to improve these conditions. It consists of two component projects: Secondary and Higher Education Scholarship in the Eastern Region and Establishment of a Technological Institute.

In addition to the execution of the two projects, the Government efforts to overcome other issues are necessary in order to improve the overall quality of secondary and tertiary education. For example, the Government needs to increase educational budget, correct regional biases in secondary and tertiary education favoring larger cities, support the system established by APREMAT and the Secondary Education Reform Project even after the project completion, and provide incentives to promote R&D.

Project No. 6.1a

1. PROJECT TITLE	Eastern Region Secondary and Higher Education Scholarship
2. LOCATION	U.S. and El Salvador
3. IMPLEMENTING AGENCIES	MINED, NGOs
4. OBJECTIVES	To improve enrollment in secondary and tertiary education through scholarship
5. EXPECTED EFFECTS	Improved students enrollment at secondary and tertiary schools
6. PROJECT COSTS	US$24.6 million
7. IMPLEMENTATION SCHEDULE	Initial implementation in Phase 1 supported by international donors; continuation for Phase 2-Phase 3

8. PROJECT DESCRIPTION

Secondary school enrollment in El Salvador is lower than other countries in Central America. One of the main reasons is high cost of schooling. Also, in tertiary education, private institutes operate without any public subsidies resulting in high tuitions and fees. However, the existing scholarships such as one utilizing FANTEL are quite limited in number and amount.

In order to improve the availability of scholarships, the project aims to establish a scholarship fund for students who could not otherwise afford secondary and tertiary education. The project components are as follows.

MINED establishes the scholarship fund. The operation of the fund may be entrusted to a third party with experience in fundraising and efficient financial management. At the same time, a fundraising division of the fund is established in the U.S. Fundraising activities are conducted both in the U.S. and El Salvador. The main source of the fund will comprise membership fees, government grants and subsidies, and donations from individuals and enterprises. Possible contributors in the U.S. are Salvadorans living in the U.S., U.S. citizens, government, foundations, NGOs, Salvadoran hometown associations, and private companies. In El Salvador, Central and local governments, citizens, private companies, parents and guardians, and NGOs may contribute. International donors and NGOs may also be sought for contributions.

Scholarships will be given to students from low-income households in the form of either grant or loan depending on the income level and qualifications.

Project No. 6.1b

1. PROJECT TITLE	Technological Institute Establishment
2. LOCATION	La Union
3. IMPLEMENTING AGENCIES	MINED
4. OBJECTIVES	To develop human resources that comply with the regional needs with the development of La Union Port and FPEZ
5. EXPECTED EFFECTS	Provision of technicians and workers with skills and knowledge that comply with the regional demands generated by the development of the port and FPEZ.
6. PROJECT COSTS	US$6.0 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

Enrollment and the number of schools are much lower in the Eastern Region than the population share. Especially, no tertiary educational institute exists in La Union and Morazan. Currently, the Government has a plan to establish a technological institute in La Union, attached to "Centro Escolar de La Unión" high school. The institute will offer courses in technical career development and vocational training. The project consists of the following components.

Component 1: Construction of a new technological institute in La Union
- To demolish the unused and deteriorated infrastructure of the high school.
- To construct new buildings for use by technological institute.

Component 2: Provision of necessary equipment
- To procure equipment necessary for planned courses, including computers, laboratory equipment, workshop equipment, and audiovisual facilities.

Component 3: Provision of training for professors and instructors
- To transfer technical knowledge and skills and teaching methods either by national and/or international experts.

Component 4: Curriculum development
- To develop curricula for planned courses in naval mechanics, marine biology, hotel management and tourism, port development and administration, naval electronics, electronic communications, and environmental management
- Add courses in ICT as proposed.

Component 5: Vocational training course development
- To plan short-term training courses for the unemployed and company employees.
- To develop courses in fishery, handicraft, foreign languages, and computer; add courses in tourism (e.g., guest services and hotel administration), electrics, electronics, mechanics, computer maintenance, etc., as proposed by MINED.

Project No. 6.1d

1. PROJECT TITLE	Eastern Region Research Center
2. LOCATION	Core facilities in San Miguel linked to institutes throughout the Eastern Region
3. IMPLEMENTING AGENCIES	Member institutes of the regional research system in cooperation with CND
4. OBJECTIVES	(1) To strengthen the knowledge base and enhance the research capacity to support the sustainable Eastern Region development; and (2) To provide regional and business information for prospective investors
5. EXPECTED EFFECTS	(1) Comprehensive database for socioeconomic conditions and potentials accessible by all; and (2) Strong research-business links to allow technological innovation
6. PROJECT COSTS	US$2.5 million
7. IMPLEMENTATION SCHEDULE	Phase1: establishment of core facilities and organization, basic surveys to establish database Phase 2: strengthening links with private sector institutes, business communities, and international organizations

8. PROJECT DESCRIPTION

The project will establish a comprehensive database on socioeconomic conditions and potentials in the Eastern Region and a network linking research institutes, business communities, and support agencies. The database will be easily accessible by all, and information will be exchanged between them through the network. This will strengthen research-business linkages to allow technological innovation to support the Eastern region development.

Five research institutes in the Eastern Region, viz., UGB, UES, UNIVO, ITUS, and ITCA San Miguel have agreed to establish a regional research system with the assistance of CND. They will share facilities and resources and coordinate research activities. To support their activities, the project will establish an initial database with GIS developed through the JICA Study.

The database will be expanded in steps generating additional socioeconomic data by surveys. Data useful for prospective investors will be compiled, including business information for training opportunities, potential markets and partners, and available technologies and resources.

Eventually, research institutes, business communities and government agencies providing support services will be all linked for common database use and information exchange. This way, both research capacity and inter-group communication will be enhanced and technology development facilitated.

Project No. 6.2

1. PROJECT TITLE	SMEs Support Program
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	CONAMYPE, INSAFOCOOP, INSAFORP, Ministry of Labor (MOL), Infocentro, NGOs, municipalities
4. OBJECTIVES	(1) To provide a comprehensive package of support to SMEs; and (2) To develop scores of viable enterprises for the Eastern Region development drive
5. EXPECTED EFFECTS	(1) Active business atmosphere with the enterprises consistently entering the market; and (2) Competitive regional economy
6. PROJECT COSTS	US$34.6 million
7. IMPLEMENTATION SCHEDULE	Establishment of new institutions in Phase1; Continuous operation in Phase 2-Phase 3

8. PROJECT DESCRIPTION

The program offers support to new, micro, small and medium enterprises (SMEs) and their associations by different programs, and introduces a new scheme to expand opportunities for skill development. The programs to support enterprises of different sizes and at different stages are as follows:

1) incubation centers for new enterprises
2) micro entrepreneur training for micro enterprises,
3) modern corporate management introduction for small and medium enterprises, and
4) business association establishment to support the establishment of business associations.

The new scheme for skill training is the Eastern Region skill development fund establishment. This will introduce an incentive for employees to receive training and competition in providing training courses in order to expand training opportunities and improve their quality.

Project No. 6.2a

1. PROJECT TITLE	Eastern Region Skill Development Fund Establishment
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	MOL, INSAFORP
4. OBJECTIVES	To improve quality and quantity of vocational training in the Eastern Region
5. EXPECTED EFFECTS	(1) Increased number of training providers; (2) Wide choice of training providers for trainees; and (3) Increase in number of training providers with the increased demand in training
6. PROJECT COSTS	US$22.2 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

In order to prepare for the takeoff of the economy of the Eastern Region, skill development of its labor force is necessary. In the Region, currently the number of training courses offered by INSAFORP and other organizations is insufficient. High-quality training courses should be developed and diversified to enhance the quality of workforce. The project aims to establish the Eastern Region skill development fund. The project outline is as follows.

The Eastern Region skill development fund is established with subsidies from central and local governments, employees' contributions from their payroll, and international support. Training vouchers are issued by INSAFORP. These vouchers are used by trainees (individuals and companies) to cover certain portion of course fees. Training institutes return the vouchers to INSAFORP and receive payment. INSAFORP establishes eligibility requirements, issue vouchers, and monitor quality and compliance.

Courses offered by the Eastern Region Skill Development Fund should be developed in a systematic way (e.g., introducrtory electricity course followed by intermediate and advanced courses) so that they can meet the demand of students with various levels. INSAFORP should set the target level of achievement for each course and after the completion of the course, certificates will be issued to those students who obtain certain grades. This will facilitate enterprises to hire personnel with desired skills.

Project No. 6.2b

1. PROJECT TITLE	Incubation Centers
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	Infocentro
4. OBJECTIVES	To provide one-stop shops for individuals or a group of people who wish to setup a company
5. EXPECTED EFFECTS	More employment in the Eastern Region
6. PROJECT COSTS	US$4.4 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

In many countries, incubation centers play major roles in entrepreneurial development but such services are currently not available in El Salvador. These centers offer office space, desks, chairs, Internet-ready computers, meeting space, and logistic support at low cost. In addition, many also provide technical advisory service and other assistance such as providing a necessary database. In other words, they constitute a one-stop shop for an individual or a group of individuals who wish to set up a company. The project aims to develop incubation centers in the Eastern Region. The following are the components of the project.

Component 1: Establishment of incubation centers

Infocentro headquarters appoints Infocentros in the Eastern Region to establish incubation centers. The designated infocentros offer office quarters, meeting rooms, computers with Internet access, telephones, chairs, copy machines, and secretarial services. The headquarters contracts advisors necessary for enterprise establishment covering such areas as law, accounting, corporate management, business plan preparation, training, etc. Advisors for the micro entrepreneur training (Project No. 6.2d) are contracted for the project as well. The headquarters establishes a database on financial sources, law, governmental/non-governmental assistance, training, etc.

Component 2: Invitation of entrepreneurs

Each Infocentro incubator invites entrepreneurs to become its tenants. If there are too many applicants, priority will be given to those submitting more creative and marketable business proposals. Office quarters will be leased at low cost for one year. Entrepreneurs are expected to move out and have their office elsewhere after that period. The headquarters organizes an entrepreneurial contest once a year for the tenants and rewards the most successful entrepreneur of the year. The winner will receive a reward such as free access to FAT (Fondo de Asistencia Técnica), which helps finance technical assistance, advisory, and consultancy services for enterprises.

Project No. 6.2c

1. PROJECT TITLE	Modern Corporate Management Introduction
2. LOCATION	San Salvador for head office functions with extensive operation in the Eastern Region
3. IMPLEMENTING AGENCIES	CONAMYPE with international support program for SMEs
4. OBJECTIVES	(1) To modernize corporate management of SMEs in order to strengthen competitiveness of their products; and (2) To train Salvadoran consultants for management diagnosis and consultancy.
5. EXPECTED EFFECTS	(1) Viable SMEs competitive in open economy and free trade; and (2) Upgraded Salvadoran management consultants to support development of SMEs.
6. PROJECT COSTS	US$4.4 million
7. IMPLEMENTATION SCHEDULE	Initiation in Phase 1; continuous operation in Phase 2-Phase 3

8. PROJECT DESCRIPTION

The project consists of a diagnosis program for SMEs and a training program for local consultants to allow continual corporate management diagnosis and consultancy. CONAMYPE, the government agency to promote SMEs in El Salvador, is the main executing agency. At present, a senior expert dispatched by JICA is supporting CONAMYPE.

A diagnosis team is formed to provide corporate diagnosis as on-the-job training. The program offers also off-the-job training, including entrepreneur training and skill training. The operation of the diagnosis program is schematically shown in Figure 1. The diagnosis team provides also training for Salvadoran consultants as illustrated in Figure 2. Possible contents of these component programs are described below.

(1) Off the job training

The corporate management program provides short and medium-term courses for entrepreneurs and managerial staff. Business environments in the Country have reached a turning point in accordance with the progress in globalization. It necessitates introducing new corporate management methods in order to respond to market needs. Also, a sales promotion program should be provided. Sales promotion is indispensable to strengthening the financial bases of enterprises. This program offers how to promote sales activities and how to analyze corporate strategy based on market information. The curricula may comprise such programs and courses as presented below.

a) Corporate management program:
   - Basic management theory in market economy,
   - Strategic marketing theory,

Figure 1. Diagnosis Program Scheme

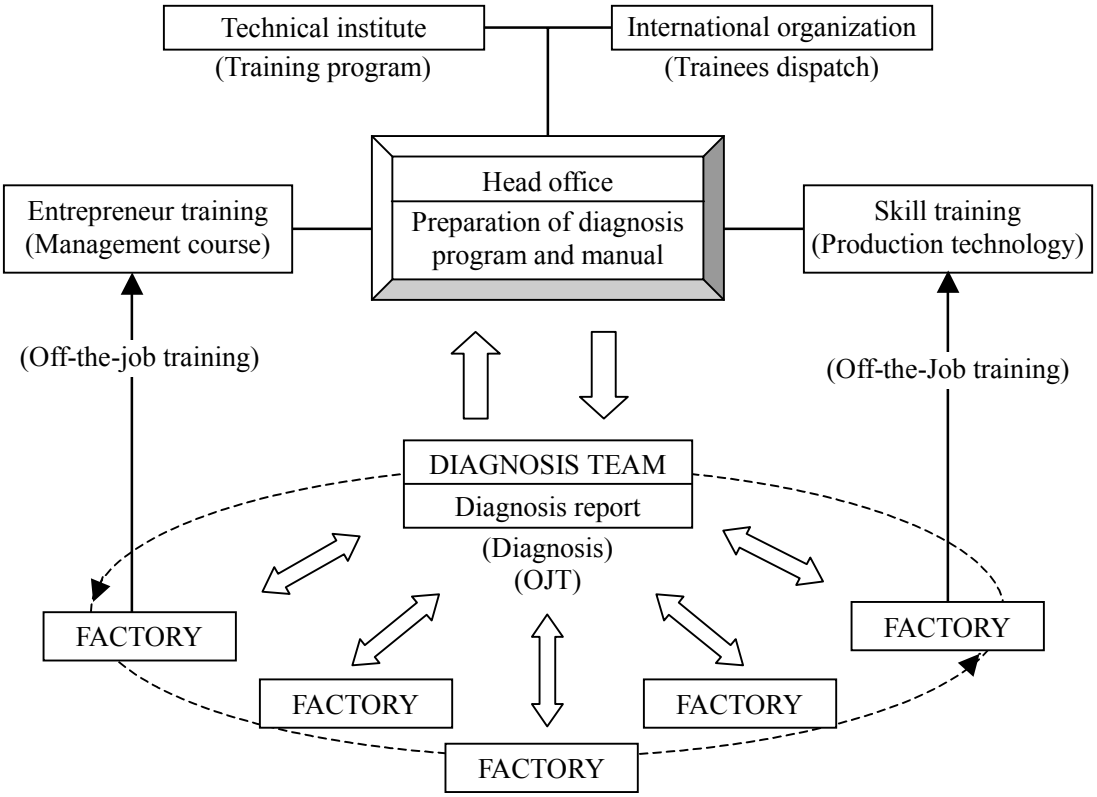
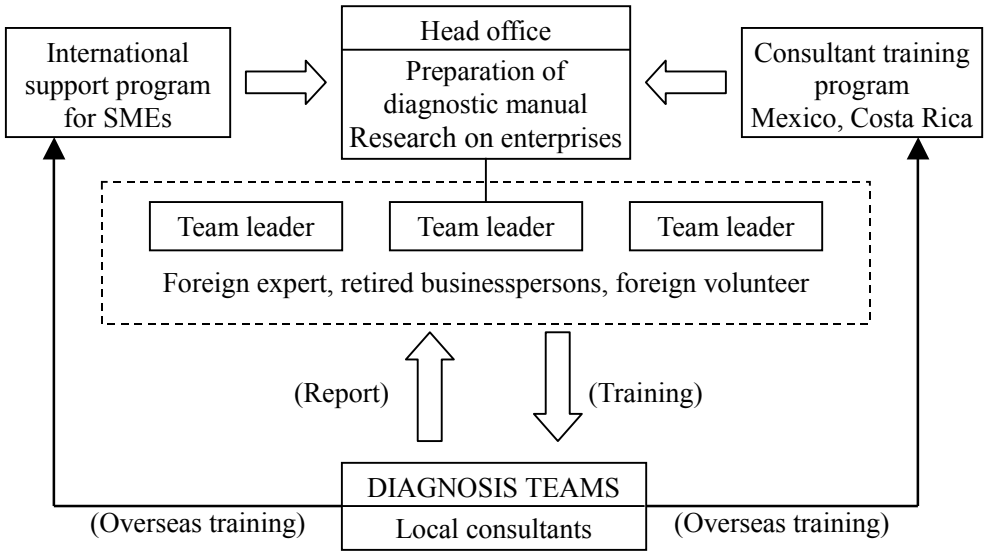


Figure 2. Training Program for Local Consultants



- Method of analysis on business situations and markets,
- Preparation of business planning,
- Production schedule, and
- Method of analysis on new investment.

b) Sales promotion training program:
- Integrated market strategy,
- Analysis method for marketing analysis, demand forecast, market promotion,
- Adjustment between corporate strategy and sale strategy,
- Human development for sales personnel, and
- Information from after service.

(2) Circuit diagnosis program including OJT

Innovation and modernization of enterprises cannot be achieved in a short time. As a long-term training program, a diagnosis system (or circuit diagnosis program) should be established. This program aims to strengthen the competitiveness of enterprises through improvement of corporate management, production control and cost reduction. Contents of diagnosis are outlined below for further study.

a) Production control: rationalization and productivity, cost reduction, production schedule, process control, quality control (QC), inventory control, procurement and maintenance; and

b) Labor control and training: personnel affairs, QC circle, etc.

(3) Financial control

At first, a task force prepares a concrete program of diagnosis, manuals and checklists. International support by experienced organizations should be required. A group of team leaders with experiences (e.g., foreign experts, retired businessmen/women, foreign volunteers, and accountants) is organized to train diagnosis teams. Diagnosis teams consisting of local experts of corporate management and production control take charge of several enterprises. Each team goes on fieldtrips to diagnose and supervise company innovations. The team visits each enterprise for about a week at a time and four times a year. The team points out problems and instructs the enterprise on innovation. On the next visit, the team leads the enterprise to a next step of innovation.

A diagnosis group consists of two or three members and five diagnosis groups are organized to be in charge of the Metro, Para central, Central, Western, and Eastern regions, respectively. It is recommended that three diagnosis groups be organized in the first stage.

Project No. 6.2d

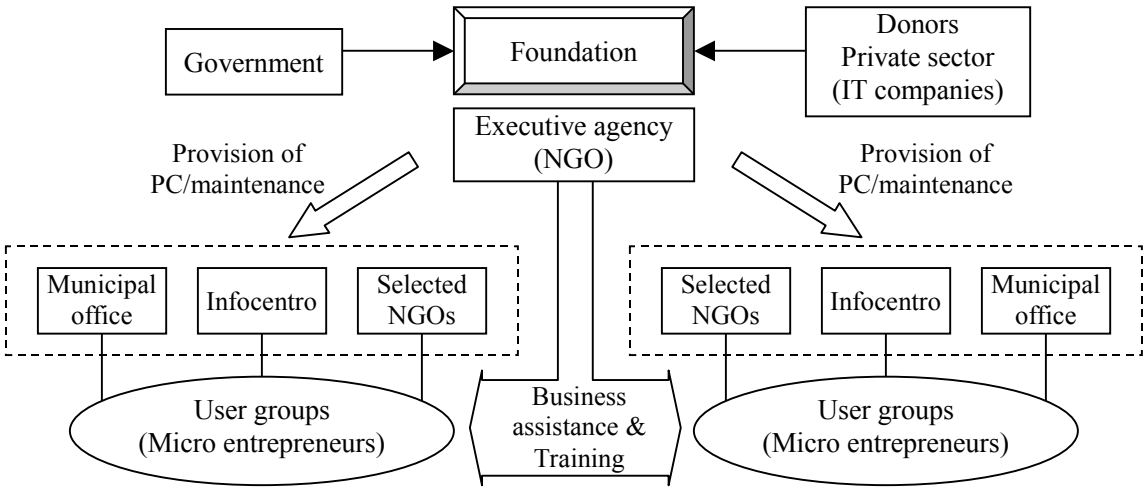
1. PROJECT TITLE	Micro Entrepreneur Training Program
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	Infocentro, municipalities, NGOs
4. OBJECTIVES	(1) To improve access by micro entrepreneurs to business information; and (2) To support micro entrepreneurs to prepare business plans based on the business information obtained
5. EXPECTED EFFECTS	Change in the business culture with micro entrepreneurs' recognition of the importance of business management
6. PROJECT COSTS	US$0.9 million
7. IMPLEMENTATION SCHEDULE	Phase1-Phase 3

8. PROJECT DESCRIPTION

The program provides computers for municipal offices and NGOs in rural areas and allows micro entrepreneurs to obtain business information through the Internet as a first step of business training. Existing foundations or NGOs would become the executing agencies with support of the Government, donor agencies and the private sector including IT companies.

Municipal governments, supported by selected NGOs and Infocentro, would organize micro entrepreneurs groups in the respective areas. Each selected executor would dispatch a business assistant team to the client entrepreneurs group to provide training and business assistance. The operation of the program is schematically shown below.

Operation of Micro Entrepreneur Training Program



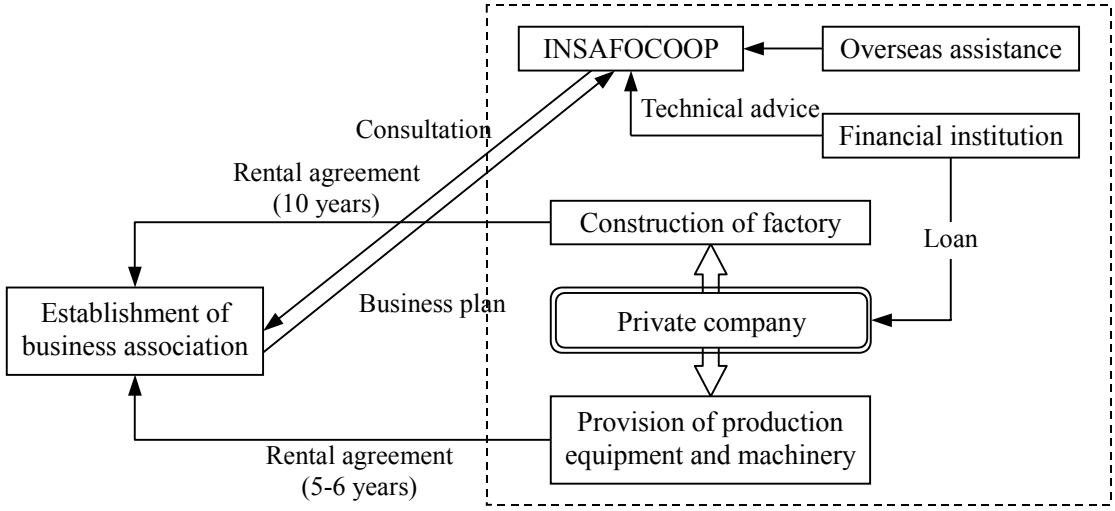
Project No. 6.2e

1. PROJECT TITLE	Business Associations Establishment Program
2. LOCATION	La Union industrial zone
3. IMPLEMENTING AGENCIES	INSAFOCOOP
4. OBJECTIVES	(1) To build factories and facilities for rent or lease to corporate associations to establish in the La Union industrial zone; and (2) To facilitate SMEs to establish a new factory
5. EXPECTED EFFECTS	Fully operational industrial zone in La Union port area with many SMEs established.
6. PROJECT COSTS	US$2.7 million
7. IMPLEMENTATION SCHEDULE	Phase1-Phase 3

8. PROJECT DESCRIPTION

The program supports the establishment of business associations by SMEs that want to move into factories in an industrial zone. A private firm (e.g., leasing company and developer) would construct rental factories in an industrial zone and provide equipment and machinery for leasing. INSAFOCOOP, the government agency to develop cooperatives and provide a registration system with a database for them, would support SMEs on procedures for organizing a business association. The association would submit its business plan for a leasing contract. The operation of the program is schematically shown below.

Operation of Business Associations Establishment Program



INSAFOCOOP would need to be supported by technical experts to implement this new scheme. The financial institute providing a loan to the private firm would also provide technical advice to INSAFOCOOP.

Each business association would perform the following functions.

(1) Joint activities related to production:
- Procurement of materials, machine parts, fuel, etc.,
- Training of employees,
- Common welfare facilities,
- Distribution system and tie-up with transport companies, and
- Anti-pollution measures.

(2) Marketing activities:
- Joint handling of orders,
- Joint sales promotion and market research,
- Exhibition hall/space for products, and
- Development of new products under a common brand name.

(3) Promotion of IT:
- Rationalization of production processes by introduction of computer system.

Project No. 6.3

1. PROJECT TITLE	ICT Human and Institutional Development Program
2. LOCATION	El Salvador with emphasis on the Eastern Region
3. IMPLEMENTING AGENCIES	CONACYT, MINED/ITCA, INSAFORP
4. OBJECTIVES	(1) To improve the skill level of ICT related personnel at all levels; and (2) To promote e-culture among communities
5. EXPECTED EFFECTS	(1) Improved skills of ICT-related personnel at all levels; and (2) Promotion of the ICT sector
6. PROJECT COSTS	US$6.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

With the development of the La Union port and the FPEZ in the Eastern Region, especially with call centers and a logistic center, high-grade intelligence services should be promoted at the same time. Upgrading the quality of human resources in the sector is crucial for this, and it is necessary to develop the skills of employees at all levels. It is important to train not only engineers but also policymakers to realize effective ICT-related policies. In addition, there is a necessity to develop end-users and facilitate them to obtain jobs and use their skills at work.

The program aims to improve the skills of ICT-related personnel at all levels and to promote e-culture among communities. It consists of four component projects:

- ICT Policymaker Strengthening Project,
- ICT Engineers and Technician Strengthening Project,
- ICT End-User Training Project, and
- Model E-Community Center.

Project No. 6.3a

1. PROJECT TITLE	ICT Policymakers Strengthening
2. LOCATION	El Salvador
3. IMPLEMENTING AGENCIES	CONACYT
4. OBJECTIVES	To improve the skills and knowledge of ICT policymakers
5. EXPECTED EFFECTS	Improved policymaking in the ICT sector
6. PROJECT COSTS	US$0.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

It is important to update and upgrade the skills and knowledge of ICT policymakers in order to make effective ICT policies suited for promoting economic activities in the Country. The project aims to train the government officers in charge of ICT policymaking both at the national and the municipal levels. Foreign experts will be dispatched to CONACYT, which is responsible for coordinating ICT-related activities in El Salvador, in order to transfer applicable technologies to the policymakers. CONACYT has recently drafted the national policy on informatics for approval by MOE.

The project consists of the following three components.

Component 1: Technology transfer from foreign experts to CONACYT staff

The following are examples of subjects for technology transfer:
- ICT-related laws and policies,
- Planning, documentation, and implementation of policies for social economic activities using ICT,
- Dissemination of success and unsuccessful cases of ICT promotion policies,
- Dissemination of market needs for ICT in developed country, and
- Consideration of rural areas and the socially disadvantaged to avoid the digital divide.

Component 2: Seminars and workshops for governments and communities
The possible topics of the seminars/workshops will be:
- Central and municipal government: the same as the topics mentioned above, and
- Local communities: introduction of business using ICT (e-commerce, homepage building, etc), ICT related services offered by governments and private companies (ex. where and how they can receive training, have access to necessary database, etc).

Component 3: Development of ICT-related programs/projects
A framework for national ICT policies will be formulated and programs developed to set up high-tech parks first in San Salvador and second in La Union.

Project costs are estimated below.

(Unit: US$)

Cost Item	Description	Qty	Unit	Unit price	Amount
Expert					
airfare	1 round trip	5	person	6,500	32,500
per diem	2 weeks	5	person	120x14	84,000
consultant fee	2 weeks	5	person	50,000	100,000
Equipment	1 computer & 1 printer	1		2,000	2,000
Seminar in local cities	room rental, half day	10	time	230	2,300
Transportation					
vehicle	rental with a driver	4	month	1,680	6,720
fuel		4	month	150	600
Personnel	1 assistant	4	month	600	2,400
Administrative costs		4	month	500	2,000
Subtotal					463,040
Contingency					46304
				Total	509,344

Project No. 6.3b

1. PROJECT TITLE	ICT Engineers and Technician Strengthening
2. LOCATION	Eastern Region mainly
3. IMPLEMENTING AGENCIES	MINED, ITCA Santa Tecla
4. OBJECTIVES	(1) To develop skill, of ICT teachers, universities, other technological institutes, high schools, and vocational institutions nationwide; (2) To develop skill, of students majoring in ICT; (3) To conduct vocational training in ICT to enterprise workers, self-employed, and unemployed; and (4) To develop curricula and methods of ICT teachers' training
5. EXPECTED EFFECTS	Skill development of people in ICT at various levels
6. PROJECT COSTS	US$5.1 million
7. IMPLEMENTATION SCHEDULE	Phase 1-Phase 3

8. PROJECT DESCRIPTION

Development of ICT engineers and technicians is essential for the development of the ICT sector. In the Eastern Region, highly skilled human resources in this sector are needed for the development of the La Union port and the FPEZ. The project aims to develop engineers and technichians in the ICT sector. In addition, vocational training targeting at end-users is conducted. Moreover, since ICT skills become obsolete quickly, a system to regularly train ICT teachers will also be established. A committee comprising MINED, foreign experts, ITCA staff, and the private sector develops the curricula and methods of ICT teachers' training so that ICT personnel will be trained even after the project. The following are the components of the project.

Component 1: Technology transfer to ICT Department staff, ITCA Santa Tecla
- Dispatch of foreign ICT experts (long and short-term) to ITCA Santa Tecla, and
- Provision of necessary training equipment to ITCA Santa Tecla.

Component 2: Training by ITCA Santa Tecla staff for various groups
- Training for ITCA San Miguel staff; ICT professors/instructors of universities, other technological institutes, high schools, and vocational training institutes nationwide; and students of ITCA, and
- Short-term vocational training courses for the unemployed and company employees.

Component 3: Development of curricula and methods of periodic ICT teachers'training
- Curricula and methods of ICT teachers' training developed by a committee comprising MINED, foreign experts, staff, and the private sector.

Project No. 6.3c

1. PROJECT TITLE	ICT End-Users Training
2. LOCATION	Eastern Region
3. IMPLEMENTING AGENCIES	Training institutions and private trainers in the Eastern Region/INSAFORP
4. OBJECTIVES	To train ICT End-users
5. EXPECTED EFFECTS	Increased ICT skills of people in the Eastern Region
6. PROJECT COSTS	US$0.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

As the use of computers, Internet, and basic business application software has become common globally, it is important that people acquire these skills to be marketable in the job market as well as utilize them at work. Moreover, with the development of the La Union port and the FPEZ, the demand for workers with basic knowledge and skills of computers is expected to rise.

The project aims to train ICT end-users using the Eastern Region skill development fund introduced by Project No. 6.2a or through conventional INSAFORP training. The following are the components:

Component 1: Planning and development of training courses to be offered by training institutes in the Eastern Region; Systematic devleopment of training courses that meet a wide range of trainees' needs;

Component 2: Provision and management of the ICT-training courses; and

Component 3: Course evaluation and feedback assessment.

Project No. 6.3d

1. PROJECT TITLE	Model E-Community Center
2. LOCATION	Eastern Region – one of municipalities where an Infocentro is located
3. IMPLEMENTING AGENCIES	Infocentro, ITCA
4. OBJECTIVES	(1) To strengthen Infocentro as a center to promote e-culture; and (2) To provide various ICT services to local communities
5. EXPECTED EFFECTS	(1) Coordinated government agencies' efforts for an e-government; and (2) Upgraded community services
6. PROJECT COSTS	US$0.4 million
7. IMPLEMENTATION SCHEDULE	Phase 1 (2 years in the latter half)

8. PROJECT DESCRIPTION

The project will establish a model e-community center in the Eastern Region, building upon an existing Infocentro. It will extend initial efforts under Project No. 6.2b (Incubation Centers) and Project No. 6.2d (Micro Entrepreneur Training Program), and expand the e-culture and e-services throughout local communities.

The center should be established initially with the functions listed below in view of urgent demand for the services and the revenue generation possibility.

1) Business center services (e.g., fax, telex, telegram, photocopying, scanning, printing, and initial loan) and community banking based on the Bangladesh's Grameem Bank model. This function will leverage on the existing Infocentros in the Region to support the local small businesses. The fee collected could subsidize the Infocentros. The business center would also establish a rolling fund supported by international, domestic, and overseas Salvadoran donors. This fund will assist the poorest of the poor in starting their business.
2) Training services (e.g., basic computer training, distance learning and English language courses). Funding should be secured from user fees, government budget, and private scholarships. Human resources development is desperately needed in the region.
3) Local government unit (LGU) services (e.g., complaints filing/processing, real estate taxes, business permits and licenses, recruitment, call center/BPO certificate), which will be funded by user fees and license fees and a percentage of tax (as commission). This function will serve as a model or an experiment to demonstrate e-service's contribution to a cost-saving, efficient government. The local government could also issue licenses for skilled workers and professionals who might need them in their job application to international companies that are expected to locate in the area after the La Union port.

In implementing the project, ongoing and planned efforts by various government agencies should be taken into account to coordinate and prioritize different services. The project will be funded mainly from three sources: 1) Government payments for services rendered, from the savings in employing the e-strategy; 2) local taxes to support services such as libraries and local tourism promotion; 3) donations from charitable groups and individuals. Infocentros should approach Salvadorans and private international charity organizations (e.g., Bill Gates Foundation) for the support of the establishment of an e-library. The Government may also allocate some fund for specific, development-oriented components of this project. The project will provide software development, networking equipment and staff training at various local government agencies.

The project costs for the two-year implementation are estimated in the table below.

(Unit price: US$)

Item	Description	Qty	Unit	Unit price	Amount
A. Investment cost					
a. Office rental (additional room)	36 mos.	100	m^2	2	7,200
b. Additional computers		10	set	1,250	12,500
c. Office supplies				5,000	5,000
d. Software and network consultants	6 mos.	2		2,000	24,000
e. In-house network specialist	24 mos.	1		1,000	24,000
f. Network equipment and software		1			50,000
g. E-library establishment					50,000
h. Entrepreneurship center budget					20,000
i. Training center budget shared with INSAFORP					20,000
B. Recurrent cost					
a. Secretary & assistant	2	24	months	150	7,200
b. Local expert	3	24	months	1,000	72,000
c. Utilities		24	months	425	10,200
d. Administrative costs		24	months	300	7,200
C. Subtotal					309,300
Contingency (10%)					30,930
Total					340,230

Project No. 6.4

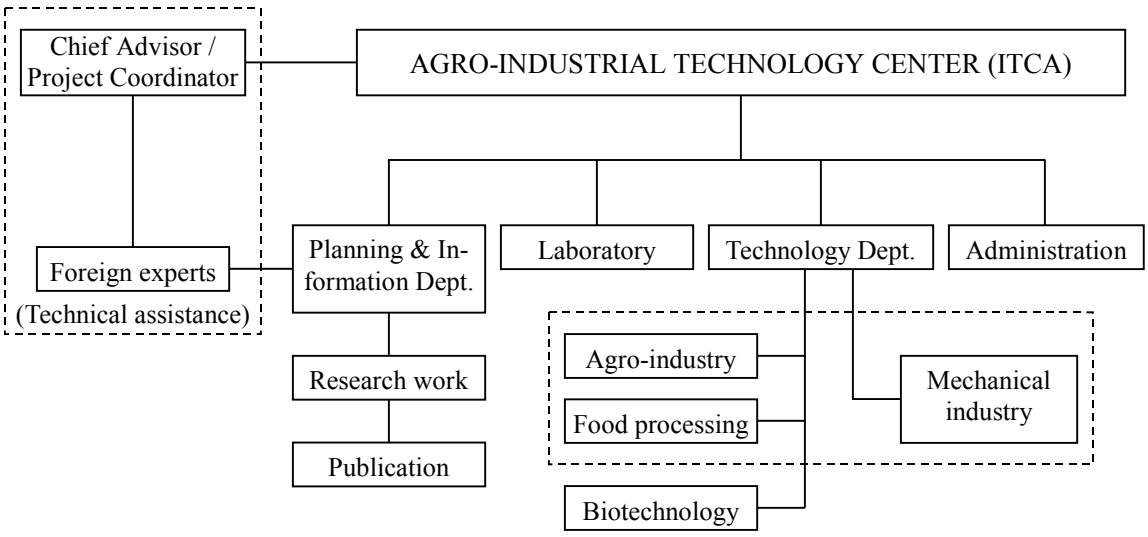
1. PROJECT TITLE	Agro-Industrial Technology Center
2. LOCATION	San Salvador
3. IMPLEMENTING AGENCIES	CONACYT
4. OBJECTIVES	(1) To support the creation of new industries; (2) To support the development and adaptation of production technologies; and (3) To promote advanced production technologies
5. EXPECTED EFFECTS	(1) Upgraded production technologies for international competitiveness; and (2) Capacity for technological innovation
6. PROJECT COSTS	US$1.5 million
7. IMPLEMENTATION SCHEDULE	Phase 1

8. PROJECT DESCRIPTION

The project supports the establishment of the National Laboratory of Legal Metrology proposed by CONACYT to test and experiment for technology development, and extends it into the Agro-Industrial Technology Center (AITC). The AITC is to specialize in production technologies related to agro-business, especially food processing. The metal works and machinery industry should also be covered as it supplies production machinery and equipment.

The AITC will have four departments: planning and information, technology, laboratory, and administration. The proposed organizational structure is illustrated in the figure below.

Organization of Agro-Industrial Technology Center



The following functions of each department are recommended for further study.

(1) Technology department

Consultant services on the production technology in the following fields will be provided based on companies' requests:

- Process food engineering (e.g., canned vegetables and fruits, pickles, and soft drinks),
- Biotechnology,
- Fundamental food manufacturing for local industries, and
- Designing and processing of industrial machine and its parts.

(2) Laboratory

Testing, calibration and analysis services for products, semi products and materials will be provided and certificate of testing issued.

(3) Planning and Information department

Planning and information services will be provided for:

- Joint and sponsored research on production technologies for commercialization,
- Research on fundamental technologies for the agro-industry, and
- Diversification of the agro-industry.

A detailed program for the establishment of the AITC should be worked out with technical support of foreign experts to be dispatched to CONACYT.

Final Report
Volume 3
Project Report

Part 2

In-Depth Studies

In-Depth Study No. 1: Poultry-Vegetables Integrated Farming (Avi-Horta)

1. Introduction and Justification

The poultry industry has been designated by the Master Plan as one of the eight most promising indigenous industries to be promoted in the Eastern Region. While the CAFTA would expose the aviculture in El Salvador to severe competition against import from the U.S., feed costs would also be reduced. The feed availability would increase also by the establishment of the La Union port. It would be essential for the Salvadoran aviculture to maintain its competitive advantage in the Central American market. The Eastern Region would hold a key to this as it would take advantage of importing feed and also its proximity to Honduran and Nicaraguan markets.

As commercial poultry operations are established in the Eastern Region, partly shifting from the Western region, farmers in the Region should be well prepared to link up with them to take advantage of the opportunity. The farmers should acquire technology and management skills for aviculture, and establish competitive production methods with low feed costs. One possible way is to combine aviculture with vegetables production for an integrated farming (Avi-Horta).

The Avi-Horta integrated farming could reduce production costs by feeding poultry with waste vegetables. This would have a side effect of reducing the risk of over-production of perishable vegetables. Chicken droppings would, in turn, be used as fertilizer to produce organic vegetables for higher prices. The ongoing CENTA project for vegetables production under small scale irrigation, supported by JICA technical cooperation, may be transferred to the Eastern Region and combined with aviculture for a new model of integrated farming.

As the first step to realize these potentials, the Avi-Horta model should be pilot implemented. A few modules of poultry and vegetables combinations should be experimented to establish the most viable model in the Eastern Region.

2. Objectives and Scope

Objectives of the Avi-Horta model project are:

(1) to establish the most viable model for poultry-vegetables integrated farming,
(2) to contribute to increasing income of farmers, and
(3) to motivate farmers for productive and market-oriented agricultural activities and equip them with necessary skills and experiences.

An association of farmers' cooperatives would be organized to become the owner of the project. Several cooperatives may be involved, each specializing into a particular combination of vegetables to grow and poultry at certain scale. Three or four vegetables such as tomato, green pepper, cucumber and loroco should be combined with aviculture for chicken meat and eggs. Each member farmer may own 2-5mz of farmland.

3. Existing Conditions of Vegetable Production and Poultry

3.1 Existing Conditions of Vegetable Production

(1) Demand and supply in El Salvador

According to the MAG statistics in 2002 (Oficina de Políticas y Estrategias), the actual cultivation area of eight principal vegetables is about 4,000ha. The combined national production of these vegetables is 81,600ton annually. The total national demand of vegetables is calculated to be 128,800ton at 20kg consumption per capita per year. This would require the cultivated area of 6,400ha at the average effective yield of 20kg vegetables per/ha. El Salvador imported the balance of 47,200ton vegetables annually at US$25.4 million (f.o.b.) in 2001 as shown in Table 1. The recent Israel investment in the tomato plantation will add 10% of its production to the national market (2,000ton) in 2004.

Table 1. Demand-Supply Balance for Edible Vegetable Products in El Salvador, 2001

Crop	Demand (t/y)	Natl. production (t/y)	Import (t/y)	(%)
Tomato	35,044	17,637	17,407	49.7
Green pepper	8,160	6,886	1,274	15.6
Kidney bean	3,312	2,674	638	19.3
Carrot	3,310	400	2,910	87.9
Potato	14,484	5,601	8,883	61.3
Cabbage	22,587	13,500	9,087	40.2
Onion	7,708	1,120	6,588	85.5
Cucumber	34,154	33,758	396	1.2
Total	128,759	81,576	47,183	

Source: MAG-Oficina de Políticas y Estrategias, 2002.

(2) Crop budgets and production factors

Crop budgets for selected vegetables are presented in Table 2.

Table 2. Crop Budgets for Selected Vegetables

Crop	Crop yield	Unit price	Gross income	Costs ($)						Net income
				Seed	Fertilizer	Chemicals	Material	Land prep.	Labor	
Tomato										
Actual	20	3	6,857	457	331	663	651	57	1,143	3,554
High crop	40	3	13,714	457	331	663	651	57	1,714	9,840
Green pepper (Chile dulce)										
Actual	20	17	33,714	2,629	354	594	2,057	57	1,143	26,880
High crop	40	17	50,571	2,629	354	594	2,057	57	1,714	43,166
Cucumber										
Actual	16	2	3,237	114	149	457	571	57	1,371	517
High crop	30	2	6,069	114	149	457	571	57	2,057	2,663
Kidney bean										
Actual	3.9	3.3	1,293	26	11	149	0	0	526	581
Loroco		($/kg)								
Actual	3.2	3.0	9,600	640	1,120	800	960	320	2,080	3,680

Source: CENTA-JICA, JICA Study Team.

Performance of the vegetable production depends on many factors. More important ones are 1) seed selection, 2) application of agro-chemicals against damages by insects, 3) fertilizer application, 4) water supply, and 5) provision of a nursery (typically 4m by 10m covered by a net).

(3) Existing conditions in the Eastern Region

In the Eastern Region, some 1,000ha farmland is devoted to vegetable production. A survey was conducted in the Region to find out suitable locations for the Avi-Horta model project implementation, mainly in the Bajo Lempa area in Usulutan, the Anamoros and the Lislique areas on the northern part of La Union, and the Jocoro area in the southeast of Morazan. The criteria applied for the selection of suitable sites are: 1) dominance of small farm holdings, 2) possibility to cultivate a few different crops, and 3) existence of nearby market.

The following relevant features were also noted for different areas.

a) Bajo Lempa areas organized and managed by Asociación Mangle
   There are: nursery house; training and cultivation programs; products collection, selection, depositing and distribution facility; and marketing efforts. Also, financial arrangements for initial investment for seed, fertilizer and simple irrigation system installations could be made.

b) Anamoros and Lislinque areas organized by the cooperatives
   There is less than 1mz area for cultivating two to four edible vegetables with own pond or water tank by using rainwater or by pumping up from the river or well.

c) Jocoro areas organized by the cooperative
   There are about 5mz for cultivating two to five edible vegetables, papaya, eucalyptus, indigo plant, and other fruits by using well water and gushing water. Also, there is a pond for tilapia cultivation and small-scale apiculture. In addition to edible vegetable cultivation, farmers' families keep about 50-60 hens in the same area for the markets nearby.

3.2 Existing Conditions of Aviculture in El Salvador

(1) Production

The Salvadoran aviculture industry contributes 1.5% of the GDP. The total production of chicken meat and eggs is shown in Table 3.

Table 3. Aviculture Production in El Salvador

Products	Unit	2000	2004
Chicken meat	(10^3lb)	165,574	161,114
Eggs	10^3	1,103,063	1,103,000
Total*	10^3lb	137,883	137,875

* Converted at 8eggs/lb according to AVES
Source: MAG-Oficina de Políticas y Estrategias 2002.

Table 4. Comparison of Aviculture Production Costs

(Unit: US¢/lb)

Cost item	USA	Brazil	China	El Salvador	Holland	Japan	Russia
Feed	16.0	13.6	26.2	38.2	30.3	43.0	58.6
(%)	(62.3)	(59.1)	(76.2)	*(80.5)	(62.0)	(53.3)	(70.0)
Chicken starter	3.8	6.4	2.0	4.9	9.3	12.4	8.4
(%)	(14.8)	(27.8)	(5.8)	(10.3)	(19.0)	(15.4)	(10.0)
Labor	3.6	2.0	1.0	2.4	4.1	4.3	3.3
(%)	(14.0)	(8.7)	(2.9)	(5.1)	(8.4)	(5.3)	(3.9)
Other	2.3	1.0	5.0	2.0	5.2	21.0	13.4
(%)	(8.9)	(4.3)	(14.6)	(4.1)	(10.6)	(26.0)	(16.0)
Total	25.7	23.0	34.2	47.5	48.9	80.7	83.7
(%)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Price to retailer	55.8	42.6	60.3	69.7	88.0	147.9	120.2

* According to local survey, the recent percentage is 70% (calculated by AVES)

Source: MAG-Oficina de Politicas y Estrategias 2002.

The production costs of aviculture are compared in Table 4 between El Salvador and other major producing countries. In El Salvador, 85% of producers are small or micro-scale.

According to the information of FEDAVICAC, the Central American region produced 17.6 million chickens and 4.9 million eggs in 1998, and the total chicken meat production was 338,000 ton (Table 5).

Table 5. Chicken Meat Production in Central America and Other Countries

(Unit: 1,000t)

	1990	World share (%)	1998	(%)
El Salvador	33	0.1	48	0.1
Costa Rica	43	0.1	80	0.2
Guatemala	67	0.2	120	0.2
Honduras	28	0.1	54	0.1
Nicaragua	7	0.0	36	0.1
Panama	25	0.1	48	0.1
Total	203	0.6	386	1.0
Mexico	750	2.1	1,558	3.0
USA	8,667	24.5	12,724	24.8
Brazil	2,356	6.7	4,490	8.8
China	2,583	7.3	7,740	15.1

Source: MAG-Oficina de Politicas y Estrategias
INCAE "Centroamérica y, el Comercio International de Productos Avícolas, Costa Rica
FEDAVICAC, JICA Study Team

(2) Import and Export

Statistics by SIECA for 1994-2001 show that El Salvador is the principal exporter to Honduras and Guatemala in the region. The total export value of Salvadoran aviculture products fluctuates widely in US$10-21 million during 1990-2001.

The Central American countries imported the processed products of chicken meat with value of

US$51.7 millions during 1996-98 as shown in Table 6.

Table 6. Import of Chicken Meat by Central American Countries, 1996-98

(Unit:US$10^6)

Products	El Salvador	Costa Rica	Guatemala	Honduras	Nicaragua	Total	(%)
Meat & entrails	1.9	0.4	22.8	9.7	2.8	37.6	72.6
Whole chicken	0.2	0.0	2.1	0.4	0.2	2.9	5.6
Chicken breast	0.1	-	1.5	0.0	-	1.6	3.1
Others	3.3	-	2.4	2.7	1.2	9.6	
Total	5.5	0.4	28.8	12.8	4.2	51.7	100.0

Sources: SIECA and MAG.

Also, the Central American countries import eggs with value of US$26.3 millions during 1996-98 as shown in Table 7.

Table 7. Import of Eggs by Central American Countries, 1996-98

(Unit: US$10^6)

From \ To	El Salvador	Costa Rica	Guatemala	Honduras	Nicaragua	Total	(%)
Total	3.7	3.1	1.5	24.3	14.5	47.0	100.0
1. Central America	1.9	0.6	0.4	21.9	1.5	26.3	55.9
El Salvador	-	0.3	0.3	20.7	0.6	21.9	46.6
Costa Rica	0.5	-	0.0	-	0.7	1.2	2.6
Guatemala	1.3	0.3	-	1.0	-	2.7	5.7
Honduras	0.1	-	-	-	0.2	0.3	0.5
Nicaragua	-	-	-	0.2	-	0.2	0.5
2. Other Countries	1.8	2.5	1.1	2.3	13.0	20.8	44.1
USA	1.0	2.1	0.9	1.8	10.9	16.8	35.7
Panama	0.7	0.3	0.0	0.5	1.9	3.5	7.3
Others	0.1	0.0	0.2	0.0	0.2	0.5	1.0

Sources: SIECA and MAG.

(3) Existing conditions in the Eastern Region

Aviculture producers in the Eastern Region are small and micro. Typically in Usulutan, small and micro producers hold 200-500 chickens each. They produce for self-consumption and marketing in their neighbors and nearby markets.

4. Model Project for the Eastern Region

A model project is formulated for a candidate site in the Bajo Lempa area. Existing conditions and required facilities at the candidate site are summarized in Table 8. Other considerations to enhance the viability of vegetable cultivation are the following:

1) selection of seed, cultivation method, control of insects, and protective afforestation with seedlings;
2) early cultivation by using simple greenhouses; and
3) extension of cultivation period by irrigation using rain water tanks, and development of year-round cultivation to better cope with price fluctuations.

Table 8. Existing Conditions of and Required Facilities for Model Project Site

Items	Present Conditions	Required Facilities
Surface area	5mz	0.25mz land to be used for cultivation
Well	12m deep	To be combined with spring water available
Pond	Existing	-
Pump	Existing	-
Piping	-	PVC pipes with valves
Crops	Tomato, green pepper, cucumber,	Seed selections
	loroco, pipian, kidney bean, etc.	Fertilizer (chicken droppings available)
	In addition, papaya, etc.	Agro-chemicals
	cultivated	Materials
Henhouse	Existing for 60 units	New facility for 50 units
Others	Tilapia cultivation	Land preparation
	Apiculture	Nursery installation
	Afforestation (eucalyptus)	(4m x 10m covered with net)

(1) Aviculture component

The aviculture operation starts with 50 chickens and mixed feed. Chickens will be sold after eight weeks at the average weight of 6lbs/chicken. Initial and monthly operating costs are estimated as follows.

Cost item	Unit cost	Quantity	Total cost	Explanation
Initial costs				
[1] Starter chickens	$0.45/unit	50 units	$22.5	
[2] Henhouse	$0.8/$m^2$	40m^2	$1,000.0	4m x 10m
Monthly operating costs				
[3] Mixed feed	$0.311/kg	180kg	$56.0	120g/day/unit
[4] Labor	$1.0/day	30 days	$30.0	
[5] Others	-	-	$10.9	([1]+[3]+[4]) x 10%

The total initial cost is US$1,022.5. The total annual operating cost is calculated to be US$1,163. The total operating cost for the eight-week delivery cycle is calculated to be US$215.5. Assuming the price to consumers at US$0.90/lb, the gross sales value is US$270.0. The net profit, not including the depreciation cost of the henhouse, is US$54.5.

(2) Horticulture component

The vegetable cultivation starts on farm of 0.25mz with tomato, green pepper and cucumber. Initial costs and annual operating costs are estimated as follows for two cases: pump irrigation and rainwater irrigation with a tank.

i) Irrigation system			In case of rainwater/tank	
- Pump:	$	657.2	$ 657.2	
- Well:	$	228.6	--	
- PVC pipes & valve:	$	314.3	$ 314.3	(2,000ℓ tank)
	$	1,200	$ 971.4	

ii) Annual operations costs

- Irrigation:	$ 450.0	$ 225.0	
- Land preparation:	$ 80.0	$ 80.0	
- Fertilizer, etc.:	$ 500.0	$ 250.0	
- Materials:	$ 80.0	$ 80.0	
- Fuel:	$ 70.0	$ 70.0	
- Labor:	$ 320.0	--	(Family labor)
	$ 1,500.0	$ 705.0	

Production costs for the selected vegetables are summarized in Table 9, and the net income derived from cultivation of these vegetables on 0.25mz land is calculated in Table 10.

Table 9. Annual production Costs of Selected Vegetables

(Unit: US$)

Crop	Seed	Fertilizer	Chemicals	Materials	Land Preparation	Labor	Total
Tomato	80	58	116	114	10	200	578
Green Pepper	460	62	104	340	10	200	1,176
Cucumber	20	26	80	100	10	206	442

Table 10. Net Income Calculation for Selected Vegetable

	Yield (kg/0.25Mz)	Unit Price ($/10kg)	Gross Income ($)	Costs ($)	Net Income ($)
Tomato	3,500	3.43	1,200	578	622
Green Pepper	3,500	16.86	5,900	1,176	4,724
Cucumber	2,800	2.02	566	442	124
Loroco	560	3.00/kg	1,680	1,036	644

The total annual cost of vegetable production is calculated as US$4,482, including 100% depreciation of the initial costs for pumped irrigation system (US$971) and the simple greenhouse (US$1,000), labor costs (US$606), and other operating costs (US$1,815). The total gross sales value is calculate to be US$7,666, consisting of sales value of tomato (US$1,200), green pepper (US$5,900), and cucumber (US$566). The net income is US$3,273.

The integrated operation of aviculture and vegetable production allows savings in feed cost for aviculture, fertilizer cost for vegetable production, labor cost due to maximum use of family labor, and some material costs. The total saving is estimated to be some US$500, resulting in 15% increase in net profit.

In-Depth Study No. 2: Processed Milk Production

1. Background

Dairy products in El Salvador are protected by high tariffs, but within the Central American region no tariffs applies to milk. The production cost of milk is higher in El Salvador than in other Central American countries as well as in the U.S. At present, the milk production in El Salvador, particularly in the Eastern Region suffers from illegal import of milk avoiding the payment of the value-added tax. The strengthening of milk production is vital for the survival of the dairy industry in the Country, which would face harsh competition once the CAFTA with the U.S is effected. With the view to examining a necessary condition for the dairy industry, the viability of milk industry is analyzed.

The milk industry in El Salvador generally faces the following problems:

(1) Inadequate sanitation practice by dominant small producers,
(2) Problems in milk transportation such as insufficient refrigerated trucks and inadequate containers,
(3) Use of imported milk and milk powder resulting in unfair competition,
(4) Lack of quality control in the dairy industry, and
(5) Illegal trade of low price or donated products.

Overcoming these problems would be a prerequisite to establishing viable milk and dairy industries.

2. Objectives

The objectives of the project are the following:

(1) To establish a regional enterprise for the whole milk industry, encompassing collection, processing and marketing of milk and manufacturing of milk products;
(2) To contribute to the establishment of a reliable market for milk producers; and
(3) To showcase a model of a profitable business in the Eastern Region based on organizing of small producers.

3. Project Description

The project will establish a milk collection, processing and marketing system to handle 30,000 ℓ/day milk. The milk collection system consists of trucks transport milk, milk collection tanks, and collection house and facilities. The milk processing system consists of facilities for pasteurization, cream removal, cheese and butter making, and products packing as well as a building to house all the equipment.

Local milk producers should be organized to form a regional enterprise. A feasibility study for the milk processing plant should be carried out, including a realistic funding plan. The

members of the enterprise are expected to make some capital contributions, and a loan should be obtained to raise the required investment capital. The milk collecting sites, size and location of the processing plant, and marketing channels should be determined.

4. Expected Effects and Project Costs

The purchase price of raw milk is assumed to be US$0.314/ℓ. At 30,000ℓ milk processed daily for 365 days, the annual purchase cost is calculated to be US$3,438,300. The gross sales price of processed milk is assumed at US$0.750/ℓ to make the annual gross sales value US$8,212,500. The net sales value is the balance between the two, US$ 4,774,200. It is assumed that the maximum production and sales would be attained in the fourth year.

Based on these estimates, the cash flow table is constructed as shown in Table 1. The internal rate of return (IRR) is calculated to be 11.6% for the initial 10-year operation, which is considered to be reasonable.

Table 1. Cash Flow of Processed Milk Production

(Unit: US$)

	Cost				Gross benefit	Cash flow
Year	Capital	O&M	Replacement	Total		
1	1,235,500	3,838,600		5,074,100	2,400,000	-2,674,100
2		3,838,600	100,000	3,938,600	3,000,000	-938,600
3		3,838,600	100,000	3,938,600	4,000,000	61,400
4		3,838,600	100,000	3,938,600	4,874,200	935,600
5		3,838,600	100,000	3,938,600	4,874,200	935,600
6		3,838,600	100,000	3,938,600	4,874,200	935,600
7		3,838,600	100,000	3,938,600	4,874,200	935,600
8		3,838,600	100,000	3,938,600	4,874,200	935,600
9		3,838,600	100,000	3,938,600	4,874,200	935,600
10		3,838,600	100,000	3,938,600	4,874,200	935,600

IRR	11.6%

Investment costs for the project implementation and annual operation and maintenance costs are estimated as follows.

Investment costs	
Milk collection system	US$269,040
Milk processing plant	769,500
Vehicles for product delivery	150,000
Office building & equipment	47,000
Total	US$1,235,540

Annual operation and maintenance costs	
Purchase of raw milk	US$3,438,300
Packing materials	84,000
Personnel	138,240
Electricity	6,300
Fuel	1,750
Marketing activities	120,000
Other	50,000
Total	US$3,838,590

In-Depth Study No. 3: Agro-Business Center Establishment (Project No. 1.3)

1. Background

The lack of business information and limited access to such information constrains the development of local industries. Industrial linkages are difficult to form under such a condition. The project will provide a database for business information and consulting services to support business development by local enterprises. For this purpose, the existing Agronegocios of MAG will be strengthened particularly for its functions in the Eastern Region.

Agronegocios was established by MAG in 1999 utilizing the FANTEL fund. It provides information to support the agro-industry. Out of the 10 branches in the Country, three are located in the Eastern Region: two in Usulutan and one in San Francisco Gotera. The project will support the establishment of another branch in La Union.

In general, a business center serves various industries. The proposed agro-business center, however, should specialize in agro-business in the Eastern Region. It should also involve the machinery industry as a support industry for agricultural and processing machinery and its parts for agro-businesses. The agro-business center will be instrumental in providing vital input to the agro-industrial complex envisioned in the Eastern Region master plan.

2. Objectives

The objectives of the project are to (1) provide local business information and business opportunities and resources, (2) strengthen business linkages through information exchanges between various actors in the public and private sector, and (3) promote the entrepreneurial culture in the Eastern Region.

3. Project Description

The agro-business center will have three sections: database system, consulting services, and administration. A permanent exhibition hall should also be constructed to exhibit high quality local products. The functions of each section are described.

(1) Database system

The database section collects macro level information on production technology and products in the Eastern Region. The database links with existing networks of international and domestic databases. A number of chambers of commerce and consulting institutes in El Salvador have databases of their member companies and most countries have information centers for international trade such as JETRO in Japan. The final goal of the database system is to become a show window demonstrating that the Eastern Region is a producer of high quality agro-related products. The functions of this section include the following:

- Collection of domestic market information,

- Collection of regional information,
- Linking with network in other regions and foreign information centers,
- Collection of enterprise information by questionnaires, and
- Collection market information from magazines and Internet with translation.

(2) Consulting services

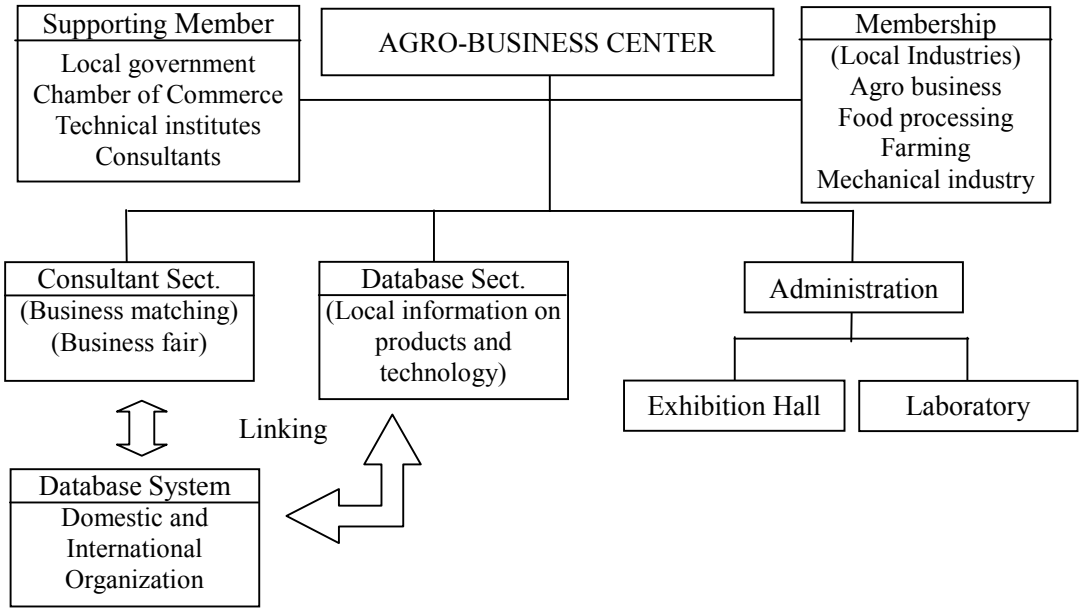
The consultant services section will provide the following services to create business opportunities:

- Introducing regional products and production technology from/to the region,
- Market research for regional products,
- Research on potentials of local businesses,
- Arranging business tie-ups, associations, and joint ventures,
- Introducing buyers, dealers and distributors, and
- Support for participation in business fairs.

(3) Administration

An exhibition hall and a laboratory belong to the administration section. Major regional products are exhibited in the hall and the administration staff escort foreign visitors and missions. A laboratory provides testing machines for the quality of products and materials.

Translation and e-mail services should also be provided by the section that will serve as a central e-mail post office to receive, hand-deliver, type, and send e-mail on behalf of customers as well as offer faxing, photocopying and international telephone call services. The section will also be in charge of periodical publication of agro-business information and conduct of seminars for research works.



4. Expected Effects and Project Costs

(1) Expected effects

The project would support SMEs and also medium scale enterprises that face difficulty in obtaining business information. In business circumstance today, quick response for business communication is required. The center would link regional information to other regions and international networks and could speedup business communications to create business opportunities. In addition, information necessary for business decision-making would be provided by the center.

The center would create business opportunities by spreading regional information to Central American countries and around the World. Business linkages among the regional industries, for instance, between food processing and machine manufacturers would be strengthened. It is expected that the entrepreneurial culture would be cultivated in conformity with market requirements.

(2) Project costs

The project costs are estimated at US$179,300 for the initial investment and US$6,150 per month for operation costs as detailed below. The acquisition of land is not included in these costs. The Phase 1 costs for five years, therefore, total US$0.55 million.

1. Startup costs

Construction of office & exhibition hall	US$140,000
Office equipment	10,000
Transportation (vehicle)	13,000
Contingency	16,300
Total	US$179,300

2. Operation costs (US$/mo.)

Office stuff	
- Manager (1)	US$2,200
- Officer/Analyst (2)	2,000
- Assistant (5)	3,000
- Office attendant (1)	150
Utilities and other office expenses	1,000
Total	US$8,350

In-Depth Study No. 4: Organic Fertilizer R&D and Production (Project No. 1.4)

1. Background

Agriculture in El Salvador declined during the civil war, and has been stagnant since then. The Country has been importing increasing amount of various agricultural and agro-processed products, including fresh fruits and vegetables, supported in part by large amount of remittances and easy import under the open economy policy. Increasing agro-related import may undermine the macroeconomic stability of El Salvador, on the one hand. On the other, further degradation of primary production sector may constrain the further development of the Salvadoran socio-economy.

Revitalization of the agricultural sector, therefore, is critically important for sustaining the sound socioeconomic performance of El Salvador. Along this line, MAG has been making efforts to strengthen selected agricultural activities, including the production of selected fruits and vegetables. Such efforts should focus on more promising activities for El Salvador to be specialized in with the view to establishing competitiveness in the globalizing economy and the free trade, although a certain degree of diversification is also necessary for the growth of the sector as a whole.

Increasing the productivity is a key for revitalizing the agricultural sector, while ensuring its sustainability. Productive and sustainable crop production requires the adequate use of fertilizer to prevent the degradation of soil fertility and to minimize environmental pollution due to excessive use of chemical fertilizer. Practice of organic agriculture is one way to avoid these problems. El Salvador at present imports 170 tons of fertilizer annually. According to a fertilizer importer, approximately 10% of fertilizer imported is organic. Thus the market for organic fertilizer exists in El Salvador and is expected to expand, partly replacing demand for chemical fertilizer.

Organic agriculture is also a meaningful way to produce specialty products. The awareness has been growing recently worldwide for the importance of sustainable agriculture and food safety. Consequently, the demand for organic products has been growing. El Salvador produces currently organic products of coffee, cashew nuts, sugarcane and even some fruits and vegetables for export mainly to the U.S., Canada, and European countries. The organic products fetch prices generally 30% higher than the prices of non-organic products.

As the La Union port is established in the Eastern Region, opportunities for exporting new products would expand, including organic products. International communities to develop in and around the port area would demand more healthy and safe products such as organic fruits and vegetables. The Eastern Region development induced by the La Union port will accelerate the urbanization, and both residents and visitors will demand more high-value products in the urban markets.

2. Objectives

The main objectives of the project are (1) to develop appropriate organic fertilizer applicable to various crops, and (2) to contribute to the establishment of organic agriculture and products particularly in the Eastern Region. The successful implementation of the project will lead to the establishment of new agribusiness and the alleviation of poverty by increasing income levels in rural areas through both crop production with higher productivity and value-added and related agribusiness.

3. Project Description

(1) Components

The project encourages early construction of small-scale organic fertilizer plants piloted to support the organic agriculture. There are various types of organic fertilizer and their production technologies are not yet well established. The private sector needs to conduct a feasibility study to determine the appropriate fertilizer suitable for particular crops promising in the Eastern Region, and to establish production technology based on raw materials and other input available in the Region.

To facilitate such private sector initiatives, the public sector should conduct a pre-survey on available technologies and raw materials as well as existing and potential producers of organic fertilizer. Private enterprises and NGO's are invited to submit proposals to establish small-scale organic fertilizer plants by selected technologies. The public sector evaluates the proposals, and supports the feasibility study by successful applicants. Construction will follow based on the results of the feasibility study with the technical assistance by the public sector.

The participation of the public sector is indispensable to ensure the adoption of appropriate technology and also to set up a monitoring and evaluation system for authorization of organic products. The quality of organic products is the most essential condition especially for export.

Construction of small-scale plants will serve for research purposes as well to develop the fertilizer industry on a commercial base. These plants serve as proper disposal places for organic wastes from livestock and crop producers and processing industries.

(2) Expected effects

From the viewpoint of the industry, the project will demonstrate a system for establishing new businesses. The procedure including a feasibility study and the establishment of a pilot plant with technology development supporting the commercialization is applicable to other new business fields.

The project will contribute also to the restoration and enhancement of environment. Increased use of organic fertilizer will not only enhance agricultural productivity but also improve soil fertility. Organic agriculture also improves water retention capacity of land. This particularly

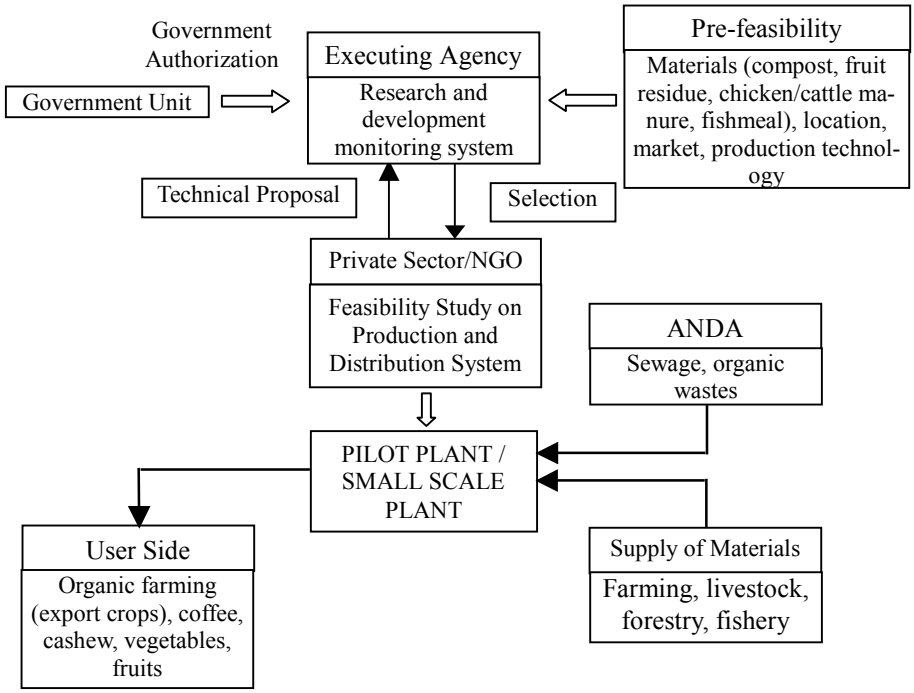
applies to organic coffee production under shade trees. Reduction of organic wastes from livestock activities will contribute to improving water quality as well.

Use of organic fertilizer produced mainly from local raw materials will reduce the amount of fertilizer import. More viable crop production using organic fertilizer will reduce dependence on imported crops. In many ways, the project will contribute to establishing the reputation of El Salvador and the Eastern Region for high quality organic products.

4. Action Plan

The implementation agency in the public sector needs to be designated. There are several kinds of candidates to execute the project such as agricultural institutes and federations. The National School of Agriculture (ENA), and the National Center for Agriculture, Livestock and Forestry Technology (CENTA) are public institutions of agriculture. CENTA provides the technology transfer to improve agricultural productivity targeting at small and medium farmers. The Salvadoran Federation of Agrarian Reform Cooperatives (FESACORA), founded in 1982, consists of 180 cooperatives of producers of coffee, sugarcane, fruits and vegetables in the entire Country. It is estimated that some 15% of their products are organic products. The Inter-American Institute for Cooperation of Agriculture (ITCA) is another important institute to be involved in the project.

MAG should designate the main complementing agency and establish implementing arrangements involving all the institutes described above. A procedure and structure to implement the pilot project of small-scale fertilizer plant are illustrated bellow.



5. Project Costs

The project costs are estimated at US$500,000 for the initial implementation, including a pre-survey, a feasibility study and associated administrative costs, construction of small-scale fertilizer plants and associated research and technical support. The feasibility study will cost US$30,000. Other costs represent rough estimates as the scale and type of the plants and necessary technical supports will be determined by the feasibility study.

In-Depth Study No. 5: Sugar Mill Power Generation (Project No. 1.5)

1. Background

The Chaparrastique sugar mill operates four months a year, consuming about 650,000 tons of sugarcane every year. Currently the plant has two units for a total 3.5MW, which is more than enough for plant consumption. The project intends to increase the capacity to around 12MW, replacing the existing units.

Over the years, the Chaparrastique sugar mill have had several studies and inquiries related to expansion of power generation. The most thorough study, *Energy From Sugarcane Cogeneration In El Salvador*, was done by Winrock International Institute for Agricultural Development, for USAID in 1994. This in-depth study uses the basic assumption provided by the USAID report, though the sugarcane volume at the mill had been doubled since then from 276,359 ton in 1993 to 650,000 ton in 2003.

2. Present Production

During the 2002-03 season, the Chaparrastique sugar mill produced 1,335 ton of sugar, consuming 665,759 ton of sugarcane. Part of byproducts was utilized to generate electricity for consumption at the mill. The total electricity generated over the four-month operation was 6.88 million kWh. This corresponds to 68% of the maximum possible generation by the existing 3.5MW units. The total electricity consumed at the mill was 7.09 million kWh. Thus, the mill had to purchase 203,000kWh electricity from the distribution company EEO. The unit electricity requirement for the processing of sugarcane is calculated to be 10.8kWh per ton of sugarcane processed.

3. Project Description

The project will add 6MW-generating capacity and improve the efficiency of the existing capacity as well to generate the annual energy of 83 million kWh. Subtracting the use at the mill, some 75 million kWh of electricity will be available during the 8-month off-season. The average annual MRS price of electricity is US$0.0677/kWh based on the record by the Units of Transactions (UT) between 1998 and 2003 (Table 1), if Bunker C oil is used as supplemental fuel during the off-season. According to the mill manager, other renewable fuel may be used instead of petroleum.

This co-generation system incorporates the following features.

(1) The mill could also produce power for sale economically using a lower steam pressure (600 lb. per square inch).
(2) The cost of co-generating power could be reduced in a number of circumstances, because the mill could purchase used equipment or use some of the existing ones.
(3) The power output level estimated assumes that the mills' internal steam requirements

remain the same as they are currently.

(4) The value of co-generated power to the national grid should be avoided cost of a thermal generator, mostly likely above the MRS price.

(5) In-season cogeneration will not result in any incremental environmental degradation, since no additional fuel will be burned, and environmental quality will benefit from corresponding reduced combustion emissions at oil-fired power plants. Use of oil as a supplemental fuel for year round operation will.

Table 1. The Avoided Cost of Alternative Thermal Power

(Unit:$)/MWh)

Month	1998	1999	2000	2001	2002	2003	Average
1	58.45	61.33	86.99	64.08	67.69	75.11	68.94
2	70.6	57.87	91.84	66.35	70.75	78.87	72.71
3	59.2	61.94	106.66	66.84	56.06	78.6	71.55
4	54.92	61.46	173.71	72.51	64.85	78.27	84.29
5	73.21	65.75	74.39	70.49	69.12	70.26	70.54
6	59.76	76.81	65.34	70.77	53.05	60.16	64.32
7	52.04	64.94	58.12	73.61	63.91	72.03	64.11
8	46.67	57.21	63.97	69.88	70.01	74.47	63.70
9	46.55	61.39	64.84	54.53	66.57	65.46	59.89
10	52.3	56.92	58.87	58.32	67.43		58.77
11	58	67.34	60.5	63.14	71.98		64.19
12	66.45	74.42	59.58	69.83	72.79		68.61

Source: www.ut.com.sv

*Shaded Are Sugar Mill Operation Months

4. Project Evaluation

The project will provide an incremental electricity generation for sale to the grid at a rate of US$0.0677/kWh. The average incremental cost of this power generation is calculated to be US$0.0577/kWh. The basic assumptions for this calculation are summarized in Table 2.

Based on these assumptions, the economic analysis on the project has been conducted. The benefit and cost flows were constructed for a 20-year project life and the economic internal rate of return (EIRR) was calculated as shown in Table 3.

As shown, the EIRR is calculated to be 14.2%, indicating the viability of the project from the economic point of view. The sugar mill, however, may not have sufficient financial capacity to invest in the project. A credit should be guaranteed by the Government to provide incentives to the sugar mill in view of the economic viability.

Table 2. Summary of Basic Assumptions

	In Season	Off Season	Unit	Total
Month	4	8	Month	12.0
MW	8	12	MW	10.7
Total MWh*	23,360	63,072	MWh	86,432
Auxilary MWh	7,086	1,261	MWh	8,347
Available MWh	16,274	61,811	MWh	78,085
Variable O&M, $/kWh	0.0025	0.0025	US$	216,080
Fixed O&M, $/kW	0	20	US$	180,000
Fuel Cost, US$/kWh	0	0.03	US$	1,892,160
MRS-Avoided Cost	$70.45	$66.22	US$/MWh	$67.63
Construction Cost				**US$, 000'**
Boiler, 600 psi				$4,566
Turbogenerator				$2,702
Piping, civil, electrical, foundation				$7,268
Erection				$1,577
Engineering				$806
Miscellaneous				$1,692
Contingency				$1,861
TOTAL				$20,472
$ per gross kW				$1,706

Note: * Plant factor during the Off-season is 90%

Table 3. Economic Analysis of the Chaparrastique Sugar Mill Co-generation

Net Benefits of the 12 MW Bio-Mass Generation Units

Year	Cost US$	Fixed O&M	Variable O&M	Fuel Cost	kWh Generated	kWh Generated (Off-Season)	Total Benefits	Total Cost	Net Benefits
1	$20,472,000	$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$22,760,240	-$17,520,268
2		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
3		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
4		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
5		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
6		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
7		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
8		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
9		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
10		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
11		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
12		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
13		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
14		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
15		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
16		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
17		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
18		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
19		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732
20		$180,000	$216,080	$1,892,160	16,274,000	61,810,560	5,239,972	$2,288,240	$2,951,732

Assumptions Summary:	
Opportunity Cost/Discount Rate	10%
Construction Cost: $ per gross kW	$1,706
Available kWh	78,084,560
Fixed O&M	180,000.0
Variable O&M	216,080
Fuel Cost	1,892,160
Year of Installation	1
Sell to Grid Price (In-Season)	$0.070
Sell to Grid Price (Off-Season)	$0.066
NPV Cost	$38,091,986
NPV Benefits	$6,518,850
NPV of Generation	664,777,877
EIRR	16%
Average Incremental Cost US$	0.057

In-Depth Study No. 6: Usulutan Bypass Road Construction (Related to Project No. 4.1a)

1. Background

Usulutan is the entrance to the Eastern Region. The Pan American highway (CA1) runs through the northern part, and CA2 runs through the southern part of the Province. The CA2 serves the department capital of Usulutan. According to the results of the traffic survey conducted by the JICA Study Team, the traffic volume at the San Marcos bridge on CA2 was 5,400 in 12 hours and the traffic volume at the Cuscatlan bridge on CA1 was 2,200.

The traffic on CA2 has been increasing rapidly with the growth rate of about 10% per annum, but so far no significant traffic congestion is observed on the trunk road, except along the section passing through the city center. As the La Union port becomes operational, traffic of heavy cargo vehicles will increase to aggravate the congestion on CA2, which will serve as the main artery linking the port and the most advanced part of the Country.

Traffic congestions exert various negative effects on the citizen's socio-economy such as increase of travel time and transportation costs, traffic accidents, pollution by exhaust gas, etc. To avoid these conditions, the bypass for Usulutan should be constructed urgently, following the bypass for La Union.

2. Objectives

The project has three specific objectives as follows:

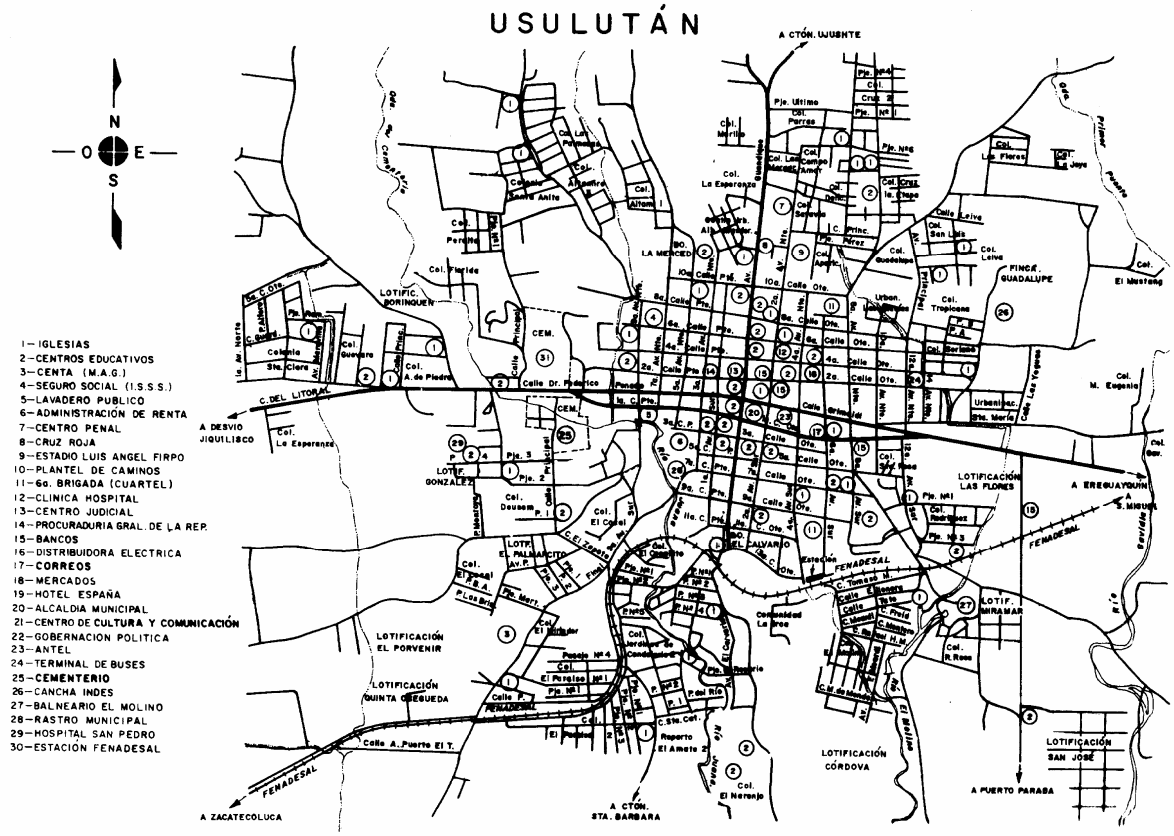
(1) To alleviate existing and foreseen traffic congestion on CA2 through the city of Usulutan;
(2) To improve the living environment for residents; and
(3) To ensure efficient transport of cargoes utilizing the La Union port.

3. Existing Conditions of the Project Area

The population of the department of Usulutan in 2000 was 338,332, and the population of the municipality of Usulutan was 69,097. Usulutan has land area of 2,130km^2 or 28.8% of the total land in the Eastern Region. The total road length is 943.1km with density of 0.44km/km^2. This density is smaller than the average 0.48km/km^2 in the Country. The number of car registration in 2002 is 947 vehicles, and it shares only 2.6% of the whole Country of 36,908 vehicles.

CA2 runs through the central part of Usulutan city as shown in Figure 1. Traffic congestion is significant because through traffic is mixed with the inter-city traffic. It is very difficult to pass through the central part of the city because a market occupies the area and most city roads inside have one lane. Traveling speed is reduced to about 10km per hour.

Figure 1. CA2 in the Usulutan City



4. Project Formulation

(1) Alignment

The proposed bypass will run through the southern part of the city for 10km length as shown in Figure 2. It is proposed to locate about 2km away from the city taking into consideration the expansion of the urbanized area. A connection with CA2 and the bypass should be planned by a flyover to avoid traffic congestion at the intersection.

(2) Design standard

Based on the "Direccion General de Caminos", the design standard and typical cross section to be applied for the class of highway "Primary" are presented in Table 1 and Figure 3, respectively.

5. Project Evaluation

The objective of project evaluation is to assess the project from the viewpoint of national economy through comparing resource input (economic costs) and output (economic benefits).

Figure 2. Proposed Alignment of the Usulutan Bypass

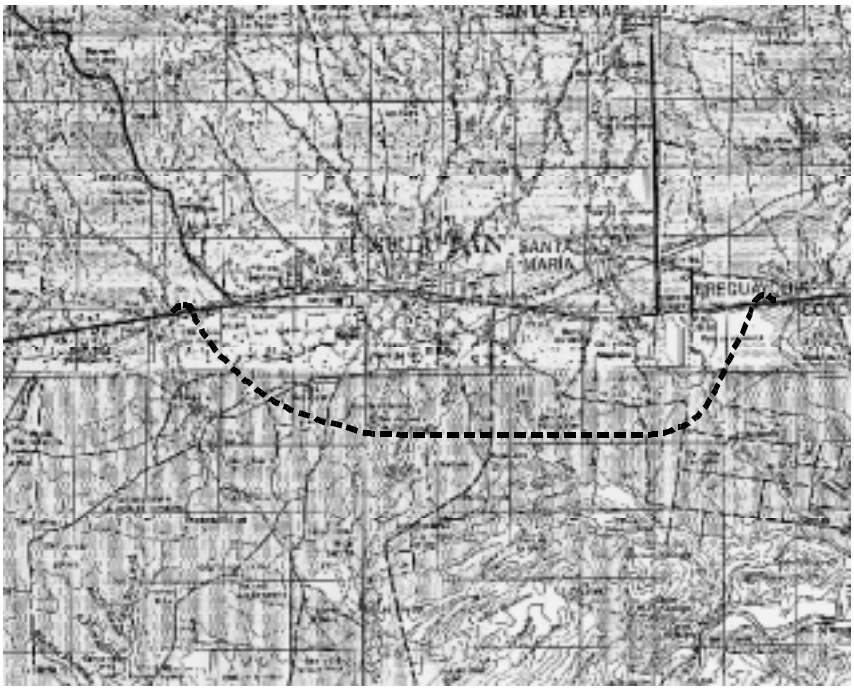
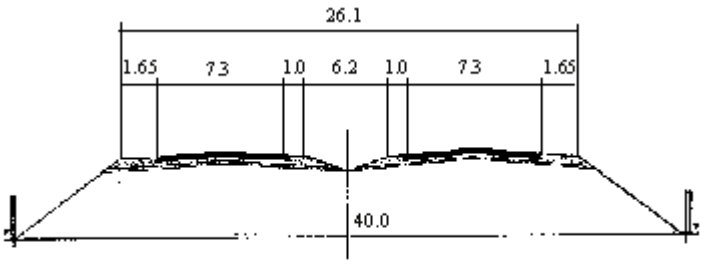


Table 1. Design Standard for Primary Highway Applicable to the Usulutan Bypass

Design element	Type of flat terrain
Design Speed	90 km/h
Maximum Grade	3.5%
Minimum Radius	327.46 m
Minimum Distance between Horizontal Curves	60.00 m
Minimum Sight Distance	160.00 m
Width of Highway	26.10 m
Pavement Width	7.30 m (2 lanes@3.65m)
Shoulder Width	5.30 m
ROW Width	40.00 m
Pavement for Roadways	Asphalt Concrete
Pavement for Shoulders	Double surface treatment

Source: MOP.

Figure 3. Typical Cross Section of Primary Highway Applicable to the Usulutan Bypass



(1) Economic project cost

The project cost is estimated at US$13.9 million based on the unit price of US$1.6 million/km, excluding transfer items of taxes and duties from the financial cost. Taxes are estimated at 13% based on the previous studies.

(2) Project benefit

In general, the following economic benefits are quantified in road projects:

- Savings in vehicle operating costs (VOC savings), and
- Savings in travel time cost of passengers in vehicles.

The calculation of benefits was based on the difference between the costs under "with and without" scenarios.

1) Existing traffic volume

According to the results of the OD survey conducted by the JICA Study Team, traffic to pass through the city center is calculated at 2,470 vehicles in 12 hours. Daily traffic is calculated at 3,100 vehicles by using the 24-hours/12 hours ratio of 1.26 calculated by MOP based on the results of 24-hour traffic count survey. Average annual daily traffic (AADT) is calculated at 2,740 vehicles based on weekly and monthly ratio estimated also by MOP. These data are given in Table 2.

Table 2. Data Used to Determine the Existing Traffic

(1) Traffic volume

	12 hours count			24 hours count		
	San Salvador-San Miguel	San Miguel-San Salvador	Total	San Salvador-San Miguel	San Miguel-San Salvador	Total
Passenger Car	549	351	900	692	442	1,134
Taxi	27	4	31	34	5	39
Minibus/Microbus	87	38	125	110	48	158
Bus	18	19	37	23	24	47
Pickup	430	495	925	542	624	1,166
Truck	172	108	280	217	136	353
Trailer	118	48	166	149	60	209
Motorcycle	6	0	6	8	0	8
Total	1,407	1,063	2,470	1,775	1,339	3,114

(2) Weekly ratio

Mon	Tue	Wed	Thu	Fri	Sat	Sun
0.90	0.88	0.89	0.92	0.86	0.91	1.05

Source: MOP.

(3) Monthly ratio

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.00	0.97	1.00	0.99	1.01	1.01	0.98	0.95	1.08	1.11	0.98	0.90

Source: ibid.

(4) AADT

	S. Salvador-S. Miguel	S. Miguel-S. Salvador	Total
Pickup	477	549	1,026
Passenger Car	609	389	998
Truck	191	120	311
Trailer	131	53	184
Mini bus/Microbus	97	42	139
Bus	20	21	41
Taxi	30	4	34
Motorcycle	7	0	7
Total	1,562	1,178	2,740

2) Future traffic demand forecast

The future traffic demand was forecasted based on the growth rate estimated by the PNODT study as shown in Table 3. The results of the forecast are summered in Table 4.

Table 3. Growth rate of Traffic

(% per year)

	P/C	Heavy Car
2003-2010	6.9	4.1
2010-2020	3.9	4.7

Source: PNODT.

Table 4. Forecast Traffic Demand

	P/C	Heavy Car	Total
2003	2,238	502	2,740
2010	3,570	656	4,226
2020	5,336	1,038	6,374

Source: JICA Study Team.

3) Calculation of VOC saving

The benefits of VOC savings are calculated based on the following method:

Benefits = (Traffic Volume)*(UVOC (w/o) – UVOC (w/))*Road Length*365

where UVOC (w/o): unit VOC in without project case

UVOC (w/): unit VOC in with project case.

The unit VOC is taken from the PNODT study as shown below.

	VOC ($/km)	
	With Case	Without Case*
Private vehicles	0.14	0.18
Heavy vehicles	0.30	0.39

* JICA Study Team's estimate
Source: PNODT.

4) Calculation of travel time cost saving

The benefits of travel time cost savings are calculated based on the following method:

Benefits = (Traffic Volume)*(UTC)*(Travel Time (w/o) –Travel Time (w/))*365

where UTC: unit travel time cost
Travel Time (w/o): travel time in without project case
Travel Time (w/): travel time in with project case

The unit time cost is taken to be US$35/hour based on the PNODT study.

(3) Economic evaluation

1) Conditions of economic evaluation

The following conditions are set for the economic evaluation.

- Construction period: 2 years
- Commissioning year of the Project: 2010
- Evaluation period: 20 years after commissioning
- Opportunity cost of capital (discount rate): 12%

2) Results of economic evaluation

Based on the above conditions, the costs and benefits cash flows were prepared as shown in Table 5.

Table 5. Economic Evaluation of the project

	Costs (US$)			Benefits (US$)			Cash Flow
	Construction	Maintenance	Total	VOC Savings	Time Savings	Total	
2008	6,960,000		6,960,000				-6,960,000
2009	6,960,000		6,960,000				-6,960,000
2010		696,000	696,000	101,704	2,842,821	2,944,525	2,248,525
2011		696,000	696,000	106,049	2,959,404	3,065,453	2,369,453
2012		696,000	696,000	110,579	3,080,768	3,191,347	2,495,347
2013		696,000	696,000	115,303	3,207,109	3,322,412	2,626,412
2014		696,000	696,000	120,229	3,338,631	3,458,860	2,762,860
2015		696,000	696,000	125,365	3,475,547	3,600,912	2,904,912
2016		696,000	696,000	130,721	3,618,078	3,748,799	3,052,799
2017		696,000	696,000	136,306	3,766,454	3,902,760	3,206,760
2018		696,000	696,000	142,129	3,920,915	4,063,044	3,367,044
2019		696,000	696,000	148,201	4,081,710	4,229,911	3,533,911
2020		696,000	696,000	154,532	4,249,102	4,403,634	3,707,634
2021		696,000	696,000	161,134	4,423,356	4,584,490	3,888,490
2022		696,000	696,000	168,018	4,604,756	4,772,774	4,076,774
2023		696,000	696,000	175,196	4,793,596	4,968,792	4,272,792
2024		696,000	696,000	182,681	4,990,180	5,172,861	4,476,861
2025		696,000	696,000	190,485	5,194,826	5,385,311	4,689,311
2026		696,000	696,000	198,623	5,407,864	5,606,487	4,910,487
2027		696,000	696,000	207,108	5,629,639	5,836,747	5,140,747
2028		696,000	696,000	215,956	5,860,509	6,076,465	5,380,465
2029		696,000	696,000	225,182	6,100,847	6,326,029	5,630,029

The results of the evaluation are summarized below.

- Economic internal rate of return (EIRR): 18.6%
- Net present value (NPV): US$ 6,936,814
- Benefit cost Ratio (B/C): 1.4

In-Depth Study No. 7: Secondary and Higher Education Scholarship (Related to Project No. 6.1a)

1. Background

For secondary schools, the enrollment rate in El Salvador is lower compared to other countries in Central America: 69.5% in Peru, 62.5% in Panama, 54.0% in Ecuador, 49.0% in Nicaragua, and 48.5% in Costa Rica (Table 1). High costs of attending secondary schools are considered as a major reason for the low enrollment rate. In 2002, the average monthly cost to attend public secondary schools ranged from ¢50 or US$5.71 to ¢150 or US$17.1, and private school enrollment costs at least ¢100 or US$11.4 (APREMAT, Guia para Padres de Familia, 2000). These costs correspond to 10-20% of the average per capita monthly household income in most departments. Also, a recent study indicates that costs of uniform, textbook, food, transport and others account for 57% of the total direct cost of secondary education (World Bank, *Secondary Education in El Salvador: Education Reform in Progress,* 1999). Moreover, the survey conducted in 1997 to population of age 16 to 18 years revealed reasons for not attending secondary schools as: need to work for 32.6%, family problems for 23.7%, excessive cost for 17.5%, and no value for 18.1%.

Table 1. Secondary Education Enrollment Rates for Selected Countries in Latin America, 1999

Country	Sec. ed. gross enrolment rate
Colombia	72.5
Peru	69.5
Mexico	64.0
Panama	62.5
Ecuador	54.0
Nicaragua	49.0
Costa Rica	48.5
El Salvador (2000)	37.7
Bolivia	37.0
Honduras	33.0
Guatemala	25.0

Sources: UNICEF homepage (http://www.unicef.org); MINED. *Educación para Todo,* 2002.

Also for tertiary education, private institutes are run without any public subsidies resulting in high cost of attendance. Financial incentives need to be strengthened to encourage students to enroll in secondary schools and tertiary education.

2. Objectives and Scope

In order to overcome this situation, the project aims to establish a scholarship fund for those willing students who cannot afford secondary and tertiary education, and to improve the enrollment rate at these levels of education through scholarship. Fundraising activities for

scholarship will be done in the U.S. as well as in El Salvador. The Ministry of Education (MINED) is the prime implementing agency to work with NGO. During the first five years of the project implementation, contribution from international donors is expected.

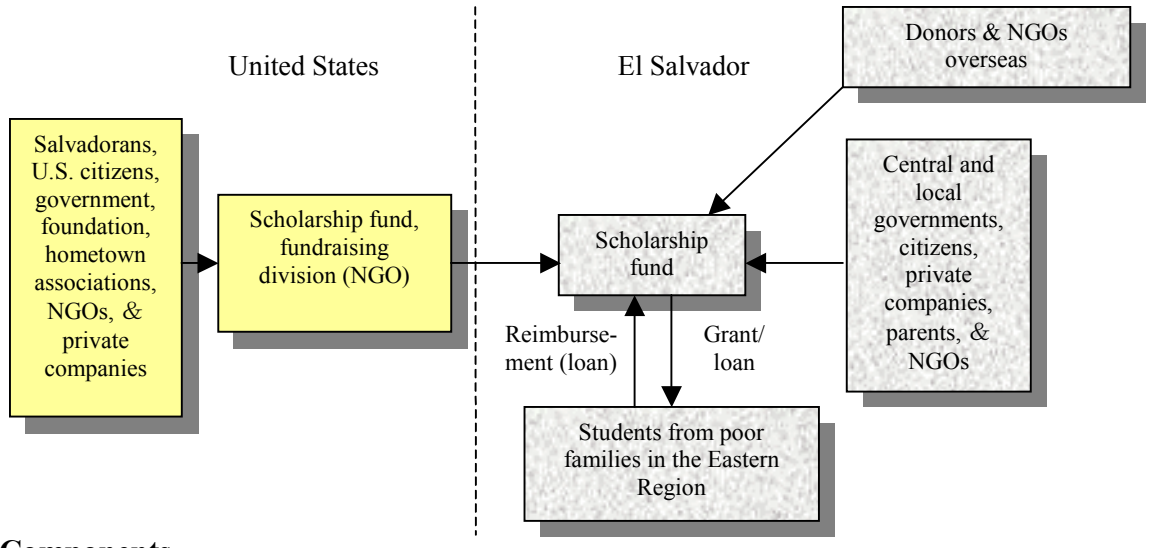
3. Project Description

(1) Setup

The scholarship fund is established to support willing youth to pursue and accomplish secondary and tertiary education. To raise fund from a wide range of sources, an NGO is established in the U.S. and in El Salvador. In the U.S., NGOs play active roles in various social and economic functions. The revenues of all the NGOs in the U.S. account for as much as 8% of the GNP. The composition of the income sources for all the NGOs in 1999 consisted of: membership fees and service fees for 51%, contribution by the Government for 27%, and donation from individuals and enterprises for 21%. For donations, contributions from individuals are the largest, accounting for 76%, followed by foundations for 12%, enterprises for 4%, and bequest for 8%. Tax exemption for grants to NGOs is a factor for the large amount of donation (Misawa, Funding Mechanism of NPOs in the United States, 2003).

Operation of the fund may be entrusted by MINED to a third party having experience in fund raising and management for efficiency. Fundraising activities are to be conducted both in the U.S. and El Salvador. Main sources of fund would be as follows:

- U.S.: Salvadorans, U.S. citizens, government, foundations, NGOs, hometown associations, and private companies
- El Salvador: central and local governments, citizens, private companies, parents, and NGOs
- Others: overseas donors and NGOs



(2) Components

The project consists of two major components as follows.

Component 1: Establishment of the scholarship fund

- MINED selects an NGO (or consortium of NGOs) through tendering, that will be in charge of fund raising and management in order to ensure efficiency. If a consortium of NGOs is to be formed, it will consist of national NGOs with experience in scholarship management and an international NGO with experience in fundraising in the U.S.
- The selected NGO sets up a fund-raising division in the U.S, preferablely in a large city with a large Salvadoran population.
- The designated NGO staff obtain training in the U.S. There are a number of training programs for NGOs in the U.S. For example, the Columbia University offers one-month training course as listed in Table 2.

Table 2. Training Program for NGO Managers at Columbia University, 2002

	Dates	Contents
Week 1	1/27-2/1	Leadership, management theory, management strategy, balanced sheet, marketing basics, organizational theory
Week 2	3/3-3/8	Ability to negotiate, financing, cost management, cost-profit analysis, enterpreneurship, marketing practice, group project (case study)
Week 3	4/7-4/12	Financial management, fund management, organizational management, group project (case study), strategic management planning
Week 4	5/5-5/10	Strategic alliance, asset management, organizational risk management, dealing with donators, organizational governance, group project (case study)

Source: Columbia University brochure, 2002.

- The NGO elaborates and reviews strategies to collect as much fund as possible. The strategies include (1) researching and identifying newspapers, Internet websites, TV, and magazines, which are read and seen most by Salvadorans; (2) advertising using those means; (3) combining marketing tools such as alliance with the bank (e.g., soliciting customers who send remittance from the bank to donate a certain portion to the scholarship fund in exchange for less handling charges and commissions); (4) maintaining good communication with embassies, consulates, and hometown associations in the U.S. and tying up with them on parties and seminars; and (5) making efforts to establish the name value of the NGO.

Component 2: Fund-raising activities

- The NGO solicits fund both in El Salvador and in the U.S. through membership fees, donations (from individuals, enterprises, hometown associations, charity concerts, bazaars, book sales, and parties), and governmental and non-governmental grants.
- Seminars are conducted periodically both in the U.S. and El Salvador on the economic, social and educational status quo in the Eastern Region and on the progress of the scholarship program.
- Staff receives further training periodically.

Component 3: Offering scholarship

- A scholarship committee is formed composing of MINED and NGOs.
- The scholarship committee sets the eligibility criteria and guideline for grant/loan applicants.
- The committee invites youth from the poor family in the Eastern Region who wish to apply for scholarship through advertisement.
- The committee selects grant/loan recipients based on applicants' socioeconomic background and academic potentials through essay, personal references and interviews (both applicants and their guardians if possible).
- The committee offers scholarship either as grant or loan depending on the needs and circumstances of students (based on their family income levels, etc.).
- Scholarship recipients are required to submit a transcript to the scholarship fund management committee.
- If the recipients' grades do not meet the minimum GPA requirements set by the committee or if they leave school, their scholarship will be terminated.

(3) Beneficiaries

The main beneficiaries of the project are socio-economically disadvantaged students in secondary or tertiary education in the Eastern Region.

(4) Implementation schedule

The schedule for the first five years is shown in Figure 1.

Figure 1. Project Implementation Schedule

	Year																			
	1				2				3				4				5			
Component	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1: Establishment of scholarship fund																				
MINED selects NGO through tender.																				
NGO sets up fundraising division in U.S.																				
NGO staff obtain training in U.S.																				
Elaborate strategies for fundraising																				
2: Fundraising																				
Solicit fund in El Salvador & U.S.																				
Organize seminars periodically both in U.S. & El Salvador																				
Staff receive further training																				

Component	Year																			
	1				2				3				4				5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3: Applicants screening																				
Form scholarship committee																				
Committee sets eligibility & selection criteria & guidelines																				
Invite applicants of scholarship																				
Select winners																				
Offer scholarship																				

4. Project Costs

The project costs for the first five years are estimated in Table 3.

Table 3. Initial Project Costs (for First Five Years)

	Item	Descriptions	Qty	Unit	Unit price (US$)	Amount (US$)
El Salvador	A. Investment cost					5,315,550
	a. office rental and supplies					31,950
	office rental	60 months (San Miguel)	100	m^2	2	12,000
	Computer		10		1,250	12,500
	Printer		2		600	1,200
	office supplies		1		6,250	6,250
	b. staff training in the U.S.					240,600
	air ticket	round trip	3	people	700	2,100
	per diem	30 days x 1 time	3	people	150	13,500
	Course attendance fee	30 days x 1 time	3	people	2,500	225,000
	c. staff training in El Salvador					11,250
	per diem	0.5 months x 5 times	5	people	600	7,500
	Course attendance fee	0.5 months x 5 times	5	people	300	3,750
	d. Seminar					7,750
	Room	S. Salvador/S. Miguel, 1 day each	5	times	1,550	7,750
	e. transportation					19,500
	vehicle purchase	used	1		7,000	7,000
	Gasoline		60	months	150	9,000
	air ticket	El Salvador-Los Angeles	5	times	700	3,500
	f. advertisement	newspaper	10	times	450	4,500
	g. scholarship fund					5,000,000
	B. Recurrent cost					472,500
	a. personnel					417,000
	Staff	5 person	60	months	1,000	300,000
	Secretary & assistant	3 person	60	months	600	108,000
	office attendant	1 person	60	months	150	9,000
	b. utilities		60	months	425	25,500
	c. administrative cost		60	months	500	30,000
	Subtotal					5,788,050

	Item	Descriptions	Qty	Unit	Unit price (US$)	Amount (US$)
U.S.	A. Investment cost					157,090
	a. office rental and supplies					80,715
	NGO establishment		1	time	500	500
	office rental	60 months (Los Angeles)	100	m^2	10	60,000
	Computer		10		1,250	12,500
	Printer		2		600	1,200
	office supplies		1		6,515	6,515
	b. staff training					41,875
	per diem	7 days x 5 times	5	people	150	26,250
	Course attendance fee	0.3 months x 5 times	5	people	2,500	15,625
	c. Seminar					5,000
	Room	Los Angeles, 1 day	5	times	1,000	5,000
	d. transportation					19,500
	Vehicle	used	1		7,000	7,000
	Gasoline		60	months	150	9,000
	air ticket	Los Angeles-San Salvador	5	times	700	3,500
	e. advertisement	newspaper	10	times	1,000	10,000
	B. Recurrent cost					1,506,000
	a. personnel					1,398,000
	Director	1 person	60	months	5,000	300,000
	Staff	3 persons	60	months	3,000	540,000
	Secretary & assistants	4 persons	60	months	2,000	480,000
	Office attendant	1 person	60	months	1,300	78,000
	b. utilities		60	months	1,000	60,000
	c. administrative cost		60	months	800	48,000
	Subtotal					1,663,090
	Contingency (10%)					745,114
	Total					8,196,254

In-Depth Study No. 8: Eastern Region Skill Development Fund Establishment (Project No. 6.2a)

1. Background

In order to prepare for the take off of the economy of the Eastern Region, skill development of its labor force is necessary. In the Region, currently absolute numbers of training courses conducted by INSAFORP and other organizations are inadequate. High quality training courses should be offered and diversified to enhance the quality of workers.

The skill development fund has been successfully operated in many countries since it was first introduced in Singapore in 1979. Employees should contribute to the fund from their payroll in the form of tax, and the Government provides a matching grant. In Singapore, the rate of tax was 4% initially, which has now been reduced to 1%. Deducting training fee from payroll will induce workers to receive training. This is in contrast with the INSAFORP scheme, whose main financial source is employers' contributions. According to a survey conducted in 1998 by the skill development fund of Singapore, workers who received training have seen the increase in income levels, knowledge and skills by 10-20%, quality of services in the enterprise improved by 11-20%, and quality of products improved by 1-10%. In addition, 60% of the surveyed enterprises increased their net profits and achieved cost reduction as a result of improved skills of their employees.

2. Objectives and Scope

The project aims to establish a skill development fund in the Eastern Region to significantly increase the number of vocational training courses and improve their quality. The fund should be established by subsidies from the central and local governments, employees' contributions from their payrolls, and contributions by international donors. Training vouchers are issued by INSAFORP and are used by trainees to cover part of course fees. Both private individuals and enterprises are eligible for vouchers, which are used by trainees to cover certain amount of the course fee. With vouchers, trainees can select programs and providers. The main objectives for issuing vouchers are to (i) ensure the efficiency of training systems by exposing providers to market forces, (ii) enable trainees to choose from variety of training providers, and (iii) increase the number of training providers with increasing training demand.

Both courses provided by INSAFORP and the Eastern Region skill development fund should be developed in coordination for systematic skill development, meeting the demand of trainees at different levels. INSAFORP should establish eligibility requirements, monitor quality and compliance, and issue a certificate after the completion of the course. This will facilitate enterprises to hire personnel with proper skills.

Examples of courses to be offered through this system are listed in Table 1.

Table 1. Example of Training Courses To Be Offered in the Eastern Region

Field	Subject
IT	Database design and management, network design and management, system design, programming language/method, web-design, security, Word, Excel, Powerpoint, Access, internet, and operating system,
Tourism	Tourguide, hotel receptionist, maid, cooking, hygien, waiter, and handcraft
La Union Port/ FPEZ development	Crane operation, forklift operation, loading/unloading, refrigeration, electrics, electronics, plumbing, machine processing, metal processing, computer maintenance, mechanics, machine maintenance, physical distribution management, and occupational safety
Enterprise management	Accounting, marketing, management strategy, business manner, human resource management, report writing, exporting, importing, quality control, e-commerce, and secretarial work
Enterpreneurship	Business model establishment, business plan preparation, law, management strategy, accounting, and leadership development
Others	Dye works, apparel design, food processing, wood processing, and English

Source: JICA Study Team.

3. Project Description

(1) Components

The project components are as follows.

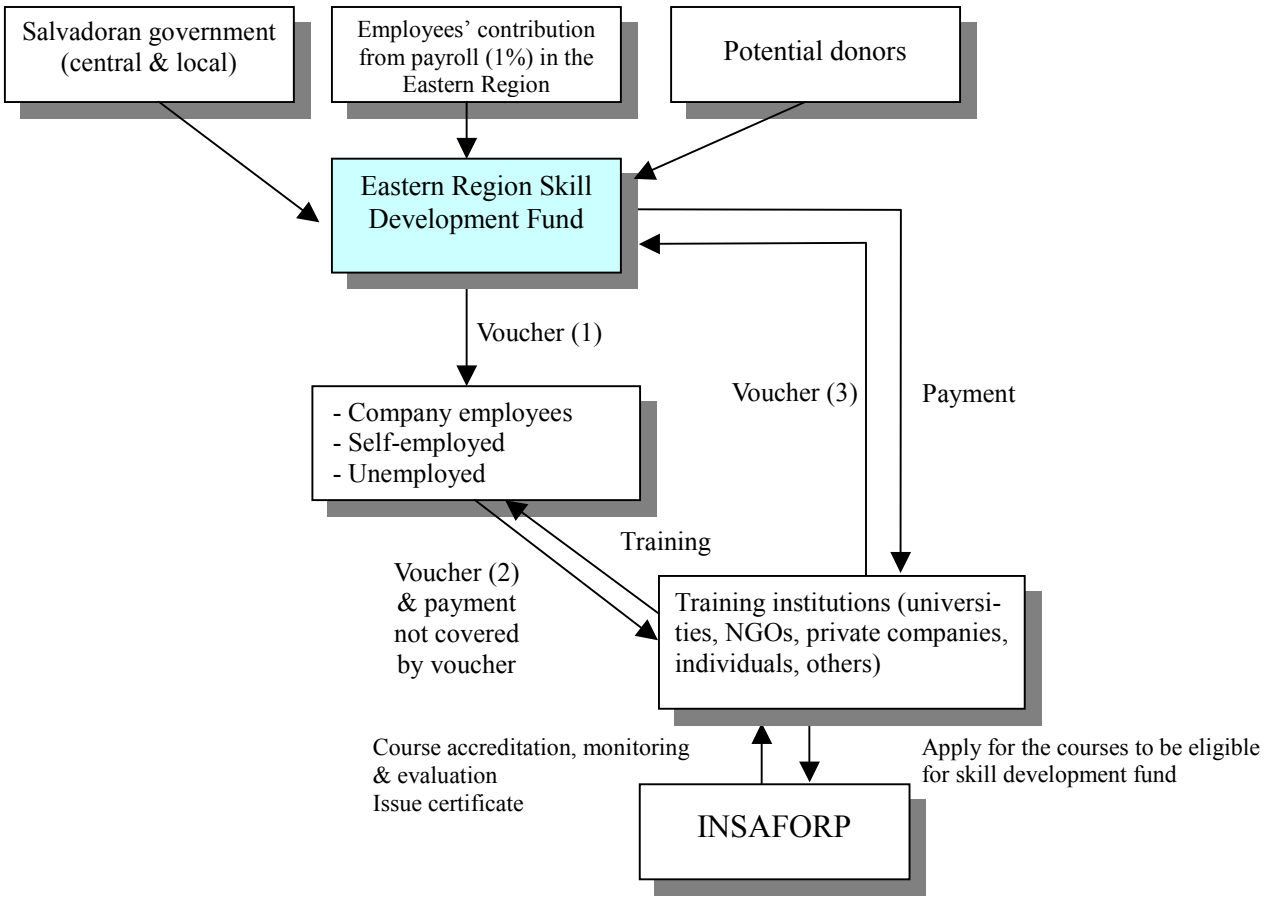
Component 1: Establishment of Eastern Region Skill Development Fund

- INSAFORP sets up an office for the skill development fund.
- An international expert specializing in fund management is dispatched to formulate the skill development fund. Also, a national expert (lawyer) is employed.
- MOL formulates the Eastern Region Skill Development Committee. The members will be representatives of MOL, INSAFORP and other related ministries as well as the international and the national expert.
- The Committee draws up the bill for the Eastern Region skill development fund.
- MOL submits the bill to the Congress.
- Once the bill passes the Congress, the Eastern Region skill development fund is established composing of subsidies from central and local governments, employees' contribution from their payroll in the Eastern Region, and international donors.
- Local staff are trained by the international expert for the operation and administration of the skill development fund.
- Seminars will be conducted in order to disseminate the concept and usage of the skill development fund. Targets will be training institutions and citizens in the Eastern Region.

Component 2: Operating Eastern Region Skill Development Fund

- Training vouchers are issued by INSAFORP.

- Interested enterprises and individuals receive vouchers from the skill development fund office or its agencies. Vouchers are used by trainees (individuals and companies) to cover certain amount of the course fee. Training institutes return the vouchers to the skill development fund office and receive payment.
- INSAFORP establishes eligibility requirements, issue vouchers, and monitor quality and compliance.
- Ttraining institutions develop courses conducted by the Eastern Region skill development fund in a systematic way (e.g., beginner level electricity followed by intermediate and advanced electricity courses) so that they can meet the demand of students at various level. Once developed, they will be submitted to the skill development fund office for approval. The approved courses will be eligible for vouchers.
- After completion of the course, certificates will be issued to those students who obtain certain grade. This will facilitate the enterprises to hire personnel with certain skill.



(2) Implementing agencies

The Ministry of Labor (MOL) is the principal implementing agency with INSAFORP as its executing arm. Contribution from international donors is expected for the first five years.

(3) Implementation schedule

The implementation schedule of the project is shown in Figure 1.

Figure 1. Project Implementation Schedule

Component	Year 1 Q1	Q2	Q3	Q4	2 Q1	Q2	Q3	Q4	3 Q1	Q2	Q3	Q4	4 Q1	Q2	Q3	Q4	5 Q1	Q2	Q3	Q4
1: Establishment of Eastern Region Skill Development Fund																				
Set up skill development fund office.																				
Hire national expert (lawyer).																				
Dispatch international expert.																				
Formulate Eastern Region Skill Development Committee.																				
Committee draws up the bill.																				
Submit the bill to the congress.																				
Eastern Region Skill Development Fund is established.																				
Training to local staff.																				
Seminar for dissemination of concept & usage of Skill Development fund																				
2: Operating Fund																				
Training vouchers are issued by INSAFORP.																				
Enterprises & individuals receive vouchers.																				
INSAFORP establishes eligibility requirements, issue vouchers, & monitor quality & compliance.																				
Training institutions develop courses conducted by the Eastern Region in systematic way																				
INSAFORP set the target level of achievement for each course.																				
After completion of the course, certificate will be issued to those students who obtain certain grade.																				

(4) Beneficiaries

Beneficiaries of the project are company employees, the self-employed and the unemployed.

4. Project Costs

The estimates of the project costs for the first five years are presented in Table 2.

Table 2. Initial Project Costs (for First Five Years)

Cost item	Description	Qty	Unit	Unit price (US$)	Amount (US$)
A. Investment cost					6,047,715
a. office rental and supplies					18,515
office	60 months (San Miguel)	100	m^2	2	12,000
office supplies		1		6,515	6,515
b. consultancy by a foreign expert					903,500
air ticket	3 round trips	1	person	6,500	19,500
per diem	36 months	1	person	4,500	162,000
fee	36 months	1	person	20,000	720,000
equipment	1 computer & a printer	1		2,000	2,000
c. national consultant					67,200
per diem	12 months	1	person	600	7,200
fee	12 months	1	person	5,000	60,000
d. seminar					13,000
room	San Salvador/San Miguel, half day each	20	times	650	13,000
e. transportation					16,000
vehicle	used	1		7,000	7,000
gasoline		60	months	150	9,000
f. voucher issue		5	years	5,000	25,000
g. advertisement	newspaper	10	times	450	4,500
h. skill dev fund					5,000,000
B. Recurrent cost					652,500
a. personnel					597,000
director	1 person	60	months	3,000	180,000
staff	5 people	60	months	1,000	300,000
secretary & assistants	3 people	60	months	600	108,000
office attendant	1 person	60	months	150	9,000
b. utilities		60	months	425	25,500
c. administrative costs		60	months	500	30,000
Subtotal					6,700,215
Contingency (10%)					670,022
Total					7,370,237

In-Depth Study No. 9: Incubation Centers (Project No. 6.2b)

1. Background

There is a need to create new employment opportunities at a relatively rapid pace to keep up with the growth in the labor force in El Salvador. Also the establishment of the La Union port will open up new opportunities for a wide range of business.

An incubation center is considered to be a successful model in many countries for developing new business and supporting entrepreneurial development. In the United States, for example, 850 incubation centers were located nationwide supporting 6,458 companies in 2000. In Japan, for the same year, 203 incubation centers were offering services to 2,247 enterprises nationwide (cf. http://www.dir.co.jp/kj/ Archives/SR013702.pdf). These centers usually offer office space, desks, chairs, internet-connected computers, meeting space, and logistic support at low costs. In addition, many also provide technical advisory services on such subjects as (law, technology, financial source, governmental/non-governmental assistance, etc.) and other assistance such as providing necessary database on product price, possible customers, training, etc. In other words, they are one-stop-shops for an individual or a group of individuals who wish to set up a company. The first center of this sort in El Salvador should be established in the Eastern Region.

In El Salvador, Infocentro is established by the Government and now operates as a nonprofit organization. Infocentros help to establish e-government procedure, support small businesses by offering virtual offices, let citizens and students use computer and internet, and train them in using Internet. There are 40 Infocentros throughout the country, among which eight are in the Eastern Region as shown below.

Infocentros in the Eastern Region

Department	La Union	San Miguel	Usulutan
Location	La Union Santa Rosa de Lima Intipuca	San Miguel No.1* San Miguel No.2* Gotera	Santiago de Maria* Usulutan

*Franchised to private operators
Source: Infocentro.

2. Objectives and Scope

The project aims to establish incubation centers capitalizing on the existing Infocentros to be selected by their headquarters. Each center offers office spaces, meeting rooms, computers with Internet access, telephones and facsimiles, copy machines, other office equipment and furniture, and secretarial services. The headquarter recruits and contracts advisors necessary for enterprise establishment specialized in law, accounting, corporate management, business planning, training, etc. They also maintain database of financial sources, governmental and

other support available training opportunities, etc. Each Infocentro incubator invites entrepreneurs to become its tenants. If there are too many applicants, priority will be given to those submitting more creative and marketable business proposals. Office spaces will be leased at low rents for one year, after which entrepreneurs are expected to leave to establish their own office elsewhere. The headquarters should conduct an entrepreneur contest once a year for tenants and reward the most successful one. Winners may receive reward such as access to "Fondo de Asistencia Técnica (FAT)".

The implementing agency of the project is Infocentro, and contribution from international donors is expected for the first five years.

3. Project Description

(1) Components

The project consists of the following major components.

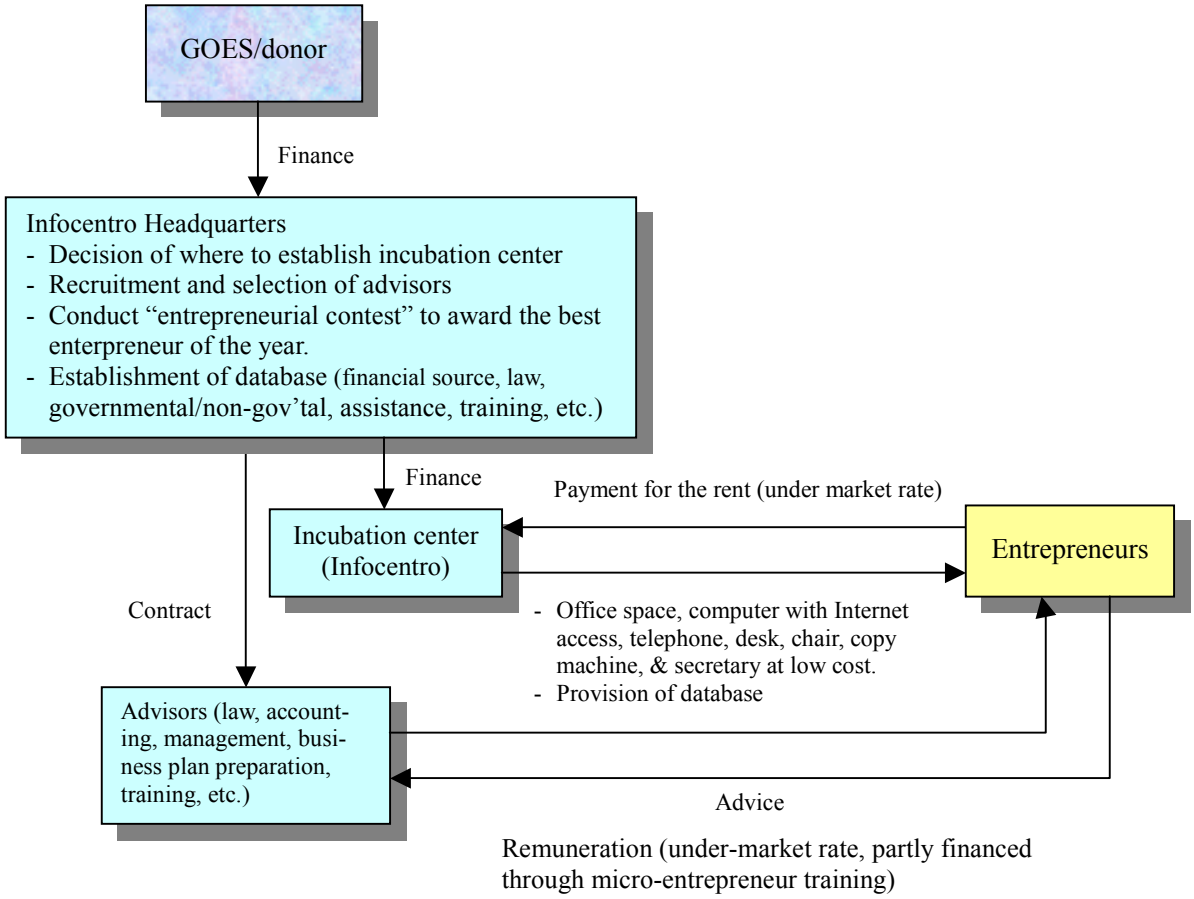
Component1: Establishment of incubation center

- The Infocentro headquarter makes a decision on which Infocentros in the Eastern Region should be established as incubation centers. Headquarters finances the selected Infocentros.
- Headquarters invites foreign experts to support database construction and management, and incubation center management.
- Selected Infocentros build self-contained incubation spaces, including office supplies, computers with the Internet access, telephones, chairs, copy machines, and secretaries. Since each Infocentro comes with meeting rooms, it is not necessary to construct new ones.
- The Infocentros conduct seminars periodically to explain entrepreneurs the benefits of incubation centers.
- Headquarters recruits and contracts advisors necessary for enterprise establishment in such subjects as law, accounting, management, business plan preparation, training etc. Possible sources of these advisors would be the ones hired in Project No. 6.2d Micro Entrepreneur Training. Remunerations for the advisors will be partly financed through that project and expenses of the tenants will be lower than market rate.
- Headquarters establishes and maintains a database for financial sources, law, governmental/ non-governmental assistance, training, etc.

Component 2: Invitation of entrepreneurs

- Each Infocentro incubator invites entrepreneurs to become their tenants. If there are too many applicants, priority will be given to those with creative and marketable business proposals. Office spaces will be rent at low cost for the duration of one year. Entrepreneurs are expected to take off after that period.
- Necessary database and advisory service will be provided to tenants.

- Headquarters conducts an entrepreneurial contest once a year for the tenants and reward the most successful entrepreneur of the year. Winners will receive reward such as free access to FAT (Fondo de Asistencia Técnica), which finances technical assistance, advisory, and consultancy service for enterprises.



(2) Implementation schedule

The project implementation schedule is presented in Figure 1.

4. Project Costs

The project costs for the first five years are estimated in Table 1.

Figure 1. Project Implementation Schedule

Component	Year 1				2				3				4				5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1: Establishment of incubation center																				
Infocentro headquarter decides & finances which Infocentros to establish incubation centers																				
Dispatch of foreign experts.																				
Selected Infocentros build incubation spaces.																				
Organize seminars																				
Headquarter recruits & contracts advisors																				
Headquarter establishes & maintains database																				
2: Invitation of entrepreneurs																				
Each Infocentro incubator invites tenants.																				
Necessary database & advisory service provided for tenants																				
Entrepreneurial contest by headquarters																				

Table 1. Initial Project Costs (for First Five Years)

Item	Descriptions	Qty	Unit	Unit price (US$)	Amount (US$)
A. Investment cost					642,525
a. office rental and supplies					9,275
computer	3 locations	5		1,250	6,250
printer	3 locations	1		600	600
copy machine	3 locations	1		850	850
telephone	3 locations	5		15	75
fax	3 locations	1		100	100
desk/chair	3 locations	5		250	1,250
cabinet	3 locations	1		150	150
b. database construction		1		2,000	2,000
c. seminar					4,600
room	half day (Eastern Region)	20	times	230	4,600
d. consultancy by foreign experts					605,000
airfare	1 round trips	2	people	6,500	13,000
per diem	12 months	2	people	4,500	108,000
fee	12 months	2	people	20,000	480,000
hand-carry equipment	1 computer & a printer	2	sets	2,000	4,000
e. entrepreneurial contest					1,150
commendation ceremony	half day (San Miguel)	5	times	230	1,150
f. transportation					16,000
vehicle purchase	used	1		7,000	7,000
gasoline		60	months	150	9,000
g. advertisement	newspaper	10	times	450	4,500
B. Recurrent cost					343,500
a. personnel					288,000
staff	1 person x 3 locations	60	months	1,000	180,000
secretary	1 person x 3 locations	60	months	600	108,000
b. utilities		60	months	425	25,500
c. administrative costs		60	months	500	30,000
Subtotal					986,025
Contingency (10%)					98,603
Total					1,084,628

In-Depth Study No. 10: Modern Corporate Management Introduction (Project No. 6.2c)

1. Background

One serious problem of local enterprises is their low level of profitability and competitiveness, because they do not have proper corporate management. To cope with present business situation, management methods need to be adjusted to make them more market-oriented. Although a number of institutes have provided management courses in El Salvador, most of them are "Off the Job Training". In order to innovate corporate management, "On the Job Training (OJT)" is important as well as "Off the Job Training." Therefore, an integrated consulting system consisting of "OJT", "Off the Job Training" and "Diagnosis" should be established for industrial development. In addition, capable consultants are not available to conduct business-consulting services, so it is necessary to provide a training system for professional local consultants.

2. Objectives

The objectives of the program are to (1) modernize the corporate management of SMEs in order to strengthen competitiveness of their products and (2) train Salvadoran consultants for management diagnosis and consultancy.

3. Program Description

The project consists of a diagnosis program for SMEs and training program for local consultants as shown in Figure 1 and Figure 2. In addition to diagnosis, the training program includes basic and applied theories for the corporate management (off-the-job training), and training in factories (on-the-job training) for modernization of the management method and production technologies.

The following training curricula are subject to a further study based on enterprise needs and availability of experts and local consultants.

(1) Off-the-job-training

The corporate management program provides short and medium term courses for entrepreneurs and management staff. Business environments in El Salvador have reached a turning point under the progress of globalization. They need new corporate management methods in order to address market needs. As a second step, sales promotion programs would be provided. Sales promotion is indispensable to strengthen the financial basis of companies. This program offers knowledge on how to promote sales activities and how to analyze corporate strategies based on market information. The contents of curricula are shown below as examples.

Figure 1. Diagnosis Program Scheme

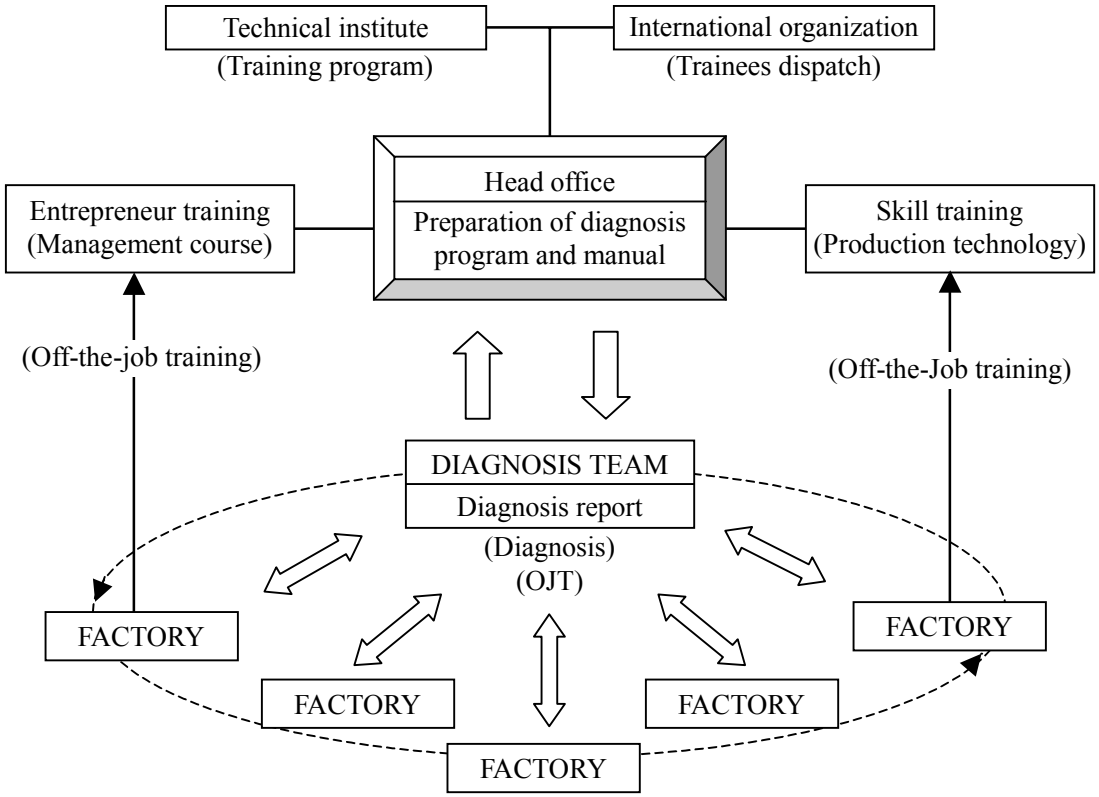
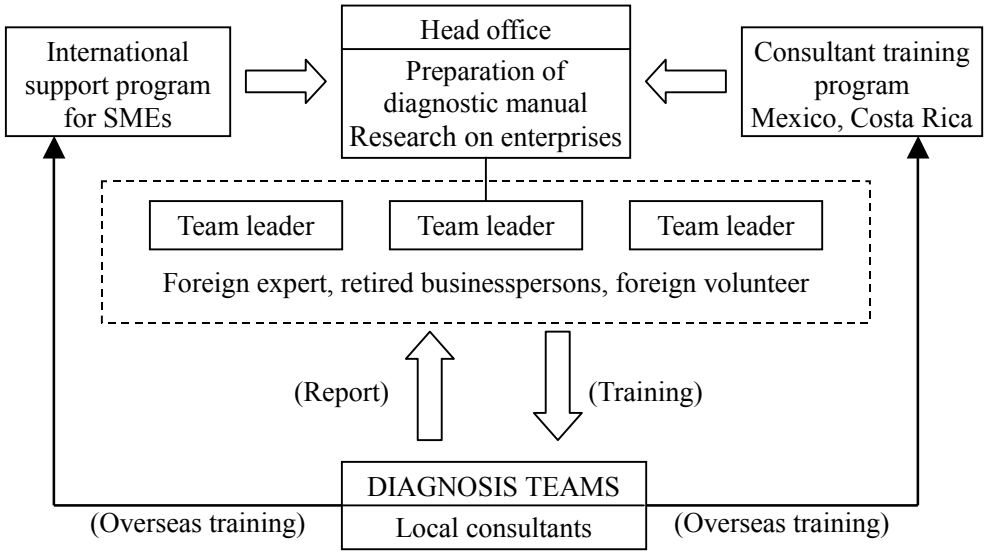


Figure 2. Training Program for Local Consultants



(a) Corporate management program
- Basic management theory in the market economy
- Strategic marketing theory
- Analysis method on business circumstances and market
- Preparation of business planning
- Production schedule
- Analysis method for new investment

(b) Sales promotion training program
- Integrated market strategy
- Analysis method for marketing analysis, demand forecast, market promotion
- Adjustment between corporate strategy and sale strategy
- Human development for sales personnel
- Information from after service

(2) Circuit diagnosis program including OJT

Innovation and modernization of enterprises cannot be achieved in a short period. As a long term training program, a diagnosis system (Circuit Diagnosis Program) should be established. This program aims to strengthen enterprises competitiveness through improving corporate management; production controlling production, and reducing costs. The contents of diagnosis are mentioned below for further study.

- Production control: rationalization and productivity, cost reduction, production schedules, process control quality control, inventory control, procurement and maintenance
- Labor control and training: personnel affairs, QCC, etc., and
- Financial control.

At first, a task force prepares a concrete program of a diagnosis, a manual, and a checklist. International support from experienced organizations should be required. A group of team leaders with experiences such as foreign experts, retired businessmen, foreign volunteers, and accountants is organized to train diagnosis teams. Diagnosis teams, which consist of the local experts on corporate management and production control, take charge of several enterprises. A team goes on a tour for undertaking diagnosis and supervising company innovation. A team visits enterprise for about one week at a time, and four times a year. The team points out the problems at each visit and instructs them in how to innovate. On the next visit, the team leads the enterprise to next step of innovation.

A diagnosis group consists of two or three members and five diagnosis groups are organized for the areas of Metro, Para central, Central region, Western region and Eastern region. It is recommended that three diagnosis groups should be organized in the first stage.

4. Program Implementation

CONAMYPE, the government agency to promote SMEs development, is the main executing agency for the program. It provides technical assistance to SMEs by operating the Technical Assistance Fund (FAT) as described below. An expert on SMEs has been dispatched by JICA to assist CONAMYPE. Implementing conditions of the program are presented.

(1) Technical Assistance Fund (FAT)

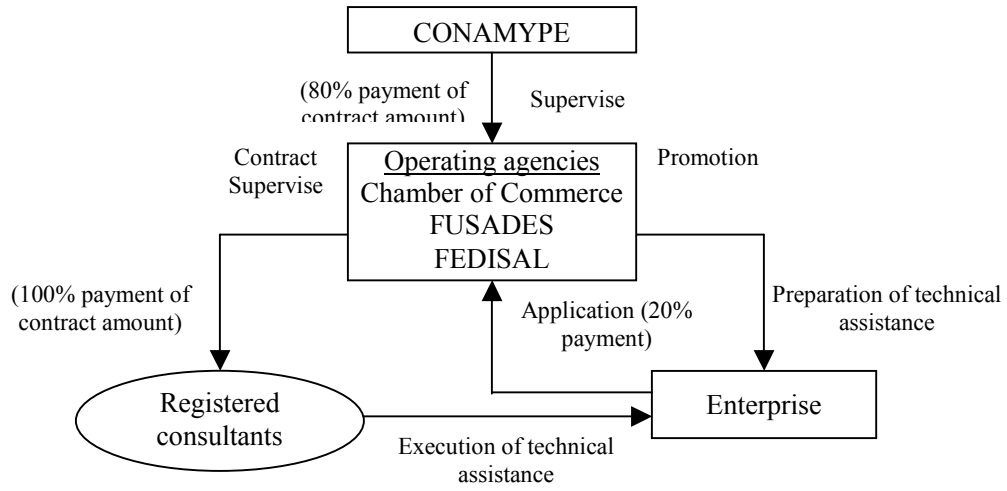
The FAT facilitates improving the corporate management of local enterprises by providing consulting and technical services. The FAT services are offered in the areas of production, trade, corporate management and export. The enterprises subject to FAT are manufacturing, agro-industries, commerce and services.

(2) Annual budget

The annual budget for the FAT is US$5 million through the Ministry of Finance, US$2 million from the national budget and US$3 million from international organizations such as IDB, USAID and the Central American Bank for Economic Integration.

(3) Technical assistant

A consultant registered in the CONAMYPE database provides technical assistance. The Chamber of Commerce, FUSADES and FEDISAL have been nominated as operating agencies for the FAT. The operating agencies receive applications from enterprises and execute pre-surveys to prepare an assistance plan. The FAT system, however, is not widely known to SMEs.



(4) Contract amount for technical assistance

The contract amount for technical assistance depends on assistance contents. The maximum amounts are presented below. The FAT provision covers 80% of the contract amount and the enterprise bears the remaining 20%.

- Individual consulting: $550

- Group consulting: $3,000
- Associative consulting: $1,000
- Exportation consulting: $3,000

(5) Registered CONAMYPE consultants

There are about 700 local consultants registered in the CONAMYPE database. The 138 consultants are qualified as junior, standard and senior consultants.

5. Expected Effects and Project Costs

(1) Expected effects

The implementation of the program forms the basis for the industrial development with SMEs as it will facilitate the technological innovation and management improvement. The program is expected also to be instrumental in changing entrepreneurial culture. Various other measures provided by related government agencies would not be effective unless entrepreneurs fully understand the needs to improve corporate management.

(2) Project costs

The project costs are estimated to be US$49,000 for the initial investment and US$16,600 per month for operation costs with three diagnosis teams during Phase 1. CONAMYPE can provide office spaces for the headquarters. Other costs for off-the-job training (4 times/day x 5 days) and overseas training for diagnosis teams (2 person/year) are estimated at about US$13,000 during phased. The Phase 1 costs, therefore, total US$1.06 million. The program should be continued with the expansion of coverage.

Project Costs

Startup (US$)	
Office space (existing)	--
Office equipment (3 PCs)	5,500
Transportation (3 vehicles)	39,000
Contingency	4,450
Total	48,950

Operation (US$/mo.)	
Management staff	
- Manager (1)	2,200
- Supervisor (1)	1,700
Training staff	
- Team leader (3)	4,500
- Trainee team (6)	7,200
Office expenses (utilities, etc.)	1,000
Total	16,600

Other (US$/yr.)	
Seminar	10,000
Overseas training	
- Attendance fee	500
- Airfares	1,400
Accommodations	1,250
Total	13,150

In-Depth Study No. 11: Micro Entrepreneur Training Program (Project No. 6.2d)

1. Background

Promoting SMEs is one of the most important issues for economic development in El Salvador. SMEs account for about 90% of the total number of enterprises in El Salvador. According to DIGESTYC information, however, SMEs employ only 25% of the total workers. It is vital to promote SMEs for expanding employment opportunities. The survey on existing enterprises, conducted as part of the Study, has clarified that most entrepreneurs do not have basic knowledge for corporate management due to lack of access to business information. The program provides access to information through the Internet and training on how to utilize the information.

2. Objectives

The objectives of the program are to give micro-entrepreneurs in the Eastern Region access to business information through the Internet, and to provide business assistance services as the first step of their business training for them. It is necessary for micro-entrepreneurs to change their entrepreneurial culture because most of them are conservative and do not want to change their way of business. The training team instructs them on how to analyze business information through the Internet for their business strategy and prepare their business plans.

3. Program Description

(1) Components

The program supplies computers to municipal offices and NGOs in rural areas. The existing facility of Infocentro would also be utilized for the program. Existing foundations or NGOs would become the executing agencies with support from the Government, donors and the private sector including IT companies. Each selected executor provides training guidance and organizes training teams and business assistance teams. Infocentro and the municipal offices and selected NGOs that receive PCs organize micro-entrepreneur groups in surrounding areas. The executor dispatches assistance team to entrepreneur groups to provide training and business assistance.

(2) Executing agency

Infocentro will be the main executing agency for the program in urban areas. In rural areas, NGO's having good track records for technical assistance and innovation should be selected to form a business assistance team.

4. Program Costs

The number of computers necessary for the program should be examined further, but is

tentatively assumed to be ten. Business assistants need to be trained. Including these and other costs, the initial costs are estimated as shown below to total US$48,000. Operating costs consist of the employment of business assistants and other utility and office costs. For the initial operation with three business assistants, the monthly operation cost is estimated at US$6,000 as also given below. The total program costs for the first five years in Phase 1 are calculated to be US$0.41 million.

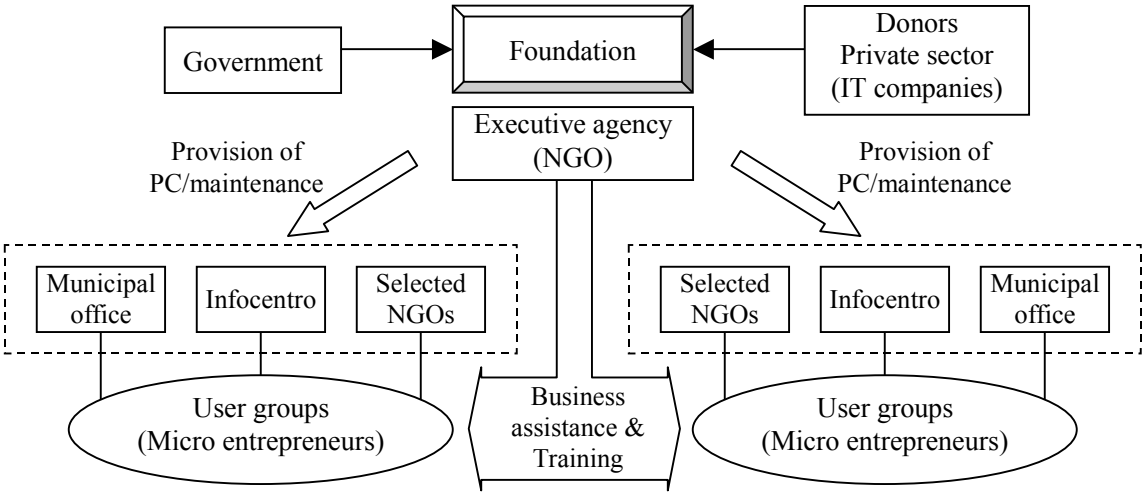
1. Initial costs (US$)

Computers sets & photocopy machine (10)	27,000
- Transportation (1 vehicle)	7,000
- Training for business assistants	9,600
Contingency (10%)	4,360
	Total US$47,960

2. Operation costs (US$/mo.)

Business assistants (3)	4,500
Utilities and other office expenses	1,500
	Total US$6,000

Operation of Micro Entrepreneur Training Program



In-Depth Study No. 12: Business Associations Establishment Program (Project No. 6.2e)

1. Background

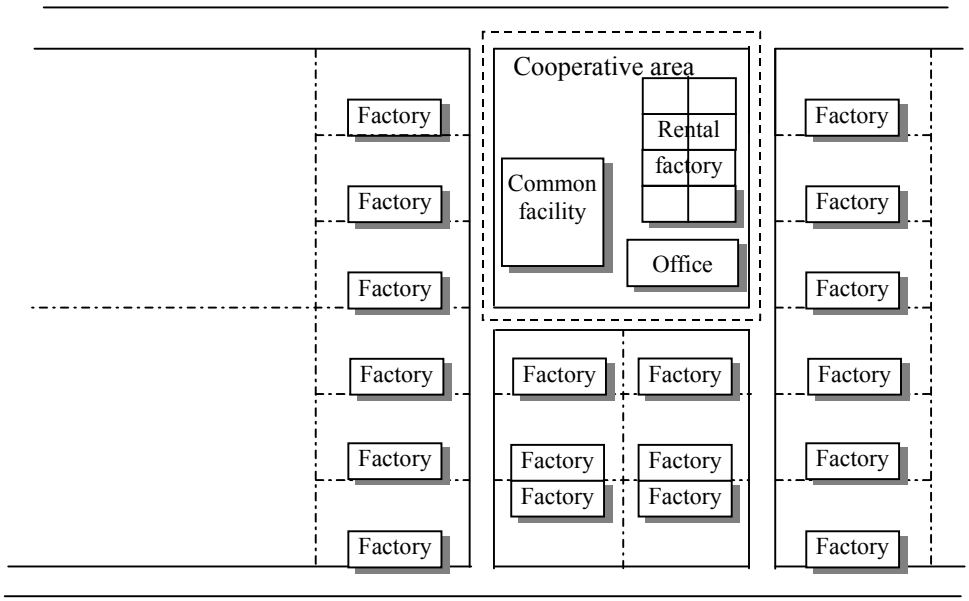
Despite the Government's expectation that the private sector would promote their business to overcome the present economic turmoil, individual enterprises face various problems that they cannot solve by themselves. Business associations or cooperatives, working together, would be able to achieve results more effectively rather than each of individual enterprises working alone. While some organizations in the public and the private sectors such as chambers of commerce have tried to organize SME cooperatives, this approach has not produced much outcome in the industrial sector. To strengthen industrial linkages in the Eastern Region, it is necessary to organize cooperatives in this sector as well. The project provides a new scheme to support the establishment of industrial cooperatives with a leasing system for factory buildings and production equipment.

2. Objectives

The objectives of the project are to (1) promote the establishment of SMEs in industrial zones through the organization of a cooperative and (2) introduce rational management to enhance their competitiveness.

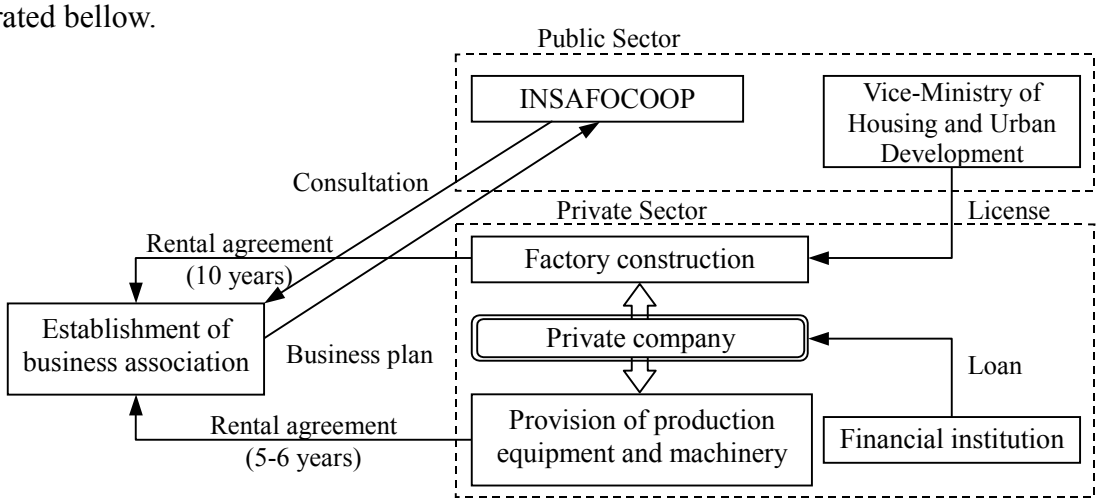
3. Project Description

A private company such as a leasing company or a developer constructs rental factories, in an industrial zone and provides equipment and machinery for leasing. SMEs who want to move into the factories must organize a cooperative, which then submits a business plan for the leasing contract. For large cooperatives, offices and common facilities such as a meeting room, exhibition space and canteens are included in the construction. These facilities are operated by the cooperative.



The private company is the implementing agency, but government agencies are involved in the project. The Vice Ministry of Housing and Urban Development (VMVDU) under MOP, which established the national plan for territorial development and territorial strategy for investment programs in infrastructure projects, provides a license to the private company for the construction. VMVDU has received seven proposals for construction of industrial zones, and one of them has been started.

INSAFOCOOP is the governmental organization for developing cooperatives and providing a registration system and database. INSAFOCOOP supports the procedures for organizing cooperatives. The operation of the program with these implementing and support agencies is illustrated bellow.



Each cooperative association would undertake the following.

(1) Joint activities related to production:
Procuring materials, machine parts, fuel, etc.,
Training employees,
Common welfare facilities,
Distribution system and tie-ups with transport company, and
Anti-pollution measures;

(2) Marketing activities:
Receiving orders jointly,
Joint sales promotion and market research,
Exhibition hall/space for products, and
Developing new products under one brand name; and

(3) Promoting IT:
Production rationalization by introduction of computer system.

The leasing system would make the initial investment smaller for SMEs. It reduces the production costs and thus strengthen their competitiveness. Each cooperative would strengthen business linkages between member SMEs and also with other cooperatives.

In-Depth Study No. 13: ICT Human and Institutional Development Program (Project No. 6.3)

1. Objectives

To support the development of La Union port and the FPEZ in the Eastern Region, especially attracting call centers and logistic functions, ICT human resources development is vitally important. Not only ICT engineers and technicians but also ICT policymakers and end-users need to be trained. The program aims to improve the skill of ICT related personnel at all levels. It covers ICT policymakers, ICT engineers and technicians, ICT end-users, and model e-community center.

2. ICT Policymakers Strengthening

(1) Background and objectives

It is important to upgrade the skill and knowledge of ICT policy makers in order to make apt ICT policies suited for promoting economic activities of the Country. Currently, the National Commission on Science and Technology (CONACYT) is responsible for coordinating ICT-related activities in El Salvador. The board of directors of CONACYT is composed of representations from MOE, MINED, the Ministry of Foreign Affairs, universities, professional organizations, medium and small enterprisess, and the agricultural sector. CONACYT provides advice to the Government through the Ministry of Economy and facilitates cooperation between international organizations and local institutions, and between business enterprises and universities. It has drafted recently the national policy on informatics for approval by MOE.

This component project aims to train government officers in charge of ICT policymaking both at the national and municipality levels by sending a foreign expert to CONACYT. It will be implemented by CONACYT for four months initially.

(2) Components

A foreign expert specializing in ICT policies will be dispatched to CONACYT to conduct technology transfer for four months. The terms of reference for the expert will be as follows.

<u>Component 1: Technology transfer from a foreign expert to CONACYT staff</u>

A foreign expert on ICT policies will be sent to CONACYT. Technology transfer to the CONACYT staff will be done in the following areas:

- Law and policies related to ICT,
- Planning, documentation and implementation of policies for social economic activities using ICT,
- Dissemination of success and failure cases of ICT promotion policies,
- Dissemination of ICT experiences in the developed country, and

- Consideration of rural areas and the socially disadvantaged when formulating policies.

Component 2: Seminars and workshops for governments and communities

The expert conducts seminars and workshops for governments (MOE, Ministry of Planning, municipalities, etc) and local communities in cooperation with CONACYT staff. The possible topics will be:

- For the Central and municipal governments: the same as the topics mentioned in Component 1; and
- For local communities: introduction of business using ICT (e-commerce, website development, etc.), and ICT related services offered by governments and private companies such as where and how they can receive training, have access to necessary databases, etc.

Component 3: Development of ICT related programs/projects

The expert reviews the existing national ICT policies, modifies and improves them if necessary in cooperation with CONALYT staff. They develop future ICT programs/projects in accordance with the revised policies.

(3) Implementation Schedule

The project implementation schedule is as follows.

Month	1				2				3				4			
Component	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1: Technology transfer from a foreign expert to CONACYT staff																
2: Conduct seminars and workshops for governments and communities																
3: Development of ICT related programs/projects																

(4) Costs

The project costs are estimated below.

(Unit price: US$)

Item	Description	Qty	Unit	Unit price	Amount
Expert					
airfares	1 round trip	1	person	6,500	6,500
per diem	4 months	1	person	4,500	18,000
consultancy fee	4 months	1	person	20,000	80,000
equipment	1 computer & 1 printer	1		2,000	2,000
Seminar facility in local cities	half day	10	times	230	2,300
Transportation					
vehicle	rental with a driver	4	months	1,680	6,720
gasoline		4	months	150	600
Personnel (assistant)		4	months	600	2,400
Administrative costs		4	months	500	2,000
Subtotal					120,520
Contingency					12,052
Total					132,572

3. ICT Engineers and Technicians Strengthening

(1) Background and objective

Tthe Eastern Region development dedmands highly skilled engineers and technicians in the ICT sector, for successful development and operation of the La Union port and the FPEZ. This component project aims to develop engineers and technichians in the ICT sector for the purpose. Foreign ICT experts are dispatched to ITCA Santa Tecla together with necessary equipment to train ITCA staff, who, in turn, provide training to ICT teachers at universities, technological institutes, high schools, and vocational institutes throughout the Country. Moreover, since ICT skills go out of date very quickly, it is also necessary to create a system to train ICT teachers periodically. During the project, a committee comprising MINED, foreign experts, ITCA staff, and the private sector develop the curricula and methods of ICT teachers' training so that ICT personnel will be trained even after the project. Short-term vocational training courses are also offered to the unemployed and enterprise workers. The project will be implemented mainly by MINED and ITCA Santa Tecla for three years initially.

(2) Components

The following are components of the project.

Component 1: Technology transfer from foreign experts to ITCA Santa Tecla staff at the System and Information Network Engineering Department

A group of foreign ICT experts are dispatched to ITCA Santa Tecla. The possible fields of experts to be dispatched for the short and long terms are:

- project management (team leader),
- database design and management,
- network design and management,
- system design,
- programming language/method,
- web design,
- security,
- training management,
- mainetenance and operation of machinery and equipment,
- curriculum development,
- textbook development and teaching material development, and
- project coordination.

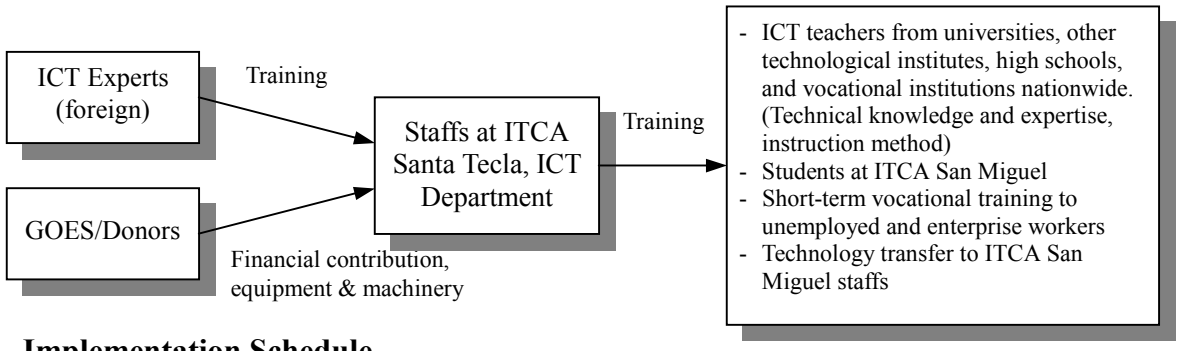
Equipment, machinery, and other materials necessary for the implementation of the Project will be provided. Land, building, facilities, and administrative personnel are to be provided by ITCA Santa Tecla. Technology transfer is conducted to ITCA staff by foreign experts.

Component 2: Training conducted by ITCA Santa Tecla staff to various groups

Foreign experts and ITCA Santa Tecla staff who have received technology transfer visit ITCA San Miguel periodically and conduct technology transfer to staff there. Periodic trainings are conducted also from ITCA staff to ICT teachers from universities, other technological institutes, high schools, and vocational training institutes nationwide. Priorities will be given to those from the Eastern Region. The contents of training will be technical knowledge and expertise regarding ICT and instruction method. At the same time, the same staff will teach students of ITCA. Short-term vocational training courses are conducted by ITCA staff to the unemployed and enterprise workers. This may be part of INSAFORP conventional training or the new ones using the skill development fund proposed in Project No. 6.2a. ITCA staff are also trained in their own fields of speciality in foreign countries periodically.

Component 3: Development of curricula and methods of periodic ICT teachers'training

A committee comprising MINED, foreign experts, ITCA staff, and the private sector are formulated to review and develop the curricula and methods of periodic ICT teachers' training.



(3) Implementation Schedule

The project implementation schedule for the initial three years is shown below.

Component \ Year	1				2				3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1: Technology transfer from foreign experts to staff at ITCA Santa Tecla												
Dispatch of foreign ICT Experts (Long-term)	■	■	■	■	■	■	■	■	■	■	■	■
Dispatch of foreign ICT Experts (Short-term)		■		■		■		■		■		■
Provide necessary machinery and equipment	■											
ITCA provides land, building, facilities, and administrative personnel.	■											
Technology transfer is conducted to ITCA staffs by foreign experts	■	■	■	■	■	■	■	■	■	■	■	■
2: Training conducted by ITCA Santa Tecla staff to various groups												
Foreign experts and staffs at ITCA Santa Tecla visits ITCA San Miguel periodically and conduct technology transfer to staffs there.		■		■		■		■		■		■
Periodic trainings are conducted from ITCA staffs to ICT teachers of educational and vocational training institutes nationwide		■		■		■		■		■		■

Component \ Year	1				2				3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
ITCA staff teach students.												
ITCA staff teach short-term vocational training courses to company employees and those unemployed.												
Provide counterpart training overseas.												
3: Development of ICT teachers' training curriculum and method												
Form committee.												
Committee reviews and develops the curriculum and method of periodic ICT teachers' training.												

(4) Costs

The project costs for the initial three-year period are estimated below.

(Unit: US$)

Item	Description	Qty	Unit	Unit price	Amount
A. Investment cost					4,658,380
a. international experts (long-term)					2,710,500
airfare	3 round trips	3	people	6,500	58,500
per diem	36 months	3	people	4,500	486,000
consultant fee	36 months	3	people	20,000	2,160,000
hand carry equipment	1 computer & 1 printer	3	sets	2,000	6,000
b. international experts (short-term)					264,000
airfare	1 round trip	8	people	6,500	52,000
per diem	1 month	8	people	4,500	36,000
consultant ee	1 month	8	people	20,000	160,000
hand carry equipment	1 computer & 1 printer	8	sets	2,000	16,000
c. equipment		1	set	1,500,000	1,500,000
d. staff training in foreign country					70,000
airfare	1 round trip	10	people	2,500	25,000
per diem	1 month	10	people	4,500	45,000
e. training of San Miguel staff					13,500
per diem for ITCA Santa Tecla staff	1 month x 15 times	3	people	600	13,500
f. teaching material development	text, didactic materials, etc.	3	years	10,000	30,000
g. transportation					65,880
vehicle with a driver		36	months	1,680	60,480
gasoline		36	months	150	5,400
h. advertisement	newspaper	10	times	450	4,500
B. recurrent cost					76,500
a. local personnel					43,200
secretary & assistant	2 people	36	months	600	43,200
b. utilities		36	months	425	15,300
c. administrative costs		36	months	500	18,000
Subtotal					4,734,880
Contingency (10%)					473,488
Total					5,208,368

4. ICT End-Users Training

(1) Background and objectives

Today, the use of computers for the Internet and basic application software (e.g., word-processing, spreadsheet and database) has become common globally. It is important to realize that people are expected to acquire these skills as a prerequisite of better employment

opportunities and to use the skills in their everyday work. Along with the development of the La Union port and the FPEZ, the demand for workers with basic computer knowledge and skills will rise. This component project aims to train ICT end-users using vouchers issued by the Eastern Region skill development fund introduced in Project No.6.2a or through conventional INSAFORP training. Training institutions and private trainers in the Eastern Region will complement the project in cooperation with INSAFORP continuously.

(2) Components

The project aims to provide ICT training to end-users and technicians as follows. Training institutions in the Eastern Region plan and develop training courses. Courses should be developed in systematic way so that it is possible to meet the wide demand of trainees. Examples of training courses are: database design and management, network design and management, system design, programming language/method, web-design, security, business software (word processing, spreadsheet, presentation), internet, and operating system. These courses may be conducted during evenings as well as day time as many expected trainees are enterprise workers. Training institutions conduct evaluation after the completion of each training course, and feed back the results into planning for the next one.

(3) Implementation Schedule

The project will be implemented according to the schedule below.

Year	1				2				3				4				5			
Component	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Plan and develop training courses.																				
Execute the ICT training courses.																				
Evaluate training courses																				

(4) Costs

The project costs are estimated below.

(Unit price: US$)

Item	Description	Qty	Unit	Unit price	Amount
Computers and equipment					27,200
computer		20		1,250	25,000
printer		2		600	1,200
copy & fax machine		1	set	1,000	1,000
Personnel					281,000
trainer	1 person x 0.5 month	50	times	5,000	125,000
administrator	2 person	60	months	1,000	120,000
secretary & assistants	1 person	60	months	600	36,000
Textbook development		1	set	10,000	10,000
Utilities		36	months	425	15,300
Administrative costs		36	months	500	18,000
Advertisement	Newspaper	50	times	450	22,500
Subtotal					374,000
Contingency (10%)					37,400
Total					411,400

Annex to Section 3

1. Outline of ITCA

ITCA is a national technological institute under the Ministry of Education administered by a private entity, FEPADE. It is the largest and the most prestigious technological institute and it is a leading institution of technical education in El Salvador. It has four campuses located in Santa Tecla, Santa Ana, San Miguel, and Zacatecoluca. In 2000, ITCA had 60% of all students studying in technological institutes. It has been shifting its emphasis to IT-related disciplines. The number of students in each campus in 2001 is as follows

Enrollment at ITCA Campuses, 2001

Campus	No. of students	Ratio (%)
Santa Tecla	2,685	67.80
Santa Ana	652	16.46
San Miguel	343	8.66
Zacatecoluca	280	7.07
Total	3,960	100.00

Source: ITCA, *Memoria de Labores 2001*.

Departments in each campus are as follows. ITCA Santa Tecla offers widest courses practically in all engineering disciplines, including computer engineering. ITCA San Miguel has three departments. These are: Civil Engineering and Construction, Electric Engineering, and System and Information Network Engineering. Students in broad IT-related disciplines account for 40% of all the ITCA students.

Departments at Each Campus of ITCA

Campus	No. of departments	Departments
Santa Tecla	13	Civil Engineering and Construction, Architecture, Electric Engineering, Industrial Electronic Engineering, **Computer Maintenance**, Electronic Communication Engineering, Mechanical Engineering, Industrial Engineering, Industrial Tailoring, Automotive Mechanics, Chemical Laboratory, **System and Information Network Engineering**, and Food Preparation and Service
Santa Ana	3	Electric Engineering, Automotive Mechanics, and **System and Information Network Engineering**
Zacatecoluca	2	**System and Information Network Engineering** and **Computer Maintenance**
San Miguel	3	Civil Engineering and Construction, Electric Engineering, and **System and Information Network Engineering**

Note: Computer-related departments are in bold.
Source: ITCA, *Memoria de Labores 2001*.

2. Lists of Computer Hardware and Software at ITCA Santa Tecla and San Miguel (System and Information Network Engineering Department)

ITCA Santa Tecla

There are ten computer laboratories all connected with Internet and LAN. As of September 2003, it has eight full-time staff members and seven part-timers for the System and Information Network Engineering Department. A long-term JICA expert in charge of curriculum development from the Japanese Ministry of Education will be sent to ITCA Santa Tecla for the duration of one year by the end of March 2004. The following are the lists of hardware and software at ITCA Santa Tecla (Source: ITCA Santa Tecla).

Hardware					
CPU	Clock speed	RAM	Hard disk	Qty	Use
AMD Athlon	1.8GHz	256MB	40GB	4	Administrative
AMD Athlon	2.0GHz	256MB	40GB	63	Laboratories
AMD Athlon	2.0GHz	256MB	40GB	2	System server, Mitchell server
Intel 80386	33MHz	16MB	170MB	1	Spectro-photometry laboratory
Intel 80486	50MHz	4MB	270MB	1	Book consultation
Intel 80486	66MHz	32MB	3.2GB	24	Administrative
Intel 80486	100MHz	16MB	850MB	61	Administrative and laboratories
Intel Celeron	266MHz	32MB	3.2GB	48	Administrative and laboratories
Intel Pentium	100MHz	32MB	3.2GB	14	Administrative and laboratories
Intel Pentium	133MHz	32MB	3.2GB	25	Administrative and laboratories
Intel Pentium	150MHZ	32MB	3.2GB	77	Administrative and laboratories
Intel Pentium	200MHz	32MB	3.2GB	28	Administrative and laboratories
Intel Pentium II	350MHz	256MB	40GB	1	Mail server
Intel Pentium II	350MHz	320MB	40GB	1	Proxy server
Intel Pentium II	400MHz	64MB	10GB	10	Professors, administrative, and laboratories
Intel Pentium II	400MHz	196MB	9GB	1	File server
Intel Pentium III	450MHz	256MB	40GB	1	Payroll server
Intel Pentium III	550MHz	64MB	10GB	48	Professors, administrative, and laboratories
Intel Pentium III	550MHz	128MB	40GB	1	DHCP server
Intel Pentium III	600MHz	64MB	20GB	42	Professors, administrative, and laboratories
Intel Pentium III	700MHz	128MB	10GB	23	Professors
Intel Pentium III	733MHz	1GB	18GB	2	Systems and database server
Intel Pentium III	1.0GHz	128MB	20GB	1	Polycom server
Intel Pentium 4	1.5GHz	256MB	40GB	4	Professors and administrative
Intel Pentium 4	1.6GHz	256MB	40GB	159	Laboratories and professors
Intel Pentium 4	2.0GHz	256MB	40GB	41	Laboratories and professors
Intel Pentium Xeon	n.a. (multi, 2-processor)	1GB	30GB	4	Virtual education, backup, Netplain, mail servers
Intel Pentium Xeon	n.a. (multi, 4-processor)	1GB	30GB	1	Systems and database server
			Total	688	

Software
Microsoft Windows NT Server 4.0 CAL
Microsoft Exchange Server 5.5
Microsoft SQL Server 7.0
Microsoft Visual Studio Pro 6.0
Microsoft Visual FoxPro 6.0
Proyect 98 W95/Nt
Microsoft FrontPage 2000 Win95/Nt
Microsoft Windows 98 II Edición
Microsoft Office Pro 2000 W9x/Nt
Microsoft Office 2000 W9x/Nt

Software
Norton Antivirus solution 9X
Symantec PC anywhere 32 8.0
Norton Utilities 4.0 Win98/95
Microsoft Visio Pro 5.0 SGL
Tripley Play
Corel Draw 8 Win95/NT
Novell Netware 5.1
McAfee Antivirus
MOLP Acad Visio Pro. 2000 English
Norton Antivirus 2000 V6.0 Sp. Acad
Microsoft Office Pro BKSHF97 Sp. AE
Microsoft FrontPage 98 Sp. AE
Autodesk AutoCAD Lite 2000
Microsoft Windows Server 2000 Sp ACAD
Microsoft Windows CAL 2000 Eng. Open no level Academic
Linux Mandrake Operating System 7.0 Deluxe
Linux Starter Kit Operating System
Linux Programming Development Kit CD
Linux Utilities 2.0 Operating System
Teksoft CAD/CAM ProCAM 2000
Mitchell On-Demand
Mitchell Transmission
Carlson Survey and Road
Microsoft Windows Millennium Edition (Upgrade)
Label Matrix 4.9
Microsoft Windows Millennium EDTN SPA
Microsoft Office XP PRO Enterprise Win32 SP OLP NL AE
Microsoft FrontPage 2002 Win32 SP OLP NL AE
Macromedia Home Site Ver. 4.5 95/98/NT/Wme/W2K
Acad Flash 5 / Freehand 10 Studio
Microsoft Windows XP PRO SPA OLP NL AE LATAM Only
Microsoft Office XP PRO/FrontPage Enterprise Win32 SP OLP NL AE
Microsoft SQL Server 2000 Standard EDTN SP AE CD 10CLT
Microsoft SQL Server CAL 2000 Standard EDTN SP AE CD 10CLT
ACAD Corel Draw 10 95/98/Wme/NT/W2K
Norton Antivirus 2002 Ver. 8.0
Microsoft Visio PRO ACAD Ver. 2002 SP AE CD WIN 95/98/NT/W2K/ME/XP
Crystal Report Ver. 8.5 Developer FP ACAD
Microsoft Windows 2000 PRO OEM
Panda Antivirus
Microsoft Windows XP Home Edition OEM (Donated from Korea)
Microsoft Office XP Win32 SP. Academic OPEN (Donated from Korea)
Microsoft Windows 2000 advanced Server SP. AE. 25 cl. FPP (Donated from Korea)
Microsoft Windows Server CAL 2003 SP. Academic OPEN (Donated from Korea)
Microsoft Exchange 2000 Server SP. A.E. 5Cl FPP (Donated from Korea)
Microsoft Exchange 2000 CAL All languages (Donated from Korea)
Norton Antivirus 2003 OEM (Donated from Korea)

ITCA San Miguel

Four rooms, network laboratory, videoconference room, Computer Center A and B are equipped with computers connected via LAN and to the Internet. There are three full-time staff members and seven part-time employees employed at the System and Information Network Engineering Department. A JICA volunteer (system engineer) will be sent to ITCA San Miguel for the duration of two years. However, its timing has not yet been decided. The following are the lists of hardware and software of ITCA Santa Miguel (Source: ITCA San Miguel).

- Network Laboratory

Hardware					
CPU	Clock speed	RAM	Hard disk	Qty	Use
AMD Athlon	1.5GHz	256MB	40.0GB	1	Server
AMD Athlon	1.9GHz	256MB	40.0GB	12	User
Intel Pentium II	266MHz	62MB	4.0GB	1	User
Intel Pentium 4	1.5GHz	256MB	40.0GB	1	Server
			Total	15	

Software
Microsoft Windows 98
Linux Mandrake 9.1
Windows NT 4.0
Microsoft Office 2000
Norton Antivirus 2000
Microsoft SQL Server 7.0
Microsoft Internet Explorer 6.0
Autodesk AutoCAD 2000

- Videoconference Room (Computers and other equipment are donated by KOICA in April, 2003)

Hardware					
CPU	Clock speed	RAM	Hard disk	Qty	Use
Intel Pentium III	1.0GHz	256MB	20.0GB	1	Server
Intel Pentium 4	1.7GHz	256MB	40.0GB	1	Server
Intel Pentium 4	1.7GHz	256MB	40.0GB	20	Users
			Total	22	

Software
Microsoft Windows XP
Microsoft Windows 2000 Professional
Microsoft Office 2000
Norton Antivirus 2002
Internet Explorer 6.0

- Computer Center A & B (with a total of 48 computers, 24 in each room, installed)

Hardware					
CPU	Clock speed	RAM	Hard disk	Qty	Use
Intel Pentium II	266MHz	64MB	4.0GB	30	
Intel Pentium II	266MHz	64MB	30GB	2	
Intel Pentium II	266MHz	64MB	40GB	16	
			Total	48	

Software
Microsoft Windows 98 OEM
Microsoft Office 2000
Microsoft Visual Studio 6.0 (Microsoft Visual Basic, Microsoft Visual FoxPro, Visual C++)
Microsoft Project
Microsoft Internet Explorer 6.0
Apache, MySql
Autodesk AutoCAD 2000
PHP
Norton Antivirus 200

In-Depth Study No. 14: Agro-Industrial Technology Center (Project No. 6.4)

1. Background

A technology center has been proved to be effective in promoting regional industrial development. All the local governments in Japan, for example, provide industrial technology centers to promote their local industries. The technology centers conduct research on available business information to promote new production technologies necessary for innovation and systemizing production. They also provide services such as technical development, guidance, training and testing for products and materials. It is difficult for the private sector, particularly SMEs, to develop industrial technology without this kind of assistance. In addition, acquiring ISO certificates will be important for export business. There is, however, a little requirement for acquiring ISO at present. A consulting service for ISO certification should also be included as another function of the technology center.

CONACYT proposes to establish a National Laboratory of Legal Metrology. Proposed functions of the laboratory are similar to those of the industrial technology center (ITC) proposed here. Considering the present situation in El Salvador such as the economic scale, level of industrial technology and the sizes and locations of the existing companies, one center is sufficient for the entire Country. Therefore, the ITC should be included in the proposed National Laboratory of Legal Metrology to be established in San Salvador.

2. Objectives

In general, private enterprises cannot afford the testing experiments and employing researchers necessary for technology development. It is important for the public sector to provide research institutes to complement efforts of private enterprises. Therefore, the main objectives of an ITC are to (i) create the industrial environment to promote new business, (ii) support technical capability for developing new products and technology and (iii) promote and innovate production technology for existing industries.

3. Project Description

(1) Characterization of ITC

The Eastern Region has high potentials in agriculture, and the establishment of an agro-industrial complex is considered to be highly instrumental in promoting export-orientated production and processing of agro-products. Therefore, it is recommended that the proposed ITC specialize in production technology related to agro-business especially food processing. As the metalworking and mechanical industry supply production machinery and equipment as well as maintenance parts, they should also be included. In order to establish an integrated ITC, a further study is required to formulate a detailed program. Foreign assistants with advanced experience for administration and operation are also required, because the knowledge base of

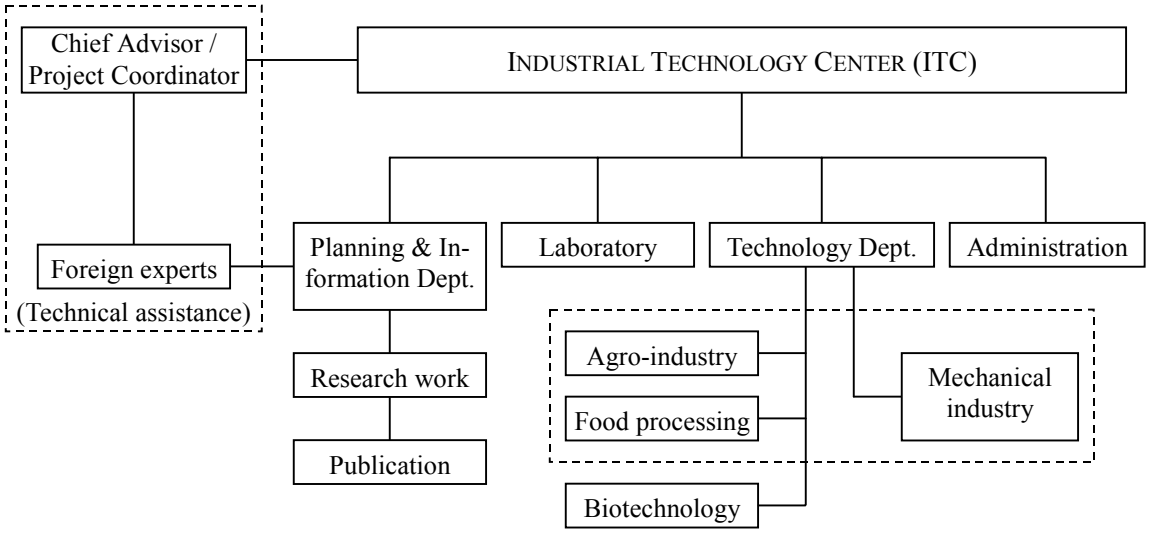
production technology in El Salvador is not sufficient to operate the ITC.

Under the international cooperation scheme, NGOs are taking supporting actions for micro entrepreneurs in Bajo Lempa. Those activities are mainly for the agriculture sector, and they provide several factories in order to transfer production technologies for fruit juice, bakery and cheese. The ITC, on the odder hand, provides the integrated technology necessary for agro-business in the entire Country.

(2) Organizational structure and functions of ITC

The proposed ITC has four departments: technical department, planning and information department, laboratory and administration as shown in Figure 1.

Figure 1. Organization of Agro-Industrial Technology Center



It is recommended that the following be further examined as related to the project.

1) Technology department
   Consulting services for production technology will be provided based on requests by companies but the following areas should be strengthened:
   - Process food engineering (canned vegetables and fruits, pickles, soft drinks),
   - Biotechnology,
   - Fundamental food manufacturing for local industry, and
   - Designing and processing of industrial machine and parts.
2) Laboratory
   Testing, calibration and analysis services for products, byproducts and materials should be provided, and certificates issued after testing.
3) Planning and information department
   The following should be undertaken:
   - Joint and sponsored research on production technology for commercialization,

- Research on fundamental technology for agro-industry, and
- Diversification of agro-industry.

As a future program, the ITC should provide an advanced service to support ISO certificates acquisition necessary for exports. At present, there are few enterprises that can afford to acquire the certificate due to high costs, approximately US$70,000.

(3) Implementing agency

CONACYT is the main implementing agency of the project. At present, CONACYT proposes to establish the National Laboratory of Legal Metrology, which is important for industrial development in El Salvador. The main role of the laboratory is to become a legal office for national measurement standards. The proposed main users of the laboratory are:

- Industries including agro and cattle rising, in their production process or quality control,
- Commerce dedicated to sales promotion, and
- Others for testing and calibration that provides services to the public.

Since these functions are similar to those of the proposed ITC, it is recommended that the project be included in the National Laboratory of Legal Metrology.

International cooperation will be necessary to support the establishment of the ITC, for experts on industrial technology are not available in El Salvador.

4. Expected Effects and Project Costs

(1) Expected effects

The ITC would response to the needs of the private sector for the introducing new production technology by providing a wide range of technological support. Based on the innovation of production technology, their profitability and competitiveness would be strengthened. It is also expected to change the entrepreneurial culture of local enterprises through introduction of modern technology.

(2) Project costs

The project costs are tentatively estimated at US$1.5 million, including the facilities and equipment of one ITC and its initial operation. The details of the project costs should be worked out in a further study.

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Part 3

Additional Action Proposals

Additional Action Proposal No. 1: Attracting Logistics and Distribution Centers

1. Background

The Salvadoran government has had intention of inviting logistics and distribution related companies into the Country. The free zone (FZ) regime, which allows distribution companies to locate inside the free zone, and strategic location of the Country in the Central America are the main factors to attract such industries. Recently, PROESA invited the Uruguayan logistic company to hold a seminar on the development of the industry. In addition to the new La Union port, the development of this sector will be vital for the Eastern Region to have sustainable growth as it will stimulate other industries by offering logistic services and give more opportunities for new investments.

2. Project Approach

(1) Evaluation of the environment for logistics and distribution centers

To attract logistics and distribution companies, it is necessary to evaluate the present business environment for such industries. A comparative analysis with Uruguay will clarify general conditions (Table 1). According to the comparative analysis, especially logistic services and supporting industries (e.g., 3PLs and value-added logistics services) and IT are the weak part of the business environment in El Salvador. Also, the limited human resources could hinder the development in the future. However, despise the difference in the scale of the economies, there are similarities between the two countries such as more or less the same FZ regime and opportunities for respective regional integration.

Table 1. Conditions to Attract Distribution & Logistic Center

Condition	Uruguay	El Salvador
Strategic geographic location	Center of Mercosur Brazil/Argentine boarder	Center of northern C.A. Guatemala/Honduras boarder
Legal frame	FZ	FZ
Human resources	High literacy Elementary/intermediate education is compulsory Cost-free education Labor force availability Development of logistics know-how	Relatively low literacy (75%) Elementary/intermediate education is compulsory Cost-free education Insufficient skilled labor No logistic related academic curriculum
Logistic services & support	Montevideo: Management/Administrative Capital of Mercosur Port of Montevideo advantages Carrasco International Airport Gateway to Mercosur main highways Reliable multi-modal transport	Well developed financial sector with less experience in trade business High function port & concession scheme International Airport connected to major cities in C.A. and U.S. Roads connected to Guatemala and Honduras
Information technology (IT)	FZM: own teleport Competitive communications rate Door to door connection Platform AS400 based online inventory system Internet on line connection with your inventory e-business logistics 3PL supplier Warehousing inventory system	Optical fiber installed Competitive communications rate Call center is about to begin operating Small sized IT industry

Sources: JICA Study Team and presentation materials of Costa Oriental.

(2) Enforcement of local logistics and distribution related industries

It is important to strengthen the existing logistics and distribution related industries, for these industries can act as service providers for those logistics and distribution companies. Since the program and tools to enforce the industrial cluster exist, use of this governmental program should be taken into consideration.

3. Action Plan

(1) Making profiles of companies involved in logistic and distribution

It is important to know the present capability and human resource of the industry as well as problems they are facing. This kind of industrial profile may also help investors in the decision making process as well as an investment promoter to understand strong and weak parts of the industry. The following aspects are important for investors to choose an investment site as logistic center:

1) Quality of the warehouses and existing infrastructure,
2) Experiences in operation,
3) Geographic location, and
4) Efficiency of custom process.

(2) Formulating and fostering the logistics cluster

The cluster should include the following actors:

i) Shipper/consigners,
ii) Truck companies,
iii) Shipping companies,
iv) Forwarders,
v) Warehouse/Storage,
vi) Air lines,
vii) CEPA,
viii) Aduana,
ix) Port operators, and
x) Government.

These actors may form the chamber of commerce. In order to enforce the weak part to the cluster, a governmental scheme such as FAT can be utilized for modernization of the industry. Promotion activities taking into consideration the adoption of International Standard ISO9000 series should be started for the future international business.

(3) Improving business environment for logistics and distribution industries

During the cluster meeting, the common goal should be set among actors and different topics discussed such as regulations, infrastructure, multi-modal and electronic data interchange. If it

is necessary, the research on the topics should be conducted for detail analysis by foreign consultants.

One of the factors impeding the logistic business in the Country is the inefficient custom clearing system. Although there have been improvements in the customs system for the last couple of years, for example, introducing electronic customs clearing, there still is room to reduce the time of the customs clearing process. This is a topic that the cluster may tackle first.

The other factor is availability of human resources. Once the industry starts to develop, the human resources would turn out to be short within the Country. There is a possibility to access to logistics-related Salvadoran experts living abroad. Although the exact number of experts available in U.S. is not yet known, there are Salvadorans working in this field. It is better to hire someone who has experience as well as strong commitment to the Country. For the long term, it is necessary to install the formal education curricula for fostering logistic experts in the Country although there are logistic related courses already available (e.g., Salvadoran Chamber of Commerce and Industry). There is a possibility to have collaboration such as distance learning with foreign universities already with such curricula.

(4) Investment promotion activities

The first step is to make foreign companies aware of the strategic location of El Salvador and services provided including the new La Union port. Potential investors of direct investments may be assembled based on the present commodity flow in Central America. It is important to increase the demand for logistics by introducing the distribution center as well as world-class logistic service companies, which provide competitive services in the Country.

The following may be potential sectors to build distribution centers in the Region:

- Pharmaceutical,
- Electronics,
- Automobile,
- Consumer group, and
- Construction materials.

After identifying the promising sector for the distribution center, PROESA should organize a mission consisting of related logistic service companies and FZ owners. It is important to prepare a promotion kit (consisting of CD, brochure, etc.) designed for presentation and distribution to interested companies.

Additional Action Proposal No. 2: Formulation of Mechanism to Connect Salvadorans in the U.S. and Projects in El Salvador

1. Background

Overseas Salvadorans, especially those in the U.S., are potentially significant investors but currently lacking in access to information on business opportunities in El Salvador. On the other hand, the Salvadoran government has identified this potential but never taken serious actions to attract them systematically. According to the survey conducted as part of the Study, Salvadorans living in the U.S. are willing to invest about US$7,500 per individual on average. The most favorable destinations of their investment are commercial, agriculture and artisan projects.

2. Objectives and Expected Effects

The objectives of the project are:

(1) To establish the link between Salvadoran investors living abroad and productive projects in El Salvador; and

(2) To increase the amount of investments from Salvadoran investors living abroad.

The project is expected to increase investments in El Salvador by mobilizing financial and human resources of overseas Salvadorans. Local people, currently dependent on remittances, will be motivated to renew, develop and strengthen their links with their family members, friends and acquaintances overseas.

3. Action Plan

(1) Working group

There are many institutes that should be involved in the project, such as PROESA, the Ministry of Foreign Affairs, MOE, CND, ASI, CAMAGRO, and counterparts in the U.S. The working group should be formed in the immediate future to discuss possible approaches including institutional framework and how to identify potential investors among Salvadorans living in the U.S.

(2) Survey on potential investors

According to the survey conducted as part of the Study, Salvadorans living in the San Francisco area show particularly high interests in investment. As a first step, a further survey should be conducted for Salvadorans in San Francisco and its vicinities to determine factors such as investment destinations and contents of information, in which they are most interested, possible investment types (share, bond or loan), and degrees of investors' involvement in the project. The focus group of respectable Salvadoran entrepreneurs should be conducted to find their interests and to collect their comments on such projects.

(3) Networking of Salvadoran entrepreneurs in the U.S.

Once the possible approach is identified through the survey, the network of Salvadoran investors should be established. The core of the network is a group of Salvadoran investors in the U.S. Similar organizations are found in other emigrant communities such as IndUS Entrepreneur of Indian communities (TiE, see Annex). This group can be formed within the Chamber of Commerce and Industry of Salvadoran Entrepreneurs or simply selected from successful Salvadoran businesspersons in the U.S. (El Rescate, an NGO based in the U.S., may help identify such investors.) This group is expected to act as the counterpart as well as the promoter in the matching system.

(4) Creation of a database of viable projects

It is necessary to compile project information as much as possible. Feasibility of all projects in this database should be verified to keep certain credibility of the system. There is a possibility to get information of FAT or FOEX beneficiary companies, which have already done feasibility studies. Focus may be placed on agriculture, tourism and export projects at the beginning. Other institutions may also have lists of viable projects. For example, RUTA of MAG identified 15 new agricultural investment projects aiming at ethnic markets in the U.S.

(5) Information exchange system

The purpose of databases is to distribute the information of projects regularly to the potential individual investors and/or to investor groups. Before information exchange starts, it is important to determine the following factors:

1) Target groups of both ends (potential investors and project owners),
2) Content of information to be provided,
3) Communication channels (via e-mail, web-sites, workshops, phone, visiting and etc.), and
4) Monitoring system.

If it is found that an investor needs third party project evaluation, a local/foreign consultant should be introduced by the main organization. It is better to involve the academic sector such as business schools in the U.S. that can offer business assistance (e.g., project evaluation, business plan and marketing) for the project. When there are enough potential investors showing their interests on particular projects, the mission from the U.S. should be formed to examine the actual project sites and to meet project owners.

The following are important considerations in promoting and operating a project.

- It is difficult to coordinate between different actors in two countries unless the core of the mechanism takes strong leadership.
- The private sector should be the main driving force for the project, even though the public sector may take the initiative. The public sector should remain in the mechanism as a supporting institution.

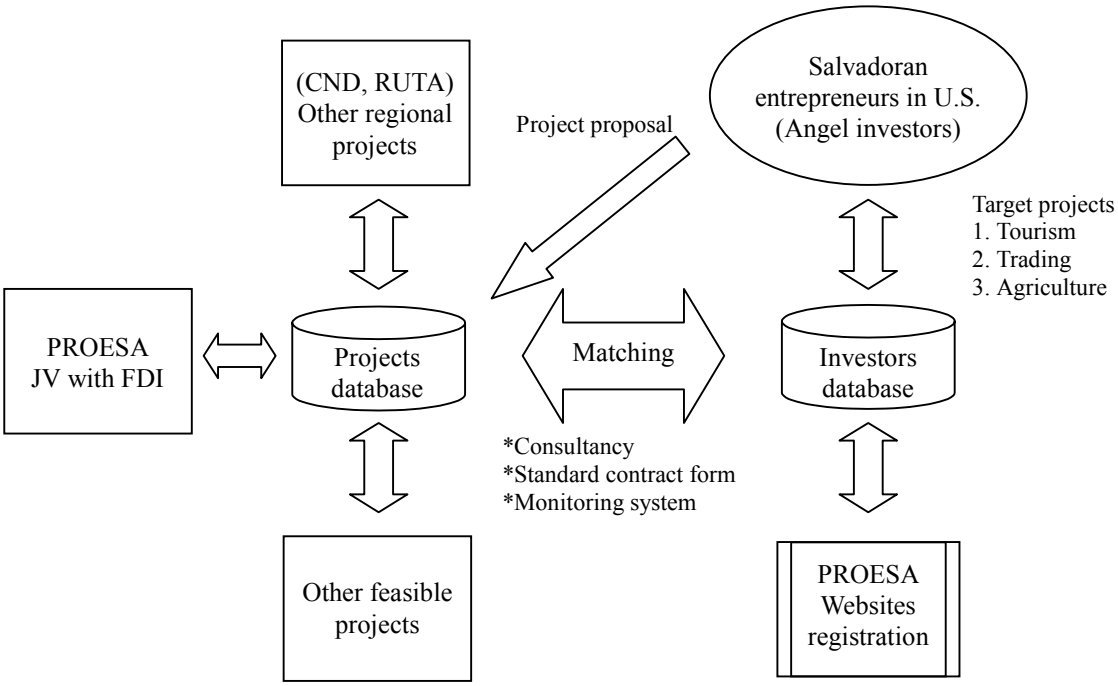
- It is important to build credibility of the matching process. Granted that investments always involve risk of financial losses, the process should be made transparent to investors.

(6) Other promotion activities

In addition to the above, it should be considered to launch the following related activities for the promotion of the project:

(1) Technical assistance for potential investors,
(2) Legal assistance by ONI,
(3) Monitoring of ongoing projects, and
(4) Incentives for small investors.

Matching Mechanism between Local Projects and Salvadoran Investors Abroad



Annex 1: IndUS Entrepreneurs (TiE)

TiE is a non-profit global network of entrepreneurs and professionals, founded in 1992 in Silicon Valley, California. Although its birth name, The Indus Entrepreneurs, signifies the ethnic South Asian or Indus roots of the founders, TiE now stands for Talent, Ideas and Enterprise. It is an open and inclusive organization that has rapidly grown to more than forty chapters in nine countries.

The core group of TiE comprises angel investors who have made a fortune in their business in the U.S. and have recycled their wealth in venture capital. They invest their funds into a new generation of startups in India as well as JV and investment funds operating in India and the U.S.

Annex 2: Examples on How to Approach Investors in the U.S.

Potential investors in the U.S. may be approached through the following:

1. Starting websites or newsletters aiming at Salvadoran investors in the U.S. to provide investment information,
2. Organizing investment seminars or workshops facilitated by Salvadoran consulates,
3. Placing a promoter on a commission base in the U.S.,
4. Appointing a staff member in charge of handling small investments (e.g., US$100,000 to 500,000) in PROESA,
5. Holding a contest of projects to attract investors, and
6. Providing a matching fund for a project expected to generate a number of new employment opportunities in the Eastern Region.

Additional Action Proposal No. 3: Promoting IDB Backoffice Outsourcing

1. Background

(1) BPO market

The global BPO market is estimated to worth more than US$240 billion by 2005 (Gartner, consulting firm). So far the main focus of BPO has been on India, but other countries also have BPO facilities such as Philippines, Czechoslovakia and Hungary. Affiliated computer services (ACS), a Dallas-based IT and BPO firm have operations in Jamaica, the Dominican Republic, Barbados, Mexico and Ghana. Some leaders of developing countries are deeply involved in marketing their respective countries. The Philippine president, for instance, visited Canada to attract call centers to the Southeast Asian countries. The Costa Rican president was personally involved in bringing Intel to San Jose.

(2) El Salvador's advantages

El Salvador is the first to approach IDB for possible BPO operation. El Salvador has favorable conditions for the promotion of BPO services, including the following:

1) strong Government commitment and a competitive business environment, ranked second in Latin America by the World Competitive Center;
2) competitive telecommunications market (monthly cost of a dedicated-120-voice-channel T1 line between the US and Salvador below US$10,000);
3) relatively inexpensive labor with bilingual ability (e.g., annual salary of an accountant in El Salvador compared to that of IDB staff);
4) reputation for hardworking;
5) training institutions such as INSAFORP and Infocentros capable of training on demand;
6) the to-be-constructed La Union port to boost the economy and new investment opportunities in El Salvador; and
7) proximity to the U.S. with one of the largest Spanish speaking markets.

El Salvador's electricity rates and international phone rates are the lowest among the Central American countries (Table 1 and Figure 1).

(3) El Salvador's weaknesses

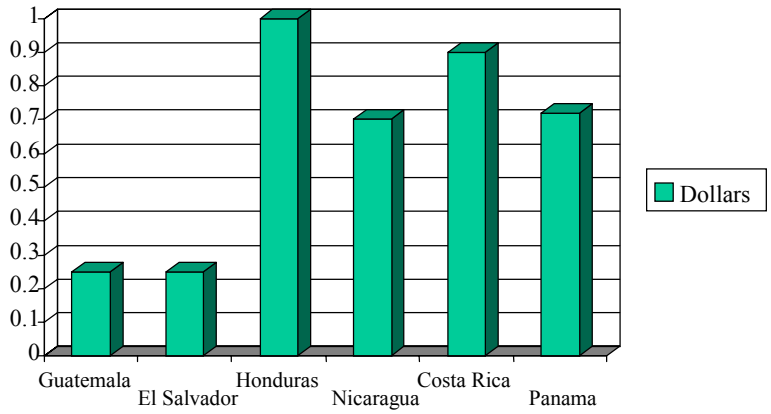
Weaknesses of El Salvador for promoting BPO services are also to be noted. So far only one call center has been established, although an American company has committed to establish the services with a possible seat requirement of 1,000 and a European company is scheduled to relocate a part of its operation to El Salvador with 500 seats. El Salvador still largely lacks a pool of professionals with experiences working with international companies.

Table 1. Electricity Tariff Comparison

Customer	Consumption Level	EEGSA Guatemala	CAESS El Salvador	ENEE Honduras	EDNyS Nicaragua	ICE Costa Rica	EDE Panama
Residential							
	100 kWh	7.59	8.16	5.87	7.92	5.75	12.11
	250 kWh	7.49	11.14	8.04	7.86	6.54	11.81
	1000 kWh	11.35	10.35	11.03	11.28	10.01	11.66
Commercial							
	1000 kWh	12.59	10.24	11.38	11.63	11.03	8.08
	15000 kWh, 41 kW	13.18	7.93	11.38	10.38	9.54	10.09
	50000 kWh, 137 kW	13.16	7.92	11.38	11.05	8.66	10.08
Industrial							
	15000 kWh, 41 kW	13.18	7.93	11.38	10.33	9.54	10.09
	50000 kWh, 137 kW	13.16	7.92	11.38	10.39	8.66	10.08
	100,000 kWh, 274 kW	12.21	7.92	9.20	10.40	8.66	9.55

Source: El Diario de Hoy, November 15, 2002

Figure 1. Comparison of Tariffs on International Calls to the U.S.



Main weaknesses are: 1) an educational system has not yet produced a large number of qualified professionals as compared to Costa Rica and Chile; 2) a critical mass of software developers and computer application technicians necessary to maintain the BPO infrastructure has yet to be created.

2. Rationale

Establishment of BPO services for international organizations would contribute to enhancing the image and the status of El Salvador as well as strengthening links with them. As a development agency, IDB has been engaging in facilitating the development in its member countries, and nothing would be more helpful than IDB's assistance in fostering the IT industry in El Salvador.

3. Project Approach and Strategy

El Salvador needs to build up a portfolio of American call centers and other BPOs that have made commitment to operate in the Country. Working with the IT cluster, a database should be established for software and electronic engineers as well as a roster of accountants, auditors, and bookkeeping clerks. A newly established national language test center should provide certification to professionals and workers who speak English.

PROESA should approach the leadership of IDB to market the BPO model based on the World Bank's successful experience in India. The support of the US government should be solicited through USAID and the Department of the State and the support of the Japanese government, the two largest shareholders of IDB. Similar enquiry could be made to the World Bank, IMF, and UN agencies (for their respective Latin American Operations) and multinational corporations serving large Spanish-speaking customers in America: AT&T, MCI, Amazon.com, and others in areas such as Shared Services/Backup Offices, call centers, data centers, customers relationship management, software development, etc.

4. Expected Effects

The BPO strategy could reduce, at minimum, IDB's administrative operations cost by 15%, or US$47 million, based on the World Bank's experience (Table 2). More important, the India experiences proved that BPO strategy could substantially improve the IDB's operation quality (accuracy, on-time delivery, better and faster service, new ideas, etc.) because the Salvadoran employees would be qualified, long-term dedicated, and highly motivated. The saved resources could then be used to further assist the developing countries in Latin America.

Table 2. Potential Savings for IDB

(Unit: US$10^6)

	2002	2001
Administrative operations cost	316	300
Total expenses	2,257	2,768
15% of administrative cost	47	45
15% of total cost	339	415

Source: IDB, *Annual Report*, 2002.

Appendix

Call Centers Study Results by Market
Caribbean Call Center Profile

Market	No. of centers	No. of agents	No. of seats
Jamaica	13	3,153	3,153
Dominican Republic	7	2,821	3,665
Puerto Rico	6	1,985	1,600
Trinidad	7	1,010	940
Barbados	3	263	243
San Kitts	2	128	178
Granada	2	725	450
Santa Lucia	1	600	450
Guyana	1	125	400
Antigua	1	200	226
San Vicente	1	144	228
Total	44	11,154	11,613
CARICOM (%)	31 (75%)	6,268 (56%)	6,266 (53%)

GDP Multiplier of Call Centers in Selected Markets

Country	Hourly wage	Daily wage	Annual income (US$)	Total agents	Multiplier	GDP impact (US$)
Jamaica	2.05	16	6,000	3,000	9	162,000,000
Trinidad	2.95	24	8,800	1,174	5.5	57,000,000
Santa Lucia	2.86	23	8,000	600	5	24,000,000
Dominican Republic	0.99	7.92	1,900	2,821	(superior) 9 (inferior) 5	48,239,100 26,799,500

Call Center Estimate in Jamaica

Labor costs (Estimate in US$)

Call Center Staff	Number	Unit cost	Total cost
Call center manager	1	80,000	80,000
Supervisors	4	15,000	60,000
Network administrator	1	25,000	25,000
Systems analyst	1	30,000	30,000
Programmer	1	23,000	23,000
Office/HR manager	1	25,000	25,000
Call center agents	100	6,000	600,000
Accountant	1	25,000	25,000
Administrative assistant	1	8,500	8,500
Payroall clerk	1	7,000	7,000
Receptionist/Telephone operator	1	5,500	5,500
Office attendant	1	2,000	2,000
Labor Costs	114		891,000
Fringe benefits (25% of Labor Costs)			222,750
Total Labor Costs			1,113,750

Source: JAMPRO 2002.

Comparative Pricing per Agent/Hour

Country	Price/agent hour (US$)
India	10.00-16.50
Irland	27.00-28.00
Jamaica	15.50-16.50
United States	27.00-29.00
United Kingdom	29.00-30.00

Source: Philip Cohen, 2002 – International call center consultant.

Jamaica Digiport International Ltd. Telecommunications Costs

MAYAS/DJFS Fibre International Private Line Circuits

Bandwidth (Kbps)	Installation charge (US$)	Month-by-month term (Per month US$)	One-year term (Per month US$)
512	3,800.00	12,445.00	8,075.00
768	3,800.00	15,325.00	9,025.00
1544 (T1)	5,950.00	25,605.00	14,500.00
(E1)	5,950.00	N/A	17,500.00

Caribbean Call Centers Parameters by Country

País	No. of centers	No. of seats	No. of agents
Jamaica	13	3,153	3,153
Dominican Republic	7	3,865	2,821
Puerto Rico	6	1,600	1,985
Trinidad	7	940	1,010
Barbados	3	243	263
San Kitts	2	178	128
Granada	2	450	725
Santa Lucia	1	450	600
Guyana	1	400	125
Antigua	1	226	200
San Vicente	1	228	144
Total	44	11,613	11,154

Source: NCS International, *Caribbean Call Center Overview*.

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Part 4

Industrial Location Planning for the Eastern Region and Macrozoning for La Union-Conchagua Area

Industrial Location Planning for the Eastern Region and Macrozoning for La Union-Conchagua Area

1 Industrial Land Demand Projection

1.1 Industrial Land Demand in El Salvador

Industrial land demand is projected for El Salvador for the year 2019. The projection was made following the steps below:

a. Estimate of industrial value-added generated per area
b. Estimate of growth of industrial value-added
c. Estimate of incremental industrial value-added between now and the target year 2019
d. Estimate of land area required for producing estimated level of incremental industrial value-added

Assumptions

The assumptions and results are presented in Table 1.1. The assumptions are summarized as follows.

a. Industrial value-added per area was estimated applying two methods: estimate based on the result of the Industrial Location Survey ("ILS" hereafter) and macroeconomic data. ILS was conducted to collect information from 112 companies operating in 14 existing free trade zones (FTZs) in EI Salvador. The results of ILS are presented in Survey Report (Volume 5). ILS succeeded in collecting information from 21 companies on their sales values in 2002 and their land area in FTZs. The average sales value was calculated at US$1,098 per m^2. Applying a value-added ratio at 35%, the ratio in Japan in 1992, the average industrial value-added generated in m^2 is estimated at US$384. The macroeconomic data indicated that an increase of industrial value-added at US$1,420 million was achieved between 1993 and 2002. The total FTZ area developed during this period was 354ha. Combining these two values, industrial value-added per area is calculated at US$401 per m^2. Based on these results, industrial value-added applied for the present analysis is set at US$400 per m^2.
b. The rate of industrial value-added growth in Case 1 is assumed referring to the socio-economic framework for El Salvador established in the present study. That for Case 2 is set at double the Case 1 level. The socio-economic framework is established in Table 1.2.

Table 1.1. Industrial Land Demand Projection for El Salvador in 2019

Item	Values		Remarks
1. Industrial value added per land area in El Salvador in 2002	400	$/m^2 in 2002	ILS result
2. Economic growth rate			
(2-1) Scenario 1	4.8	%/year	Socio-economic framework
(2-2) Scenario 2	9.6	%/year	Double the scenario 1 assumed
3. GDP/industrial value added in El Salvador			
(3-1) GDP in current price	13,139	US$10^6 in 2000	Progress Report
(3-2) Proportion of industrial sector	30.2	%	Progress Report
(3-3) Industrial value added	3,968	US$10^6 in 2000	
4. Industrial value added in year 2019			
(4-1) Scenario 1	9,670	US$10^6 in 2019	from (2-1) and (3-3)
(4-2) Scenario 2	22,645	US$10^6 in 2019	from (2-2) and (3-3)
5. Increase in indutrial value added			
(5-1)Scenario 1	5,702	US$10^6 between 2000 and 20	(4-1)-(3-3)
(5-2) Scenario 2	18,677	US$10^6 between 2000 and 20	(4-2)-(3-3)
6. Incremental land demand in the future			
(6-1) Scenario 1	14,255,453	m^2 between 2000 and 2019	(5-1)/1.
	1,426	ha between 2000 and 2019	(6-1)/(10,000m^2/ha)
(6-2) Scenario 2	46,692,224	m^2 between 2000 and 2019	(5-2)/1.
	4,669	ha between 2000 and 2019	(6-2)/(10,000m^2/ha)
7. Step-wise land development requirement			
(7-1) Scenario 1			
- year 2010	750	ha	50 ha/year
- year 2019	1,426	ha	
(7-2) Scenario 2			
- year 2010	2,457	ha	164 ha/year
- year 2020	4,669	ha	

Table 1.2. Socio-economic Framework for El Salvador

Sector	GDP (US$10^6)		Growth rate (%/year)
	2000	2019	2000 – 2019
Agriculture	1,300	1,825	1.8
Industry	4,000	9,231	4.5
Services	7,800	16,736	4.1
Total	13,100	27,792	4.0

Results

Based on the methodology and assumptions presented above, industrial land demand in El Salvador is estimated in Table 1.3 for the years 2010 and 2019.

Table 1.3. Industrial land Demand in El Salvador Projected for 2010 and 2019

(Unit: ha)

Year	Case 1	Case 2
2010	750	2,457
2019	1,426	4,669

1.2 Distribution of Industrial Land Demand among Regions

The industrial land demand projected for El Salvador for the year 2019 under Case 1 is distributed among regions and departments in the Eastern Region as shown in Table 1.4.

Table 1.4. Allocation of Industrial Land Demand among Regions and Areas for 2019

Region/area	Proportion (%)	Area (ha)
El Salvador	100	1,426
Eastern Region	50	713
Other regions	50	713
Eastern Region	100	713
La Union	40	285
San Miguel	30	214
Usultan	20	143
Morazan	10	71
La Union	100	285
Port hinterland	18	50
Other areas	82	235

The distribution was made based on the following considerations.

- As the ILS results show, expectation for the Eastern Region development is high among potential investors. The ILS results include an evaluation of two major cities in El Salvador, San Salvador and Santa Ana, and the Eastern Region before and after developments in terms of possibility for investment, assuming "100" for perfect location and "0" for impossible location. The average score given to the Eastern Region in the future was highest at 71, compared with Santa Ana (68) and San Salvador (65). The Eastern Region would likely open the new gateway toward the Pacific Ocean side and create new links with Honduras and Nicaragua. Considering these aspects, a half of the future industrial location in El Salvador is assumed to take place in the Eastern Region.
- The departments of La Union and San Miguel are the leading areas of industrial location in the Eastern Region as indicated by the ILS result, clarifying potential investors' view on major cities in the Eastern Region. Potential investors perceive the four cities in the Eastern Region as shown in Table 1.5 as investment location.

Table 1.5. Evaluation of Potential Investors' on 4 Cities in the Eastern Region

(Unit: %)

Departments	Very attractive	Worth consideration	No possibility	Total
La Union	42	45	13	100
San Miguel	41	40	19	100
Usultan	9	57	34	100
San Francisco Gotera	1	23	76	100

High evaluation of San Miguel would be based on the city's present function as the regional commercial center and expectation for further growth in the future. La Union is highly valued by the port and hinterland development project and possibility for business growth through the new marine gateway and cross-border activities with Honduras and Nicaragua. While San Miguel is oriented more toward commercial activities, La Union could be geared more toward industrial location. Usulutan has a fairly good potential with two inter-American highways running through it and abundant water resources available. Morazan's possibility would depend on its improved links with La Union and western regions through the northern longitudinal road project and its potential for producing raw materials. Considering all these aspects, distribution of industrial land among the four departments is assumed as shown in Table 1.4.

- La Union stretches from north to south with its eastern border facing Honduras. With economic links with Honduras and Nicaragua strengthened taking advantage of its location, La Union as a whole would be in a position to provide opportunities for enhancing manufacturing value-added to commodities that at the beginning start to flow as transported goods. Two kinds of industrial processing are foreseen: processing of raw materials produced in other part of El Salvador, Honduras and Nicaragua, processed on the way and

exported from La Union and, the other type, processing of raw materials or parts imported though the La Union port and exported though the La Union port or transported along the inter-oceanic logistic corridor in Honduras and exported from the Cortes Port on the Atlantic side. The ILS result on raw materials procurement for the companies operating in the existing FTZs supports this second possibility. The proportions of the regions named as the origins of raw materials procurement were as follows.

- Asia: 37.5%
- North America: 22.7%
- El Salvador: 13.6%
- Central America: 13.6%
- Europe: 8.0%
- South America: 4.5%

The direct hinterland of the La Union port is the best location for this type of processing: raw materials and parts imported to the port, transported to a location right behind the port, preferably FTZ, processed there and final products exported from the La Union port. The first type of processing raw materials originating in El Salvador, Honduras and Nicaragua, could be developed either at the direct port hinterland or anywhere along the major roads between raw material production site and the La Union port. In consideration of constraint in land availability in the hinterland area where sloping land at the foot of the Conchagua volcano stretches toward the coastline, a total of 50ha is allocated to the La Union port hinterland for industrial development.

1.3 Identification of Potential Industrial Areas in the Eastern Region

Industrial land thus estimated can be distributed to areas with favorable conditions for industrial location. Land areas in the Eastern Region suitable for industrial development are identified according to the following criteria, applying a GIS.

- Slope of less than 2%
- Facing the existing major roads
- A land mass of more than 100ha
- Areas without serious inundation

The identified areas suitable for industrial development are shown in Figure 1.1. The land areas by department are summarized in Table 1.6.

Figure 1.1. Potential Industrial Area in the Eastern Region

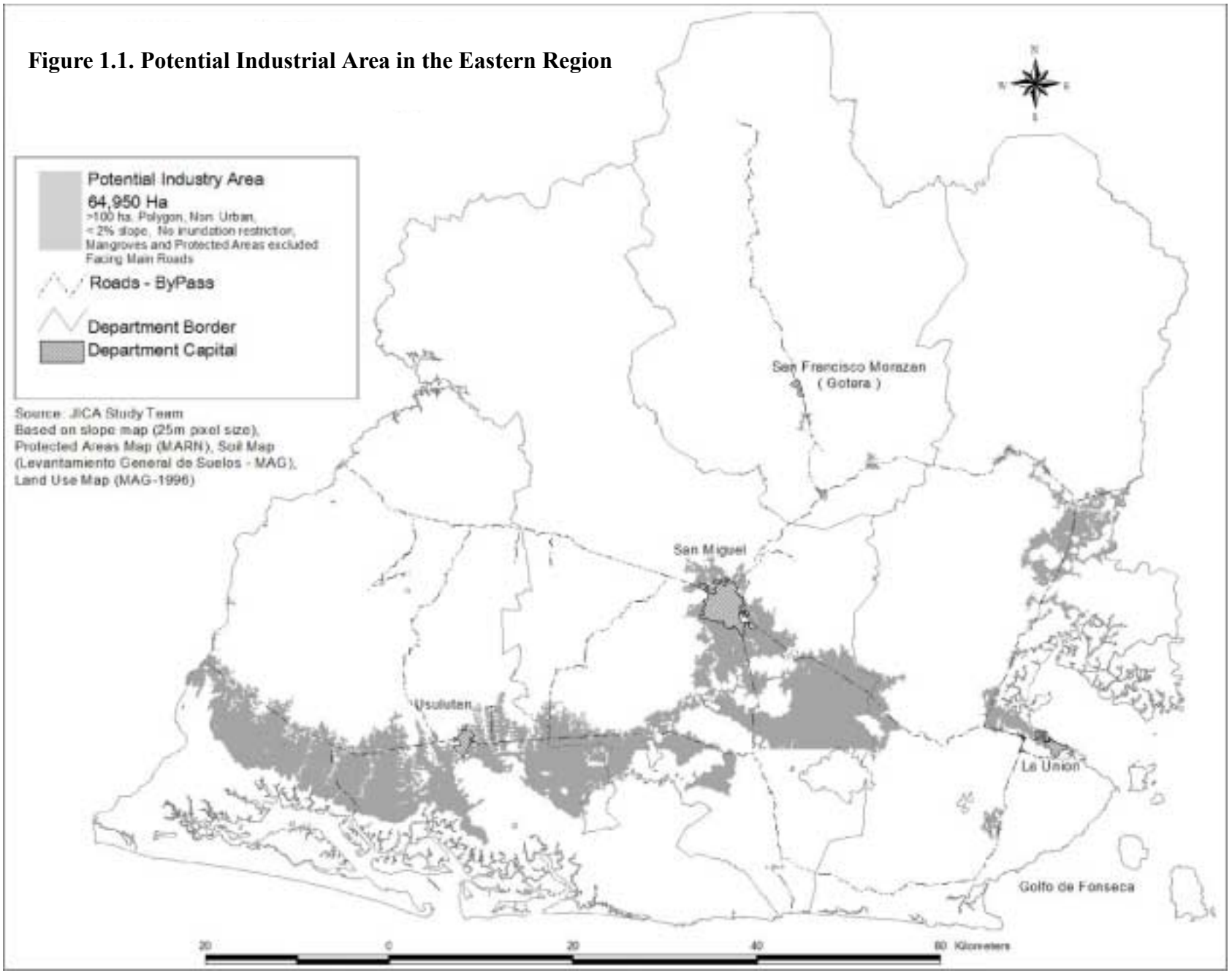


Table 1.6. Land Area Suitable for Industrial Development in the Eastern Region

Departments	Land suitable for industrial devt. (ha)
La Union	9,163
San Miguel	25,710
Usulutan	29,728
San Francisco Gotera	348

A vast land suitable for industrial development is found along the east-west axis along CA No.2 in Usulutan and San Miguel departments all the way to the city of San Miguel and extending thereon along CA 2 toward the city of La Union. Two major areas found in La Union include the area around Pasaquina close to the Amatillo border and the area extending to the northwest from the existing La Union urban area. Only limited areas are suited for industrial development in Morazan due to its mostly mountainous topography.

2 Macrozoning for La Union-Conchagua Area

2.1 Objective

The development of La Union port and its hinterland is expected to spearhead the growth of the Eastern Region. It would be vital that the la Union-Conchagua area as a whole be developed in a functional and environmentally attractive manner so that investments begin to be attracted to this area and growth momentum be created at the time of port commissioning. An appropriate urban development plan needs to be prepared first so that all the development projects and activities, both public and private, can be guided within the planned framework. The first step of this urban planning process would be to prepare macrozoning of the La-Union-Conchagua area, which would specify the general locations of the envisaged urban functions such as industry, logistics, business and commerce, tourism and water front upgrading and residential function.

2.2 Planning Framework for Macrozoning

2.2.1 Industrial and logistic area

An area of 50ha in total is planned for a free trade zone at the immediate hinterland of the La Union port, for industrial function and logistic functions.

2.2.2 Population

Method

In order to provide the basis for macrozoning in the La Union-Conchagua area, population in the La Union hinterland is projected according to the following steps.

a. Estimate of industrial population
   - Number of workers per area
   - Industrial area
   - Number of workers in the industrial area
   - Dependency ratio
   - Population associated with industrial employment

b. Estimate of service population
   - Proportion of service employment to industrial employment
   - Estimate of service employment
   - Dependency ratio
   - Population associated with service employment

c. Estimate of port population
   - Estimate of port employment
   - Dependency ratio
   - Population associated with port

Assumptions

The following assumptions are applied to the population projection.

a. The number of workers per area of industrial land is assumed at 120 per ha, referring to the types of industries in the existing FTZs in El Salvador (food, beverage, textile, clothes, paper, and machinery) and the number of workers per area for these types of industries in Japan.
b. Industrial/logistic area is assumed to be 50ha.
c. The dependency ratio, i.e., the ratio of the number of persons dependent on a working member of a household, is estimated at 1.6, based on the socio-economic data of the La Union municipality.
d. Given the socio-economic framework for the Eastern Region in 2019, the industrial and services employment is projected as follows.
   - Industrial employment: 109,000
   - Services employment: 372,000

   The ratio of service employment to industrial employment, therefore, is derived at 3.4.
e. Port employment is projected based on the feasibility study for the La Union Port Revitalization Project prepared in 1998. It is estimated at 1,350 in 2019.

Results

The employment and population in the La Union-Conchagua area in 2019 are projected as shown in Table 2.1 and summarized as follows.

Table 2.1. New Job Opportunities and Associated Population in La Union in 2019

Item	Value		Remarks
1. Industry-related			
1-1 Employment per area	120	per ha	Based on Japan's experience for types of industries in El Salvador FTZs
1-2 Industrial area	50	ha	
1-3 Employment in 2019	6,000	workers	(1-1)*(1-2)
1-4 Dependency ratio	1.6	per worker	*Based on La Union data
1-5 Total population related with industry	15,600		(1-3)+(1-3)*(1-4)
2. Service-related			
2-1 Employment in Eastern Region 2019			
2.1.1 Industrial employment	109,000	workers	Socio-economic framework
2.1.2 Service employment	372,000	workers	Socio-economic framework
2.1.3 Proportion to industrial population	3.4	(index)	(2.1.2)/(2.1.1)
2-2 Service employment	20,477	workers	
2-3 Dependency ratio	1.6	per worker	
2-4 Total service population in La Union	53,240		(2-2)+(2-2)*(2-3)
3. Port-related			
3-1 Employment	1,350		**Based on data in FS report for La Union Port Project
3-2 Dependency ratio	1.6	per worker	
3-3 Total port population	3,510		(3-1)*(2.1.3)
4.Total population	72,350		(1-5)+(2-2)+(3-2)
4-1 Existing population	36,175		50% of total assumed
4-2 Inflow from outside	36,175		50% of total assumed

*Dependency ratio

Urban population in La Union	59,207	in 1992
Number of houses	12,474	in 1992
Number of apartments	520	in 1992
Number of families per apartment	20	assumed
Number of people per family	2.6	per family

**Port employment

Estimate for 2005	450	
Cargo volume in 2015 as proportion of that in 2005	3.0	approximate
Estimate for 2015	1,350	(450*3.0)

Total employment:	27,700
Industry:	*6,000*
Service:	*20,400*
Port:	*1,300*
Total population:	72,300

In preparing a macrozoning plan, it is assumed that the projected population be accommodated by a new residential area and the existing urban area in equal proportion as follows.

Population in new urban area:	36,000
Population in existing urban area:	36,000

2.3 Macrozoning

Figure 2.4 presents a macrozoning for the La Union-Conchagua area for 2019 based on a geographic information system (GIS) according to the following steps:

1) Preparation of a land use map of the La Union-Conchagua area (Figure 2.1),
2) Preparation of a slope map (Figure 2.2),
3) Identification of development potential area according to three factors: “non-built-up area”, “slope of less than 6%” and “altitude of less than 300m” (Figure 2.3), and
4) Selection of development areas from the development potential areas based on the planning framework explained above and a set of factors (Figure 2.4).

The land use map for 2002 was prepared based on the IRS satellite imagery data and ground truth surveys. An area of 146.98km^2 or 14,698ha is covered, extending to Punta El Chiquilin to the east, the southern slope of the Conchagua volcano to the south and the junction of the road to El Amatillo and that to San Miguel to the west. This area is distributed among different land uses as shown in Table 2.2.

A slope map was prepared based on the topographic map of 1/25,000 scale with 10m contour lines. Average slopes of 25m-25m pixels were calculated so that all the pixels are classified into “0-2%”, “2.01-4.00%”, “4.01-6.00%”, “6.01-8.00%”, 8,01-10.00%” and “more than 10%” slope categories. The results are presented in Figure 2.2.

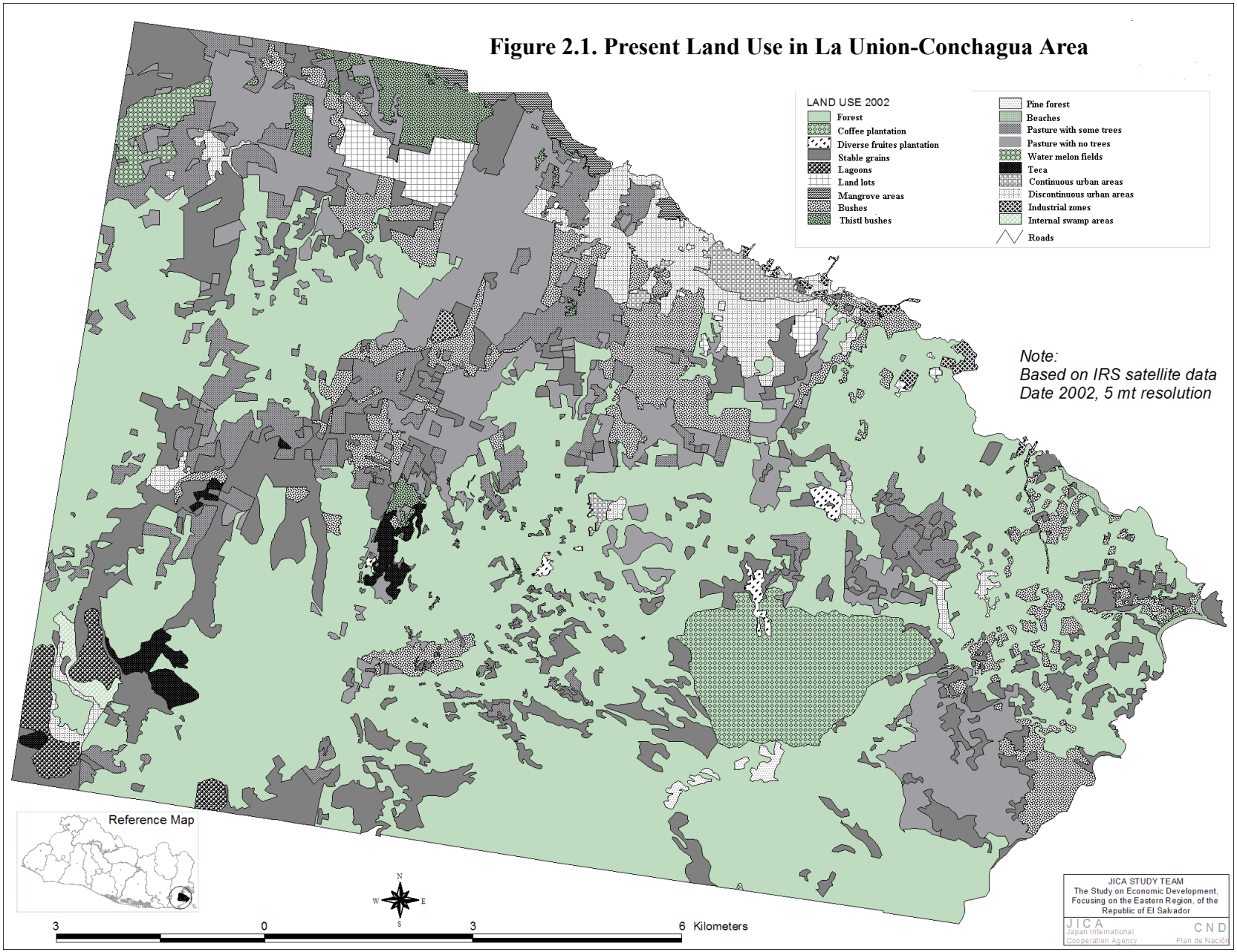


Figure 2.1. Present Land Use in La Union-Conchagua Area
LAND USE 2002
Forest
Coffee plantation
Diverse fruites plantation
Stable grains
Lagoons
Land lots
Mangrove areas
Bushes
Thistl bushes
Pine forest
Beaches
Pasture with some trees
Pasture with no trees
Water melon fields
Teca
Continuous urban areas
Discontinuous urban areas
Industrial zones
Internal swamp areas
Roads
Note:
Based on IRS satellite data
Date 2002, 5 mt resolution
Reference Map
N
W
E
S
3
0
3
6 Kilometers
JICA STUDY TEAM
The Study on Economic Development, Focusing on the Eastern Region, of the Republic of El Salvador
JICA
Japan International Cooperation Agency
CND
Plan de Nación

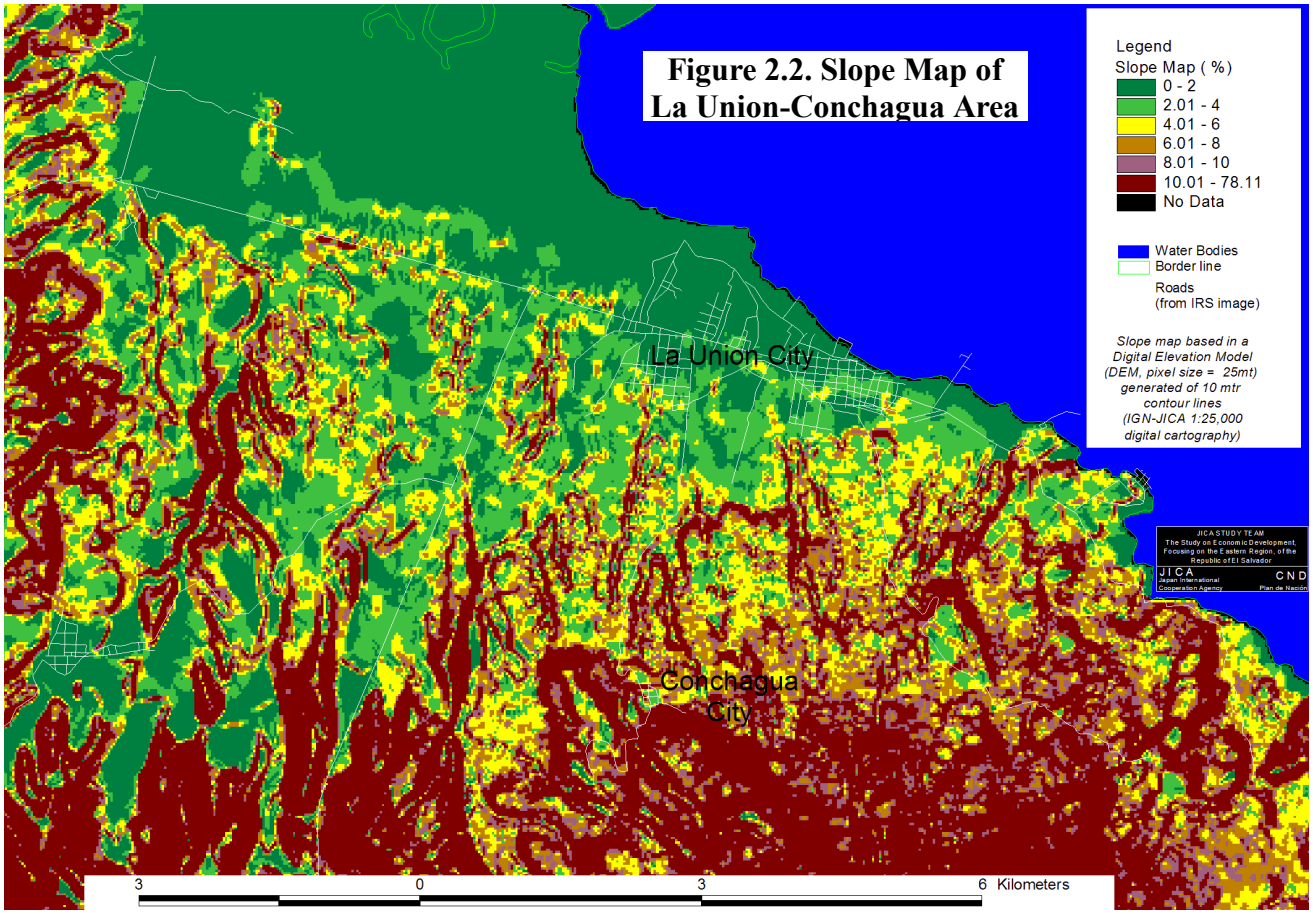


Figure 2.2. Slope Map of
La Union-Conchagua Area
Legend
Slope Map (%)
0 - 2
2.01 - 4
4.01 - 6
6.01 - 8
8.01 - 10
10.01 - 78.11
No Data
Water Bodies
Border line
Roads
(from IRS image)
Slope map based in a Digital Elevation Model (DEM, pixel size = 25mt) generated of 10 mtr contour lines (IGN-JICA 1:25,000 digital cartography)
La Union City
Conchagua City
JICA STUDY TEAM
The Study on Economic Development, Focusing on the Eastern Region, of the Republic of El Salvador
JICA
Japan International Cooperation Agency
CND
Plan de Nación
3 0 3 6 Kilometers

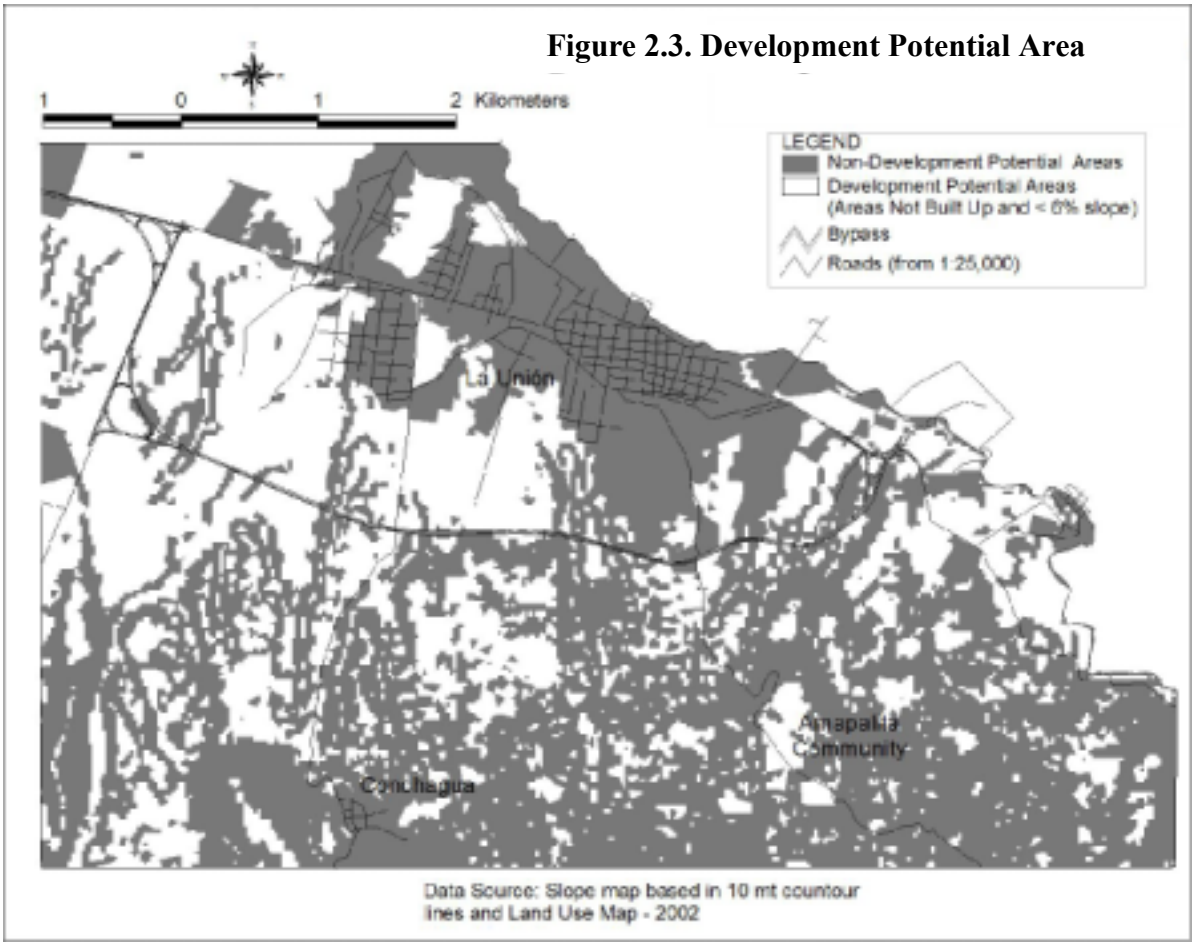


Figure 2.3. Development Potential Area
1 0 1 2 Kilometers
LEGEND
Non-Development Potential Areas
Development Potential Areas
(Areas Not Built Up and < 6% slope)
Bypass
Roads (from 1:25,000)
La Unión
Conchagua
Amapalita Community
Data Source: Slope map based in 10 mt countour lines and Land Use Map - 2002

Figure 2.4. Macrozoning for La Union-Conchagua Area

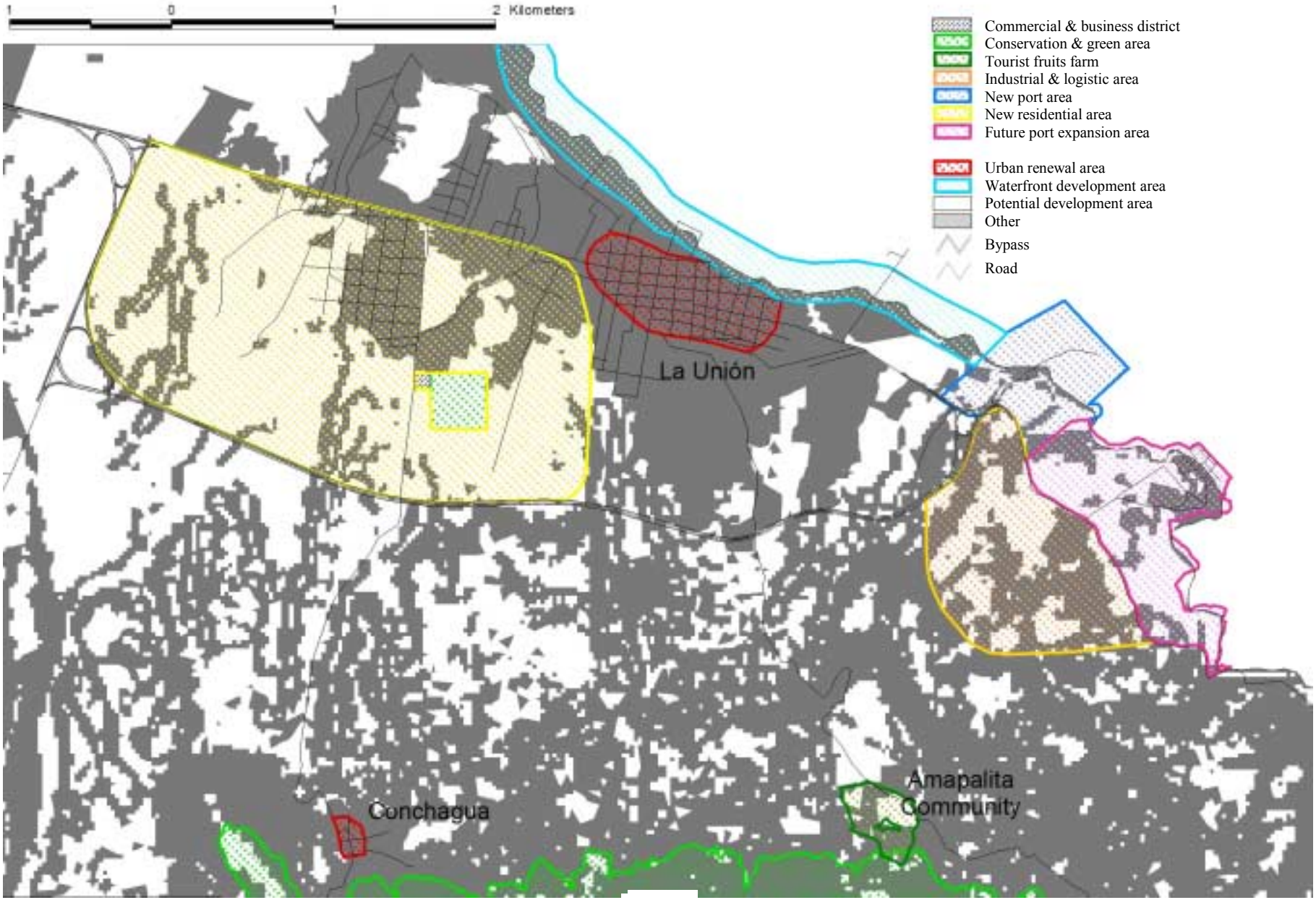


Table 2.2. Land Use Distribution of La Union-Conchagua Area in 2002

Land Use	Area (ha)	%
Continuous urban area	84	0.6
Discontinuous urban area	467	3.2
Industrial area	47	0.3
Area planned for residential development	160	1.1
Stable grain area	2,036	13.9
Watermelon field	85	0.6
Coffee plantation	521	3.5
Diverse fruits plantation	37	0.3
Teca area	115	0.8
Internal swamp zone	31	0.2
Pasture with some trees	966	6.6
Pasture without trees	1,548	10.5
Bushes	857	5.8
Thistle bushes	209	1.4
Forest	7,274	49.5
Mangrove area	83	0.6
Pine forest	28	0.2
Lagoons	129	0.9
Beach	20	0.1
Total	**14,699**	**100.0**

The areas with development potential are defined as follows:

- Areas not exploited or possible to be converted to other uses (non built-up areas),
- Areas with average slope of less than 6%, and
- Areas where special consideration for conservation is not necessary.

Areas with average slopes of less than 6% is judged as potential development areas in consideration of constraint in the availability of flat land in the La Union-Conchagua area and possibility of development with investment cost within a reasonable range. In terms of the need for conservation, the area with an altitude of more than 300m, which is found mostly on the Conchagua volcano slope, is designated as the conservation area for maintaining the water recharging function.

Based on the planning framework, GIS analysis results and considerations presented below, a macrozoning was worked out as shown in Figure 2.4.

a. The area with an altitude higher than 300m is designated as the preservation area. All the rivers and groundwater originate in the Conchagua volcano and this area serves as water recharging area for rivers and groundwater. Only limited development on spot is permitted in this area, for example, for tourism and recreational development.

b. An area of 70 to 80ha is designated as industrial and logistic area at the location right behind the planned port area based on the two factors: direct access to the port and availability of relatively flat land.
c. The possibility for expansion is considered for port, industrial and logistics functions. An area of about 100ha to the southeast from the port is planned for this purpose. This is the only flat area remaining with direct access to the port. Allocation among port, logistics and industrial functions should be determined as actual demand for these functions begin to arise in the future.
d. The port and its vicinities, with an area of 50 to 60ha, are designated according to the project design already prepared by the Government.
e. Waterfront in La Union is an important asset for recreational and tourism development. The waterfront area could be developed in different forms such as restaurant and souvenir shop area (e.g., Fishermen's Wharf in San Francisco, California, the U.S.), promenade, park, fishing wharf, and tourist park with such attractions as aquarium and swimming pool. Mooring facilities would be needed in this area for local residents moving between La Union and islands as well as for tourist boats.
f. A fruit farm for tourists is planned at Amapalita/Conchaguita community, taking advantage of existing fruits farming here. Tourists can visit the farm, experience harvesting and bring back harvested fruits.
g. The new residential area is designated considering two factors: altitude and relation with the bypass and the existing urban area. It would be possible to develop water supply facilities in a cost-efficient manner if residential development takes place in the areas with lower altitude because of shorter depth for drilling wells and lower requirement for pumping up water to consumers. The bypass route is running at an altitude of 60-70m, which is an allowable level for realizing cost-efficient water supply system development. From the viewpoint of ensuring a comfortable living environment, it would be better to avoid the bypass running in the middle of new residential area. For these reasons, the new residential area is contained to the north of the bypass. The new residential area expands over an area of about 550ha. A new residential development is to be planned within this boundary in an area of about 360ha avoiding slopes and built-up areas. The population density is assumed at 100 people per ha with a mixture of detached houses and multi-story buildings.
h. Allocation of the new residential area can be broadly assumed as follows.

    Total area: 360ha (100%)
    Residential area: 180ha (50%)
    Park/green area: 90ha (25%)
    Other area: 90ha (25%)

The park and green area would include a green belt separating the residential area from the

bypass to ensure a good living environment and a central park. The central park would serve the whole La Union- Conchagua area and the surrounding region. The area for the park is 20ha. The park area will provide space for relaxation, recreation and leisure and also accommodate large-scale facilities such as football stadium and gymnasium. Cultural facilities such as theaters and museums can also be located in this area at the northern part adjacent to the commercial and business district.

i. The commercial and business district (CBD) is planned at a junction of the two roads running north to south from the existing major road leading to La Union downtown and the road connecting La Union and Conchagua.

j. The existing urban area will be revitalized for providing higher level commercial and business environment, taking advantage of its location facing the sea in case of La Union and local architectural characteristics. The Conchagua urban area will be revitalized as the base for tourism and recreational activities. A systematic approach would be needed to achieve successful urban renewal, which would be the first case in El Salvador. In this sense, legal and institutional frameworks for carrying out urban revitalization programs need to be clarified.

3 Projects/Programs Proposed

The following projects are proposed for the La Union-Conchagua area in order to make the area functional and environmentally attractive.

Urban development projects

La Union Free Trade Zone (LUFTZ)
La Union new urban development
La Union-Conchagua urban renewal
La Union-Conchagua waterfront Development
Distribution core development
Tourist core development
IDB back office

Human resource development projects

La Union Technological Institute

Infrastructure projects

Urban water supply
Transmission line and substation
Wastewater system

Solid waste management

The outlines of the three projects, La Union Free Trade Zone (LUFTZ), La Union New Urban Development Project and La Union-Conchagua Urban Renewal Project, and also of La union-Conchagua Waterfront Development Program are presented below. Their project profiles are contained in Part 1 of this volume.

La Union Free Trade Zone Project

The La Union FTZ will be established in the industrial-logistic zone designated right behind the port area. Its maximum area will be 50 ha based on industrial land demand projection. It is recommended that development and operation at the initial stage be undertaken by a public organization, the proposed Development Corporation, in consideration of the need to provide various privileges to make the investment in La Union FTZ an attractive option at an early stage of the development. Utility tariffs, for example, need to be competitive with other FTZs in El Salvador. Profit maximizing principles by the private sector could make this kind of special approach difficult. Once the momentum for investment in the La Union FTZ is gained or all the land lots are filled, the management could be transferred to private hand. Special tax incentives could be provided in the La Union FTZ as a trial case at the beginning, which may be extended to other parts of the Eastern Region later on. A feasibility study needs to be carried out prior to promoting this project to implementation, including delineation of the specific area for FTZ development. The feasibility study needs to clarify the most cost-effective delineation and size of the La Union FTZ.

La Union New Urban Development Project

Figure 3.1 presents a phased development plan for the new urban area. The new urban development is planned in potential development area designated according to the following criteria of macrozoning: slope of less than 6%, non-built-up area, and area lower than 300m in altitude

It is proposed that an area of 150ha adjacent to the existing La Union urban area be developed in the first phase by the year 2009. The second phase development is to take place in an area of 210ha to the west by the year 2019. At the center of the two areas, a park is planned taking advantage of the natural undulation. A football stadium could be accommodated in this area. Across the existing road, an area of 1ha is planned as the commercial and business district. The land uses in respective phase as well as for the whole area are planned as presented in Table 3.1.

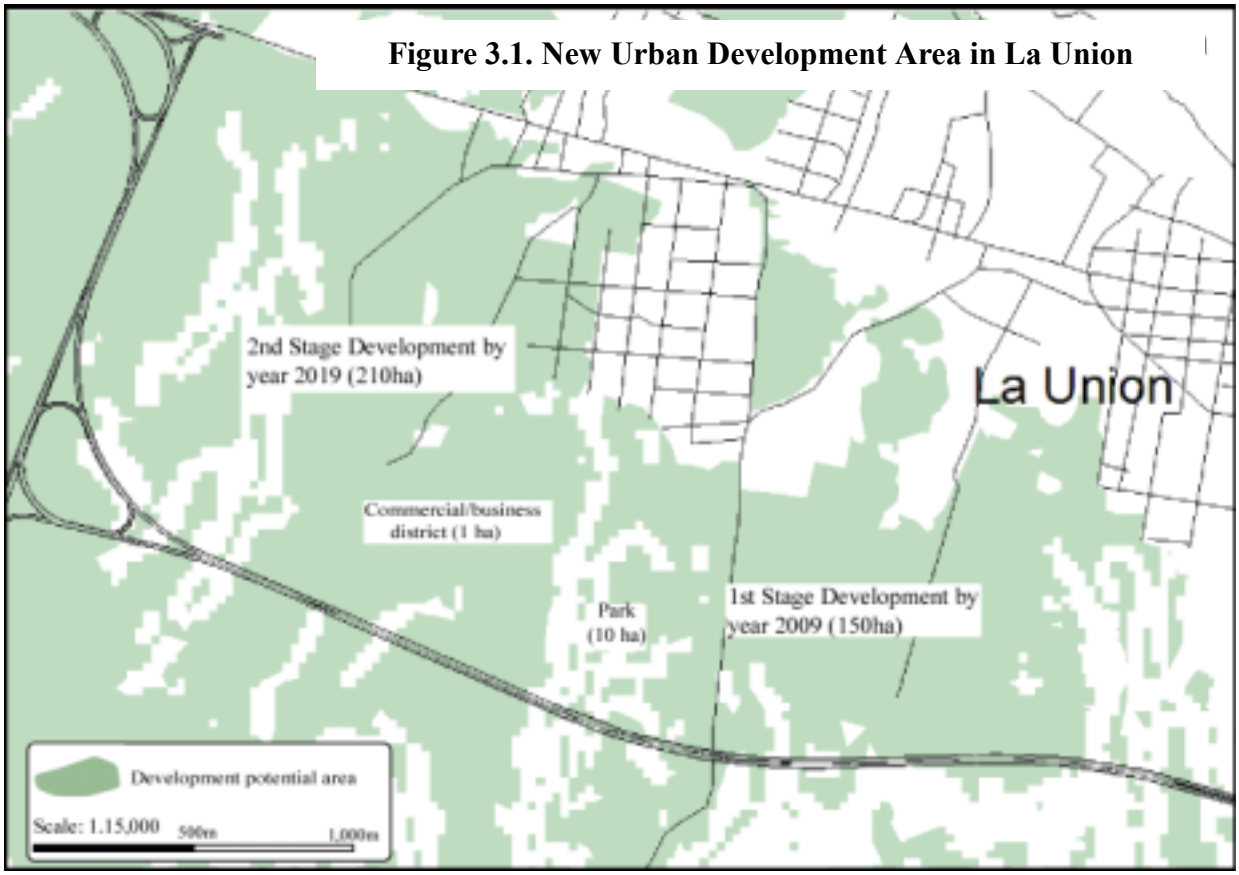


Figure 3.1. New Urban Development Area in La Union

Table 3.1 Land Use in New Urban Area

	2004-2009		2009-2019		2004-2019	
Land use	(ha)	(%)	(ha)	(%)	(ha)	(%)
Residential area	69	46	97	46	166	46
Roads	30	20	42	20	72	20
Parks/green area	28	19	40	19	68	19
Educational facilities	15	10	21	10	36	10
Other	8	5	11	5	18	5
Total	150	100	210	100	360	100
	42%		58%		100%	

A housing development is planned for high, medium and low-income population, which respectively is assumed to account for 20%, 60% and 20%. High-income population is assumed to live in detached houses, while the medium and low income population is assumed to live in 3-story condominiums. Land area allocated to each group is estimated to be 69ha, 83ha and 14ha respectively as shown in Table 3.2 with a set of assumptions.

Table 3.2. Land Area Requirement for Residential Development in New Urban Area

	Income level			
	High	Medium	Low	Total
Proportion in population (%)	20	60	20	100
Population	7,200	21,600	7,200	36,000
Number of persons per household	2.6	2.6	2.6	-
Number of household units	2,769	8,308	2,769	13,846
Type of houses	detached house	condominium	condominium	-
Floor area per unit (m^2)	150	100	50	-
Number of household units per building	1	50	100	-
Number of buildings	2,769	166	28	2,963
Common space per building (%)	0	20	20	
Total floor area per building (m^2)	150	6,000	6,000	-
Number of floors	2	3	3	-
Builing area/building (m^2/building)	100	2,000	2,000	
Building area/Land area (%)	40.0	40.0	40.0	
Land requirement per building (m^2)	250	5,000	5,000	
Total land requirement (ha)	69	83	14	166

Number of buildings by phase

	1st phase (-2009)	2nd phase (-2019)	Total
High income (detached houses)	1,154	1,615	2,769
Medium income (condominium)	69	97	166
Low income (condominium)	12	16	28

The Development Corporation will be responsible for:

a. Preparation of a land use plan of the residential area,
b. Legalization of the land use plan and its application,
c. Supervision of residential development to be carried out by the private sector,
d. Purchase of land to be used for public purposes (e.g., park, administrative services, etc.), and
e. Development of public facilities.

The existing legal framework for land use control needs to be clarified.

La Union-Conchagua Urban Renewal Project

Part of the existing urban area in La Union and Conchagua will be renewed with a view to creating an urban environment that is more efficient and unique with characteristics different from the new CBD planned in the new residential area. Urban renewal by the cooperation of public and private parties would significantly enhance touristic value of the two urban areas.

Its effects are summarized as follows:

- Enhancement of land use efficiency,
- Creation of an environment suited to higher grade commercial, business and tourist facilities,
- Increase in land use allocation for public space such as road and park, and
- Minimization of disasters.

The urban renewal project would proceed in the following steps:

- Preparation of an urban renewal plan,
- Legalization and agreement preparation for urban renewal plan,
- Implementation by public-private cooperation, and
- Guidance of individual private building renewal projects according to the prepared agreement and urban renewal plan.

Since there seems to be no previous examples of urban renewal in El Salvador, it would be necessary to start from analyzing the examples of other countries in the following aspects and their applicability to El Salvador:

- Legal system concerning land right and residential right,
- Planning and implementation process,
- Financial support programs, and
- Forms of public and private cooperation.

La Union-Conchagua Waterfront Development Program

CND has been in contact with the La Union municipality, Conchagua municipality and various local groups to discuss desirable waterfront development projects. The following list together with Figure 3.2 presents the proposed waterfront development projects as agreed in these discussions. It is proposed that all the projects be implemented in the first phase of the whole planning period until 2019, which is between year 2004 and 2009. The development cost for the first stage is estimated at US$10.1 million.

a. 1st stage (up to 2007)

1.1 Reconstruction and expansion of pier
1.2 Construction of seawall
1.3 Expansion of urban recreation area
1.4 Development of restaurant and complementary area
1.5 Construction of sports complex
1.6 Road expansion project
1.7 Sewerage stem development project for the urban area

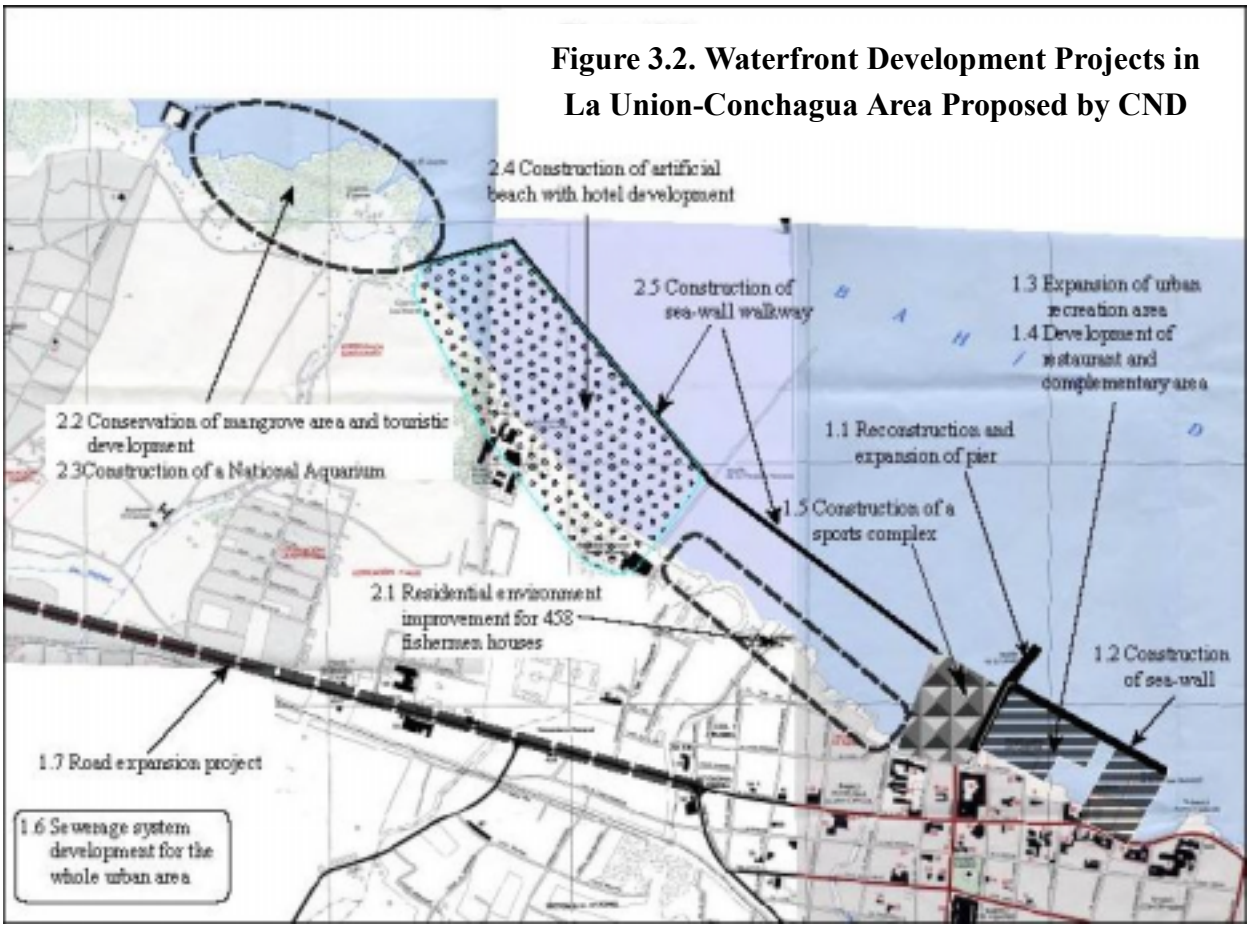


Figure 3.2. Waterfront Development Projects in La Union-Conchagua Area Proposed by CND

b. 2nd stage (up to 2009)

2.1 Residential environment improvement for 458 fishermen houses

2.2 Conservation of mangrove area and tourism development

2.3 Construction of a national aquarium

2.4 Construction of artificial beach with hotel development

2.5 Construction of sea-wall walkway

Final Report
Volume 3
Project Report

Part 5

Pre-Feasibility Study on Rio Grande de San Miguel
Water Resources Development and Management Project

Pre-Feasibility Study on Rio Grande de San Miguel Water Resources Development and Management Project

1. Background

The Rio Grande de San Miguel (hereinafter referred to as "San Miguel river"), is the second largest river in the Republic of El Salvador, located in the eastern part of the Country having a catchment area of 2,247km^2. In the center of the river basin is located San Miguel city, the regional center of the Eastern Region.

The basin has problems with water resources such as a difficulty in water use due to the long dry season from November to April, pollution of the river water and lagoons, sediment runoff from the mountain areas, decrease in groundwater tables, etc. Even during the rainy season, most parts of the Eastern Region experience dry spells called "*canícula*" for 6-30 days. Severe dry spells are experienced in the middle and the lower basins of the San Miguel river.

In the middle and the lower basins, there is a vast area of land with a potential mainly for agricultural development. Such a flat area is valuable in the Country, where mountainous areas prevail. However, due to the lack of irrigation infrastructures, the present agricultural productivity in the area is not high. Also, the large area that stretches from the Jiquilisco bay to the northwestern part of the Olomega lagoon suffers from severe floods of long duration due to its large rainfall depth, flat topography, and small river discharge capacity. Thus, most of the land is currently used for livestock grazing.

2. Objectives

The project has tree specific objectives as follows:

(1) To increase agricultural production by irrigation;

(2) To mitigate flood damages and enhance development potentials; and

(3) To enhance water and land environment through watershed management.

3. Existing Conditions of the Project Area

3.1 Topography and Geology[1)]

The San Miguel river basin occupies 10.7% of the national territory surrounded be mountain ridges with altitude of 300 m to 2,000 m, having a catchment area of 2,247 km^2. There are two large volcanoes, San Miguel and Usulutan, located in the western part of the basin. The area along the middle and lower reaches of the San Miguel river are flat and flood prone.

[1] Source: mostly from "The study on Comprehensive Flood Control for the Rio Grande de San Miguel", JICA, 1997.

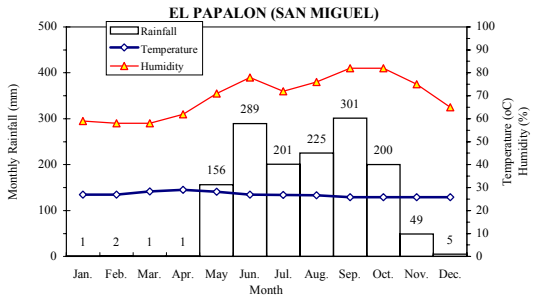
The geology of the basin is characterized by the volcanic layers consisting of pyroclastic rocks, mudflow deposit, lava, alluvial deposit, etc. The mudflow deposit areas are easily eroded and produce much sediment discharge into the rivers but flood discharge is relatively small because they are high in permeability.

3.2 Climate

The average monthly temperature in San Miguel ranges from 26°C in January to 29°C in April with an annual rainfall average of 26.9°C. The average monthly humidity at San Miguel rages from 58% in February to 82% in September.

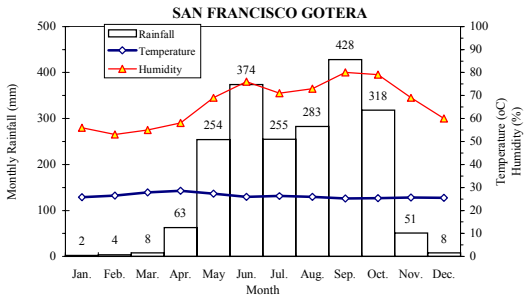
The annual average rainfall depth of the San Miguel basin is about 2,000mm in the northern mountainous area and about 1,500mm in the southern flat area with an average value of 1,673mm. About 93% of the annual depth occurs in the wet season from May to October as shown in the Figure 3.1.

Figure 3.1. Monthly Rainfall in the San Miguel River Basin



El Papalon Station (San Miguel)

Month	Rainfall (mm)	Tempera-ture (°C)	Humidity (%)	Wind Velocity (km/h)	Wind Direction
Jan.	1	26.9	59	5.0	N
Feb.	2	27.0	58	5.0	N
Mar.	1	28.3	58	5.0	S
Apr.	1	29.0	62	5.0	S
May	156	28.2	71	3.0	S
Jun.	289	26.9	78	1.0	SE
Jul.	201	26.8	72	5.0	N
Aug.	225	26.7	76	5.0	N
Sep.	301	25.9	82	5.0	S
Oct.	200	25.8	82	1.0	S
Nov.	49	25.8	75	5.0	N
Dec.	5	25.8	65	5.0	N
Annual	1,431	26.9	70		



San Francisco Gotera Station

Month	Rainfall (mm)	Tempera-ture (°C)	Humidity (%)	Wind Velocity (km/h)	Wind Direction
Jan.	2	25.8	56	3.6	N
Feb.	4	26.5	53	3	N
Mar.	8	27.9	55	3	N
Apr.	63	28.6	58	3	N
May	254	27.4	69	3	N
Jun.	374	26.0	76	3	N
Jul.	255	26.3	71	3	N
Aug.	283	25.9	73	3	N
Sep.	428	25.3	80	3	N
Oct.	318	25.4	79	3	N
Nov.	51	25.6	69	3	N
Dec.	8	25.5	60	3	N
Annual	2,048	26.4	67		

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, JICA (1997)

Rainfall Station	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Hopango	4	3	9	44	152	285	327	305	341	239	36	9	1,754
Santiago de Maria	1	4	11	46	189	320	257	279	404	269	73	12	1,865
El Papalon (San Miguel)	1	2	1	1	156	289	201	225	301	200	49	5	1,431
La Union	1	0	8	33	219	263	178	213	361	246	47	6	1,575
San Francisco Gotera	2	4	8	63	254	374	255	283	428	318	51	8	2,048

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, JICA (1997)

3.3 Socioeconomic Conditions

Based on the annual statistics (2001, DIGESTYC), the population of the San Miguel river basin in 2000 was estimated as 550,848. According to the JICA flood control study in 1997, 46% of the population was urban and 54% rural. The average family size in the basin has been estimated to be 4.3 persons/household, composed of 4.0 persons/household in the urban area and 4.6 person/household in the rural area. The flood prone area would have an area of 181.8km^2 and a population of 250,000.

The population in the Eastern Region increased at the average annual rate of 1.59% during 1992-2000. The crude birth and death rates in the Region are calculated at 29.1 and 6.4 per 1,000 respectively, based on data by department reported (DIGESTYC).

The GRDP data at department or regional level have not been obtained. The GRDP in the Eastern Region is derived by sector from the employment figures by assuming the labor productivity in the Region is 10% lower for all the three broad sectors than the natural figures. The GRDP is thus calculated to be US$1,768 million, consisting of US$367 million or 20.8% in agriculture, US$324 million or 18.3% in industry, and US$1,077 million or 60.9% in services. The per capita GRDP is calculated at US$1,380 in the Eastern Region, corresponding to 66.1% of the per capita GDP of El Salvador.

3.4 Land Use

The present land use of the basin consists of urban 29km^2 (1.3%), agriculture 359km^2 (16.0%), pasture 1,464km^2 (65.2%), forest 331km^2 (14.7%), and others 64km^2 (2.8%), as shown in Figure 3.2. Present land use in the basin is dominantly pastureland. In the flood prone area, present land use consists mainly of pasture (57.0%), and sugarcane field (15.9%) as shown in Table 3.1.

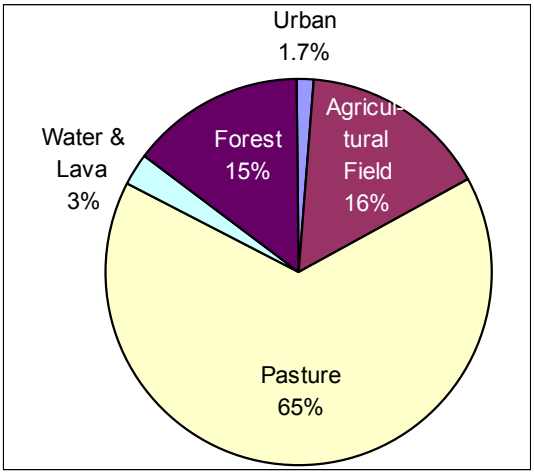


Figure 3.2. Land Use in San Miguel River Basin 1995

Table 3.1. Present Land Use in Inundation Area of San Miguel River Basin (1995)

Area	Land Use	Annual Crop	Surager-cane	Grazing (Pasture)	Bush & Forest	Urban	Other	Total
San Miguel	(ha)	22.9	169.3	251.6	41.2	164.7	50.4	700
	(%)	3.3%	24.2%	35.9%	5.9%	23.5%	7.2%	100%
Olomega	(ha)	896.7	1,687.0	6,095.8	109.5	0.0	1,050.9	9,840
	(%)	9.1%	17.1%	61.9%	1.1%	0.0%	10.7%	100%
Jocotal	(ha)	479.7	701.6	2,446.7	36.0	0.0	774.1	4,438
	(%)	10.8%	15.8%	55.1%	0.8%	0.0%	17.4%	100%
Usulutan	(ha)	465.3	325.6	1,522.7	417.8	0.0	398.6	3,130
	(%)	14.9%	10.4%	48.6%	13.3%	0.0%	12.7%	100%
TOTAL	(ha)	1,864.6	2,883.5	10,316.8	604.5	164.7	2,274.0	18,108
	(%)	10.3%	15.9%	57.0%	3.3%	0.9%	12.6%	100%

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, 1997, JICA.

3.5 River Basin

The basin is subdivided into the following three parts:

- Upper basin Upstream of San Miguel city: mountain areas for main sources of water;
- Middle basin San Miguel-Olomega: large flood area with potential for agriculture and urban development; and
- Lower basin Jocotal-Estuary: large flood area with agricultural development potential.

The characteristics of the basin are summarized as follow:

- Major tributaries are concentrated in the upper basin;
- The vegetation of the basin is poor consisting mainly of pasture and upland field area; and
- Land erosion is remarkable in the mudflow deposit areas; the erosion in other areas is not so serious, though sediment runoff would be lager than that of the forest area.

3.6 River Conditions

The characteristics of the San Miguel river are as follows.

- The riverbed slopes of the flood prone areas near the lagoons of Jocotal and Olomega are 1/2,300 and 1/1,700, respectively. The discharge capacity of the channels is very small compared to the flood discharge.
- The dikes, one on the right bank in the lower reach constructed by the Government and others in the flood prone areas constructed by private entities.
- There is no dam in the basin.

3.7 Water Quality

The river water is polluted due to domestic and industrial wastewater effluents. The value of BOD at Villerias (upstream of San Miguel city) and Moscoso (downstream of San Miguel city) during the dry season in 1981 recorded high concentration of 6.6 and 15.2 mg/liter, respectively. The values of BOD during the wet season were less than 3.0mg/ liter. The BOD and COD values in May 1996 at Moscoso as observed by JICA (1996) were 4.67 and 40.98mg/ liter, respectively.

San Miguel River

The pollutant sources of the San Miguel river are considered as follows:

- Urban sewage from San Miguel city,
- Cattle waste scattered all over the area, and
- Wastewater from sugarcane and coffee processing.

The water quality of the Olomega lagoon is also low in TP, TN, BOD and COD. The BOD and COD values in May 1996 at the center of the Olomega Lake measured by JICA (1996) were 10.0 and 16.3 mg/ liter, respectively. The pollutant sources of the lake are considered to be from own catchment and floodwater from the San Miguel river.

3.8 Water Supply

Service coverage for water supply by ANDA in the Eastern Region is below the national average (88% in 2001). In terms of population coverage in urban areas, the coverage by ANDA is 85% in Usulutan, 64.5% in San Miguel, 62.5% in Morazan, and 72% in La Union at department levels. In the major cities over 10,000 urban population in the San Miguel basin, the population coverage are 86.3% in Usulutan city, 71.6% in San Miguel, 62.5% in San Francisco Gotera cities, as shown in Table 3.2.

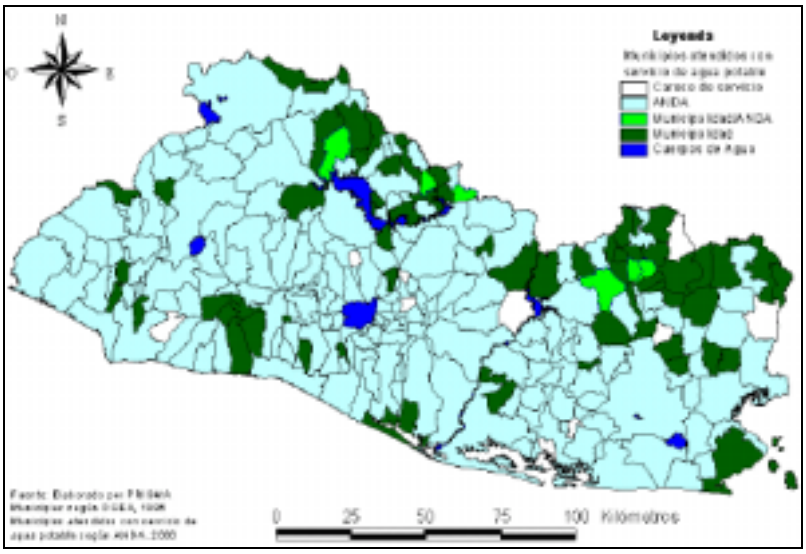
Most of the cities use groundwater and springs as sources of water supply (Figure 3.3). The current situation of water supply to San Miguel city and Usulutan city is summarized in Table 3.3. ANDA supplies potable water to the capital city of Usulutan by tapping groundwater with springs and deep wells in the coastal plain, at the rate of $0.3m^3$/sec. San Miguel city is supplied from the groundwater intake located on the eastern slope of San Miguel volcano; its intake rate is $0.7m^3$/sec from springs and deep wells exploited by ANDA.

Table 3.2. Current Situation of Urban Water Supply by ANDA in San Miguel River Basin

No.	Department	Municiparity	San Miguel Basin	No. of Connection (Household)	Supply *1) Population (people)	Urban Population (people)	Population Coverage (%)	Monthly Consumption (m^3/month)	Unit Consumption (liter/c/d)
1	Usultan	Usultán	20%	7,666	38,330	44,407	86.3	325,500	283
3	Usultan	Santa Elena	100%	1,256	5,060	5,060	100.0	45,100	297
4	Usultan	Jucuapa	40%	2,138	8,922	8,922	100.0	82,400	308
5	Usultan	Santiago de María	10%	2,141	10,705	12,668	84.5	0	
8	Usultan	Estanzuelas	100%	481	2,405	3,140	76.6	18,900	262
10	Usultan	Jucuarán	30%	227	1,135	1,633	69.5	9,700	285
15	Usultan	Santa María	100%	234	1,170	2,591	45.2	9,200	262
17	Usultan	California	30%	208	1,040	1,722	60.4	0	
18	Usultan	Concepción Batres	90%	180	900	2,356	38.2	8,500	315
SUB TOTAL				**14,531**	**69,667**	**82,499**	**87.0**	**695,100**	**287**
1	San Miguel	San Miguel	100%	22,332	111,660	156,036	71.6	1,048,000	313
2	San Miguel	Chinameca	80%	1,313	6,565	7,564	86.8	50,500	256
3	San Miguel	San Rafael Oriente	100%	896	4,480	8,375	53.5	31,600	235
4	San Miguel	El Tránsito	100%	1,064	5,320	7,760	68.6	45,100	283
5	San Miguel	Sesori	20%	230	1,150	1,457	78.9	8,400	243
6	San Miguel	Moncagua	100%	381	1,905	2,279	83.6	17,300	303
7	San Miguel	Uluazapa	100%	146	730	1,403	52.0	4,800	219
8	San Miguel	Quelepa	100%	180	849	849	100.0	8,500	334
9	San Miguel	Lolotique	20%	765	2,802	2,802	100.0	26,300	313
12	San Miguel	San Jorge	100%	282	1,410	4,364	32.3	8,200	194
13	San Miguel	Chirilagua	60%	614	3,070	5,120	60.0	23,500	255
SUB TOTAL				**28,203**	**139,941**	**198,009**	**71.0**	**1,281,100**	**268**
1	Morazan	San Francisco Gotera	100%	1,711	8,555	13,691	62.5	83,000	323
2	Morazan	Jocoro	50%	408	2,040	3,509	58.1	16,500	270
4	Morazan	Chilanga	100%	135	675	1,892	35.7	5,400	267
5	Morazan	Sensembra	100%	87	435	1,002	43.4	3,600	276
SUB TOTAL				**2,341**	**11,705**	**20,094**	**57.9**	**108,500**	**284**
4	La Unión	San Alejo	20%	533	2,665	4,409	60.4	18,900	236
7	La Unión	Yucuaiquin	30%	414	1,610	1,610	100.0	18,900	391
8	La Unión	Yayantique	48%	134	670	1,534	43.7	4,500	224
9	La Unión	El Carmen	40%	506	2,143	2,143	100.0	10,400	162
SUB TOTAL				**1,587**	**7,088**	**9,696**	**88.8**	**404,900**	**253**
TOTAL (Urban Area in S.Miguel Basin)				**46,662**	**228,401**	**310,298**	**73.6**	**2,489,600**	**273**

Source: Boletín Estadístico No.23, 2001, ANDA.
Note *1) Assumed 5 person/houshold (average number of urban family) for urban area.

Figure 3.3. Municipalities with the Potable Water Supply System (2001)



Source: PRISMA, 2001.

Table 3.3. Current Situation of Urban Water Supply in San Miguel and Usulutan Cities

Name of City		San Miguel City	Usulután City
Administration of Water Supply System		ANDA	ANDA
Water Source		GW (95%) + Spring (5%)	GW (41%) + Spring (59%)
No. of W.Source (Groundwater Wells)	(wells)	13	3
Depth of Wells	(m)	120 ~ 180 m	20 m
No. of W.Source (Surface water)	(sites)	1 spring (Moncagua)	1 spring (La Ceiba)
No. of receptions (intake)	(nos.)	5	2
Current Total Daily Production Capacity	**(m^3/day)**	**31,135**	**11,750**
Current Water Demand (Dec. 2001)			
No. of Connection Households	(HH)	22,332	7,666
Estimated Supplied Population (HH x 5 pers.)	(people)	111,660	38,330
Service Coverage Ratio in Servoce Area	(%)	71.6%	86.3%
Population coverage in Municipality	(%)	47%	56%
Mean Monthly Consumption	(m^3/month)	1,048,000	325,500
Daily Mean Consumption (Demand)	**(m^3/day)**	**34,930**	**10,850**
Unit Daily Mean Consumption	(liter/p/d)	313	283
Deficit (Production Capacity - Demand)	**(m^3/day)**	**-3,795**	**900**
Operattion Years	(years)	> 60 Years	> 40 years (since 1962)
Illigal Connection Rate	(%)	35%	> 1.3%
Water Loss Rate	(%)	30%	(unknown)
Service of Supply 24 hours a day	-	YES	NO

Source: ANDA (2002)

The coverage ratio appears high but it does not guarantee a full access, due to following problems:

a) Average supply time fluctuates between 16 and 18 hours per day;

b) Quality of the water does not assure the consumers' health (hence increased demand for bottled water); and

c) Disorderly organization creates areas of difficult access.

The production and supply capacity is not enough to meet the water demand in San Miguel city. Water supply capacity needs to be expanded continuously in most municipalities to meet growing demands due to urbanization. Moreover, those systems were established over 40 or 60 years ago and the rates of water losses are high. Improvement and rehabilitation of the existing supply systems are also required. At present, only San Miguel city has an expansion plan for a larger water supply system covering several communities. To meet future water demand in these cities, rehabilitation and new expansion projects will be required.

3.9 Sewer System

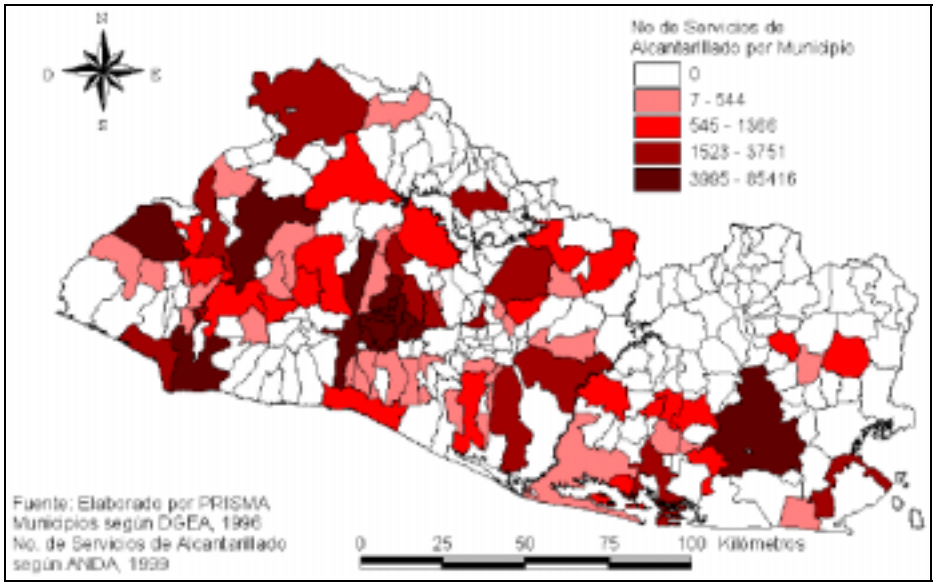
In total of 87 municipalities in the Eastern Region, only 16 municipalities (18%) have sewer systems by ANDA and the remaining 71 municipalities (82%) lack services of sewer systems as shown in Table 3.4 and Figure 3.4.

Table 3.4. With/Without Sewer Systems by Municipalities in Eastern Region (2001)

No.	Department	No. of Municipalities	With Service by		With Service		Without Service	
			ANDA	Others				
11	USULUTAN	23	7	-	7	**30%**	16	70%
12	SAN MIGUEL	20	4	-	4	**20%**	16	80%
13	MORAZAN	26	2	-	2	**8%**	24	92%
14	LA UNION	18	3	-	3	**17%**	15	83%
TOTAL (Eastern Region)		**87**	**16**	**-**	**16**	**18%**	**71**	**82%**

Source: ANDA, Boletin Estidístico, No.23 (2001).

Figure 3.4. Distribution of the Sewer System by Municipalities (1999)



Source: PRISMA, 2001.

According to the RAS-ES study[2], situations of sanitation/ sewer system at the national level are summarized as follows. Of the rural population, 79% has infrastructure systems for the disposition of human wastes. Only 38% of the rural population has appropriate disposition of human wastes. As for the water supply systems, only 21% has treatment of served water.

The coverage by latrines is another aspect that should be considered for rural sanitation. An education program for community development is most important activity for rural sanitation. The actual situation of sanitation/ sewer system by department is evaluated by the RAS-ES study as shown in Table 3.5. The lowest real coverage is in the La Union department at 35%.

[2] Red de Agua y Saneamiento de El Salvador, Diagnostico Sobre la Situacion de Agua y Saneamiento en El Salvaador, USAID, (2001).

Table 3.5. Situation of Sanitation System by Department (2001)

No.	Department (Eastern Region)	Coverage of Sanitation System (Unit=%)			
		Constructed facility	In Use	Real covering	Covering
		a	b	c=a x b	
11	**Usultan**	71	71	**51**	5
12	**San Miguel**	85	55	**47**	8
13	**Morazán**	64	71	**47**	27
14	**La Unión**	64	55	**35**	7

Sources: RAS-ES, USAID, 2001.

3.10 Groundwater Conditions

Usulutan has abundant groundwater resources derived from both young volcanic rocks and alluvial plains. Moderate to large quantities of groundwater are available throughout the year in most part of the department, including the capital city, except high altitude areas and hillsides of the Usulután volcano, coastal areas, and a very small area in the northwest. The best aquifers are found in upper layers of the San Salvador formation. The geothermal water associated with the Usulután volcano contains high levels of mineralization.

In San Miguel, moderate to large quantities of groundwater are available in some 20% area of the department, including San Miguel city and areas to the west, north and south of the city. Areas along the Río Grande de San Miguel are also favorable for groundwater endowments, but the water is contaminated closer to the river. The southern part of the department, particularly to the north and west of the Olomega lagoon, is also favorable for groundwater exploration. Groundwater in some areas, however, contains arsenic due to volcanic activities. In the northern part of San Miguel, only moderate quantities of groundwater are expected in some areas, derived from old volcanic rocks.

Old volcanic rocks cover most part of Morazán, and thus groundwater potentials are generally low. Detailed surveys, geophysical exploration and infiltration tests would be necessary to identify favorable aquifers.

San Miguel city is supplied water mainly by the groundwater. The groundwater level in San Miguel city has dropped due to concentrated locations of intake wells as shown in Table 3.6.

3.11 Floods

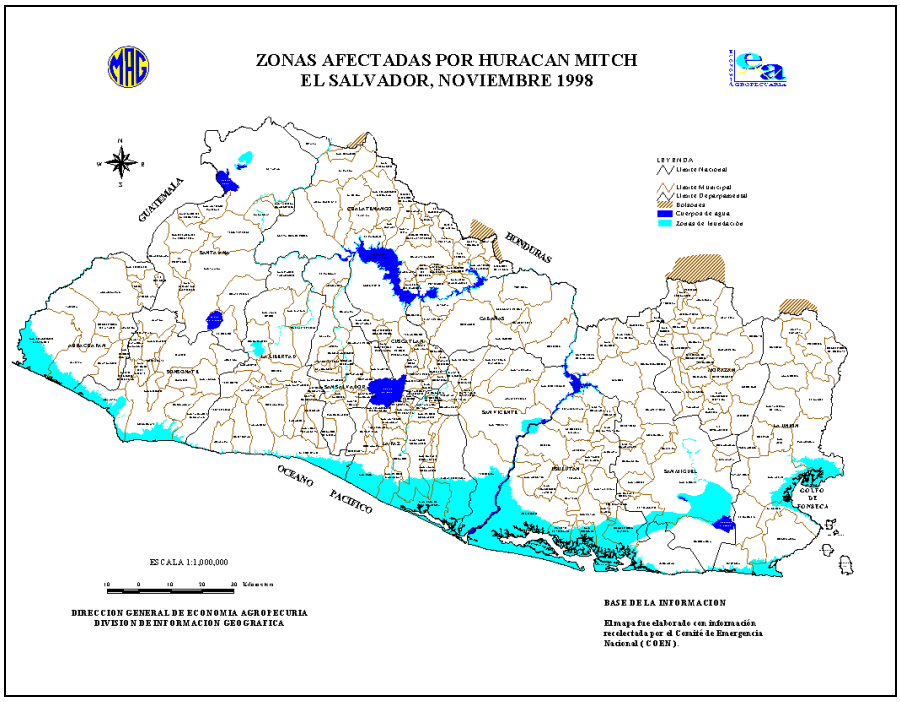
Not only downstream areas but also some midstream and upstream areas are subject to habitual inundation in El Salvador. While the Country is rarely subject to direct attacks of hurricanes, hurricane-induced rainfalls often cause extensive flooding. In the Eastern Region, extensive lowland areas were inundated by storms caused by the hurricane Mitch from the Lempa downstream, through the Jiquilisco bay area, to the northwestern area of the Olomega lagoon and also in the area around the La Union bay, the southeastern tip around Tamarindo, and a small area along the middle reach of the Lempa river downstream of the September 15 dam (Figure 3.5).

Table 3.6. Wells for Water Supply by ANDA and Groundwater Tables in San Miguel City

Well Location Name	WELL NO.	Dia	Production in 1996	Water Table Lowering		Groundwater Depth (m)											
						1958	1966	1970	1972	1973	1982	1985	1989	1992	1994	1995	1996
		(inchi)	(m^3/d)	(m)	(m/year)												
La Paz	1	12	1,003	8.30	0.38					10.92						19.22	
	2	16		0.91	0.04			15.25								16.17	
	3	12	1,144	15.71	0.79				13.73					29.43			
	4	10	1,458	1.53	0.51									11.29		12.81	
Hillerman	1	16	4,320	8.08	0.38					13.27		13.27			21.35		
	2	14		6.10	0.29					13.73		13.54			19.83		
	3	16	4,320	0.00	0.00					20.44					20.44		
Belen	1	16	1,116	1.53	0.05		9.76					9.75					11.29
	2	16	725	2.75	0.11			13.73				26.80					16.47
	3	16		2.14	0.10					9.76		10.58				11.90	
El Molino	1	10	1,496	11.47	0.88						2.26					13.73	
El Sitio	1	12	6,034	0.61	0.15									23.79			24.40
	2																
Jalacatal	1	16/18	3,456	1.53	0.04	30.50											32.03
	2																
Brigada	1	8		3.05	0.44								11.44				14.49
Moncagua	1		379														
Tlaloc	1																
San Carlos	1		774														

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, 1997, JICA

Figure 3.5. Inundation Area by the Hurricane Mitch (November 1998)



Source: MAG.

The flooded areas in the past are located along the San Miguel river at around the Olomega lagoon, around the Jocotal lagoon, near San Miguel city, and the river mouth delta area. According to the study by JICA (1997), those are considered to be a potential flood area and the total area is 181km^2. The estimated population in the potential flood area in 1992 was 32,700. There are frequent flood areas around Olomega and Jocotal with the total of 75km^2 where flooding occurs almost every year. The past major floods have occurred in 1969, 1975, 1980, 1988, 1991, 1992, 1995 and 1998. The floods occur mainly from August to October.

The 1995 flood inundated the areas of San Miguel (2.8km^2), around Olomega (88.5km^2), around Jocotal (35.8km^2) and Usulutan (6.6km^2) with the total area of 133.7km^2 excluding the lake water area. The maximum depth and duration of the 1995 flood are 0.5m and 4 days in the San Miguel area, 0.2m and 8 days in the area around Olomega, 1.5m and 11 days in the area around Jocotal and 0.9m and 49 days in the Usulutan area according to the interview made by the JICA study in 1997.

The present land use of potential flood area consists of pasture (57%), sugarcane field (16%), annual crops fields (10%), etc. as shown in Table 3.1. The lands are good for agriculture, if there is no flood.

3.12 Droughts

In the Eastern Region, rain shadow areas are found in the eastern most area around the Fonseca gulf and along the border with Honduras and in the midstream of the Río Grande de San Miguel to the east of the San Miguel volcano. Even during the rainy season, some areas experience dry spells called "*canícula*" for 6-30 days. Most part of the Eastern Region experience moderate dry spells, except for the northern part of the Torola river basin and the area of the volcanic formation. Severe dry spells are experienced along the Pacific coast from the Jiquilisco bay to the La Unión bay and the southern part of La Unión especially along the border with Honduras (Figure 3.6).

Runoff coefficients are relatively small for most rivers in El Salvador despite a small area of remaining forest cover and degraded forest resources. Areas underlain by relatively young volcanic rocks function effectively as recharging areas for groundwater. Also heavy rainfalls immediately following dry spells or prolonged drought tend to be absorbed more easily by soil. Relatively high evapotranspiration, ranging 1,400-1,900mm/year as observed, is another factor for the low runoff coefficients. Evapotranspiration is particularly high in the Eastern Region: 1,964mm in San Miguel, 1,944mm in La Union, and 1,986mm in San Francisco Gotera. The runoff coefficients are even lower in the Eastern Region: 14% for the Rio Grande de San Miguel basin. This implies conversely, even discounting the higher evapotranspiration, groundwater potentials are high in the Eastern Region.

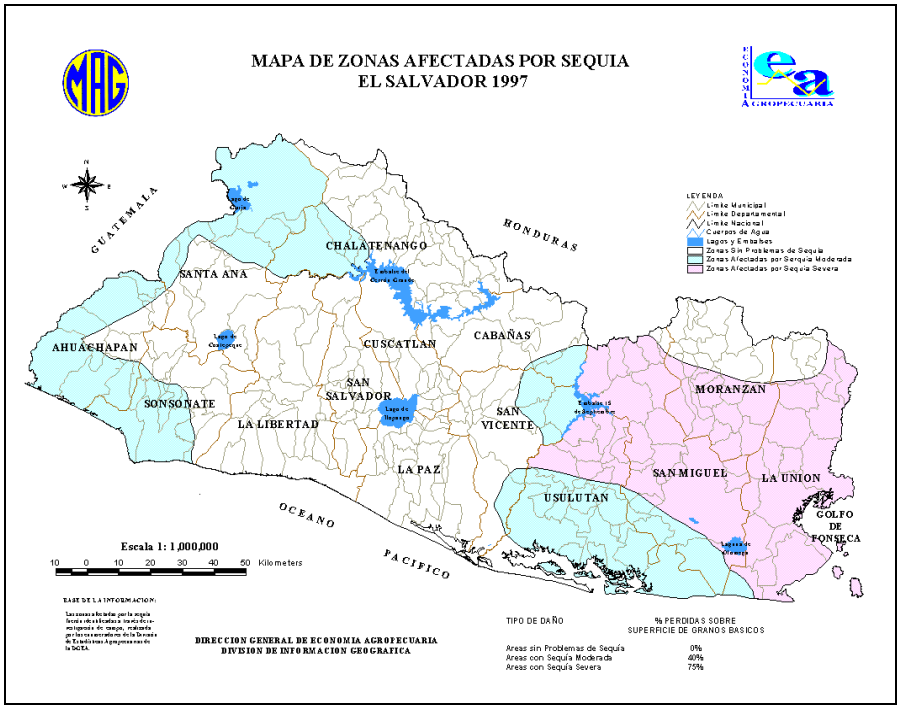
The El Niño in 1997-1998 was especially significant for the Central American region (US$475 million losses reported). The drought in 2001 was also serious especially in the Eastern Region or 44 municipalities of San Miguel, La Union, Usulutan and Morazan.

The damages of the 1997-1998 drought in El Salvador were estimated as follows:

- GDP growth: Reduction from 4.57% to 4.04% (-0.53%)
- Total damages: US$ 160 million (1.4 thousand million colons)

- Maize: -166,500 ton (-3.7 million quintals, i.e., -25.2%)
- Coffee: -24,225 ton (-539 thousand quintals, i.e., -17.1%)
- Fisheries (shrimp): -1,200 ton (-16.3%)
- Hydropower (CEL): -US$17.14 million

Figure 3.6. Zones Affected by Drought in El Salvador, 1997



Source: MAG.

3.13 Deforestation

The deforestation has been a serous problem in El Salvador for a long time and is still continuing. It has been caused by human activities such as agriculture, livestock, extraction of fuel supply and the civil conflict. According to the JICA study (1997), forest area in the San Miguel River basin is only 331 km^2 (15% of the catchment area). The forest area in the whole country had been decreased from 1,903 km^2 in 1978 to 1,290 km^2 in 1990 with an annual deforestation rate of 51 km^2 per year. The annual average erosion depth in the upper basin is in the order of 1.0mm/year and it is not so large. The value of deforested mudflow deposit areas, however, is much higher and a large volume of sediment is discharged into the river. The river discharge, both of flood and low-flow, is considered to be affected by deforestation.

Several reforestation projects are under implementation for soil conservation and reconstruction of natural ecosystems in the area. These projects are implemented by NGOs funded by Canada, U.S., etc.

3.14 Olomega Lagoon

The Olomega lagoon is now used mainly for fisheries purpose. According to the JICA study (1997), the most common species for fishery are Guapote Tigre, Tilapia, Bagre, Mojarra, etc., and the annual production ranges from 760 to 56 tons depending on the lake water level and other reasons. The area and the average water depth of the lake are about 20km^2 and 2m, respectively.

Presently, a concrete structure exists at the outlets of the channel and upstream channel has been buried leaving the lowest lake edge El. 65.2m. The outlet structure of the Olomega lagoon has history of conflicts between the fishermen and the farmers as follows.

Before 1940:	The main course of the San Miguel River had been located in the south of the present river
1940's	A severe drought hit the area and the area of the Olomega lagoon retreated. The farmers taking advantage of the lagoon water retreat, placed their landmark inside the present lake area.
1960-1970	MAG and landowners shifted the course of the river northward to the present position in order to protect the area from flooding.
1977, 1978	A severe drought hit again and the lagoon area shrank. The fishermen temporarily had to move to the artificial lakes along the Lempa River for fishery.
1977, 1978	A dike was constructed to protect the northern area of the lagoon from flooding
1984-1986	The fishermen group closed the outlet from the Olomega lagoon to the Olomega Drainage in order to keep the lake water level.
1989-1992	The lake water rose and overflowed into the Olomega Drainage in uncontrolled way.
1992	The water flow started to form a single stream into the Olomega Drainage. However, the outlet from the lake was still not a channel but a random overflowing.
1995 (Mar.)	An NGO, which is representing the fishermen, constructed a concrete weir at the entrance of the Olomega Drainage.
1995-196	The side of the concrete weir was scoured by flood flow.
1996 (Jun.)	The NGO submitted and application to MAG for construction of a weir.
1996-1997	The side of the concrete weir was scoured further.

Presently, the lagoon surface is being maintained higher than that in 1970's. The minimum lake water level during the dry season in 1996 was El.64.8 m. Consequently, the fishermen want to maintain and repair the concrete structure to secure the maintenance of the present lake water level, while the farmers want to recover the once cultivated land on the north of the Olomega lagoon.

Existing Dike at Middle Reach of San Miguel River

Concrete Weir at Entrance of Olomega Drainage (Rio Pelota)

3.15 Jocotal Lagoon

The Jocotal lagoon has an area of about 5km^2 with an average depth of 1.5m. The lagoon is used for fishery and, at the same time, is a precious area for flora and fauna such as migratory birds, fishes, and other wetland animals. The lagoon and the surrounding area (18.8km^2) are designated as an Environmental Conservation Area of the Republic. The kinds of fish for fishery are similar to those of Olomega. During the dry season, the migratory birds stay in and around the lake. In the flood season, the San Miguel river carries much sediment and polluted water into the lake giving impact on its ecology.

3.16 Existing and Potential Irrigation Area

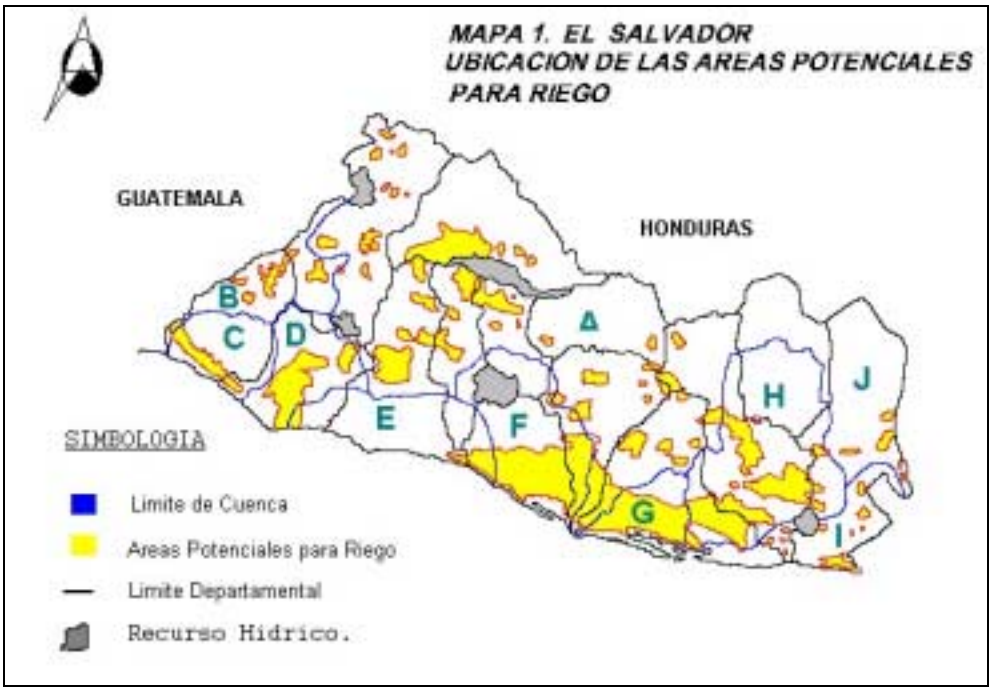
Only small irrigation facilities exist in the Eastern Region to cover 330ha in San Miguel, 62ha in Usulután, and 90ha in Morazán (Table 3.7). Potential irrigation area was evaluated by the PLAMDARH study by UNDP in 1982 (Figure 3.7, Table 3.8). The potential irrigation area of the San Miguel river basin (Region H) is 2,735km^2.

Table 3.7. Existing Irrigation Area in the Easter Region (2002)

ID. No.	Name	Location	Area (ha.)	Type of Irrigation System	Water Source	Cultivations	No. of Farmers	Intake Discharge (Little / sec)
REGION IV - SAN MIGUEL								
43	CHAPELTIQUE	CHAPELTIQUE, D. SAN MIGUEL	329.7	Gravity	RIO CHAPELTIQUE	PASTURE, CEREALS	90	471
REGION IV - MORAZAN								
44	YAMABAL	YAMABAL, D/MORAZAN	43.4	Gravity	RIO YAMABAL	GRASSES, MUSACEAS & VEGETABLES	38	62
45	AGRICULTORES UNIDOS DEL RIO GUALABO	C/SAN BARTOLO , J/GUATAJIAGUA, D/MORAZAN	46.9	Gravity	RIO GUALABO	GRASSES & VEGETABLES	26	67
REGION IV - USULUTAN								
46	EL CARAO	C/ANCHILA, J/CONCEPCION BATRES, D/USULUTAN	46.9	Gravity	RIO MENDEZ and RIO SAN ILDEFONSO	VEGETABLES, CEREALS	31	67
47	CEIBA HUECA	CONCEPCION BATRES, D/USULUTAN	14.7	Gravity	RIO MENDEZ	VEGETABLES, CEREALS	30	21

Source : MAG, (2002).

Figure 3.7. Potential Irrigation Area in El Salvador



(Source: MAG)

Table 3.8. Potential Irrigation Area (ha) in El Salvador

Region	Class of Soil Type					Total (ha)
	I	II	III	IV	V	
A	295	10,551	34,362	15,182	7,189	67,579
B	-	2,453	2,496	3,856	2,035	10,840
C	753	2,425	4,600	2,133	2,341	12,252
D	755	4,195	7,186	11,374	5,358	28,868
E	-	2,207	2,121	1,643	734	6,705
F	3,100	12,907	21,328	12,623	4,100	54,058
G	5,020	10,250	8,510	3,540	2,650	29,970
H	1,264	10,503	12,719	8,696	8,390	41,572
I	-	852	3,603	2,351	2,280	9,086
J	-	-	3,793	2,518	6,294	12,605
Total	11,187	56,343	100,718	63,916	41,371	273,535

Source: "Plan Maestro de Desarrollo y Aprovechamiento de los Recursos Hidricos" (PLAMDARH), UNDP, 1982.

4. Related Projects and Plans

4.1 Overview

Major projects, studies and plans related to water resources development and flood control for the San Miguel river basin are as follows.

1) Groundwater Research Project, FAO, 1964
2) Rio Grande de San Miguel Basin Evaluation, MAG, HARZA, 1966
3) Olomega Project, MAG, HARZA, 1967
4) Preliminary Soil Conservation Program, MAG, 1967
5) Usulután - San Miguel Irrigation Project, MAG, TRANARG, 1976
6) Water Resources Master Plan (PLAMDARH), UNDP, 1981
7) Hydropower Generation M/P of the San Miguel River, CEL, 1982
8) San Francisco Gotera Irrigation Project, MAG, 1989
9) Irrigation and Drainage Project, Region "C", MAG, 1989/ 1991
10) Hydropower Projects in Lempa and San Miguel Rivers, CEL, 1995
11) National Environmental Strategy and Action Plan, SEMA, 1994
12) Comprehensive Flood Control for Rio Grande de San Miguel, JICA, 1997

Most previous studies were conducted from the viewpoint of single purpose, i.e., only for irrigation, hydropower, or flood control. As mentioned above, this area is characterized by problems of floods and droughts. There was an experience of failure in irrigation project without flood measures in the basin. MAG constructed irrigation canal and pump station at the left bank of the San Miguel river near the Los Ranchos village in the 1990's. These irrigation canals, however, were practically destroyed by the hurricane Mitch in 1998. It is important that watershed development project should be implemented incorporating both measures at the same time.

4.2 Olomega Project (MAG/HARZA, 1967)

In 1967, MAG formulated an irrigation and flood control project for the Olomega valley to the north of the Olomega lagoon. The purposes of the project are as follows:

1) to protect the area of north of the Olomega lagoon from flood damage, and
2) to irrigate the area of north of the Olomega lagoon.

After studying various alternatives including the San Esteban multipurpose dam to attain the irrigation and flood control purposes, following combination of facilities was selected.

i) For flood control

- Utilization of the Olomega lagoon as a retarding basin together with embankments to the north of the lake and a floodway to divert flood discharge from the San Miguel river to the lagoon, and
- Drainage pipe from Lake San Juan Area to the San Miguel river.

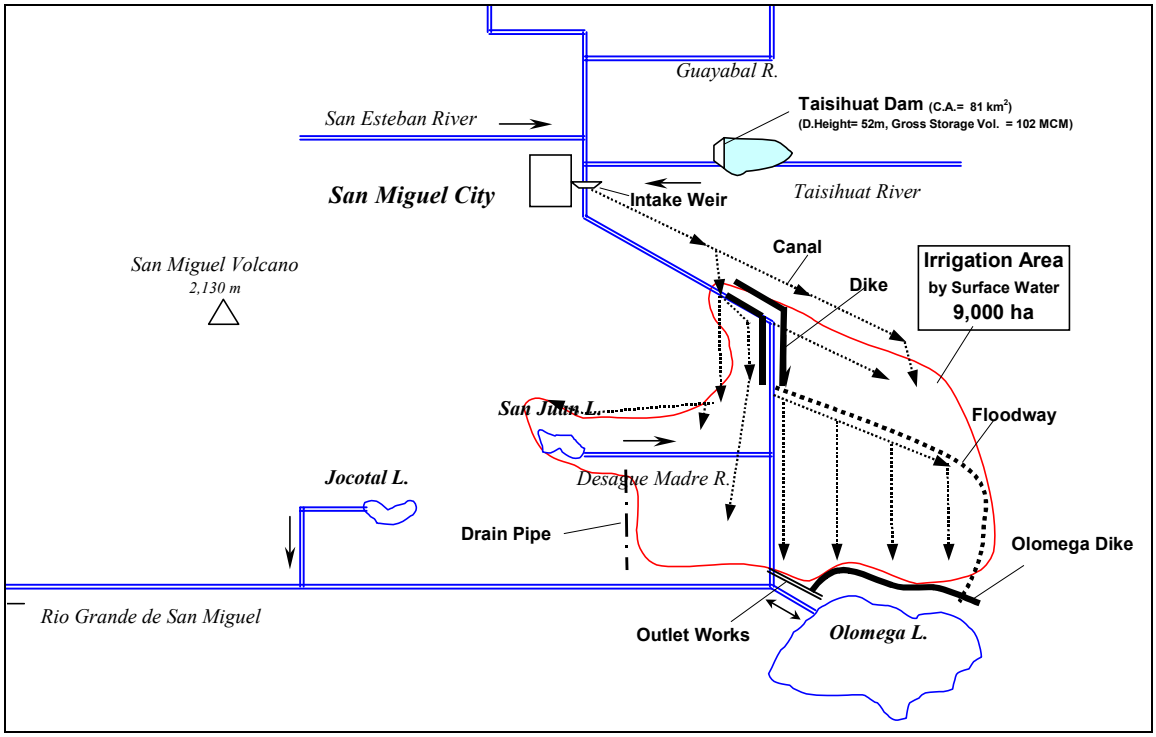
ii) For irrigation:

- Construction of the Taisihuat dam (Catchurart area=81km^2, dam height=52m, gross storage volume=102MMC) and intake facilities for water source, and
- Irrigation channels to convey and distribution water to the irrigation area.

The overall configuration of the project is shown in Figure 4.1.

By implementing these projects, it is possible to irrigate and mitigate inundation on 9,000ha of farmland.

Figure 4.1. Concept of Olomega Project (MAG/ HARZA, 1967)



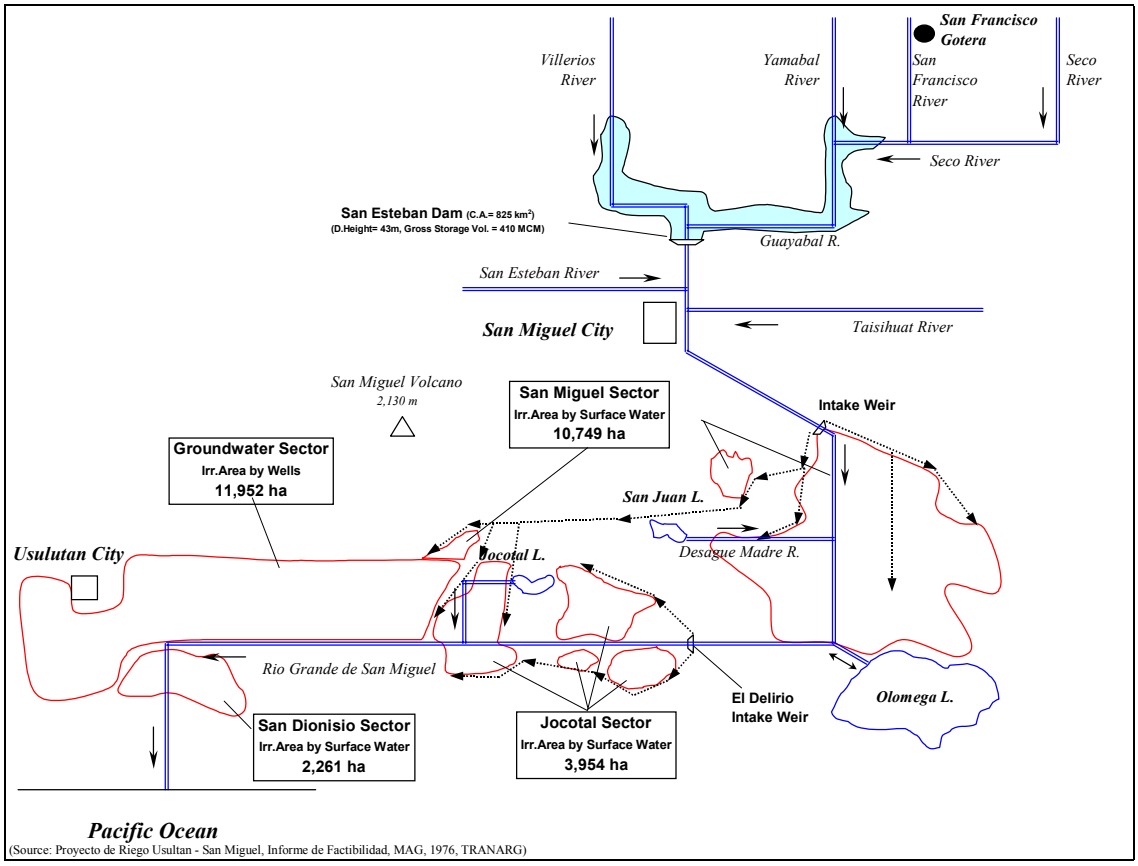
4.3 Usulutan-San Miguel Irrigation Project (MAG/TRANARG, 1976)

In 1976, MAG formulated a major irrigation project covering a large area of Usulutan and Sun Miguel. The purpose of the project was to irrigate an area of 29,000 ha extending from Usulutan to the Olomega valley. The project area is divided into four sections. The San Miguel section has the San Esteban dam as the main structure. In the Jocotal section and the San Dionisio section, the water sources are the San Miguel river, the Olomega lagoon and

groundwater near the Jocotal lagoon. The intake structures for the above two sections in the river are at El Derilio and Vado Marine respectively. In "Aguas Subterraneas Sector" of Usulután area, the source is groundwater.

Figure 4.2 shows the concept of the whole project. Table 4.1 shows outline of the project and the project cost in 2003 price that was estimated using updated cost in 1990 price by JICA study (1997) and the price escalation from 1990 to 2003 by consumer price index during 1990 to 2003.

Figure 4.2. Concept of Usulutan - San Miguel Irrigation Project (MAG/ TRANARG, 1976)



(Source: Proyecto de Riego Usultan - San Miguel, Informe de Factibilidad, MAG, 1976, TRANARG)

Table 4.1. Outline of Usultan - San Miguel Irrigation Project (MAG, TRANARG, 1976)

Sector	Irrigation Area (ha)	Required Water (MCM)	Intake Site	Available Water	Cost (million US$), Price in 2003							Unit Irr. Cost (US$/ha)
					S.Esteban Dam	Intake Wier	Canal	Irrigation	Others	Tot.Pjt.Cost (with dam)	Irr. Cost (w/o dam)	
San Miguel - Olomega	**10,749**	171.7	San Esteban	San Esteban Reservoir (Reservoir Volume 105MCM)	40.01	0.00	44.17	14.67	17.00	115.86	**75.85**	7,056
Jocotal	**3,954**	49.5	El Delirio, Jocotal pump	San Miguel River (2.5-9.1 m^3/s), Jocotal (1.2 m^3/s), Olomega (65 MCM/year)		1.44	17.27	2.46	5.48	26.65	**26.65**	6,739
Aguas Subterraneas (Conception Batres)	**11,952**	125.6	(wells)	Groundwater (240 MCM/year)		0.00	10.43	5.48	47.13	63.04	**63.04**	5,274
San Dioniso	**2,261**	29.2	San Dioniso	San Miguel River (7-14.5 m^3/s), Lake Olomega (65 MCM/year)		0.52	6.71	0.89	2.93	11.06	**11.06**	4,890
TOTAL	**28,916**	**376.0**								**216.60**	**176.59**	**6,107**

Source: Based on The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, JICA, 1997.

4.4 Comprehensive Flood Control Study (JICA, 1997)

In 1997, JICA made a comprehensive flood control plan for the San Miguel river basin. After studying various alternatives including the San Esteban dam to attain the irrigation and flood control purposes, formulation of the flood control master plan (for 10-year probable flood) and the feasibility study for the priority project (for 2-year flood) were conducted.

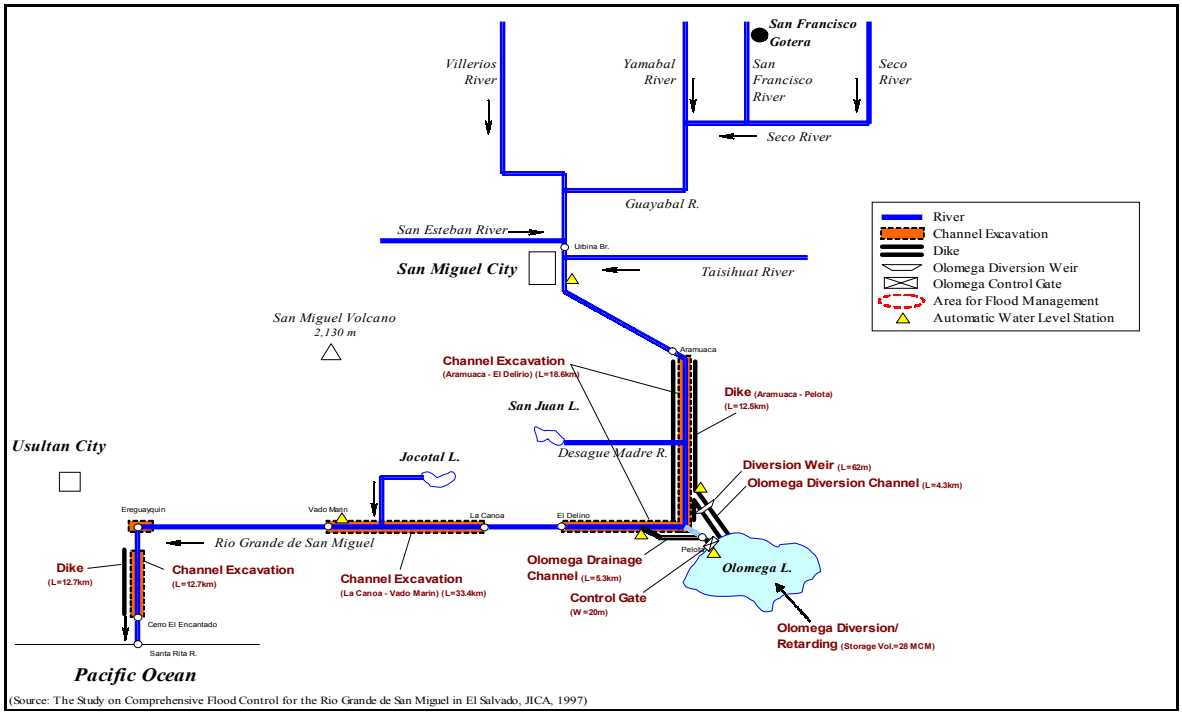
The structural and non-structural measures for the master plan consist of the following:

i) River improvement (100.7km),
ii) Floodwater storage in the Olomega lagoon,
iii) Floodplain management project, including flood forecasting/warning, land use regulation, flood proofing and education to the residents, and
iv) Watershed management project including reforestation of 30,000ha, erosion control of 20,000ha and groundsill at 30 places.

The flood area reduction was estimated at 10,400ha against 10-year flood (estimated population in 2020 is 47,000).

Concept of the proposed flood control project by the JICA's 1997 study is schematically shown in Figure 4.3.

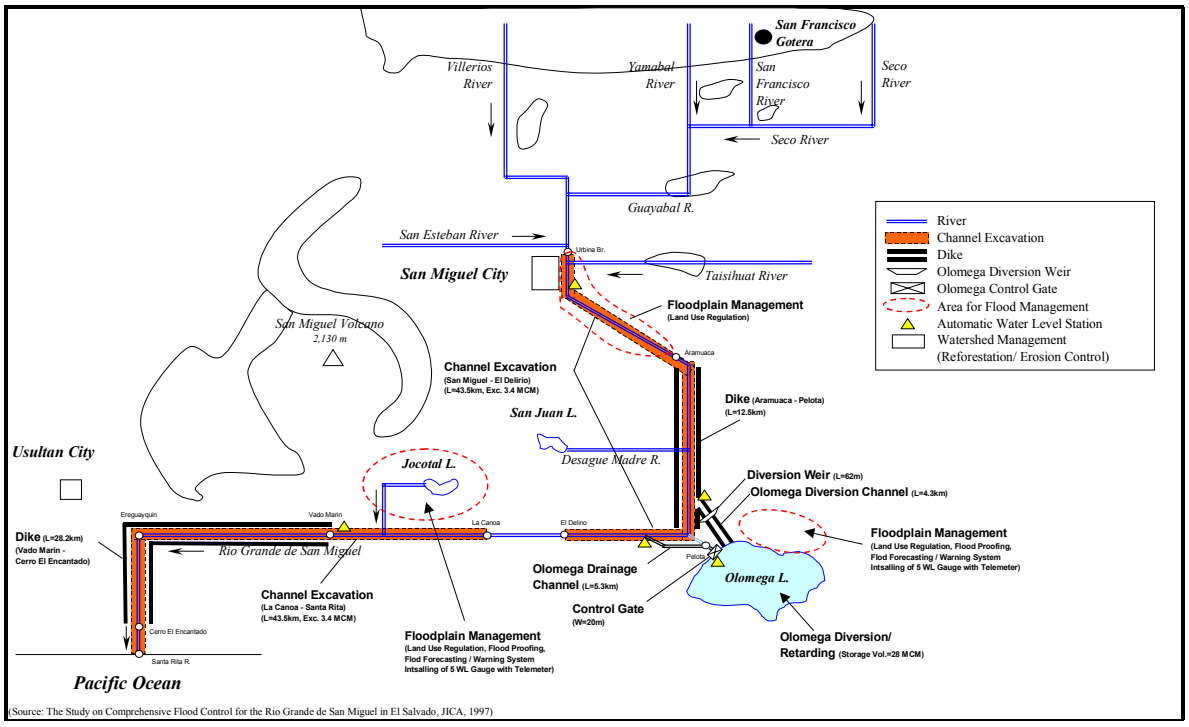
Figure 4.3 (1). Concept of San Miguel River Flood Control Project (JICA, 1997)



(Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel in El Salvado, JICA, 1997)

[Priority Project for 1/2-Year Probable Flood]

Figure 4.3 (2). Concept of San Miguel River Flood Control Project (JICA, 1997)



(Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel in El Salvado, JICA, 1997)

[Master Plan Project for 1/10-Year Probable Flood]

5. Proposed Project Formulation

To contribute to the regional and the national economic development, the proposed project should include a combination of flood control and irrigation/drainage development. To satisfy the requirement, a multipurpose dam is conceived. Also, previous irrigation project studies are outdated, and market conditions for crops have largely changed between 1970's and the present. The proposed crops and the cropping patterns in the previous studies should be updated and the method of irrigation (mostly traditional surface irrigation and open canal) would also need to be reexamined.

5.1 Proposed Projects

Based on the previous project proposals and studies, combination of flood control and irrigation/drainage is required as a priority project for the large-scale irrigation in the middle and lower parts of the San Miguel river basin. Size of reservoir is determined to meet the irrigation requirement and flood control needs.

The following components are included.

1) Flood control:
   - Río Grande midstream river improvement,
   - Olomega diversion, and

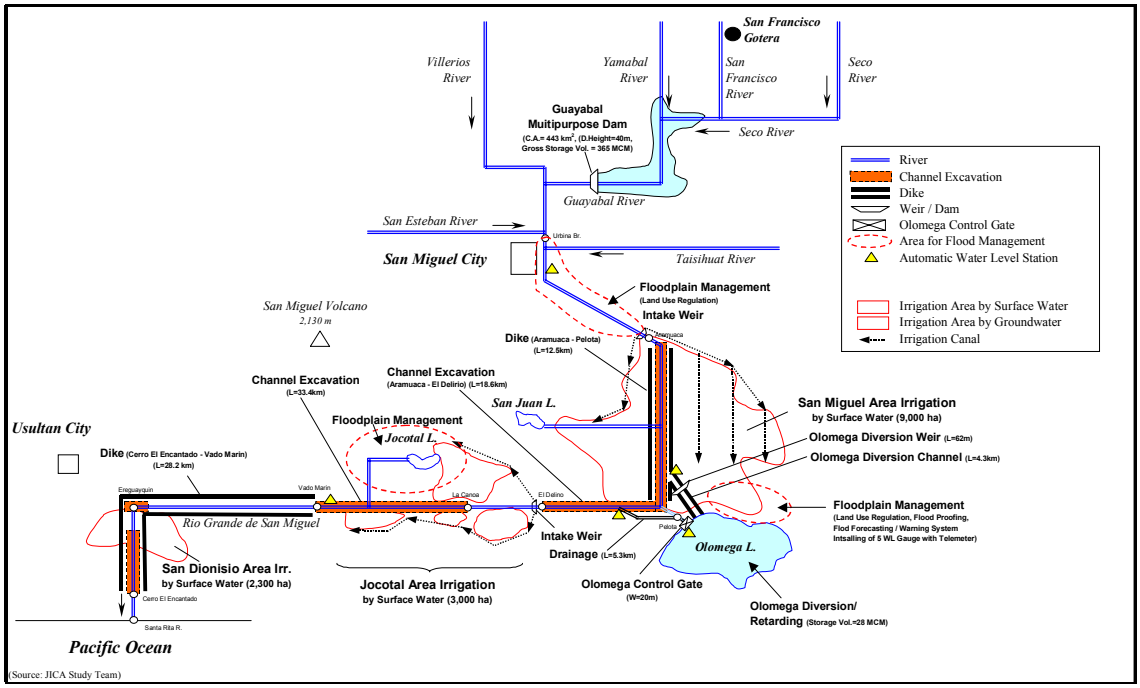
- Flood plain management.

2) El Guayabal multipurpose dam project, and
3) Irrigation and drainage:
   - San Miguel irrigation (9,000ha),
   - Jocotal irrigation (3,000ha), and
   - San Dionisio Irrigation (2,300ha).

River improvement will include channel excavation and dike construction along the middle reach for floods of the 1/10-year return period. The Olomega diversion includes a diversion weir, diversion/drainage channel, and control gate drainage.

The multipurpose dam may have irrigation, flood control, hydropower, fisheries, tourism and water supply purposes. There are several studies on the dams/reservoirs in the San Miguel river basin. According to the previous studies, the San Esteban dam (catchment area=825km^2, dam height=43m, storage volume=410MMC) or Taisihuat dam (catchment area =81km^2, dam height=52m, storage volume=102MMC) were selected. However, in this study, after the evaluation of the alternative sites, the El Guayabal dam (catchment area=443km^2, dam height=42 m, storage volume=285MMC) is selected due to economical and environmental superiority.

Figure 5.1. Proposed San Miguel River Development and Management Project



Irrigation and drainage projects for a total area of 14,300ha will be supplied water by the proposed El Guayabal dam. For alternative irrigation areas, the Conception Batres area is also irrigable by using groundwater as proposed by MAG-TRANARG (1976).

5.2 Flood Control Project

(1) General

Basic concept of flood control project is the same as in the 1997 JICA study, which recommended the priority project for floods of 1/2-year return period and the Master Plan project for 1/10-year floods (Section 4.4). Updating of the feasibility study and detailed design of the project are also recommended.

(2) Target area to be protected

The project will cover 162km^2 (16,200ha) out of flood prone area of 181km^2 (18,100ha) excluding low areas around the lagoons.

(3) Design flood

Flood control structures are designed for the 10-year flood. Implementation of the project with staged small-scale developments is recommended to realize large benefits in a cost-effective way.

(4) Project outline

The features of the proposed San Miguel river flood control project are summarized in Table 5.1. Each component of the project is descried below.

River improvement

The 1997 JICA study recommended as a priority project a combination of dikes and channel excavation along the middle and the downstream reaches of the Río Grande and diversion of flood water into the Olomega lagoon, which would serve as a retarding basin to provide protection against floods of 10-year return period. The combination of the proposed dikes and channel excavation along the middle reach and the El Guayabal dam is expected to provide much more effective flood protection.

Olomega diversion

A portion of the floodwater is to be diverted to the Olomega lagoon through a diversion weir and 4.3km-long channel. The Olomega lagoon is expected to serve as a retarding basin with storage volume of some 25 million m^3. A control gate will be installed at the outlet to regulate the water level in the lagoon at 200m. The water stored in the lagoon is to be used for irrigation in Jocotal and other areas downstream.

Flood plain management

While a reasonable level of flood protection is provided by the measures outlined above for most areas, flood plain management is equally important to support the livelihood adapted to flooding. Proper land use should be promoted in flood-prone areas. Guidance should be

Table 5.1 Features of San Miguel River Flood Control Project

DESCRIPTION		Master Plan Project (Proposed by JICA 1997 Study)	
RIVER IMPROVEMENT			
Project Cost Fixed cost (not including price escalation)		1097.4 million colones (as of Dec. 1996)	**153.9 million US$** (as of 2003)
Fund Required including price escalation		1577.6 million colones (as of Dec. 1996)	**221.2 million US$** (as of 2003)
Construction Works	Construction Period	10 years	
	Excavation (m^3):	14,956,000	
	Embankment (m^3):	1,843,000	
	Revetment (m^3):	6,000	
	Ground sill (site):	4	
	Weir (site):	2	
	Slice (site):	15	
	Bridge (site):	5	
Reduction of Flood Area 5 for 10-yr. flood	San Miguel	0.4	
	Olomega	61.8	
	Jocotal	28.2	
	Usulutan	13.6	
	Total	104.0	
Beneficiary in the Protect	San Miguel	200	
	Olomega	27,900	
	Jocotal	12,700	
	Usulutan	6,100	
	Total	46,900	
Social Impact	Positive Impact:	- To enable effective land use and developmet of the basin, - To ensure this people's livelihood in the basin, - To ensure stable fishery in lakes of Olomega and Jocotal, - To create employment opportunities during construction, and - To improve sanitaly conditions.	
	Negative Impact:	- Distubance of communities during construction	
	- Land acquisition	779 ha	
	- House compensation:	20 houses	
Environmental Impact		- Mitigation of inflow of polluted and sediment contained water of the San Miguel River - Stabilization of water level in lakes of Olomega and Jocotal	
Economic Viability: EIRR (%)		14.6%	

FLOOD PLAIN MANAGEMENT	
Estuary Arae	Land use regulation and flood proofing
Jocotal Area	Land use regulation, flood proofing and flood forecasting/warning to mitigate damage in non-dike reaches
Olomega Area	
Near San Miguel City	Land use regulation to mitigate damage in urban area

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, 1997, JICA.
Note: Price escalation from 1997 to 2003 is used in the equation below.
(Cost [US$] in 2003) = (Cost [colons] in 1997) x (excange rate in 1997 of 0.114 US$/colons) x (CPI from 1997 to 2003 of 1.23)

provided for construction of houses with elevated floors and provision of flood shelters on high grounds to protect property including cattle. These measures should be combined with an early flood warning system to reduce damages by habitual floods. Recent efforts by SNET to establish the early flood warning system in the Río Grande basin, supported by USAID, should be strengthened.

The proposed floodplain management project consists of the following:

- flood forecasting/warning (five water level stations and warning to the residents),
- land use regulation,
- flood proofing like elevated floor housing etc, and

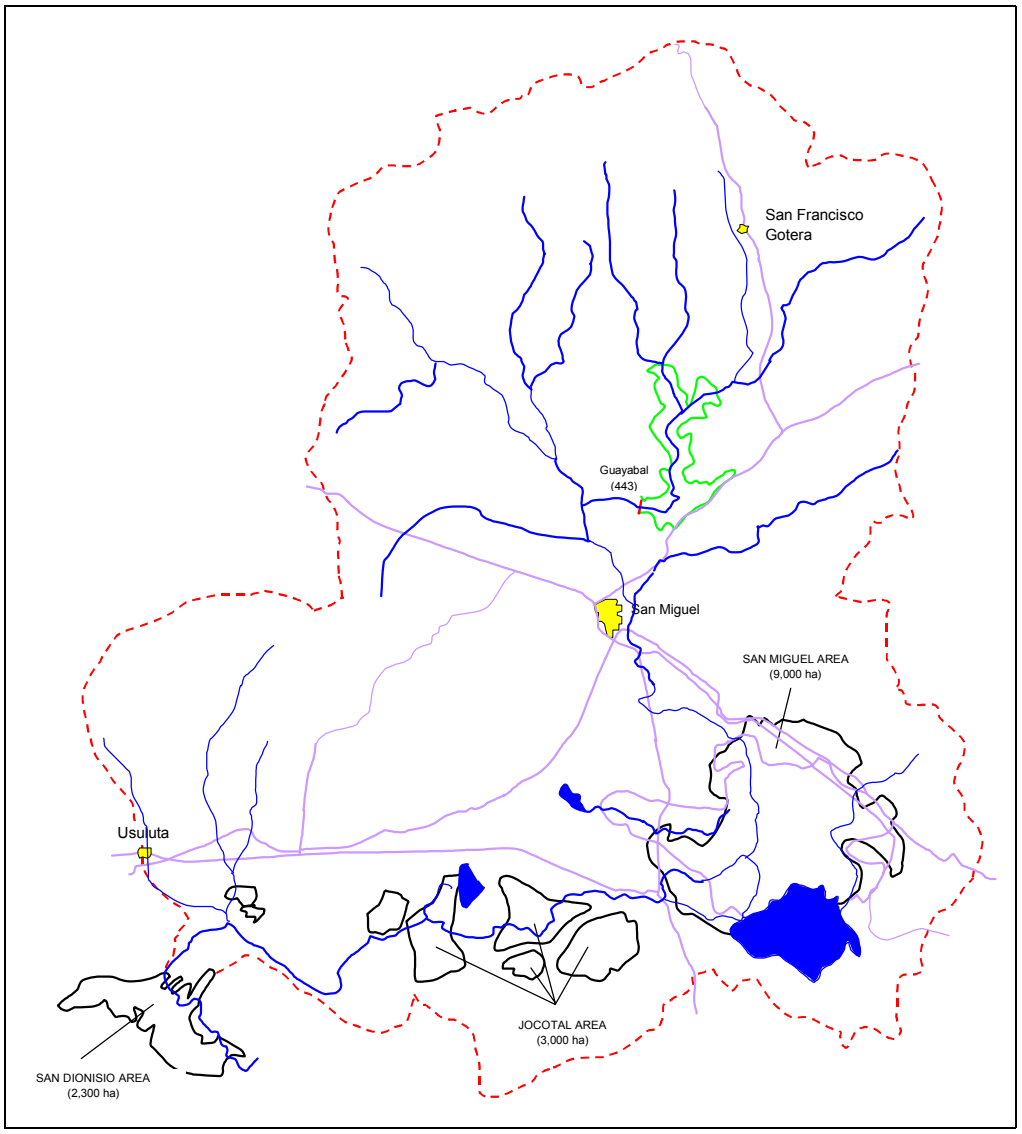
- education to the residents.

5.3 Irrigation and Drainage Project

(1) Proposed irrigation area

Proposed areas for the irrigation and drainage project (Figure 5.2) are San Miguel area (9,000ha), Jocotal area (3,000ha), and San Dionisio area (2,300ha).

Figure 5.2. Proposed Irrigation Area by El Guayabal Dam



San Miguel irrigation

The previous studies identified potential irrigation areas of 9,000ha along the middle reaches of the Río Grande, and a total of 29,000ha extending from the Olomega valley to the downstream Río Grande in Usulutan. The San Miguel irrigation area with 9,000ha can be protected from

medium floods of over 10 years return period by the El Guayabal dam in combination with the dikes and channel excavation along middle reaches of the San Miguel river. This area, in turn, can be irrigated by water to be released from the El Guayabal dam. More promising cropping patterns under irrigation have been worked out at this time in view of new market opportunities.

Jocotal irrigation

Channel excavation is provided for 33.4km along the Jocotal irrigation area extending in 3,000ha. The area can be irrigated by surface water of Río Grande to be supplied partly from the Olomega lagoon. Intake sites are planned at downstream of El Delirio by weir and the Jocotal pump.

San Dionisio irrigation

The San Dionisio irrigation area will be about 2,300ha. The area can be irrigated by surface water of Río Grande to be supplied partly from the Olomega lagoon. The intake site is planned at the San Dionisio site downstream of the San Miguel river.

Conception Batres area irrigation (alternative)

As an alternative irrigation area, the Conception Batres area of 12,000ha is also irrigable by using groundwater as proposed by MAG-TRANARG (1976). However, at this stage, the Conception Batres area is not included since groundwater development should be based on careful evaluation of the potential of well yields and the impact to the hydro-geological conditions in the areas.

(2) Irrigation project cost

The proposed development project by the Usulutan-San Miguel irrigation project (MAG-TRANARG) was evaluated in 1976. The project cost estimate is too old and should be re-evaluated by a detailed study in the future. At this stage, the irrigation cost was estimated by using price escalation from updated cost in 1990 price by the 1997 JICA study. The estimated unit irrigation cost (US$/ha) is shown in Table 5.2.

Table 5.2. Updated Unit Irrigation Cost by Usulutan-San Miguel Irrigation Project

CPI defrator 1990 to 2003= 2.62

Sector	Irrigation Area (ha)	Cost (million US$), Price in 1990						Cost (million US$), Price in 2003					
		San Esteban Dam	Intake Wier	Canal	Irrigation	Others	Total	S.Esteban Dam	Intake Wier	Canal	Irrigation	Others	Tot.Pjt.Cost (with dam)
San Miguel - Olomega	10,749	15.27		16.86	5.60	6.49	44.22	40.01	0.00	44.17	14.67	17.00	115.86
Jocotal	3,954		0.55	6.59	0.94	2.09	10.17		1.44	17.27	2.46	5.48	26.65
Aguas Subterraneas (Conception Batres)	11,952		0.00	3.98	2.09	17.99	24.06		0.00	10.43	5.48	47.13	63.04
San Dioniso	2,261		0.20	2.56	0.34	1.12	4.22		0.52	6.71	0.89	2.93	11.06
TOTAL	28,916						4.22						216.60

Source: Based on The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, JICA, 1997.

Using the unit irrigation cost given in Table 5.2, irrigation project costs are estimated as shown in Table 5.3. The total irrigation project cost will be US$ 95.0 million.

Table 5.3. Estimated Irrigation Project Cost

Sector	Unit Irr. Cost (US$/ha)	Proposed Irrigation Area (ha)	Irrigation Project Cost (million US$)
San Miguel - Olomega	7,060	**9,000**	**63.5**
Jocotal	6,740	**3,000**	**20.2**
San Dioniso	4,890	**2,300**	**11.2**
TOTAL	**6,110**	**14,300**	**95.0**

Source: JICA Study Team.

(3) Irrigation project benefits

Using present and proposed cropping patterns, the annual irrigation benefits can be estimated as shown in Table 5.4. Under the new cropping patterns, the San Miguel, Jocotal and San Dionisio irrigation are assessed at a preliminary level to yield an estimate of annual irrigation benefit at US$ 85.9 million, US$ 28.6 million and US$ 22.6 million, respectively.

Table 5.4 (1). Estimated Annual Benefits of San Miguel Irrigation Project (9,000 ha)

Project Area: 1 **San Miguel-Olomega**
Irrigation Area (ha) = 9,000

	Crop	1. Present/Without Irrigation Project				2. With Irrigation Project				Annual Project Benefit
		Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	(US$/year)
1	Beans	500	3.4%	306	153,000	600	3.4%	306	183,600	30,600
2	Cassava (yucca)	1,110	0.9%	81	89,910	1,590	5.0%	450	715,500	625,590
3	Chile, sweet	11,800	0.6%	54	637,200	12,690	15.0%	1,350	17,131,500	16,494,300
4	Maize	490	20.4%	1,836	899,640	680	9.3%	837	569,160	-330,480
5	Green maize (elote)	785	2.4%	216	169,560	990	7.0%	630	623,700	454,140
6	Sorghum	460	3.7%	333	153,180	575	3.7%	333	191,475	38,295
7	Cucumber	1,240	0.3%	27	33,480	1,630	3.0%	270	440,100	406,620
8	Onion	7,400	0.4%	36	266,400	8,590	12.0%	1,080	9,277,200	9,010,800
9	Rice	740	0.4%	36	26,640	970	0.4%	36	34,920	8,280
10	Sugarcane	862	5.0%	450	387,900	959	5.0%	450	431,550	43,650
11	Tomato, salad	9,300	0.5%	45	418,500	10,560	12.0%	1,080	11,404,800	10,986,300
12	Tomato, paste	3,170	0.8%	72	228,240	3,890	6.0%	540	2,100,600	1,872,360
13	Zuchinni, (pipian)	350	0.4%	36	12,600	510	1.0%	90	45,900	33,300
14	Melon	6,830	0.6%	54	368,820	8,180	20.0%	1,800	14,724,000	14,355,180
15	Mango	2,900	0.8%	72	208,800	3,830	8.0%	720	2,757,600	2,548,800
16	Watermelon	690	0.7%	63	43,470	960	3.0%	270	259,200	215,730
17	Avocado	3,500	0.6%	54	189,000	4,430	9.0%	810	3,588,300	3,399,300
18	Lemon persian	4,865	0.8%	72	350,280	5,950	10.0%	900	5,355,000	5,004,720
19	Papaya	15,220	0.7%	63	958,860	16,740	8.0%	720	12,052,800	11,093,940
20	Passion fruit	7,970	0.4%	36	286,920	9,620	14.0%	1,260	12,121,200	11,834,280
21	Plantain	700	0.7%	63	44,100	1,030	3.0%	270	278,100	234,000
22	Pasture	650	55.5%	4,995	3,246,750	850	10.0%	900	765,000	-2,481,750
	TOTAL		**100.0%**	**9,000**	**9,173,250**		**167.8%**	**15,102**	**95,051,205**	**85,878,000**

Source: JICA Study Team.

Table 5.4 (2). Estimated Annual Benefits of Jocotal Irrigation Project (3,000 ha)

Project Area: 2 **Jocotal**
Irrigation Area (ha) = 3,000

	Crop	1. Present/Without Irrigation Project				2. With Irrigation Project				Anuual Project Benefit
		Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	(US$/year)
1	Beans	500	3.4%	102	51,000	600	3.4%	102	61,200	10,200
2	Cassava (yucca)	1,110	0.9%	27	29,970	1,590	5.0%	150	238,500	208,530
3	Chile, sweet	11,800	0.6%	18	212,400	12,690	15.0%	450	5,710,500	5,498,100
4	Maize	490	20.4%	612	299,880	680	9.3%	279	189,720	-110,160
5	Green maize (elote)	785	2.4%	72	56,520	990	7.0%	210	207,900	151,380
6	Sorghum	460	3.7%	111	51,060	575	3.7%	111	63,825	12,765
7	Cucumber	1,240	0.3%	9	11,160	1,630	3.0%	90	146,700	135,540
8	Onion	7,400	0.4%	12	88,800	8,590	12.0%	360	3,092,400	3,003,600
9	Rice	740	0.4%	12	8,880	970	0.4%	12	11,640	2,760
10	Sugarcane	862	5.0%	150	129,300	959	5.0%	150	143,850	14,550
11	Tomato, salad	9,300	0.5%	15	139,500	10,560	12.0%	360	3,801,600	3,662,100
12	Tomato, paste	3,170	0.8%	24	76,080	3,890	6.0%	180	700,200	624,120
13	Zuchinni, (pipian)	350	0.4%	12	4,200	510	1.0%	30	15,300	11,100
14	Melon	6,830	0.6%	18	122,940	8,180	20.0%	600	4,908,000	4,785,060
15	Mango	2,900	0.8%	24	69,600	3,830	8.0%	240	919,200	849,600
16	Watermelon	690	0.7%	21	14,490	960	3.0%	90	86,400	71,910
17	Avocado	3,500	0.6%	18	63,000	4,430	9.0%	270	1,196,100	1,133,100
18	Lemon persian	4,865	0.8%	24	116,760	5,950	10.0%	300	1,785,000	1,668,240
19	Papaya	15,220	0.7%	21	319,620	16,740	8.0%	240	4,017,600	3,697,980
20	Passion fruit	7,970	0.4%	12	95,640	9,620	14.0%	420	4,040,400	3,944,760
21	Plantain	700	0.7%	21	14,700	1,030	3.0%	90	92,700	78,000
22	Pasture	650	55.5%	1,665	1,082,250	850	10.0%	300	255,000	-827,250
	TOTAL		**100.0%**	**3,000**	**3,057,750**		**167.8%**	**5,034**	**31,683,735**	**28,626,000**

Source: JICA Study Team.

Table 5.4 (3). Estimated Annual Benefits of San Dionisio Irrigation Project (2,300 ha)

Project Area: 4 **San Dioniso**
Irrigation Area (ha) = 2,300

	Crop	1. Present/Without Irrigation Project				2. With Irrigation Project				Anuual Project Benefit
		Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	Net profit (US$/ha)	Planted area (%)	Planted area (ha/year)	Benefit subtotal (US$/planted area)	(US$/year)
1	Beans	500	3.4%	78	39,100	600	3.4%	78	46,920	7,820
2	Cassava (yucca)	1,110	0.9%	21	22,977	1,590	5.0%	115	182,850	159,873
3	Chile, sweet	11,800	0.6%	14	162,840	12,690	15.0%	345	4,378,050	4,215,210
4	Maize	490	20.4%	469	229,908	680	9.3%	214	145,452	-84,456
5	Green maize (elote)	785	2.4%	55	43,332	990	7.0%	161	159,390	116,058
6	Sorghum	460	3.7%	85	39,146	575	3.7%	85	48,933	9,787
7	Cucumber	1,240	0.3%	7	8,556	1,630	3.0%	69	112,470	103,914
8	Onion	7,400	0.4%	9	68,080	8,590	12.0%	276	2,370,840	2,302,760
9	Rice	740	0.4%	9	6,808	970	0.4%	9	8,924	2,116
10	Sugarcane	862	5.0%	115	99,130	959	5.0%	115	110,285	11,155
11	Tomato, salad	9,300	0.5%	12	106,950	10,560	12.0%	276	2,914,560	2,807,610
12	Tomato, paste	3,170	0.8%	18	58,328	3,890	6.0%	138	536,820	478,492
13	Zuchinni, (pipian)	350	0.4%	9	3,220	510	1.0%	23	11,730	8,510
14	Melon	6,830	0.6%	14	94,254	8,180	20.0%	460	3,762,800	3,668,546
15	Mango	2,900	0.8%	18	53,360	3,830	8.0%	184	704,720	651,360
16	Watermelon	690	0.7%	16	11,109	960	3.0%	69	66,240	55,131
17	Avocado	3,500	0.6%	14	48,300	4,430	9.0%	207	917,010	868,710
18	Lemon persian	4,865	0.8%	18	89,516	5,950	10.0%	230	1,368,500	1,278,984
19	Papaya	15,220	0.7%	16	245,042	16,740	8.0%	184	3,080,160	2,835,118
20	Passion fruit	7,970	0.4%	9	73,324	9,620	14.0%	322	3,097,640	3,024,316
21	Plantain	700	0.7%	16	11,270	1,030	3.0%	69	71,070	59,800
22	Pasture	650	55.5%	1,277	829,725	850	10.0%	230	195,500	-634,225
	TOTAL		**100.0%**	**2,300**	**2,344,275**		**167.8%**	**3,859**	**24,290,864**	**21,947,000**

Source: JICA Study Team.

(4) Increase in employment opportunities by irrigation

Employment opportunities are expected to increase by irrigation. Profitability of crops and labor requirements under "with and without" irrigation project conditions are estimated as shown in Table 5.5. Estimated job opportunities created by the irrigation project are shown in Table 5.6. The total permanent jobs (assuming one permanent job for every 250 person-day/year) are estimated at 21,900 person-days/year by the irrigation project.

Table 5.5. Profitability of Crops and Labor Requirement by Irrigation Project

	Crop	1. Present/Without Irrigation Project				2. With Irrigation Project			
		Production Cost (US $/ha)	Labor Used (Man-day/ha)	Gross Sell (US $/ha)	**Net Profit (US $/ha)**	Production Cost (US $/ha)	Labor Used (Man-day/ha)	Gross Sell (US $/ha)	**Net Profit (US $/ha)**
1	Bean								
2	Cassava (Yucca)	940	88	2,050	**1,110**	1,450	100	3,040	**1,590**
3	Chile, Sweet	3,910	370	15,710	**11,800**	5,090	385	17,780	**12,690**
4	Corn (Technified)	740	70	1,230	**490**	1,190	75	1,870	**680**
5	Green Corn (Elote)	890	76	1,675	**785**	1,210	80	2,200	**990**
6	Sorghum								
7	Cucumber	2,210	220	3,450	**1,240**	2,600	230	4,230	**1,630**
8	Onion	2,860	250	10,260	**7,400**	3,660	275	12,250	**8,590**
9	Rice (Technified)	1,360	85	2,100	**740**	1,630	90	2,600	**970**
10	Sugarcane	580	69	1,442	**862**	950	80	1,909	**959**
11	Tomato, Salad	5,950	550	15,250	**9,300**	6,940	585	17,500	**10,560**
12	Tomato, Paste	3,280	385	6,450	**3,170**	3,850	410	7,740	**3,890**
13	Zuchinni, (Pipian)	1,330	129	1,680	**350**	1,830	135	2,340	**510**
14	Melon	1,570	125	8,400	**6,830**	2,320	140	10,500	**8,180**
15	Watermelon	1,650	130	2,340	**690**	2,420	140	3,380	**960**
16	Avocado	1,860	100	5,360	**3,500**	2,970	125	7,400	**4,430**
17	Lemon Persian	1,630	150	6,495	**4,865**	3,300	165	9,250	**5,950**
18	Papaya	3,880	337	19,100	**15,220**	5,760	360	22,500	**16,740**
19	Mango	1,230	55	4,130	**2,900**	2,570	70	6,400	**3,830**
20	Passion Fruit	4,030	257	12,000	**7,970**	5,980	300	15,600	**9,620**
21	Plantain	3,220	147	3,920	**700**	4,430	160	5,460	**1,030**
22	Pasture								
23	* Coffee (High Elevation)	1,230	60	1,550	**320**	2,540	80	4,500	**1,960**
24	Coffee (Low Elevation)	800	35	990	**190**	1,590	45	2,250	**660**
25	Cashewnuts	750	60	1,455	**705**	1,280	65	2,220	**940**
26	Coconuts	1,620	170	2,980	**1,360**	2,100	190	3,915	**1,815**
27	Indigo	530	18	1,400	**870**	720	25	2,030	**1,310**
28	Kenaf	1,430	200	1,500	**70**	667	40	1,400	**733**
29	Hemp (Agave)	385	57	890	**505**				

Sources: From No. 1 to 23, MAG, Crop Production Cost 2001-2002, Modified by Study Team.
Indigo: JICA-Technoserve, 2003. Kenaf and Agave: Study Team
* Farmers Toasting and Selling Directly

Table 5.6. Estimates of Job Opportunities Created by Irrigation Projects

Irrigation Area (ha) = 14,300

	Crop	1. Present/Without Irrigation Project				2. With Irrigation Project			
		Labor Used (Man-day/ha)	Area Planted (%)	(ha/year)	Total Labor (Man-day/yr)	Labor Used (Man-day/ha)	Area Planted (%)	(ha/year)	Total Labor (Man-day/yr)
1	Bean	55	3.4%	486	26,741	60	3.4%	486	29,172
2	Cassava (Yucca)	88	0.9%	129	11,326	92	5.0%	715	65,780
3	Chile, Sweet	370	0.6%	86	31,746	385	15.0%	2,145	825,825
4	Corn	70	20.4%	2,917	204,204	75 *	9.3%	1,330	99,743
5	Green Corn (Elote)	76	2.4%	343	26,083	80	7.0%	1,001	80,080
6	Sorghum	70	3.7%	529	37,037	75 *	3.7%	529	39,683
7	Cucumber	220	0.3%	43	9,438	230	3.0%	429	98,670
8	Onion	250	0.4%	57	14,300	275	12.0%	1,716	471,900
9	Rice	85	0.4%	57	4,862	90	0.4%	57	5,148
10	Sugar cane	69	5.0%	715	49,335	80	5.0%	715	57,200
11	Tomato, Salad	550	0.5%	72	39,325	585	12.0%	1,716	1,003,860
12	Tomato, Paste	325	0.8%	114	37,180	425	6.0%	858	364,650
13	Zuchinni, (Pipian)	129	0.4%	57	7,379	135	1.0%	143	19,305
14	Melon	125	0.6%	86	10,725	140	20.0%	2,860	400,400
15	Mango	55	0.8%	114	6,292	70	8.0%	1,144	80,080
16	Watermelon	130	0.7%	100	13,013	140	3.0%	429	60,060
17	Avocado	100	0.6%	86	8,580	125	9.0%	1,287	160,875
18	Lemon Persian	150	0.8%	114	17,160	165	10.0%	1,430	235,950
19	Papaya	337	0.7%	100	33,734	360	8.0%	1,144	411,840
20	Passion Fruit	257	0.4%	57	14,700	300	14.0%	2,002	600,600
21	Plantain	147	0.7%	100	14,715	160	3.0%	429	68,640
22	Pasture	45	55.5%	7,937	357,143	65 **	10.0%	1,430	92,950
	TOTAL		**100.0%**	**14,300**	**975,017**		**167.8%**	**23,995**	**5,272,410**

Source: JICA Study Team

Cropping Intensity = 1.7

Permanent Jobs [persons] (one Permanent Job for every 250 Man-day/year) = **21,090**

Note-1): Labor oportunities under Present/Without condition in the project area are estimated only once a year.
Note-2): The Areas Indicated for each crop under present/without project are estimates of the Study Team considering MAG data and field direct sources; actual data are Not available for this area.
Note-3): With irrigation project conditions, annual crops will be planted 2 to 3 times a year. Labor is estimated considering the proposed cropping pattern, with respectives % of area proposed for each crop. Project Area multiplied by each % indicated in Cropping Pattern.
* : Improved pasture.
** : Areas of Corn and Surghum are reduced under Irrigation due to low profit crops of high profitability are proposed to be planted in large areas.

(5) Initial environmental examination (IEE) for irrigation project areas

Conservation areas in and around the San Miguel river basin are shown in Figure 5.3. The proposed Jocotal irrigation areas are located in/around following conservation areas:

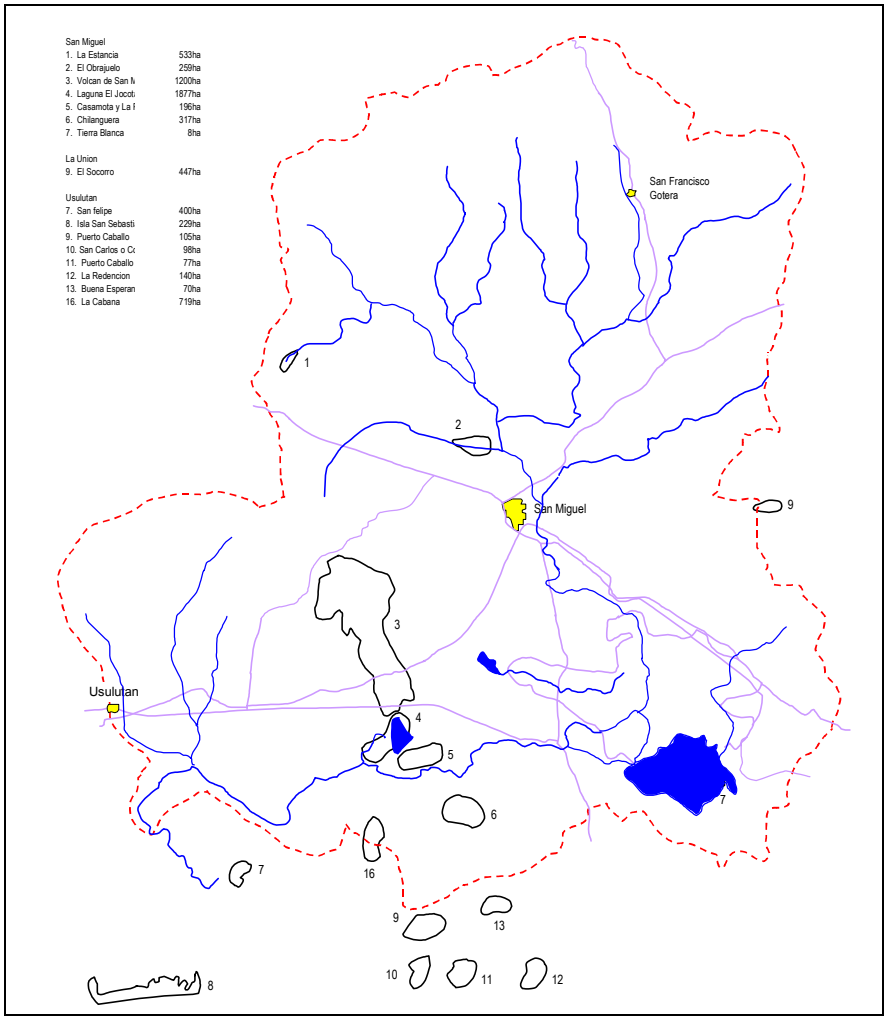
No. 4. Laguna El Jocotal wih 1,877ha,

No. 5. Casamota y La Pezota with 196ha, and

No. 6. Chilanguera with 317ha.

For the project implementation, detailed environmental impact assessment will be required.

Figure 5.3. Conservation Areas In and Around the San Miguel River Basin



6. Preliminary Feasibility Study on El Guayabal Multipurpose Dam Project

6.1 Alternative Study for Candidate Dam Sites

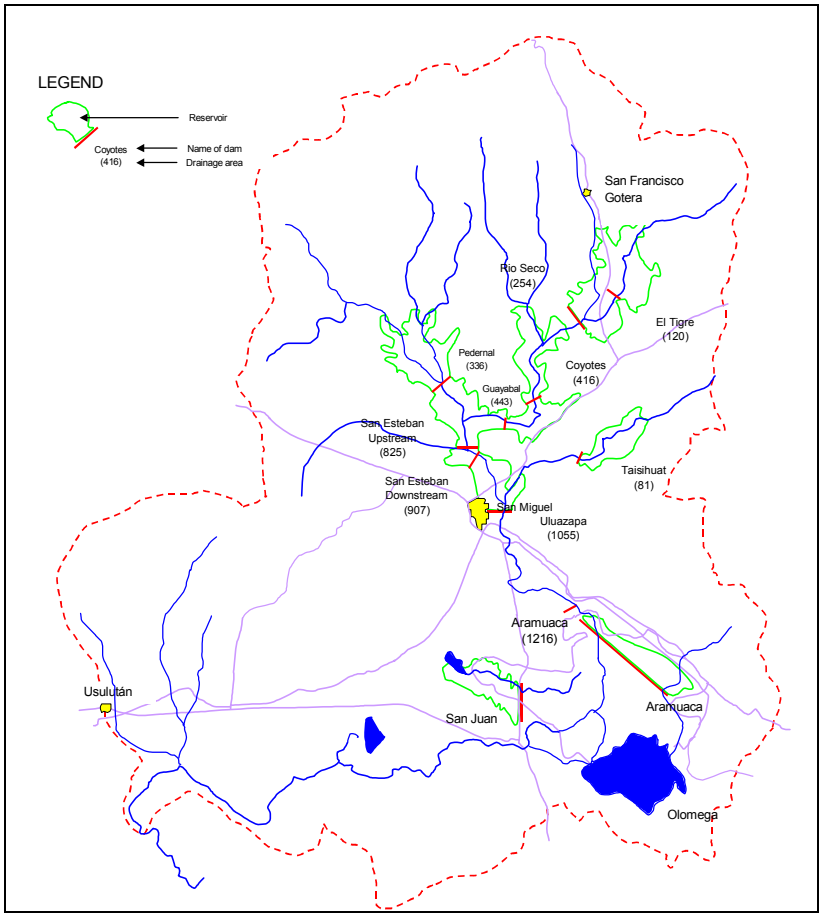
(1) Proposed alternative dam sites

The multipurpose dam will have irrigation, flood control, hydropower, fisheries, tourism and water supply purposes. There are several studies on the dams/reservoirs in the San Miguel river basin. The upper basin of the San Miguel river is classified into two areas; one part is steep mountain area and the other is comparatively flat valley. A group of dams situated in the steep mountain area will have small reservoirs. Those small dams have only limited

catchment area and they have practically no effect on flood control downstream and excluded in selection of the multi-purpose dam site. Those in the flat valley area are large in their reservoir volumes.

Figures 6.1.1 and 6.1.2 show alternative sites for dam/reservoir in the San Miguel River basin studied by MAG-HARZA in 1967 and JICA in 1997, respectively.

Figure 6.1.1. Dam Sites Studied by MAG-HARZA 1967



According to the previous studies, the San Esteban dam (catchments area=825km^2, dam height=43 m, storage volume=410MMC) or the Taisihuat dam (catchments area=81km^2, dam height=52 m, storage volume=102MMC) were selected for the multipurpose dam site. However, in this study, after the evaluation of the alternative sites, the El Guayabal dam (catchments area=443km^2, dam height=42m, storage volume=285MMC) is selected because of its economical and environmental superiority.

(2) Storage capacity curves

In this study, following eight sites were evaluated for the multipurpose dam (Table 6.1.1). The relationship between reservoir water level elevation (H), reservoir water surface area (A) and storage capacity (V) (hereinafter called the H-A-V curve) for each alternative dam site is

Figure 6.1.2. Dam Sites Studied by JICA 1997

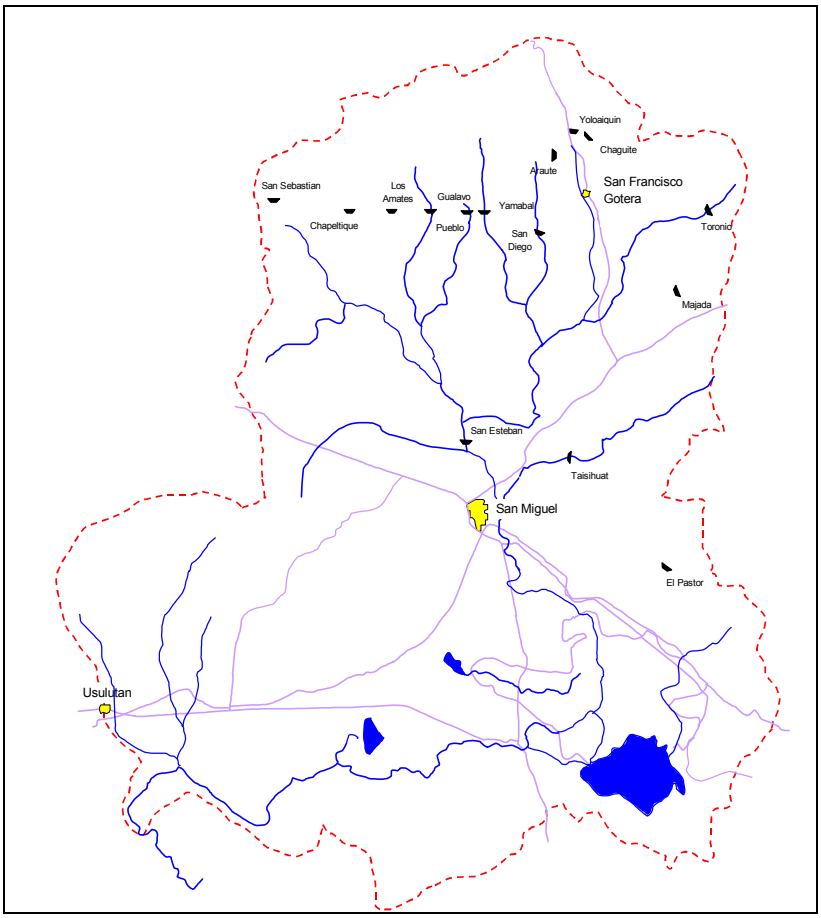


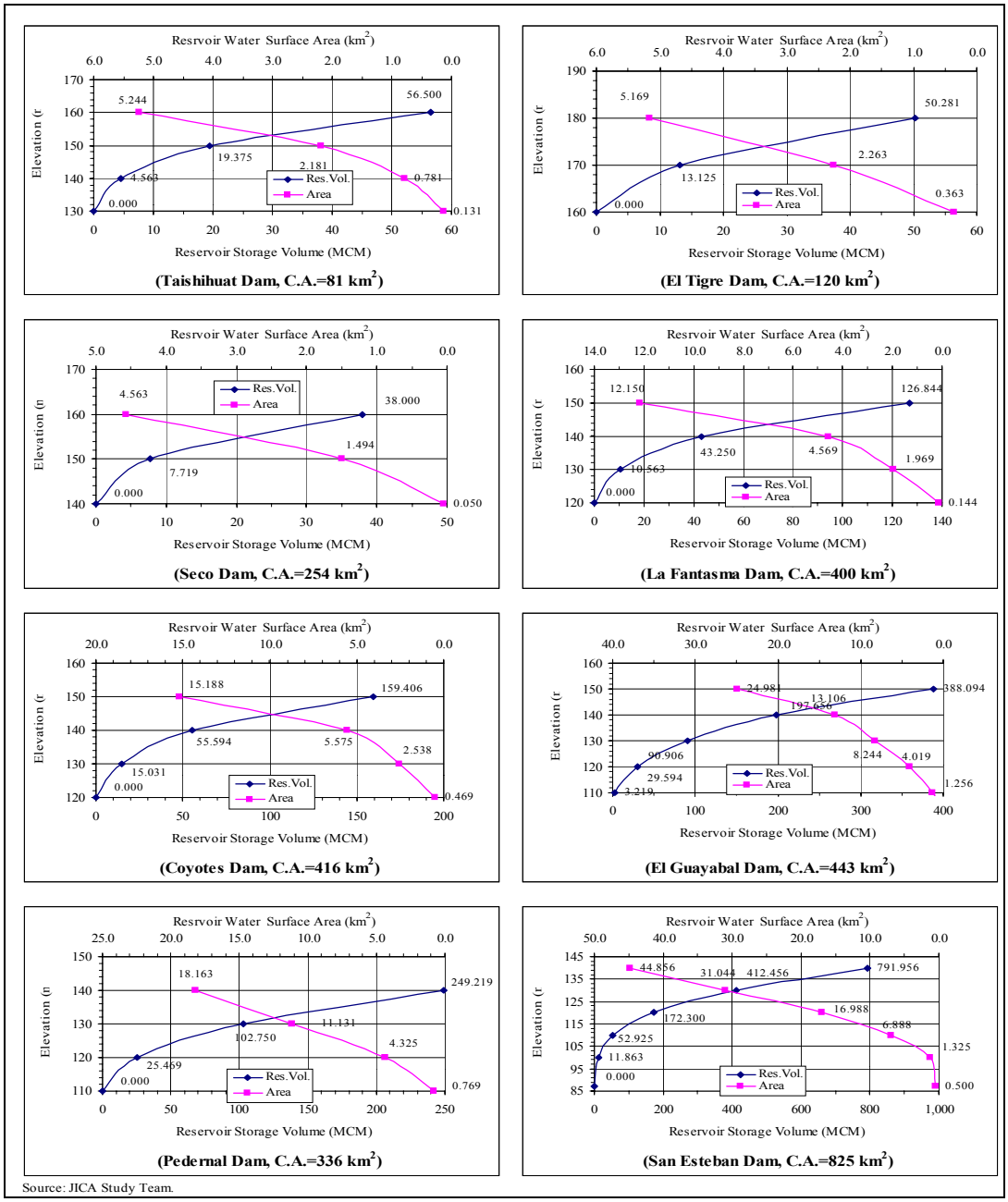
Table 6.1.1. Summary of Alternative Dam Sites Studied

No.	Dam Site	River Name	Catchment Area (km^2)	Riverbed Elevation (El.m)	Topo.Max. Elevation (El.m)	Max. Res. Area (km^2)	Max. Res. Volume (MCM)	Max. Dam Height (m)	Max.Embank. Vol.(Fill-type) (MCM) *1)	Max.Resettle. H.hold (1988) (HH) *2)
1	Taisihuat	Rio Taisihuat	81	130	160	5.2	56.5	30	0.198	70
2	El Tigre	Rio Seco	120	160	180	5.2	50.3	20	0.140	95
3	Seco	Rio Seco	254	140	160	4.6	38.0	20	0.097	59
4	La Fantasma	Rio San Antonio Chavez	400	120	150	12.2	126.8	30	0.304	176
5	Coyotes	Rio Guayabal	416	120	159	15.2	159.4	39	0.359	191
6	El Guayabal	Rio Guayabal	443	105	150	25.0	388.1	45	0.673	424
7	Pedernal	Rio Villerias	336	110	140	18.2	249.2	30	1.527	147
8	San Esteban	Rio Grande de San Miguel	825	87	130	31.0	412.5	43	1.722	590

Source: JICA Study Team.
Note *1): Equation used for dam embankment volume calculation: Volume (V) = 1/2*W*H*(L1+L2)+1/6*(S1+S2)*H^2*(L1+2*L2)
where, assumed W (Dam Crest Width) =10m, S1 (U/S Slope) =2, S2 (D/S Slope) =1.8
Note *2): Number of resettlement households is estimated following method.
village dot in the topographic map of 1/25,000 scale (IGM, 1990) is assumed as 2.2 household/dot.
(based on 1/10,000 scale map, IGM, 1980 reviced 1988).
Population per household in the study area is assumed as 4.4 people/house.

developed by using the 1:25,000 scale map (IGN, 1990). The H-A-V curves for the alternative dam sites are shown in Figure 6.1.3. Table 6.1.2 shows the H-A-V relationship at the proposed El Guayabal dam site.

Figure 6.1.3. Reservoir Area and Storage Capacity Curves of Alternative Dam Sites



Source: JICA Study Team.

Table 6.1.2. Reservoir Storage Capacity at El Guayabal Dam (Rio Guayabal, C.A.= 443 km²)

Elevation (H) (m)	Dam Height (m)	Dam Crest Length (m)	Reservoir Area (A) (km^2)	Storage Capacity (V) (10^6 m^3)
105	0.0	25	0.03	0.0
110	5.0	140	1.26	3.2
120	15.0	190	4.02	29.6
130	25.0	220	8.24	90.9
140	35.0	280	13.11	197.7
150	45.0	400	24.98	388.1

(3) Dam embankment volume

The following equation is used for dam embankment volume calculation.

[Fill-type dam]

$$V_f = 1/2 * W * H * (L_1+L_2) + 1/6 * (S_1+S_2) * H^2 * (L_1+2 * L_2),$$

where V_f: dam embankment volume (m^3)

W: dam crest width (m), (assumed 10 m)

H: dam height (m)

L_1: dam crest length (m)

L_2: dam bottom length (river bed width) (m)

S_1: upstream slope of dam (m)

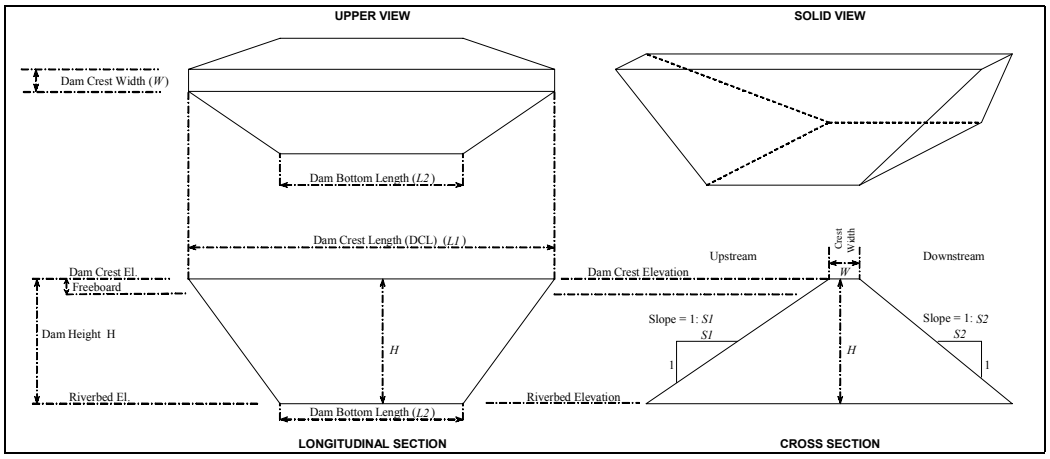
S_2: downstream slope of dam (m)

Table 6.1.3. Average Slope of Typical Fill-Dams

Type of Dam	S1	S2
Earth-Fill	3.0	2.5
Rock-Fill	2.0	1.8
CFRD (Concrete Facing Rock-fill)	1.4	1.3

Source: "Guide Manual for Development Aid Programs and Studies of Hydro Electric Power Projects", New Energy Foundation, Japan, 1996.

Figure 6.1.4. Simplified Futures of Fill-type Dam



[Concrete gravity dam][3]

In the case $H^2 \times L_1 <= 100 \times 10^3$: $V_c = k_1 \times (H^2 \times L_1)^{0.59}$, and

in the case $H^2 \times L_1 > 100 \times 10^3$: $V_c = k_2 \times (H^2 \times L_1)$,

where, V_c: concrete volume of dam (m^3)

k: coefficient (see table below)

[3] Source: "Guide Manual for Development Aid Programs and Studies of Hydro Electric Power Projects", New Energy Foundation, Japan, 1996.

Table 6.1.4. Coefficient *k* for Estimation of Concrete Volume of Concrete Gravity Dam

L_2/L_1	k_1	k_2
0.5	38.0	0.34
0.4	35.5	0.30
0.3	32.4	0.27
0.2	27.5	0.21
0.1	22.4	0.16

Source: "Guide Manual for Development Aid Programs and Studies of Hydro Electric Power Projects", New Energy Foundation, Japan, 1996.

(4) Preliminary cost estimate of dam

Based on the dam embankment volume determined above and unit prices, the preliminary cost estimates of each dam are conducted. Table 6.1.5 shows estimated preliminary cost of the El Guayabal dam-by-dam height.

Table 6.1.5. Preliminary Cost Estimates of Dam Construction Cost and Compensation Cost

[Rock-fill Dam Case]

Site: **El Guayabal** **C.A.(km^2)** **443.0**
River: **Rio Guayabal** **Basin: Rio Grande de San Miguel**

Crest Elevation (m)	**Dam Height [H] (m)**	Reservoir Area (km^2)	**Reservoir Volume (MCM)**	Crest Length [L1] (m)	Crest Width [B] (m)	Bottom Length [L2] (m)	Embank.Vol. (Fill-type) *1) (MCM)	Dam Embank. Cost *2) (US$ 10^6)	Spillway Cost *3) (US$ 10^6)
105	0.0	0.031	0.000	25.0	10.0	25.0	0.000	0.00	0.00
110	5.0	1.256	3.219	140.0	10.0	25.0	0.007	0.28	0.11
120	15.0	4.019	29.594	190.0	10.0	25.0	0.050	1.96	0.78
130	25.0	8.244	90.906	220.0	10.0	25.0	0.138	5.35	2.14
140	35.0	13.106	197.656	280.0	10.0	25.0	0.309	12.04	4.81
150	45.0	24.981	388.094	400.0	10.0	25.0	0.673	26.17	10.47

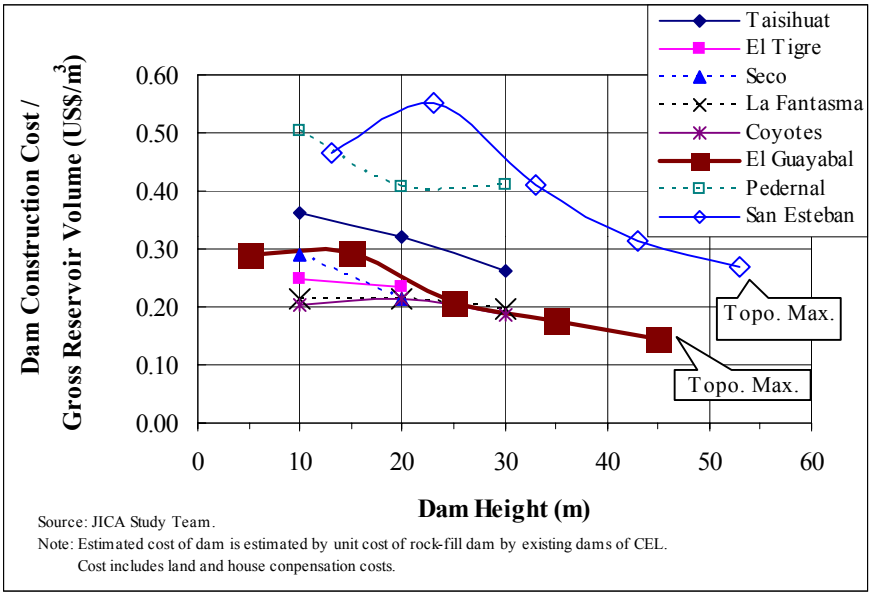
Crest Elevation (m)	**Dam Height [H] (m)**	**Resettlement**		Compensate Road (C.A.7) (km)	Compensation Cost (US$ 10^6)			Others *9) Costs (15%) (US$ 10^6)	**Total Dam Cost (US$ 10^6)**	Unit Cost Res.Water (US$/$m^3$)
		Household (HH) *4)	Person *5) (person)		(House) *6)	(Land) *7)	(Road) *8)			
105	0.0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.000
110	5.0	12	3	0.00	0.24	0.18	0.00	0.12	0.93	0.290
120	15.0	80	18	3.05	1.60	0.59	2.59	1.13	8.65	0.292
130	25.0	147	33	5.58	2.94	1.20	4.74	2.46	18.83	0.207
140	35.0	272	62	7.09	5.44	1.91	6.03	4.53	34.77	0.176
150	45.0	424	96	0.00	8.48	3.65	0.00	7.32	56.08	0.145

Source: JICA Study Team.
Note *1): Equation used for dam embankment volume calculation: Volume (V) = 1/2*W*H*(L1+L2)+1/6*(S1+S2)*H^2*(L1+2*L2)
where, assumed W (Dam Crest Width) =10m, S1 (U/S Slope) =2.0, S2 (D/S Slope) =1.8
Note *2): Unit cost of dam embankment (rock fill type) = 38.90 US$/$m^3$
(source: San Miguel Flood Control F/S, JICA, 1997. Based on the CEL's 15 de Septiembre Dam Cost)
Note *3): Cost of spillway is assumed 40% of dam embankment cost.
(source: San Miguel Flood Control F/S, JICA, 1997. Based on the CEL's 15 de Septiembre Dam Cost)
Note *4): Number of households are counted by using 1/10,000 Topo. Map (IGN, 1980 and revised 1988).
Note *5): Population per household in the study area is assumed as 4.4 people/house.
Note *6): Unit cost of house composition (assumed 100 ***20,000*** US$/house (source: JICA Study Team/ CND)
Note *7): Unit cost of land composition = 145,972 US$/$km^2$, (source: Rio Grande de San Miguel Flood Control F/S, JICA, 1997)
Note *8): Unit cost of primary road (2 lanes) = 850,000 million US$/km (Source: JICA Study Team)
Unit cost of rural road = 22.44 US$/m, (source: Rio Grande de San Miguel Flood Control F/S, JICA, 1997)
Note *9): Other cost is assumed as 15% of total cost.

(5) Comparison of proposed dam sites

Figure 6.1.5 shows the comparison of proposed dam sites by unit reservoir water cost. According to this comparison, the El Guayabal dam with the dam height of around 40m is found to be the most economical scheme.

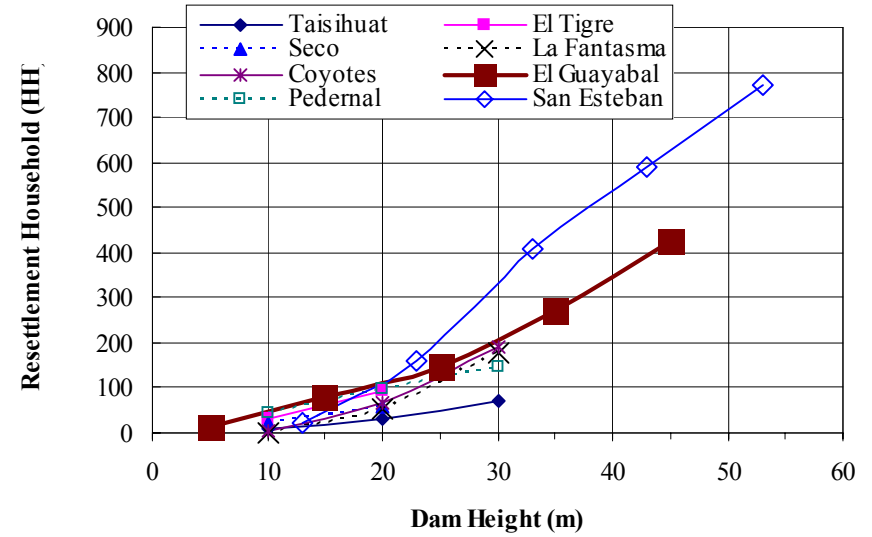
Figure 6.1.5. Comparison of Proposed Dam Sites by Unit Reservoir Water Cost



Source: JICA Study Team.
Note: Estimated cost of dam is estimated by unit cost of rock-fill dam by existing dams of CEL.
Cost includes land and house conpensation costs.

Resettlement of households to be required by each dam project is shown in Figure 6.1.6. The numbers of households in the proposed reservoirs are estimated by using 1/25,000 scale topographic map (IGN, 1990) and the number of dot of household are counted by each reservoir water surface elevation. Each household dot in the 1/25,000 scale map is assumed 2.2 households per dot on the basis of 1/10,000 scale map (IGN, 1980 revised 1988).

Figure 6.1.6. Comparison of Proposed Dam Sites by Required Resettlement Households



Source: JICA Study Team.
Note: Estimated cost of dam is estimated by unit cost of rock-fill dam by existing dams of CEL.
Cost includes land and house conpensation costs.

The estimated number of required resettlement households by the proposed El Guayabal dam

project is much smaller than the San Esteban dam project. Based on these conditions, the El Guayabal dam site is selected as a candidate site for the dam project.

6.2 Hydrology

(1) Rainfall

For the reservoir operation study of the proposed dam, rainfall at reservoir surface is required. The rainfall data from 1961 to 1990 (30 years) used for the reservoir operation study are shown in Table 6.2.1.

Table 6.2.1. Monthly Rainfall at San Miguel El Papalon

Station : 1961-1966: San Miguel, (1967-1990: estimated by using annual rainfall at El Papalon)
Latitude : 13° 26' N **Longitud : 88° 08' W**
Elevation (m) : 80.0

(Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1961	0.0	1.0	8.0	48.0	165.0	188.0	240.0	92.0	456.0	366.0	56.0	2.0	1,622
1962	0.0	0.0	0.0	16.0	206.0	310.0	144.0	180.0	395.0	274.0	74.0	0.0	1,599
1963	0.0	10.0	2.0	16.0	161.0	288.0	339.0	161.0	479.0	175.0	177.0	1.0	1,809
1964	0.0	0.0	0.0	19.0	100.0	233.0	325.0	230.0	194.0	238.0	20.0	3.0	1,362
1965	0.0	0.0	0.0	6.0	136.0	281.0	209.0	241.0	505.0	66.0	1.0	3.0	1,448
1966	1.0	17.0	0.0	86.0	163.0	400.0	236.0	338.0	176.0	164.0	28.0	6.0	1,615
1967	*0.8*	*0.7*	*2.5*	*20.6*	*159.6*	*229.9*	*194.6*	*195.4*	*278.5*	*222.9*	*34.2*	*5.4*	1,345
1968	*0.7*	*0.6*	*2.3*	*19.1*	*147.8*	*213.0*	*180.3*	*181.0*	*258.0*	*206.5*	*31.6*	*5.0*	1,246
1969	*1.0*	*0.9*	*3.1*	*25.5*	*197.4*	*284.4*	*240.8*	*241.8*	*344.6*	*275.8*	*42.3*	*6.7*	1,664
1970	*0.9*	*0.8*	*2.8*	*23.7*	*183.4*	*264.2*	*223.7*	*224.6*	*320.2*	*256.2*	*39.3*	*6.2*	1,546
1971	*0.7*	*0.6*	*2.2*	*18.0*	*139.4*	*200.8*	*170.0*	*170.7*	*243.3*	*194.7*	*29.8*	*4.7*	1,175
1972	*0.7*	*0.6*	*2.2*	*18.6*	*143.7*	*207.0*	*175.3*	*175.9*	*250.8*	*200.7*	*30.8*	*4.9*	1,211
1973	*1.0*	*0.9*	*3.1*	*25.4*	*196.6*	*283.2*	*239.8*	*240.7*	*343.1*	*274.6*	*42.1*	*6.7*	1,657
1974	*0.9*	*0.8*	*2.8*	*23.5*	*181.6*	*261.7*	*221.6*	*222.4*	*317.0*	*253.7*	*38.9*	*6.2*	1,531
1975	*0.8*	*0.7*	*2.6*	*21.9*	*169.5*	*244.2*	*206.8*	*207.6*	*295.9*	*236.8*	*36.3*	*5.8*	1,429
1976	*0.8*	*0.7*	*2.5*	*20.8*	*161.0*	*231.9*	*196.4*	*197.2*	*281.0*	*224.9*	*34.5*	*5.5*	1,357
1977	*0.5*	*0.4*	*1.5*	*12.4*	*96.0*	*138.3*	*117.1*	*117.5*	*167.5*	*134.1*	*20.5*	*3.3*	809
1978	*0.8*	*0.7*	*2.6*	*21.2*	*164.3*	*236.7*	*200.4*	*201.2*	*286.8*	*229.5*	*35.2*	*5.6*	1,385
1979	*0.9*	*0.8*	*2.8*	*23.0*	*178.3*	*256.9*	*217.5*	*218.4*	*311.2*	*249.1*	*38.2*	*6.1*	1,503
1980	*1.2*	*1.1*	*3.8*	*31.3*	*242.7*	*349.7*	*296.1*	*297.3*	*423.7*	*339.1*	*52.0*	*8.2*	2,046
1981	*1.0*	*0.9*	*3.1*	*25.4*	*196.6*	*283.2*	*239.8*	*240.7*	*343.1*	*274.6*	*42.1*	*6.7*	1,657
1982	*0.8*	*0.7*	*2.6*	*21.5*	*166.7*	*240.1*	*203.3*	*204.1*	*291.0*	*232.9*	*35.7*	*5.7*	1,405
1983	*0.7*	*0.6*	*2.3*	*18.8*	*145.4*	*209.5*	*177.4*	*178.1*	*253.9*	*203.2*	*31.1*	*4.9*	1,226
1984	*0.8*	*0.7*	*2.6*	*21.9*	*169.5*	*244.2*	*206.8*	*207.6*	*295.9*	*236.8*	*36.3*	*5.8*	1,429
1985	*0.9*	*0.8*	*2.8*	*23.3*	*180.8*	*260.5*	*220.5*	*221.4*	*315.6*	*252.6*	*38.7*	*6.1*	1,524
1986	*0.8*	*0.7*	*2.5*	*20.7*	*160.6*	*231.4*	*195.9*	*196.7*	*280.4*	*224.4*	*34.4*	*5.5*	1,354
1987	*0.7*	*0.7*	*2.3*	*19.4*	*150.1*	*216.2*	*183.1*	*183.8*	*262.0*	*209.7*	*32.1*	*5.1*	1,265
1988	*1.4*	*1.2*	*4.3*	*36.1*	*279.5*	*402.7*	*341.0*	*342.3*	*487.9*	*390.5*	*59.8*	*9.5*	2,356
1989	*1.1*	*1.0*	*3.6*	*30.0*	*232.6*	*335.2*	*283.8*	*284.9*	*406.1*	*325.0*	*49.8*	*7.9*	1,961
1990	*0.8*	*0.7*	*2.7*	*22.0*	*170.7*	*246.0*	*208.2*	*209.1*	*298.0*	*238.5*	*36.5*	*5.8*	1,439
Ave.	0.7	1.5	2.5	24.5	171.5	259.0	221.1	213.4	318.7	239.0	41.9	5.3	1,499
Max	1.4	17.0	8.0	86.0	279.5	402.7	341.0	342.3	505.0	390.5	177.0	9.5	2,356
Min.	0.0	0.0	0.0	6.0	96.0	138.3	117.1	92.0	167.5	66.0	1.0	0.0	809

Note: Jan.1961 - Dec.1966: Observed data (Source: F/S Proyecto de Olomega, MAG, HARZA, 1967)
Jan.1967 - Dec.1990: Estimated by using observed annaul rainfall (source: SNET) and averaged monthly rainfall pattern from 1927 to 1966 record (source: F/S Proyect de Olomega, HARZA, 1967)

(2) Evaporation

Estimation of the evaporation from reservoir water surface uses average monthly evaporation at the El Papalon station (Table 6.2.2) and the Pan evaporation rate of 0.85.

Table 6.2.2. Monthly Evaporation at San Miguel El Papalon

(Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	N	N	N	N	N	392	251	333	167	186	59	N	N
1974	N	N	N	N	N	N	N	N	137	127	149	189	N
1975	223	214	253	270	201	170	N	171	133	141	120	170	N
1976	204	236	286	236	211	134	200	199	166	150	132	192	N
1977	223	227	291	261	198	148	205	190	172	178	172	195	2,346
1978	244	242	267	232	214	191	205	197	152	169	154	175	2,461
1979	215	239	262	246	189	168	187	191	124	156	131	171	2,441
1980	199	235	265	243	199	199	179	167	157	148	136	194	2,279
1981	202	217	N	N	N	N	N	N	N	N	N	N	N
Average	**216**	**230**	**271**	**248**	**202**	**200**	**204**	**207**	**151**	**157**	**132**	**184**	**2,402**

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, Supporting Report, JICA, 1997.

(3) Inflow

Stream flow record at Villerias

Villerias and Moscoso are the only places where a long term stream flow records are available in the upper and middle basin of the San Miguel river. The monthly stream flow at the proposed dam site is estimated by using observed/generated discharge at the Villerias station (910 km2) and the catchment area ratio. The observed and generated monthly stream flow at Villerias is shown in Table 6.2.3.

The monthly discharges from May 1965 to April 1981 (except July 1976) are based on observed data (Source: PLAMDARH, UNDP, 1981). Discharges during May 1961 - April 1970, June 1979 and May 1981 - April1990 are discharges generated by the PNODT study. The generation of the missing data is by using the following formula (MAG/DGRNR).

$$Q_i = a \times V_i + b \times V_{i-1} + c \times V_{i-2} + d,$$

$$V_i = \sum \left(p_{i,j} \times S_j \right), \text{ and}$$

$$\begin{vmatrix} a \\ b \\ c \\ d \end{vmatrix} = \begin{vmatrix} \sum V_i & \sum (V_{i-1}) & \sum V_{(i-2)} & n \\ \sum V_i 2 & \sum (V_i * V_{i-1}) & \sum (V_i * V_{i-2}) & \sum V_i \\ \sum (V_i * V_{i-1}) & \sum (V_{i-1}) 2 & \sum (V_{i-1} * V_{i-2}) & \sum (V_{i-1}) \\ \sum (V_i * V_{i-2}) & \sum (V_{i-1} * V_{i-2}) & \sum (V_{i-2}) 2 & \sum (V_{i-2}) \end{vmatrix}^{-1} \times \begin{vmatrix} \sum Q_i \\ \sum (Q_i * V_i) \\ \sum (Q_i * V_{i-1}) \\ \sum (Q_i * V_{i-2}) \end{vmatrix},$$

where Q_i: mean monthly discharge in the month of "i" [million m^3/month]

V_i: volume of monthly total rainfall in the month of "i" [million m^3]

$p_{i,j}$: mean monthly rainfall in the month of "i" at the mesh No. of "j"[4] in the catchment area

S_j: area of the portion of mesh "j" corresponding to the basin

n: number of data for correlation

[4] The region of El Salvador has been divided in a mesh of 22 x 24 square of 7 x 7 km^2. (Source: PNODT study, 2003)

Table 6.2.3. Observed and Generated Mean Monthly Discharge at Villerias Station

Rio Grande de San Miguel

River : Grande de San Miguel Elevation (m) 87.43 Latitude (N) 13°31´
Station : Villerias C.A. (km2) 910 Longitude (W) 88°11´
Period: 1970 - 1979

Unit: m3/sec

Year	Month	1 Jan.	2 Feb.	3 Mar.	4 Apr.	5 May	6 Jun.	7 Jul.	8 Aug.	9 Sep.	10 Oct.	11 Nov.	12 Dec.	Annual
1961	1	*3.43*	*2.59*	*2.25*	*2.93*	*5.62*	*18.35*	*42.40*	*19.91*	*71.61*	*33.55*	*13.13*	*7.04*	18.57
1962	2	*3.06*	*1.67*	*1.37*	*2.08*	*0.30*	*46.73*	*32.70*	*36.71*	*49.20*	*50.85*	*12.66*	*4.58*	20.16
1963	3	*1.58*	*1.76*	*1.90*	*2.29*	*9.22*	*29.21*	*32.92*	*24.87*	*45.67*	*23.19*	*11.51*	*6.42*	15.88
1964	4	*2.48*	*1.46*	*1.36*	*2.45*	*1.32*	*45.90*	*57.73*	*52.40*	*44.99*	*26.97*	*8.79*	*3.30*	20.76
1965	5	*1.56*	*1.60*	*1.43*	*1.87*	9.78	18.21	13.50	17.87	56.76	24.82	9.35	6.28	13.59
1966	6	4.55	3.61	2.70	6.19	17.81	48.99	44.47	29.31	39.00	37.78	11.92	8.77	21.26
1967	7	7.30	6.14	6.73	7.68	6.13	19.15	10.86	10.53	30.32	34.83	7.95	5.95	12.80
1968	8	4.82	3.97	2.94	3.37	7.98	23.15	16.34	11.35	36.13	31.84	11.63	6.73	13.35
1969	9	5.30	3.84	3.23	3.71	9.63	30.81	23.83	52.46	143.30	64.19	17.40	5.46	30.26
1970	10	3.96	3.11	2.34	2.30	12.40	36.00	28.70	36.30	65.90	55.70	9.95	5.09	21.81
1971	11	3.41	2.52	2.16	2.22	6.53	18.60	7.69	50.70	43.50	58.30	9.45	4.32	17.45
1972	12	3.04	2.14	1.62	2.73	9.74	17.30	6.15	7.06	17.60	30.10	6.45	2.85	8.90
1973	13	2.17	1.71	1.78	2.93	10.20	58.90	22.30	35.30	74.50	88.10	12.70	5.78	26.36
1974	14	3.70	2.19	1.91	2.15	4.31	11.53	7.78	7.36	46.11	27.93	3.95	2.20	10.09
1975	15	1.71	1.45	1.32	1.42	9.87	7.28	12.66	29.84	69.78	43.19	23.74	3.97	17.19
1976	16	4.42	2.61	1.89	4.81	5.11	58.28	*13.27*	6.41	15.55	17.55	3.73	2.05	11.31
1977	17	1.49	1.33	1.19	1.06	5.35	22.20	2.49	9.36	12.63	6.96	4.98	2.44	5.96
1978	18	1.35	1.24	1.14	1.61	5.42	8.42	21.19	22.64	69.67	40.89	5.55	2.75	15.16
1979	19	2.11	1.72	1.70	1.68	5.24	31.68	43.11	36.81	97.49	9.66	20.92	4.10	21.35
1980	20	2.92	2.01	1.61	1.43	14.37	66.12	29.43	53.92	66.75	87.54	16.35	4.24	28.89
1981	21	2.68	1.86	1.69	1.64	*14.07*	*51.29*	*43.03*	*36.43*	*53.86*	*50.55*	*12.15*	*4.14*	22.78
1982	22	*1.86*	*1.99*	*1.64*	*2.06*	*30.23*	*45.24*	*23.97*	*4.70*	*63.57*	*33.15*	*10.92*	*3.83*	18.60
1983	23	*1.72*	*1.55*	*1.62*	*2.33*	*4.69*	*18.09*	*13.35*	*23.81*	*30.25*	*33.12*	*10.98*	*5.11*	12.22
1984	24	*2.17*	*1.87*	*1.74*	*2.05*	*11.57*	*25.84*	*43.79*	*26.11*	*52.77*	*26.50*	*9.27*	*3.18*	17.24
1985	25	*1.44*	*1.47*	*1.36*	*2.59*	*5.97*	*16.12*	*33.67*	*40.70*	*32.41*	*34.01*	*12.99*	*7.59*	15.86
1986	26	*2.75*	*1.55*	*1.40*	*1.84*	*17.51*	*30.79*	*21.47*	*30.70*	*35.06*	*28.49*	*9.40*	*3.58*	15.38
1987	27	*1.50*	*1.48*	*1.84*	*2.43*	*4.40*	*35.25*	*48.65*	*33.62*	*34.83*	*10.34*	*5.25*	*2.06*	15.14
1988	28	*1.41*	*1.49*	*1.41*	*2.23*	*7.52*	*55.29*	*41.10*	*84.67*	*75.46*	*51.98*	*11.82*	*4.29*	28.22
1989	29	*1.63*	*1.47*	*1.37*	*2.65*	*8.85*	*29.25*	*44.90*	*45.86*	*87.78*	*43.81*	*12.41*	*5.02*	23.75
1990	30	*2.12*	*1.69*	*1.63*	*2.88*	*8.74*	*29.79*	*18.99*	*26.08*	*55.31*	*41.21*	*11.00*	*4.56*	17.00
Average		2.79	2.17	1.94	2.65	8.84	26.03	16.52	23.32	51.48	40.16	9.92	4.62	15.87
Max.		7.30	6.14	6.73	7.68	30.23	66.12	57.73	84.67	143.30	88.10	23.74	8.77	143.30
Min.		1.35	1.24	1.14	1.06	0.30	7.28	2.49	4.70	12.63	6.96	3.73	2.05	0.30

Notes) May 1965 - Apr.1981: Observed data (Source: PLAMDARH, UNDP, 1981) (except Jul. 1976)
May 1961 - Apr.1970, Jun. 1979 and May 1981 - Apr.1990 : estimated discharge
(Source: Plan Nacional de Ordenamieinto y Desarrollo Territorial (PNODT), MARN, MOP&Vivivdu, Epypsa&Iberinsa, 2002)
Jan.1961 - Apr.1961 and May 1990 - Dec.1990: monthly average during 1965-1981.

It has 20 files of MS-Excel, provided by the MAG/DGRNR, which show the monthly mean flow records for each specified period. It also has a file of MS-Excel with the monthly mean rainfall (mm) of El Salvador for the period of between 1961 and 1990 (Centella et al.). These rainfall values in mesh data are proportionate for all territories of El Salvador. The tool used to manipulate the files of Excel and to make the calculations is Visual Basic 6.0 of Excel.

The monthly mean discharges for the period from Jan.1961 to Apr.1961, and from May 1990 to Dec.1990 use the average monthly discharges during 1965-1981. Table 6.2.3 shows that the minimum monthly discharges of the year at Villerias generally occurred in March with the average of 2m^3/sec. The maximum monthly discharge of the year occurred in September or October but the average value varies greatly ranging from 13m^3/sec to 143m^3/sec.

Estimated stream flow discharge at dam site

As there exist no stream flow data available at the dam site of El Guayabal, it was estimated by using specific discharge at Villerias (catchments area=910 km^2). The ratio of catchment area

of El Guayabal Dam site to those of Villerias is 0.487.

$$Q_{(dam)} = Q_{(Villerias)} \times CA_{(dam\ site)} / CA_{(Villerias)},$$

where $Q_{(dam)}$: inflow discharge at dam site [m^3/sec]

$Q_{(Villerias)}$: discharge at Villerias [m^3/sec]

$CA_{(dam\ site)}$: catchment area at dam site [km^2] (El Guayabal dam site=443km^2)

$CA_{(Villerias)}$: catchment area at Villerias [km^2] (910km^2)

Estimated monthly discharges (inflow) at proposed El Guayabal dam site are shown in Table 6.2.4.

Table 6.2.4. Estimated Monthly Inflow at El Guayabal Dam Site

River : Rio Guayabal **Elevation (m) 105.00**
Station : El Guayabal **C.A. (km2) 443**
Period: 1961 - 1990

Unit: m3/sec

Year	Month	1 Jan.	2 Feb.	3 Mar.	4 Apr.	5 May	6 Jun.	7 Jul.	8 Aug.	9 Sep.	10 Oct.	11 Nov.	12 Dec.	Annual
1961	1	1.67	1.26	1.09	1.43	2.74	8.93	20.64	9.69	34.86	16.33	6.39	3.43	9.04
1962	2	1.49	0.81	0.67	1.01	0.15	22.75	15.92	17.87	23.95	24.75	6.16	2.23	9.81
1963	3	0.77	0.86	0.92	1.11	4.49	14.22	16.03	12.11	22.23	11.29	5.60	3.13	7.73
1964	4	1.21	0.71	0.66	1.19	0.64	22.34	28.10	25.51	21.90	13.13	4.28	1.61	10.11
1965	5	0.76	0.78	0.70	0.91	4.76	8.86	6.57	8.70	27.63	12.08	4.55	3.06	6.61
1966	6	2.22	1.76	1.31	3.01	8.67	23.85	21.65	14.27	18.99	18.39	5.80	4.27	10.35
1967	7	3.55	2.99	3.28	3.74	2.98	9.32	5.29	5.13	14.76	16.96	3.87	2.90	6.23
1968	8	2.35	1.93	1.43	1.64	3.88	11.27	7.95	5.53	17.59	15.50	5.66	3.28	6.50
1969	9	2.58	1.87	1.57	1.81	4.69	15.00	11.60	25.54	69.76	31.25	8.47	2.66	14.73
1970	10	1.93	1.51	1.14	1.12	6.04	17.53	13.97	17.67	32.08	27.12	4.84	2.48	10.62
1971	11	1.66	1.23	1.05	1.08	3.18	9.05	3.74	24.68	21.18	28.38	4.60	2.10	8.49
1972	12	1.48	1.04	0.79	1.33	4.74	8.42	2.99	3.44	8.57	14.65	3.14	1.39	4.33
1973	13	1.06	0.83	0.87	1.43	4.97	28.67	10.86	17.18	36.27	42.89	6.18	2.81	12.83
1974	14	1.80	1.07	0.93	1.05	2.10	5.61	3.79	3.58	22.45	13.60	1.92	1.07	4.91
1975	15	0.83	0.71	0.64	0.69	4.80	3.54	6.16	14.53	33.97	21.03	11.56	1.93	8.37
1976	16	2.15	1.27	0.92	2.34	2.49	28.37	6.46	3.12	7.57	8.54	1.82	1.00	5.50
1977	17	0.73	0.65	0.58	0.52	2.60	10.81	1.21	4.56	6.15	3.39	2.42	1.19	2.90
1978	18	0.66	0.60	0.55	0.78	2.64	4.10	10.32	11.02	33.92	19.91	2.70	1.34	7.38
1979	19	1.03	0.84	0.83	0.82	2.55	15.42	20.99	17.92	47.46	4.70	10.18	2.00	10.39
1980	20	1.42	0.98	0.78	0.70	7.00	32.19	14.33	26.25	32.49	42.62	7.96	2.06	14.06
1981	21	1.30	0.91	0.82	0.80	6.85	24.97	20.95	17.73	26.22	24.61	5.91	2.02	11.09
1982	22	0.91	0.97	0.80	1.00	14.72	22.02	11.67	2.29	30.95	16.14	5.32	1.86	9.05
1983	23	0.84	0.75	0.79	1.13	2.28	8.81	6.50	11.59	14.73	16.12	5.35	2.49	5.95
1984	24	1.06	0.91	0.85	1.00	5.63	12.58	21.32	12.71	25.69	12.90	4.51	1.55	8.39
1985	25	0.70	0.72	0.66	1.26	2.91	7.85	16.39	19.81	15.78	16.56	6.32	3.69	7.72
1986	26	1.34	0.75	0.68	0.90	8.52	14.99	10.45	14.95	17.07	13.87	4.58	1.74	7.49
1987	27	0.73	0.72	0.90	1.18	2.14	17.16	23.68	16.37	16.96	5.03	2.56	1.00	7.37
1988	28	0.69	0.73	0.69	1.09	3.66	26.92	20.01	41.22	36.73	25.30	5.75	2.09	13.74
1989	29	0.79	0.72	0.67	1.29	4.31	14.24	21.86	22.33	42.73	21.33	6.04	2.44	11.56
1990	30	1.03	0.82	0.79	1.40	4.26	14.50	9.24	12.69	26.93	20.06	5.36	2.22	8.28
Average		1.36	1.06	0.95	1.29	8.84	26.03	16.52	23.32	51.48	40.16	9.92	4.62	15.46
Max.		3.55	2.99	3.28	3.74	14.72	32.19	28.10	41.22	69.76	42.89	11.56	4.27	69.76
Min.		0.66	0.60	0.55	0.52	0.15	3.54	1.21	2.29	6.15	3.39	1.82	1.00	0.15

Source: JICA Study Team.

(4) Probable flood discharge

The annual maximum peak discharges at the Villerias and the Moscoso stations are shown in Table 6.2.5 and 6.2.6, respectively.

Table 6.2.5. Annual Maximum Peak Discharge at Villerias (Rio Grande de San Miguel)

C.A. = 910 km^2

Year	Month	Date	Waterlevel (m)	Discharge (m^3/s)	Rank	Excess Proba-bility	Return Period (Year)	Remark
1970	9	4	5.66	**866.0**	2	78.57%	4.67	
1971	9	2	5.12	**734.0**	3	64.29%	2.80	
1972								No data
1973	10	8	4.01	**490.0**	6	21.43%	1.27	
1974	9	20	5.44	**685.0**	4	50.00%	2.00	
1975	9	24	6.83	**1,079.1**	1	92.86%	14.00	
1976								Data incomplete
1977	6	15	5.04	**578.9**	5	35.71%	1.56	
1978	9	21	4.58	**462.1**	7	7.14%	1.08	

Source: MAG.
Source: The Study Comprehensive Flood Control for the Rio Grande de San Miguel, JICA, 1997.

Table 6.2.6. Annual Maximum Peak Discharge at Moscoso (Rio Grande de San Miguel)

C.A. = 1,074 km^2

Year	Month	Date	Waterlevel (m)	Discharge (m^3/s)	Rank	Excess Proba-bility	Return Period (Year)	Remark
1964								Data incomplete
1965	9	8	3.72	**494.7**	11	30.00%	1.43	
1966	6	22	6.36	**917.1**	3	83.33%	6.00	
1967	10	5	5.15	**719.5**	8	50.00%	2.00	
1968	9	24	4.02	**538.7**	10	36.67%	1.58	
1969	9	4	8.30	***1,982.0***	1	96.67%	30.00	Note*1)
1970	9	4	5.64	**880.0**	4	76.67%	4.29	
1971	9	3	5.48	**841.5**	5	70.00%	3.33	
1972	10	8	4.08	**777.4**	6	63.33%	2.73	
1973	9	16	8.48	**921.0**	2	90.00%	10.00	
1974	9	8	3.26	**218.3**	15	3.33%	1.03	
1975	9	24	6.90	**709.8**	9	43.33%	1.76	
1976	6	5	7.27	**760.9**	7	56.67%	2.31	
1977	6	16	4.96	**405.1**	12	23.33%	1.30	
1978	9	21	5.34	**382.1**	14	10.00%	1.11	
1979	8	31	6.19	**395.3**	13	16.67%	1.20	

Source: MAG.
Source: The Study Comprehensive Flood Control for the Rio Grande de San Miguel, JICA, 1997.
Note*1): revised by JICA 1997 Study. (orginal data was recorded as 2,784.88 m3/s)

For dam designs, probable flood discharge of more than 1/200-year return period is required. According to the Japanese standard for design of dams, dam design flood is required to be the flood discharge at 1.2 times of 1/200-year flood discharge for fill-type dam. In the world, the probable maximum flood (PMF) discharge or 1/1000 to 1/10,000-year flood discharge is used for the design of dams in general.

There was an existing study on the probable flood by the 1997 JICA study. However, the study report shows the probable flood discharge values up to only the 1/200-year flood. Thus, re-analysis of the probable flood discharges using the above record is required in this study.

The annual maximum flood records are available for 15 years at Moscoso and only seven years for Villerias. As longer records are available at Moscoso, estimation of the probable floods at the proposed dam site uses the annual maximum flood at this station. The highest water level was recorded at Moscoso in September 1969. However, the converted discharge is too large compared with other years' discharge and discharge record at other gauging stations, and thus it was reviewed by the 1997 JICA study. Also, in the calculation of the probable flood peak

discharge at Moscoso, the maximum discharge of 1969 was not used because of unreliable data. The estimated probable flood peak discharge at the Moscoso station is shown in Table 6.2.7 and Figure 6.2.1. Among the applied formulas, the formula of the Log-Peason Type-III has the best conformity.

Table 6.2.7. Probable Flood Peak Discharge at Moscoso

C.A. = 1,074 km^2 (m^3/sec)

Return Period (Year)	Excess Probability	Computation Method				Reference
		Iwai Formula	**Log Peason Type-III**	Gumbel Formula	**Ven Te Chow Formula**	**JICA 1997 Study**
1.01	0.9901	218	**218**	192	276	
1.50	0.6667	493	**493**	507	524	**330**
2	0.5000	593	**593**	609	604	**610**
5	0.2000	853	**853**	858	800	**870**
10	0.1000	1,031	**1,031**	1,023	930	**1,050**
20	0.0500	1,205	**1,205**	1,181	1,054	**1,230**
25	0.0400	1,261	**1,261**	1,231	1,094	
30	0.0333	1,307	**1,307**	1,272	1,126	
40	0.0250	1,380	**1,380**	1,336	1,176	
50	0.0200	1,437	**1,437**	1,386	1,215	**1,450**
80	0.0125	1,558	**1,558**	1,490	1,297	
100	0.0100	1,616	**1,616**	1,539	1,336	**1,650**
200	0.0050	1,800	**1,800**	1,692	1,457	**1,850**
300	0.0033	1,909	**1,909**	1,781	1,527	
500	0.0020	2,050	**2,050**	1,894	1,615	
1,000	0.0010	2,246	**2,246**	2,046	1,735	
2,000	0.0005	2,448	**2,448**	2,199	1,855	
5,000	0.0002	2,726	**2,726**	2,400	2,014	
10,000	0.0001	2,944	**2,944**	2,553	2,134	

Note: Number of Samples = 14 (without maximum value of 1969 Flood)
Source: JICA Study Team, 2003.

The probable flood at the proposed dam site is estimated by using the probable flood at Moscoso adjusted by the following *Creager*'s Curve[5].

$$Q_p = (46 * 0.02832) * C * (0.3861 * A)^a \text{ , and}$$

$$a = 0.894 * (0.3861 * A)^{-0.048},$$

where Q_p: Peak discharge [m^3/sec]

C: *Creager*'s coefficient

A: Catchment area [km^2]

The *Creager*'s coefficients for various return periods estimated by the probable flood peak discharge at Moscoso are shown in Table 6.2.8.

In the San Miguel river basin, almost all hydrological stations stopped to observe after the civil war. At present, three stream gauge stations (Villerias, El Delirio and Vado Marin) are operating with telemeter automatic water level gauging systems newly installed by SNET. Table 6.2.9 and Figure 6.2.2 show stream gauge stations in the San Miguel river basin.

[5] Creager, W.P., Justin, J.D. and Hinds, J. : Engineering for Dams, Vol. 1, John Wiley & Sons, Inc. pp.125-126, 1944.

Figure 6.2.1. Frequency Curve of Probable Flood Peak Discharge at Moscoso (C.A. = 1,074 km^2) Rio Grande de San Miguel

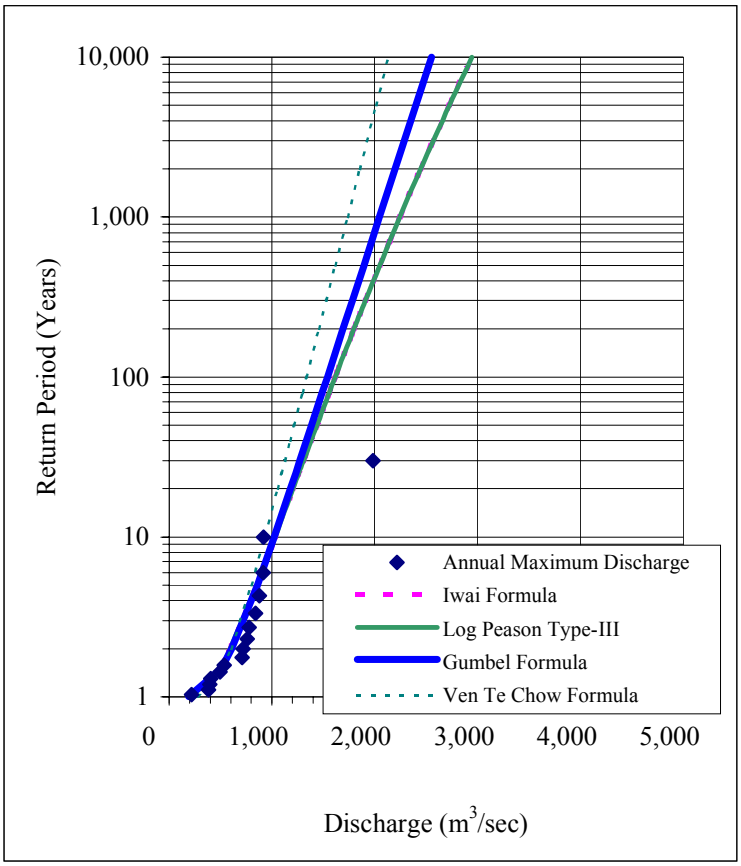


Table 6.2.8. *Creager*'s Coefficient and Probable Flood Peak Discharge at Moscoso and El Guayabal Dam Site

Flood Return Period (Year)	*Creager*'s Coefficient C	Flood Peak Discharge (m^3/s)	
		Moscoso WL. Station C.A.= 1,074 km^2	El Guayabal Dan Site C.A.= 443 km^2
1.05	6.65	507	325
2	7.99	609	391
5	11.25	858	551
10	13.42	1,023	657
20	15.49	1,181	758
50	18.18	1,386	890
100	20.19	1,539	988
200	22.19	1,692	1,086
1000	26.84	2,046	1,314
10000	33.48	2,553	1,639

Source: JICA Study Team.

Creager's Curve: Q = (46 * 0.02932) * C * (0.3861 * A) ^a

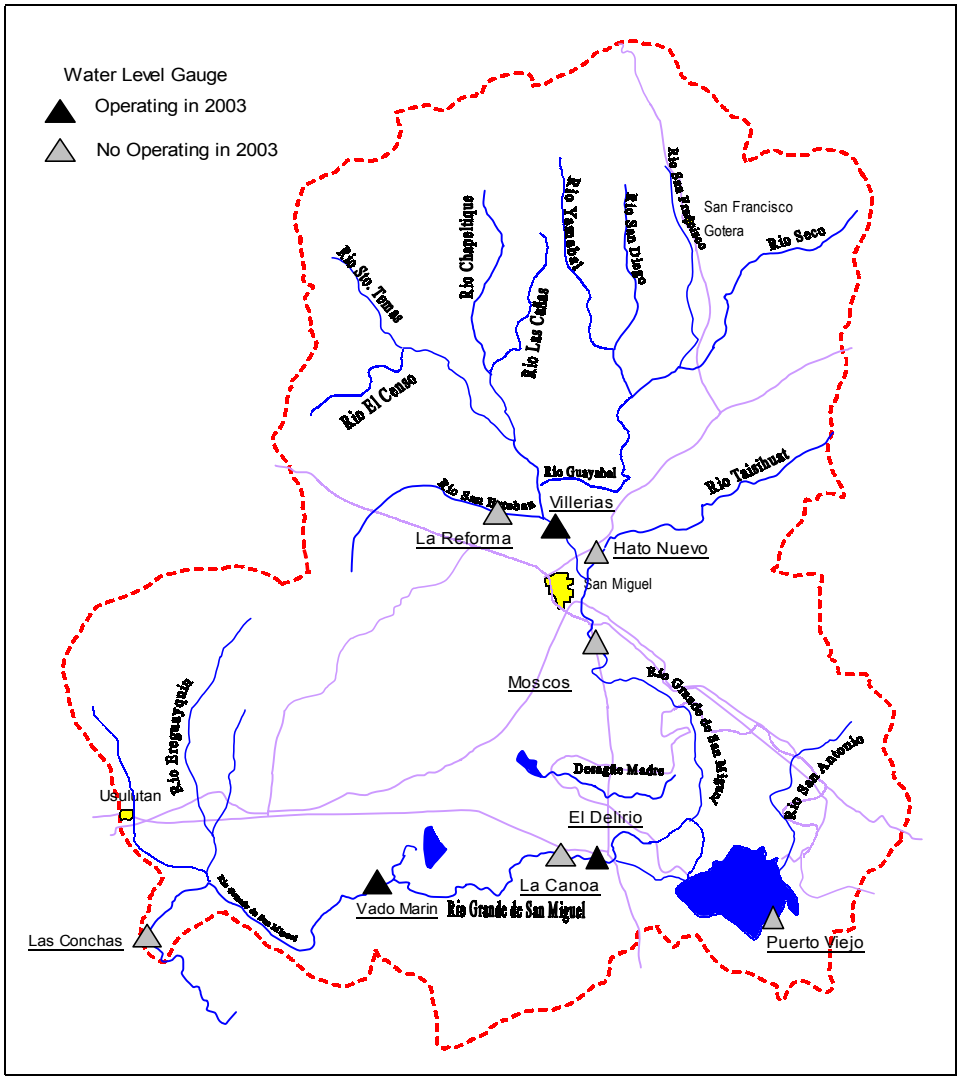
a = 0.894 * (0.3861 * A) ^ -0.048

Table 6.2.9. List of Stream Gauge Station in San Miguel River Basin

No.	Code	Station Name	River	Department	Catchment Area (km^2)	Latitude	Longi-tude	Item	Elevation (MSL)	Open - Close	Reopen - Close	Reopen - Close	Remarks
1	48-02-01	La Reforma	San Esteban	San Miguel		13.32	88.13	H,Q	206.57	1965 - 1978			
2	48-01-05	Villerias	San Miguel	San Miguel	910	13.31	88.11	H,Q	87.43	1965 - 1980	1995 - 1996	2001 -	USGS/ GOES
3	48-04-01	Hato Nuevo	Taisihuat	San Miguel		13.29	88.09	H,Q	92.87	1967 - 1977			
4	48-01-01	Moscoso	San Miguel	San Miguel	1,074	13.26	88.09	H,Q	76.02	1958 - 1981			PAES
5	48-01-03	La Canoa (El Delirio)	San Miguel	San Miguel	1,637	13.20	88.09	H,Q	-	1962- 1982		2001 -	
6	48-01-02	Vado Marin	San Miguel	San Miguel	1,900	13.18	88.17	H,Q	18.78	1959- 1981	1994 - 1996	2001 -	GOES
7	48-01-04	Las Conchas	San Miguel	Usulutan	2,237	13.17	88.25	H,Q	15.23	1963 - 1982			USGS/ GOES
8	48-03-01	Puerto Viejo	Olomega lagoon	San Miguel	-	13.18	88.03	H	63.58	1966 - 1982			

Source: JICA Study (1997), SNET (2002). Notes) H = Water level (Self recording), Q = Discharge (Converted from H)

Figure 6.2.2. Locations of Stream Gauging Station in San Miguel River Basin

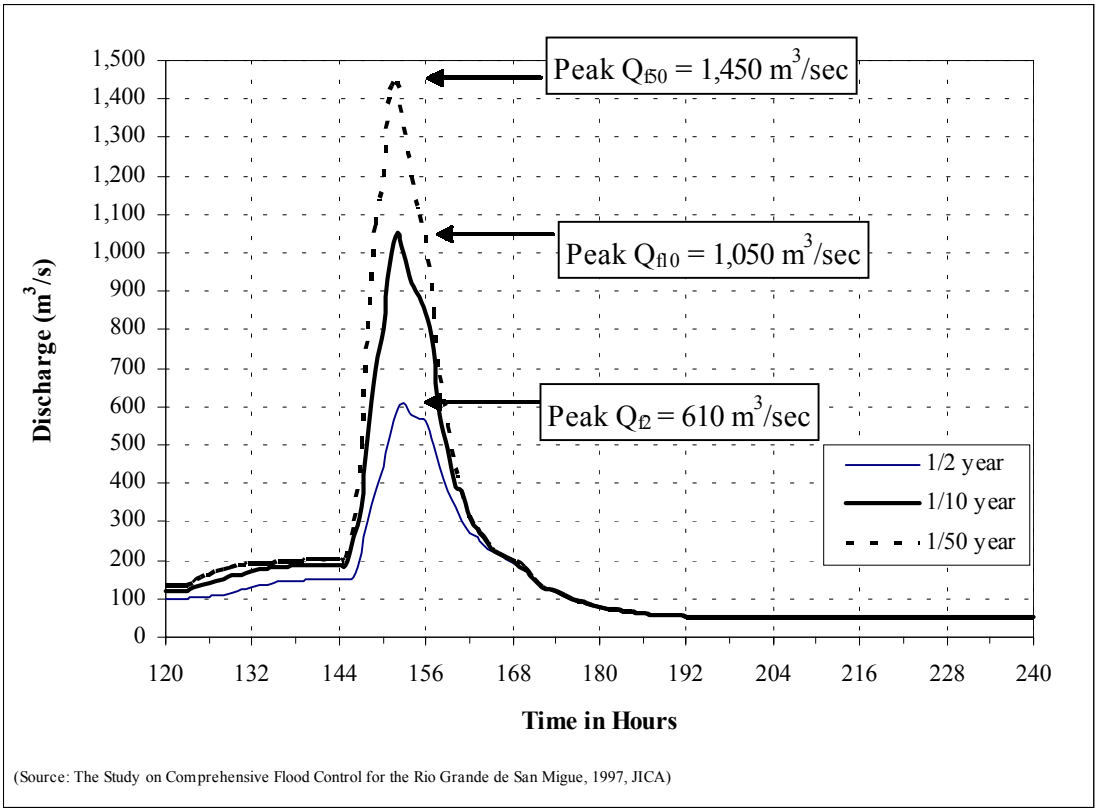


The probable flood discharge should be updated by using available recent data of observed water levels or discharges at the next study stage.

(5) Design flood

The design flood hydrograph at Moscoso (Figure 6.2.3) prepared by the 1997 JICA study was used for the flood routing calculation of the proposed El Guayabal dam. Using the design flood hydrograph at Moscoso and the probable flood peak discharge described above, the design flood hydrograph at proposed El Guayabal dam site is prepared as shown in Figure 6.2.4.

Figure 6.2.3. Design Flood Hydrograph at Moscoso (C.A.=1,074 km^2) by 1997 JICA Study



(Source: The Study on Comprehensive Flood Control for the Rio Grande de San Migue, 1997, JICA)

(6) Sedimentation

Sedimentation is one of the critical factors to govern the reservoir storage space allocation planning. The most practical way to estimate the sediment yield rate is to apply survey data of existing reservoirs in the vicinity of the dam site. As there is no existing reservoir in the same catchment, survey data from those artificial reservoirs on the Lempa river were referred to. This method is justified as the land use map of the whole country shows similarity between the Lempa river basin and the San Miguel river basin.

Table 6.2.10 shows the survey data of four reservoirs on the Lempa river. The calculated average sediment yield rate is 948 m^3/year/km^2 or 0.95 mm/year.

Figure 6.2.4 (1). Design Flood Hydrograph at Proposed El Guayabal Dam Site (C.A.=443km^2)

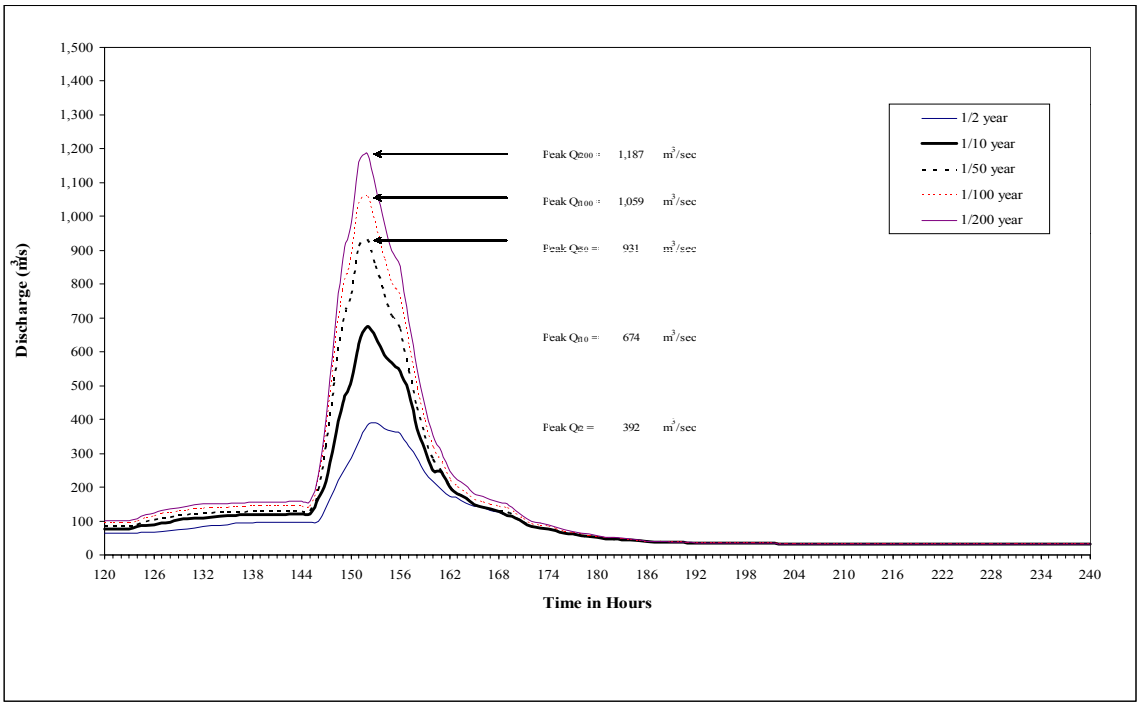


Figure 6.2.4 (2). Design Flood Hydrograph at Proposed El Guayabal Dam Site (C.A.=443km^2)

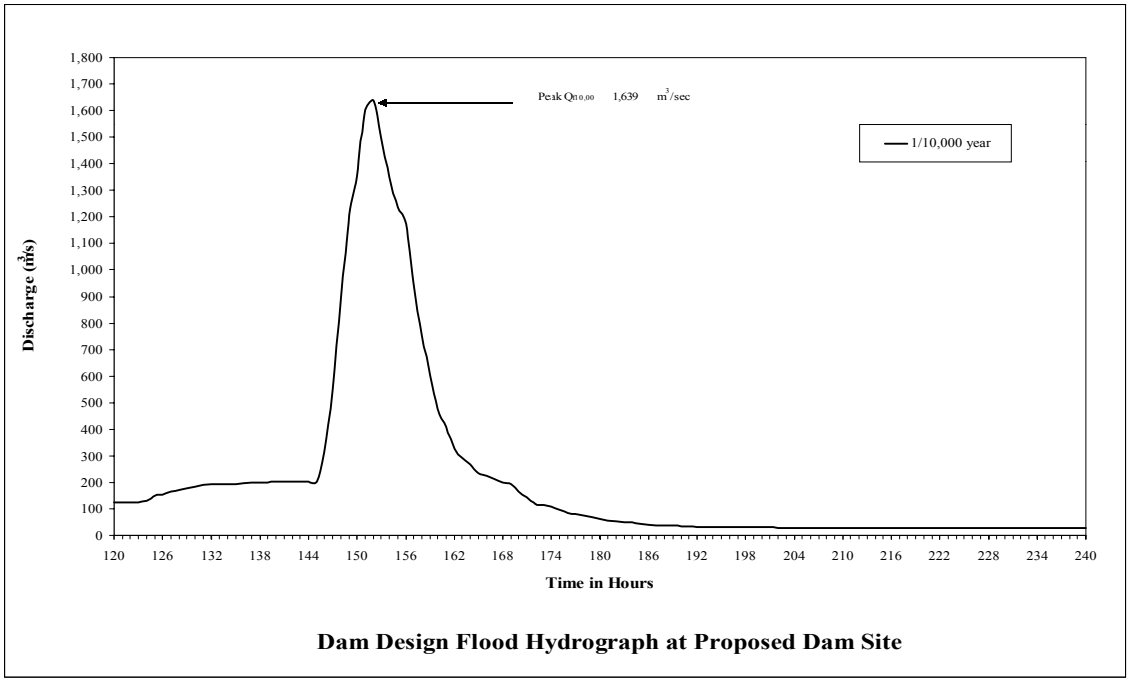


Table 6.2.10. Survey in Existing Reservoirs on Lempa River

Reservoir Name	Catchment Area (km^2)	Residual Catchment (km^2)	Initial Year	Initial Volume (MMC)	Volume in 1994 (MMC)	Annual Sediment (MMC)	Specific Sediment (m^3/year/km^2)	Specific Sediment (mm/year)
Guiha	2,768	2,768	1963	560	508.7	1.65	598	0.60
Cerron Grande	8,584	5,816	1976	2,180	2,026.2	8.54	1,469	1.47
5 de Noviembre	9,863	1,279	1974	65	40.7	1.19	930	0.93
15 de Septiembre	17,524	7,661	1983	393	335.5	5.23	682	0.68
Weighted Average							948	0.95

Source: CEL. (cited by JICA 1997 Study).

On the other hand, the whole basin was studied by JICA 1997 study from the viewpoint of erosion. An aerial photograph analysis and field investigation revealed no serious erosion except the mudflow deposit area surrounding the Usulutan volcano, which is different from the catchments of those dams studied here.

Sediment discharge surveys were conducted in this study, in the forms of water quality survey and sedimentation survey. As all samples taken in this study are at small discharge, it tends to underestimate the total annual sediment discharge.

Finally, taking into account the aforementioned points, the planned sediment yield rate is determined to be 1,000 m^3/km^2/year. In 100 years, the total sediment yield is calculated as 42 million m^3 at the El Guayabal dam site as shown in Table 6.2.11. The corresponding reservoir water elevation is El. 122m.

Table 6.2.11. Estimated Reservoir Sedimentation in Proposed El Guayabal Reservoir

Denudation Rate of Sediment	1.00 mm/year	Source: JICA 1997 Study.
Sediment Bulk Dencity	1,150 kg/m^3	Source: Murthy, B. N., (1977). "Res. Sedimentation", C.B.I.P., No. 126) 500 - 1,800 kg/m^3
Specific Sediment Yield	1,150 t/km^2/year	
Deposition Rate	509,000 t/year	
Mean Annual Inflow at Q.obs. Station	15.87 m^3/sec	Average of 30 years
Mean Annual Inflow at Dam Site	133.86 m^3/sec	Q(dam) = Q(KC) * A(dam) / A(KC)
Capacity-Inflow Ratio	2.13	(Gross Res. Capacity) / (Annual Inflow)
Trap Efficiency	95%	According to the Brune curves (U.S. Bureau of Reclamation, 1974)
Annual Sediment Inflow Volume	420,478 m^3/year	950 m^3/yr/km^2 (Source: Existing reservoir of Lempa River, CEL)
Life (year) of Reservoir for Sedimentation	100 year	Referred to Japanese Dam Standard
Dead Storage Vol. for Sediment	42.05 x 10^6 m^3	

Source: JICA Study Team.

6.3 Geology

No geological investigation has been conducted for the proposed El Guayabal dam site. Detailed geological investigation is required at the stage of a full feasibility study. Geological investigation for the San Esteban site was conducted by some previous studies. The distance between these proposed sites of San Esteban and El Guayabal is about 2km only. Thus, in this stage, both sites are assumed to have similar geological conditions.

In the study by MAG-TRANARG in 1977, a geological investigation including borings was carried out and the geological section of proposed San Esteban dam site was estimated. In the

1997 JICA study, a review of previous studies and surface investigation were combined to make geotechnical analysis on the dam site as follows.

The foundation rock is composed of various volcanic rocks such as vitric tuff, tuff (fine to sandy), basaltic lava, and volcanic breccia that are covered by unconsolidated talus deposit, river deposit and terrace deposit. Hard and fine lava are fit for dam foundation and construction materials, but porous rock and/or agglomerate rock are troublesome for dam foundation due to its heterogeneous soundness and high permeability.

The recommendable maximum dam height is estimated about 155m above mean sea level from the topographical point of view. The width of right ridge is not so large and leakage shall be checked in terms of distribution of permeable lava.

The groundwater table in the left bank is low. Judging from this hydrogeological condition, permeability of foundation rock may be high in general. Consequently, length of curtain grouting line and depth of grouting may be large.

Core and filter materials may be obtained near the dam site in the reservoir. Mineral materials especially riprap materials, however, shall be brought from the far site near the Pan American highway.

6.4 Water Demand

(1) River maintenance flow

At present, there is no regulation/law concerning river maintenance flow to be discharged from a dam/reservoir in El Salvador. In this study, the minimum outflow from the proposed El Guayabal dam for the river maintenance flow is set at the average monthly discharge in March at the dam site. The average monthly discharge in March at the proposed dam site is 0.95 m^3/sec, averaged from 1961 to 1990 (30 years) as already shown in Table 6.2.4.

(2) Domestic water demand[6]

Present water demand

The water for domestic purposes in the Study Area depends mainly on groundwater. The present domestic water demand and supply in the departments of San Miguel and Usulutan in March 1996 are shown in Table 6.4.1.

The table shows that the total demand in the two departments is 85,720 m^3/day, while the total supply capacity is 62,400m^3/day, making the ratio of supply to demand 73%. Among the municipalities, San Miguel city is experiencing a large deficit, while Usulutan has surplus of water supply.

[6] Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, JICA, 1997.

Another related water problem of San Miguel city is continuous lowering of groundwater table as shown in Table 6.4.2. The rate is 0.05m/year to 1.0m/year depending upon the location. Observing the distribution of wells and Table 6.4.2, the main cause of the problem might be the concentration of wells in a small area.

Table 6.4.1. Projected Domestic Water Demand in 2020

Department	Municipality	System	Population	(1996)		Capacity	Ratio	Source	Projection	Projection	New Water	Rio Grande
			(1996)	(l/p/d)	(m^3/d)	1996 (m^3/d)	(%)	(1996)	in 2020	2020 (m^3/d)	(m^3/d)	River (m^3/d)
San Miguel	San Miguel	El Sitio	186,267	250	46,567	32,225	69	GW	298,027	74,507	42,282	50% 21,141
	Chinameca	El Liano	15,000	150	2,250	376	17	GW	24,000	3,600	3,224	
	Moncagua	Los Nacimientos	4,100	125	513	433	84	GW	6,560	820	387	
	Quelepa	Los Nacimien	3,900	125	488	279	57	GW	6,240	780	501	
	Lototique	La Piscina	4,000	125	500	482	96	GW	6,400	800	318	
	San Rafael Ote	El Almendro	7,000	150	1,050	505	48	GW	11,200	1,680	1,175	
	San Jorge	El Almendro	4,500	125	563	86	15	GW	7,200	900	814	
	El Ttansito	El Maranon	10,441	175	1,827	1,626	89	GW	16,706	2,924	1,298	
	San Gerardo	Antigua-Tacot	3,133	125	392	89	23	GW	5,013	627	538	
	Chirilagua	Zapatagua	6,000	150	900	576	64	GW	9,600	1,440	864	
	Guasori	Guanaste	3,765	125	471	103	22	GW	6,024	753	650	
	C/El Liano El A.	San Matias	2,887	125	361	432	120	GW	4,619	577	145	
	Carolina	Miracapa	4,610	125	576	612	106	GW	7,376	922	310	
	Uluazapa	La Palma	4,000	125	500	230	46	GW	6,400	800	570	
	Sub-total		259,603		56,956	38,054	857		415,365	91,129	53,075	21,141
Usultan	Usultan	El Molino	35,000	200	7,000	8,245	118	GW	56,000	11,200	2,955	
	Jucuapa	La Cruz	16,000	150	2,400	2,016	84	GW	25,600	3,840	1,824	
	San Buenaventura	Pila del Cura	3,000	125	375	289	77	GW	4,800	600	311	
	Nusva Grumada	Rio Umana	4,000	125	500	99	20	GW	6,400	800	701	
	C/Jocotillo	Rio Umana	1,900	100	190	95	50	GW	3,040	304	209	
	Mercedes Umare	Sante Anita ll	4,000	125	500	860	172	GW	6,400	800	0	
	Villa El Tfo.	Baltazar Orell	6,200	150	930	2,160	232	GW	9,920	1,488	0	
	Estanuelas	El Aceituno	7,150	150	1,073	504	47	GW	11,440	1,716	1,212	
	Jiquilisco	Los Cactus	12,564	175	2,199	817	37	GW	20,102	3,518	2,701	
	Santa Elana	Los Mangos	8,814	150	1,322	828	63	GW	14,102	2,115	1,287	
	Sgo de Maria	El Milagso	20,000	250	5,000	2,930	59	GW	32,000	8,000	5,070	
	Berlin	Pierdona	7,878	150	1,182	1,224	104	GW	12,605	1,891	667	
	California	Tetraloffa	3,000	125	375	10	3	GW	4,800	600	590	
	Alegffa	Palmara	3,500	125	438	1,260	288	GW	5,600	700	0	
	Santa Marfa	El Pozo	7,362	125	920	172	19	GW	11,779	1,472	1,300	
	Concep. Batres	El Tempisque	2,000	125	250	33	13	GW	3,200	400	367	
	Ozatlan	La Poza	6,500	150	975	145	15	GW	10,400	1,560	1,415	
	Oucuaran	El Since	3,500	125	438	44	10	GW	5,600	700	656	
	Puerto El Triun	El Tercio	12,481	175	2,184	2,432	111	GW	19,970	3,495	1,063	
	C/El Pozon	Tetzalogia	1,000	100	100	58	58	GW	1,600	160	102	
	C/El Jicaro	Tetzalogia	1,000	100	100	58	58	GW	1,600	160	102	
	Tecapan	Tetzalogia	2,500	125	313	58	19	GW	4,000	500	442	
	Sub-total		169,349		28,762	24,337	85		270,958	46,019	21,682	0
	Sub-total		428,952		85,718	62,391	73		686,323	137,148	74,757	21,141
										Future Domestic Water Demand Projection in 2020 (m^3/sec) =		**0.24**

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, JICA, 1997.

Table 6.4.2. Wells in San Miguel City

Well Location Name	Well No.	Dia. (inch)	Production in 1996 (m^3/d)	Water Table lowering (m)	(m/year)	Groundwater Depth(m) 1958	1966	1970	1972	1973	1982	1985	1989	1992	1994	1995	1996
La Paz	1	12	1,003	8.30	0.38					10.92						19.22	
	2	16		0.91	0.04			15.25								16.17	
	3	12	1,144	15.71	0.79				13.73					29.43			
	4	10	1,458	1.53	0.51									11.29		12.81	
Hillerman	1	16	4,320	8.08	0.38					13.27		13.27			21.35		
	2	14		6.10	0.29					13.73		13.54			19.83		
	3	16	4,320	0.00	0.00					20.44					20.44		
Belen	1	16	1,116	1.53	0.05		9.76					9.75					11.29
	2	16	725	2.75	0.11			13.73				26.80					16.47
	3	16		2.14	0.10					9.76		10.58				11.90	
El Molino	1	10	1,496	11.47	0.88						2.26					13.73	
El Sitio	1	12	6,034	0.61	0.15									23.79			24.40
	2																
Jalacatal	1	16/18	3,456	1.53	0.04	30.50											32.03
	2																
Brigada	1	8		3.05	0.44								11.44				14.49
Moncagua	1		379														
Tlaloc	1																
San Carlos	1		774														

Source: The Study on Comprehensive Flood Control for the Rio Grande de San Miguel, JICA, 1997.

Future water demand

According to the population projection for the Study Area, the population will increase by 92% from 1992 to 2010. By extrapolating this trend, the population in the Study Area in 2020 was estimated. If the specific water consumption remains as estimated at present, the total water demand for domestic use will increase to 137,150m^3/day in 2020. Thus, the increment of

demand is 74,760m^3/day (0.87m^3/sec), which should be supplied by new water sources (Table 6.4.1).

The ANDA East Region office studied water supply schemes to meet the present deficit and future demand increase in the area. According to their plan, groundwater is more preferable than surface water, considering the water quality and the available amount of water.

The problem of lowering groundwater table will be solved by diversifying well locations toward the south where a large groundwater potential is expected. However, in order to make a quantitative study of the plan, it is necessary to acquire data by test borings and pumping tests.

In this study, it is assumed that most of the incremental domestic water demand will be supplied by groundwater because of the location of intake site, limited river flow during the dry season and the water quality. However, it is planned that 50% of the future incremental water demand in San Miguel city will be supplied by the proposed El Guayabal multipurpose dam. The required domestic water demand for San Miguel city by the El Guayabal dam is estimated at 21,140m^3/day (=0.24m^3/sec) as shown in Table 6.4.1.

(2) Irrigation water demand

Present water demand

Presently, agricultural water use of San Miguel river is very small. Only one pumping station is located on the main river and the total intake of water is less than 0.2m^3/s estimated from the diameter of the pump installed (cf. 1997 JICA study).

In the upper basin of the river, many small-scale irrigation systems are taking water from small streams. Table 6.4.3 shows all registered water rights at present. The total amounts of registered water rights are l.0 m^3/s, used mainly for grazing.

Future water demand

There are various irrigation projects in the area and the most ambitious one is the Usulutan-San Miguel irrigation project prepared in 1977. The study covers the middle and the lower basin and the total target irrigation area is 28,900ha. The study also includes a proposal for new cropping patterns and an irrigation water demand study. The total irrigation water demand in the area calculated in the Usulutan-San Miguel irrigation project is 376 million m^3 annually, of which 126 million m^3 is from groundwater.

As previous irrigation project studies are very old, needs of market have largely changed between the 1970's and the present. The proposed crops and the cropping patterns in the previous study should be updated.

Table 6.4.3. Water Right Registered in the San Miguel River Basin

No.	No.	Water Source	Municipio	Canton	Irr.Area (MZ)	Irr.Area (ha)	Crop	Amount (L/sec)	Hour (hr/day)	Day
583	1	Chapeltique River	San Miguel	San Pedro	5	3.5	Grass	40.00	12	8
578	2	Chapeltique River	San Miguel	Hualamd	3	2.1	Grass	30.30	24	10
752	3	Chapeltique River	San Miguel	Hualamd	3.5	2.5	Grass	35.35	24	10
819	4	Chapeltique River	San Miguel	La Trinidad	4	2.8	Grass	40.40	24	10
821	5	Chapeltique River	San Miguel	San Pedro	5	3.5	Grass	50.50	24	10
825	6	Chapeltique River	San Miguel	Hualama	1	0.7	Grass	16.16	12	8
845	7	Chapeltique River	San Miguel	La Trinidad	3	2.1	Grass	30.30	24	10
820	8	Chapeltique River	San Miguel	Suburbiol	1	0.7	Grass	20.20	12	10
815	9	Chapeltique River	San Miguel	San Pedro	2	1.4	Grass	16.20	12	8
816	10	Chapeltique River	San Miguel	San Pedro	1	0.7	Grass	16.20	12	8
1019	11	Chapeltique River	San Miguel	Santo Tomas	3	2.1	Grass	24.30	24	8
1021	12	Chapeltique River	San Miguel	San Pedro	5	3.5	Grass	24.30	24	8
1022	13	Chapeltique River	San Miguel	Hualama	5	3.5	Grass	31.59	24	8
1027	14	Chapeltique River	San Miguel	San Pedro	2	1.4	Grass	24.30	24	8
1026	15	Santo Tomas	Chapel Tique	San Geronimo	6	4.2	Maiz/Rice	20.17	12	8
822	1	Chapeltique River	Chapel Tique	San Pedro	2	1.4	Grass	40.40	12	10
823	2	Chapeltique River	Chapel Tique	San Pedro	2	1.4	Grass	40.40	12	10
824	3	Chapeltique River	Chapel Tique	San Pedro	3	2.1	Grass	60.60	12	10
821	4	Chapeltique River	Chapel Tique	San Pedro	5	3.5	Grass	50.50	24	10
578	5	Chapeltique River	Chapel Tique	Hualama	3	2.1	Grass	30.30	24	10
752	6	Chapeltique River	Chapel Tique	Hualama	3.5	2.5	Grass	35.35	24	10
919	7	Chapeltique River	Chapel Tique	La Trinidad	4	2.8	Grass	40.40	24	10
	1	Santo Tomas	Chapel Tique	San Geronimo	4	2.8	Grass	40.40	24	10
953	1	Guayabal River	Yamnabal	Lauo Grande	3	2.1	Maiz	30.61	24	8
954	2	Guayabal River	Guat Jiagua	San Bartalon	3	2.1	Grass	24.44	24	8
955	3	Guayabal River	Guat Jiagua	El Jacaral	10	7.0	Grass	81.00	14	8
982	4	Los Amates	Guat Jiagua	Pajiagua	10	7.0	Rice	16.00	24	8
983	5	Los Amates	Guat Jiagua	Goyade	3.5	2.5	Rice	47.00	24	8
1018	6	Guayabal	Guat Jiagua	Guayaabal	2	1.4	Grass	32.00	12	8
1028	7	Ras Canas	Guat Jiagua	San bartalo	6	4.2	Grass/Maiz	61.23	24	8
TOTAL					**113.5**	**79.5**		**1,051**		

Source: The Sutdy on Comprehensive Flood Control for the Rio Grande de San Miguel, Supporting Report, 1997, JICA.

Present and proposed cropping patterns

Due to repeated flooding and severe droughts, the present land use in the flood prone area along the middle and lower reaches of Rio Grande de San Miguel is mostly pasture (55%) and sugarcane (5%) as shown in Figure 6.4.1. A more promising cropping pattern under irrigation has been worked out in view of new marketing opportunities as shown in Figure 6.4.2.

Irrigation water requirement

Using the proposed cropping pattern and the meteorological data, the crop water requirements were estimated by applying the modified Penman method (FAO-CropWat-4). The meteorological data from the FAO-CLIMWAT-database were also used. Potential evapotranspiration (ETo) and effective rainfall are shown in Table 6.4.4.

Figure 6.4.1. Present Cropping Pattern in Flood Prone Area of San Miguel River

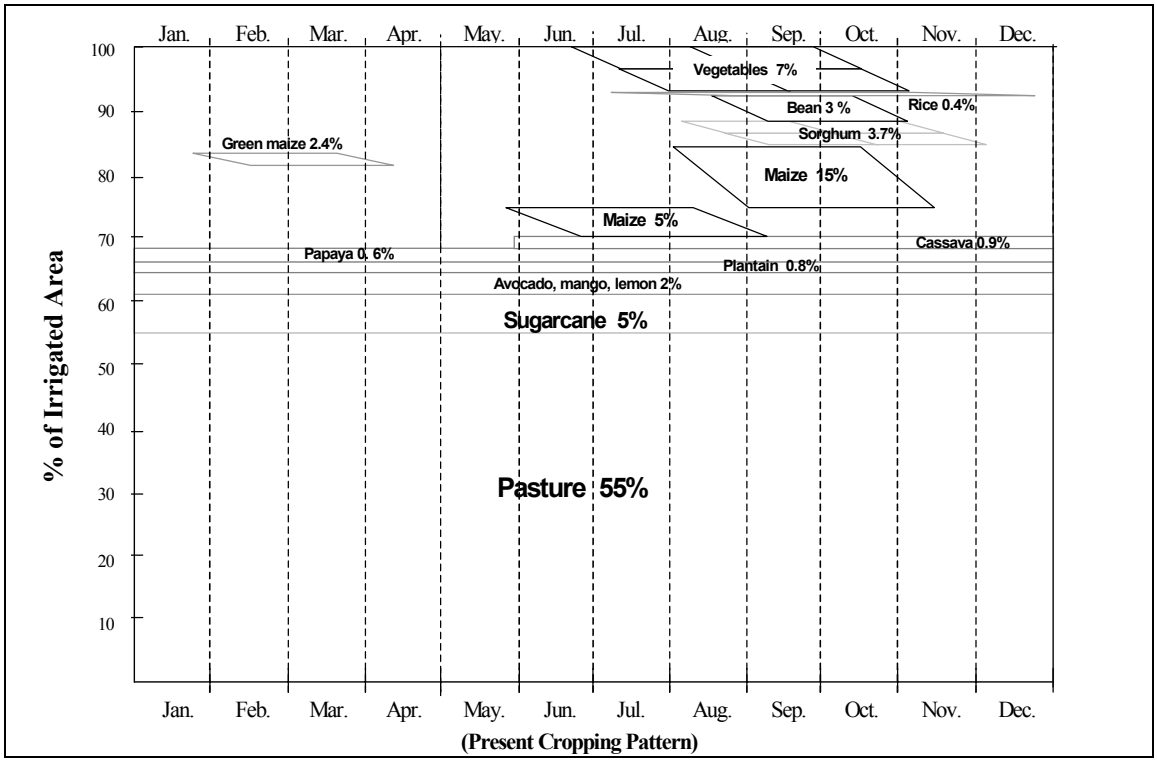


Figure 6.4.2. Proposed Cropping Pattern for Irrigation Area of San Miguel River [after Irrigation Project with El Guayabal Dam]

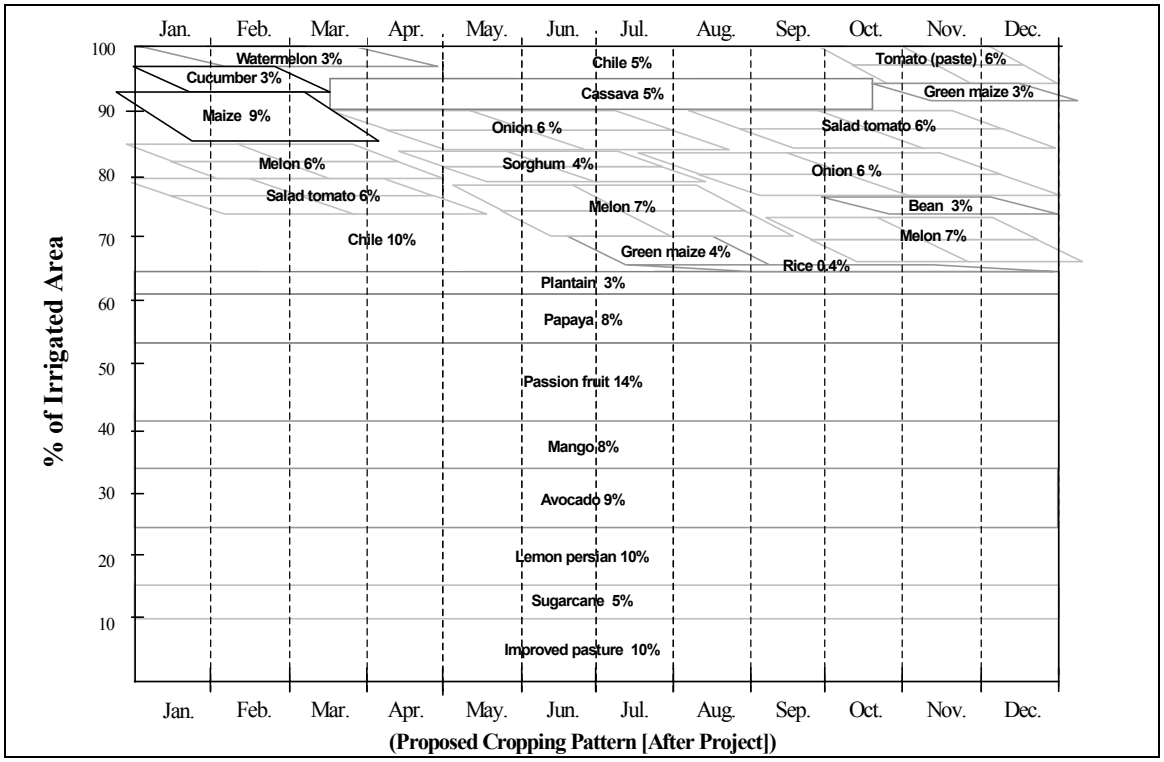


Table 6.4.4. Potential Evapotranspiration (ETo) and Effective Rainfall

Season	Period (Date)			Days	ETo (mm/period)					Effective Rainfall (mm/period)				
				Station:	El Papalon (San Miguel)	San Miguel (San Miguel)	La Carrera (Usultan)	La Union (La Union)	Santa Cruz Porrillo (San Vicente)	El Papalon (San Miguel)	San Miguel (San Miguel)	La Carrera (Usultan)	La Union (La Union)	Santa Cruz Porrillo (San Vicente)
				Elev.(m):	80	80	75	95	30	80	80	75	95	30
				Latitude:	13.26	13.27	13.19	13.19	13.26	13.26	13.27	13.19	13.19	13.26
				Longitude:	88.07	88.07	88.31	87.52	88.48	88.07	88.07	88.31	87.52	88.48
Dry Season	1/1	~	1/15	15	72.37	79.20	79.36	86.44	72.39	0.00	0.00	0.00	0.00	0.00
	1/16	~	1/30	15	77.02	83.15	82.21	90.52	74.89	0.00	0.00	0.00	0.00	0.00
	1/31	~	2/14	15	81.08	86.53	84.45	93.73	76.99	0.00	0.00	0.00	0.00	0.00
	2/15	~	3/1	15	84.27	89.07	85.91	95.86	78.56	0.00	0.00	0.00	0.00	0.00
	3/2	~	3/16	15	86.44	90.61	86.55	96.83	79.52	0.00	0.00	0.00	0.00	0.00
	3/17	~	3/31	15	87.55	91.05	86.36	96.65	79.85	0.02	0.09	0.13	0.22	0.34
	4/1	~	4/15	15	87.59	90.40	85.43	95.42	79.58	1.41	0.73	0.54	0.15	0.86
	4/16	~	4/30	15	86.68	88.71	83.86	93.31	78.77	21.01	23.94	23.11	23.98	23.97
	5/1	~	5/15	15	84.92	86.11	81.79	90.52	77.51	43.31	49.94	46.53	50.64	47.04
Rainy Season	5/16	~	5/30	15	82.50	82.76	79.39	87.27	75.90	60.21	69.59	64.09	69.03	64.41
	5/31	~	6/14	15	79.60	78.86	76.81	83.79	74.05	66.90	77.34	72.24	75.25	72.71
	6/15	~	6/29	15	76.41	74.63	74.22	80.31	72.09	66.52	76.59	73.62	73.08	74.50
	6/30	~	7/14	15	73.13	70.32	71.77	77.04	70.14	64.41	73.41	73.04	68.86	74.38
	7/15	~	7/29	15	69.95	66.17	69.59	74.15	68.29	61.89	69.42	71.00	64.65	72.59
	7/30	~	8/13	15	67.04	62.41	67.80	71.80	66.64	62.74	69.28	71.34	65.08	72.87
	8/14	~	8/28	15	64.54	59.27	66.48	70.09	65.28	64.58	70.84	71.89	67.96	72.99
	8/29	~	9/12	15	62.56	56.94	65.68	69.08	64.26	68.06	75.09	74.47	73.80	74.95
	9/13	~	9/27	15	61.19	55.58	65.42	68.80	63.62	71.18	79.97	78.08	80.14	77.95
	9/28	~	10/12	15	60.48	55.30	65.69	69.22	63.38	66.84	77.54	75.90	78.77	75.35
	10/13	~	10/27	15	60.42	56.16	66.45	70.27	63.54	53.34	65.55	66.31	67.11	65.70
	10/28	~	11/11	15	61.00	58.13	67.64	71.86	64.07	29.11	41.01	45.46	41.96	45.26
Dry Season	11/12	~	11/26	15	62.13	61.13	69.15	73.84	64.91	2.33	8.56	12.02	8.64	15.49
	11/27	~	12/11	15	63.72	64.99	70.88	76.07	66.00	0.10	0.25	0.09	0.15	0.12
	12/12	~	12/26	15	65.63	69.43	72.71	78.38	67.24	0.00	0.00	0.00	0.00	0.00
	12/27	~	12/31	5	22.33	24.18	24.64	26.63	22.70	0.00	0.00	0.00	0.00	0.00
	Total			365	1,780.55	1,781.09	1,830.24	1,987.88	1,730.17	803.96	929.14	919.86	909.47	931.48

* ETo (potential evapotranspiration) and rainfall data are distributed using polynomial curve fitting. (by using "FAO-CropWat 4", Windows Ver. 4.3)
Climate data used by "FAO-CLIMWAT-database".

For estimation of the irrigation water requirements, the irrigation efficiencies are assumed as follows.

- Conveyance efficiency (*Ec*): 0.90 (Based on ICID/ILRI Study)
- Field canal efficiency (*Eb*): 0.85 for brick canal (Based on ICID/ILRI Study)
- Field application efficiency (*Ea*): 0.70 for surface irrigation method in medium soil (Source: U.S. Department of Agriculture)
- Distribution efficiency (Ed): $Ed = Eb \times Ec = 0.77$
- Farm efficiency (*Ef*): $Ef = Eb \times Ea = 0.60$
- Irrigation project efficiency (*Ep*): $Ep = Ea \times Eb \times Ec = 0.54$

The estimated monthly irrigation water requirements and the calculation are shown in Tables 6.4.5 and 6.4.6, respectively.

(3) Hydropower generation

Present water demand

There used to be the San Esteban hydropower station but it was abandoned in 1991. There is no hydropower station in the San Miguel river basin at present.

Table 6.4.5. Irrigation Water Requirement (Irrigation Area=14,300 ha)

Month		Irrigation Water Requirement (m^3/ sec)
1	Jan.	**11.84**
2	Feb.	**11.99**
3	Mar.	**12.70**
4	Apr.	**10.62**
5	May	**2.55**
6	Jun.	**0.14**
7	Jul.	**0.73**
8	Aug.	**0.03**
9	Sep.	**0.00**
10	Oct.	**0.00**
11	Nov.	**7.31**
12	Dec.	**11.33**
Average		**5.84**

Source: JICA Study Team.

Table 6.4.6. Irrigation Water Requirements (Irrigation Area = 14,300 ha)

Crop # : [All crops]
Block # : [All blocks]
Calculation time = 15 Day(s)
Irrigation Efficie = 70%
Irrigation Efficie = 70%

Climate Station: 1 **El Papalon (San Miguel)**
Elev.(m): 80 m
Latitude: 13.26 N
Longitude: 88.07 E

Unit Irrigation Area (ha): **14,300**
Distribution Efficiency (Ed): **77%**

Season	Period (Date)			ETo *1) (mm/ period)	Planted Area ** (%)	Crop Kc *2)	CWR *3) (ETm) (mm/ period)	Total *1) Rain (mm/ period)	Effect.*4) Rain (mm/ period)	Irr. Req. (mm/ period)	FWS *5) (l/s/ha)	FWS *5) (m^3/ period/ Crop Area)	W.Loss. (Canal) (m^3/ period/ Crop Area)	Irrigation Water Requirement (m^3/ period/ Crop Area)	Irrigation Water Requirement (m^3/ sec)
Dry Season	1/1	~	1/15	72.37	99.00	0.84	60.79	0.00	0.00	60.79	0.67	12,418,692	2,918,393	15,337,085	**11.83**
	1/16	~	1/30	77.02	96.13	0.79	60.85	0.00	0.00	60.85	0.67	12,429,928	2,921,033	15,350,961	**11.84**
	1/31	~	2/14	81.08	91.67	0.75	60.81	0.00	0.00	60.81	0.67	12,422,614	2,919,314	15,341,929	**11.84**
	2/15	~	3/1	84.27	90.33	0.74	62.36	0.00	0.00	62.36	0.69	12,739,216	2,993,716	15,732,932	**12.14**
	3/2	~	3/16	86.44	87.40	0.74	63.97	0.00	0.00	63.97	0.71	13,067,258	3,070,806	16,138,064	**12.45**
	3/17	~	3/31	87.55	89.60	0.76	66.54	0.04	0.02	66.52	0.73	13,588,677	3,193,339	16,782,016	**12.95**
	4/1	~	4/15	87.59	88.07	0.76	66.57	1.41	1.41	65.16	0.72	13,310,930	3,128,069	16,438,999	**12.68**
	4/16	~	4/30	86.68	87.87	0.75	65.01	25.89	21.01	44.00	0.49	8,988,571	2,112,314	11,100,886	**8.57**
	5/1	~	5/15	84.92	90.53	0.76	64.54	61.15	43.31	21.23	0.23	4,336,822	1,019,153	5,355,976	**4.13**
Rainy Season	5/16	~	5/30	82.50	94.67	0.79	65.18	88.23	60.21	4.97	0.05	1,014,279	238,355	1,252,634	**0.97**
	5/31	~	6/14	79.60	96.00	0.83	66.07	99.17	66.90	0.00	0.00	0	0	0	**0.00**
	6/15	~	6/29	76.41	97.00	0.89	68.00	98.92	66.52	1.48	0.02	303,344	71,286	374,630	**0.29**
	6/30	~	7/14	73.13	99.67	0.93	68.01	96.25	64.41	3.60	0.04	735,612	172,869	908,481	**0.70**
	7/15	~	7/29	69.95	100.00	0.94	65.75	93.79	61.89	3.86	0.04	789,156	185,452	974,607	**0.75**
	7/30	~	8/13	67.04	100.00	0.94	63.02	97.31	62.74	0.28	0.00	56,710	13,327	70,036	**0.05**
	8/14	~	8/28	64.54	96.27	0.90	58.09	102.49	64.58	0.00	0.00	0	0	0	**0.00**
	8/29	~	9/12	62.56	93.67	0.85	53.18	109.50	68.06	0.00	0.00	0	0	0	**0.00**
	9/13	~	9/27	61.19	94.80	0.82	50.18	114.37	71.18	0.00	0.00	0	0	0	**0.00**
	9/28	~	10/12	60.48	95.67	0.81	48.99	105.21	66.84	0.00	0.00	0	0	0	**0.00**
	10/13	~	10/27	60.42	98.60	0.83	50.15	79.41	53.34	0.00	0.00	0	0	0	**0.00**
	10/28	~	11/11	61.00	99.13	0.85	51.85	36.53	29.11	22.74	0.25	4,645,457	1,091,682	5,737,140	**4.43**
Dry Season	11/12	~	11/26	62.13	98.60	0.88	54.67	2.33	2.33	52.34	0.58	10,693,213	2,512,905	13,206,118	**10.19**
	11/27	~	12/11	63.72	99.00	0.90	57.35	0.22	0.10	57.25	0.63	11,694,949	2,748,313	14,443,261	**11.14**
	12/12	~	12/26	65.63	99.00	0.89	58.41	0.00	0.00	58.41	0.64	11,932,472	2,804,131	14,736,602	**11.37**
	12/27	~	12/31	22.33	99.00	0.88	19.65	0.00	0.00	19.65	0.65	4,014,296	943,360	4,957,656	**11.48**
				1,781			**1,470**	**1,212**	**804**	**730**	**0.34**	**149,182,196**	**35,057,816**	184,240,013	**5.84**

*1) ETo (reference crop evapotranspiration) and Rainfall data are used climate data of "FAO-CLIMWAT-database".
ETo calculated using the FAO Penman-Montieth equation (by "FAO-CropWat 4"). (Angstrom's coefficients a=0.25, b=0.5)
The ETo and rainfall data are distributed using polynomial curve fitting. (by "FAO-CropWat 4")
*2) Crop Kc = (Average crop efficiency for time step Kc) x (Crop Area).
*3) Crop Water Requirements (CWR) = ETo x Kc
*4) Effective rainfall is estimated by using USDA Soil Conservation Service Method (by "FAO-CropWat 4").
*5) Field Water Supply (FWS) = 1 hectare x (Irrigation Water Requirement) x (100 / Irrigation Efficiency)

Future water demand

CEL has a long-term projection of electricity demand in the Country. Between 1995 and 2010, the total amount of electricity demand will increase by 600MW, requiring new power plants or import from other countries. If the present share of hydropower continues, which is about a half of the total power supply, 300MW of electricity should be generated by hydropower plants

in these 15 years.

6.5 Reservoir Operation

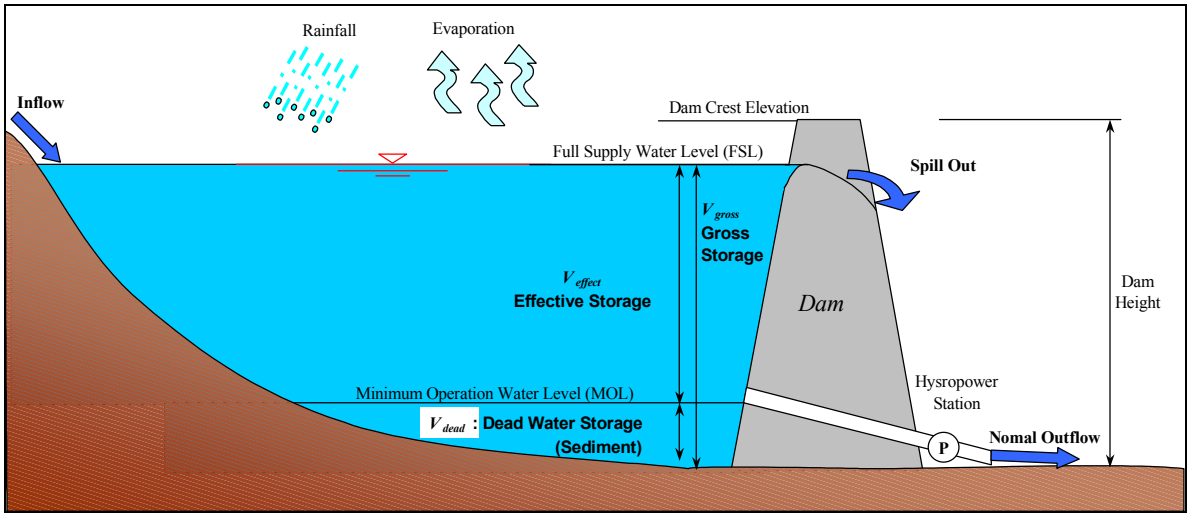
The operation of the proposed reservoir is simulated using a water balance model, which calculates the change in reservoir storage as inflow minus outflow and loss. It is expressed by the following mass balance equations:

[Reservoir Water Balance]

$V_t = V_{t-1} + I_t + R_t - E_t - (Spill_t + Release_t)$,

where
- V_t: reservoir storage at the end of month t, [MMC=10^6 m^3]
- V_{t-1}: reservoir storage at the end of previous month t-1, [MMC]
- I_t: reservoir inflow from upstream during the month t, [MMC]
- R_t: rainfall at reservoir water surface during the month t, [MMC]
- E_t: evaporation losses from the reservoir during month t, [MMC]
- $Spill_t$: spill out from the reservoir during the month t, [MMC]
- $Release_t$: normal outflow from the reservoir during the month t, [MMC] (outflow through the hydropower turbine)

Figure 6.5.1. Concept of Reservoir Operation Model



Calculation of the reservoir operation is conducted by time step of a month and for a period of 30 years using generated monthly inflow at the proposed dam site from 1961 to 1990. Design outflow should satisfy water requirements for river maintenance flow at the dam site together with irrigation water requirement and domestic water requirement. The reservoir is operated as the multipurpose dam that includes irrigation water supply, domestic water supply, flood control and hydropower. However, the main purpose is the irrigation water supply. Thus, the hydropower will be generating using outflow for the irrigation water supply, domestic water supply and river maintenance flow. The results of the reservoir operation study are shown in Attachment 6.5.

6.6 Flood Routing

(1) Water balance

The retarding effects of flood by the dam is simulated based on the relation between the reservoir water level, storage volume and outflow from the spillway and outlet facility using the following equation:

$$\frac{dS}{dt} = I - O,$$

where S: Storage volume [m^3],

I: Inflow into reservoir [m^3/sec], and

O: Outflow from reservoir [m^3/sec].

(2) Conditions of spillway

To evaluate flood control effect and design of emergency spillway, flood routing simulation was conducted. The flood control spillway and emergency spillway are planned for the proposed El Guayabal dam under the following conditions.

1) Normal flood control spillway (non-gate type):

Crest elevation = El. 142.0m (normal height water level = full supply level)

Crest width: B_1 = 50m

Design flood peak inflow discharge = 789m^3/sec (1/20-year flood)

2) Emergency spillway (non-gate type):

Crest elevation = El. 143.7m (maximum height of 1/20 flood routing simulation)

Crest width : B_2 = 100m

Design flood peak inflow discharge = 1,639m^3/sec (1/10,000-year flood)

In this study, non-gate type spillways are proposed to avoid difficult operation of flood control gates.

(3) Initial conditions

The initial conditions of each flood routing calculation are as follows:

H_i = El. 142.0m (normal height water level = full supply level), and

V_i = 235.7 x $10^6 m^3$ (Dead water storage 42.1MMC + Effective storage 193.7MMC),

where H_i: Initial water level of flood routing calculation [El.m], and

V_i: Initial Storage volume [m^3] at Hi.

(4) Overflow discharge formula

The following discharge formula was used for calculation of spillway overflow discharge:

$$Q = C \times B \times H^{3/2}$$

$$C = 1.704\left(1 + 0.648 \times H/R\right)^{1/2}$$

$$R = 0.920 \times H_d$$

where, Q: Overflow discharge at spillway [m^3/sec]

C: Discharge factor [$m^{1/2}$/sec]

B: Spillway crest width [m]

H: Upstream total hydraulic head (= reservoir water level - crest elevation) [m]

H_d: Flow depth over spillway crest [m] (H/H_d assumed 1.0)

R: Radius of crest curvature [m]

(Source: Handbook of Hydraulic Formula, Japan)

(5) Results of flood routing

The flood hydrographs of inflow and outflow at the proposed El Guayabal dam site by return period of 1/2, 1/10, 1/20, 1/100, 1/200, and 1/10,000 years (dam design flood) are shown in Attachment 6.6.

6.7 Features of Proposed Dam

Features of the proposed El Guayabal dam are schematically shown in Figure 6.7 and Table 6.71. The proposed dam height is 41.9m, decided on the results of sediment analysis, reservoir operation study to satisfy irrigation and domestic water requirements and river maintenance flow, flood routing, and required freeboard for dam safety. The dam is proposed as a rock-fill dam based on a comparison of preliminary estimates of dam construction costs. The maximum reservoir water level will be El. 144.6m and the gross reservoir storage volume is 285.3MMC (net 193.7MMC).

Figure 6.7.1. Schematic Features of Proposed El Guayabal Dam

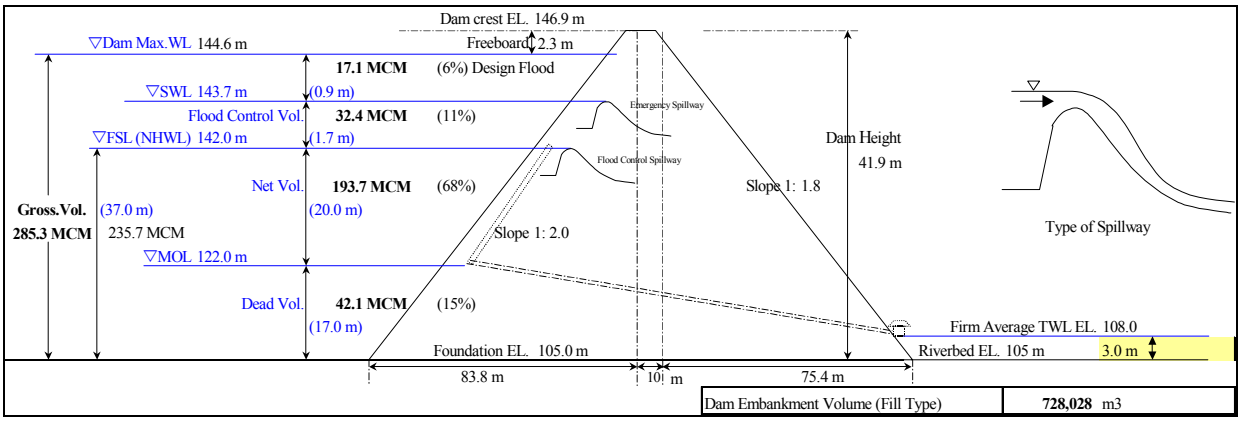


Table 6.7.1. Features of Proposed El Guayabal Dam and Reservoir

Features of Dam		
Dam Height (m)	41.9	m
Riverbed Elevation	105.0	El.m
Dam Bottom Length (DBL)	25.0	m
Dam Crest Elevation	146.9	El.m
Dam Crest Length (DCL)	362.8	m
Dam Crest Width	10.0	m
Freeboard Height	2.3	m (Japanese Standard)
Upstream Slope	1: 2.0	
Downstream Slope	1: 1.8	
Dam Embankment Vol.	0.73	MCM

Features of Reservoir			
Gross (Total) Storage Vol.	($x10^6$ m^3)	285.3	from H-A-V
Dam Design Flood Storage	($x10^6$ m^3)	17.1	from H-A-V
Flood Control Vol.	($x10^6$ m^3)	32.4	from H-A-V
Effective (Net) Storage Vol. (Ve)	($x10^6$ m^3)	193.7	from H-A-V
Dead Storage Vol.	($x10^6$ m^3)	42.05	
Dam Design Max.WL	EL.m	144.6	
Surcharge (Flood Control) Water Level	EL.m	143.7	
Full Supply Level (FSL) (Normal High WL)	EL.m	142.00	
Minimum Operation Level (MOL)	EL.m	122.00	from H-A-V
Max.Reservoir W.Surface Area	km^2	18.6	
Resettlement Households	HH	342	
Pan Evaporation Rate for Res.W.Surface		0.85	
Average Inflow Volume (Vi) per Year	($x10^6$ m^3)	274.9	
RCF (Reservoir Control Factor) = Ve/Vi*100	(%)	70.4	(>95%, OK)
Head Variation Ratio = (LWL-TWL)/(HWL-TWL)		0.4	(Francis, >0.7)

Source: JICA Study Team.

6.8 Cost Estimate

(1) Investment costs

Construction costs of the project are estimated in detail by component project: The El Guayabal multipurpose dam with hydropower, San Miguel, Jocotal and San Dionisio irrigation, river improvement works and others. The total investment cost for the dam is estimated at US$65.8 million, not including the hydropower facilities. The cost includes those for relocation of a stretch of the national road CA7 and some rural roads, mitigation measures for adverse environmental effects and monitoring (US$479,000), and the resettlement costs (US$20.3 million) as detailed in Table 6.8.1. The total investment cost increases to US$94.0 million if hydropower is included.

Investment costs for irrigation total US$95.0 million consisting of US$63.5 million for San Miguel, US$20.2 million for Jocotal, and US$11.3 million for San Dionisio. The total investment cost for river improvement works is estimated to total US$140.0 million, including river channel excavation and revetment, dykes, other structures and appurtenant works, and watershed management corresponding to the Master Plan project of the 1997 JICA study for flood protection against 10 year flood. In addition, a feasibility study and detailed design may cost US$7.25 million.

(2) O&M costs

The annual operation and maintenance cost for river improvement works is estimated at US$0.51 million or 0.4% of the corresponding investment cost. The annual operation and maintenance cost of the dam and the irrigation system is taken to be 2% of their combined investment costs or US$2.9 million. In addition, the replacement cost is incurred every 10 years, equivalent to 5% of the investment cost for the dam and the irrigation system.

Table 6.8.1. Summary of Project Cost of El Guayabal Dam (Financial Cost)

(without Hydropower Case)

(Unit: x 1,000 US$)

Items	Total Cost	L/C	F/C	Note
1. Preparation and Land Acquisition	**25,567**	**25,534**	**33**	
(1) Access Road	5,069	5,069	0	
(2) Compensation & Resettlment	20,332	20,332	0	include relocation of existing road
(3) Camp & Facilities	167	133	33	
2. Envirionmental Mitigation Cost	**479**	**191**	**287**	
3. Resettlement Cost	**7,507**	**7,507**	**0**	
4. Civil Works	**15,958**	**8,849**	**7,109**	
(1) River Diversion Scheme	629	504	126	
(2) Dam	8,502	3,491	5,011	
(3) Spillway	5,201	3,959	1,242	
(4) Intale	421	280	140	
(5) Headrace	184	140	44	
(6) Surge Tank	0	0	0	
(7) Penstock	94	56	38	
(8) Powerhouse	0	0	0	
(9) Tailrace Channel	31	25	6	
(10) Tailrace Outlet	135	90	45	
(11) Miscellaneous	760	304	456	(1) ~ (10) x 0.05
5. Hydraulic Equipment	**935**	**187**	**748**	
(1) Gate, Valve and Screen	868	174	694	
(2) Penstock	67	13	54	
6. Electric-Mechanical Equipment	**0**	**0**	**0**	Turbine and Generator, etc.
7. Transmission Line	**0**	**0**	**0**	
8. Miscellaneous of E&M	**140**	**56**	**84**	
9. Sub Total (Direct Cost)	**50,586**	**42,325**	**8,262**	1+2+3+4+5+6+7+8
10. Administration Cost	**1,518**	**1,518**	**0**	(Direct cost) x 0.03
11. Engineering Service Cost	**6,070**	**2,428**	**3,642**	(Direct cost) x 0.12
12. Physical Contingency	**5,059**	**2,581**	**2,478**	(Direct cost) x 0.1
13. Price Contingency (Interest During Construct	**2,580**	**1,806**	**774**	=(9+10+11) x 0.4 x i x T
Total Project Cost of Dam	**65,813**	**50,657**	**15,156**	9+10+11+12

Source: JICA Study Team.

6.9 Implementation Schedule

The implementation schedule for the El Guayabal multipurpose dam project, including the flood control river improvement project (the master plan level for 10-year flood, proposed by JICA 1997 study) and the irrigation projects, is prepared as shown in Table 6.9.1.

6.10 Economic Benefits

(1) Irrigation benefit

The irrigation benefit of the project is estimated as the difference in the total net benefit under "with project" and "without project" conditions. The unit net benefit per ha of irrigation area is calculated based on the respective cropping patterns "with" or "without" the project. The annual unit net benefit is calculated to be US$9,542 per ha (Table 6.10.1). The total irrigation benefit is calculated by multiplying the unit benefit with the irrigation area according to the stage-wise development of the three irrigation schemes.

Table 6.9.1. Project Implementation Schedule

Description			Phase	Implementation Schedule by Phase														
				Phase-1 2004-2009						Phase-2 2010-2014					Phase-3 2015-2019			
			Year	2004 1-yr	2005 2-yr	2006 3-yr	2007 4-yr	2008 5-yr	2009 6-yr	2010 7-yr	2011 8-yr	2012 9-yr	2013 10-yr	2014 11-yr	2015 12-yr	2016 13-yr	2017 14-yr	2018 15-yr	2019 16-yr
Flood Control Project	Structural Measure (1) Priority Project (for 1/2-yr Flood)	1. Loan Process (1)																
		2. Detailed Design (1)																
		3. Land Acquisition (1)																
		4. Tendering (1)																
		5. Construction to cope with 2-year flood																
	Structural Measure (2) Rest of Master Plan (for 1/10-yr Flood)	1. Feasibility Study																
		2. Loan Process (2)																
		3. Detailed Design (2)																
		4. Land Acquisition (2)																
		5. Tendering (2)																
		6. Construction to cope with 10-year flood																
	Non-structure Measure	1. Floodplain Management																
		Land use Regulation/ Flood Proofing																
		Flood Forecasting/ Warning																
		Education to the residents																
		2. Watershed Management																
		Reforestation																
		Erosion Control																
El Guayabal Dam & Irrigation Project	Study and Preparation	1. Feasibility Study																
		2. Loan Process																
		3. Detailed Design																
		4. Land Acquisition																
		5. Tendering																
	Structural Measure	6. Construction																
		(1) El Guayabal Dam																
		(2) San Miguel Irrigation & Drainage (9,000ha)																
		(3) Jocotal Irrigation & Drainage (3,000ha)																
		(4) San Dioniso Irrigation & Drainage (2,300 ha)																

Source: JICA Study Team.

(2) Benefit foregone

The proposed dam will inundate the existing farmland in the proposed reservoir area. This benefit foregone is estimated to be US$1,514,096 based on the existing agricultural land use in 1,486ha farmland to be inundated.

(3) Flood control benefit

The flood control benefit estimated by the 1997 JICA study is US$12.1 million (in 1997 price) for the priority project. As a result of enhanced flood protection with the dam, the land productivity in flood prone area will increase, and the increase is estimated at six times. Accordingly, the flood control benefit will also increase. Flood control benefits are calculated for floods of different return periods, and the expected value of the flood control benefit is calculated to be US$22.8 million.

(4) Hydropower benefit

The hydropower benefit is estimated conventionally based on costs of alternative thermal power having equivalent generating performance. It consists of the kW benefit corresponding to investment cost of the alternative thermal, and the kWh benefit corresponding to fuel and O&M costs of the alternative thermal. These are derived for various levels of installed power generating capacity and the total energy generated.

Table 6.10.1. Estimated Annual Irrigation Benefits (US$/year/ha)

	Crop	1. Present/Without Irrigation Project				2. With Irrigation Project				Anuual Project Benefit (US $/Year)
		Net Profit (US$/ha)	Planted Area (%)	Planted Area (ha/year)	SubTotal Benefit (US$/Planted Area)	Net Profit (US$/ha)	Planted Area (%)	Planted Area (ha/year)	SubTotal Benefit (US$/Planted Area)	
1	Bean	500	3.4%	0.034	17.0	600	3.4%	0.034	20.4	3.4
2	Cassava (Yucca)	1,110	0.9%	0.009	10.0	1,590	5.0%	0.050	79.5	69.5
3	Chile, Sweet	11,800	0.6%	0.006	70.8	12,690	15.0%	0.150	1,903.5	1,832.7
4	Corn	490	20.4%	0.204	100.0	680	9.3%	0.093	63.2	-36.7
5	Green Corn (Elote)	785	2.4%	0.024	18.8	990	7.0%	0.070	69.3	50.5
6	Sorghum	460	3.7%	0.037	17.0	575	3.7%	0.037	21.3	4.3
7	Cucumber	1,240	0.3%	0.003	3.7	1,630	3.0%	0.030	48.9	45.2
8	Onion	7,400	0.4%	0.004	29.6	8,590	12.0%	0.120	1,030.8	1,001.2
9	Rice	740	0.4%	0.004	3.0	970	0.4%	0.004	3.9	0.9
10	Sugar cane	862	5.0%	0.050	43.1	959	5.0%	0.050	48.0	4.9
11	Tomato, Salad	9,300	0.5%	0.005	46.5	10,560	12.0%	0.120	1,267.2	1,220.7
12	Tomato, Paste	3,170	0.8%	0.008	25.4	3,890	6.0%	0.060	233.4	208.0
13	Zuchinni, (Pipian)	350	0.4%	0.004	1.4	510	1.0%	0.010	5.1	3.7
14	Melon	6,830	0.6%	0.006	41.0	8,180	20.0%	0.200	1,636.0	1,595.0
15	Mango	2,900	0.8%	0.008	23.2	3,830	8.0%	0.080	306.4	283.2
16	Watermelon	690	0.7%	0.007	4.8	960	3.0%	0.030	28.8	24.0
17	Avocado	3,500	0.6%	0.006	21.0	4,430	9.0%	0.090	398.7	377.7
18	Lemon Persian	4,865	0.8%	0.008	38.9	5,950	10.0%	0.100	595.0	556.1
19	Papaya	15,220	0.7%	0.007	106.5	16,740	8.0%	0.080	1,339.2	1,232.7
20	Passion Fruit	7,970	0.4%	0.004	31.9	9,620	14.0%	0.140	1,346.8	1,314.9
21	Plantain	700	0.7%	0.007	4.9	1,030	3.0%	0.030	30.9	26.0
22	Pasture	650	55.5%	0.555	360.8	850	10.0%	0.100	85.0	-275.8
	TOTAL		**100.0%**	**1.000**	**1,019.3**		**167.8%**	**1.678**	**10,561.2**	**9,542**

Source: JICA Study Team.

6.11 Economic Analysis

Based on the estimated costs and benefits of the project, a table of cost and benefit streams is constructed. Investment costs of different components are allocated to different years during the respective construction periods. The annual O&M costs are calculated according to implementation schedule of different components. The annual benefits are calculated following the implementation schedule and assumed buildup periods to attain the maximum benefit by each component. The cost-benefit table thus constructed for a case without the hydropower component is given in Table 6.11.1. Based on this table, the EIRR is calculated to be 29.0%, indicating high economic viability of the project.

If the hydropower component is included, both the project costs and benefits will increase. Due to high costs of generators and turbines, however, the EIRR value is reduced, although the net benefit will increase. Sensitivity analyses are also conducted under the increase in project costs. Even if the investment cost for the dam doubles, the EIRR is still 22.6% higher than the opportunity cost of capital, 12%.

6.12 Initial Environmental Examination

An initial environmental examination (IEE) has been conducted for the project. The IEE has identified the following positive impacts:

(i) Impact on agricultural activities,
(ii) Impact on tourism activities,
(iii) Establishment of news crops under irrigation,
(iv) Positive changes in flow regime of the river,
(v) Positive effects on groundwater,
(vi) Reduction of erosion,
(vii) Strengthening of social organization through flood control works,
(viii) Improvement of public administration, and
(ix) Positive effects on the Olomega lake and the Jocotal lake.

Possible negative impacts pointed out by the IEE include the following:

(1) Seismic, flood and landslide risk of the upper catchment area,
(2) Change in quality of water for various uses,
(3) Effects on terrestrial and aquatic flora and fauna,
(4) Relocation of roads,
(5) Inundation of productive lands in the reservoir area,
(6) Effects on wetland, biological corridor and the Ramsar site (Jocotal),
(7) Land ownership, and
(8) Telecommunications, and power and water supply.

Table 6.11.1. Economic Evaluation of San Miguel River Development Project

[with El Guayabal Multipurpose Dam (Dam Height = 41.9 m) + Total Irrigation Area of 14300 ha]

Cost of Irr. (Economic Cost)	88.82	
Cost of Dam (Economic Cost	57.61	
Study (F/S+D/D)	5%	7.32 for Dam & Irr.Project
O&M Cost (every year)	2.0%	for Dam & Irr.Project
Replacement Cost (10-yr)	5.0%	for Dam & Irr.Project

Project Area (Sector)	Irr. Area (ha)	Irr.Cost (US$106) Pjt. Cost	Econo. C.	Irr.Benefit (US$106/yr)
San Miguel-Olomega	9,000	63.54	59.40	85.88
Jocotal	3,000	20.22	18.90	28.63
San Dionisio	2,300	11.25	10.51	21.95
TOTAL	**14,300**	**95.01**	**88.82**	**136.45**

Discout Rate: 12.0%

(Unit : US$ 10^6)

Year After Pjt.	Disc. Year	Year		Economic Cost: Study F/S&D/D	Dam: Invest.	Dam: O&M	River Imp.(M/P): Invest.	River Imp.(M/P): O&M	Irrigation (Investment): (San Miguel)	Irrigation (Investment): (Jocotal)	Irrigation (Investment): (S.Diosisio)	Irr. O&M	Replace-ment	Total Cost	NPV (Cost)	Economic Benefit: Irrigation Benefit	Lost *1) Benefit	HEP (Fuel)	Flood Control	Total Benefit	NPV (Benefit)	Net Cash Flow (B - C)
	1	2005		1.83			3.01							**4.84**	4.32	0.00	0.00			**0.00**	0.00	-4.84
	2	2006		1.83			1.40							**3.23**	2.58	0.00	0.00		0.00	**0.00**	0.00	-3.23
	3	2007	Phase-1				14.51							**14.51**	10.33	0.00	0.00		0.00	**0.00**	0.00	-14.51
	4	2008		1.83			14.51	0.06						**16.40**	10.42	0.00	0.00		0.00	**0.00**	0.00	-16.40
	5	2009		1.83			14.51	0.12						**16.46**	9.34	0.00	0.00		2.35	**2.35**	1.33	-14.11
	6	2010			5.76		16.44	0.18	5.94					**28.32**	14.35	0.00	0.00		4.69	**4.69**	2.38	-23.63
	7	2011			11.52		14.87	0.24	11.88				0.36	**38.87**	17.58	0.00	-0.76		7.04	**6.28**	2.84	-32.59
	8	2012	Phase-2		20.16		12.38	0.30	20.79				0.77	**54.41**	21.97	21.47	-1.51		9.39	**29.34**	11.85	-25.06
	9	2013			11.52		12.09	0.35	11.88				1.01	**36.86**	13.29	42.94	-1.51		11.74	**53.16**	19.17	16.30
	10	2014			8.64		12.09	0.41	8.91				1.19	**31.24**	10.06	64.41	-1.51		13.81	**76.70**	24.70	45.47
1	11	2015				1.15	12.09	0.46		1.89	1.05	1.25		**17.89**	5.14	85.88	-1.51	0.00	15.83	**100.19**	28.80	82.30
2	12	2016				1.15	12.09	0.51		3.78	2.10	1.36		**21.01**	5.39	85.88	-1.51	0.00	19.98	**104.34**	26.78	83.33
3	13	2017	Phase-3			1.15		0.57		6.62	3.68	1.57		**13.58**	3.11	98.52	-1.51	0.00	22.79	**119.80**	27.45	106.21
4	14	2018				1.15		0.57		3.78	2.10	1.69		**9.29**	1.90	111.16	-1.51	0.00	22.79	**132.44**	27.10	123.15
5	15	2019				1.15		0.57		2.84	1.58	1.78		**7.91**	1.44	123.81	-1.51	0.00	22.79	**145.08**	26.51	137.18
6	16	2020				1.15		0.57				1.78		**3.49**	0.57	136.45	-1.51	0.00	22.79	**157.73**	25.73	154.23
7	17	2021				1.15		0.57				1.78		**3.49**	0.51	136.45	-1.51	0.00	22.79	**157.73**	22.97	154.23
8	18	2022				1.15		0.57				1.78		**3.49**	0.45	136.45	-1.51	0.00	22.79	**157.73**	20.51	154.23
9	19	2023				1.15		0.57				1.78		**3.49**	0.41	136.45	-1.51	0.00	22.79	**157.73**	18.31	154.23
10	20	2024				1.15		0.57				1.78	5.85	**9.34**	0.97	136.45	-1.51	0.00	22.79	**157.73**	16.35	148.38
11	21	2025				1.15		0.57				1.78		**3.49**	0.32	136.45	-1.51	0.00	22.79	**157.73**	14.60	154.23
12	22	2026				1.15		0.57				1.78		**3.49**	0.29	136.45	-1.51	0.00	22.79	**157.73**	13.03	154.23
13	23	2027				1.15		0.57				1.78		**3.49**	0.26	136.45	-1.51	0.00	22.79	**157.73**	11.64	154.23
14	24	2028				1.15		0.57				1.78		**3.49**	0.23	136.45	-1.51	0.00	22.79	**157.73**	10.39	154.23
15	25	2029				1.15		0.57				1.78		**3.49**	0.21	136.45	-1.51	0.00	22.79	**157.73**	9.28	154.23
16	26	2030				1.15		0.57				1.78		**3.49**	0.18	136.45	-1.51	0.00	22.79	**157.73**	8.28	154.23
17	27	2031				1.15		0.57				1.78		**3.49**	0.16	136.45	-1.51	0.00	22.79	**157.73**	7.40	154.23
18	28	2032				1.15		0.57				1.78		**3.49**	0.15	136.45	-1.51	0.00	22.79	**157.73**	6.60	154.23
19	29	2033				1.15		0.57				1.78		**3.49**	0.13	136.45	-1.51	0.00	22.79	**157.73**	5.90	154.23
20	30	2034				1.15		0.57				1.78	7.32	**10.82**	0.36	136.45	-1.51	0.00	22.79	**157.73**	5.26	146.91
21	31	2035				1.15		0.57				1.78		**3.49**	0.10	136.45	-1.51	0.00	22.79	**157.73**	4.70	154.23
22	32	2036				1.15		0.57				1.78		**3.49**	0.09	136.45	-1.51	0.00	22.79	**157.73**	4.20	154.23
23	33	2037				1.15		0.57				1.78		**3.49**	0.08	136.45	-1.51	0.00	22.79	**157.73**	3.75	154.23
24	34	2038				1.15		0.57				1.78		**3.49**	0.07	136.45	-1.51	0.00	22.79	**157.73**	3.35	154.23
25	35	2039				1.15		0.57				1.78		**3.49**	0.07	136.45	-1.51	0.00	22.79	**157.73**	2.99	154.23
26	36	2040				1.15		0.57				1.78		**3.49**	0.06	136.45	-1.51	0.00	22.79	**157.73**	2.67	154.23
27	37	2041				1.15		0.57				1.78		**3.49**	0.05	136.45	-1.51	0.00	22.79	**157.73**	2.38	154.23
28	38	2042				1.15		0.57				1.78		**3.49**	0.05	136.45	-1.51	0.00	22.79	**157.73**	2.13	154.23
29	39	2043				1.15		0.57				1.78	7.32	**10.82**	0.13	136.45	-1.51	0.00	22.79	**157.73**	1.90	146.91
30	40	2044				1.15		0.57				1.78		**3.49**	0.04	136.45	-1.51	0.00	22.79	**157.73**	1.70	154.23
31	41	2045				1.15		0.57				1.78		**3.49**	0.03	136.45	-1.51	0.00	22.79	**157.73**	1.51	154.23
32	42	2046				1.15		0.57				1.78		**3.49**	0.03	136.45	-1.51	0.00	22.79	**157.73**	1.35	154.23
33	43	2047				1.15		0.57				1.78		**3.49**	0.03	136.45	-1.51	0.00	22.79	**157.73**	1.21	154.23
34	44	2048				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	1.08	154.23
35	45	2049				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.96	154.23
36	46	2050				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.86	154.23
37	47	2051				1.15		0.57				1.78		**3.49**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.77	154.23
38	48	2052				1.15		0.57				1.78	7.32	**10.82**	0.05	136.45	-1.51	0.00	22.79	**157.73**	0.68	146.91
39	49	2053				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.61	154.23
40	50	2054				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.55	154.23
41	51	2055				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.49	154.23
42	52	2056				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.44	154.23
43	53	2057				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.39	154.23
44	54	2058				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.35	154.23
45	55	2059				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.31	154.23
46	56	2060				1.15		0.57				1.78		**3.49**	0.01	136.45	-1.51	0.00	22.79	**157.73**	0.28	154.23
47	57	2061				1.15		0.57				1.78	7.32	**10.82**	0.02	136.45	-1.51	0.00	22.79	**157.73**	0.25	146.91
48	58	2062				1.15		0.57				1.78		**3.49**	0.00	136.45	-1.51	0.00	22.79	**157.73**	0.22	154.23
49	59	2063				1.15		0.57				1.78		**3.49**	0.00	136.45	-1.51	0.00	22.79	**157.73**	0.20	154.23
50	60	2064				1.15		0.57				1.78		**3.49**	0.00	136.45	-1.51	0.00	22.79	**157.73**	0.18	154.23
				7.32	57.61	57.61	139.98	29.76	59.40	18.90	10.51	90.91	35.14	**507**	137.50	6,774.34	-81.00	0.00	1,178.74	**7,872**	437.58	7,365
											88.82										B-C :	300.09
																					B / C :	3.18
																					EIRR :	**29.0%**

Source: JICA Study Team.

Note: Lost benefit indicates estimated crop benefit that would have been gained at the area inundated by the dam project.

"R.Imp.": Flood control benefit by river improvement project that was proposed by JICA 1997 study (flood control project master plan for 10-year flood).

These possibilities are partly reflected in planning for the project. Particularly, the following features are noted.

1) The maintenance flow of the river is incorporated in the project, corresponding to the average monthly flow in March or 0.95m^3/sec at the proposed dam site. Effects on the wetland, the Jocotal lagoon and the ecosystem of the Jiquilisco bay with mangrove forests should be further investigated.
2) The increase in low flow during the driest period will improve the quality of river water downstream of San Miguel city. It is estimated preliminarily that the BOD value of 74mg/l at present would improve to 10mg/l due to the discharge from the dam.
3) The combination of the river improvement, Olomega diversion channel, and the control gate at the lake would allow the control of turbid water into the lake and lake water level. Effects of these on fishery in the lake should be further investigated.
4) The potentially most serious problem is the relocation of people (some 350 households) from the reservoir area and their resettlement together with support measures. A resettlement plan should be prepared by the participatory approach from the early stage of further project development. All the information related to the project should be made open from the beginning, and an open planning system should be adopted with the participation of all the stakeholders.

6.13 Summary and Recommendations

(1) In this pre-feasibility study, a comparative analysis has been conducted on alternative dam sites examined by the 1997 HARZA study, based on reviews of this and other studies, in order to formulate a multipurpose dam project for both flood control and irrigation. The analysis has established that the El Guayabal dam is much better than the San Esteban dam proposed by HARZA as the former ensures the effective storage volume comparable to that of the latter at much smaller construction costs. The reservoir area is also much smaller, and so is the number of houses to be relocated by El Guayabal rather than San Esteban.

(2) The El Guayabal dam site (catchment area=443km^2) is located on a tributary upstream of the San Esteban dam site (catchment area=825km^2). As it locates at a narrow valley, construction costs of the dam will be smaller. With the much smaller catchment area, the flood flow and sediment inflow will be smaller to make the dead volume and the design flood smaller. Still, the El Guayabal dam will provide the effective storage volume comparable to that of the San Esteban dam with the similar dam height.

(3) According to the topographic map at scale 1/10,000 (produced in 1980 and modified in 1988) obtained from IGM, with the dam height of 41.9m at El. 144.6m, the reservoir surface area will be 18.6km^2 at the design flood storage, which will require relocation of

342 households.

(4) The El Guayabal dam will allow to control the 20 year flood and reduce it to the equivalent of 1.8 year flood at Moscoso (catchment area=1,074km^2) just downstream of San Miguel city. The 100-year flood will be reduced to 3.8-year flood.

(5) If combined with the priority project for river improvement recommended by the 1997 JICA study that will cope with the 2-year flood, the El Guayabal dam will be able to cope with the 20-year flood.

(6) The El Guayabal dam is a relatively low dam of 42m in height to be operated mainly for irrigation water supply purpose. Inclusion of the hydropower component, according to this study, will reduce the EIRR value due to high costs of generators and turbines.

(7) This option of hydropower should be further examined in view of effective use of renewable energy for intake and draining pumps.

(8) There exists no regulation related to the maintenance flow of a river in El Salvador. In the present study, the maintenance flow is set at the average monthly flow in March in consideration of downstream uses and effects.

(9) The El Guayabal dam would allow to increase low flow at Villerias (catchment area=910km^2) from 2m^3/sec to about 10m^3/sec.

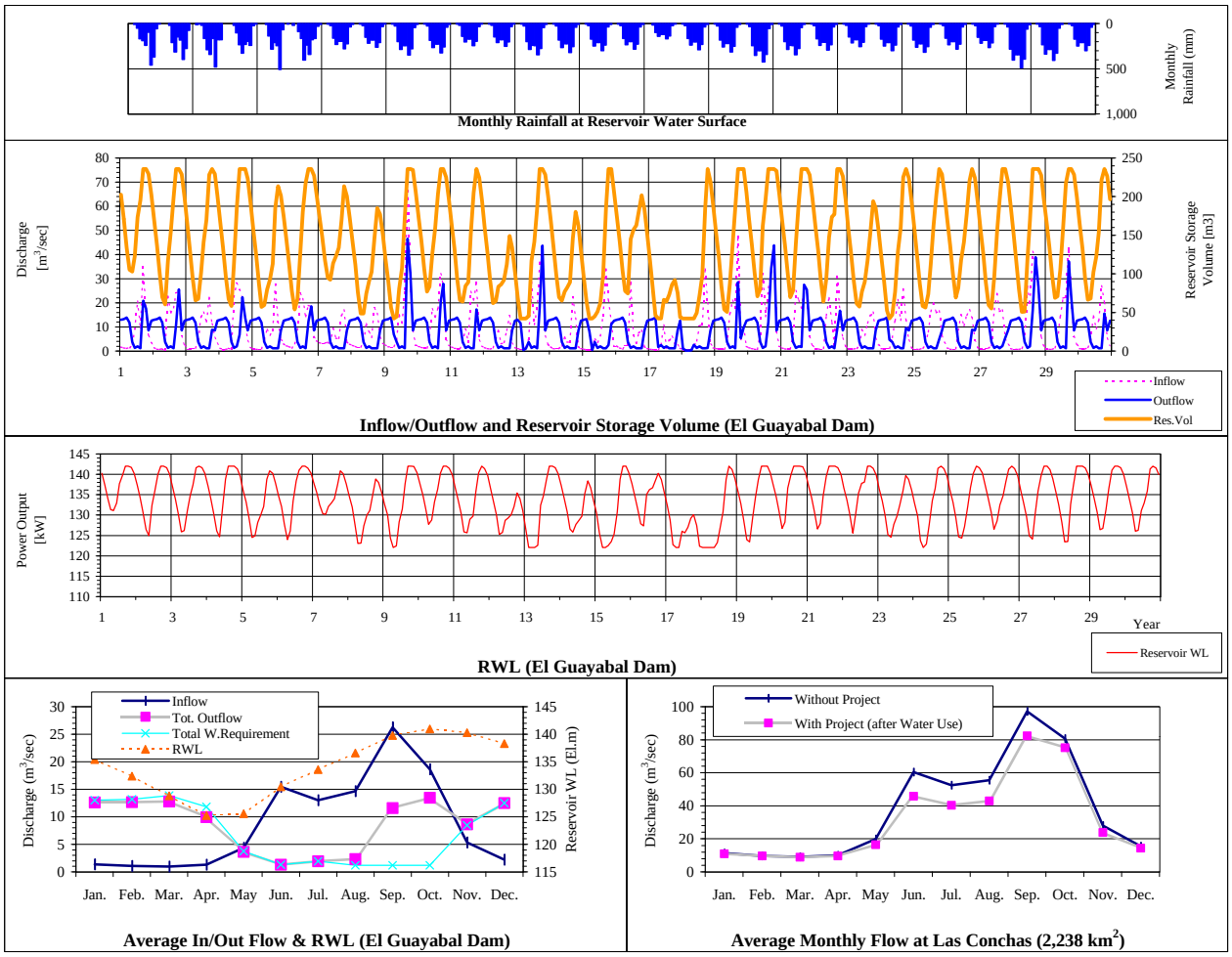
(10) The increase in low flow will also contribute to improving the quality of river water from 74mg/l BOD to about 10mg/l BOD during the dry season.

(11) The water intake for irrigation in 14,300ha will reduce the river flow, but the discharge from the El Guayabal dam including the maintenance flow will allow to maintain the average flow at the furthest downstream of Las Conchas (catchment area=2,238km^2) equivalent to the present flow, according to the simulation by this study. Effects on mangrove areas of the Jiquilisco bay, however, should be further investigated.

(12) The project incorporates also the water supply for San Miguel city, where the water demand is expected to increase significantly along with the Eastern Region development.

(13) The most serious problems associated with any dam project are related to the natural and social environment. The El Guayabal dam involves serious problems of relocation and resettlement of people in the proposed reservoir area. A comprehensive environmental impact assessment (EIA) should be conducted in the next stage, and alternatives be examined by the participatory approach to build consensus among stakeholders including local people and NGOs.

(14) Data used for this study, including hydrological, topographic and geological data, are not sufficient. More detailed analyses and cost estimate should be undertaken through a feasibility study. In particular, the irrigation development plan needs to be updated with more viable cropping patterns under irrigation in view of new marketing opportunities.

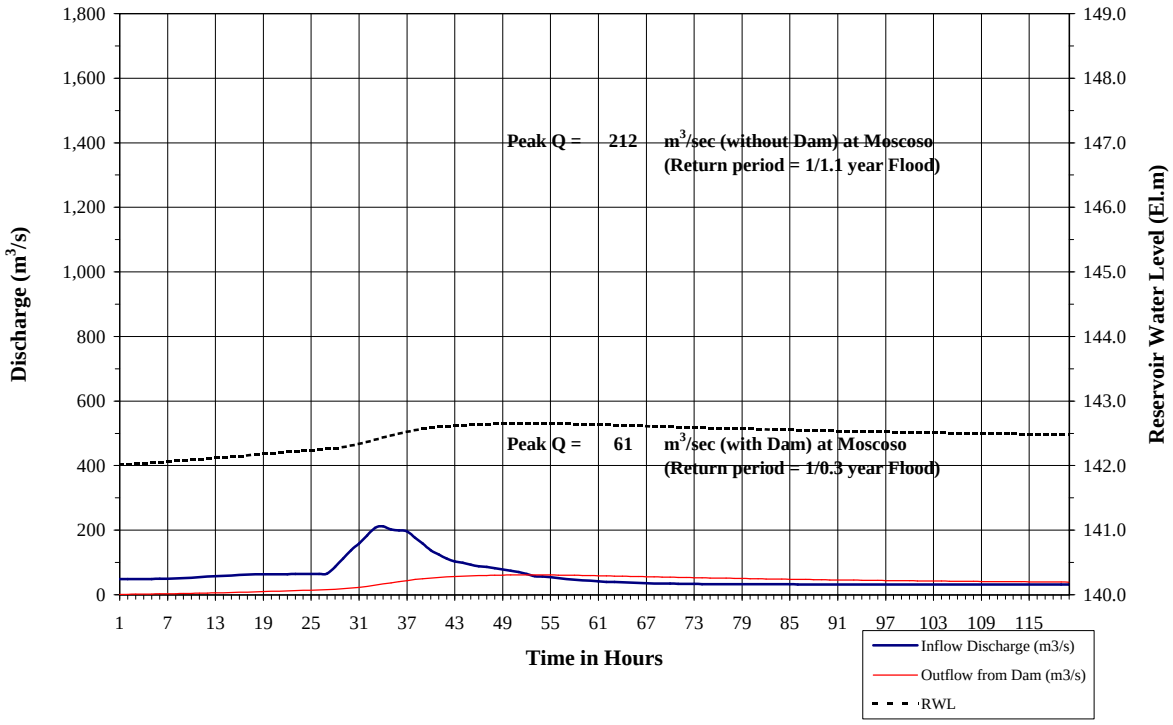


(7) Design Outflow (m³/sec)

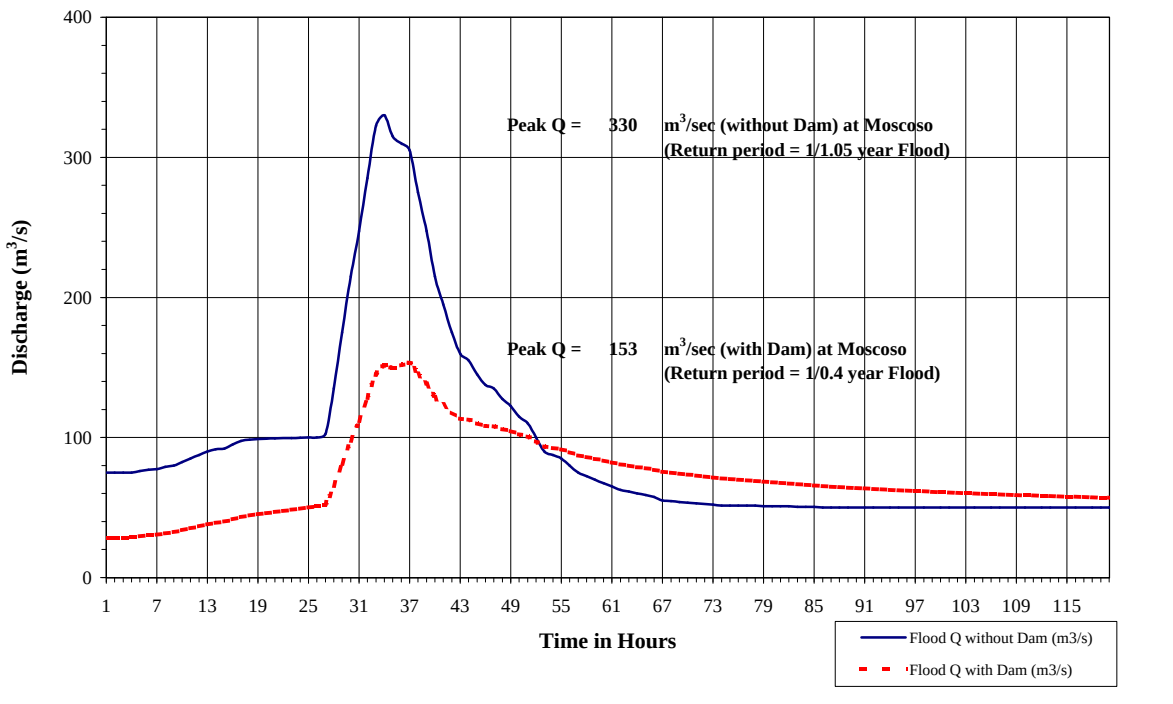
	Month	Ave. Inflow	Min. Inflow	Irrigation W.Demand	Domestic W.Demand	Design Outflow	Maintenance Flow	**Total W.Req.**
1	Jan.	1.36	0.66	11.84	0.24	**12.08**	**0.95**	**13.03**
2	Feb.	1.06	0.60	11.99	0.24	**12.23**	**0.95**	**13.17**
3	Mar.	0.95	0.55	12.70	0.24	**12.94**	**0.95**	**13.89**
4	Apr.	1.29	0.52	10.62	0.24	**10.86**	**0.95**	**11.81**
5	May	4.30	0.15	2.55	0.24	**2.79**	**0.95**	**3.74**
6	Jun.	12.67	3.54	0.14	0.24	**0.38**	**0.95**	**1.33**
7	Jul.	8.04	1.21	0.73	0.24	**0.97**	**0.95**	**1.91**
8	Aug.	11.35	2.29	0.03	0.24	**0.27**	**0.95**	**1.21**
9	Sep.	25.06	6.15	0.00	0.24	**0.24**	**0.95**	**1.19**
10	Oct.	19.55	3.39	0.00	0.24	**0.24**	**0.95**	**1.19**
11	Nov.	4.83	1.82	7.31	0.24	**7.55**	**0.95**	**8.49**
12	Dec.	2.25	1.00	11.33	0.24	**11.57**	**0.95**	**12.52**
	Max.	25.06	6.15	12.70	0.24	12.94	0.95	13.89
	Min.	0.95	0.15	0.00	0.24	0.24	0.95	1.19
	Ave.	7.73	1.82	5.77	0.24	6.01	0.95	6.96

(8) Average Monthly Flow (m³/sec)

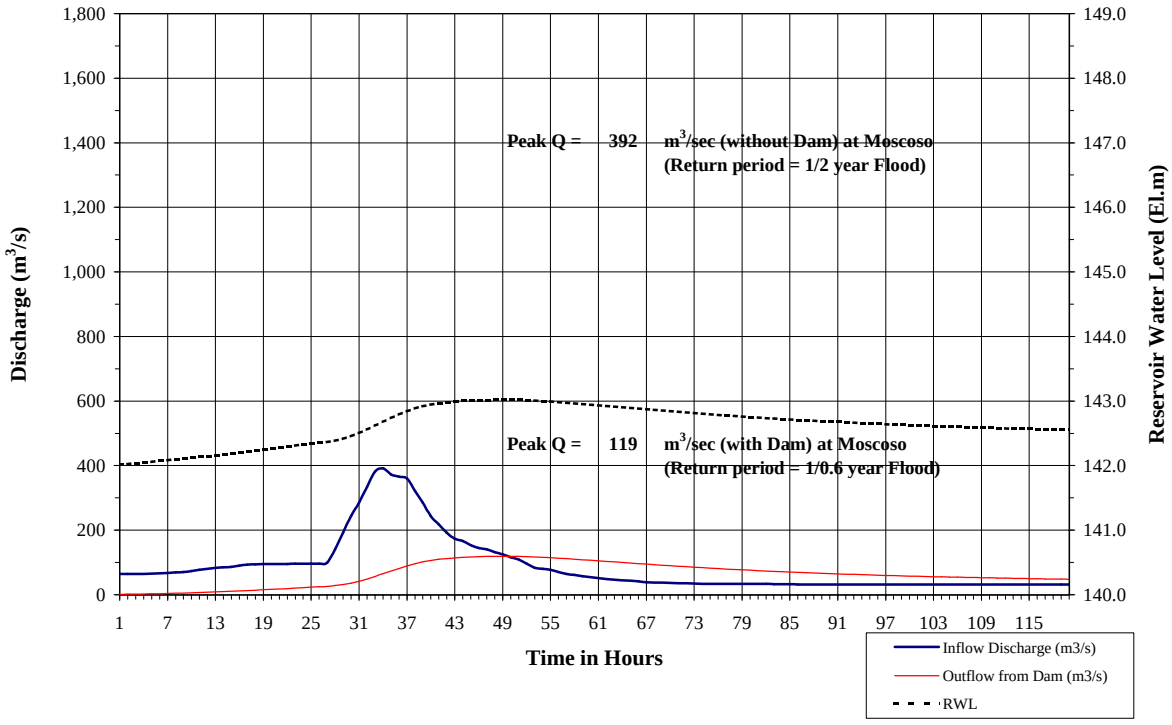
Month	at Villerias (910 km²)		at Las Conchas (2,238 km²)		
	w/o Dam	with Dam	w/o Pjt.	with Pjt.	Deference
Jan.	2.8	14.1	11.4	11.0	-0.4
Feb.	2.2	13.8	9.7	9.6	-0.1
Mar.	1.9	13.8	9.0	8.9	-0.1
Apr.	2.7	11.3	10.1	9.7	-0.4
May	9.0	8.3	19.8	16.4	-3.4
Jun.	31.8	17.6	60.5	45.9	-14.6
Jul.	26.7	15.6	52.4	40.3	-12.1
Aug.	30.1	17.8	55.5	42.9	-12.6
Sep.	53.9	39.3	97.2	82.3	-14.9
Oct.	38.2	33.1	80.6	75.2	-5.4
Nov.	10.9	14.2	28.1	23.8	-4.3
Dec.	4.6	14.9	15.5	14.3	-1.2
Max.	143.3	120.0	235.7	236.7	
Min.	0.3	0.7	5.1	5.3	
Ave.	17.9	17.8	37.5	31.7	



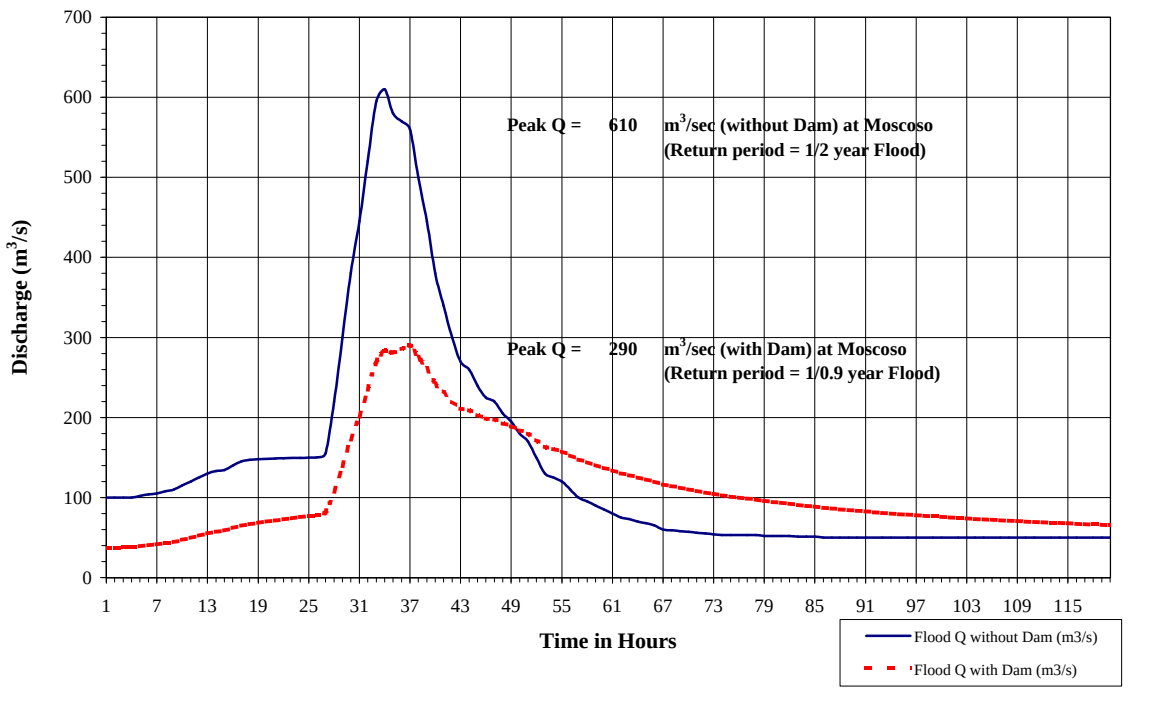
Flood Hydrograph and Reservoir Water Level (1/1.05 year Flood)
at Proposed El Guayabal Dam Site



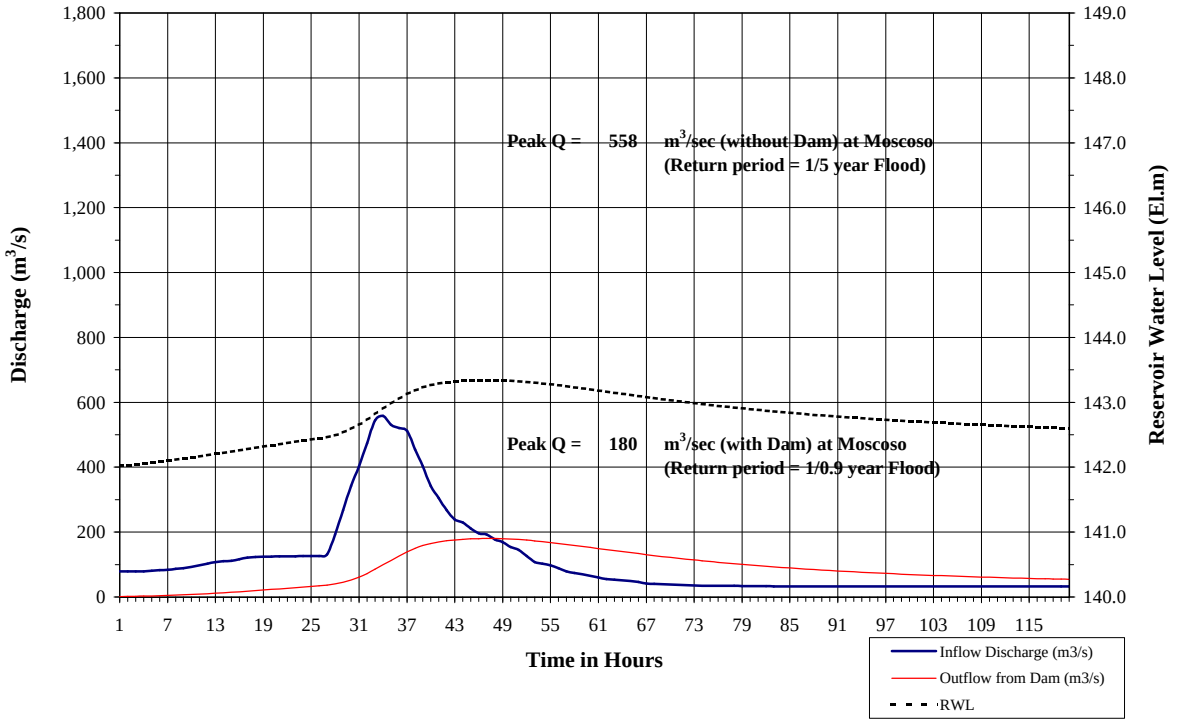
Flood Hydrograph at Moscoso Station (1/1.05 year Flood)
(With / Without El Guayabal Dam Conditions)



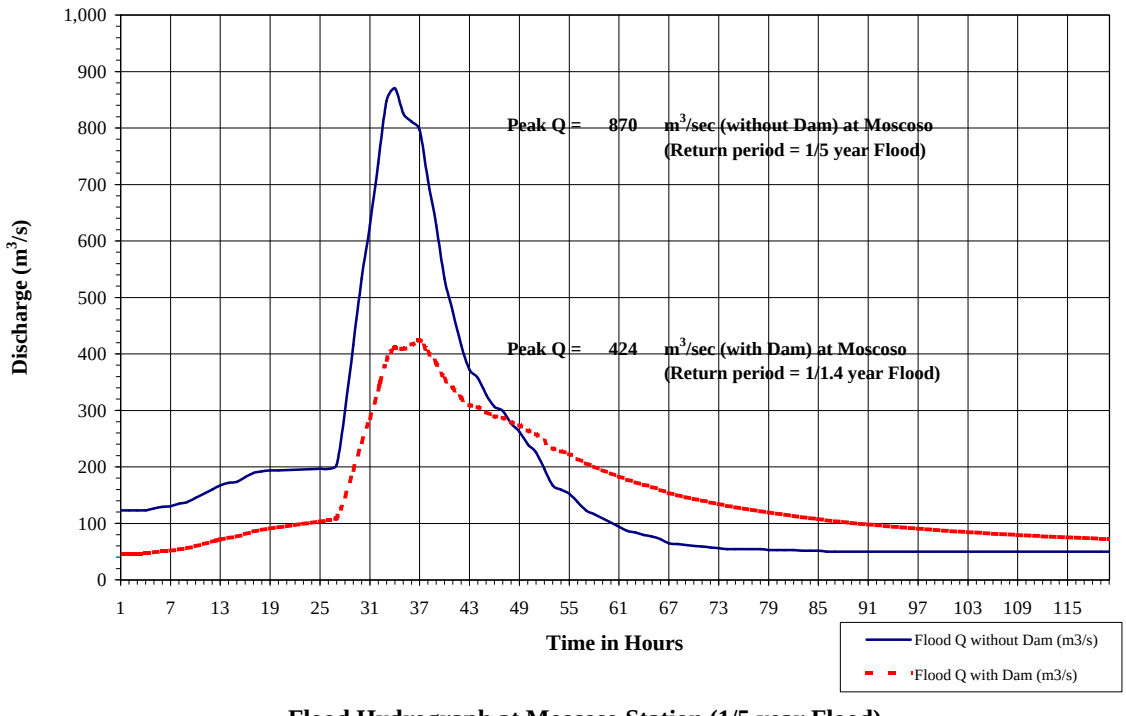
Flood Hydrograph and Reservoir Water Level (1/2 year Flood)
at Proposed El Guayabal Dam Site



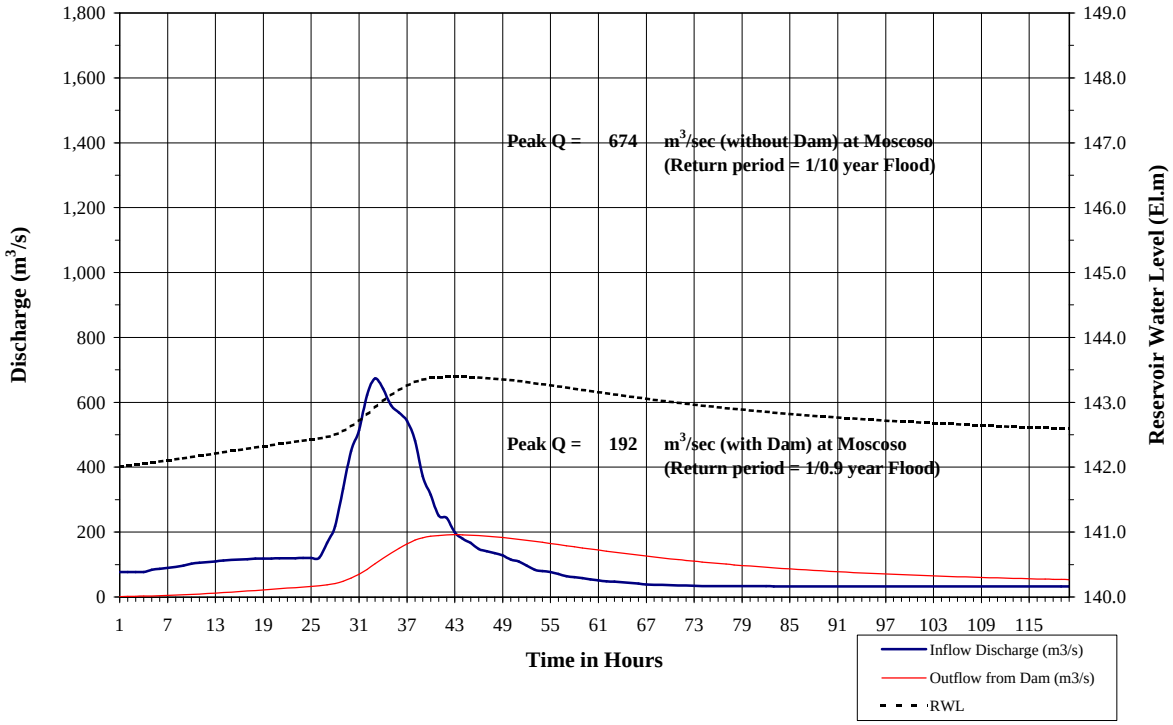
Flood Hydrograph at Moscoso Station (1/2 year Flood)
(With / Without El Guayabal Dam Conditions)



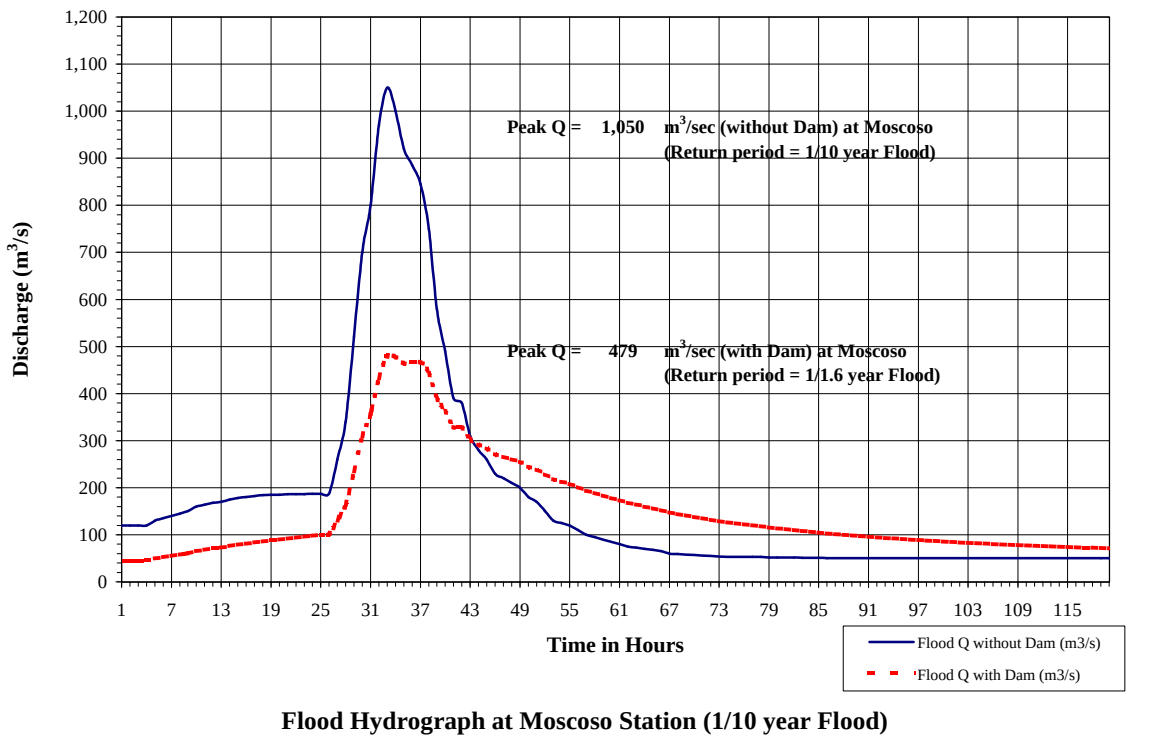
Flood Hydrograph and Reservoir Water Level (1/5 year Flood)
at Proposed El Guayabal Dam Site



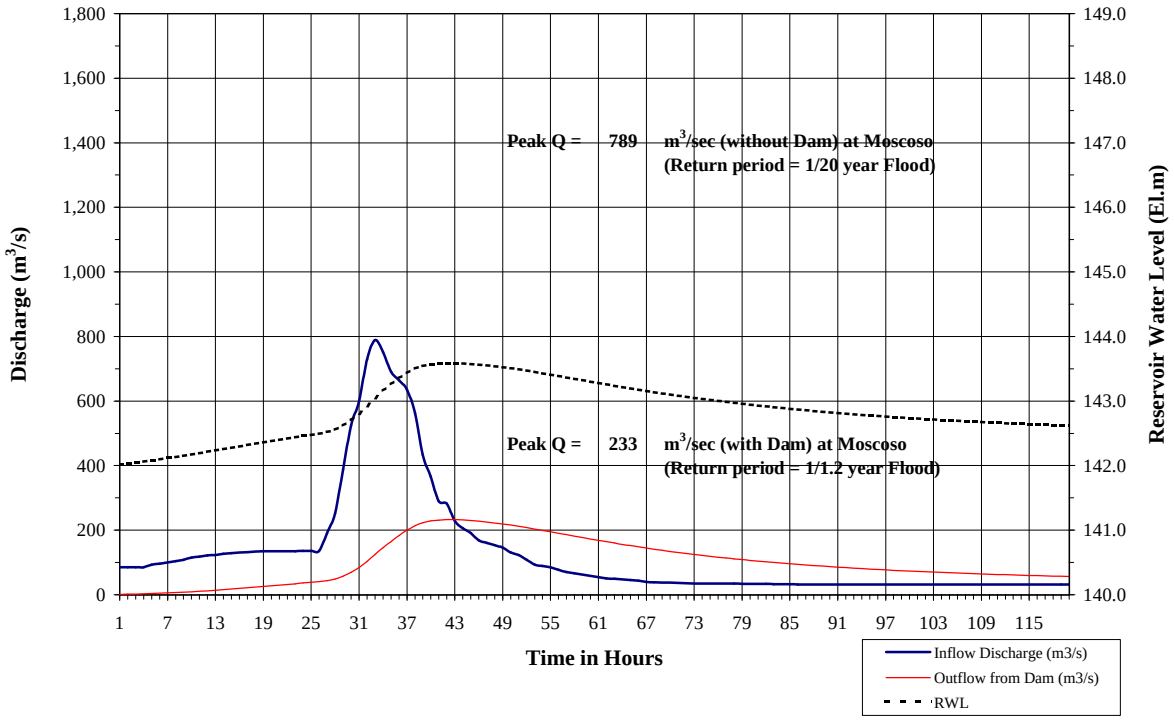
Flood Hydrograph at Moscoso Station (1/5 year Flood)
(With / Without El Guayabal Dam Conditions)



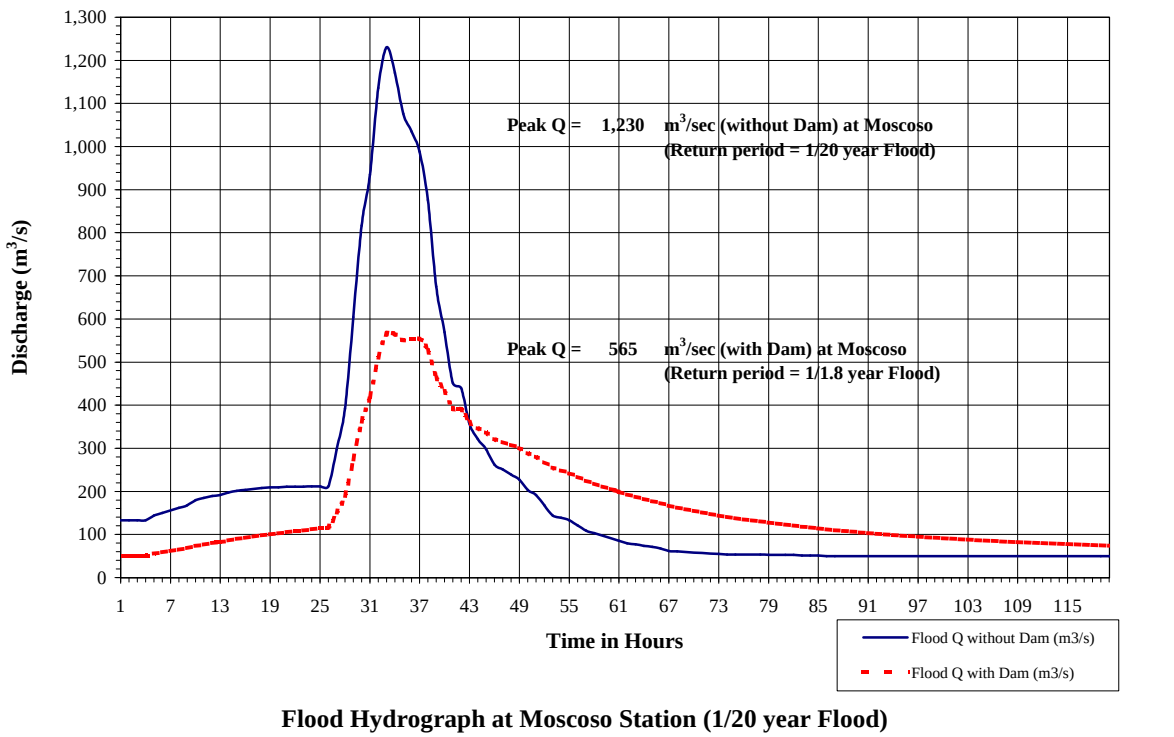
Flood Hydrograph and Reservoir Water Level (1/10 year Flood)
at Proposed El Guayabal Dam Site



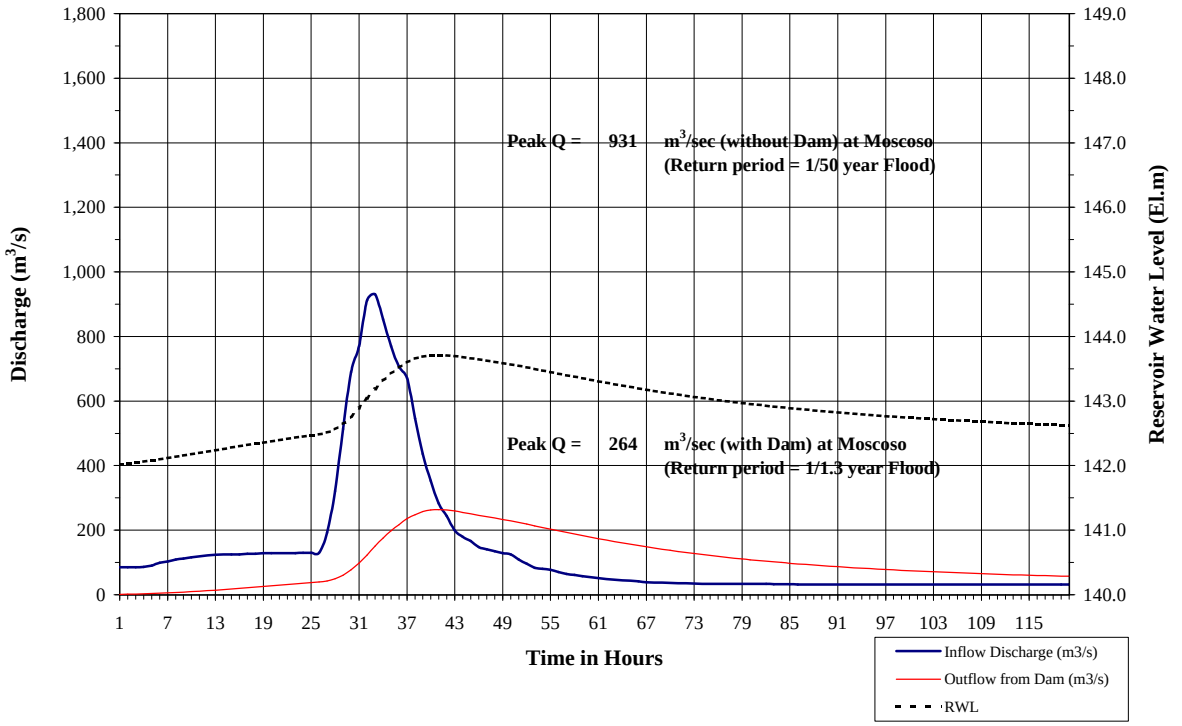
Flood Hydrograph at Moscoso Station (1/10 year Flood)
(With / Without El Guayabal Dam Conditions)



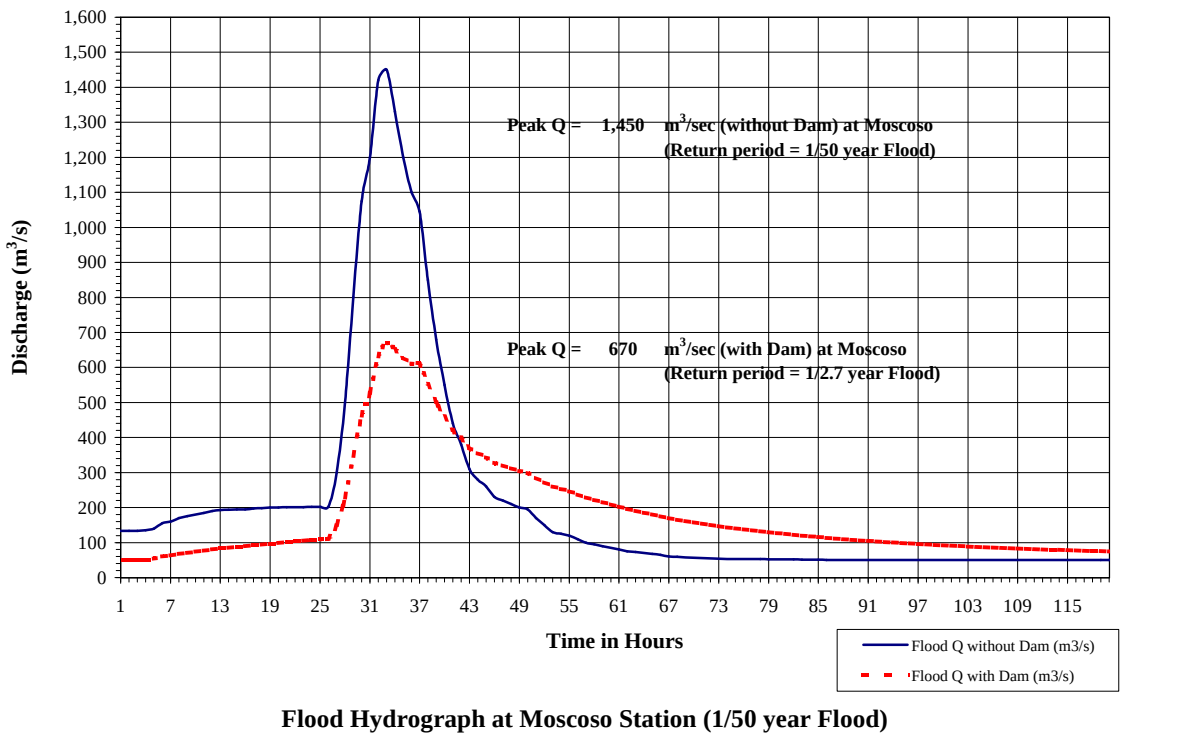
Flood Hydrograph and Reservoir Water Level (1/20 year Flood)
at Proposed El Guayabal Dam Site



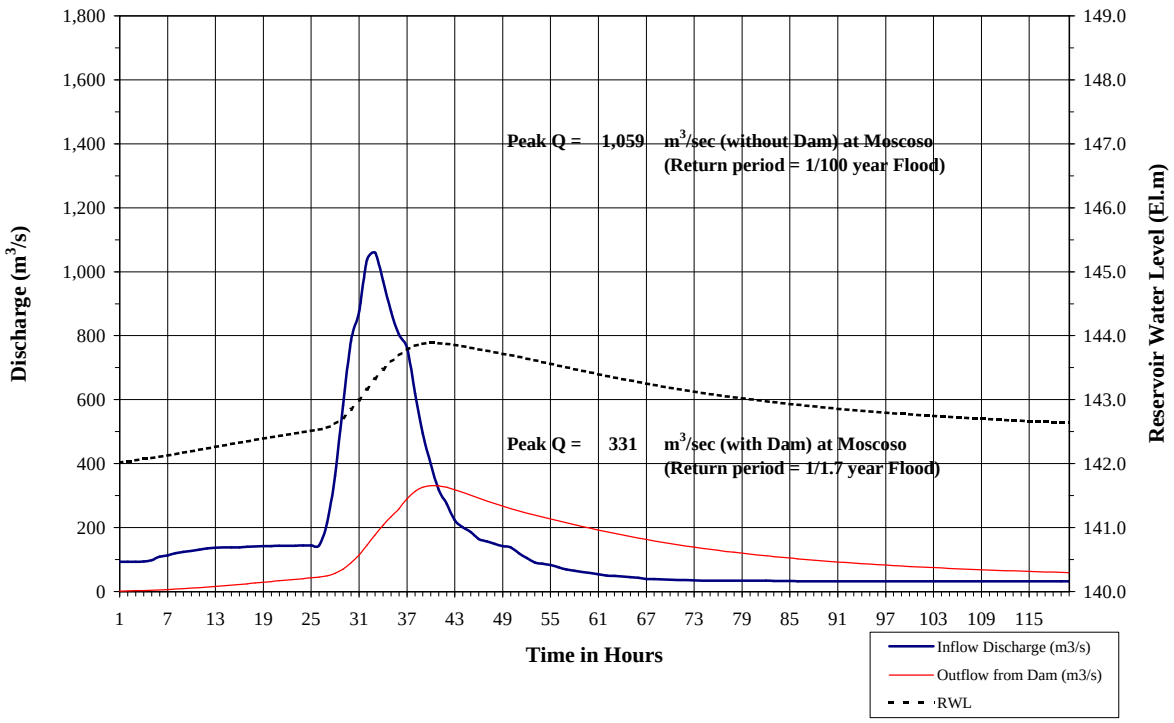
Flood Hydrograph at Moscoso Station (1/20 year Flood)
(With / Without El Guayabal Dam Conditions)



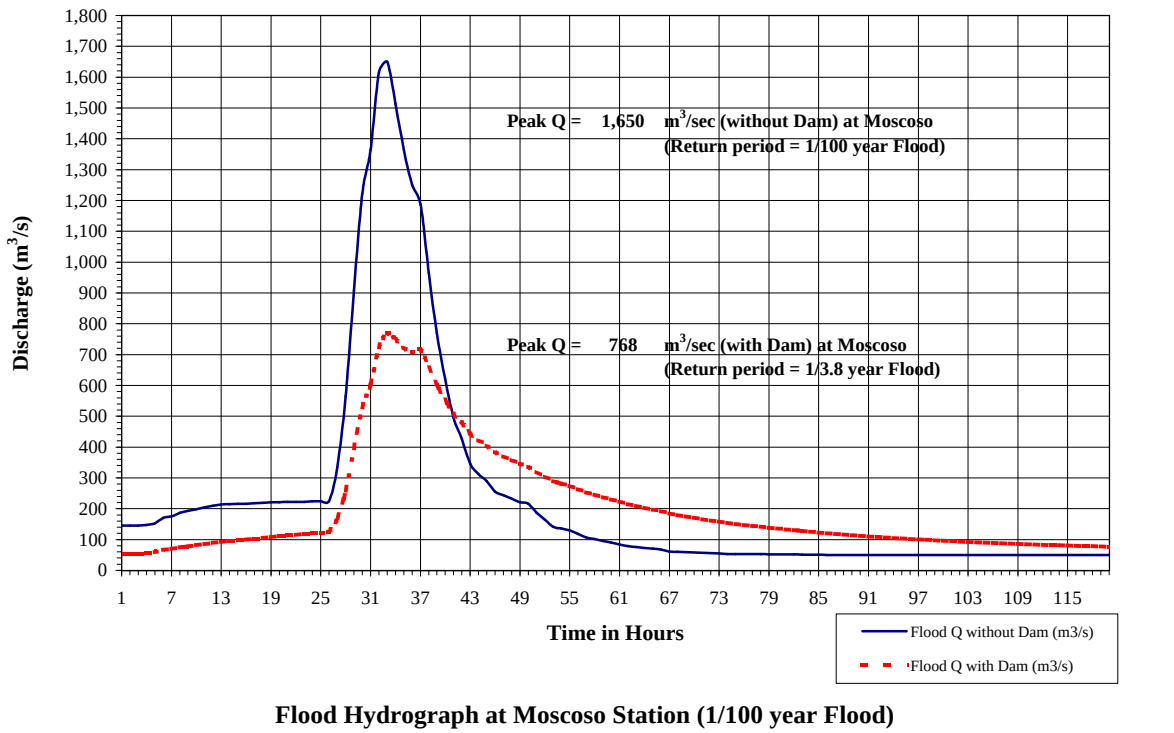
Flood Hydrograph and Reservoir Water Level (1/50 year Flood)
at Proposed El Guayabal Dam Site



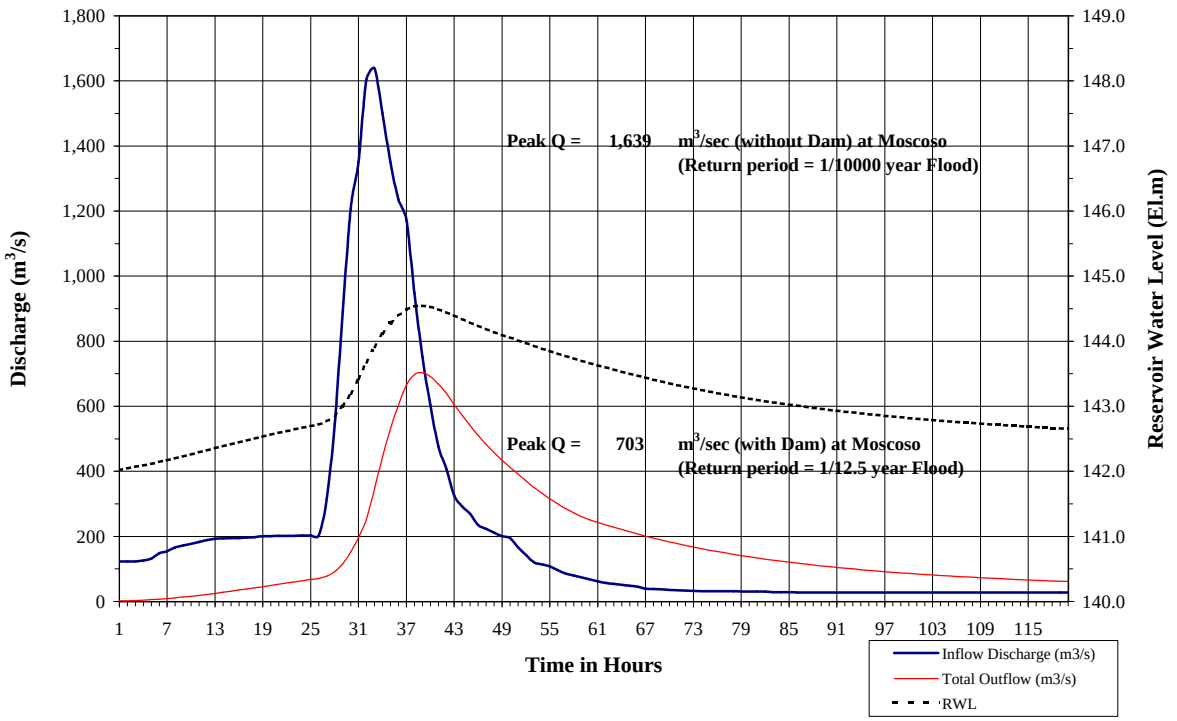
Flood Hydrograph at Moscoso Station (1/50 year Flood)
(With / Without El Guayabal Dam Conditions)



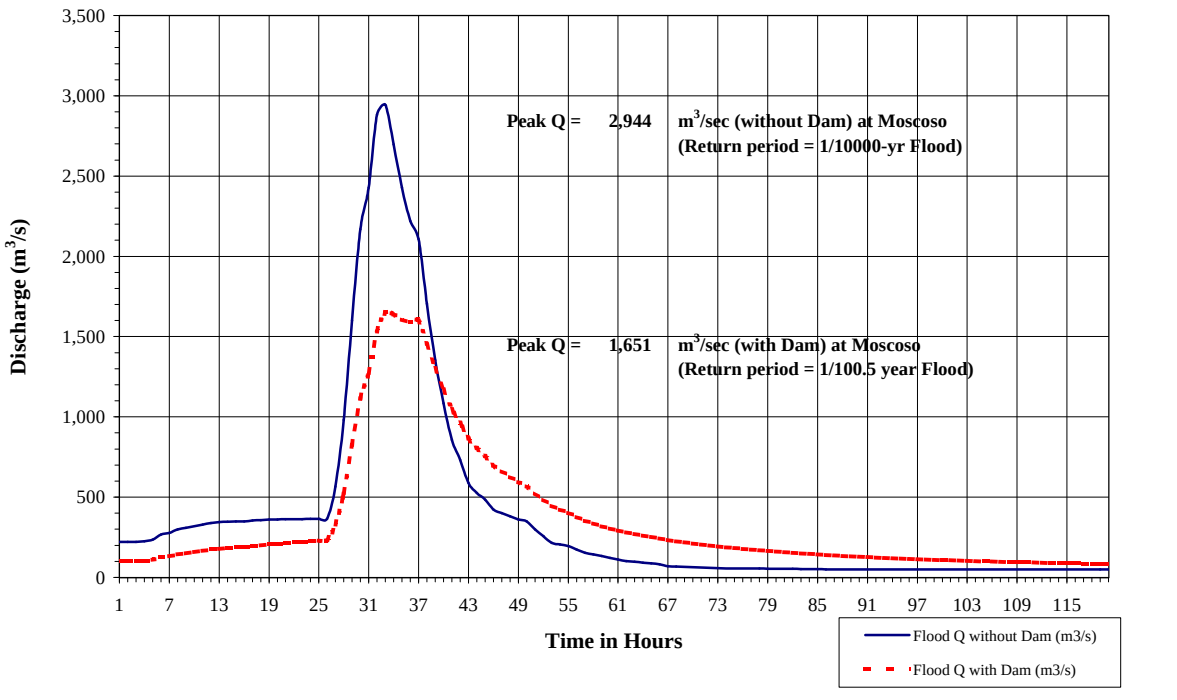
Flood Hydrograph and Reservoir Water Level (1/100 year Flood)
at Proposed El Guayabal Dam Site



Flood Hydrograph at Moscoso Station (1/100 year Flood)
(With / Without El Guayabal Dam Conditions)



Flood Hydrograph and Reservoir Water Level (1/10000-yr Flood)
at Proposed El Guayabal Dam Site



Flood Hydrograph at Moscoso Station (1/10000-yr Flood)
(With / Without El Guayabal Dam Conditions)

Final Report
Volume 3
Project Report

Part 6

Initial Environment Examination (IEE)

Initial Environmental Examination (IEE)

1. Introduction

The initial environmental examination (IEE) has been conducted as part of the Study, focusing on the two major development projects of the Eastern Region development master plan: (1) the Free Port and Economic Zone establishment program, and (2) the Rio Grande de San Miguel water resources development and management project. The work has been entrusted to a local firm, ARCADIS Euroconsult par Latinoamerica y el Caribe, S.A. de C.V. (Eurolatina), under the supervision of the JICA Study Team in close collaboration with the CND counterpart team. The firm was selected to undertake the IEE through a competitive bidding. First, five local firms were shortlisted and invited to a pre-bid meeting on September 30, 2003. Four out of the five firms submitted proposals for the IEE by October 10. The proposals were evaluated by the CND/JICA joint team. Through a contract negotiation, Eurolatina was finally selected to conduct the IEE, which has initiated effectively on October 15. The interim report of the IEE was submitted on November 10 in compliance with the contract between the JICA Study Team and Eurolatina, and the draft final report was submitted by December 12 as agreed between the two parties. The results of the IEE, conducted by Eurolatina, are summarized here. Full contents of the IEE will be compiled separately and submitted to CND as well as JICA. The results as summarized here represent tentative conclusions, as the full contents are still being examined in detail. The summary results are presented below by project after the brief explanation of the methodology used by Eurolatina in consultation with the CND/JICA joint team.

2. Methodology

The IEE conducted at this time is slightly more detailed than the kind usually carried out at the time of master planning. The depth of analysis is more likely that of preliminary environmental impact assessment (EIA). Accordingly, the Leopold matrix method was adopted as a main tool for the analysis. The method assesses both significance and magnitude of possible environmental impact. The assessment is judgmental rather than quantitative, but numerical values are attached to both the significance and the magnitude for comparative assessment of various impacts on different aspects of the environment. This would allow to identify in a more convincing way more important aspects of the environment to be looked into for the EIA at the next stage and more likely impacts that should be anticipated with the project and that may be mitigated, if the impacts are negative, through further project development.

The significance of possible impacts is assessed by the criteria of intensity, extension, effect and persistence. The numerical assessment method using these criteria is summarized in Table 1.

Table1. Criteria and valuation for assessing the Significance of Possible Impacts

Criteria	Qualification	Quantification
Intensity (IN)	- Low - Medium - High	1 5 10
Extension (EX)	- Local - Zonal - Regional - National	1 3 6 10
Effect (EF)	- Indirect - Direct	5 10
Persistence (PE)	- Brief - Temporary - Permanent	1 (Less than 1 year) 5 (From 1 to 4 years) 10 (From 5 to more years)
Significance (I) = IN + EX + PE + EF		

Source: Eurolatina.

The magnitude is assessed for those impacts, positive or negative, that have been found more significant. These are called relevant impacts. The numerical assessment of the magnitude follow the method summarized in Table 2.

Table2. Method of Assess the Magnitude of Relevant Impacts

Criteria	Qualification	Quantification
- Reversibility of the impact, effect or change made by the activity or project.	Low	1
- Effect or change capable of being mitigated through human actions and/or the environment's capacity of self-recovery.	Medium	5
- Irreversibility of the impact, effect or change made	High	10

Source: ibid.

3. IEE for the Free Port and Economic Zone Establishment Program

3.1 Assessment Framework

The anticipated impacts of the Free Port and Economic Zone (FPEZ) establishment program are assessed by major component project of the program. The following seven component projects are separately assessed:

(1) Port, industrial and logistic development and their future expansion,
(2) Waterfront development
(3) Urban renewal of the La Unión city,
(4) Urban renewal of the Conchagua city,
(5) New urban area development,
(6) Agro-tourism area development, and
(7) Nature preservation of the Conchagua volcano area.

For each component project, impacts are assessed for both the construction stage and the operation stage. Both positive and negative impacts are subject to the assessment. Possible positive and negative impacts anticipated in the influence area of the FPEZ, broadly defined, are also identified.

3.2 Impact Assessment

The anticipated impact of the FPEZ establishment program is assessed by using a Leopold matrix constructed for each component project. The significance of impacts is assessed first for each project with respect to various environmental factors, and more significant impacts are identified. Second, the magnitude is assessed only for those portions of the project identified with more significant impacts. The results of the assessment for the first component project are shown in Table 3.

Based on the Leopold matrices for all the component projects, anticipated relevant impacts, both positive and negative, are extracted. The results are summarized in Table 4 for the FPEZ area and in Table 5 for environmental factors affected.

Table 3. Leopold Matrix for Impacts from Development and Expansion, and Future Industrial and Logistics Area

Stages / Activities / Environmental Factors		Execution						Operation																A.I.
		Future expansion Indust. & Logistics Zone		T.I.	Indust. & Logistics Area		T.I.	Future expansion industrial & logistics Zone						P.I.	Area for future industrial & logistics Zone							P.I.	
		construction/ infrastructure	buildings	Temporary Impact	construction infrastructure	buildings	Temporary Impact	generation of solid waste	effluent emissions	gas emissions	sound emissions	labor activity (industry)	service supply	Permanent Impacts	generation solid wastes	effluent emissions	gas emissions	sound emissions	laboral activity (industry)	service supply	Permanent Impacts	Added Impacts
Físico- Spatial	Topography	10 / -22		0	10 / -22		0							0							0	-44
	Soils physical composition	10 / -31	10 / -31	0	10 / -31	10 / -31	0							0							0	-124
	Hydrology/dynamics/quantity	5 / -26	5 / -26	0	5 / -26	5 / -26	0							0							0	-104
	Forestry resources	10 / -26	10 / -26	0	10 / -26	10 / -26	0							0							0	-104
	Microclimate*		1 / -17	0		1 / -17	0					1 / -17	1 / -17	0					1 / -17	1 / -17	0	-102
Fisico	Hydrogeology	10 / -22	10 / -22	0	10 / -22	10 / -22	0							0							0	-88
	Natural landscaping	10 / -31	10 / -31	0	10 / -31	10 / -31	0							0							0	-124
	Flood risk	5 / 17		0			0							0							0	17
	Hydroerosion	1 / 17	1 / 17	0	1 / 17	1 / 17	0							0							0	68
	Marine_coastal dynamics	5 / -12	5 / -17	0			0							0							0	-29
Físico- Spatial	Roads	10 / 23	10 / 40	0	10 / 23	10 / 40	0			-31	-31	10 / 26	6 / 26	-62			-31	-31	10 / 26	5 / 26	-62	106
	Houses			0			0					10 / 23	6 / 23	0					10 / 23	5 / 23	0	92
	Hospital/basic health	1 / -5	1 / -5	0	1 / -5	1 / -5	0	-31	10 / -31	-5	-17	10 / 28	5 / 28	-53	-31	5 / -31	-5	-17	5 / 28	5 / 28	-53	-76
	Electricity	1 / -10	5 / -20	0	1 / -10	5 / -20	0	-5	1 / -5	-5		10 / 31	5 / 31	-10	-5	5 / -5	-5		10 /31	10 / 31	-10	34
	Potable water	5 / -10	5 / -20	0	5 / -10	5 / -20	0	-5	1 / -31	-5		5 / -31	5 / -31	-10	-5	5 / -31	-5		10 / -31	5 / -31	-10	-266
Spatial-infraestruct and buildings	Sewage/rain water	5 / -10	5 / -10	0	5 / -10	5 / -10	0		10 / -31	-5		10 / -31	10 / -31	-5		5 / -31	-5		10 / -31	5 / -31	-5	-236
	Solid wastes disposal	5 / -20	5 / -31	0	5 / -20	5 / -31	0					5 / -31	5 / -26	0					10 / -31	5 / -26	0	-216
	Port /art/ind facilities			0			0						10 / 40	0						10 / 40	0	80
	Industrial buildings			0			0					1 / 34		0					5 / 34		0	68
	Commercial buildings			0			0					5 / 26	5 / 26	0					5 / 26	10 / 26	0	104
	Change in use of soil	10 / -31	31	31	-31	10 / 31	-31					10 / 31	10 / 31	0					10 / 31	10 / 31	0	124
	Employment	1 / 23	1 / 23	0			0					10 / 40	10 / 40	0					10 / 40	40	40	206
	Income	1 / 26	1 / 26	0	1 / 26	1 / 26	0					10 / 40	10 / 40	0					10 / 40	40	40	264
Economic - Productive	Poverty level			0			0					10 / 23	10 / 23	0					10 / 23	23	23	92
	Commerce	1 / 23		0	1 / 23	1 / 23	0					10 / 28	10 / 28	0					10 / 28	28	28	181
	New services			0			0					10 / 26	10 / 26	0					10 / 26	26	26	104
	Development of new industries			0			0					10 / 40		0					10 / 40		0	80
	Water quality	5 / -28	5 / -18	0			0	-28	5 / -28	-31				-59	-18	5 / -36	-18				-36	-205
	Quality of aAquatic coastal life	5 / -28	5 / -28	0			0	-33	5 / -36	-23				-56	-18	5 / -28	-18				-36	-212
Ecosystems and natural resources	Terrestrial flora and fauna	10 / -23	10 / -23	0	10 / -33	10 / -33	0			-23	-23			-46	-23		-21	-33			-77	-235
	Aquatic flora and fauna	5 / -28	5 / -23	0			0	-28	5 / -36		-23			-51	-18	5 / -33	-14	-18			-50	-221
	Marine-coastal wetland	5 / -23	5 / -23	0			0	-28	5 / -36	-23				-51	-18	5 / -28	-28				-46	-207
	Terrestrial/fluvial ecosystem	5 / -28	10 / -33	0	10 / -28	10 / -33	0			-31				-31	-23	10 / -28	-23	-28			-74	-255
	Biological Corridor	10 / -23	10 / -28	0	10 / -19	10 / -19	0	-23	10 / -18	-18				-41	-19	10 / -18	-19	-19			-57	-223
	Social organization			0			0					5 / -33	5 / -33	0					5 / -33	5 / -33	0	-132
	Public/local administration	5 / 26		0	5 / 26		0					5 / 31		0					5 / 31		0	114
	Land possesion	10 / -17		0	10 / -17		0							0							0	-34
Social	Health	5 / -13	5 / -13	0	5 / -13	5 / -13	0					5 / 36	5 / 36	0					5 / 36	5 / 36	0	92
	Education/training			0			0					5 / 33	5 / 33	0					5 / 33	5 / 33	0	132
	Migration/immigration	5 / -31	5 / -31	0	5 / -31	5 / -31	0					5 / -31	5 / -36	0					5 / -36	5 / -36	0	-263
	Population	5 / -17		0	5 / -17		0					10 / 33	10 / 33	0					10 / 33	10 / 33	0	98
	Cultural tradition			0			0					5 / -23	5 / -23	0					5 / -23	10 / -23	0	-92
Total		0	31	31	-31	0	-31	-181	0	-200	-94	0	0	-475	-178	0	-192	-146	0	157	-359	

T.I. Temporary Impacts

P.I. Permanent Impacts

A.I. Added Impacts

* Each entry of the matrrix is either magnitude/significance or significance

Source: Eurolatina.

Table 4. Areas of Relevant Impacts of the FPEZ Establishment Program

Component project	Construction stage		Operation stage	
	Negative impact	Positive impact	Negative impact	Positive impact
Port, industrial and logistic development and expansion	Construction of infrastructure and buildings		Wastewater discharge	Employment generation Services provision
Waterfront development		Sports complex Conservation of mangroves	Solid wastes generation Dumping of domestic wastes	Tourism development Restaurants Conservation of mangroves
Urban renewal of La Unión city		Restoration of cultural heritage	Emission of exhaust gas Commercial activities	Infrastructure maintenance
Urban renewal of Conchagua city	Construction of buildings		Solid wastes generation Dumping of domestic wastes Residential activities	Infrastructure maintenance
New urban area development	Construction of buildings	Creation of green areas	Soil wastes generation Dumping of domestic wastes Residential activities	
Agro-tourism area development	Construction of buildings			Infrastructure maintenance
Nature preservation of the Conchagua volcano area buildings	Construction of buildings			Infrastructure maintenance Management of conservation area Administration

Source: Eurolatina.

Table 5. Impacts by Environmental Factor in the Influence Area of the FPEZ

Component project	Positively affected factors	Negatively affected factors		
		Physical factors	Ecological factors	Social factors
Port, industrial and logistic development and expansion	Employment Income	Potable water Sawage and stormwater	Water quality Aquatic life Terrestrial flora and fauna Aquatic flora and fauna Coastal wetland Fluvial ecosystem Biological corridor	Migration
Waterfront development	Tourism and commercial development Culture and landscapes Employment Income Poverty alleviation	Disposal of solid wastes	Water quality Aquatic life Aquatic flora and fauna Coastal wetland Biological corridor	Migration

Component project	Positively affected factors	Negatively affected factors		
		Physical factors	Ecological factors	Social factors
	Local administration Quality of life			
Urban renewal of La Union/Conchagua	Infrastructure & buildings Change in land use			
New urban area development	Development of green areas		Water quality Aquatic life	Migration
Agro- tourism area development	Tourism and commercial development			
Nature preservation of Conchagua volcano area	Management of conservation area			

Source: Eurolatina.

3.3 Recommendations

3.3.1 Recommendations by project

To prevent or minimize the possible negative impacts, recommended actions are derived for each of the component projects of the FPEZ establishment program as summarized below.

(1) Port, industrial and logistic development and expansion

1) The industrial and logistic area should be served by its own water supply system.
2) The sewer system should be separated from urban drainage system, and connected to a treatment plant.
3) The industrial and logistic areas should be operated by its own administration.
4) Industrial establishments in the area should have a built-in industrial wastes recycling program, and only clean industries should be promoted.
5) The industrial area should be allotted an exclusive cell in the sanitary landfill site.
6) Environmental impact assessment should be conducted separately for those industries involving potentially serious environmental effects.

(2) Waterfront development

1) An integrated solid wastes management program should be implemented with emphasis on the deposit and collection system.
2) An integrated housing renewal program should be designed and implemented as part of the neighbourhood improvement program.
3) Design standards should be established for buildings on the waterfront to fit to the local climate and culture.

4) The design standards should ensure access to facilities by the elderly and the handicapped.

(3) Urban renewal of La Unión city

1) An urban renewal plan should be elaborated
2) A comprehensive neighbourhood improvement program should be designed and implemented.
3) Cultural and historic patrimony buildings located along the center road should be protected.
4) A landscaping and cultural plan should be provided as part of the renewal project.

(4) Urban renewal of Conchagua town

1) A renewal plan should be incorporated into the urban renewal plan of the La Unión city.
2) Cultural and historic patrimony buildings should be protected from damages by new construction.

(5) New urban area development

1) The new urban area should be planned with housing areas, shopping mall, stadium and sports area, and open and green areas
2) Proper urban facilities should be planned in accordance with the new land development.
3) An urban traffic study should be conducted to design urban traffic facilities, including public transportation.

(6) Agro-tourism area development

1) A comprehensive development plan should be prepared for the rural settlements of Amapalita and Agua Escondida for sustainable agro-tourism.
2) Proper and continued maintenance should be provided to the access road currently in poor conditions.

(7) Nature preservation of Conchagua volcano area

- Physical boundaries of the nature conservation area should be delineated and proper signs should be posted.

3.3.2 Recommendations by physical environment

(1) Forest areas of Conchagua volcano

Conservation measures are recommended such as the following.

1) Stabilization treatment on natural drainage on the slopes of the Conchagua Volcano.

This activity includes the construction of layered retention dikes, according to the grading of the slope, made of materials already existing in the area such as stones or vegetative materials, as well as planting of forest species on both sides of the drainage. This practice would reduce the speed of flows and thus also soil erosion and dragging of materials.

2) Establishment of agroforestry systems in areas of agriculture on slopes or pastures. This activity, accompanied by the planting of live barriers or the construction of stone barriers following contours, reduces considerably the risks of soil erosion and land and rock slides.

3) Periodic pruning to create fireguard gaps, mainly in tourist forest areas, with the purpose of preventing accidental forest fires

(2) Development areas

1) Accident prevention measures should be implemented during the execution stage by enforcing minimum non-structural security standards inherent to construction work.

2) Whenever possible, all works involving removal of soil and construction of buildings shall be performed during the dry season to prevent mudslides.

3) Existing vegetation in the area for the future industrial and logistics expansion should be preserved, as well as small beaches.

4) Stabilization treatment on slopes of natural drainages should be implemented in the new residential area, by planting Vetiver hay.

3.3.3 Recommendations related to management

(1) Management of the La Unión-Conchagua development area

1) Strengthen the establishment of a management authority for La Unión-Conchagua marine-coastal areas.

2) Strengthen environmental units from the association of mayors of the Fonseca gulf.

3) Establish a public corporation to develop the marine coastal area of La Unión.

4) Incorporate principles from international agreements on conservation and development of coastal areas such as Ramsar, Northeast Pacific, and climatic changes conventions.

(2) Management of nature areas

1) Support initiatives for managing and protecting wetland environments by MARN.

2) Strengthen CODECA's organization in order to boost its participation as co-administrator of the nature area of Conchagua.

3) Foster contributions from industry and commerce to the social and environmental development of the area of Cochagua and La Unión.

4) Draw closer initiatives from non-government organizations and the financial management of the Initiatives for the Americas Fund (FIAES, Spanish acronym), and that of the National Environmental Fund of El Salvador, (FONAES, Spanish acronym).

(3) Protection of marine and coastal environment

1) Apply vigilance and prevention mechanisms for sea transport accidents.

2) Comply with the Environment Law regarding protection of the marine/coastal environment (Art. 51)

3) Train a specialized team on the control of industrial spills (Art. 51 Law on the Environment)

(4) Environmental monitoring

1) Monitor the quality of hydrographic basins in the surroundings of the Siramita basin and the Las Conchas basin.

2) Monitor the quality of coastal waters before and during the execution and operation of the FPEZ program, especially the industrial and logistics area.

3) Vigilance of compounds with high persistence on the environment (agricultural farms area in La Unión – Conchagua – Amapalita)

4) Perform an economic evaluation of environmental goods and services for fishing resources.

5) Perform control activities in order to prevent overexploitation of biological fishing resources, and implement a payment mechanism for environmental services.

(5) Urban planning

Further project development should incorporate normative and regulatory measures related to urban development, including the following:

1) Law on Urbanism and Architecture,

2) Law on the Environment:
   Art. 12-13-14 on development and territorial organization plans,
   Art. 18-19-20-21b, d, g, i, j, k, l on development projects' environmental impact assessment, and,
   Art. 7-73-74 on coastal marine resources management and protection,

3) Health Code, observation of quality standard on domestic dumping and solid waste management, CONACYT Standard (1996), and

4) Territorial Organization and Development Plan (MARN/PNODT, 2003).

3.3.4 Recommendations related to socioeconomic aspects

1) Develop a permanent environmental education program with emphasis on solid wastes management, aimed at different audiences from La Unión and Conchagua.

2) Envisage in the short term the implementation of an education and technical training program, with the purpose of adjusting local labor force to the development and demand from the industrial and logistics area, and also the expected tourist development.

3) Include within the La Unión urban downtown renovation plan a resettlement program and/or an infrastructure and housing improvement program for La Fuerteza settlement, located at the drainage gully called Chepegual.

4) Implement an educational program aimed at protecting women's health, mainly to prevent illnesses such as AIDS. The program can be coordinated between institutions such as the Salvadoran Institute for the Development of Women (ISDEMU), Ministry of Public Health and Social Assistance (MISPAS), and private non-profit organizations that execute AIDS prevention and assistance programs.

5) Implement a program aimed at protecting children against commercial exploitation, prostitution and traffic.

4. IEE for the Rio Grande de San Miguel Water Resources Development and Management

4.1 Assessment Framework

The anticipated impacts of the Rio Grande de San Miguel water resources development and management are assessed by major component project. The following four components are separately subject to the assessment:
(1) El Guayabal multipurpose dam,
(2) Rio Grande midstream river improvement,
(3) Flood plain management, and
(4) San Miguel- Jocotal- San Dionisio irrigation system.

For each component, impacts are assessed for both the construction stage and the operation stage. Both positive and negative impacts are to be examined. Possible positive and negative impacts on various environmental aspects anticipated on the influence area of the project are clarified.

4.2 Impact Assessment

Anticipated impacts of the Rio Grande de San Miguel water resources development and management are assessed by using a Leopold matrix constructed for each component. The significance of impacts is assessed first for each component with respect to various environmental factors, and more significant impacts are identified. Second, the magnitude is assessed only for those portions of the component identified with more significant impacts. The results of the assessment for the El Guayabal multipurpose dam are shown in Table 6.

Based on the Leopold matrices for all component projects, anticipated relevant impacts, both positive and negative, are extracted. The results are summarized in Table 7 for areas of impacts and in Table 8 for environmental factors affected.

Table 6. Leopold Matrix for Impacts from the Construction and Operation of the El Guayabal Dam Project

Affected Areas \ Stages		Execution				Temporary impacts - execution stage	Operation						permanent impacts execution stage	sum environmental factors impacts factores ambientales
		preparation of site	Construction of dam	supplies	communicaity movilization		*filling net volume	flood control	agricultural activity	tourist activity	fishing activity	dam maintenance		
Physical-Spatial	topography	10 / -28	10 / -21	1 / -27	1 / 8	-68	10 / 17	26	5 / 14	1 / 8	8	1 / -14	59	-9
Physical	soils physical composition	10 / -33		1 / -14		-47	10 / -33	31	5 / 31			1 / -14	15	-32
	hidrology/dynamics/quantity	5 / -23	5 / -31	1 / -14	5 / -36	-104	10 / -36	-26	5 / 23	1 / 12	36	1 / 18	27	-77
	forestry resources	10 / -16		1 / -16		-32	10 / -33	16	5 / 16	1 / 16	16	5 / -16	15	-17
	microclimate	5 / -10	5 / -10	1 / -10	1 / -10	-40	5 / 31	13	1 / 13	1 / 13	13	1 / -10	73	33
	hydrogeology	10 / 13	10 / -36	1 / -13	1 / 28	-8	10 / 36	31	5 / 27	1 / 13	-27	1 / -17	63	55
	natural landscape	10 / -26	10 / -26	1 / -14	1 / -14	-80	10 / 33	28	1 / 23	1 / 23	33	1 / -14	126	46
	seismic risk	1 / -23	1 / -33	1 / -23	1 / 21	-58	5 / -33	-23	5 / -13	1 / -13	-13	5 / -28	-123	-181
	flood risk	5 / -13	5 / -13	1 / -13	1 / 26	-13	5 / -21	-19	5 / -20	1 / -28	-28	5 / -26	-142	-155
	landslide risk	1 / -31	1 / -31	1 / -12	1 / -12	-86	5 / -33	-33		1 / -28	-28	5 / -28	-150	-236
	hydroerosion	5 / -21	5 / -21			-42	5 / -33	-28	5 / 36			5 / -24	-49	-91
Spatial-infrastructure and buildings	roads	10 / -17	10 / -17	5 / -17		-51	5 / -17	17		5 / 17		5 / -17	0	-51
	housing	10 / -31	10 / -31		10 / -31	-93	10 / -31	17		5 / 17			3	-90
	basic health				5 / -17	-17		17		5 / -17			0	-17
	telecommunications	5 / -8	5 / -8		5 / -8	-24	5 / -8	17		5 / -17		5 / -17	-25	-49
	geographic boundaries						5 / -31	31					0	0
	electricity	5 / -17	5 / -17		5 / -31	-65	5 / -31	17		5 / -31		5 / -17	-62	-127
	potable water	5 / -8	5 / -8		5 / -31	-47	5 / -17	17		5 / -31		5 / -17	-48	-95
	sewage/rainwater				5 / -17		5 / -17	17		5 / -31		5 / -17	-48	-48
	solid wastes disposal				5 / -31	-31	5 / -17			5 / -31		5 / -8	-56	-87
	effluents/industrial wastes													0
	tourist buildings									5 / 31	31		62	62
	commercial buildings									5 / 31	31		62	62
	Change in use of soil	10 / -31	10 / -31		10 / -31	-93	10 / 31	31	5 / 31	5 / 17			110	17
	scenic landscape	5 / -17	5 / -17		5 / -31	-65	10 / 31	31	5 / 31	5 / 31			124	59
Economic -Productive	agricultural livestock systems	10 / -21	10 / -28			-49	10 / -33		5 / 28				-5	-54
	employment	5 / 23	5 / 31			54	5 / -23		5 / 28	5 / 28			33	87
	income	5 / 12	5 / 26			38	5 / -23		5 / 28	5 / 28	23		56	94
	poverty level	5 / 12	5 / 12			24	5 / -23		5 / 24	5 / 28	19		48	72
	fishing/extraction		5 /-23			-23	5 / -28				28		0	-23
	commerce	5 / 12	5 / 12			24			5 / 28				28	52
	new services													0
	agroindustrial development								5 / 24				24	24
	water for agricultural and livestock use						5 / -28						-28	-28
	tourist promotion					68				5 / 31			31	99
Ecosystems and Natural Resources	water availability/ecosyst	5 / -23	5 / -21			-44	5 / -33	-28					-61	-105
	water quality multiple use (human)	5 / -23	5 / -21			-44	5 / -33	-28	5 / -28	5 / -26			-115	-159
	water quality for aquatic life	5 / -23	5 / -21			-44	5 / -33	-23	5 / -23				-79	-123
	terrestrial flora and fauna	10 / -22	10 / -26	10 / -23		-71	10 / -36	-28		5 / -18			-82	-153
	aquatic flora and fauna	5 / -17	5 / -17				5 / -33	-27			26	5 / -23	-57	-57
	Fluvial_lake wetland	5 / -23	5 / -17				5 / -36	-36				10 / -23	-95	-95
	terrestrial ecosystem	10 / -23	10 / -26			-49	10 / -36	-36					-72	-121
	Biological Corridors and protected nat. areas	10 / -17	10 / -17				10 / -33	-33					-66	-66
	Ramsar Site													0
Social	social organization	5 / -26	5 / -26		5 / -33	-85	5 / 28			5 / 28			56	-29
	public/local administration	5 / -26	5 / -26		5 / -33	-85	5 / -31			5 / 30			-1	-86
	land possession	10 / -33	10 / -33		10 / -33	-99								-99
	health	5 / -23	5 / -18		5 / -28	-69	10 / -28						-28	-97
	education/training				5 / -28	-28	5 / -28		5 / 28	5 / 33			33	5
	demand for basic services				0	0				5 / 28			28	28
	migration/immigration				10 / -28	-28								-28
	affected population	5 / -35	5 / -28		5 / -33	-96	5 / -28	17	5 / 28	5 / 31	33		81	-15
	cultural tradition	5 / -33			5 / -33		5 / -28			5 / 31			3	3
	cultural heritage	5 / 24	5 / -30			-6	5 / -24						-24	-30
	sum impacts activities	-587	-618	-196	-466	-1867	-782	6	377	254	201	-312	60	

* Each entry of the matrix is either magnitude/significance or significance.

Source: Eurolatina.

Table 7. Areas of Relevant Impacts of the Rio Grande de San Miguel Water Resources Development and Management

Component project	Construction stage	Operation stage	
	Negative impacts	Negative impacts	Positive impacts
El Guayabal dam	Construction of dam Related infrastructure and facilities Relocation of communities	Inundation of reservoir area Dam maintenance	Agricultural activities Tourism activities
Midstream river improvement	Construction of dykes Channel excavation		
Flood plain management	Natural drainage of Jocotal lagoon Degrading of outlet		
Irrigation system	Site preparation		Multiple crops production under irrigation

Source: Eurolatina.

Table 8. Impacts by Environmental Factor in the Influence Area of the Rio Grande de San Miguel Water Resources Development and Management

Component project	Positively affected factors	Negatively affected factors		
		Physical factors	Ecological factors	Social factors
El Guayabal dam		Seismic risk Flood risk Landslide risk	Quality of water for various uses Terrestrial fauna and flora	
Midstream river improvement	Hydrology (flow distribution) Hydrogeology (groundwork) Erosion (reduction) Social organization Public administration	Topography Road coverage in land use	Water availability for ecosystem Quality of water for various uses Aquatic fauna and flora Wetland conditions Biological corridor Ramsar site	Land ownership
Flood plan management	Hydrology Hydrogeology	Telecommunications Electricity Potable water		
Irrigation system				

Source: ibid.

4.3 Recommendations

4.3.1 Recommendations for physical measures

To prevent or minimize the possible negative impacts, the following physical measures are recommended.

(1) Flood control and flood plan management

1) Installation of meteorological stations at strategic sites on the El Guayabal river basin, and also of hydrometric stations in the downstream.
2) Strengthening of an early flood warning system, including training and supply of necessary equipment and materials to habitants in flood prone areas.
3) Construction of a set of dykes that work as sediment traps and stabilize water flow in the El Guayabal basin and also improvement of a network of natural drainage in the basin.
4) Planting of native species on slopes above the proposed reservoir to prevent landsides and soil erosion.
5) Formulation and implementation of reforestation, drainage control and soil conservation plans in the upper and the middle catchment areas of Rio Grande de San Miguel.
6) Incorporation of other physical measures in the project such as gabian structures for slope protection and erosion control, and vegetative cover with Vetiver grass.

(2) Irrigation System

1) Planning for efficient use of irrigation water with proper cropping cycles and irrigation methods.
2) Installation of a network of drainage for excess irrigation water.
3) Provision of adequate maintenance flow to ensure the healthy aquatic ecosystem in the downstream, including mangrove and brackish ecosystem.

4.3.2 Recommendations for management

(1) El Guayabal dam

1) Establish a monitoring system for river flow, sediments and water quality.
2) Identify local sources of water that can be tapped for surrounding communities.
3) Evaluate biodiversity, habitats, and flora ad fauna in the catchment area and the proposed reservoir area of the dam.
4) Determine nature areas to be protected.
5) Identify and control, if necessary, sources of water contamination.

(2) Irrigation system

1) Evaluate the quality of river water for irrigation use.
2) Avoid intensive irrigation development particularly in the Jocotal area.
3) Conduct limnological baseline research to ascertain chemical, physical, and biological characteristics of the Jocotal aquatic ecosystem and swamp areas.
4) Assess salinization conditions of coastal aquifers in the San Dionisio and the Concepción Batres areas.

(3) Flood control

1) Avoid significant intervention on existing riparian vegetation, preserving some meandering areas.
2) Apply guidelines on land use and zoning proposed by the Management Plan (MARN/ AECZ, 2003) regarding interventions and construction of infrastructure in the Olomega area.
3) Assess changes in fluvial environment and sedimentation process in the Olomega lake as a result of riverbed and meandering corrections and the reservoir created by the dam.
4) Observe the land zoning of the Management Plan (MARN/ AECZ, 2003) for natural estuaries and mangrove areas of Jiquilisco bay regarding the control on contamination and regulation on the use of surrounding areas.

(4) Flood plain management

1) Establish an effective basin management organization.
2) Implement the risk management guidelines prepared by the municipality of San Miguel.
3) Conduct a survey on flood prone areas with the purposes of designing drainage system and identifying evacuation areas.
4) Incorporate guidelines and regulations for managing the Jocotal area according to the Ramsar convention into the proposal for flood prevention measures.

4.3.3 Recommendations for project development

Further project development of the Rio Grande de San Miguel Water Resources Development and Management should incorporate the mitigatory measures proposed by the IEE in order to avoid, mitigate or compensate for negative impacts. Particularly important are measures related to relocation of people from the purposed reservoir area and support for resettlement and re-establishment of socioeconomic activities by the relocated people.

Consideration on various aspects related to the resettlement is derived from existing studies (Box). The resettlement plan should be prepared, encompassing areas of resettlement, housing, viable economic activities, infrastructure, social needs and other specific requirements of

families to be replaced by the proposed reservoir. Some of them may be resettled in the proposed irrigation area where flood protection and enhanced productivity would be ensured by the project.

The further project development should be undertaken by effecting a participatory approach involving all the stakeholders from the beginning and ensuring open and full access to all the relevant information. As part of a comprehensive feasibility study in the next stage, environmental impact assessment should be conducted covering both natural and social environment.

Considerations for Resettlement

Resettlement studies, mainly for the construction of hydroelectric dams identify social consequences present at individual and collective level of the population affected on aspects such as the following

- The context of their social relationships is altered.
- The productive base is modified and new political dynamics are created.
- Community structure is weakened; groups of relatives are dispersed and the cultural identity and the potential for mutual assistance are reduced.
- Affected population feels assaulted by foreign workers who alter ways of life that normally present uprooting, a social-cultural identity crisis and the aggression they are subjected to, is expressed in different moods that influence their reaction towards change.
- Work and better economic conditions expectations arise among the population.
- It is common for big dam projects effects to go beyond the temporary scope of its construction.
- Project construction processes do not consider social, economic and cultural aspects, since they are seen more like obstacles to overcome in any way.
- There is a general lack of development programs to compensate, reestablish or even improve preexisting living conditions for the relocated population, and relocation tends to be seen as a simple move.
- Involuntary resettlement causes long term hardships, impoverishment, and environmental damage unless the proper measures are carefully planned and implemented.

(cf. World Bank, 1990; M. Cemea, 1989; Scuder and Colson, 1978; Garcia Espejel, 1998)

The World Bank recommended, within the fight against poverty framework, to treat resettlements of population affected by development projects as follows: Population re-accommodations cannot be treated as a simple technical problem of moving and restitution of houses, but as a development challenge, with the purpose of achieving the reconstruction of the displaced population's productive basis. It is a policy that includes economic, ecological, social and cultural aspects and tries to go beyond a sheer monetary compensation and construction of infrastructure; it tries to be a global answer to future losses endured by the population (Graves, 1997).

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Part 7

Coffee Pilot Project

Coffee Pilot Project

1. Background

Coffee producers in El Salvador face difficulties due to the stagnating coffee prices in the international market. This situation may be overcome by (1) reducing production costs to ensure the profit margin and (2) specializing in high quality, high price products such as organic and/or gourmet coffee. In the Eastern Region, most small coffee producers sell raw coffee beans to processors, who in turn sell the processed coffee in bulk to final producers or exporters. Accordingly, both the coffee producers and the processors in he Eastern Region are in a subordinate position and often suffer from severe financial conditions. Also, inadequate treatment and processing of raw beans lead to larger processing losses and lower products' quality.

2. Objectives of Coffee Improvement

The Mater Plan for the Eastern Region development has proposed a coffee improvement project, focusing particularly on small coffee producers. The objectives of the project are:

(1) to improve coffee production and processing for high quality products,
(2) to increase income of small coffee farmers, and
(3) to contribute to protection and improvement of upper catchment areas of main rivers through traditional coffee cultivation under shade cover trees.

As a first step to realize these objectives, a pilot project has been formulated for selected small coffee farmers in the Eastern Region.

3. Project Scope

The coffee pilot project consists of the following components:

1) formation of coffee producers' organizations,
2) installation of two coffee pulping machines,
3) market survey and preliminary marketing,
4) technical extension on coffee production, harvesting, pulping, and other treatment,
5) development of trade name and logo for export coffee, and
6) processing of organic coffee certification.

4. Implementing Arrangements

The coffee pilot project has been implemented as part of the Study on Economic Development, Focusing on the Eastern Region, of the Republic of El Salvador, and carried out jointly by CND and JICA Study Team. The CND/JICA joint team is the implementing agency of the pilot project under the supervision of JICA. The team has contracted with the National Foundation

for the Development (Fundación Nacional para el Desarrollo/FUNDE) to share some of the management responsibilities for the execution of the project. Under this management organizations, cooperation and other local groups in the Eastern Region were organized for the project. They are listed below.

Cooperative/Group	Location	No. of partners
Las Marías 93 Cooperative	Chinameca (San Miguel)	73
Luz en el Horizonte Cooperative	Chinameca (San Miguel)	35
Jucuapense Cooperative	Jucuapa (Usulutan)	60
El Diluvio Associate Group	Jucuapa (Usulutan)	8
Cooperativa San Mauricio	Tecapán (Usulutan)	57
UPREX/COMUS	San Francisco Javier (Usulutan)	60
Berlín Cooperative	Berlin (Usulutan)	50
Alturas de Perquin Cooperative	Perquín (Morazan)	40
Coffee Association of Usulutan	Santiago de Maria (Usulutan)	60
Bagatela Cooperative	Santiago de Maria (Usulutan)	20
Santa Maria Cooperative	Santiago de Maria (Usulutan)	27
Las Casitas Associate Group	Alegría (Usulutan)	15
	Total	505

5. Project Implementation

The coffee pilot project was initially implemented from October 2003 through February 2004. This represents the first phase of the pilot project implementation. During this period, only a portion of the original scope of work was covered, and some tasks were modified to reflect changes in the resource availability and the timing of implementation. Specifically, the following tasks were fully covered as planned:

(1) formation and consolidation of coffee producers organizations,
(2) market survey,
(3) improvement of coffee processing, and
(4) commercialization of local coffee with initial marketing.

Coffee pulping machines were not purchased but instead the existing facilities were shared to minimize the cost. To improve the quality of products for direct marketing, however, a thresher and tow units of roasters were installed for common use by participating cooperatives. Together with additional facilities installed voluntarily by participating cooperatives, a full range of processing activities was made possible by the facilities that they own. This has allowed two participants, Las Marias 93 and UPREX/COMUCS to start marketing their products by themselves.

The following specific activities were also carried out as part of the initial implementation:

1) To pursue organic coffee certification, FUNDE contacted two enterprises: BCS through CLUSA and OCIA through UCRAPROBEX. The cooperative Las Marias 93 selected

OCIA to start the organic coffee certification process for its products.

2) For the purchase of a thresher and roasters, FUNDE requested quotations from four suppliers: Jota Gallo, Maquinaria Agricola, Talleres Sarti, and Tolleres y Equipos Industiriales. The first two manufacture only threshers, and the third did not send its quotation. Consequently, Tolleres y Equipos Industiriales was chosen for the supplier.
3) Trade Point of MOE was mobilized to carry out a preliminary market survey. Trade Point utilized its ample experience and accumulated knowledge and completed the survey at nominal cost.

The details of activities and the results of the activities are summarized below.

Component	Activities	Results
Organizing coffee consortium	✓ 4 meetings with representatives of the cooperatives and producers group members of the Coffee Consortium; in order to present the components of the coffee pilot project to the groups and create an Interim Directive. ✓ Analysis of the diverse juridical configuration for the Coffee Consortium Constitution with the support of a lawyer. ✓ 3 meetings with the Interim Directive to coordinate the execution of the Coffee Pilot Project. ✓ A Meeting with representatives of the National Program for Competitiveness and Trade Point from MOE, to request support in the creation of the Coffee Cluster in the Eastern Region, with the participation of FOEX and CONAMYPE (institutions that can collaborate with the development of the Coffee Consortium). ✓ Request of support with representatives of Lutheran World Relief (LWR), for the organic certification of the coffee production for the groups and cooperatives of the Coffee Consortium. ✓ Visits with representatives of LWR to the Santa María and Bagatela cooperatives.	✓ Creation of the Interim Directive of the Coffee Consortium. This directive will continue carrying out the necessary activities to promote coffee development in the Eastern Region. ✓ It was determined that the best legal configuration for the Coffee Consortium is as a co-operative society. ✓ The producers of Perquin reactivated the Alturas de Perquin Cooperative; with the purpose of participating as an organization in the development Coffee Consortium. ✓ The individual producers of Santiago María decided to create an organization that integrates them and it allows them to participate as an organization in the Coffee Consortium. ✓ LWR has accepted that we present to them project to support: Certification of Coffee Production, purchase of an ecological mill, diversification of production and a tour of the coffee cooperatives in Nicaragua to learn of their experience. ✓ The National Competitiveness Program of MOE has offered to advise in the creation of the Coffee Cluster of the Eastern Region, with the support of FOEX and CONAMYPE.
Coffee processing	✓ The Jucuapense Cooperative bought its own ecological coffee mill and they began operations in November 2003. The purchase was carried out with credit from the bank. ✓ UPREX/COMUS bought an ecological mill and operations began November 2003. The purchase was made with financial resources donated by partner organizations.	✓ With the purchase of the mills and the contribution by JICA for the purchase the thresher and the two roasters, Cooperative Las Marias 93 and UPREX/COMUS have installed the complete process for milling coffee that includes de-pulping, roasting, drying, thrashing and grinding. This is the most important result of the coffee pilot project supported by JICA.

Component	Activities	Results
	✓ The purchased mills have capacity to de-pulp 40qq of coffee hourly. UPREX milled 1.200qq of coffee in the 2003-2004 harvest. ✓ Purchased a coffee thresher with capacity to thresh 75 pounds every 30 minutes; this machine will be used by UPREX/COMUS in San Francisco Javier (Usulutan). The purchase was made with funds granted by JICA as part of the coffee pilot project. ✓ Two Coffee Roasters were purchased, with capacity to roast 75 pounds for every 30 minutes. One of the machines will be used by UPREX/COMUS in San Francisco Javier (Usulutan) and the other will be used by Cooperative Las Marias 93 in Chinameca (San Miguel). The purchase was made with funds granted by JICA as part of the coffee pilot project. ✓ Cooperative Las Marias 93 and UPREX/COMUS bought grinders for their coffee. This purchase is within the framework of JICA's contribution to the purchase of a thresher and the coffee roasters. ✓ Members of the Las Marias 93 and Jucuapense cooperatives as well as UPREX/COMUS participated in a seminar on technical basics for roasting and grinding coffee, carried out by the Salvadoran Council for Coffee (CSC).	✓ With the purchase of the roasters, Cooperative Las Marias 93 and UPREX/ COMUS each have capacity, to roast and to grind qq of coffee per day, this means that they can roast and to grind 1,140qq of coffee per year (Working 8 hours for day and 5 days per week). These capacities will be better taken advantage of when the market for ground coffee is developed at local, regional and national levels. ✓ With the purchase of the mills, the Jucuapense cooperative and UPREX/COMUS have had processing demands by small producers that have not been able to satisfy.
Coffee Commercialization	✓ Two working meetings with directives of the cooperative members from the Coffee Consortium to present the studies on external coffee markets carried out by Trade Point from MOE (Profiles of the coffee markets in Japan, Germany, Italy, Sweden and United States). This process will continue with the elaboration of a business plan. ✓ Coffee mill and crop inspection with Cooperative Las Marias 93 with the purpose of later certifying as accredited organic coffee. ✓ Meeting with representatives of FLO International to request support for the Coffee Consortium. ✓ Participating in an event regarding productive initiatives for fair trade coffee, held by FLO International. ✓ Two technical training and information session with technical specialists from CSC regarding "The Cup of the Excellence 2004" competition.	✓ The purchase of the roasters and the thresher will allow Cooperative Las Marias 93 and UPREX/COMUS, to develop its plans for coffee commercialization in the local, regional and national markets. ✓ Documents for the external coffee market studies elaborated by Trade Point and copies for all cooperatives members of the Coffee Consortium. ✓ With representatives of FLO International; to begin process oriented towards the creation of the Alliance for Fair Trade in El Salvador. ✓ Established commercial contacts in the United States of America that will certainly be very important for the future growth of commercialization of the Coffee Consortium.

6. Main Findings

The initial implementation of the coffee pilot project has clarified that small coffee producers, through their cooperatives, can enter into the entire chain of commercial coffee manufacturing form coffee cultivation, milling and roasting to marketing their ground coffee. For selected cooperatives, an important step has been taken for the certification of organic coffee. This process, however, needs to be followed up since the certification process would take a minimum of one year even if organic coffee cultivation has already been undertaken without applying chemicals for three to five years.

It has been proved that relatively small external support works as a catalyst for small producers to cooperate for their common goal. The clear definition of objectives and specific tasks to attain them by itself serves as an incentive for their cooperative work. It should also be emphasized that continual efforts by the local groups even before the Study, supported by CND, helped organize the local team for the pilot project and design the project more or less by themselves. It is expected, therefore, that their efforts will be continued, extending the tasks undertaken this time, and additional external support would be justified to realize the full commercialization/industrialization of small coffee production.

Annex 1: Coffee Pilot Project Design Matrix for Evaluation

Project Design Matrix for Evaluation (PDM_E)
Project Period: From 15 October 2003 to the end of March 2004
Target Group: 12 small-scale coffee growers in the Eastern Region

Project Name: Pilot Project for the Improvement of Processing and Marketing Coffee
Project Area: Eastern Region, El Salvador
Prepared in November 2003

Narrative summary	Indicators	Means of verification	Important assumptions
Overall Goal Capabilities of coffee growers in the Eastern Region will be strengthened in terms of processing & marketing.	Coffee growers in the Eastern Region will be able to ship their products toward proper markets at appropriate timing & prices.		
Objectives Existing constraints & problems against improvement of competitiveness of the Coffee Consortium & small-scale coffee growers in the Eastern Region will be identified & concrete countermeasures will be proposed.	Precise lessons identified & strategies for their implementation elaborated in the final report.	✓ Review of the final pilot project report	The coffee price in the international market will not drop sharply.
Outputs 1. 2 associative groups of small-scale coffee growers will be integrated in a legal Coffee Consortium.	1-1. Collective agreements concerning use of processing machinery, joint business/marketing plan is established. 1-2. Mechanisms for interactive learning are established.	✓ Review of the constitution record of Coffee Consortium. ✓ Interviews with Coffee Consortium groups to verify the activities that they are carrying out in collective form. ✓ Interviews with consortia leaders concerning joint activities being implemented.	
2. Quality & efficiency of coffee processing operations will be improved.	2-1. Knowledge & skills for appropriate coffee processing will be shared by the coffee growers. 2-2. Agreements for better use of the installed processing instruments are established. 2-3. Product cost for the coffee will be reduced on the trial basis (pending)	✓ Interviews with target group people to know the utility of the acquired knowledge & as they are taking to the practice. ✓ Review of the Agreements for greater use of the installed processing capacity.	
3. Marketing strategy, commercialization mechanisms & promotional material for the Coffee Consortium will be improved.	3-1. Elaborated business plan is prepared & implemented. 3-2. Certification will be obtained in terms of organic coffee production for a part of the groups 3-3. New markets & buyers will be identified; & the contact to them is established.	✓ Review of the Business Plan. ✓ Interviews with the Coffee Consortium groups to verify the Business Plan implementation, & specifically buyers identified & contacted. ✓ Review of certification document. ✓ Review of national & international market studies.	
Principal activities 1.1. Hold workshops with the groups of Coffee Consortium 1.2. Elaborate & validate the Coffee Consortium articles 1.3. Proceed legal Registry of Coffee Consortium 1.4. Assembly to Official Constitution of Coffee Consortium 2.1. Procure two mobile de-pulping machines. 2.2. Conduct training workshops in de-pulping, drying, toasted & ground of the coffee. 2.3. Prepare the groups of the Coffee Consortium to participate in the competition, "The Cup of the Excellency 2004" 3.1. Study internal & external coffee market. 3.2. Elaborate brochures & web page of the Coffee Consortium 3.3. Conduct training workshops on packed & commercialization of coffee 3.4. Apply for certification of the organic coffee production for a part of the groups of the Coffee Consortium 3.5. Elaborate business plan for the Coffee Consortium		Inputs <u>1. Project Staff</u> *Project Coordinator: 1 *Project Researcher: 1 *Project Assistant: 1 <u>2. Registration & certificate, etc.</u> *Legal registry & articles for Coffee Consortium *Certification of the organic coffee production *Mark registry for Coffee Consortium *Web page Design for Coffee Consortium *Packs for the coffee *Stickers for the packs coffee <u>3. Procurement of Equipment</u> *Two de-pulping machines <u>4. Operation costs</u> *Transport, communications, feedings, office supplies, etc. <u>Total Cost: $35,173</u>	Preconditions Coffee growers agree to work together for the purpose of the project using the provided equipment.

Annex 2: Financial Report for October 23, 2003-January 31, 2004

Item	Budget	Payment	Executed	Available
Honoraria	3.923,26	3.923,26	3.923,26	0.0
Work meetings	1.473,20	1.473,20	1.466,39	6.81
Transport	1.029,99		1.023,18	6.81
Feeding and refreshments	358,21		358,21	0.0
Travel Allowances	85,00		85,00	0.0
External coffee market study and business plan	800,00	800,00	800,00	0.0
Certification of organic coffee production in Las Marias 93 Cooperative	1.520,00	1.520,00	1.520,00	0.0
Purchase of coffee processing Equipment	4.700,00	4.700,00	4.700,00	0.0
Two coffee roasters	4.000,00		4.000,00	0.0
Contribute of US$ 500 to UPREX/COMUS for purchase one Coffee Thresher	500,00		500,00	0.0
Contribute of US$ 200 to Las Marias 93 Cooperative for purchase one Coffee Roaster	200,00		200,00	0.0
Administrative Costs	1.652,58	1.652,58	1.659,39	(6.81)
Total	14.069,04	14.069,04	14.069,04	0.0

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Part 8

Indigo Pilot Project

1. Outline of Indigo Pilot Project

1.1 Rationale and Objectives

The Indigo Pilot Project ("the Pilot Project" hereafter) has been carried out as part of the Study on Economic Development, Focusing on the Eastern Region, of the Republic of El Salvador ("the Study" hereafter). The Study is a comprehensive study project covering agriculture, industry, service, tourism, environment, infrastructures, human resources development, and social development. The Study was initiated in November 2002 and is scheduled to be completed in February 2004.

An interim finding of the Study was a high possibility of indigo to grow as a major industry in the Eastern Region of El Salvador, where most economic activities at present center around agriculture. The following aspects are noted for indigo production.

- Land suitable for indigo growing is abundantly available in the Eastern Region.
- Technologies for growing indigo plants, extracting indigotine and dyeing with natural indigo have been gradually spreading in El Salvador as a result of efforts by CONCULTURA under MINED and technical cooperation programs provided by JICA, IICA, JETRO, GTZ, and others.
- Demand for natural indigo seems to be rapidly expanding in overseas market such as Germany, France and Japan according to information circulating among indigo related parties.

Indigo is a unique product with multiple faces. Indigo plant is an agriculture product. It can be sold only after indigotine is extracted by processing indigo leaves. It is an industrial good in this sense. Dyeing clothes, for example, with natural indigo is an artistic as well as industrial process. Dyeing experience can be a touristic resource as well. Considering these complex characteristics of indigo, a comprehensive approach is adopted encompassing the entire process of i) growing the indigo plant, ii) extracting indigotine, iii) dyeing, and iv) conducting a preliminary market survey. Indigo industry could be promoted most effectively by strengthening technological and institutional linkages among all the related components.

The objectives of the Pilot Project are the following:

- To build and expand a foundation for promoting indigo industry in the Eastern Region through raising technological level of farmers and potential dye experts and pursuing an appropriate cooperation mechanism among related organizations; and
- To propose a comprehensive support program for indigo promotion to the government of El Salvador and donor organizations so that an effective support measures be intensively provided to step up the indigo activities to an industrial level in the near future.

1.2 Components of the Pilot Project

The Pilot Project is composed of the following activities.

a. Indigo farming:
   - Experimental farming at National Agriculture School (Escuela Nacional Agricoltura/ENA) to find better farming practices for indigo growing, and
   - Demonstrative farming at University of El Salvador (UES) San Miguel campus.

b. Indigotin extraction:
   - Indigotin extraction workshops at UES San Miguel campus obraje in San Miguel and Jocoro obraje(1) in Morazan, and
   - Indigotin extraction experiment utilizing a modern extraction plant designed by UES San Salvador and IICA cooperation.

c. Indigo dyeing:
   - Indigo dyeing workshops at Casa de Cultura workshop in San Miguel, and
   - Indigo dyeing competition for Japanese Ambassador's Award.

d. Marketing:
   - Preliminary marketing survey.
   - Experimental sales of indigo dyed products at the El Salvador International Airport

(1) Obraje: traditional indigotin extraction facility composed of two tanks, one for infusion and the other for oxidization

2. Activities Carried Out from July through December 2003

2.1 Preparatory Activities

2.1.1 Formation of technical and management team

The first important task was to formulate an indigo Pilot Project team, comprising technical and management staff. The total number of the team was 13 with the responsibilities described in Table 2.1.

Table 2.1. Names and Responsibilities of Pilot Project Members

Name	Responsibility/position	Affiliation
Technical Team		
Hideo Kojima	Overall technical supervision Dyeing training	Independent
Lorenzo Amaya	Cultural/historical presentation Extraction training Technical Team Manager	CONCULTURA
Carolina Rivas	Agronomy activities at UES Dyeing assistance/training	IICA

Name	Responsibility/position	Affiliation
Ana María de Hernández	Experimental farming at ENA	Universidad Doctor José Matías Delgado
Yuko Okabayashi	Preliminary marketing survey	ENA/JOCV
José Miguel Carranza	Preliminary marketing survey	Independent
Gloria Mejía		Independent
Management team		
Haruo Yamane	Project director	JICA Study Team
Tomoyasu Shidara	Project advisor	JICA Study Team
Masao Gohira	Project assistant	JICA Study Team
Herberdh Chicas	Monitoring/ reporting, administrative coordinator Accountant	Independient
Enrique Grimaldi	Driver	Independient
Oscar		ALAMO

ENA: National Agroculture Scool, JOCV: Japan Overseas Cooperation Volunteers

2.1.2 Project implementation schedule

The Pilot Project has been implemented according to the schedule shown in Table 2.2.

2.1.3 Cooperation agreements

Establishing a good network of cooperation from various organizations in El Salvador was one of the most important tasks at the preparation stage. Because of the complex nature of indigo, inputs from a number of different aspects are required, which becomes possible only with cooperation of different organizations with resources in their respective fields. The following shows the organizations with which cooperation has been agreed with and their ways of cooperation with the Pilot Project.

a. UES San Miguel
   - Provision of 3mz (2.1ha) land within their campus for constructing a shelter, obraje and modern equipment and farming indigo in, and
   - Provision of professional input by agronomy and chemistry faculties.

b. ADEL-MORAZAN (Local Development Association for Morazan): signing a cooperation agreement document on June 17, 2003
   - Provision of land in Jocoro, Morazan for constructing a shelter and an obraje, and
   - Provision of two technicians to assist and learn extraction technology.

c. IICA: signing a cooperation agreement document on June 15, 2003
   - Provision of technical service by an agriculture engineer,
   - Support in installing a modern extraction plant designed and developed in cooperation with UES San Salvador, and
   - Assistance in collecting marketing information in Latin American countries as required by the Pilot Project.

Table 2.2. Implementation Schedule

Year	2003						2004
Activity	7	8	9	10	11	12	1
(Technical Activities)							
1. Indigo farming							
1-1 UES Indigo farming							
1-1-1 Soil preparation							
1-1-2 Sowing							
1-1-3 Pruning							
1-1-4 Insect control							
1-1-5 Fertilization							
1-1-6 Cleaning							
1-1-7 Biomass harvest							
1-1-8 Seed harvest							
1-2 ENA experimental farming							
2. Extraction							
2-1 Obraje construction							
2-2 Biomass harvest							
2-3 Extraction workshop							
2-4 Dry leaves experiment							
2-5 Test/analysis of indigo tin in dry leaves							
2-7 Pilot plant extraction experiment							
3. Dyeing							
3-1 Preparation of dyeing workshop and laboratory							
3-2 Dyeing workshop							
3-3 Research on other natural colorants							
3-5 Display of dyed products at Casa de Cultura							
3-6 Ambassador's award competition					▲		
4. Marketing							
4-1 Preliminary marketing survey							
4-2 Sales at airport							
4-3 Market survey in Japan with JETRO's cooperation							
(Managerial Activities)							
5. Meetings							
5-1 Kick-off meeting		▲					
5-2 Interim Meeting				▲			
5-3 Wrap-up meeting (Draft Final Report)							▲
6. Reports							
6-1 Progress Report (1)			▲				
6-2 Progress Report (2)					▲		
6-3 Draft Final Report							▲
6-4 Final Report							*February*

d. ENA: signing a cooperation agreement document on July 24, 2003
   - Provision of an expertise and supporting staff for carrying out an experimental farming of indigo to find out better indigo farming environment and technique.

e. Dr. Jose Mathias of Delgado University signing a cooperation agreement document on September 2, 2003
   - Provision of an indigo dyeing expert to assist and carry out indigo dyeing workshops.

f. National Committee for Culture and Heritage (CONCULTURA)
   - Provision of an indigo expert for providing lectures on indigo history and culture as well as providing extraction training courses,
   - Provision of Casa de Cultura space for carrying out a dyeing workshop and research works in a laboratory, and
   - Assistance in collecting dyeing workshop participants.

g. Catholic Relief Services (CRS)
   - Logistic support to farmers to attend extraction workshops.

h. PRODERNOR, a project carried out by the Ministry of Agriculture and Livestock (MAG)
   - Logistic support to farmers to attend extraction workshops.

i. National Center for Agricultural and Forrest Technology, CENTA

2.1.4 Project design matrix (PDM)

A project design matrix (PDM) was prepared as shown in Table 2.3. The PDM clarifies goals, objectives, output and activities with measurement indicators and verification methods corresponding to these factors.

2.1.5 Construction works

Prior to the beginning of extraction and dyeing activities, a set of facilities were constructed and prepared. A local company (SEINSA) was contracted to build two traditional indigo powder extraction facilities ("Obraje", local name for this facility, is to be used hereafter) and a modern extraction facility, two stainless tanks for the extraction workshops. Regarding the dyeing activities, the facilities at Casa de la Cultura Milagro de La Paz were refurbished: one classroom for workshops and one laboratory for research activities.

The investment costs for these works are summarized in Table 2.4. The dimension of the facilities and farm area are summarized in Tables 2.5 through 2.8.

Table 2.3. Project Design Matrix (PDM) for Indigo Pilot Project

Project Design Matrix for evaluation (PDM_E)
Project Name: Indigo Pilot Project | Project Period: Six months from June 2003
Project Area: Eastern Region, El Salvador | Target Group: Organizations related with indigo (farmers, NGOs, companies) | Prepared in November 2003

Narrative Summary	Indicators	Means of Verification	Important Assumptions
Overall Goal Full scale indigo promotion program will be carried out in the Eastern Region.			
Project Purpose Technical, marketing, and organizational problems will be clarified and the corresponding countermeasures will be proposed to revive indigo industry in the Eastern Region.	*Specific and concrete countermeasures are given in the proposal by the end of the Project Period.	*Improvement of indigo products, interviews to related organizations, etc.	*Extension activities in the Eastern Region will be continued by the related organizations. *Sharp drop of indigo price will not occur.
Output 1. Suitable cultivation technique of indigo in the Eastern Region found.	*Suitable cultivation method and varieties of indigo by soil types are clearly shown in the manual and distributed to the organizations.	* Interviews, site inspection, etc.	
2. Improved quality of indigo powder.	*Indigo powder with more than 60% tine contents will be constantly obtained.	*Chemical analysis results, interviews to experts, etc.	
3. Improved design and dyeing skills.	*Complex patterns can be dyed without guidance. *Indigo works are highly evaluated in the competition.	*Interviews to technical team, etc. *Interviews in the competition, etc.	
4. Strategy developed for international indigo marketing.	*Required quality and demand of indigo products are clarified.	*Review of the marketing report, etc.	
5. The most effective arrangement for cooperation among related organizations clarified.	*Consensus was made in terms of effective arrangement for cooperation among the organizations	*Interviews to participant organizations	
Principal activities 1-1. Carry out experimental farming at ENA. 1-2. Clarify the existing technical guidance on indigo cultivation. 1-3. Prepare and distribute a technical manual on indigo farming. 2-1. Provide training on extracting indigo from fresh leaves using the traditional water tank. 2-2. Develop new technology concerning indigo extraction using dried indigo leaves. 2-3. Confirm the effectiveness of a new extraction machine. 2-4. Carry out a financial analysis for traditional and modern extraction technique. 3-1. Conduct training on designing and dyeing. 3-2. Organize a contest of indigo dyed products. 4-1. Conduct a preliminary market survey for North American, European, Asian and Latin markets. 4-2. Estimate preliminarily the demand for natural indigo dye. 4-3. Clarify important factors to enter into international market. 5-1. Exchange and share opportunities for information among participating organizations 5-2. Conduct study tours to see advanced examples of indigo growing. 5-3. Hold regular meetings with related government organizations.	**Input** 1. Project Staff <u>Technical Team</u> Overall technical supervision: 1 Cultural/Historical information dissemination: 1 Assistance in overall technical management: 1 Dyeing assistance/training : 1 Farmers networking: 1 Preliminary marketing survey: 2 <u>Management Team</u> Project Director: 1 Project Advisor: 1 Project Manager: 1 Project Assistant: 1 Monitoring/report: 1 Accountant: 1 Drivers: 3	2. Facility construction Extraction tank (conventional): 2 Modern Extraction Equipment: 1 Shelter: 2 3. Indigo powder and other dyeing raw materials 4. Cultivation equipment for ENA 5. Processing cost of Indigo dye 6. Indigo dyeing equipment 7. Chemicals for indigo dyeing 8. Sample indigo products 9. Rental charge in the airport 10. Office supplies 11. Registration fee for EXPO 12. Reporting 13. Running cost (utilities, vehicle, salaries, etc.)	Preconditions Renting of the land for the project activities are secured.

Table 2.4. Investment Cost for the Pilot Project

Component/ item	Cost ($)	%
1. Farming phase		
Labor force for land preparation, fencing and cleaning	1,260.00	
Seed		
Other (tools)	478.60	
Total		
Sub-total	35.14	7.0
	1,773.74	
2. Extraction facilities construction		
2.1. UES		
Obraje, roof and water facilities	5,942.15	
Other (powder grinder)	619.47	25.8
Sub-total	6,561.62	
2.2. Jocoro		
Obraje, roof and water facilities	5,942.15	
Other (reparations, PVC tubes)	386.23	24.9
Subtotal	6,328.38	
2.3. Stainless steel tanks at UES		
2 Tanks (infusion and oxygenation)	6,418,60	
Electricity system	910.50	
Others	60.00	29.0
Sub-total	7,389.10	
3. Dyeing Workshop		
Sink	68.58	
Laboratory refurbishment	1,184.92	
Others	1,472.80	10.7
Sub-total	2,726.30	
4. Sales at the International Airport		
Stands	685.71	2.7
Total	**$25,464.85**	**100.0**

Table 2.5. Dimensions of Obrajes

Location of the infrastructure		Height	Length	Width	Volume
		Meter			M^3
Obraje UES	Tank 1 (infusion)	1.45	2.80	1.30	5.55
	Tank 2 (oxidization)	1.40	2.80	1.28	5.02
Obraje Jocoro	Tank 1	1.28	2.80	1.28	4.59
	Tank 2	1.40	2.67	1.30	4.86

Note: The dimensions are measured for the inside of the obrajes.

Table 2.6. Dimensions of Modern Extraction Facility

Obraje: tank system	Height			Diameter	Volume (m^3)
	Height*	Tank	Cone		
	Meter				
Tank 1 (fermentation)	0.43	1.19	-	1.84	3.16
Tank 2 (oxygenación)	1.50	1.19	1.05	1.84	4.09

* From ground level to the tank bottom.

Table 2.7. Dimensions of Dyeing Workshop and Laboratory

Description	Dimensions (m)	Area (m^2)
Dyeing workshop	6.87 x 6.00	41.22
Dyeing area	10.60 x 2.87	30.42
Laboratory	5.78 x 2.60	15.03

Table 2.8. Farm Area for Indigo Growing at UES

Lot	Dimensions (m)	Area (m^2)
Lot 1 ("El Obraje")	12.00 x 57.00 80.60 x 60.00 other sub-areas	6,550.00
Lot 2 ("El Manguito")	139.6 x 47.60	6,644.96
Lot 3 ("La Calle")	60.00 x 150.00	9,000.00

2.2 Implementation of the Pilot Project

2.2.1 Farming

(1) ENA experimental farming

The National Agriculture School (ENA) has cooperated with the Pilot Project by carrying out an experimental farming of indigo to identify better growing environment and farming practices. The specific topics studied are the following.

a. Comparison of two indigo species, *Indigofera guatimalensis* and *Indigofera suffruticosa*, focusing on their adaptability to different environment and the best planting density for growth.
   - Seeding date: August 11
   - Treatments in Field: 8 → 2 species and 4 different densities (m): 0.3 x 0.3, 0.4 x 0.4, 0.6 x 0.6, 0.8 x 0.8
   - Treatment in pots with three repetitions.

b. Influence of different planting dates on biomass and indigotine yield
   - Treatment in Field: 4, Repetitions: 2 → 4 planting dates: August, September, October and November
   - Density: 0.4 x 0.4 m
   - Treatments in pots: 4, Repetitions: 3

c. Influence of different weed control
   - Seeding date: May 22
   - Date for covering soil with rice straw: July 7
   - Treatments: 6 → straw amount (kg): 0.0, 3.2, 6.5, 9.6, 12.8, 19.2
   - Density: 0.25 x 0.25 m

d. Influence of different seeding methods.
   - Seeding date: August 13
   - Treatments in field: 3 → seeding methods: direct, with pod and transplantation one month after seeding
   - Density: 0.4 x 0.4 m
   - Treatments in pots: 3 and repetitions: 3

e. Influence of soil characteristics under the same climatic condition
   - Seeding date: July 31
   - Treatments in pots: 15 → different locations' soils
   - 3 repetitions

(2) Farming activities at UES FMO

1) Experimental farming

The UES students and teachers' involvement is of high importance for the good development of the Pilot Project and the continuity of the activities after the Pilot Project finishes. For this, students from the experimental design course carried out three short investigations on agronomical aspects of indigo.

a. Different fertilizer application moments

The fertilizer used has the following composition: 15% N, 15% P and 15% K. The fertilization dosage used is 20 pounds per manzana (28.57 pound per ha).

Four different treatments are the following:

i) Without fertilization (T0),
ii) Total fertilization at 35 days after seeding (T1),
iii) Two applications: 50% at thirty five days and 50% at sixty days after the seeding (T2), and
iv) Three applications: 1/3 at thirty-five days, 1/3 at sixty days and 1/3 at ninety days after seeding (T3).

The experimental unit is composed of 36 plants. Each treatment is repeated six times for a total of 24 experimental units. The treatments are randomly assigned. This lot was seeded on August 13. There has been manual and chemical (with Paraquat) weeding control.

The evaluation factors measured three weeks after each fertilization are: the plant height, weight and diameter; the number of shoots; and powder weight and % of indigotine at the end of the investigation. The results are being tested at UES SM as of mid-December 2003 and to be provided as soon as the test is finished.

b. Seed treatment

Some indigo farmers express that they have problems with seeds germination. To analyze this

problem, *Indigofera guatimalensis* and *Indigofera suffruticosa's* seeds were treated in three experimental conditions as follows.

- Submerging for 14 hours in water
- Submerging in boiling water for 5 minutes
- Chemical seed treatment applying sulfuric acid at 10% for 10 seconds

The seeds were seeded in plastic bags. The experimental unit is composed of 10 boxes with five repetitions for each treatment, for a total of 50 boxes for each treatment

c. Influence of different organic and chemical fertilizers

The Pilot Project evaluates five types of fertilizers. Two organic fertilizers were used: the first composed by an indigo shrub compost and the other a commercial organic fertilizer. Three chemical fertilizers had different composition of N, P and K. The fertilization took place 60 days after the seeding of *Indigofera guatimalensis*. There are six repetitions for the six treatments (including non fertilization). The statistical design is totally random. Manual weed control has been made in these sections. Each of the five fertilizers was applied in an amount equivalent to containing 40 pounds of phosphorous. Their characteristics are as follows:

- Chemical formula 20-20-0 (nitrogen- phosphorus-potassium),
- Chemical formula 15-15-15,
- Indigo plants' shrub: 0.51% N, 0.92% P, 0.48% K,
- Commercial organic fertilizer AGROINAGOR® 1.55% P, 1.15% P, 0.48% K, and
- Foliar fertilizer (phosphorous component at 12%).

2) Other demonstrative land lots in UES FMO

The most important activity in these land lots was weed control. The lack of human resources close to the UES FMO was the principal reason for applying herbicides. Herbicide application could be less effective or in some cases can damage the crop if the application is not carefully made.

In one land lot, the most preponderant weed types are broadleaf plants such as *Indigofera spp.* In this case, it was difficult to select a specific herbicide to control the weed avoiding the damage to the crop. The herbicide selected was Gramoxone, a contact herbicide. This herbicide was applied with a protector so that the application be directed only to weeds and not to damage the indigo plants. In the areas where the weed was too tall, it was first cut and then Gramoxone was applied. In other crop area called "La Calle", grasses were the predominant weed. Fusilade, a specific herbicide for the particular weeds, was used. The application response was slow and not so effective as expected. The third land lot was manually weeded, because the preponderant weed was easy to eradicate.

3) Information meetings on indigo growing and extraction

The students of the experimental design course presented a report on their investigation results.

They needed a bibliography on agronomy and extraction of indigo. The Pilot Project provided these students with some materials and made a presentation on the topic. Presentation of this kind was given also to the students of chemical sciences.

The Rotary Club 20-30 attended a presentation on indigo production. The participants showed interest in promoting indigo growing and extraction in the low-income rural communities.

2.2.2 Extraction workshops

The specific objectives of indigo powder extraction workshops are as follows:

(1) Training in the theoretical and practical aspects of extraction, especially the traditional extraction techniques with understanding of cultural value of indigo,
(2) Training in biomass management,
(3) Training in finding the completion timing for infusion, oxidization and sedimentation process through visual and odor signs, and
(4) Training in separation of indigo mud from residual water.

One cycle of an extraction workshop was carried out in three days with the following activities.

Day 1

- Welcome and presentation of the participants,
- Placing biomass in the first tank with wood weight on, and
- Presentation on theory: traditional techniques for indigo extraction.

Day 2

- Learning the sign of the end of the first process (infusion) and transferring the water to the second tank,
- Oxidization work by three persons simultaneously, and
- Presentation on theory: Indigo's history and culture.

Day 3

- Separation of indigo mud from the residual water,
- Indigo mud cooking,
- Elimination of liquid content from mud by filtering through cloth,
- Questions and answers, and
- Questionnaire survey with the farmers.

The total number of participants in the extraction workshops was 419, consisting of 200 in the Jocoro workshops and 219 in UES workshops as shown in Table 2.9.

Table 2.9. Farmers Groups, Communities and the Number of Participants that Participated in Extraction Workshops

(Jocoro)	Farmers' group	Community	Number
28-30 Aug	COPADIM, Morazán	Jocoaitique, Villa El Rosario, Meanguera, Morazán	16
4-6 Sept	AECOSARLY	Santa Rosa de Lima, La Unión	4
11-13 Sept	Conchagua	La Unión	34
18-20 Sept	Corinto	Valle Verde, Morazán	28
25-27 Sept	Sinsimontique	San Simón, Morazán	42
2-4 Oct	San Isidro	San Isidro, Morazán	45
16-18 Oct	Cacaopera	Cacaopera, Morazán	31
		Sub-total	200
(UES)			
1-3 Sept	Concepción Batres	Concepción Batres, Usulután	19
8-10 Sept	Tierra Blanca	Tierra Blanca, Usulután	18
15-17 Sept	Cooperative La Estancia	Moncagua, San Miguel	25
22-24 Sept	Cooperative La Normandía	Tierra Blanca, Usulután	18
29-30 Sept/1 Oct	Cooperative La Maroma	Tierra Blanca, Usulután	32
6-8 Oct	San Alejo	La Unión	24
13-15 Oct	Cooperative Nancuchiname	Tierra Blanca, La Unión	20
20-22 Oct	Nueva Esperanza	Usulután	17
27-30 Oct	El Farito	La Unión	46
		Sub-total	219
		Total	419

Table 2.10 presents the amount of indigo powder produced, indigo content for selected samples, biomass input for two cycles and costs for purchasing indigo plants, labor cost for harvesting and transportation cost. It should be noted that biomass amount was not measured except in two cases despite the original plan due to heavier emphasis placed on training aspect than on experimental aspect and some operational deficiency. The amounts of indigo powder could be underestimated in Cycle 3 and Cycle 5 in Jocoro and Cycle 15 in UES, since part of indigo mud, a form before powder, was provided to participants in response to their request. They needed them to try dyeing at home and as a proof that they participated in the workshops. Excluding these three cases, the total amount of indigo powder produced was 11.17 kg in 13 cycles, or 0.859 kg per cycle on average. The largest output was 1.59 kg in the 11th cycle in UES. The amount of biomass used in each cycle varied depending on their availability. The amount of indigo powder produced varies depending on three factors: the amount of biomass input, level of indigotine concentration in biomass and natural conditions at the time of extraction process. Extraction technique would not affect it because all the extraction processes were managed applying the same technique by Mr. Lorenzo Amaya. Indigotine content measured were 44%, 51% and 53%. The percentages for the remaining 14 cases are under test.

Table 2.11 summarizes all the operating costs for 17 extraction cycles. The total operation cost was US$ 11,799, equivalent to US$694 per cycle.

The lack of transportation means was one of the major constraints on the part of farmers in participating in the extraction workshops. In order to overcome this constraint, two kinds of actions were taken: hiring of vehicles by the Pilot Project and assistance by such organizations as CRS and PRODERNOR by either providing transportation means or transportation allowance.

Table 2.10. Powder Production, Indigo Content and Biomass Input of Extraction Cycles

Location	Date	Powder obtained		Indigotine (%)	Biomass				Remark
		(lb)	(kg)		Input (kg)	Total price ($)	Labor for harvesting ($)	Transpor-tation ($)	
Jocoro	1 28-30 Aug	2.00	0.91	-	-	50.0	30.0	30.0	
	2 4-6 Sept	2.15	0.97	43.1	-	50.0	30.0	30.0	
	3 11-13 Sept	1.50	0.68	51.1		50.0	30.0	30.0	
	4 18-20 Sept	2.25	1.02	32.9	-	50.0	30.0	30.0	
	5 25-27 Sept	1.50	0.68	30.2	-	50.0	30.0	30.0	
	6 2-4 Oct	2.25	1.02	48.2	-	50.0	30.0	30.0	
	7 16-13 Oct	1.25	0.57	33.6	-	50.0	30.0	30.0	
Sub-total		**12.90**	**5.84**	-	-	-	-	-	
UES	8 1-3 Sept	2.50	1.13	44.0	1,000	175.0	50.0	25.0	
	9 8-10 Sept	1.00	0.45	15.3	-	112.5	20.0	25.0	
	10 15-17 Sept	3.50	1.59	53.0	-	112.5	20.0	25.0	
	11 22-24 Sept	3.00	1.36	38.0	-	200.0	70.0	25.0	
	12 29-30 Sept & 1 Oct	1.00	0.45	48.0	-	175.0	20.0	25.0	Wild indigo used
	13 6-8 Oct	1.25	0.57	40.0	-	-	-	-	
	14 13-15 Oct	1.25	0.57	38.2	-	175.0	20.0	25.0	
	15 20-22 Oct	1.25	0.57	50.6	-	250.0	30.0	40.0	
	16 27-30 Oct	1.25	0.57	41.2	-	-	32.0	-	
	17 3-5 Dec	Results under preparation			260	0.0	0.0	0.0	From UES farm
Subtotal		**16.00**	**7.25**	-	-	-	-	-	
Total		**28.90**	**13.09**	-	-				

Table 2.11 Operation Costs for Extraction Workshops

Item	$	%
Biomass (some cleaning costs included)	2,625.71	22.3%
Biomass transportation	420.00	3.6%
Labor force for biomass harvesting	425.00	3.6%
Technical assistance-professors UES	475.00	4.0%
Participants' transportation	4,676.00	39.6%
Meals and beverages	1,876.00	15.9%
Photocopies	449.04	3.8%
Other	852.37	7.2%
Total	12,409.12	100.0%

The price of biomass was negotiated between the Pilot Project staff and farmers growing indigo or owner of the land where indigo grows naturally. The factors influencing the prices were cleanliness and readiness of the biomass. Food and drinks were provided for refreshment and refilling energy for long workshop stretching into afternoon. At UES workshops, some professors provided advice in chemical aspect.

2.2.3 Experiment with modern extraction equipment

The modern extraction equipment was originally designed by engineers of the Chemical, Industrial and Mechanical Engineer Department from UES at the request of the IICA. The Pilot Project and IICA came to an agreement to actually manufacture the equipment to examine its effectiveness and efficiency as compared with traditional obraje.

The prototype consists of two stainless steel tanks. The first tank, where infusion takes place, has a cylindrical form and a valve for the liquid transferring to the second tank. In the second tank, oxygenation and sedimentation occurs. This second tank is also cylindrical but has a cone shape bottom and five valves at different levels for draining the residual water remaining after the sedimentation. It is equipped with a transparent small glass pipe installed vertically outside the tank for checking the sedimentation level inside the tank.

The objectives of experimenting the modern extraction equipment are:
(1) To examine the possibility to improve indigo quantity and quality through the introduction of a new processing technology,
(2) To examine the extraction prototype design made by UES, and
(3) To examine the technological and human resources need for the new extraction technology.

2.2.4 Dyeing workshops

In the first week, a selection was made to limit the number of participants from more than 30 to 20 so that workshops can be managed appropriately. As a result, 24 members were selected. They are from different key institutions in the Eastern Region, farmers groups, NGO, religious group and government related organizations.

The goal of the dyeing workshops is to train trainers who would disseminate the learned technology back in their groups and communities. The specific objectives are:
(1) To disseminate dyeing techniques for indigo and other natural colorants,
(2) To prepare trainees for the know-how dissemination for dyeing techniques, dyeing vat preparation and conservation, and
(3) To introduce trainees in the cloth type and other materials to which indigo can be applied.

The programs were carried out according to the following schedule.

Week 1
- Introduction to the indigo dyeing techniques,
- Preparation of the chemical formula and basic tie dye practices, and
- Indigo dyeing with three different effects that combine three different blue tones.

Week 2
- Fresh leaves dyeing for obtaining different colors and different tones,
- Basic practices in the shibori technique combining three colors, and
- Reactivation of chemical dyeing vat.

Week 3
- Introduction to the shibori technique, dyeing with Japanese techniques,
- Prepare a sample cloth showing different dyeing techniques,
- Dyeing combining shibori and tie dye techniques, and
- Reinforcing the theory for vat preparation.

Week 4
- Batik technique (wax technique), and
- Elaboration of designs combining batik and shibori**.**

Week 5
- Katazome technique, and
- Discoloring technique.

Week 6 and 7
- Dyeing with other natural colorants: bark from the palo de mora tree (yellow), bark from the nance tree (brick color) and cochineal (red), and
- Combination of these colorants.

Week 8 and 9
- Practices of all techniques and theoretical aspects of dyeing, and
- Evaluation of the techniques taught and formulation of dyeing vat

Week 10 and 11
- Selection and preparation of indigo and other natural colorants dyeing pieces for the "Japan Ambassador's Cup Dyeing Competition" and exhibition at the Eastern Region Museum.

The prices, places and quantities of the dyeing materials for the dyeing workshops are listed in Table 2.12. In total, the amount paid in El Salvador was US$628. In addition to this, a number of goods such as dyeing materials and supplementary chemicals were purchased in Japan and brought to El Salvador due to their high quality. The total purchase amount in Japan was US$2,100.

Table 2.12. List of Materials Purchased for Dyeing Workshops

Description	Quantity	Unit price ($)	Amount ($)	Sales place
Indigo powder	3kg	45.00	135.00	IICA
	2kg	49.70	99.40	Rhina de Rehmann
Hydrosulfite	1kg	3.62	3.62	Droguería Rodas
Caustic soda	1kg	0.92	0.92	Droguería Rodas
T-shirts	36	3.88	139.68	St. Jack's
Alcohol	3 units	20.95	62.85	Supermercado Hiper Paiz
Detergent	1	2.59	2.59	Hiper Paiz
Detergent	1	6.63	6.63	Hiper Paiz
Bleach	1 bottle	0.79	0.79	Hiper Paiz
Cotton IUSA Cloth	20 yards	2.38	47.60	Almacenes Pacífico
Towel	2	2.26	4.52	Hiper Paiz
Towel	1 unit	6.74	6.74	Hiper Paiz
Cloth	10yd	3.59	35.90	Almacenes Pacífico
Needles	3 pkg	0.05	0.15	Variedades Fátima
Needles	3 pkg	1.00	3.00	Almacenes Pacífico
Unstitching machine	10	0.80	8.00	Almacenes Pacífico
Unstitching machine	5	0.09	0.46	Variedades Zulma
Threading machine	12	0.19	2.28	Regina Escobar de Contreras
Threading machine	20	0.23	4.57	Variedades Fátima
Tie dye thread Omega	2	2.74	5.48	Regina Escobar de Contreras
Stitch thread	12	0.10	1.25	Regina Escobar de Contreras
Jeans' thread	3.25yd	5.91	19.21	Victoria Escobar Rosales
Glass tube	1	23.75	23.75	Almacenes Vidrí
Nylon	1yd	1.00	1.00	Variedades Fátima
Wooden frames	5	2.00	10.00	Carpintería Flores
Thinner	1 bottle	1.25	1.25	Ferretería Freund
Ebanol (pintura de asfalto)	1 bottle	1.40	1.40	Ferretería Freund
Brocha	1	0.59	0.59	Ferretería Freund
Total			628.63	

2.2.5 Preliminary marketing survey

The objectives of the preliminary marketing survey are the following:

(1) To clarify potential directions of marketing indigo products, powder and dyed products, in domestic and foreign markets; and

(2) To propose a plan for a full-scale market survey for the next stage of indigo promotion.

The preliminary marketing survey is composed of the following activities:

a. Collection of statistical data,
b. Collection of data from indigo-related experts and organizations in El Salvador,
c. Collection of marketing information through the Internet,
d. Collection of marketing information in Japan with the cooperation of Japan External Trade Organization (JETRO),
e. Sales of indigo dyed products at the El Salvador International Airport and questionnaire

survey, and

f. Visit and information collection in potential foreign markets.

Statistical data were collected in El Salvador through the Internet and in Japan at JETRO. Data in El Salvador were collected through interviews and meetings as shown in Table 2.13.

Table 2.13 Composition of the contacted groups

Investigation sample	Target achieved	Applied tool	Participants
1. Local indigo producers	15 interviews	Questionnaire with open and closed questions	15 indigo farmers from different regions of the country.
2. Organized group	4 focus groups	Guided discussion	- ASEÑICA - Nonualcos - Acopadinm - Corinto
3. Industrial indigo and marketing experts	3 interviews	Interview	- Hideo Kojima - Federico Aguilar - Lorenzo Amaya
4. Local textile industry	4 interviews	Interview	- Hilasal - IUSA - Insinca - Rayones de El Salvador
5. Artisans and dyers.	5 interviews	Interview	- Indigo Trading - Ana María Hernandez - Grace Guirola - Econatura - Lorena Garay

Through e-mail, 163 questionnaires were sent to persons and enterprises related with indigo industry such as artificial colorants producers, natural colorant users, textile enterprises, etc. These enterprises were identified in different international searchers or through specific international enterprises addresses specialized in statistics and marketing data.

The Pilot Project was able to obtain JETRO's cooperation in an informal manner. JETRO undertook a series of technical cooperation programs on indigo by dispatching a Japanese indigo expert, Professor Yoshiko Noda of Shikoku University, and receiving two trainees for dyeing techniques in Japan in the last few years. A total of 62 indigo dyed products was taken to Japan for informal exhibits for consumers and professional examination by Professor Noda. These items included both those made by the Pilot Project participants as well as goods produced by existing shops in San Salvador. A questionnaire survey was conducted in two informal exhibits in Tokyo and a total of 40 samples were collected.

A booth was opened on November 24 at the El Salvador International Airport to sell indigo dyed products and to collect information on the opinions of passengers on the goods displayed and for sale regardless of their purchase. The period of the sale was extended from two weeks as initially set until December 6 to two months until January 21 because of the positive response in the initial weeks and the coming of a peak travel season around Christmas.

Data collection at the initial stage indicated three countries as possible destinations for data collection: Guatemala, Ecuador and Peru. A Pilot Project member visited Guatemala between December 1 and 3 for contacting local artisans and exploring their reactions to the possibility of applying indigo to their products. Another visit to potential market was made between December 15-21 with the same staff visiting Ecuador and Peru.

2.2.6 Other activities

(1) Participation in Export Fair

An export fair, "2ª Exposición de productos Exportables Salvadoreños Made in El Salvador", was held at Hotel Real-Intercontinental in San Salvador on June 5 and 6, 2003. The Indigo Pilot Project participated in the fair in cooperation with the JICA San Salvador office and AZULES (Asociacion de Anileros de El Salvador). A number of goods were displayed at the booth such as poster, indigo powder, and indigo dyed cloths provided by IICA and AZULES. A pamphlet written both in English and Spanish and providing information on indigo plant, price condition, extraction process, quality control, and product readiness was distributed.

During the fair, the team was contacted by 27 people of different nationalities, many of whom came from Latin America. They expressed high interest in indigo products and asked questions on specifications, production amount, price, quality, design variety, place and contact for purchase, possible partners for negotiation, etc. A general impression through participating in the fair is a high level of interest in indigo products. Especially potential demand in Latin America seems to be high, indicating an effective marketing strategy to concentrate marketing effort at an initial stage on neighboring Latin American countries, taking advantage of geographical proximity and communication easiness.

(2) Field survey with the Eastern Region academia

One of the major tasks of this Pilot Project is to disseminate indigo's cultural identity and high potential for developing an industry. In order to achieve this task, a field trip was organized to awake the interest of the Eastern Region's academia with the participation of professors of different superior and tertiary education institutions. A visit was arranged on July 25 to an indigo field with a nearby obraje in Villa del Rosario, North Morazan, where a pioneer farmer is making an effort to revive the crop. The total number of participants in addition to the Pilot Project team was 24, mostly agronomists, including eight professors from UES, six professors from UNIVO, four professors from Universidad Gerardo Barrios, and six independent farmers representing different farmers associations in the Eastern Region.

A small survey on a questionnaire format was passed along participants to get an idea of the

different levels of knowledge and interest regarding indigo. The output of this questionnaire reflects the lack of knowledge regarding indigo and also the eagerness from the academic members to participate in the Pilot Project activities. A common uncertainty regarding marketing aspects of indigo was one of the most common comments found as answers to the questionnaire. Some professors even manifested their interest in developing a research project focusing on different social, cultural, economic and agricultural aspects of indigo.

(3) Kick-off meeting

A kick-off meeting was held on August 1, 2003 at Tropico Inn in San Miguel with the following two objectives:

a. To create a cooperative atmosphere among the technical team, management team, farmers, university professors and others as a first step to establish a cooperation mechanism of all the parties concerned under which individual efforts by each group be consolidated; and
b. To give input into government organizations concerned on the potentiality of indigo so that in the future they will begin to play a positive role in promoting the indigo industry.

About 170 people attended the meeting, indicating keen interests of local communities in indigo.

(4) Cooperation with UES in farming and curricula development

UES cooperated with the project through agronomy professors' assessment on soil preparation and seeding activities. The students of soil course supported the soil-sampling activities of the three land lots where indigo plants were grown. Three short investigations were coordinated with the students and a professor of the experimental design course.

A meeting with the deans and agriculture department professors was held to discuss the investigation topic in the short, medium and long term as a key aspect for the success in indigo production in El Salvador. The main topics discussed include:

- There are four ways of cooperative investigation at the university: students' short research in a specific course (statistics, experimental design, perennial crops, etc.), graduation thesis, professors' research and other departments' research (chemistry sciences, physics, etc.).
- The professors are willing to adopt "indigo" as a short research topic for students.
- A graduation thesis process begins in January. In order to draw interests of the students to work on indigo next year or in the future, the deans proposed that a presentation on indigo production be made, arranging visits to plantations and extraction facilities and providing manuals.
- Social and cultural researches are needed in addition to agronomical and extraction investigations. They can be carried out both at an undergraduate level and a graduate level

(master's degree).

(5) Research activities carried out by the Japanese expert

Mr. Hideo Kojima, the indigo expert contracted for the Pilot Project, carried out the following research activities:

- Application of natural colorants other than indigo,
- An appropriate technology for drying indigo leaves that would enable year-round extraction possible,
- An appropriate technology for extracting indican from dried leaves, and
- Dyeing silk with fresh indigo leaves.

(6) Obraje inauguration ceremony

An obraje inauguration ceremony was held on August 27 at the UES obraje site with the participation of about 50 people including the Japanese Ambassador, Akio Hosono, UES FMO Dean, Ingeniero Joaquín Machuca and others.

(7) Media coverage

The Pilot Project was promoted through the cooperation of different communication media. The farmers have been informed about the project activities, through interviews in radio stations, TV shows and newspapers. The media that covered the Pilot Project include four radio stations (Llanera, Norteña, Fabulosa, and Popular), one television station (Channel 67) and a newspaper (La Prensa Grafica). The objectives, components and activities were presented in these occasions.

(8) Japan Ambassador's cup indigo dyeing competition

The first competition for indigo dyed products, "Japan Ambassador's Cup Indido Dyeing Competition", was held on November 11, 2003 in San Miguel. The participants of the dyeing workshops presented their works, accompanied with technical descriptions of the dyeing process. Important guests invited to the competition served as judges to evaluate the first three prizes. The audience selected a special award.

The Japanese Ambassador presented the first prize to Ms. Yolanda de Bonilla for her bed set. Mr. Hideo Kojima, the Japanese expert and the master trainer of the Pilot Project, gave the second prize to Ms. Blanca Edith de Chévez for her summer resort dress. Mr. Haruo Yamane, the Pilot Project director, gave the third prize to Ms. Laura María Fuentes for her nightdress. The special prize was given to Mr. William Henry Perla for his towel set. After the awarding

ceremony, the graduation ceremony took place.

The event was a meaningful opportunity to show the trainees' effort in improving their dyeing techniques. At the same time, it was a chance for farmers to appreciate the final use of indigo powder and the fact that acquiring and developing dyeing skills need dedication.

3. Major Findings

3.1 Farming

(1) UES farming: observation and experiment

1) Observation

The following are the observations of indigo farming in the UES land lot.

- Good weed management is needed before and after the seeding in order to avoid weed control for more than three times a year.
- Availability of human labor close to the farm is an important factor to be taken into account for most economical weed control.
- In an organic production system, use and development of organic herbicides must be examined.
- It is necessary to perform studies on weed control, including chemical, organic and manual methods
- The indigo plants for the Pilot Project were sown in August and they flowered two months later in October. The rate of their growth is about the same as those normally seeded in June or July by indigo farmers. This could be due to the photoperiodic nature of indigo plants and the hydro-stress at the beginning of the dry season. The phenomenon needs to be studied further to find the best seeding and harvesting timing. A specific timing might be found as a result of further analysis, which could overturn the general concept shared by indigo farmers that indigo plants should be harvested when they are flowering..

2) Experiments

a. Timing of fertilizer application

Table 3.1 shows the relation between the level of indigo plant growth and fertilizer application. Statistically significant variables were height and plant weight. The best treatment was found to be T2 by which a half of the fertilizer is applied at thirty days after seeding and the other half at sixty days. The other variables were not found to be statistically significant. With more height, indigo plants can compete better against weed by growing faster. Weight increase is

due to indigo height but not due to an increase in shoot number, since this factor was statistically not significant.

Table 3.1. Influence of Chemical Fertilizer Application at Different Moments for *Indigofera Guatemalensis* (first measure)

Factors	Mean			
	T0	T1	T2	T3
(First measurement)				
Plant height (cm)	39.3	49.6	54.1	41.9
Diameter (mm)	3.8	4.6	5.6	4.1
Shoot number	21.9	27.8	27.4	23.5
Plant weight (gr.)	34.1	36.6	35.9	35.9
(Second measurement)				
Plant height (cm)	105.1	121.2	127.8	106.2
Diameter (mm)	8.7	10.0	10.9	8.7
Shoot number	43.4	49.0	48.8	44.6
Plant weight (gr.)	163.7	225.0	244.7	202.5

T0: Without fertilization
T1: Total fertilization at thirty five days after seeding
T2: Two applications: 50% at thirty five days and 50% at sixty days after the seeding
T3: Three applications: 1/3 at thirty five days, 1/3 at sixty days and 1/3 at ninety days after seeding

b. Seed pre-germination method

No significant statistical difference was found among the seed pre-germination methods. The locations of the plants, however, were such that they did not have sufficient sunlight during the daytime, and the condition might have contributed to the result. Those seed pre-germination methods need to be examined further under more controlled experimental settings.

c. Comparison of different organic and chemical fertilizers in *Indigofera guatimalensis* growth

The factors showing improvement by different fertilizer application were diameter and the number of shoots as found in a series of statistical analyses carried out as shown in Tables 3.2 through 3.6. Height and plant weight did not bear any statistical difference.

Table 3.2. Number of Shoots in Relation to Different Fertilizer Application

Treatments	Repetitions (Shoot number)						
	I	II	III	IV	V	VI	Mean
T0=without fertilization	38	42	39	38	30	35	37.0
T1=15-15-15	44	43	37	47	45	38	42.3
T2=20-20-0	37	34	40	38	39	40	38.0
T3=indigo plant shrub	48	49	46	41	43	40	44.5
T4=organic fertilizer Agroinagor	41	41	41	32	38	34	37.8
T5=foliar fertilizer	37	40	40	40	43	39	39.8

Table 3.3. Variation Analysis between Treatments and Blocks for Different Organic and Chemical Fertilizers in the number of Shoots

Variation factor	g.l	S.C.	C.M.	F.C	5% Ft	1%
Treatment	5	260.25	52.05	4.31**	2.60	3.85
Block	5	54.92	10.98	0.91n.s	2.60	3.85
Error	25	301.58	12.06			
Total	35	616.75				

Table 3.4. Comparison of Least Significant Differences for Effects of Different Organic and Chemical Fertilizer Application in the Number of Shoots

	T3 (44.5)	T1 (42.3)	T5 (39.8)	T2 (38)	T4 (37.8)	T0 (37)
T3 (44.5)	---	2.2 n.s	4.7*	6.5**	6.7**	7.5**
T1 (42.3)	---	---	2.5 n.s	4.3 n.s	4.5 n.s	5.3*
T5 (39.8)	---	---	---	1.8 n.s	2.0 n.s	2.8 n.s
T2 (38)	---	---	---	----	0.2 n.s	1.0 n.s
T4 (37.8)	---	---	---	----	---	0.8 n.s
T0 (37)	---	---	---	----	---	---

*n.s. not significant, *significant, ** very significant*

Table 3.5. Plant Diameter in Relation to Different Fertilizer Application

(Unit: cm)

Treatments	Repetitions (Diameter)						
	I	II	III	IV	V	VI	Mean
T0=without fertilization	0.70	0.60	0.60	0.50	0.50	0.6	0.58
T1=15-15-15	0.70	0.60	0.40	0.70	0.60	0.50	0.58
T2=20-20-0	0.50	0.50	0.50	0.50	0.60	0.60	0.53
T3=indigo plant shrub	0.8	0.9	0.70	0.60	0.70	0.60	0.72
T4=organic fertilizer Agroinagor	0.7	0.7	0.60	0.40	0.7	0.5	0.60
T5=foliar fertilizer	0.50	0.50	0.40	0.60	0.60	0.50	0.52

Table 3.6. Comparison of Least Significant Differences for Effects of Different Organic and Chemical Fertilizer Application in Plant Diameter

	T3 (0.72)	T4 (0.60)	T1 (0.58)	T0 (0.58)	T2 (0.53)	T5 (0.52)
T3 (0.72)	---	0.12*	0.14*	0.14*	0.19**	0.2**
T4 (0.60)	---	---	0.02n.s	0.02n.s	0.07n.s	0.08n.s
T1 (0.58)	---	---	---	---	0.05n.s	0.06n.s
T0 (0.58)	---	---	---	---	0.05n.s	0.06n.s
T2 (0.53)	---	---	---	---	---	0.01n.s
T5 (0.52)	---	---	---	---	---	---

*n.s. not significant, *significant, ** very significant*

T3, indigo plant shrub, showed the best result for the number of shoots as shown in table 3.2 through 3.4. An increase in the number of shoos results in a larger number of branches and larger quantity of biomass per area.

The diameter was improved as Tables 3.5 and 3.6 show. The best results were achieved by

using indigo plant shrub fertilizer, Case T3. This result shows that solid wastes from indigo extraction can be used for fertilizing indigo plants and other crops. This might explain why many farmers in the past grew indigo along with maize, which was not fertilized but gave better yields without fertilization. Diameter increase is favorable for indigo growing in windy areas. Larger diameter reduces the chance for the plants to fall down.

(2) ENA experimental farming

The following are the major findings.

- Indigo plants with seeds superficially seeded grew better than the ones transplanted or buried in the soil.
- Sandy and clay soils are not favorable for germination of indigo plants.
- *Indigofera suffruticosa* competes better against weed than *Indigofera guatimalensis* because it grows faster.
- The first forty days after seeding are most critical for good weed control.
- Growth was better in soils from La Palma, Suchitoto, Jujutla, San Andrés, San Simón and El Cuco than those from Acajutla and San Miguel. The nutrient content and the physical characteristics of these soils will be studied.
- Weed control by total rice straw coverage produced better results than other treatments, especially during 60 and 80 days after seeding.

3.2 Extraction

3.2.1 Obraje and modern equipment

The advantages and disadvantages of the modern equipment can be summarized as follows. Table 3.7 compares the characteristics of obraje and the modern extraction system.

Advantage

a. The duration required from plants infusion to obtaining mud was 26.5 hours for the modern equipment, while it was 37.0 hours for obraje. This shortening of processing time, due mainly to the conical shape bottom of the second tank, would enable reduction of the number of days for one cycle of extraction from three days to two days. This is equivalent to an increase of the production capacity by 50%. In the event that future demand for indigo powder has substantially grown as envisaged in the long-term scenario presented in Chapter 4, modern facility of this type would contribute to reducing the investment cost.
b. The modern equipment can be used as a mobile obraje visiting communities without obraje.
c. The modern equipment can be used more efficiently because the water contained can be warmed to speed up the process either by sunlight or fire from below.

Table 3.7. Comparison of the traditional extraction system and modern equipment

Process	Unit	Obraje (Sept. 1-3 cycle)	Modern equipment
A. Capacity			
First tank	m^3	6.52	3.16
Second tank	m^3	5.88	4.09
B. Dimension			
First tank	m	1.45 x 3.00 x 1.5	(diam)1.84 x 1.19
Second tank	m	1.4 x 3 x 1.4	(diam) 1.84 (cylinder height) 1.19 (cone height) 1.05
C. Construction cost	$	6,561	7,389
D. Processing time			
Separation of the central branch	hours	0	4
Loading biomass into first tank	minutes	30	30
Leaving biomass in water	hours	18	16
Transferring water from 1 to 2nd tank	minutes	30	30
Oxygenation	hours	2	1.5
Sedimentation	hours	15	3
Obtaining indigo mud	hours	1	1
Drying indigo mud	days	3	3
Grinding indigo	hours	0.25	0.25
Extraction hours	hours	109	98.5
E. Labor force	person-hours	51.75	53.25
F. Yield			
Biomass weight	kg	1,000	400
Powder weight	kg	1.136	0.80
Indigotine	%	44	39.8
Biomass/powder ratio		880	503

Disadvantage

a. Investment cost is higher.
b. Power supply is necessary, a difficult condition in many rural areas.
c. Users have to be trained on how to use certain equipment such as air compressor.

Concerning the quality of the outputs in terms of indigo percentage and biomass/powder ratio, no definite conclusion can be reached here, since they could be affected by other factors such as the characteristics of indigo plants and climatic conditions. Although it was originally planned that extraction be carried out using the two kinds of facilities with the same plants and on the same day, this was not realized due to operational limit.

The two types of facilities can be used in the following manner.

- Obraje: Major facilities to be adopted in the rural areas.
- Modern: To be used as a mobile unit for serving the communities with no obraje and wider application in the future when the supply capacity by obraje becomes tight.

An important factor to be noted in both cases is an appropriate treatment of wastewater. The BOD level of wastewater produced by extraction process is 27 times higher than the legal limit.

3.2.2 Extraction workshops

The following are the major findings of the extraction workshops.

- Some participants of the extraction workshops carried out some quick practices on dyeing with indigo, which increased their interest since they could learn one of its utilities.
- Other extraction workshops must be developed in which traditional techniques must be further developed. Also more practices is needed so that the participants can become confident of the visual signs in indigo extraction processes. In these workshops, programs are also necessary to include the record formats management with the purpose that the farmers can register their activities regarding the technical aspects and also the costs for the production.
- Mr. Lorenzo Amaya, the indigo expert, proposes that one of the strategies to give continuity to the indigo processing activities is the implementation and execution of a *Pointers School* to train key persons who can serve as indigo advisors or trainers to provide support to the communities of the Eastern Region. While an emphasis was placed in the Pilot Project on disseminating extraction technique to as a large number of farmers as possible, a future program could focus on limited number of farmers for intensive training to educate pointers ("Puntero"). The similar idea applied to dyeing workshop, that is to "train trainers" concept, can be applied to extraction technique.
- A questionnaire was distributed to the participants of the extraction workshops in order to evaluate their needs, expectations and the quality of the workshops. These results are shown in Table 3.8.

Some of the comments expressed in the questionnaires include the following.

a. A full-scale program is needed.
b. Establishing a marketing channel is important.
c. This kind of project should be implemented more frequently in the rural area.
d. A more comprehensive program is needed in more communities.
e. Involvement of the government institutions is needed for more support and development.
f. Continuous support is necessary.

The following are the major points clarified by the questionnaire survey.

- The most serious problem in starting indigo growing and extraction would be lack of fund and knowledge.
- The proportion of the farmers who wanted to either "grow and extract" or "grow" reached 91%, showing their high interests.
- An important factor to be considered in future would be ensuring transportation means for farmers or selecting a training location where transportation does not become a big burden for farmers.

Table 3.8. Results of Questionnaire Survey for Extraction Workshop Participants

1. Sex	Male	Female	Total				
Number	232	60	292				
%	79.50%	20.5	100%				
2. Affiliation	a. Cooperative member	b. Independient farmer	c. Association	d. Institution	Total		
Number	69	106	89	27	292		
%	23.7	36.3	30.6	9.4	100%		
3. Land area owned	a. 0.5 mz	b. 1 mz	c. 2- mz	d. 3 mz	e. > 3 mz.	f. 0	Total
Number	34	55	52	46	42	63	292
%	11.70%	19	17.9	15.6	14.3	21.5	100%
4. Experience in growing indigo	a. Yes	b. No	Total				
Number	43	249	292				
%	14.80%	85.20%	100%				
5. Reason for participating in the extraction workshop	a. Obtain knowledge	b. Learn to extract	c. is very interesting	d. Obtain better incomes	e. others	total	
Number	118	84	14	56	20	292	
%	40.50%	28.60%	4.80%	19.10%	7.00%	100%	
6. Problems they have at present for growing	a. financing	b. Obrajes lack	c. technical	d. marketing	e. lack of knowledge	f. land lack	g. others	Total
Number	84	34	25	13	69	26	41	292
%	28.6	11.7	8.6	4.5	23.6	8.9	14.1	100%
7. Evaluation of the workshops	a. Excellent	b. good	c. bad	e. others	Total		
Number	160	131	1	0	292		
%	54.70%	44.80%	0.50%	0.00%	100%		
8. Participant's intention in the future.	a. grow and	b. try to grow	c. no interes	d. others	Total		
Number	183	84	22	3	292		
%	62.60%	28.90%	7.40%	1.10%	100%		
9. Participant's expectation in the future full scale	a. want to participate	b. not	c. other	Total			
Number	284	8	0	292			
%	97.40%	2.60%	0.00%	100%			
10. Travel time from home to workshop site	a. 1 hour	b. 2 hours	c. 3-4 hours	d. > 4 hours	e. others	Total	
Number	63	56	119	42	11	292	
%	21.70%	19.30%	40.80%	14.30%	3.90%	100%	
11. Travel expenses	a. $1	b. $2	c. $3	d. $4	e. >$ 4	f. others	total
Number	34	46	71	56	75	10	292
%	11.70%	15.60%	24.30%	19.30%	25.70%	3.40%	100%

3.3 Dyeing

The following are the major findings through dyeing workshops.

- Some of the dyeing materials used in the workshops (e.g., silk, paste for katazome, cochineal, etc.) were imported from Japan and Mexico. Some local materials did not meet quality requirements such as hydrosulfite of sodium and 100% cotton cloths. These can be obstacles for dyeing techniques application and development.
- Regarding the products nationally distributed, it would be necessary that these products have qualities as specified on the labels. More stringent measures should be taken so that labels accurately present the product contents and quality. At the same time, quality of the chemicals should be improved to achieve the level displayed in the labels.
- The chemicals necessary for the formulation of dyeing vat can be bought only in San Salvador city. A distributor is needed in the Eastern Region as well. Trainees may form an organization to coordinate joint purchases of these materials for the moment. An appropriate approach would be for the government to concentrate its efforts to strengthen and expand dyers at the initial stage so that later as demand for chemicals increase commercial-oriented distributors come into business for transacting chemicals on a business basis. The government should take measures at important points to create this kind of business environment.
- Other natural colorants sources of plants origin (palo de mora bark, indigo and nance bark) are found to be available in the Eastern Region.
- Dyeing with indigo mud allows better quality results, because semisolid solution dissolves easily and no residues of colorant remain in the base of the vat. This is an advantage over powder.
- Indigo powder must be very well ground (as powder talc) to make best of the indigotine content.
- A continuity strategy for the trainees was elaborated to disseminate dyeing techniques. The trainees are committed to disseminate the techniques they learned to other interested people back in their organizations and communities.
- The free practices supervised by Mrs. Ana María de Hernández at the last sessions aimed at developing trainees' basic skills by providing an opportunity to work out products under their own initiatives. This approach proved to be highly effective. The next step training for these trainees should shift its emphasis form basic skills to application with introduction of incorporating market needs and requirements into design and cost consideration.
- Many other colors can be obtained through right combination of the four natural colorants used in the dyeing workshops.
- The results of the questionnaires distributed to the participants of the extraction workshops are shown in Table 3.9.

Table 3.9. Results of Questionnaire Survey for Dyeing Workshop Participants

1. Travel time to Casa de la Cultura	a. 0-30 minutes	b. 30-60 minutes	c.1-2 hours	d. 2 hours	Total
Number	6	4	6	2	18
%	33.3	22.2	33.3	11.1	
2. Travel expense to Casa de la Cultura	a. $ 0.00	b. $5	c.$5-10	d. More	Total
Number	16	2	0	0	18
%	88.8	11.1	0.0	0.0	
3. Profession	a. Artisans	b. Students	c. Employed	d. Running own businness	e. farmers
Number	2	2	5	2	5
%	11.11	11.11	27.77	11.1	27.77
4. Participation rate (days attending the workshop)	a. 100%	b.80-99%	c.60-79%	d. less	Total
Number	4	6	4	4	18
%	22.2	33.3	22.2	22.2	99.9
5. Reasons for participating in the dyeing workshops	Better incomes	Learn/know to dye	Interest	Others	Total
Number	5	7	2	2	16
%	31.25	43.75	12.5	12.5	100.0
6. If the participants expect to raise their income in future by applying the techniques they learned	a. Yes	b. No	Total		
Number	17	1	18		
%	94.40%	5.55	100		
7. Evaluation of the workshops from the participant's view	a. Excelent	b. Fairly good	c. Regular	d. Not good	Total
Number	13	5	0	0	18
%	72.2	27.7	0.0	0.0	99.9
8. Participant's intention in the future	a. will grow indigo	b. will try extraction	c. will continue	d. Others	Total
Number	0	0	12	6	18
%	0.0	0.0	66.6	33.3	100.0
9. Participant's expectation in the future full scale project	a. Want to participate	b. Not interested	c. Others	Total	
Number	18	0	0	18	
%	100.0	0.0	0.0	100.0	

The major comments and suggestions given were as follows.

- Indigo will bring economic development and employment.
- The institutions should support the farmers.
- Dyeing workshops in other communities are expected.
- Through this workshop participants appreciated the added value of indigo.
- Continuity and support to our trainees' group is expected.
- Promotion in high schools and military institutions would be desirable.

Mrs. Ana María de Hernández, the instructor and assistant to Mr. Kojima, made an evaluation of the participants who finished the dyeing workshops. The results are shown in Table 3.10.

Table 3.10. Evaluation of the Participants' Skills Levels

Participant	Excellent	Good	Regular	Bad	Comments
A	✔				He will be a good teacher because of his good skills at the management of every dyeing technique.
B	✔				Needs to improve her attitude to the group. Too shy and that makes her loose control of the workshop. She manages the techniques very well.
C	✔				She has good skills at shibori. One limiting aspect is that she cannot read so she needs more assistance for the formulation of the dyeing vat.
D	✔				Because of her experience she is capable of managing and organizing groups, has leadership and initiative.
E	✔				He manages the other natural colorants dyeing very well.
F	✔				She is well organized and has leadership. She also manages dyeing techniques very well.
G		✔			She needs to achieve more confidence in herself and be more constant. She cares very much about her work.
H	✔				Needs to improve her attitude to the group; needs to cooperate more with the team.
I	✔				Manages very well the techniques and participates very much.
J		✔			Needs to improve her final results with the techniques; cooperates much with the team.
K		✔			Needs to improve her final results with the techniques; participates very much.
L		✔			Shows his interest in doing this well and he achieves that.
M		✔			Needs to improve his passive attitude. More initiative and to be constant.
N			✔		To be constant and improve the management of the indigo dyeing vat.
O			✔		Needs to concentrate on the techniques management, paying more attention to the quality than the quantity. He participates very much*

Participant	Excellent	Good	Regular	Bad	Comments
P			✔		Needs more practice in the dyeing techniques and the vat formulation.
Q		✔			Manages very good shibori. Has very goods ideas, needs to improve leadership.
R				✔	Needs to improve his temperament, has adaptation and group problems. He is not a leader.

The results of the evaluation were: 44.4% excellent, 33.3% good, 16.7% regular, and 5.5% bad. It is important to note that each trainee has his/her skills and weaknesses and that complementing their abilities as a team, the results could be excellent.

Since the indigo dyeing activity has a great added value, some of these trainees are thinking of starting their own business. To show an example of this dyeing activity profitability, a cost structure with its revenue for an indigo dyed T-shirt is displayed in Table 3.11.

Table 3.11. Revenue/Cost Structure of Indigo Dyed T-shirt

Item	Value (US$)
Sales value	15.00
Costs	
- T-shirt	3.88
- Dyeing material	2.54
- Labor cost	0.60
- Indirect costs (services, transportation, depreciation, others)	1.00
- Administration (5%)	0.34
Profit	6.64

By dyeing, the value of indigo rises by six times, assuming 25g powder sold at US$1.00 or US$40 per kg.

A number of difficulties encountered by the dyers in San Salvador include the following. These dyers have been producing and selling indigo dyed materials in San Salvador at shops and personally and cooperated with the Pilot Project by supplying dyed goods for sales at the El Salvador International Airport.

- Limit in obtaining good quality cotton cloth
- Non-availability of cotton threads
- Lack of some dyeing equipment and materials such as melting pot, knots making tool, paste etc.
- Lack of knowledge on business management
- Lack of knowledge on market, preference by overseas potential customers, for example.

3.4 Preliminary Marketing Survey

3.4.1 Statistical data

Statistical data were collected through the Internet and JETRO libraries. It was found that there are no data available that directly indicates international trade trends in natural indigo. The closest were data on natural indigo and butter dyes imported to Japan. Other related data included the amount and value of natural colorants traded in the world, which could be referred to as a proxy to natural indigo to observe general trend. Table 3.12 presents the import values of natural colorants by 10 top countries from 1997 to 2001. USA and Japan are the two largest countries importing natural colorants equivalent to US$53 to 54 million in 2001, followed by the second group comprising Germany, UK, Spain and France with a range of US$20 to 29 million. While import values rose from 1997 to 2001 in seven countries including USA, Japan, Spain, France, Mexico, Denmark and Italy, they declined in three countries, Germany, UK and Hong Kong. Overall the total import values of these 10 countries remained almost constant. Judging from the market size and growth trend, Japan and USA could be potential target markets of natural indigo powder. Table 3.13 with a similar nature presents import value, amount and price of natural colorants by major countries in 1990, 1995, 2000, 2001 and 2002 between January and September. It is observed that prices are lower than the average price of natural indigo powder exported by El Salvador.

Table 3.14 presents the import amount, value and price of natural indigo and butter dyes imported to Japan between 1990 and 2002. Butter dyes are used to put yellow color to butter. After fluctuation including a big jump in 1997, the total import amount has been rising. The total import amount rose from 3,270kg in 1990 to 11,171kg in 2002, equivalent to an increase of 10.8% per year. The last three years, especially, showed a high growth. Average prices, on the contrary, have been declining at 4.1% annually.

3.4.2 Information collected from indigo-related experts and organizations in El Salvador

Marketing experiences and proposals

The following are the findings.

- An indigo farmers' association has achieved exporting indigo to Bolivia, Ecuador, Colombia and Guatemala. They have also sold locally to an English client at a price of US$225.00 per pound with an indigotine content around 80%.
- The quality achieved by this group is higher by 30% than the mean achieved by other groups that were interviewed. This group is interested in their technology transfer to other producer groups because they are willing to standardize the Salvadoran indigo quality. They mentioned about difficulties in marketing their indigo because in the international market indigo from El Salvador is regarded as having indigotine content between 40 and

Table 3.12. Import Value of Natural Colorants by Top 10 Countries in the World, 1997-2001

Country	1997	1998	1999	2000	2001	2001/1997
(Value in 10^3)						
USA	48,622	53,912	61,200	62,331	53,335	1.10
Japan	48,098	42,964	44,576	49,335	54,725	1.14
Germany	36,066	38,862	27,587	29,577	29,647	0.82
UK	28,710	25,047	23,384	19,696	17,987	0.63
Spain	22,534	17,001	15,887	24,243	25,182	1.12
France	16,886	22,374	19,093	18,343	20,016	1.19
Mexico	10,981	17,533	18,508	12,837	14,316	1.30
Hong Kong	20,528	13,606	12,096	11,977	13,745	0.67
Denmark	14,959	10,266	8,956	12,672	15,940	1.07
Italy	10,753	11,697	12,328	13,833	12,801	1.19
Total	258,137	253,262	243,615	254,844	257,694	1.00
(Growth from previous year in %)						
USA	-	10.9	13.5	1.8	-14.4	-
Japan	-	-10.7	3.8	10.7	10.9	-
Germany	-	7.8	-29.0	7.2	0.2	-
UK	-	-12.8	-6.6	-15.8	-8.7	-
Spain	-	-24.6	-6.6	52.6	3.9	-
France	-	32.5	-14.7	-3.9	9.1	-
Mexico	-	59.7	5.6	-30.6	11.5	-
Hong Kong	-	-33.7	-11.1	-1.0	14.8	-
Denmark	-	-31.4	-12.8	41.5	25.8	-
Italy	-	8.8	5.4	12.2	-7.5	-

Source: Trade Analysis System, Copyright ITC/UNSD.

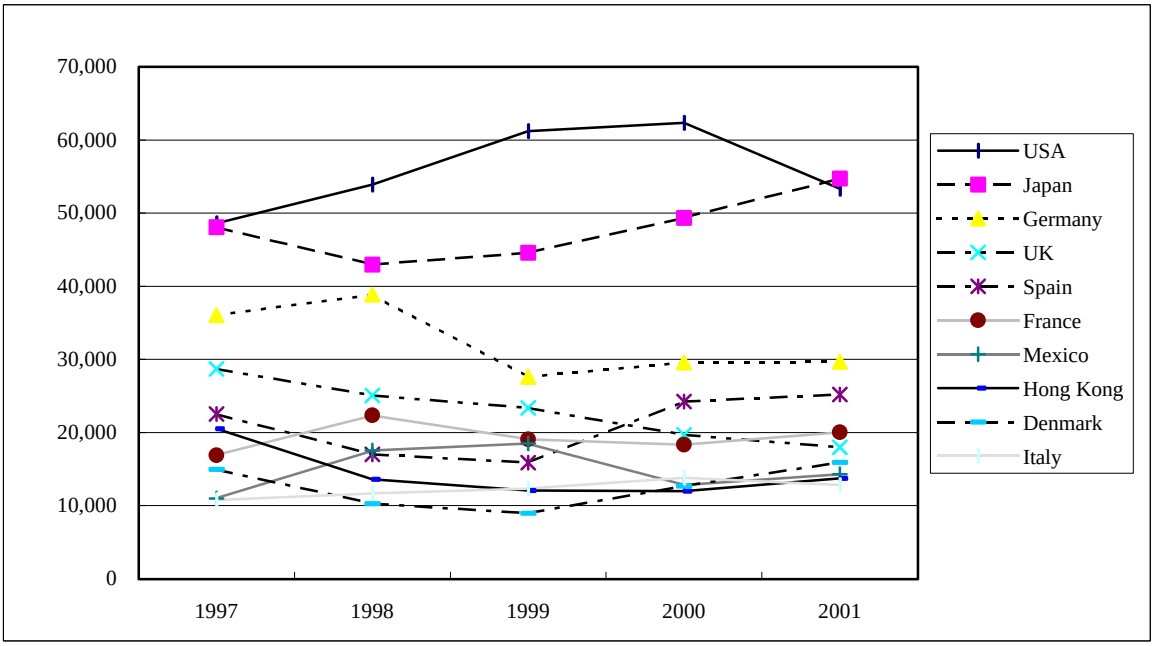


Table 3.13. Import of Natural Colorants by Major Countries, 1990-2002

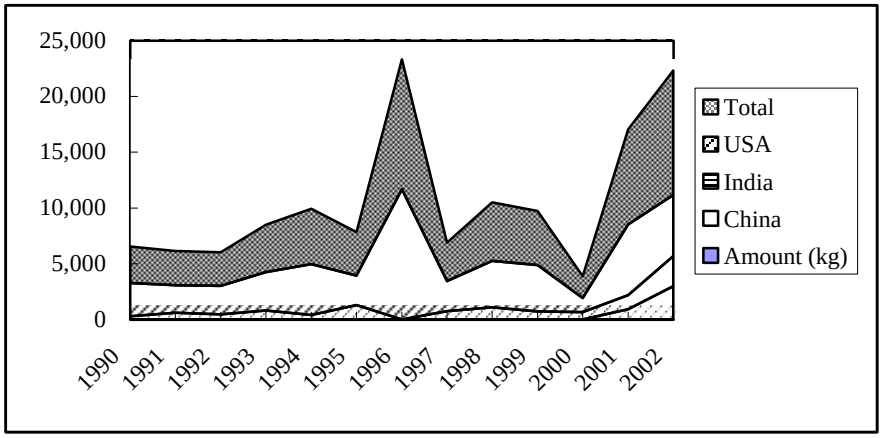
Item	1990	1995	2000	2001	2002
USA					
Amount (10^3kg)	4,228	4,367	5,215	3,550	3,704
Value (10^3)	17,891	29,071	46,412	41,046	33,210
Price ($/kg)	4.2	6.7	8.9	11.6	9.0
UK					
Amount (10^3kg)	-	-	2,588	2,067	2,231
Value (10^6)	-	-	15,897	14,074	14,269
Price ($/kg)	-	-	6.1	6.8	6.4
Germany					
Amount (10^3kg)	-	-	-	2,086	2,176
Value (10^6)	-	-	-	18,603	20,568
Price ($/kg)	-	-	-	8.9	9.5
France					
Amount (10^3kg)	-	-	-	2,924	-
Value (10^6)	-	-	-	17,542	-
Price ($/kg)	-	-	-	6.0	-
Italy					
Amount (10^3kg)	-	-	-	-	-
Value (10^6)	-	-	13,927	12,833	14,919
Price ($/kg)	-	-	-	-	-
Japan					
Amount (10^3kg)	-	2,645	2,973	3,001	2,826
Value (10^6)	-	32,573	37,877	41,288	38,074
Price ($/kg)	-	12.3	12.7	13.8	13.5

Table 3.14. Import of Natural Indigo and Butter Dyes to Japan by Source Country, 1990-2002

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Amount (kg)													
China	0	0	0	0	0	0	0	0	0	0	0	910	2,998
India	300	600	455	800	408	1,300	0	750	1,100	707	668	1,260	2,671
USA	2,970	2,475	2,565	3,450	4,560	2,625	11,670	2,700	4,159	4,159	1,265	6,349	5,502
Total	3,270	3,075	3,020	4,250	4,968	3,925	11,670	3,450	5,259	4,866	1,933	8,519	11,171
Value (thousand Yen)													
China	0	0	0	0	0	0	0	0	0	0	0	881	761
India	874	1,527	1,102	1,771	868	2,439		2,025	1,977	1,977	1,805	3,709	6,990
USA	7,254	5,834	5,421	3,969	5,251	2,530	13,854	5,028	7,291	7,291	1,880	9,847	8,310
Total	8,128	7,361	6,523	5,740	6,119	4,969	13,854	7,053	9,268	9,268	3,685	14,437	16,061
Price (Yen/kg)													
China	-	-	-	-	-	-	-	-	-	-	-	968	254
India	2,913	2,545	2,422	2,214	2,127	1,876	-	2,700	1,797	2,796	2,702	2,944	2,617
USA	2,442	2,357	2,113	1,150	1,152	964	1,187	1,862	1,753	1,753	1,486	1,551	1,510
Total	2,486	2,394	2,160	1,351	1,232	1,266	1,187	2,044	1,762	1,905	1,906	1,695	1,438
Price ($/kg)													
China	-	-	-	-	-	-	-	-	-	-	-	8.8	2.3
India	26.5	23.1	22.0	20.1	19.3	17.1	-	24.5	16.3	25.4	24.6	26.8	23.8
USA	22.2	21.4	19.2	10.5	10.5	8.8	10.8	16.9	15.9	15.9	13.5	14.1	13.7
Total	22.6	21.8	19.6	12.3	11.2	11.5	10.8	18.6	16.0	17.3	17.3	15.4	13.1

Exchange rate: 110 Yen/$ as of December 2003

Source: Japan Import Statistics for respective year.



45% with lower prices attached.

- The local quality control laboratories should check and adjust their indigotine measuring procedures, because in various commercial transactions, their results were different from the ones reported by the international laboratories.
- Dyed products' market should be studied for specific tourist points such as Roatán, Antigua Guatemala, and Belize, for marketing would be easier due to proximity and better prices.
- An indigo route is one of the proposals made by various people to promote tourism development. One can take advantage of different activities related with indigo production and dyeing as attractions for tourists. Visits to old obrajes' remains, museums and artistic shows for the colorant production and history could be part of the route program. Natural sceneries where indigo lands are located are suitable for eco-tourism and agro-tourism.
- A promotional video to attract tourism is another suggestion. The foundation of an indigo specialized museum could link the benefits of indigo nowadays with the indigo history.

Through interviews with 15 indigo farmers of different associations, the following information was obtained.

- Indigo potential supply (2003-2004): The total cultivated manzanas from 2000 to 2003 were 310.8, where plants of one to five-years of age are grown. An area of this size is able to produce around 2,480kg indigo powder according to them. The areas seeded in 2002 represent 32.3%, while that in 2003 accounts for 46.3%. The potential cultivation area in 2004 would be 484 manzanas, which might produce 3,864 kg of indigo powder based on farmers projection.
- The range of indigotine reported is between 28.0% and 58.5% with a mean at 43.0% and mode at 50.0%. India is reported to be providing powder with a range of 42 to 45% indigotine. The farmers expressed it is important to establish norms that regulate the product's quality such as indigotine percentage, powder's mesh, packaging quality and other criteria. Indigo farmers recommended establishment of a quality control center that assures the quality standard and subsequently promote the exportation process.
- Experience in national and international negotiations: Many farmers interviewed had experienced local and international marketing. The mean price per kg they have obtained in the national market is US$34.50 with an indigotine of 42.3%, while the international mean price is US$42.50 with indigotine at 43.85%. Indigo powder has been exported to such countries as Germany (42.86%), France (14.29%), Honduras (7.14%) and Peru (7.14%).
- Farmers expressed their dissatisfaction with the low prices and income, delayed payments for their indigo sales and slow exportation process.
- They suggest the following for an efficient marketing process:
  - Negotiation without intermediates and with transparency,
  - Agreement in prices and Salvadoran qualities between the different associations in order to avoid the price fall in the international market,
  - Formation of an indigo cluster and countrywide export promotion,

- Indigo quality to be measured before exportation,
- Advance payment system to be established by intermediaries with the remaining payment after the client has paid the product, and
- An organization to be established for collecting and disseminating information in a honest and efficient manner.

Organized groups

In order to grasp the organization structure of the indigo sector and its productive capacity or their potential offer in the international market, in the short term, four focus groups were interviewed. The results obtained are summarized in Table 3.15.

Table 3.15. Four Farmers Groups Interviewed

Variable	Los Nonualcos	ASEÑICA	Corinto	ACOPADIM
Year of establishment	2002	2002	2001	2001
Supporting institution	GTZ	PRODAP	CRS	ADEL Morazán
Membership	18	60	12	18
Obrajes' availability	Each farmer has his own obraje	In 2004 the group will have 4 obrajes.	The group has just one obraje.	The group has just one obraje.
Previous experience in indigo growing	The group had one experimental lot of 1.5mz in 2002.	One of his members worked in the extraction 40 years ago.	They have been trained for indigo growing and extraction by CRS.	They have been trained for indigo growing and extraction by JICA (Pilot Project) and ADEL.
Cultivated area for 2002 (mz)	1.5	30	1	1
Indigo production for 2002 (kg)	20	7	3.5	Did not process
Market	Local market through AZULES	Powder has been stored to be sold with 2003 production.	Powder has been stored to be sold with 2003 production.	--
Sales (kg)	5	--	--	--
Price US$/kg	34.5	--	--	--
Clients	Salvadoreña artisans	--	--	--
Exportations	--	--	--	--
Cultivated area for 2003 (mz)	65	33	7	22
Indigo cultivation projection area for 2004 (mz)	100	No response	7	32

Among these groups, there is only one that had knowledge about their product quality in terms of indigo content. Others had no idea of their product price. Another weakness identified was their difficulties in having access to the basic communication means to negotiate in the international market.

Another constraint pointed out is the lack of indigo extraction infrastructure. Since this crop has specific harvest timing, farmers have difficulty in processing indigo with a limited number of obrajes.

Indigo dyed artisans

Interviews were made with five artisans producing indigo dyed products. The results of the interviews are summarized in Table 3.16.

Table 3.16. Five Artisan Groups Interviewed

	Artisans				
Variable	1	2	3	4	5
Year they started the dyeing activity	1999	2000	2002	2002	2003
Identify the products with a brand	Yes	Yes	Yes	Yes	Yes
Brand registration	Yes	Yes	No	No	No
Formal sales point	Yes	Yes	No	No	No
Target market	Local and International	Local	Local and international	Not selling still	Local and International
Formal exportations	Yes	No	No	No	No
Monthly incomes US$	2,000.00	Do not remember	Do not remember	Do not remember	700.00

Regarding the final destination of their products, two persons expressed that they sell product to buyers that sell them in other countries. They, however, do not follow a formal exportation process. Some of the artisans mentioned that they are selling their products regularly at handicrafts stores in San Salvador (Redart and Nahaché).

The five artisans dye mainly textiles. Three of them dye wool, while one of them dyes ceramics, candles, leather, henequen and other natural fibers. The most sold products are: T-shirts, blouses, small pillows, bags and paintings. Actually three of them are combining indigo with other natural colorants. Two of these artisans produce their own indigo powder. The rest buy it from AZULES and their associates, with an indigotin content between 30 and 50%.

The factor they pay most attention to in terms of quality control is to prevent discoloring of the product. They wash the products to such a point that no more color would come off before selling.

Textile industry

None of the four textile enterprises interviewed have ever used natural indigo in their production process. However, three expressed some favorable attitude to indigo use under

special conditions such as competitive price, guaranteed supply in quantity and quality, adequate machinery, and good fixing to fibers. They consider that natural indigo can find a niche market for consumers in higher-income brackets.

According to the respondents, indigo success depends more on artisans' production. They believe that indigo is a niche in which designers could create new models and guarantee a stable artistic offer. They claim that textile factories do not have adequate equipment and information to use natural indigo at the industrial level.

3.4.3 Information and data obtained through Internet

(1) Indigo powder

A survey was undertaken to collect information on overseas natural indigo market through the Internet. A total of seven websites were identified. The prices offered to consumers ranged between US$108 per kg and US$650 per kg as shown in Table 3.17. Since no details were available in these websites, it was impossible to relate these price levels with quality.

The minimum available quantity for sale is 1oz (28g). Not every website has information about shipment. Two of them specify shipping cost to be charged on top of the product price.

Table 3.17. Overseas Websites Introducing Natural Indigo

No.	Company	Country	E-mail	Prices (US$/kg)
1	The Joy of Handspinning	USA	www.joyofhandspinning.com info@joyofhandspinning.com	221.98
2	Aurora	USA	www.aurorasilk.com cheryl@aurorasilk.com	136.40
3	Maiwa	Canada	www.maiwa.com maiwa@maiwa.com	119.80
4	Natural Dye Studio		www.naturaldyestudio.homestead.com dyestudio @hotmail.com	n.a.
5	Paivatar Yarns & Desing		www.paivatar.com info@paivatar.com	365.20
6	Kremer Pigmente	Germany	www.kremer-pigmente.de	108.00 122.80 650.00
7	Bountiful		www,bountifulspinweave.com	Indigo solution US$$10.00/750ml

A big difference observed between the retail price levels presented in Table 3.17 and an average sales price by AZULES at US$42 per kg could be attributed to a number of factors such as high shipment cost for small quantity, high production cost of natural indigo and large revenue margin. While a number of cases identified by the present survey indicate possibility of

success in deals with these companies, an effort should be made to contact them and explore possibility for reaching a business agreement.

(2) Dyed products

Ten websites that offer dyed products were found. They included two Salvadoran sites and those of the U.S., Asia and Europe. Table 3.18 presents the information presented in these websites.

Table 3.18. Websites for Indigo Dyed Products

	Name of company	E-mail	Prices
1	Mendels	www.mendels.com naomi@mendels.com	Pieces of 3´x4´ US$42.00
2	Aikatazome	http://aikatazome.itgo.com	Silk Kimono (38x1200cm) 200,000 yen ($1,818.00)
3	Truecolours	www.truecoloursyarns.co.uk angle@truecoloursyarns.co.uk	Price not available
4	Nong Khai Projects - Indigo	www.mekongmart.com info@mekongmart.com	Price not available
5	Bello Marini	http://home.att.net/-bellomarini/marini.html bellomarini@att.net	Price not available
6	Nakupenda Batik	http:// 216.92.140.121/wholesale.html ppbatik@cdsnet.com	Price not available
7	West African Indigo Cloth Galery	www.adire.clara.net	Old collection pieces US$450.00 each
8	** In japanese	http://plaza24.mbn.or.jp	**in Japanese
9	Índigo Trading	www.indigotrading.com indigo@indigotrading.com	Men's shirts US$ 45.00
10	Orígenes	www.origenes.com.sv origenes76@latinmail.com	Cotton trousers US$21.00

(3) Information and data collected by e-mail questionnaires survey

Originally a long questionnaire on indigo uses and market was sent to 163 enterprises of different production sectors all over the world. The questionnaires were sent to the companies shown in Table 3.19.

Table 3.19. Target Enterprises of Questionnaires Survey

Sector	No. of companies
A. Textile industry	24
B. General colorants distributors and chemicals related	112
C. Artisans that use natural colorants	10
D. Distributors of natural colorants and pigments.	7
E. Enterprises that participate in the Export Fair held in June in San Salvador	10
	163

From 163 questionnaires sent, only one was filled and returned, so it was decided to e-mail a

shorter version with only five questions. To this shorter version, 17 responses were obtained, of which 13 were fully completed. Three companies expressed they do not have interest in natural colorants. Table 3.20 shows the results.

Nine natural colorants and distributors filled up the questionnaires. Of these enterprises, eight are interested in buying indigo and four are interested in selling indigo dyed products from El Salvador. It should be noted, however, that it is easier for them to answer if they are interested in buying natural indigo powder as a raw material than indigo dyed products, which they have never seen. The price is of high concern for the two enterprises that responded positively to Question No. 2 and are interested in buying only if the prices offered can be compared with the prices they obtained from their current suppliers.

Table 3.20. Result of E-Mail Questionnaire Survey

No.	Question	Answer
1	Do you or your company use or sell natural colorants?	Yes: 9
		No: 3
		No answer: 1
2	Are you or your company interested in buying natural Indigo from El Salvador?	Yes: 8
		No: 2
		No answer:3
3	What is your customers' opinion toward natural indigo dyed products?	Very High: 1
		High: 5
		So so: 2
		Low: 0
		No answer: 5
4	What is the recent consumption trend toward natural indigo dyed products?	Increasing 4
		Stable: 2
		Decreasing: 2
		No answer: 5
5	Are you interested in selling products dyed with natural indigo from El Salvador?	Yes: 4
		No:6
		No answer: 3

3.4.4 Preliminary market survey in Japan

The existing indigo dyed products sold in El Salvador were taken to Japan together with the four works that received the first to the third prizes and the special award at the Japanese Ambassador's Indigo Dyeing Competition held in San Miguel on November 11, 2003. These products, 62 in total, were displayed in two informal exhibits for general consumers and evaluated by a Japanese indigo dyeing expert, Professor Yoshiko Noda of Shikoku University, with the cooperation of JETRO.

The two informal exhibits were held in two private companies in Tokyo on November 26 and 28. These exhibits were planned in order to sound the reaction of general Japanese consumers

to Salvadoran dyed products. For this purpose, two types of questionnaires were prepared, one requesting visitors to select at least three products that they like and evaluate each in terms of design, material, overall impression, and price (Category A), and the other asking them to select works that they think are good but need some more improvement (Category B). For the latter case, visitors were asked to mention points to be improved in addition to the evaluation of the products. The profile of the 40 people who cooperated with the questionnaire survey is given in Table 3.21.

Table 3.21. Profile of Japanese Consumers Who Cooperated with Questionnaire Survey

Factor		Number	%
Sex	Male	16	40.0
	Female	24	60.0
	Total	40	100.0
Age	10s	0	0.0
	20s	4	10.0
	30s	14	35.0
	40s	8	20.0
	50s	12	30.0
	60s	2	5.0
	Total	40	100.0
Experience in	Design	1	2.5
	Apparel	0	0.0
	Indigo dyeing	2	5.0
No experience		37	92.5
	Total	40	100.0

Table 3.22 presents the ranking of the 62 products based on the results of Category A questionnaire. There were 47 products (76%), which at least one consumer liked. It is a surprising finding that first, all the four products from the Pilot Project received at least one vote and second, the towel set was ranked second receiving nine votes and the bed set at the 6th place with eight votes among all the 62 products. This indicates the fact that proper training enables people without any experience at the beginning to gain technology at such a level as to produce items that attracts Japanese general consumers' eyes.

Table 3.23 presents the results of an evaluation made by them on each item. Their evaluations on design, overall impression, material and price on each product were totaled so that the perceptions of Japanese consumers on Salvadoran indigo products could be inferred. The portion of the consumers, who rated the products to be "excellent" on design and overall impression, reached 30%. With "good" combined, the proportion rises to 91% for design and 94% for overall impression. The materials used are valued as "good" at 49% and "normal" also at 49%. The number of samples evaluating the prices is lower due to the fact that some items did not carry price tags because the producers of these items preferred to be contacted directly to discuss the price issue. Those answering "reasonable" and "low" accounted for 56% and

Table 3.22. Ranking of 62 Products Evaluated by Japanese Consumers

	ID No.	No. of Votes	Item
1	39	13	Girls one-piece dress
2	1	9	Towel set
3	14	8	Muffler or table center
4	48	8	Scarf/handkerchief
5	59	8	Casual shirt with leather string
6	2	8	Bed set
7	15	6	Cushion cover
8	60	5	Casual shirt with leather string
9	4	5	Luncheon mat
10	42	5	Bag with indigo inside
11	10	4	Table center
12	24	4	Table center
13	37	4	Girls one-piece dress
14	43	4	Handkerchief
15	58	4	Casual shirt with leather string
16	16	3	Luncheon mat
17	53	4	Long sleeve t shirt
18	36	3	Girls one-piece dress
19	44	3	Long sleeve T-shirt
20	52	3	No sleeve shirt
21	12	2	Luncheon mat
22	17	2	Luncheon mat
23	18	2	Luncheon mat
24	19	2	Luncheon mat
25	21	2	Handkerchief
26	22	2	Luncheon mat
27	23	2	Bag with Mayan design
28	25	2	Small bag
29	26	2	Handkerchief
30	45	2	Apron
31	51	2	Children's T-shirt
32	56	2	Girls one-piece dress
33	11	2	Table center
34	20	2	Muffler or table center
35	7	1	Apron
36	31	1	Coaster
37	32	1	Coaster
38	33	1	Handkerchief
39	35	1	Girls one-piece dress
40	38	1	Girls one-piece dress
41	47	1	Apron
42	50	1	T-shirt with small bag & bandana
43	57	1	Long sleeve T-shirt
44	62	1	Summer dress with hat
45	63	1	Silk party dress
46	3	1	Apron
47	54	1	T-shirt (moon/star)
48	5	0	Small purse
49	6	0	Case
50	8	0	Cloth
51	9	0	Table center
52	27	0	Small bag
53	28	0	Small notebook
54	29	0	Coaster
55	30	0	Coaster
56	34	0	Handkerchief
57	40	0	T-shirt
58	41	0	T-shirt
59	46	0	Handkerchief
60	49	0	Dress (upper part?)
61	55	0	T-shirt (turtle)
62	13	0	Luncheon mat

Table 3.23. Evaluation of 62 Salvadoran Indigo Dyed Products by Japanese Consumers

Factor	Excellent	Good	So-so	Not good	Total
Design	41 (30.1%)	83 (61.0%)	12 (8.8%)	0 (0%)	136 (100%)
Overall impression	40 (29.9%)	86 (64.2%)	8 (6.0%)	0 (0%)	134 (100%)
Material		67 (49.3%)	67 (49.3%)	2 (1.5%)	136 (100%)
		Expensive	Reasonable	Low	-
Price		20 (25.0%)	45 (56.3 %)	15 (18.8%)	80 (100%)

Note: The number of samples was 40. Each person was requested to select at least 3 three items that they liked most and evaluate each of them for the 4 factors.

19% respectively. Altogether 75% of the people thought the prices were within a reasonable range.

A preliminary conclusion based on this finding is that Japanese consumers generally appreciated Salvadoran indigo dyed products, indicating that Salvadoran dyed products have a potential to start and develop business in Japan. While this kind of positive finding should be respected, it is at the same time necessary for Salvadoran dyers to recognize the fact that there is a big room for improvement in dyeing techniques. Further efforts will be needed to refine and upgrade dyeing and related techniques to such a level that much higher proportion of Japanese consumers would evaluate the items as "excellent". That will be the time when Salvadoran products are ready for the Japanese market. The kinds of technical improvements required are explained below based on the comments made from an indigo expert's perspective.

Professor Yoshiko Noda briefly evaluated the 62 products. Both positive and negative comments were almost equally given. The positive comments refer to weaving technique, quality of material, dyeing technique, color tone, contrast in blue and white colors, and the shape of the product. The major points for improvements are provided as shown in Table3.24. They are summarized as follows:

- Dyeing technique requiring sophistication,
- Selection of material suited to dyeing and specific dyeing technique,
- Need for sophistication in design,
- Size appropriate for Japanese market,
- Unsophisticated sewing technique,
- Lack of appropriate commodity management, and
- Need for producing clothes solely for indigo dyeing instead of using ready-made clothes.

The following aspects must be focused as important factors for improving the indigo dyeing sector:

- Upgrading of dyeing technology,
- Development of designs matching market needs and applying sophisticated dyeing technique,

Table 3.24. Necessary Improvements Pointed Out by Japanese Indigo Expert

a. There were cases in which removal of paste for Katazome was made without sufficient care with remaining trace on the products.
b. Dyeing is not beautiful due to lack of sophistication in the technique. The product can be dyed with same kind of light tone but much more beautifully with appropriate technique.
c. Color is not good.
d. The size may not match Japanese consumers (luncheon mat, apron).
e. Material difficult to be dyed is used.
f. It is not clear for what purpose the items is used.
g. Sewing is immature.
h. Itajime technique is immature.
i. Removal of wax is not enough (batik). It is better to use detergent than iron.
j. Makishibori technique is not well applied.
k. Allocation of pattern needs to be considered.
l. Some stains are observed due to immature dyeing technique. Light blue can be dyed much better with appropriate technique.
m. Tassels are too big. (muffler)
n. There should be clearer contrast between blue and white colors.
o. Using Velcro for a small bag makes it look cheap.
p. Shibori technique is immature. Its color is like that of synthetic indigo due to inappropriate use of hydrosulphite.
q. Thread is too big for a scarf.
r. Rolling should be done equally to get rid of folds. Thread for Shibori is too big that makes horizontal lines appear. Blue should appear in front.
s. The use material is not suitable for "Itajime Shibori". It is too hard and too finely woven. Dyeing technique is not good enough. It may be due to excessive deoxidization.
t. "Karamatsu Shibori" pattern should stretch all around including the back side.
u. The material is too thick, which makes dyeing difficult. Pattern is too much elaborated.
v. The strings for the bag may be too long.
w. Pattern design is too much elaborated.
x. Commodity management should be more properly done, because this item's color has faded due to too much exposure to sunlight. The color of the inner side is more beautiful.
y. Blue down part should be dyed by stretching that part tightly. This will make blue dye more beautiful. There needs to be a hole for strings to go through.
z. Design looks too elementary.
aa. The color is crying, meaning in Japan that the part supposed to be white is not really white.
bb. It can be sold as a general dyed product in Japan, but not as an indigo product.
cc. It seems a ready made dress was dyed. This approach has a limit. If you can start from making dress itself, dyed products can be improved.
dd. It would be better to use indigo also for the upper part. With the present way, the necessity for using indigo for the lower part cannot be felt.

- Upgrading of sewing technique,
- Creation of a system that enables supply of good materials, and
- Better commodity management practices.

Concerning design and color, there are different tastes depending on the market segment. It would be important to apply the highest technology to meet these market demands. Traditionally, light blue color is regarded in Japan as not favorable for indigo according to the indigo tradition in Japan. Responses from the questionnaire survey, on the contrary, showed that light blue color is also a popular color. Actually the third place in the ranking was a

muffler dyed in light blue. This kind of contradiction happens between indigo experts with long experience and set standards for indigo and general consumers much less influenced by traditional value. Although dyeing cloth in light blue is a difficult technique, many of the things shown could be dyed in much more beautiful light blue, according to Professor Noda. So an important point for Salvadoran dyers would be to find out market preferences, design by fully blooming their artistic capability and apply the best dyeing technology. Once products are supplied through this process, there will be much better response from the Japanese market with higher proportion of consumers regarding Salvadoran dyed products as "excellent".

3.4.5. Preliminary market survey at El Salvador International Airport

A preliminary market survey was initiated at the El Salvador International Airport on November 24 with the cooperation of the Executive Commission for Autonomous Ports (CEPA). Despite its original schedule to terminate it on December 6, the survey was decided to be extended until January 21, 2004, considering the positive response from passengers in the initial week and the fact that a peak season is about to come in later December and including the peak time would contribute to promotion of Salvadoran indigo products and acquiring larger samples of questionnaire with richer information. The success in 1.5-month experience encouraged the Pilot project members in charge of supplying dyed products to make a request to CEPA for allowing them to continue the sales activity after January 21 under their own initiative. CEPA considered the request and came to a decision that they would permit them to continue the activity as part of the Pilot Project until the end of April 2004. A new contract document is currently under preparation. A kiosk was established in front of Gate 9 and a number of products provided by the existing shops in San Salvador and dyeing trainees of the Pilot Project are sold there. The space for the kiosk was made available by CEPA to the Pilot Project under a special arrangement. The following part presents the result of the survey between November 24 and January 21. These information were collected by a simple questionnaire distributed to the people visiting the kiosk. The number of questionnaires collected is 136 in total with the profile of the respondents shown in Tables 3.25 and 3.26.

Table 3.25. Nationality of Respondents and Purpose of Purchase

Item	Number	%
Nationality		
Salvadorian	82	44.8
Foreign	95	51.9
Total	183	100.0
Purpose of purchase		
Souvenir	78	75.8
Use	10	10.6
Other (present)	6	6.4
Total	94	100.0

Table 3.26. Age Distribution of Respondents

Age group	(Number)				(%)			
	Male	Female	Unknown	Total	Male	Female	Unknown	Total
10's	1	1	-	2	1.4	1.0	-	1.1
20's	4	23	2	29	5.4	23.5	18.2	15.8
30's	42	51	5	98	56.8	52.0	45.5	53.6
40's	19	16	1	36	25.7	16.3	9.1	19.7
50's	6	5	3	14	8.1	5.1	27.3	7.7
60's +	2	2	-	4	2.7	2.0	-	2.2
Total	74	98	11	183	100.0	100.0	100.0	100.0

Foreign passengers accounted for slightly more than half of all the respondents. Those who purchased indigo products for souvenir also reached 79%. The majority of respondents are in the 30s regardless of the sex. The respondents who did not purchase any product reached 40 or 22% due to the reasons presented in Table 3.27

Table 3.27. Reasons for Not Buying Indigo Products

Reasons for not buying	No.	%
No credit card accepted	10	25.0
Not enough money	9	22.5
Not enough time to make a decision	4	10.0
Too expensive	5	12.5
Will come back later	5	12.5
Size not appropriate	2	5.0
Not allowed to buy	2	5.0
Not want to increase stuff to be carried	1	2.5
Just looking and walking around	1	2.5
There is a mistake in the design	1	2.5
Total	40	100.0

Most of the reasons cited for not buying any product were related more with personal or sales factors, not with the quality of the products. In actual sales activities, credit cards, for example, will be accepted. Prices and sizes could be adjusted more carefully. Other personal reasons are beyond indigo dyers' control.

The following sales were achieved.

November 24-30: $1,521.15 (daily average: $217/day)
December 1-31: $4,007.40 (daily average: $129/day)
January 1-21: $1,948.75 (daily average: $93/day)
Total: $7,477.30 (daily average: $127/day)

Table 3.28 summarizes the products evaluation. It is rather surprising that those who rated most favorably reached 36% to 69%. It is observed that in all factors except "material", the

items are evaluated more positively at the airport than in Japan: by 39% for design, 32% for overall impression, and 8% for price. The items in both cases are almost the same. This interesting difference would be reflection of the following factors:

- Japanese market is well known for its requirement for highest quality for any goods; and
- Japanese market has longer experience in trading indigo-related goods, thus the products look fresher to airport passengers with little or no experience with indigo.

Table 3.28. Evaluation of Indigo Products by Respondents

Factor	Excellent	Good	So-so	Not good	Total
1. Design					
Number	127	54	2	0	183
%	69.4	29.51	1.09	0.0	100.0
2. Overall impression					
Number	96	82	2	0	180
%	52.46	44.81	1.09	0.0	98.36
3. Material		Good	Normal	Not good	Total
Number		66	110	3	179
%		36.07	60.11	1.84	97.81
4. Price		Expensive	Reasonable	Low	Total
Number		19	161	2	182
%		10.38	87.98	1.09	99.45

In response to a question asking about color tone, the highest proportion selected “deep blue” for their preference as shown in Table 3.29.

Table 3.29. Preference in Color Tone

Tone	No.	%
Dark blue	41	22.4
Deep blue	135	73.77
Light blue	19	10.38
Total	195	106.56

Appendix 1 presents the reasons for stopping by at the stand and comments on the product he/she bought or selected for the questionnaire. The comments were mostly positive. The words used to express their view on the products included “original”, “not common”, “new”, “comfortable”, “delicate”, “good color”, “good for gift”, “attractive”, “well worked”, “He/she likes the design and color”, “cheap”, “beautiful”, “many varieties and innovation”. There were two comments on cultural aspect, one stating that the person is happy because of revival of tradition and the other person saying she/he likes Salvadoran culture. There were some requests also such as they would like to see more products like women blouse, pants and skirts and wider variety in size. Many commented about good location of the stand. There were some comments indicating that they would like to have the stand for a longer period.

3.4.6 Visits and information collection in potential foreign markets

(1) Target countries

Information collected through various channels indicated three countries as promising with export potential, easier in accessing and realistically convenient in carrying out a preliminary marketing survey: Guatemala, Ecuador and Peru. All these countries are famed for their high quality artisan products for tourists. Two possibilities are considered: sales of indigo powder to these artisans as a raw material and sales of dyed products to shops in these countries targeting tourists. Two trips were made to visit these countries: December 1-3, 2003 – visit to Guatemala and December 14-22 – visit to Ecuador and Peru.

(2) Guatemala

The towns visited include Tononocapan, San Andres Xecul, Canton Pasajoc, Salcaja, Zunil, Cantel and Quwtzaltenango. These towns have both producers and retail shops for handicrafts, textiles and ceramics. A simple questionnaire survey was carried out for 23 groups, out of which 12 answers were obtained (Table 3.30).

Table 3.30. Questionnaire Survey for Guatemalan Artisans

Business type	Number	%
Business type		
Textile artisan	5	21.7
Dyer	14	60.9
Ceramic artisan	1	4.3
Factory	1	4.3
Tread and ink seller	1	4.3
Factory and wholesale of thread and ink	1	4.3
Total	23	100.0
Interest in indigo		
Yes	7	58.3
No	5	41.7
Total	12	100.0
Expect powder sample		
Yes	7	58.3
No	5	41.7
Total	12	100.0

Type of works carried out by those people who positively answered the questionnaire include the following.

a. A ceramic artisan makes Mayan Glifos and export them to Germany, using mineral colorants from rocks and importing cobalt from Spain. He once worked for a Japanese volunteer (JOCV). He wants indications for how to dye with indigo.
b. A dyer uses ink imported from England and Germany at a cost of US$425 per 55 pounds or

US$17 per kg. They have knowledge of indigo's advantage.

c. A dyer wanted to know if synthetic wool could be dyed with natural indigo or not. (*Actually it is not possible*.) He, however, is interested in learning how to dye with indigo.
d. A thread and ink seller mentioned that a company produces threads with ecological colors, while another one produces only pure threads.

Various possibilities can be conceived in cooperating with the Guatemalan artisan sector, including:

- Selling Salvadoran natural indigo powder to Guatemalan artisans (farmers),
- Teaching them how to dye with indigo (Salvadoran dyers),
- Developing new handicrafts and clothes jointly,
- Selling the products in Guatemala, and
- Sharing the profit.

This kind of process can be explored and developed as a result of continuous effort in contacting them in order to find a best cooperation mechanism for mutual benefit. Guatemala is an easily accessible neighbor country where a large number of tourists visit. Guatemala could be the first foreign market, at which initial marketing efforts could be directed. Within El Salvador, cooperation between powder producing groups, dyers and artisans would be indispensable for creating such a business development indicated above.

(3) Peru and Ecuador

A field survey was carried out from December 14 to 22, 2003 by a Pilot Project member in Peru and Ecuador in order to explore the possibility of exporting Salvadoran indigo powder and dyed products to these countries. The major findings in these countries are summarized as follows.

Peru

a. A wide variety of handicrafts are produced in Peru by artisans and big industries. The country is divided into three major regions in terms of handcrafts production: coastal region, highland region and jungle (Amazonia) region.
b. Types of handicrafts produced in different regions in Peru are as follows according to Dr. Hernando Riveros of IICA Lima,.
    - Highland: handicraft.
    - Cusco and Puno: textiles.
    - Ayacuchos: Retablos (wood frameworks)
    - Ayacucho: quinuas
    - Piura: Chulucanos ceramics.
    - Huancayo: big carpets.
    - Cajamarca and Sierra: Calabazas painted with Buril (Buril is a kind of knife to paint

pumpkins.)

- Jungle: fibers, baskets made from natural fibers, and mimbre (willow), alpaca and llama.
- Arequipa: big textiles manufacturers

There is another kind of classification of handicrafts made by Prom Peru, which is a goverment organization to promote handicrafts and tourism.

c. Big intermediaries purchase handicrafts from producers and sell them in big shopping centers in big cities.
d. Handcrafts producers in Peru usually apply natural and synthetic colorants separately, but sometimes use them together. Natural colorants are highly appreciated by them.
e. Knowledge on indigo is very limited among handicrafts producers.
f. Application of animal fibers such as Alpaca, llamas, sheep, alpaca baby, vicuna and guanaco is popular in Peru. Baby alpaca products are especially popular with high prices.
g. Same kinds of machines are used in Peru and Ecuador.
h. Cusco is a large production and sales center of handicrafts in relation with high tourism activities. Three villages around Cusco, Chincheros, Pisal and Corao, may have a potential for indigo application because artisans there apply natural colorants. The Mendivil art, a popular art form in Cusco characterized by statue commemorating Hilario Mendevil, the founder of the country, is another possibility for indigo use.
i. Kinds of natural colorants applied include Chilka for green, Nogal for brown, Ercche for yellow, Culi for orange, Inca Suncca (inca's chin) powder from rocks for orange and Cochinilla for ginda red.
j. The handicrafts market in Peru is big with different kinds and levels of products. There are many imitation products as well. Alpaca products, however, can not be imitated.
k. Peruvian artisans use synthetic colorants for blue. Although their knowledge on indigo is limited, they generally showed high interest in indigo.
l. Macha Pichu, a worldly known Inca ruin town, has a big handicrafts market. The products sold there are procured from Cusco.

Ecuador

a. Otavaro area, north of Quito in 3-hour bus drive, is an important handicrafts production area in Ecuador. There are approximately 1,500 artisans who could be potential buyers of natural indigo powder. Handicrafts produced in this area are exported to Europe, Costa Rica and Puerto Rico. They produce mainly textile handicrafts. There are many retail shops selling raw materials for handicrafts such as colorants and threads. Although the use of natural colorants is not popular, artisans are highly interested in applying indigo to their handicrafts.
b. Leather and jeans handicrafts are produced in Tunguragua Province, five-hour bus ride to the south of Quito. Sheep wool is dyed mainly with synthetic colorants in Guano in Chimborazo Province, but sometimes mixed with natural colorants.
c. Natural colorants used in Ecuador include Chilca, Nogal and Cochinilla. Although indigo is

not known to artisans, they are highly interested in it.

d. There are handcraft markets in Quito in shopping centers. CAMARI Campesinas shops are supported by NGO. OCEPA is another NGO supporting artisans.

Implications for marketing in Peru and Ecuador

The following directions for marketing Salvadoran indigo in Peru and Ecuador are clarified based on the information collected in Peru and Ecuador and exchanges of opinion with local artisans and related organizations.

a. To establish "Salvadoran Indigo Brand" is an important task in the same way as Peru and Ecuador are famed for their handicrafts. El Salvador should concentrate its effort in brand establishment at this point of time when other countries are still far behind. Once the brand is established, people in the world associate El Salvador with best quality indigo. This kind of status would accelerate export of Salvadoran indigo. Brand establishement can be achieved by various ways such as taking advantage of world famous event such as the 2006 Football World Cup, promotion by celebrity figure and continuous information dissemination by website.
b. It should be recognized that in general indigo is not known in the two countries, but artisans are highly interested in applying indigo. Both orthodox dark blue color and lighter blue color should be considered for pormotion.
c. Two important issues to be further explored on the Salvadoran side are: standardization of indigo powder and combination of natural indigo with animal fibers.
d. Meausrement method of natural indigo powder quality for settling the price should be adjusted, if necessary, in such a manner that it becomes consistent with that of other natural colorants.
e. The order in penetrating into the two countries' market should be considered in the following way.
    1st: Otavalo/Pelideo (Ecuador) due to its smaller market and use of pure cotton suited to indigo dyeing
    2nd: Cusco (Peru), exloring into animal fibre dyeing
    3rd: Lima/Arequipa (Peru) at last due to its likelihood of large quantity demand
f. Export of dyed products to these countries seems more difficult than powder due to two factors: severer competition with local handicarafts with high quality and additional cost for transportation. Continuous efforts shold be maintained to improve dyeing technicque to the world standard by combination of daily trainings and exhbits at international fairs.
g. It would be an effective initial step to organize an opportunity for Salvadoran indigo producers and artisans from Peru and Ecuador to exchange opinions on possible ccoperation mechanism. The Director of Handicrafts, the Ministry of Tourism of the Peruvian govenment and IICA are positive in supporting this kind of initiative.

Appendices II presents the contact numbers in Guatemala, Peru and Ecuador.

3.4.7 Sector analysis based on market information

Tables 3.31 through 3.34 summarize the sector analysis based on market information collected.

Table 3.31. Strengths and Weakness of Indigo Powder Supply

Strengths	Weakness
1. The indigo cultivation area in El Salvador continues growing. 2. Producers are highly motivated to increase their indigo cultivated area. 3. Producers have a strong attitude to learn and develop different practices about indigo production, extraction and dyeing. 4. Salvadoran indigo is considered as one of the best in the world.	1. A large number of producers have a small amount of production. Some are beginner cultivators. 2. Indigotine percentage varies widely. 3. Indigo powder is not sufficiently refined. 4. The producers do not have sufficient information about indigo market and production techniques. 5. Association of some groups of producers is not yet effective. 6. Some of the producers do not have financing to build obrajes. Water shortage is another problem.

Table 3.32. Opportunities and Threats in Indigo Powder Market

Opportunities	Threats
1. Natural indigo is considered as a good colorant for Latin American handcrafts: Guatemala, Mexico, Peru, Ecuador, Bolivia, and Colombia. 2. Natural indigo can be applied in jeans production. 3. Trends and fashions toward use of natural products are rising in developed countries, especially Europe. 4. Availability of land suitable for indigo cultivation in the whole country. 5. Investment for indigo cultivation is low compared with other crops. 6. Indigo growing contribute to soil conservation 7. Technological base has been built with international cooperation programs, a big advantage over neighboring countries	1. Severe competition with other countries, for example, China 2. World recession could damage the demand because natural indigo is just an alternative product in relation to the chemical colorants, which are abundant in the market. 3. Neighbors countries can also cultivate indigo and they have more abundant land than Salvadorans.

Table 3.33. Strengths and Weakness of Indigo Dyed Products

Strengths	Weakness
1. El Salvador produces high quality indigo. 2. There are permanent training workshops for artisans' skills for dyeing products with indigo. (Casa Blanca, IICA) 3. Japanese experts have trained many people in dyeing products.	1. Until now some of the indigo dyed products can be limited to a middle and high social class, because of its high price. 2. Technology is still low to produce large quantity. 3. High quality artisans are limited. 4. Training in developing art creativity is limited. 5. Designs depend more on artisans' experience than on professional creativity.

Table 3.34. Opportunities and Threats of Indigo Dyed Products

Opportunities	Threats
1. Some trainees were trained to mix different natural colors with indigo. 2. Positive reaction by general consumers in Japan and at the El Salvador International Airport	1. Limited information on consumers' needs and preferences. 2. Competition with some Latin American countries producing high quality, but low price handicrafts.

3.5 Research Activities

The following topics were set at the beginning for research activities:

a. Application of natural colorants other than indigo,
b. An appropriate technology for drying indigo leaves that would enable year-round extraction possible,
c. An appropriate technology for extracting indican from dried leaves, and
d. Dyeing silk with fresh indigo leaves

(1) Application of other natural colorants

Three color types were examined: yellow by Palo de Mola (Cholorophora tinetoria), red by cochineal with a help of nanse (Byrsonima crassiforia) and purple by a shellfish species (Purpura panza).

Palo de Mola

Palo de Mola used to be produced in El Salvador and exported to Europe during the colonial period. They can be dyed fast both on natural textiles, both plant and animal origins. Palo de Mola wood is an extremely hard wood and used often for making axles for animal-drawn carts. Palo de Mola wood for dyeing was acquired in the form of sawdust process at a sawmill. After

an ordinary extraction by boiling and aluminum application, cotton cloths were dyed. A dark "egg-yolk yellow" was obtained. With abundance of Palo de Mora and simplicity in extraction, this color is a good color to be combined with indigo blue.

Cochineal

Clear red by cochineal is used often for goods that directly touch human bodies such as foods and cosmetics, ketchup, cookies, lipstick and medicine capsule, for example. It has been said that cochineal is difficult to be dyed on fibers of plant origin. An experiment was made to first dye a cloth with tannin, in consideration of the fact that cotton is dyed well with dye materials containing tannin. After the cloth was dyed with tannin, it was dyed with cochineal. Beautiful and dark red was obtained as a result. While tannin can be obtained from Nanse bark, which is abundant in the Eastern Region, cochineal has been imported from Mexico, Peru and other countries. Cochineal is an expensive dye material. Nanse alone can be used for dyeing brick-like red. A possibility for the future application would be something like cochineal used for a small part of indigo dyed product with a sophisticated design and excellent quality for limited high class consumers with a high price.

Shellfish purple

Field visits were made to the Cuco Beach located south of San Miguel to identify a shellfish species with the academic name "Purpura panza". Some numbers were identified and dyeing tried. A beautiful purple was obtained. It was not confirmed, though, whether or not they exist in abundance. Culturing this species would be a possibility.

(2) Drying indigo leaves and extraction

A simplified effort was made to dry indigo leaves in the laboratory. Harvested plants of 1-2 meters were hung upside down from the ropes in a room with half-opened windows on one side. The air was ventilated by sending wind using a fan placed at the room entrance. It took, on average, three to five days for the plants to dry. The dried leaves were piled up and struck with a stick, resulting in easy separation of leaves from the stems. *Indigofera guatimalensis* dried in a shorter time due to lower liquid content than *Indigofera suffruticosa.* Laboratory tests provided the results of indigo content at 24.1%, 20.9%, 19.8% and 14.0%. While these levels are lower than the average of powders, there is a big room for improving drying technology with sufficient input for research. Considering the benefit of dry leaves application, this topic needs to be studied further. Due to constraint in schedule, no work was made to extract indigo powder from dried leaves.

(3) Fresh leaves dyeing for silk

A big potential was coincidentally found in applying fresh indigo leaves to dyeing silk. First

fresh leaves dyeing was tried applying the Japanese traditional method: fresh leaves chopped up by a mixer and the liquid squeezed out used for dyeing or fresh leaves rubbed to obtain indigo juice. Since rubbing fresh leaves is difficult due to the nature of Salvadoran fresh leaves, which are hard, small and low in liquid content, the first method applying a mixer was adopted. The result, however, was not satisfactory with dyed materials showing grayish and unclear tone. Salvadoran indigo plants are considered to contain indigo brown and indigo yellow contents and they were dissolved into water.

A new way of fresh leaves dyeing was found coincidentally. The water with indigo plants dipped for 23 hours, which was originally planned to be used for measuring the indigo content in the water, was found to be a good dyeing material for silk. A beautiful light blue with slight green tone was produced by dyeing silk with this water. This kind of water is the same as that produced in traditional obrajes in the first tank. The key is the combination of this water and silk. Cotton, a much more popular material in El Salvador, can hardly be dyed by this water. Dyeing silk with fresh leaves in El Salvador has the following advantages:

- Silk can be dyed very fast;
- It generates beautiful color, internationally marketable;
- Both of the two species can be used;
- Dyeing requires only 10 to 20 minutes;
- It does not require sophisticated dyeing technique;
- Only indigo growing countries can produce the product; and
- Tariff for importing silk into El Salvador is as low as 15%.

4. Strategy and Action Plan

4.1 Long-term Scenario for Indigo Industry Development

The basic concept in indigo promotion is "Plan in the long-run and act in the short-run." In order to conceptualize a long-term scenario for indigo development, a supply and demand balance of indigo powder and dyed products in the long run is worked out based on a set of assumptions as shown in Table 4.1. This scenario is prepared for El Salvador as a whole rather than only for the Eastern Region because nationwide cooperation would be vital in promoting indigo dealing with the world market.

The first part provides the present indigo growing area at 324ha in El Salvador. This is equivalent to the production of 9,257g of indigo powder assuming 29kg per ha. Applying a set of assumptions established based on the experience of the extraction activities by the Pilot Project, the number of obrajes required to achieve this production target is estimated to be 180 in total. With the most economical method applied, the investment needed would be US$540,000.

Table 4.1. Indigo Supply-Demand Scenario by Year 2020

1. Indigo Cultivation at present		
Area cultivated with indigo in El Salvador in 2003	324.0	ha in 2003
Powder productivity	20.0	kg/mz
	28.6	kg/ha
Powder that can be produced	9,257	kg
Obraje capacity		
Amount of powder produced	1	kg/cycle
Number of cycles per week	4	cycles/week
Number of weeks per year when indigo plants are available	12.9	weeks
Number of cycles per year	51.4	cycles/year
Amount of powder to be produced by an obraje in a year	51.4	kg/year
Number of onbraje required to process all plants grown	180	obrajes
Construction cost		
Investment cost per obraje	$3,000	per obraje
Total investment cost	$540	thousand
2. Production of dyed products		
Amount of indigo powder required for dyeing a T-shirt	33.3	gram/T shirt
Number of T-shirt that can be dyed with present powder supply	277,714	T shirts
3. Development of indigo dyers/shop network		
Number of T-shirts one shop can sell	10	T-shirt/day
	300	T shirts/month
	3,600	T shirts/year
Number of shops needed to sell all the T-shirts	77	shops
4. World Demand for T shirt		
Population	10,000,000,000	persons
T-shirt consumption	1	T-shirt/person/year
T-shirt demand	10,000,000,000	T shirts/year
Supply by El Salvador	0.1%	set as target
Demand for Salvadoran T shirt	10,000,000	T shirts/year
Number of shops needed	2,778	shops
Amount of indigo powder required	333,333	kg
Land area to be cultivated for indigto growing	11,667	ha
	16,667	mz
Average farm area per farmer	1	mz
Number of farmers to benefit	16,667	
Number of obrajes needed	6,481	
Investment cost required	$19,444	thousand
5. Economic impact		
T shirt price	$20	
Total sale	$200,000,000	per year
Value added ratio	50%	
Value added to be generated	$100,000,000	per year
GDP in El Salvador	$14,227	million in 2002
Constribution of indigo T-shirt to GDP	0.70%	

The amount of indigo powder needed to dye a T-shirt is about 33 grams according to the Pilot Project's experience. The indigo powder, therefore, that could be produced at present at 9,257 kg could die about 277,000 T-shirts. Assuming a shop sells 10 T-shirts a day, the number of shops needed for selling 277,000 T-shirts a year would be 77.

The question is if this magnitude of production and sales can be achieved or not. An assumption is made that 0.1% of the world demand for T-shirts is to be filled by Salvadoran T-shirts or T-shirts dyed with Salvadoran indigo powder by the year 2019. This is rather a long-term target than projection. Based on the same assumptions applied before, the total number of shops required to meet the world demand for T-shirt at 8.1 million per year would be 2,247. The impacts on farmers are summarized as follows.

- Amount of indigo powder to be produced: 269,600kg
- Land area to be cultivated with indigo: 9,436ha
- Number of farmers to benefit: 13,400 farmers
- Number of obrajes needed: 5,242

Economically this magnitude of indigo growth would contribute to raising GDP in 2002 by 0.6% (Table 4.1).

An ambitious goal is recommended for indigo growth, which is for Salvadoran T-shirts and powder to fulfill 0.1 % of the world T-shirt market. To achieve this goal, "Indigo Suppliers Network 1000" (abbreviated as "ISN 1000" hereafter) is proposed to be established by the year 2019, the final target year for the present Study. ISN 1000 means that the establishment of 1,000 indigo dyers and shops in El Salvador is aimed at by 2019. ISN 1000 will provide all kinds of products dyed with indigo and other natural colorants in all the forms possible such as clothes, ceramics, cosmetics and decorations. The portion of powder that cannot be processed within El Salvador can be exported to overseas artisans and shops, selling similar goods.

4.2 Strategies

The strategies for indigo promotion include the following:

- Recognition of indigo as an important cultural asset of El Salvador,
- Establishment of El Salvador brand,
- Maximization of value added with emphasis on final goods,
- Creation of market,
- Continued effort in powder marketing and development of new products, and
- Creation of a cooperative and support mechanism with minimum investment.

Indigo as a cultural asset

It has been known that there were more than 7,000 obrajes in El Salvador for extracting indigo powder during the colonial time. This level is coincidentally close to the number of obrajes required to achieve the scenario at 6,400 shown in Table 4.1. Indigo promotion should be regarded as the revival of Salvadoran history and heritage instead of regarding it just as an economic opportunity. Confidence of Salvadoran people in their own culture will be reinforced. This kind of recognition at the base would facilitate understanding of farmers, dyers, exporters and all the related parties to the promotion activities and lead to acquiring cooperation and support more easily from wider segments of the society. Activities such as tourism and developing links with overseas artisans would also be smoothly undertaken.

Establishment of El Salvador Brand

It would be important that Salvadoran indigo be regarded with prestige by overseas markets so that people would associate high quality indigo with El Salvador. A number of ways such as follows are possibile for Salvadoran brand establishment.

- Continuous advertisement by website
- Taking advantage of international events such the football world cup and fairs
- Advertisement by well-known celebrities

All these actions can be taken simultaneously. An example of taking advantage of international events would be to convince national football team of Italy with a nickname “Azuri” (meaning “blues”) to make their players wear indigo dyed uniforms at the next world cup games in Germany in 2006. The same can be tried for Japanese team or even Salvadoran team, which both wear bluish uniforms. Football related goods for supporters could also be dyed with natural indigo.

Emphasis on final goods than on raw material

An emphasis in indigo promotion should be placed on final goods, i.e., dyed products due to the following reasons:

a. Higher value added is expected from dyed goods than from indigo powder,
b. Dyeing requires sophisticated techniques, which makes it difficult for other countries to catch up once technology is rooted in El Salvador, and
c. Final goods are less affected by overseas market condition in price and quantity than powder.

Emphasizing dyed goods does not mean that farmers’ needs do not have to be considered. It is opposite. Demand-led promotion would ensure market outlet for raw materials and provide better price for indigo powder. It is recommended that the relationships established in the Eastern Region between farmers and dyers be developed into a system of mutual cooperation,

in which dyers place orders to these farmers for the next year's powder.

Creation of market

Indigo products should be promoted recognizing the importance of creating market rather than trying to seek existing market. Indigo products are different from basics in daily life such as TV and food. Consumers turn their eyes to and buy them only when products are attractive enough. They do not pay attention if they are not attractive.

Products should be elaborated so that they meet specific requirements of the target segment in a market. A preliminary marketing survey in Japan revealed that there is a variety in consumers' preferences. The sales activity at the airport indicated that generally non-Japanese consumers are more generous in appreciating Salvadoran indigo products. There are different kinds and levels of requirements to a commodity. It would be important for dyers to recognize these different characteristics of each market segment, select a market that matches his/her strengths and artistic sense and promote sales of the priority goods. Two ways of thinking would be possible. On the one hand, dyers can seek producing a good that will be universally appreciated. On the other hand, they can produce something very unique carrying some ethnic originality. As far as goods are made with good technology, both types of goods have a high potential for successful promotion.

"Marketing creation strategy" should take into account both market potential and communication easiness. Potential market could be defined as follows in the order of easiness in access:

- Eastern Region market,
- Salvadoran market,
- Central American market (Guatemala, Costa Rica),
- South American market (Ecuador, Peru),
- USA market,
- European market, and
- Japanese market.

While direct contacts should be sought for the markets easier to access, application of modern communication technology such as E-commerce needs to be promoted for promoting Salvadoran indigo products to the markets located in distance and where IT penetration is higher.

Cntinued effort in powder marketing and development of new products

While final goods in the form of dyed products should be emphasized as explained above, continuous efforts should be maintained to develop powder market and new types of products applying indigo powder at the same time. The need for developing powder market is derived

from the following factors.

- Expectation is high among farmers for the indigo's possibility to become an alternative crop to traditional crops such as coffee.
- There seems to be a certain level of demand for indigo powder in overseas market, mainly from artisans.
- Powder production requires relatively simpler technology compared with dyeing, therefore could offer faster solution to poverty alleviation.

Preliminary marketing survey in Japan and through the Internet obtained some positive views on Salvadoran indigo powder. A Japanese dyeing expert commented that Salvadoran indigo has a good quality and above all is economical. In response to the questionnaire survey through e-mail, there was one request from a Canadian artisan for a sample. Although large-scale order at such a magnitude as to replace synthetic indigo seems unlikely, a certain level of demand could be developed in the form of accumulating numerous small quantity orders from overseas artisans.

There are some information concerning new ways of applying indigo such as cosmetics and medical use. A medical research made by the University of El Salvador indicated a possibility to apply natural indigo for identifying bacteria that causes vaginal infection. These possibilities should be further explored and necessary measures and actions taken.

Creation of a cooperative and support mechanism with minimum investment

A cooperative and support mechanism should be created in the two aspects: cooperative mechanism among farmers, dyers and exporters; and support mechanism by government and other organizations. First farmers and dyers in the Eastern Region, for example, cooperate basically as a supplier of a raw material and buyer, but also as partners in improving their products, both powder and dyed products. Information on the kind of powder quality required for better dyeing should be transmitted to farmers so that they put their effort to improve the powder quality. Provision of better powder would lead to upgrading dyed products, further developing new market and bringing in higher standard requirement, an upward spiral effect. The network, thus, started at a local level, could develop into an international network as qualities of both powder and dyed products improve. As going through this kind of process, farmers will be ready to respond to a large quantity offer from a jeans factory, for example, later. They will be standing in a more advantageous and autonomous position.

The Government and other organizations should provide support measures with minimum investment. There already has been an accumulation of indigo-related technology in El Salvador as a result of efforts made by some organizations such as Concultura with international cooperation programs. These resources should be effectively utilized. A possible support mechanism could contain the following division of roles.

MAG/CENTA: dissemination of farming technology

ITCA:	dissemination of dyeing and sewing techniques
CONCULTURA:	dissemination of extraction techniques and cultural value
PROESA:	export promotion
UES:	research and development
CORSATUR	preparation and implementation of an indigo tourism promotion plan
MOE:	small business development
CND:	coordination

Many of the organizations, which cooperated with the Pilot Project, could support this mechanism. An important factor on the Salvadoran side would be to have a strong promoter who would take positive actions in making promotion and coordination. A logo could be created to symbolize Salvadoran indigo and used for sales promotion under this initiative.

4.3 Follow-up and Action Plan

4.3.1 Follow-up activities

The following activities were discussed and arranged in January 2004 among the Pilot Project members and related organizations so that the momentum created by the Pilot Project implementation be maintained or even accelerated.

(1) Support for small-scale comprehensive indigo promotion program

Two NGOs that cooperated with the Pilot Project prepared a proposal for the implementation of a small-scale indigo promotion program in Morazan Department. The proposal contains all the components related with indigo such as farming, extraction, dyeing, marketing and research activities, similar scope to that of the Pilot Project but on a smaller scale. The Study Team made a recommendation that the capacity of the facilities, that of obraje for example, be adjusted to such a level as to be consistent with the volume of dyed products that could be sold in the USA market where these NGOs have specific marketing outlets. The need for laying an emphasis on marketing dyed products as explained in "4.2 Strategy" above was stressed. It is planned that the proposal will be submitted to donor agencies for financial support.

(2) Maintenance and of Jocoro obraje

It was confirmed with ADEL-Morazan that the obraje constructed in the premise of ADEL Morazan in Jocoro, Morazan Province, be maintained and used by them for training purpose. Some farmers might use it for production purpose.

(3) Farming and extraction activities at UES San Miguel

UES San Miguel ("UES-SM" hereafter) is interested in making a research on agronomical analysis of indigo such as altitude, soil, fertilization and harvest timing capitalizing on the

indigo planted by the Pilot Project in the UES-SM campus. Since UES-SM lacks human resources to carry out the research, however, UES-SM would need cooperation of farmers. It would be necessary for CND to arrange a meeting between UES-SM and farmers committee comprising two representatives from each department to explore possible cooperation mechanism. The cooperation would be needed also for chemical analysis at the extraction stage. While UES-SM is keen to take up such subjects as "comparison of modern equipment and obraje" and "relation between indigo powder percentage and relevant factors", the lack of fund constrains them in carrying out these researches. IICA is ready to provide data on existing findings for the latter topic, from which UES-SM could develop their own research utilizing the obraje constructed in the UES-SM campus and with the cooperation of farmers.
In response to a proposal by the Study Team that integration of indigo subject, especially extraction and dyeing, into their curriculum be desirable, UES-SM suggested that a conference be held with the participation of farmers, dyers, students and professors to discuss the issue. CND is expected to arrange this kind of opportunity.
UES-SM is now capable of measuring indigotine percentage in a simplified manner as a result of provision of some chemicals by the Pilot Project and training of a chemist in San Salvador.

(4) Dyeing activities
The dyeing workshop participants formulated a group called ACOTENO (Cooperative Association of Dyers in the East), prior to the completion of the Pilot Project. The ACOTENO's main objective is to continue dyeing activities utilizing the dyeing equipment used in the Pilot Project and handed over to CND. ACOTENO members will share the equipment according to the regulation on which the members are currently preparing. The Study Team pointed out a possibility of the JICA San Salvador office to support ACOTENO's activity through arranging visits of a JOCV dyeing expert to San Miguel for providing training at intermediate and advanced levels.

(5) Airport sales
The success in 1.5-month experience at the airport encouraged the Pilot Project members in charge of supplying dyed products to make a request to CEPA for allowing them to continue the sales activity after January 21 under their own initiative. CEPA considered the request and came to a decision that they would permit them to continue the activity as part of the Pilot Project until the end of April 2004. A new contract document is currently under preparation.

4.3.2 Action plan

It is recommended that the following actions be taken between 2004 and 2006. The main supporting organizations are indicated.

(1) Creation of Indigo Promotion Task Force ("IPTF" hereafter), comprising the following

organizations and stakeholders→ under CND's initiative

a. Government organizations: MOE, MAG/CENTA, ITCA, CONCULTURA, PROESA, CORSATUR, CND
b. Donor organizations: IICA, JICA, GTZ
c. Educational organizations: Dr. Jose Matias Delgado University (DJMDU), UES, UES-SM, ENA
d. Farmers groups
e. Dyers groups
f. Export companies

(2) Preparation for and participation in the International Indigo Conference scheduled in September 2004[(1)] → IPTF

[(1)] *International Indigo Conference is planned by IICA, CONCULTURA, GTZ and other organizations in September 2004, inviting prominent indigo and natural colorant dyeing experts from all over the world. Details are under preparation.*

(3) Marketing

a. Development of contacts with Central American artisans and shops (Guatemala/Costa Rica) to explore possible cooperation mechanism→ PROESA/IICA
b. Development of contacts with South American artisans and shops (Ecuador/Peru) to explore possible cooperation mechanism→ PROESA/IICA
c. Marketing activity in USA with the cooperation of Salvadoran associations → PROESA/IICA
d. Preparation of an indigo tourism promotion plan→ CORSATUR/municipalities
e. Development of new products→ITCA/DJMDU
f. Creation of a website → DJMDU/MOE/ITCA

(4) Dyeing

a. Introductory dyeing courses by Salvadoran dyers → DJMDU/ITCA/Dyers groups
b. Intermediate and advanced dyeing courses by JOCV expert based in El Salvador and Japanese dyeing experts dispatched on a short-term basis→ JICA
c. Introductory, intermediate and advanced course on product design→ ITCA/DJMDU
c. Introductory course on business management, especially cost management and marketing→MOE
d. Survey on material procurement (cotton threads, good quality cotton cloth, silk etc.) → MOE

(5) Extraction

a. Creation of Puntero School, at which specific extraction technology focusing on various timing judgment, is taught for a limited number of capable farmers representing farmers groups → CONCULTURA/ITCA/UES/UES-SM
b. Research and development of improved extraction technology with chemical analyses and proper wastewater management→ UES/UES-SM
c. Provision of financial assistance program to support extraction facility construction in

key locations for training and production→ MOE

d. Preparation of a nation-wide quality control organization→ MOE/ITCA

(6) Farming

a. Continuation on agronomical researches on indigo and integration of the results→ ENA/UES-SM

b. Preparation of a guide to indigo farming→ ENA/CENTA

Appendix I. Reasons for Stopping by at Kiosk and Comments on Indigo Products at El Salvador International Airport

Reason for stopping by	Comments
I can wear t-shirts all year.	(none)
(none)	Should include more colors like bags, paper or recycle. Symbols for all, like añil.
I can use the sweater at home in cold weather	If I had more money, I would have bought something.
Because I like the color and it is cheap.	The kiosk is excellent, in a good place and the products are beautiful.
I like the design.	The kiosk and products are beautiful.
(none)	It is beautiful.
It looks very original and I like things from El Salvador and the color is excellent.	The place is good and adequate, The products are beautiful and there are different things
The products are attractive.	The kiosk is beautiful and very attractive.
(none)	The kiosk is excellent and in a good place. There are very beautiful products
I like batik.	The kiosk is in a good place. I like the products
There are many sizes, the design are delicate and well worked.	The place is good and the decoration is beautiful, I like the handicrafts made with Indigo.
Para las salidas de baño.	The kiosk is in an excellent place and the products are very adequate.
They are very delicate.	The location is good.
It attracts me.	The location is good.
It catches my attention.	The kiosk is excellent and is in a good place, I like it very much.
It can be used in many ways.	The kiosk is beautiful and the products, too.
Because of the beautiful color.	The location is good.
(none)	To have more products like pants and skirts.
Because of its good quality	(none)
They are very soft.	It would be good to have more products.
It is a good present for young people.	Everything is beautiful.
They are comfortable and fit well.	(none)
Because of the design and variety of its uses.	The products are beautiful and if I had more money I would buy more.
They are comfortable	(none)
Because of the design	(none)
The design has details.	There is not enough variety.
(none)	The location is good.
The product is not common.	The products should have different designs or styles.
The design is original and beautiful.	The location is good for sale and the products seem to be good.
The design is original and beautiful.	(none)
Everything is beautiful.	(none)
(none)	To have more sizes of each product.
Because of the design	(none)
It shows the Salvadorian culture.	Beautiful
(none)	To be longer
The product is not common.	(none)
I like it.	The products are good
I like the designs and details	Very beautiful and pleasant place
(none)	More blouses for young women
I like the color.	(none)
I like the design.	The tablecloth is too big and does not have style. It is rustic.
Because the design is beautiful.	(none)

Reason for stopping by	Comments
Because of the variety and innovation of the products	To have original designs made by the owners
I like the design and color	It is good and has many products.
The products are new.	The person who attends the kiosk is very kind.
It is the clothes I use more frequently.	(none)
The product is not common and the tradition has been revived.	I do not like the tablecloth because it does not have style and it looks rustic.
The product is not common.	(none)
I like blue.	To have more promotion, to be longer at the airport
I like it.	(none)
It catches my attention.	It looks good and has a good color.
(none)	It is good that somebody is encouraging this initiative.
The product is not common.	(none)
I like the design.	(none)
It is original.	(none)
The product is not common.	It is excellent and the place is beautiful and adequate, I would like it to be longer.
It has a good design and it is an art.	(none)
I like it because the textile is soft and I like the design.	(none)
It catches my attention. I like its blue color..	Beautiful place, it catches your attention.
I like it because of the design. It is difficult to make the designs.	(none)
The products are attractive.	(none)
Because of its blue color.	It is beautiful.
The products are not common and it is good to rescue what has been lost.	It is beautiful and the place is good.
The products are not common.	(none)
I like the design. They are not common.	I like it very much.
It catches your attention.	It is a beautiful place. I like it very much
I like it very much. I like blue.	I like the place very much.
It can be worn with other things.	To have variety of designs.
Because of its color, the design and the texture.	I like the place but it should have more variety.
Because of its design and quality.	It is excellent
(none)	I liked the place very much.
Because of the color and the products are original.	(none)
The products are attractive.	(none)
In general it is excellent I like it very much.	(none)
Because of the variety.	(none)
The design is not common and it is not easy to do it.	It is beautiful and it is in an denudate place.
I like very much the blue and the designs.	(none)
It catch your attention and it is not traditional.	Congratulations, the place is beautiful.
(none)	It has very good presentation.
It has a casual style.	It is very good.
They are beautiful (pillows).	To have reasonable prices and promotions.
They are different and useful.	The design is beautiful, things are well shown, the seller is kind.
I like everything. This is a good idea.	(none)
Because the design is different.	Very original and different.
Because of the shibori technique.	To be longer at the airport.

Reason for stopping by	Comments
It is soft.	He will come back to buy something for his daughter
(none)	She is a coffee grower and would like to know more about indigo.
(none)	To have more variety for children
It is different.	She likes the products. Somebody gave her a picture of indigo (batik) as a present.
(none)	To have longer t-shirt.
(none)	Everything is beautiful.
You can wear.	It is good.
Good quality	To have more information about indigo plant
(none)	Wants to know about the stability of the color in the textile and if the item gets shrunk
(none)	A friend of hers wrote a thesis about Indigo in Jose M. Delgado University
Because of its use	(none)
(none)	Put a song, for promotion.
(none)	Wish you all the best for the rescue of indigo culture in El Salvador.
(none)	In transit... has seen products in Costa Rica made with indigo.
(none)	Has bags made of indigo and likes the different styles here.
(none)	He is a pilot. Wanted it to say El Salvador.
(none)	Different types of materials. He prefers quality.
It has different designs and I like everything. In general they are beautiful.	The place is beautiful and it has a good location. I would like it to be here longer.
I like very much the designs.	(none)
I like its color and size.	(none)
It catch my attention because of the designs	It is not godd not to accept credit cards. Do not have bigger sizes like XXL
I like very much the designs.	Everything is beautiful. The kiosk is located in a good place.
I like everything because it is rescuing ancestral things.	It is in a good place.
I like the designs	Do not accept credit cards
I like very much the designs.	I like the place and it is a bad thing you do not accept credit cards.
I like the way of making the designs of the Salvadorian people.	(none)
I like the product.	(none)
I like the designs. They are attractive	I like the place and it is a bad thing you do not accept credit cards.
I like the designs, they are attractive.	(none)
I like the design for my daughter.	The products are beautiful.
The products are attractive.	(none)
They are useful.	To accept credit cards. The product is beautiful
To her personal use	To have blouses with a more female style.
I like the color of the t-shirt for children.	To accept credit cards
The t-shirt is comfortable.	To have more variety of blue tones.
(none)	To have more sizes for women.
I like it.	(none)
(none)	To accept credit cards
For present.	He would have bought a t-shirt if credit card is accepted.
I like the design. It can be worn with many other clothes.	To have more sizes.
I like the design and it reads El Salvador.	(none)
In general I like everything and the color is very attractive.	(none)

Reason for stopping by	Comments
I like very much the designs.	(none)
They are attractive.	To accept credit cards.
I like the designs.	To accept credit cards.
(none)	Congratulations, the place is beautiful. To accept credit cards.
They are beautiful.	(none)
It is not common.	(none)
The color is attractive.	To accept credit cards.
The designs are attractive.	Everything is beautiful.
I like everything.	(none)
I like the designs and the blue color	To accept credit cards
It would be better if it had a zipper.	It is beautiful.
The color is nice, but it is too small. There must be bigger sizes.	It is beautiful and practical
I like the designs They are different, but there must be bigger sizes.	(none)
All are beautiful.	It is a nice and creative place.
They are creative and attractive, the color blue is not so strong.	(none)
The culture is being rescued.	(none)
They are comfortable.	Just a few reads El Salvador, To have bigger sizes.
The products are attractive	(none)
They are different and attractive.	If credit cards were accepted, she would have bought a t-shirt
The designs are not common,	Good luck.
I liked very much the material and design,	(none)
I like the designs,	Nice place. To accept credit cards
The designs are different and not common,	(none)
The Maya designs	Excellent place.
I like it because it is not common, it would be better if it were bigger,	(none)
The designs are attractive.	(none)
I like very much. It is not common.	The place is beautiful. I like it.
Never have seen dye candles.	Congratulations, beautiful place.
It would be good to show dying process.	(none)
I like it because they are small.	Nice place and attractive for foreigners.
Nice designs.	(none)
I like them very much.	(none)
They are beautiful.	(none)
I like it because it is small and it have beautiful designs.	(none)
I like very much the blue color.	(none)
They are beautiful and they are not common.	(none)
It is beautiful for girls.	(none)
It is nice and I like it very much.	(none)
It is a nice souvenir.	(none)
He can wear it.	(none)
(none)	He likes the place.

Appendix II. Information on People Visited in Guatemala, Peru And Ecuador and Related Data

Table A-1. Businesspeople Visited in Quetzaltenango Neighborhood in Guatemala (September 1-3, 2003)

Location	Person contacted	Kind of work	Interest in indigo	Indigo sample required (Potential consumers)	Market and production process information	Complementary Information
1. Totonicapán	Félix Solís	Textile artisan				
	Federico Tzic	Textile artisan				
	Pablo Chuc	Textile artisan	Yes	Yes		
	Marcos Cutz	Dyer	No	No		
	Basilio Gutierrez	Textile artisan	No	No		
	Rafael Santos Gutierrez / Alfarería San Francisco 766-4419	Ceramic artisan	Yes	Yes	He exports to Germany, he makes Mayan Glifos, he use mineral colorants taken from rocks, he imports cobalt from Spain, and he worked for JOCB from Japan.	He wants indications for dyeing indigo
2. Cantón Pasajoc	Alberto Nicolás Ordóñez Tintorería El Diamante Pje. Tzamsajoc – Totonicapán	Dyer	Yes	Yes	The price of the barrel of 55 pounds of German ink is $425. Ink comes from England and Germany	Mr. Ordóñez knows the indigo advantages
3. San Andrés Xecul	Miguel José Chancoy 1° Av. – 06, Zona 1 Barrio Juan Pablo II	Dyer	Yes	Yes, 3 samples	He wants to be sure that indigo also can be applied in synthetic wool	Interest in obtaining indigo dyeing techniques
	Sr. Ventura Zona 1	Dyer				
	Mateo Desiderio Hernández Barrio Pachacol – Calle Principal 4-43	Dyer	Yes	Yes		
	Andrés Bonifacio	Dyer	Yes	Yes		
	Andrés Zaquiqui	Dyer				
	Nicolás Zaquiqui	Dyer				
	Venancio Zajché	Dyer				
	Martín Florentín	Dyer				
	Lucas Cux	Dyer				
	Juan Daniel Zaquic	Dyer				

Location	Person contacted	Kind of work	Interest in indigo	Indigo sample required (Potential consumers)	Market and production process information	Complementary Information
	Nicolás Ordoñez	Dyer				
	Tienda y tintorería La Estrellita. Familia Sacche – Saquil Zona 1, 2° Calle 3-13	Dyer				Absent PD: This city is basically dedicated to dyeing work and there are almost 20 businessmen.
4. Zunil	Cooperativa de Tejedoras Santa Ana 765-3885 Gerente: Candelario Ramos Chai	Textile artisan	No	No	The members of the cooperative are 550 women that make skirts and blouses	They say that Mish thread brand is better than Coyote brand because the last one has speck
5. Cantel	Fábrica de Tejidos Cantel Km. 218	Industrial plant	No	No		
6. Salcajá	Jorge Senobio Soto 3° Av. 3-14, Zona 1	Thread and ink seller	Yes	Yes	They say that Mish thread brand has ecological colors while Coyote brand only pure new thread	They sell ink from Germany and England
7. Quetzaltenango		Industrial plant and wholesalers of thread and ink	No	No		Some people say in Salcajá in Quezaltenango they don't have handcraft production but they have industry that use chemical inks.

Table A-2. Businesspeople Visited in Peru and Ecuador (December 14-21, 2003)

Location	Person contacted	Kind of work	Interest in indigo	Address/Telephone	Market and production process information	Complementary Información
Ecuador: Quito (Dec. 14)	Mercado Artesanal Mariscal: Raúl Santellan	Handicraft seller	Yes	Mercado La Mariscal, Local 144. Phone 099471691, 5936925185	In Cotacachi, Luis Alberto Tituaña exports pure new cotton to United States. Alpaca fiber is mixed with fiber of different colours of other alpacas.	His father Julián Santellan lives in Otavalo and he only works with wool.
	José Urtado Salasaca. Mercado La Mariscal	Handicraft seller	Yes	Reyna Victoria Aillón, puesto # 157 Cell 099681851	Cantón Ambato: The workers are specialized in making leather. Cantón Otavalo: Specialized in Textiles. Cantón Guano: They used sheep wool. Cantón Cacha: They process wool and dye it.	
Ecuador: Otavalo (Dec. 15)	Peguche: Carlos Pastillo.	Handicraft seller		Primera entrada de la Pana a la segunda casa.	They use Batik technique they dye 100% cotton	
	Peguche: Marina Muenala: Galería Peguche Guazi.	Handicraft seller	Yes	Primera entrada a Peguche.	In addition to the indigo blue they ask for other colorants.	
	Peguche: Benjamín Terán	Artisan	Yes			
	Quinchuqui				They use 100% natural cotton buy they also use chemical colorants.	
	Carabuela: Daniel Perugachi	Artisan	Yes		They use lamb wool and the acrilic cotton to make sacks, hats, gloves, socks. They bring their products to Otavalo and later this is exported. In Carabuela there are more than 1,500 artisans.	Before they produced handicraft and now they use machines. Before they produced 1 sack per day, now they produce 12 sacks per day.
	Ilumán: Carlos Alfonso Conterón Córdova.	Artisan. He is a teacher in wool and cotton handicraft He is a leader of GNO of artisans.	Yes		The artisan used to buy wool in Otavalo and they only make the hat. They use from nogal from brown color.	He wants to meet indigo cultivation in El Salvador.

Location	Person contacted	Kind of work	Interest in indigo	Address/Telephone	Market and production process information	Complementary Informatión
	Otavalo: Luis Saran Zig	Dyer and seller	Yes		In the central park there are Ecuadorian and Peruvian products. There are distributors of thread, colorants and raw materials.	
	Otavalo: Mauricio Benitez	Owner of thread storage.	Yes	Phone 2920029 Cell 098539227 maurobox71@hotmail.com	He has a big interest for indigo and he wants to sell Salvadoran products dyed with indigo.	He wants to have a license or representation of Salvadoran products.
Ecuador: Quito (Dec. 16)	Camari: Patricia Castillo.	Coordinator of handicraft purchases	Yes	Phone 5932549407, 2567112 Fax 2230634 camari@uio.satnet.net Marchena Oe 2-38 Ibersalles (Santa Clara)	They have big interest in purchasing dyed products but they don't want to buy indigo powder. They want to observe Salvadoran products in the second week of January. They want to see the prices list.	
	OCEPA: Organización Comercial Ecuatoriana de Productores Artesanales.	President: Miguel Salazar.	Yes	Versalles y Carrión, Oe 2-32. Phone 2557276, 2557273		
	Mercado Santa Clara		No		Around the popular market there are many people who sell ceramic, silver and straw items.	
	IICA		No		Their programs are oriented to organics fruits and vegetables. Next year they will take care of handicraft.	
Perú: Lima (Dec. 17-19)	Promperú	Government organization oriented to the tourism increase	No	Av. Basadre y 10 Calle	They gave me information about handicraft and the address of artisans and handicraft businessmen	
	Indian Market: Petit Thouars	Handicraft Market	Yes	Av. Petit Thouars, Miraflores.	They use natural colorants from herbs like parsley, cocaine fiber, urine from alpaca, vicuña, guanaco, llama, and sheep to fix colorants. Baby alpaca is the best quality in this kind of products.	They use marijuana and cocaine fibers to make candies, clothes and polos. They spin the alpaca fiber and they clean it with manual machines. This is a market with low prices.

Location	Person contacted	Kind of work	Interest in indigo	Address/Telephone	Market and production process information	Complementary Informatión
	Ministry of Foreign Trade and Tourism	José A Zavala Ríos (Director of Handicraft Promotion)	Yes	Calle 1 Oeste, # 50-60, Urb. Corpac San Isidro Lima 27 jazavala1@hotmail.com Phone 99160206	He shows interest to meet indigo cultivation. He supports the ecological trend.	www.mincetur.gob.pe In this web page the Peruvian handicraft production is detailed.
	Larcomar Handicraft Market		No		There are 3 major boutiques of high quality: Alpaca 111, Incas Threasure, Perú Handicraft	They sell textile handicraft, leather and ceramics of high quality at high prices.
	International Organization of Peruvian Artisans	Moner Lizama Huaman	Yes	ciap@amanta.rep.net.pe Calle Víctor Navarro Mz. B Lt. 13, Urbanización El Establo. Phone 1-5684018 Fax 1-5677882 Apartado 668, Lima 100	In Ayacucho artisans know about natural indigo but they only use chemical indigo. They also use natural colorants like cochinilla and nogal. This last one doesn't need a chemical fixer because it comes from hot weather.	He is very interested in buying indigo, they have contacts with CORDES in El Salvador through the Latin American network of community trade.
	GHM Business: Representatives of Peruvian Handicrafts		No		We visited them but the person responsible was not there.	
	Peruvian Hands		No		They didn't show any interest in buying indigo.	
	Peruvian Roots.	Cristian Calirgos (Manager)	Yes	xtian@peruraices.com Phone 511-4648370, 9945-4729, 9944-0632	They show interest in using indigo. They work in Piura region with artisans. They sell Chulucanas handicraft wich is a decorative ceramics make by hands. They use natural colorants from roots. They have red and browns colors but they don't have blue one. They use green and blue colorant from chemicals. They get the brown colors from rock in the mountains. They make the designs for artisans and they work textiles with Chipiba tribe in the jungle north of Amazonas. They export to the United States and Israel.	Their foreign clients are asking for natural colorants. They provide the shops in Arcomar. They bake the ceramics with mango leaves an they polish them with stones. They ask for exclusives designs for the artisans to sell a very diferentiated product.

Location	Person contacted	Kind of work	Interest in indigo	Address/Telephone	Market and production process information	Complementary Informatión
	IICA	Dr. Hernando Riveros Serrrato (Executive Director of PRODAR)	Yes	Av. Jorge Basadre 1120, San Isidro. Apartado 14-0185. Phone 511-4224583, 422-8336 hriveros@iicacrea.org.pe prodar@iicacrea.org.pe	They manage FIAR fund and the marketing finance fund in order to the producers networks present projects. They can support these activities: visit training in obrajes between small and big producers. They can support also the image campaign for indigo, the rout for agrotourism of indigo, the use of web page of IICA to promote Salvadoran indigo.	This program support giving technical cooperation to small producers who want to give added value to their products. They support training visit for agroindustry in developing countries and the producers' networks. They believe that indigo and loroco are two important products that can be differentiated as typical products from El Salvador. Dr. Riveros gave me a handicraft classification in Perú which is inlcuded as attachment.
	Petit Thouars Market: Inocencio Hernández (Artisans Asociation: Ichimay Wari)	Artisan and seller of handicrafts	Yes	Av. Petit Thouars 5466, stand 105. Phone: 3345017, 4300263	He is going to apply indigo in wool. He uses nogal, cochinilla and airampo. From nogal he uses the nut to get brown color. He use the leaves to get light colors and he uses the stem to get dark colors. Nogal doesn't need reactives.	He says that artisans association in Lurín is integrated by 10 artisans of ceramics, 1 retablos hand maker and 2 textiles hand makers.
	Wool Trade from Perú, S.A.	Idilio Salinas Huamani (Chief of Dyeing Products Department)	Yes	Phone: 451-1070, Casilla 4041 Fax. 5114-640250 Mariscal O.R. Benavides 5082 Callao 2 - Perú.	The enterprise works with alpaca and sheep wool and with synthetic thread. He thinks that indigo can be fix in the alpaca thread with a high difficulty because the thread is very thing and weak and is organic and because caustic soda can spoil it.	
Perú: Cuzco and Machupichu	Workshop Hilario Mendibil		Yes	In front of Plaza San Blas in Cuzco.	They work popular art and use rice, potatoes and wheat pasta	They use manual textile machines.

Location	Person contacted	Kind of work	Interest in indigo	Address/Telephone	Market and production process information	Complementary Informatión
(Dec. 20-21)					and also gypsum. With these raw materials they make religious images, which later they paint with natural colorants. The creativity of image with long neck is based on the long neck of alpaca. They report that in Chincheros there are workers of textiles from sheep wool, alpaca, and baby alpaca. There are also some textile handmakers in Pizal and Corao.	
	Hermenegilda Contreras	Artisan and seller	Yes	Chinchero, Cuzco Phone: 84401069 Brother: Natividad Héctor Contreras Quispe. San Juan de Miraflores Cucharca, Lima. Phone. 012927218	She wants to buy indigo to be sent to his brother in Lima. She will apply the indigo in wool and cotton. She uses natural colorants as chilca, nogal, erche, culi, inkasunka, and cochinilla. Cochinilla comes from Limatambo Valley and it is sold in the Cuzco shops. In Puno the indians work with alpaca and they get products like cinchas, correas, carpets, sacks, table roads, blankets, etc. Among the artisans towns around Cuzco there are San Blas, Chincheros, Pucará.	These people don't work anymore with chemical colorants and they want to buy indigo. They apply the technique of "Mate burilado" painting the pumpkins. The alpaca thread gives different colors like brown, gray, beige, lead and dark lead. These threads are put together and they don't use any chemical and natural colorants in alpaca products.
	Handicraft market in Machu Pichu		No		In Aguascalientes, close to Machu Pichu there is a popular market in wich different handicrafts are sold to the tourism with high prices. Here there are not handcraft producers, just sellers.	

Table A-3. Artisanal Products (Main Zones of Production)

	Amazonas	Ancash	Arequipa	Ayacucho	Apurímac	Cajamarca	Cuzco	Huancavelica	Huanuco	Ica	Junín	Lambayeque	La Libertad	Lima	Loreto	Madre de Dios	Moquegua	Pasco	Piura	Puno	San Martín	Tacna	Tumbes	Ucayali
Fleeting Art																								
Carpets or flower petals		*	*	*	*	*	*	*	*	*	*	*	*	*			*	*	*	*		*	*	
Fireworks	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*		*	*	
T'anta wawas (breads)		*	*	*	*		*	*			*			*					*	*				
Candle and giant wax candles		*	*	*			*							*										
Funeral art						*								*						*				
Pottery	*	*	*	*	*	*	*				*			*	*	*			*	*				*
Basket and straw articles						*					*	*							*		*			
Images				*			*							*										
Masks		*				*	*				*				*				*					
Retablos				*			*							*										
Huamanga stone carvings				*																				
Wooden carvings							*			*														
Jewelry																								
Silversmith				*			*	*			*								*					
Gold filigree				*										*					*					
Semi-precious stones											*	*	*						*					
Carved gourds				*				*			*	*												
Leather goods			*		*															*				
Sarhua boards				*																				
Textiles																								
Hessian weave							*							*										
Embroidery			*								*									*				
Cotton thread inlays			*								*	*		*										*
Tapestries				*							*	*		*										
Needlepoint			*			*	*				*			*						*				
Decorative utensils					*	*																		

Table A-4. Principales Conglomerados Artesanales

Ubicación	Conglomerado y/o Pueblo Artesanal	Linea Artesanal
Ancash	Taricá Huaraz Carhuayoc	Cerámica Textil (plano y de punto) Tejidos planos
Ayacucho	Huamanga Quinua	Tallado en piedra y textiles Cerámica
Cusco	San Blas Chincheros Sicuani Pisac	Imaginería Tejidos de punto Peletería Cerámica
Huancavelica	Yauli Castillapata	Textil (tejido de punto) Textil (tejido plano)
Ica	Grocio Prado-Chincha "El Chaco"-Paracas-Pisco Distrito y provincia de Ica Nazca	Tejido de fibra vegetal Adornos de restos marinos Joyería en oro Cerámica
Junin	San Pedro de Cajas San Jerónimo de Tunán Acos y Quilcas Cochas Hualhuas Chilca	Tejidos planos Filigrana de plata Cerámica Mates burilados Tejidos planos Textiles
La Libertad	Huanchaco	Totora
Lambayeque	Cuidad Eten Villa Eten Monsefú	Tejidos de paja Tejidos de paja Tejidos de paja Tejidos en telar Bordados
Piura	Chulucanas Catacaos Simbilá	Cerámica Filigrana de plata Cerámica
Puno	Taquile Pucará Ilave Isla de los Uros	Tejido de punto Cerámica Tejido de punto y plano Artesanía en totora y bordados
San Martín	Lamas Rioja	Cerámica Paja toquilla
Tacna	Distrito de Sama-Las Yaras	Canastas de junquillo
Tumbes	Cancas-Zorritos	Adornos restos marinos
Ucayali	San Francisco de Yarinacocha	Pulseras, collares, aretes de semillas, telas bordadas, pintadas y cerámica

Table A-5. Principales Productos Artesanales por Region

Region	Línea de Produccion	Productos Artesanales
Ancash	Bordados	Mantos, capas, estandartes, bandas.
	Tallados en piedra	Esculturas, replicas de cabezas clavas, lanzones, templo de Chavin, tumis, portafotos, portalapiceros y sillas torneadas con asiento de junco.
	Bisutería	Pulseras, aros, collares, aretes, chaquiras.
	Talabartería	Monturas, jáquimas, correas, riendas.
	Joyería	Aretes, prendedores, aros, esclavas.
Apurimac	Madera	Muebles tallados de huarango
	Tejidos planos	Mantas, frazadas, mantones de lana de oveja y alpaca.
	Tejidos de punto	Chompas tejidas a mano y a máquina.
	Cerámica	Tejas y utensilios de casa (Cántaros, ollas, tazas, platos, floreros)
	Muñequería	Muñecas con trajes típicos de cada ciudad.
Arequipa	Textil	Prendas de vestir, tejidos y artículos de ganchillo, tapices, alfombras y bordados.
	Pieles y cueros	Prendas de vestir, bolsos y similares, artículos deportivos, correas.
	Madera	Marcos y artículos decorativos, muebles.
	Joyería	Anillos, aretes, collares, etc.
	Cerámica	Artículos utilitarios y decorativos
	Talla de sillar y piedra	Artículos decorativos.
Ayacucho	Tejido plano	Tapices, pasadizos, pisos.
	Cerámica	Iglesias, toritos, chismosas, escenas costumbristas (mujeres cargando a sus hijos, parejas comiendo, músicos tocando violín, arpa, waqra pututo), nacimientos, cruces de la pasión
	Peletería	Mantas, cubrecamas, alfombras, pisos.
	Retablos	Escenas costumbristas y religiosas
	Orfebrería	Adornos en filigrana en plata
	Tallados en piedra de Huamanga	Escenas costumbristas y religiosas
Cajamarca	Tallados en piedra	Iglesias, campesinos, motivos costumbristas, piletas, bancas, motivos mineros.
	Repujado en cuero	Sillas de montar
	Tejidos a telar (callua)	Telares, alfombras, alforjas.
	Fibra vegetal	Cunas, paneras, cestos para ropa, roperos, sofás, muebles.
	Cerámica	Utilitaria y decorativa, con diseños de animales y plantas, dibujos geométricos.
	Espejos cajamarquinos	Marcos para espejos en vidrio pintado.
	Tejidos a crochet	Mantelería, pisos, tapetes, etc.
Cusco	Tejidos de punto y tejidos planos	Chompas, fajas (cintas multicolores), ponchos.
	Peletería y cuero	Alfombras, prendas de vestir y accesorios, adornos.
	Cerámica	Chaquiras, gargantillas, pulseras, aretes, vasijas, costumbres del hombre andino, etc.
	Imaginería	Imágenes sagradas, vírgenes, ángeles.
	Joyería en plata	Aretes, collares ,brazaletes.
	Muñequería	Muñecas con vestimenta típicas de la región.

Region	Línea de Produccion	Productos Artesanales
	Bisutería	Collares, aretes, gargantillas, pulseras (bronce, cobre o alpaca, cerámica, pedrería).
	Pintura popular	Réplicas de la pintura cusqueña.
	Tallados y dorados en madera	Marcos, cofres, muebles, retablos.
	Retablería	Altares con motivos religiosos.
Huanuco	Cerámica	Ollas globulares de cuello corto, cántaros, jarrones, keros ceniceros, floreros y artículos decorativos con diseños de la cultura Kotosh.
	Fibras vegetales: cabuya, panca de choclo, bambú.	Platos recordatorios, negritos portalapiceros, portavasos y Productos decorativos con figuras representando costumbres lugareñas.
	Tallados en masilla	Llaveros, loros, silbatos personajes(souveniers).
	Cornoplastía	Portalapiceros y otros productos decorativos.
	Fibra vegetal	bolsas, canastas.
	Textilería	Mantas, cinturones, chullos y otras prendas de vestir.
	Muñequería	Muñecas con atuendos típicos de la Región (negritos).
	Tallados en madera topa	Tallados de animales en madera.
Huancavelica	Tejidos de punto	Chalinas, medias, fajas, gorros, mitones.
	Tejidos planos	Manta de Lircay, alfombras, frazadas, mantas.
	Cerámica	Ollas, cántaros, tazas, platos, tinajas.
	Talabartería	Maletines, portafolios, cartapacios, carteras, billeteras, monederos, correas.
Ica	Fibra vegetal	Bolsas, carteras, sombreros.
	Artículos de restos marinos	Artículos decorativos, souveniers.
	Cuero	Forro para botellas de vino y pisco.
	Cerámica	Réplica de la cultura Nazca, paneras, cántaros, ceniceros
	Bisutería	Diversa.
	Tallado en piedra	Figuras de Nazca.
Junin	Tejidos de punto	Chompas de alpaca, ovino y algodón a mano y/o a máquina.
	Tejidos planos	Alfombras, cubrecamas, ponchos, mantones, murales, etc.
	Mates burilados	Decorativos.
	Platería	Filigrana y joyería
	Cueros	Casacas, chalecos.
	Peletería	Cubrecamas, pisos, etc.
	Bisutería	Collares, pulseras, etc.
	Cerámica	Silbatos en diversas figuras, cántaros antropomorfos y fitomorfos.
	Manualidades	Arpilleras, vinchas, bordados.
La Libertad	Bisutería	Collares, muñequeras, pulseras, aretes, portaencendedores, esculturas, etc.
	Orfebrería	Placas recordatorias, ceniceros, llaveros, candelabros, caballitos de totora, jarrones, keros, etc.
	Siluetas de alambre	Parejas de marinera, caballos de paso, ventanas coloniales.
	Cerámica	Artículos utilitarios y decorativos, estatuas con vestimenta típica y ancestral, orejeras del Señor de Sipan, alegorías de Chan Chan.
	Madera	Retablos, balcones coloniales, artículos utilitarios, decorativos, juguetes decorativos en triplay, esculturas en madera.
	Cuero: talabartería y repujados	Bozales para caballo, fundas para guitarra, llaveros, prendas de vestir, correas, sombreros, carteras, artículos de badana. Sillones, perezosas

Region	Línea de Produccion	Productos Artesanales
	Bordados	Fundas para licuadoras, tostadora, manteles, vestidos típicos de marinera.
	Tejidos a telar	Ponchos, fajas, alforjas, chalinas, guantes.
	Fibras vegetales	Caballitos de totora, paneras, pantallas, pisos.
Lambayeque	Cueros y talabartería	Casacas, bolsos, correas, maletines, monederos, billeteras, monturas, pedreras, riendas, estribos, carolas, cinchos, fundas, cuero repujado.
	Fibra vegetal	Sombreros, bolsos, individuales, carteras, flores, petates y otros adornos; sandalias, muebles, etc.; mates burilados.
	Orfebrería	Joyas, réplicas de artículos y recursos históricos-culturales, souveniers.
	Tejidos	Vestimenta histórico-culturales, mantos tapices, ponchos, bolsos, pisos, individuales, fajas, tejidos a palito y crochet
	Bordados	Réplicas de ornamentas (reyes, pre-inca), vestidos, mantos, servilletas, banderolas, estandartes.
	Cerámica	Replica de huacos, cerámica utilitaria, ornamentas de guerreros y reyes, pre-incas e incas.
	Madera	Artículos utilitarios para el hogar, réplicas de animales.
	Juguetería y adornos	Muñecas, réplicas de animales, recuerdos, juguetes varios, etc.
	Bisutería	Recuerdos religiosos y no religiosos, réplicas.
Loreto	Fibra vegetal	Hamacas, jicras, bolsas de chambira, cortinas, pantallas, cestos, muebles de lianas.
	Madera	Torneados en madera: fruteros, licoreras, joyeros y adornos; tallados en raíces de aves y representaciones costumbristas.
	Artesanía nativa	Arcos, flechas, pucunas a base de palmera-pona
	Tejidos a telar	Tejidos de la comunidad nativa Ticuna
	Cerámica	Utilitaria y decorativa.
	Tallados en madera (palo santo)	Loros, guacamayos, tucanes, peces ornamentales y mascaras de nativos así también vivencias selváticas como la vida del ribereño, la pesca en canoa
	Confecciones y manualidades	--
Madre De Dios	Tejidos en fibras vegetales	Cestería en tamishi, sombreros, cortinas, lámparas, sicras, vestimentas, bolsos, adornos, hamacas, abanicos.
	Madera	Artículos tallados y torneados, utensilios de cocina, muebles, retablos, tallados ecológicos.
	Cerámica	Utensilios de cocina y artículos decorativos.
	Artesanía nativa	Flechas, collares, arcos, lanzas, etc.
Moquegua	Tejidos de punto	Chompas, chalinas, chalecos, gorras, medias.
	Tejidos planos (de 4 estacas)	Ponchos, lliccas, bolsos, fajas alfombras
	Fibra vegetal (carrizo)	Esteras trenzadas, canastas de caña y mimbre.
Pasco	Textilería	Mantas, frazadas, alfombras, tapices, chompas, prendas de vestir y sus accesorios.
	Madera	Muebles para el hogar, marcos, etc.
	Filigrana de cobre	Cuadros con motivos de la actividad minera, escudos departamentales y personajes ilustres.
	Fibra de resina	Cuadros con motivos de la actividad minera, escudos departamentales y personajes ilustres.
	Talabartería	Maletines, carteras, billeteras, llaveros y adornos de cuero.
	Platería	Medallas, collares, aretes, anillos, prendedores y demás adornos.

Region	Línea de Produccion	Productos Artesanales
	Bordaduría	Disfraces, tapices y cuadros decorativos.
	Juguetería	Florería, peluches y adornos diversos.
	Cerámica	Ollas, vasijas, veleros, piraguas y cigarreras.
	Productos de semillas	Collares, pulseras, aretes, etc.
Piura	Fibra vegetal	Sombreros, canastas, bolsas, carteras, petates, alfombras, esteras.
	Alfarería/ cerámica	Utilitaria y escultórica
	Orfebrería	Filigrana, joyería
	Cuero	Artículos en cuero repujado y talabartería.
	Torneado en madera zapote	Utilitarios y decorativos, miniaturas, etc.
	Tejidos de punto	Chompas, guantes, chalinas, gorros.
	Tejidos planos	Mantas, cubrecamas, pisos,
Puno	Tejidos de punto	chompas, ruanas y capas de alpaca.
	Cerámica	Cerámica grotesca y vidriada, como: ollas globulares, jarras, platos decorados, toros, tinajas.
	Peletería	Cubrecamas, alfombras ,pisos, tapetes.
	Instrumentos musicales	Flautas, zampoñas, antaras, quenas.
San Martin	Fibras vegetales	Bolsas, carteras, sombreros, sombreros tejidos en paja bombonaje
	Cerámica/alfarería	Cerámica utilitaria como: vasijas, platos
	Bisutería	collares, aretes y otros adornos de uso personal hechos de semillas
	Tarjetas de plumas	tarjetas decorativas de plumas de aves de la región.
Tacna	Tejidos plano	Tapices, alfombras, mantas, cubrecamas.
	Tejidos de punto y ganchillo	Chompas, Chalecos, chalinas, guantes , chullos.
	Fibra vegetal	Muebles de junquillo y mimbre: juego de sala, bares, sillas, mesas.
	Artículos en cobre y bronce	Trofeos, figuras de animales, adornos y trabajos en cobre repujado.
Tumbes	Tallados en madera	Figuras humanas y de animales
	Trabajos en pasalla (hojas de plátanos)	Estampas costumbristas tales como: el larvero, el arrocero, el cangrejero, lagartos , tigrillos; cuadros sobre sitios turísticos y recursos naturales.
	Trabajos en deshechos marinos	Adornos en conchas, caracoles, escamas y ostras, como: cortinas, tarjetas, flores, etc.
	Joyería-perlería	Aretes, collares, adornos para mujeres.
Ucayali	Tejidos planos	Telas, prendas de vestir de uso diario y ceremoniales, manteles, servilletas y otros productos textiles, bordados o pintados, con diseños geométricos y técnicas tradicionales.
	Cerámica	Tinajas ceremoniales, platos, vasijas típicas, entre otros, con diseños de la comunidad nativa shipiba.
	Esculturas talladas en madera	Personajes, animales, representaciones de artículos utilizados en la vida diaria y paisajes costumbristas de los nativos.
	Bisutería ecológica	Collares, pulseras, aretes elaborados con semillas, escamas, mostacillas, chaquiras, etc.
	Escultura y tallados en marfil vegetal	Llaveros y artículos decorativos.
	Fibra vegetal	Abanicos, cofres, paneras, cestas, sombreros, etc.
	Artículos nativos	Arcos, flechas, lanzas, macanas (arma de pelea), etc.
Fuente: Direcciones Regionales de Industria y Turismo.		

Table A-6. Lineas Artesanales Identificadas por Regiones

Las líneas artesanales por identificadas por regiones son las siguientes:

Amazonas: Se han identificado 09 líneas artesanales entre las cuales están: tejidos a telar (hilo y lana) cordelería de fibras vegetales, cerámica-alfarería, trabajos en madera y raíces, trabajos en piedra, trabajos (adornos) de material reciclado, confecciones de prendas de vestir, juguetería y calzado.
Ancash: Se han identificado 15 líneas artesanales entre las cuales se menciona las siguientes: zona sierra: tejido de punto, tejidos planos, sillas artesanales, cerámica, bordados, tallados, esculturas, bisutería, sombrerería, bisutería, talabartería, en la zona costa destacan: muebles, estructuras metálicas, forrados con junco, juguetería, florerías, trenzado de junco, fabricación de esteras, cestería tejidos de punto y manualidades.
Apurímac: Se han identificado 18 líneas artesanales, tales como: tejidos a telar, tejidos de punto, prendas de vestir, maletas, calzado, puertas y marcos de madera, productos trenzables, cerámica, producción de lápidas, estructura metálica, hojalatería, mueblería, sombrerería, juguetería, imaginería, joyería, bordados, instrumentos de cuerda (guitarras, violines).
Arequipa: Se han identificado 09 líneas artesanales, tales como: tejidos de puntos, tejidos planos, trabajo en piel, madera, metal, joyería, cerámica, tallados en piedra, talabartería.
Ayacucho: La artesanía ayacuchana se caracteriza por contar con una diversidad de líneas que superan las 50 especialidades y que expresan la creatividad y habilidad manual del artesano entre las principales tenemos: tejidos a telar, cerámica, peletería, retablos, tallados piedra de Huamanga, repujado en cuero, existen otras líneas pocas demandadas que se mantienen estables, como el tallado en madera, talabartería confección de instrumentos de cuerda, imaginería, utensilios de madera, cestería tallados en madera. Un tercer grupo de líneas incluye algunas que se encuentran en extinción, tales como mate burilado, hojalatería, sombrerería, forja, cerería, filigrana y pergaminos, finalmente podemos mencionar a un grupo de especialidades nuevas que hicieron su aparición en los últimos años, tales como florería, juguetería, bordados de manta, adornos de papel, rafia y globos, adornos de yeso, tablas de Sarhua.
Cajamarca: Se han identificado 10 líneas artesanales, tales como: tejidos en callua y telar (lana de ovino e industrial), cerámica utilitaria y decorativa, tejidos a palitos, tejidos a crochet lana e hilo industrial, tejidos en fibra vegetal (paja toquilla, mimbre, etc.), tallados en piedra marmolina y cantería, tallado en madera, cuadros cajamarquinos, bisutería y carpintería.
Cusco: Se han identificado 20 líneas artesanales, en todas las provincias del departamento del Cusco, se desarrollan una gran variedad de líneas de producción artesanal, destacando las que utilizan recursos naturales de la zona tales como: cerámica, peletería, bisutería, confecciones de vestimenta típica, bordadura, imaginería, platería, coreoplastía, cerería, muñequería, mascarería, cestería, pintura popular, hojalatería, tallado en madera, retablería y decoraciones en pan de oro.
Huancavelica: Se han identificado 10 líneas artesanales, tejidos planos, tejidos de punto y ganchillo, talabartería y cueros, estatuillas y adornos, juguetería, cirios y velas, peletería, cerámica, cestería y carpintería.
Huánuco: Se han identificado 16 líneas artesanales, cerámica, cornoplastía, textilería, artesanía en bambú, cestería, bordadura, indumentaria típica, cuadro con semillas e insectos, artesanía en fique, artesanía en arena y madera, artesanía en material trenzado, pirograbados, tallados en madera, artesanía en raíces, confección en prendas de vestir y joyería.
Ica: Se han identificado 11 líneas artesanales, bisutería, joyería, cerámica al frío, cerámica alfarería, cuero, juguetería, muebles tejidos, cerámica al frío y junco, adornos marinos, madera, tallados en piedra.
Junín: Se han identificado 09 líneas artesanales, tejidos planos, tejidos de punto, mates burilados, orfebrería, cueros, peletería, manualidades, bisutería, cerámica.
La Libertad: Se han identificado 24 líneas de producción artesanal, tales como: Trabajos en metal: bisutería, orfebrería, siluetas de alambra.

Trabajos en minerales: cerámica, moldes de yeso. Trabajos en madera: tallados, juguetes decorativos, y educativos en tripley, esculturas en madera. Trabajos en cuero: talabartería, prendas de vestir y artículos diversos, artículos en badana, repujado en cuero y suela. Confecciones: tejidos a máquina bordados a mano, manualidades a telar, palillo, crochet, telar y fribolité, vestidos típicos de marinera, tejidos a telar, bordados en alto relieve. Dibujos y pinturas: serigrafía, pintura en textura en alto y bajo relieve. Fibras vegetales: caballitos de totora, confección de paneras, pantallas, pisos. Artesanía diversa: instrumentos musicales, pirograbados, mates burilados, trabajos en papel maché y pergamino.
Lambayeque: Se han identificado 10 líneas de producción artesanal: cuero y talabartería, fibra vegetal, orfebrería, hilados, tejidos, bordados, cerámica, madera, juguetería, adornos y bisutería.
Loreto: Se han identificado 13 líneas artesanales de producción artesanal: bisutería, torneado y tallado en palo sangre, tallado y pintura en palo balsa, tejidos y marcramé, instrumentos musicales, cerámica nativa, cerámica regional, pinturas amazónicas, tejidos de mimbre (muebles), imaginería en fibras, arcos y lanzas decoradas, maracas, mates burilados y taxidermia.
Madre de Dios: Se han identificado 06 líneas artesanales de producción artesanal: artesanía nativa (flechas, collares, arcos, lanzas, shicras, abanicos), tejidos en corteza y fibras vegetales, tejidos en yarina para techos de vivienda, tallados en madera, cerámica y muebles en madera.
Moquegua: Se han identificado 15 líneas artesanales, tales como: prendas de vestir, puertas y ventanas de madera, calzado y artículos de cuero, tejido de punto, muebles de madera, artículos de metal, productos de carrizo, estampados, juguetería, bolsos y maletas, tapices y alfombras, cerería, cerámica, hilados de fibra, joyería.
Pasco: Se han identificado 17 líneas artesanales, tales como: textilería, carpintería, filigrana en cobre, tallados en madera, prendas de vestir, platería, peletería, cerámica, juguetería y manualidades, fibra de resina, talabartería, fierro forjado, fibras vegetales, artículos en semilla, tallado de raíces, bisutería, taxidermia.
Piura: Se han identificado 13 líneas artesanales, tales como: tejidos planos, tejidos en fibra vegetal, tejidos de punto, tapices y alfombras, prendas de vestir, artículos de cuero, calzado, torneado de madera, muebles tejidos de paja, cerámica, artículos en yeso, orfebrería, juguetes de tela y otros.
Puno: Se han identificado 08 líneas artesanales, tales como: tejido de punto, tejidos planos, bordadura, cerámica, peletería, instrumentos musicales, cestería y hojalatería.
San Martín: Se han identificado 07 líneas artesanales, tales como: cerámica, tejidos de paja bombonaje, tarjetas de plumas, artesanía ecológica (trabajos en raíces, semillas, hueso, etc.), papel hecho a mano, tallados en madera y juguetería.
Tacna: Se han identificado 06 líneas artesanales, tales como: tapices y alfombras, tejido de punto y ganchillo, muebles de junquillo y mimbre, artículos de cobre - bronce - níquel, marcos tallados, cerámica al frío.
Tumbes: Se han identificado 12 líneas artesanales, tales como: fibra vegetal (pasaya), desechos marinos, florería, tallados en madera, pinturas al óleo, juguetería, perlería, pergamino, cerámica al frío, serigrafía, artículos en vidrio, textil.
Ucayali: Se han identificado 07 líneas artesanales, tales como: cerámica, cestería, madera, tejidos planos, bisutería, tallados en marfil vegetal, artesanía nativa (lanzas, palo de lluvia, macanas, cortinas, etc.)

Appendix III. Evaluation of Indigo Pilot Project

1 Project Information

- Project Name: Indigo Pilot Project (hereafter, the Project)
- Project Period: Six months from June 2003
- Target Group: Organizations related with indigo (farmers, NGOs, companies)

1.1 Background

El Salvador used to be one of the largest exporters of natural indigo during the Spanish colonial period and indigo was one of its main exporting commodities. In the 19th century, when synthetic chemical dyes were invented, indigo industry in the Country dependent on the natural indigo lost its competitiveness and declined quickly.

Just after the end of the civil war in the early 1990s, a CONCULTURA staff member and his collaborators began the initiative in rediscovering and preserving the culture and tradition of declined natural dye technologies, which was considered to be necessary for the recovery of the Country's identity and solidarity. Consequently, since 1992, CONCULTURA has undertaken the Project for Indigo Industry Revival to reclaim the traditional dye technologies in cooperation with international organizations such as JICA, JETRO and GTZ.

Following the project by CONCULTURA, various projects were implemented for the purpose of promoting indigo dyeing including:

1) Dispatch of JOCV staff for the instruction of indigo dyeing at Santa Ana (1999-present),
2) The program to support the revitalization of the indigo industry in El Salvador by JETRO (1999-2003), and
3) Instruction of dyeing by JICA experts (2002-2003).

Partly due to the results of these activities, more people have started to pay attention to indigo and the indigo cultivation area has been increasing in El Salvador. The Study on Economic Development, Focusing on the Eastern Region, of El Salvador (hereafter, the Study) by JICA recognized the potential of the indigo industry to vitalize the regional economy for the following reasons:

1) The indigo industry was once deeply rooted in the society of El Salvador and the people in the Eastern Region are ready to accept the indigo industrialization;
2) Soil suitable for indigo cultivation is abundant in the Eastern Region; and
3) The demand for natural dyes including indigo is rapidly expanding in Europe and other countries.

Natural indigo dye in El Salvador, however, has not been fully recognized as a potential exporting material due to its limited supply and the lack of quality control. Also, export of indigo dye powder is not sufficient to vitalize the national economy. Therefore, it is necessary

in the long run to increase the values of the indigo products through disseminating and improving both knowledge and experiences of dyeing techniques.

Given this background, the indigo pilot project (hereafter, the Project) was implemented by the pilot project team comprising members of the JICA Study Team, CONCULTURA, IICA, Delgado University, ENA, and other groups. The objective of the pilot implementation was to clarify the constraints in technologies (cultivation, extraction, dyeing), marketing and institutionalization and to propose countermeasures based on the results of the implementation, which will be reflected in the Master Plan of the Study.

1.2 Outline of the Project (see Table 2.3 for PDM_E)

Project objectives

(1) To clarify technical, marketing and organizational problems, and
(2) To propose the corresponding countermeasures to revive the indigo industry in the Eastern Region.

Overall goal

To carry out a full-scale indigo promotion program in the Eastern Region.

Outputs

1. Suitable cultivation technique of indigo in the Eastern Region is found out.
2. Quality of indigo powder is improved.
3. Design and dyeing skills are improved.
4. Strategy will be developed in terms of international indigo marketing.
5. The most effective arrangement for cooperation among related organizations will be clarified.

Main activities

1.1. Undertake experimental farming at ENA.
1.2. Clarify technical guidance for the current indigo farming.
1.3. Prepare and distribute a technical manual on indigo farming.

2-1. Provide training on indigo extraction from fresh leaves using the traditional water tank.
2-2. Develop a new technology on indigo extraction using dried indigo leaves.
2-3. Confirm the effectiveness of new extraction equipment.
2-4. Conduct a financial analysis on the traditional and modern extraction techniques.

3-1. Conduct training on designing and dyeing.
3-2. Organize a contest of indigo dyed products.

4-1. Conduct a preliminary market survey on North American, European, Asian and Latin

markets.

4-2. Estimate preliminarily the demand for natural indigo dye.

4-3. Clarify important factors to enter into international market.

5-1. Exchange and share information among participating organizations

5-2. Organize a study tour to observe examples of advanced indigo farming.

5-3. Hold regular meetings with related government organizations.

2 Evaluation of Pilot Project

2.1 Methodology

The Project was evaluated in terms of the following five criteria of the PCM (Project Cycle Management) method, which is widely adopted in JICA projects.

1) Relevance: Whether the "project purpose" and "overall" goal are meaningful as project objectives
2) Effectiveness: The extent to which the "project purpose" has been achieved via "outputs"
3) Efficiency: Whether the implementation process has been productive, i.e., the extent o which "inputs" have been converted to "outputs"
4) Impact: Whether the effects of the implementation are positive and negative, either direct or indirect
5) Sustainability: Whether the benefits of the project will sustain after the termination of assistance.

The purpose of the Project is to collect as much information and data as possible through its implementation, thereby clarifying the constraints and the concrete countermeasures for the Master Plan of the Study. Thus, the evaluation emphasizes the relevance and effectiveness of the Project. To minimize biases, the JICA Study Team and CND staff jointly conducted the evaluation. It was also attempted that the knowledge was transferred to CND through the evaluation procedure based on the PCM method.

The evaluation procedure was as follows:

1) Preparation of PDM for evaluation (PDM_E)
2) Data collection through secondary data review (e.g., books, reports and web sites), interviews with stakeholders, site observations, etc.
3) Preparation of draft evaluation results by the JICA Study Team based on the collected data.
4) Elaboration of the evaluation results through discussions between the Japanese and Salvadoran sides.

2.2 Results of Evaluation

(1) Relevance: High relevance of the pilot implementation

As stated in the background of the Project, the implementation is highly relevant for three reasons. First, the indigo industry has been historically familiar to the Salvadorans and there are certain needs for the revival of the industry. Second, the indigo growers and the related groups in the Eastern Region have been invited to participate in the workshops that CND has conducted. Third, the international demand for natural dyes including indigo is considered to be increasing.

With respect to the relevance of the project formulation, the logical relationships among components such as project objective, overall goal, outputs, and main activities are well interrelated. However, some activities, such as the cultivation experiment, which clearly require more time to complete than others, are considered to be infeasible to produce sufficient output within the limited time available.

(2) Effectiveness: Incomplete evaluation

The evaluation of the effectiveness of the Project is based on the review of the Final Report of the Project to be compiled in December 2003, in which findings constraints, and corresponding countermeasures are described. According to the interviews and the results of the site inspection conducted for the evaluation, it appears that some of the outputs indicated in the PDM_E have not been achieved mainly due to the lack of time, and the data collection has not been completed.

(3) Efficiency: Moderate overall efficiency

Inputs to the Project were prepared rather intensively because the implementation period was relatively short for the variety of components involved, and the cost was considered to be relatively high. Despite these, the efforts made in the limited time should be highly evaluated.

The Project staff are also highly evaluated. Top-level experts in different fields were assigned from both the Japanese and Salvadoran sides and worked diligently to complete their tasks. In addition to the assigned Project staff from CONCULTURA, ENA, IICA, Delgado University, UES, etc., the Japanese Embassy and CEPA among others also offered cooperation. The experience is recognized as significantly important for the future activities in the indigo industry development.

However, the facilities installed at UES and Jocoro received somewhat lesser evaluation. The construction work of the obrajes was not totally satisfactory and problems such as leakage around the pipe and low drainage of the septic tank were found during the site inspection.

(4) Impact: Positive impacts observed

Since the implementation period was short, it is difficult to fully evaluate the impacts of the Project. However, some of the Project activities have generated positive impacts. On November 11, a contest of indigo dyed products was held with the participation of the trainees of the dyeing workshops conducted as part of the Project. The next day, most of the prize-winning works were displayed at the workshop organized by CND in La Union, which attracted the participants' attention. A local newspaper (*El Diario de Hoy*, November 20, 2003) also featured an article on these events. Moreover, from the end of October through the beginning of December, the JICA El Salvador office organized the "Encuentro Japon (Encounter with Japan)" week, and Salvadoran indigo products were exhibited throughout the event. Further, on November 24, 2003, as part of the Project, trial sales of Salvadoran indigo products at the international airport started, and the initial success in the sales has led to its extension through April 2004. Through these events and activities, more Salvadoran people have renewed their acquaintance with Salvadoran indigo products.

(5) Sustainability: Uncertain sustainability of the Project

The Project was implemented on a pilot project basis as part of the Study. It is desirable that it be completely handed over to the Salvadoran side so that the activities will be continued independently by the Salvadoran staff to achieve the initially targeted goal. Arrangements for the transfer of the Project to the Salvadoran side have yet to be made.

2.3 Conclusions, Recommendations, and Lessons Learned

(1) Conclusions

The Project implementation is relevant considering the historical background, the Salvadorians' familiarity with indigo dyeing and the prospect of the expanding international demand. For the implementation of the Project, many organizations from both the Japanese and Salvadoran sides worked closely in tandem. That the project was administered under such coordinative efforts is quite significant for the future institutionalization for the revival of the indigo industry. A more in-depth review of the Project activities in depth, however, has revealed that some of the activities might not have been carried out satisfactorily and that there may be gaps between the present situation and the targeted goal. A monitoring system has been proposed and organized, albeit not functioned fully yet, and the transparency of the management has yet to be established.

Communication and collaboration among relevant organizations, specifically with the JICA El Salvador office and CND, are yet to be sufficiently established. Although the JICA El Salvador office that is expected to serve as the implementing agency of full-scale indigo projects in the future had started indigo projects prior to the Project by the JICA Study Team

and CND, its opinions and experiences were not effectively shared and reflected in the Project management due to insufficient communication. If consultation with the JICA El Salvador office were sought in advance, the comparatively high construction cost of the indigo extraction facilities and the malfunction of obrajes due to improper construction and supervision by the contractor might have been avoided.

(2) Recommendations

Immediate actions to be taken

The Salvadoran side with CND and the Project staff as a core should take immediate actions to continue the Project activities, including institutional setup, accumulation of cultivation experiments, operation and maintenance of obrajes, etc.

Obraje construction

To prevent the malfunctioning of obrajes, trial extraction should be run at least two times after the completion of construction to confirm the proper functioning of the obrajes. Also, relevant articles should be included in the contract of the construction works so that the contractor will be legally bound to repair and/or redo the construction if problems occur after the completion of obrajes.

(3) Lessons learned

Careful and feasible project formulation

Generally, it is desirable that any project be piloted to examine its viability within limited time available. In the Project, too many components might have been included for the six-month period, which was apparently insufficient to achieve all the activities designed. It is advised that project components be properly prioritized so that more time and input can be used for higher priority components in consideration of the time and resources available.

Communication and cooperation with stakeholders

The interviews with various stakeholders revealed that cooperation or communication had not been established sufficiently among the related organizations or even within the Project team. The lack of communication sometimes led to insufficient information sharing among the stakeholders, related organizations and the Project team. Because of this, useful information, experiences and opinions of relevant organizations and stakeholders were not reflected effectively in the management of the Project, partly accounting for the problems observed. A lesson should be learned that it is crucial to establish cooperation and share information with relevant organizations and stakeholders as much as possible to manage a project effectively and efficiently and steer clear of potential roadblocks to the project achievement.

Appendix IV. Photos

1

Indigo plant

2

Mr. Amaya giving a lecture on indigo at UES obraje site

3

Indigo plants carried to obraje's first tank

4

Oxidizing indigo water at the second obraje level

5

Silk dyed with indigo water before drying

6

Mr. Lorenzo Amaya teaching drying method of indigo mud at UES obraje

7

Dyeing workshop participants drawing designs by wax (batik)

8

A workshop participant drawing a design by wax (batik)

9

Cloth dyed with indigo

10

Items dyed with indigo at the dyeing workshop at Casa de Cultura La Paz. (1)

11

Items dyed with indigo at the dyeing workshop at Casa de Cultura La Paz. (2)

12

Cloth dyed with natural colorants

13

A kiosk at the El Salvador International Airport selling indigo products

14

Items sold at El Salvador International Airport kiosk

15

Modern indigo extraction facility installed at UES San Miguel

16

Indigo plant soaked in the modern extraction tank (1st tank)