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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

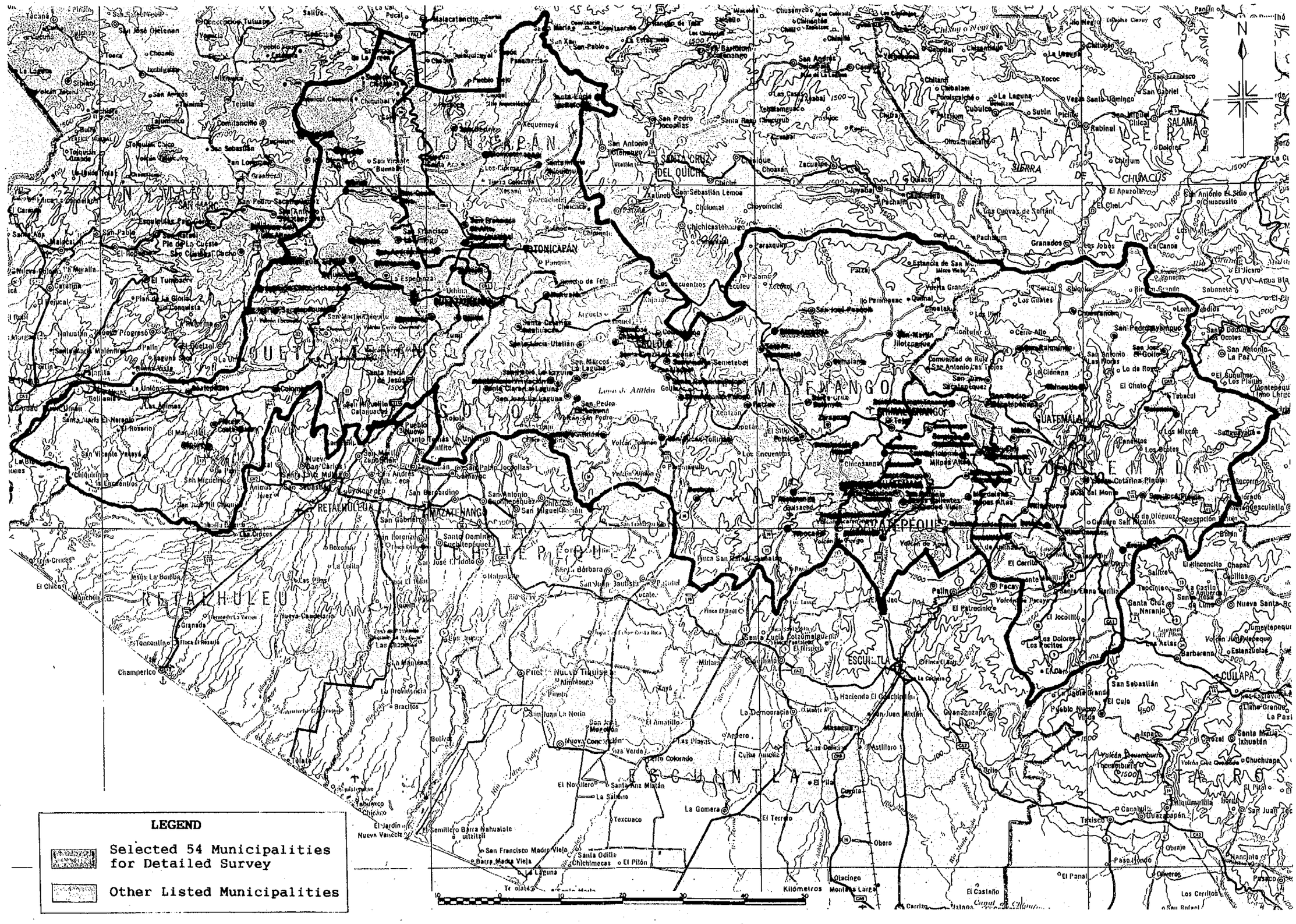
INSTITUTO DE FOMENTO MUNICIPAL
REPUBLIC OF GUATEMALA

THE STUDY ON GROUNDWATER DEVELOPMENT IN THE CENTRAL PLATEAU AREA IN GUATEMALA

SUMMARY REPORT

JULY 1995

KOKUSAI KOGYO CO., LTD., TOKYO

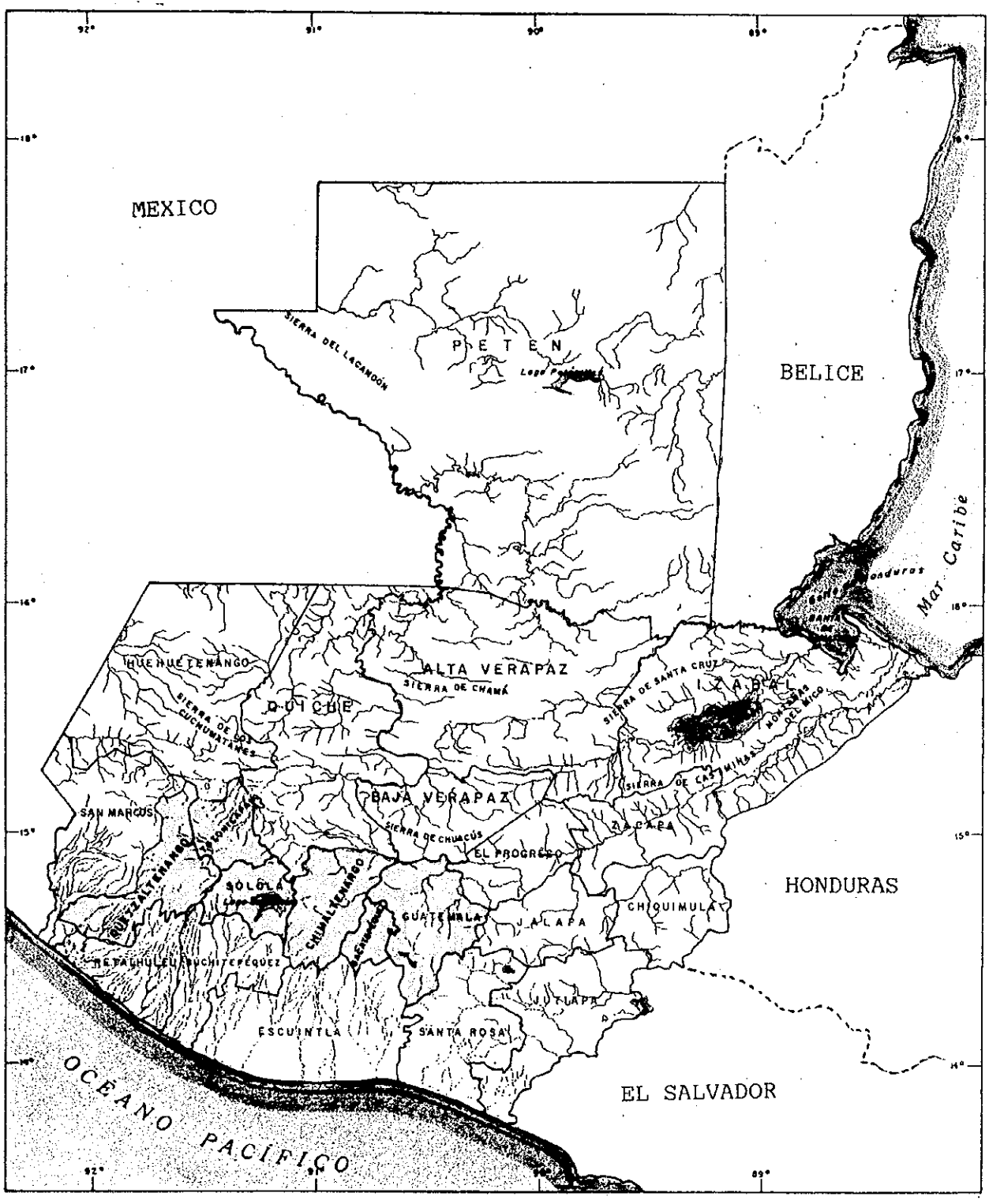


LEGEND

Selected 54 Municipalities for Detailed Survey

Other Listed Municipalities

LOCATION MAP OF STUDY AREA



Area de Estudio

CONTENTS

1 INTRODUCTION

1.1 General

This is the Final Report on the Groundwater Development Study in the Central Plateau Area in Guatemala ("The Study"), which was carried out in accordance with the "Scope of Work" agreed upon between the Instituto de Fomento Municipal (INFOM) and the Japan International Cooperation Agency (JICA) in September 1993.

The Study Area covered six Departments in the Central Plateau Area of Guatemala, where the 96 municipalities proposed for the Study are situated.

The Study commenced in February 1994, and terminated upon submission of the Final Report in June 1995. The Study period was divided into two phases:

Phase I (from February 1994 to July 1994):

- Categorization of the 96 municipalities based on water supply shortage condition, socioeconomic features and new water sources
- Preliminary planning of water source development by categorization

Phase II (from July 1994 to June 1995):

- Feasibility study on the 10 prioritized municipalities mainly pertaining to groundwater development.

1.2 Background of the Project

Guatemala is situated to the south of the Yucatán Peninsula in Central America and covers a total area of about 108,900 km^2. The estimated total population in 1992 was 9.9 million, of which more than 40% was concentrated in the "Central Plateau Area" where the capital city, Guatemala City, is situated.

The Central Plateau Area, occupying about one tenth of Guatemala, is composed of groups of mountainous basins with elevations ranging from 800 to 2,400 meters above sea level. Annual precipitation of 1,000 to 1,500 mm offers favorable conditions for agricultural production and living. The area has high potential for social, economic, and cultural development.

In spite of these attributes, many municipalities, even in the major cities of the Central Plateau Area have poor water supply services. The average coverage of water supply services in the plateau area, outside Guatemala City, was estimated at 69% in 1988, with an average service period of less than 12 hours/day. The main water source is

spring water, but the capacity of the springs in many municipalities has become insufficient as the population increases. In 1993, it was found that, of the 96 municipalities in this area, services in 29 were unable to supply the desired 150 liters per capita per day. The number of municipalities with deficient water supply services is projected to increase to 42 municipalities by the year 2010 if new supply sources are not developed. Further, it is expected that the existing water source will be replaced with groundwater pumping in the future. However, groundwater development faces several technical and economic problems due to the topographic and hydrogeologic features of the Central Plateau Area.

With this background, the Government of the Republic of Guatemala requested the Japanese Government, in January of 1990, to cooperate in formulating a water supply source development plan focusing on groundwater development.

On the basis of this request, JICA dispatched a preliminary study team to Guatemala in May and again in September 1993, and formulated the Scope of Work (S/W) related to the execution of the groundwater development study.

1.3 Objectives of the Study

The objectives of the Study were:

1) To formulate a water supply source development plan for the candidate municipalities by categorization of the 96 municipalities with respect to water source development potential, water demand, and socioeconomic situation

2) To formulate a water supply plan for the 10 prioritized municipalities and study its feasibility

3) To carry out technology transfer to the counterpart personnel during the course of the Study

1.4 Study Area

The Study Area covers the 6 Departments of Quetzaltenango, Totonicapan, Sololá, Chimaltenango, Sacatepequez and Guatemala in the Central Plateau Area, with the exclusion of Guatemala City.

Phase I of the Study covered the 96 municipalities and their surroundings, as shown on the location map. In Phase II, the Study focused on the 10 prioritized municipalities and a feasibility study was carried out.

1.5 Study Components and Sequence

The major purpose of the Study was to devise a water source development plan to meet the increasing water demand in the concerned municipalities. Most of the existing water supply services rely on spring water, in particular, springs situated at elevations higher than the residential areas they serve, allowing distribution by natural flow, which is a system with markedly reduced cost of operation and maintenance. However, such springs seem to have been fully exploited, leaving little room for future development. Possible alternative sources are:

- Spring development at lower elevations
- Collection of shallow groundwater by construction of shallow wells or infiltration gallery

However there are problems involved in the introduction of new water sources, such as the following.

- Insufficient new water source development potential
- Poor water quality, especially surface water
- Higher operation and maintenance costs, in particular, water supply systems which require motorized pumping

Consequently, Phase I comprised the following activities.

1) Water source development study with emphasis on groundwater development, including:

   - Hydrogeology
   - Meteorology, hydrology and water quality

2) Socioeconomic study:

   - Water demand
   - Existing water supply system and service level
   - Social environment
   - Willingness to improve water supply service and ability to pay for the operation and maintenance

3) Categorization of and priority assignment to the municipalities for the establishment of a water source development strategy, based on the results of the above two study components

In Phase II, a feasibility study for the water supply project in the 10 selected municipalities was carried out with the following 3 study components.

1) Confirmation of the hydrogeological condition by conducting detailed hydrological/hydrogeological surveys including test drilling and pumping tests

2) Facility design of water intake (well), water transmission and distribution pipelines for the 10 municipalities; and a trial improvement plan

(distribution system) in one municipality

3) Project evaluation including project cost estimation

The Study flow chart and the work items are presented in Fig. 1.3.1, and the work schedule is shown in Fig. 1.3.2.

The progress of the Study is briefly described below.

Phase I: Six and a half months, January to July 1994

The first four months were spent in Guatemala for data collection and arrangement, and detailed surveys of 49 municipalities. The 96 municipalities were categorized in terms of socioeconomic and hydrogeological conditions. Progress Report (1) was prepared and a series of discussions were held at the beginning of June in Guatemala.

The collected data and information were brought back to Japan and analyzed for the establishment of a water source development strategy. The Interim Report was prepared containing results obtained up to then, along with the tentative plan for the Feasibility Study of the 10 municipalities in Phase II.

Phase II: Nine and a half months, July 1994 to May 1995

The five months from July to December were devoted to a detailed hydrological and hydrogeological survey for the preparation of the hydrogeological map, and for the collection of additional data for the Feasibility Study. Progress Report (2) was prepared before the end of these five months.

After three months of analytical work in Japan from January 1995, the Draft Final Report was prepared covering all areas of the Study. The conclusions and results were discussed with the Guatemalan officials concerned in May 1995.

Submission of the Final Report:

The Final Report was prepared based on the comments of the Guatemalan government officials on the Draft Final Report, and sent to the Government of Guatemala from JICA through diplomatic channels. This marked the end of the Study.

1.6 Technology Applied

The following technologies were applied during the course of the Study.

a. For the study of water source development potential (in particular, groundwater)

a-1 Hydrogeology

(Phase I)

- Review of existing geological studies, report/ information
- Interpretation of aerial photographs (topography and geology)
- Geological field reconnaissance
- Review of existing drilling records (lithology and pumping rates)
- Geophysical prospecting (electric resistivity sounding) for classification of geological formations and for depth sounding
- Interviews on water usage and source (spring, groundwater)

(Phase II)

- Detailed hydrogeological field reconnaissance
- Aerial photograph interpretation
- Electric resistivity sounding
- Test drilling and geophysical logging
- Pumping tests to determine the hydraulic parameters of aquifers

a-2 Hydrology

(Phase I)

- Collection and review of meteorological data
- Collection and arrangement of discharge data
- Preliminary analysis of water balance in basins
- River flow observations to determine where to set up the flow measurement stations
- Spring discharge measurement
- Analysis of water quality (pH, Electric Conductivity)

(Phase II)

- Installation of automatic water level gauge in the drilled wells and monitoring of water levels
- Measurement of spring and river discharge
- Analysis of water quality

b. Social environment and socioeconomy in Phase I

b-1 Social environment and existing water supply systems

- Collection and review of information in each municipality
- Distribution and collection of questionnaires
- Interviews on existing service level, willingness to upgrade service level and ability to pay operation and maintenance costs
- Inspection of existing intake, transmission, storage,

and distribution facilities
- Interviews on water allocation (domestic use, agricultural use and industrial use)
- Sanitary environment survey by interviews and water quality analysis

b-2 Socioeconomy

- Collection and review of financial statistics
- Interviews with heads of municipalities on municipal financial affairs
- Interviews on industries and income levels in the municipalities, and the ability to pay water rates

c. Water supply system design survey in Phase II

- Survey on domestic water consumption
- Measurement of water production for domestic use
- Topographic and land use survey along the proposed transmission line
- Capacity of distribution tank
- Cost estimation of material for facility construction
- Cost estimation for facility construction and facility operation and maintenance

1.7 Study Team

For the smooth conduct of the Study and effective transfer of technology, INFOM organized a steering and coordinating group, and a counterpart group to form the INFOM/JICA joint "Study Team" which consisted of the following members.

Guatemalan side:

a) Steering and coordinating group members:

Lic. Gustavo Leal, INFOM Manager
Ing. Tofic Abularach, Management Adviser
Ing. Carlos Salvatierra, Head of Operation and Maintenance Dept.
Ing. Ulrich Seifert, Head of Operation Section
Ing. Adán Pocasangre, Technical Adviser

b) Counterpart members:

Ing. Rafael Girón, INFOM Coordinator
Ing. Nelson Díaz, Civil Engineer
Licda. María del Rosario Alcantara, Biochemist

JICA members:

Eng. Kunio Fujiwara, Leader (Groundwater development)
Eng. Atsuo Kanda, Co-Leader (Hydrogeology, Natural environment)

Eng. Masatoshi Tanaka (Geophysics, Hydrology A, Test drilling A)
Eng. Masahiro Yamaguchi (Hydrology B)
Eng. Akiko Mukade (Water quality, Sanitary environment)
Eng. Shuji Arakawa (Water supply facility)
Eng. Masaharu Kina (Socioeconomy A)
Eng. Masaru Obara (Socioeconomy B)
Eng. Masayuki Ogata (Test drilling B)
Ms. Xiomara Yamaguchi (Administrative support)
Eng. Valerio Gutierrez (Administrative support)

Fig. 1.3.1 OPERATION PLAN FLOW CHART

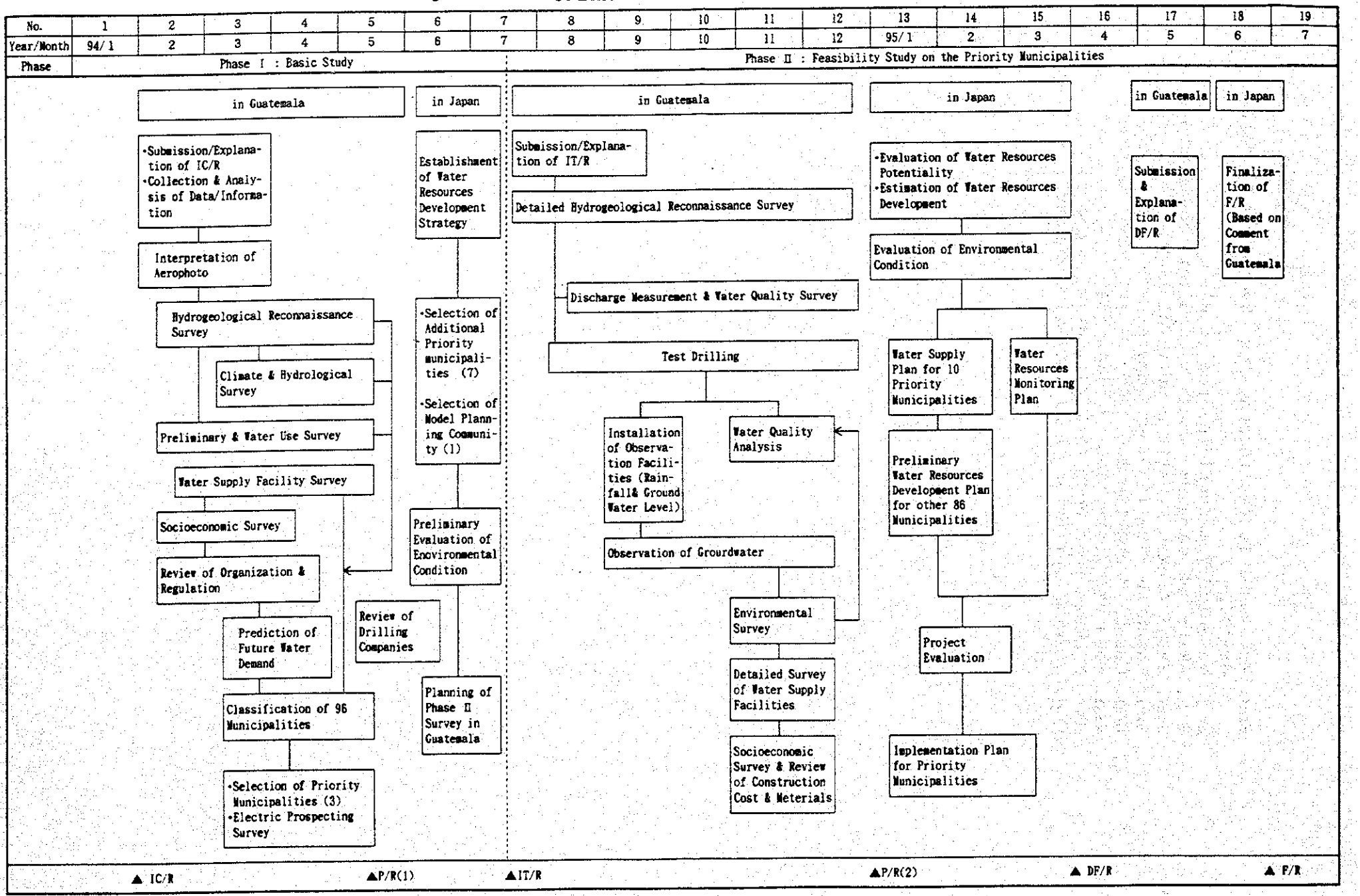
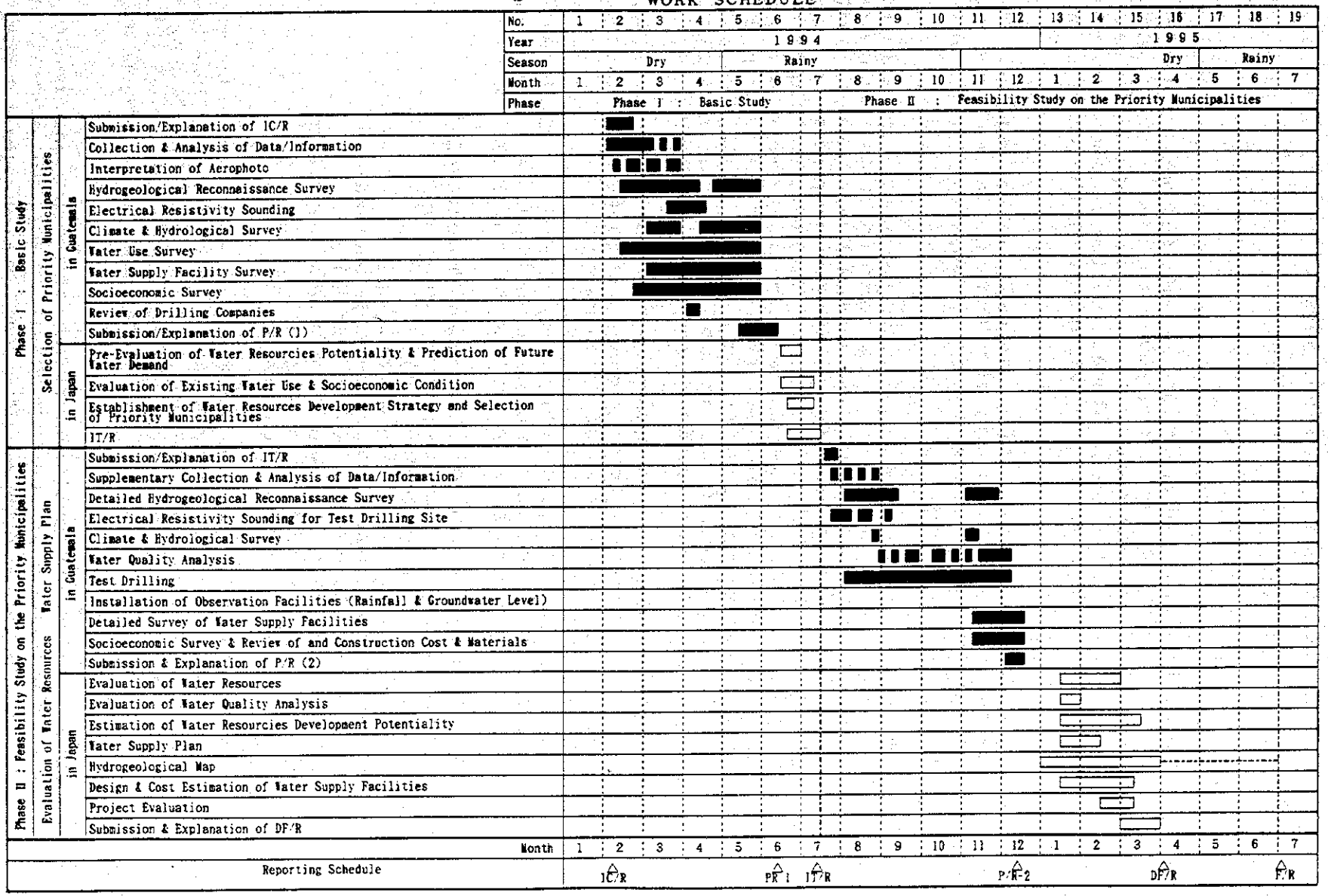


Fig. 1.3.2 WORK SCHEDULE



2. GENERAL CONDITION OF THE STUDY AREA

2.1 Natural Conditions

2.1.1 Topography

Guatemala is located approximately between north latitudes 14° and 18°, and west longitudes 88° and 92°. Situated south of Mexico and northwest of Honduras and El Salvador on the Central American isthmus, Guatemala encompasses a land area of 108,900 km^2, extending between the Atlantic and Pacific oceans.

The land area is naturally divided into 3 regions: the coastal plains of the south, the "Central Plateau", and the forestal plains of the north. The "Study Area" is situated in the Central Plateau.

The Central Plateau region, occupying about one tenth of the land area of the country, is composed of the mountains of the Sierra Madre and the Cuchumatanes ranges, with elevations ranging from 600 m in the southeast to over 3,000 m in the northwest. These mountainous highlands comprise numerous intramountain basins and a chain of young volcanoes extending in the NW-SE direction along the southwestern margin of the Central Plateau. The major peaks are Tajumulco (4,220 m, the highest peak in Central America), Acatenango (3,960 m) and Fuego (3,835 m).

The Study Area, located southeast of the Central Plateau region, consists mainly of Neogene and Quaternary volcanic rocks and covers an area of 8,643 km^2.

The area was divided, for this Study, into 9 main intramountain basins corresponding roughly with the groundwater basins shown below and in Fig.2.1.1.

a) Río Samalá basin (Quetzaltenango-Totonicapán)
b) Río Chixoy o Negro basin (Totonicapán)
c) Lago Atitlán basin (Sololá)
d) Río Coyolate basin (Chimaltenango)
e) Río Pixcayá basin (Chimaltenango-Guatemala)
f) Río Guacalate basin (Sacatepéquez)
g) Río Las Vacas/Lago Amatitlán basin (Guatemala)
h) Río Los Plátanos basin (Guatemala)
i) Río Aguacapa basin (Guatemala)

Rivers flowing from the central mountain belt to the Caribbean Sea (Río Chixoy o Negro, Río Pixcayá, Río Las Vacas, and Río Los Plátanos) have relatively gentle currents, while those emptying into the Pacific Ocean (Río Samalá, Río Coyolate, Río Guacalate, and Río Acuacapa) are generally rapid flowing.

Lakes Atitlán and Amatitlán, noted for their scenic beauty, are caldera lakes formed as a result of volcanic activities during the Pleistocene period. Lake Atitlán forms a semi-

closed water basin.

2.1.2 Geology

The principal rock units of the Study Area are divided hydrogeologically into 3 groups. They are the basement group, the Tertiary volcanic group, and the Quaternary volcanic group, in ascending order.

The basement group, which consists of metamorphic rocks, Cretaceous series, and intrusive rocks, is hydrogeologically categorized as the impermeable basement of groundwater basins.

Metamorphic rocks composed of phyllite and schists are probably of the upper Paleozoic era. They are largely exposed in the northeastern region of the Study Area.

The Cretaceous series is lithologically divided into 3 subgroups: lower calcareous subgroup, middle volcanic subgroup (basaltic rocks), and upper clastic subgroup. The lower calcareous subgroup, consisting of limestone and dolomitic limestone of the early Cretaceous period, occurs in a massive form with weak stratification. This subgroup is partially faulted and fractured and forms partial water-bearing zones with a thickness estimated at about as much as 500 m. The middle volcanic subgroup consists mainly of fractured basaltic lava with pyroclastic materials with a thickness estimated at about 350 m. The upper clastic subgroup consists of conglomerate, greywacke, and calcareous radiolarite, with an estimated thickness of about 450 m. This subgroup is regarded as of the late Cretaceous Period.

Intrusive rocks composed of granodiorite, quartz diorite and quartz monzonite are generally found as massive rock bodies. The geological age of their intrusion in the Study Area is presumably of late Cretaceous or Paleocene.

The Tertiary volcanic group is composed entirely of volcanic materials from the Miocene and Pliocene epochs and is generally divided into lower and upper subgroups.

The lower subgroup is composed mainly of latitic (trachyandesitic) to dacitic welded tuffs. The upper subgroup consists of rhyolitic, andesitic to basaltic, and pyroclastic lava, volcanic mud, and tuff.

The Tertiary volcanic group varies markedly in thickness depending on its origin and areas of volcanic eruption. Rocks of this group are highly fractured and form localized water-bearing zones.

The Quaternary volcanic group is divided into 3 subgroups of Pleistocene volcanics, Holocene volcanics and alluvial deposits.

The Pleistocene volcanics (Qp) are mainly composed of pumice sediments (fall and pyroclastic flow types). These pumice sediments are generally solidified and are partially accompanied with lake deposits. The intramountain basins in the Study Area are filled mostly by these pumice sediments and form major water bearing layers (main aquifer).

The Holocene volcanics (Qv) consisting of lava flow, volcanic mud flows (laharic deposits), tuff, cones and domes are exposed along the volcanic chain extending in the NW-SE direction near the southwest edge of the Central Plateau.

The alluvial deposits (Qa) are found mainly along valleys and lake shores, and are composed of secondary sediments of the volcanic materials mentioned above. The alluvial deposits in this area contain good aquifers.

2.1.3 Climate

The Study Area is divided, from east to west, into 6 departments: Guatemala, Sacatepéquez, Chimaltenango, Sololá, Totonicapán and Quetzaltenango. Most of these places are in the Central Plateau, except for the southern parts of Quetzaltenango.

The elevation of the Central Plateau varies from 1,500 to 3,000 m, and Guatemala City and Quetzaltenango City are located at 1,500 m and 2,500 m above sea level, respectively. The climate of the municipalities in the Study Area is either tropical or typical of a highland depending on their location.

The average temperature varies in the Study Area, from a minimum 18.8°C in January to a maximum 22.2°C in April at the Potrero Station, and from a minimum 11°C in January to a maximum 14.7°C in May at Labor Ovalle Station.

Rainy season is generally from May to October. The monthly rainfall has two peaks, June and September (Fig. 2.1.2). In general, most of the candidate municipalities in the Study Area have an average annual rainfall of between 1000 and 1,200 mm, with the exception of areas in the southern part of Quetzaltenango like Colomba which has over 3000 mm.

Shown below are the average, maximum and minimum temperatures, as well as the annual rainfall at the 4 stations of INSIVUMEH, Santa Cruz Balanyá, Labor Ovalle and San Jerónimo, which are at the eastern, central, western and southern parts of the Study Area, respectively.

Station (Elevation in m)	Annual Rainfall (mm)	Temp.(°C) Avg. Max. Min.	Temp.(°C) Max. in month	Temp.(°C) Min. in month
INSIVUMEH, Guatemala (1,502m)	1,200	18.3 24.4 14.0	19.8 (Apr.)	16.5 (Dec.)
Sta. Cruz Balanyá, Chimaltenango (2,080 m)	970	16.3 22.6 9.5	17.8 (May)	14.4 (Jan.)
Labor Ovalle, Quetzaltenango (2,380 m)	840	13.3 21.7 5.8	14.7 (May)	11.0 (Jan.)
San Jerónimo, Quetzaltenango (1,000 m)	3,842	22.9 27.7 18.0	28.5 (Apr.)	16.5 (Jan.)

2.1.4 Land Use

The present land use conditions were analyzed for development of groundwater in the Central Plateau Area.

A land use map covering the entire Study Area was prepared based on data and maps (1:500,000) provided by IGM (National Geographical Institute), and field surveys carried out by the Study Team.

The total land area of the Study Area is estimated at 8,643 km², and is divided into the Departments of Guatemala (2,126 km²), Chimaltenango (1,979 km²), Sololá (1,092 km²), Totonicapán (1,030 km²), Sacatepéquez (465 km²) and Quetzaltenango (1,951 km²).

Land use is classified into the following five major categories.

* Cultivated lands - consist of cultivated and agricultural land;
* Pasture and shrubs - include pasture, shrub and bush lands;
* Forest land - forests, include dense vegetation and sporadic forests;
* Wetlands - consist of lakes, ponds, swamps, marshes, etc.;
* Others - consist of sandy and rocky areas.

As observed on the present land use map (Fig, 2.1.3), cultivated lands predominate in the Study Area (39.2%), followed by pastures and shrubs (37.9%). The Department of Guatemala holds 38% of the total percentage of cultivated lands in the Study Area, while Chimaltenango holds 27.9% of

the pastures and shrub land.

The major categories of land use in each Department are detailed in Table 2.1.1.

This table shows that 77.1% of the Study Area is made up of pasture and shrub lands, indicating that many of the inhabitants are essentially involved in agricultural activities and, to a lesser extent, livestock.

Due to the unavailability of land use data at municipal level, a detailed classification of land use could not be worked out. The general land use condition was therefore assumed and described below.

The land use pattern in most of the surveyed municipalities (49) are similar, except for those located near Guatemala City, such as Mixco, Villa Nueva, Santa Catarina Pinula (the most urbanized areas of the Study Area, culturally and socioeconomically interwoven with the metropolitan area) and portions of the municipalities of Villa Canales, Fraijanes and Chinautla. Cultivated lands extend widely into other municipalities.

Municipal towns are basically characterized by a "plaza" along with churches and public offices, and are surrounded by commercial stores in low colonial style buildings. Many villages are spread sporadically around the town proper.

Principally, the municipalities are surrounded with agricultural lands (mini-farms) and pasture or shrubs.

As for the land use characteristics around the municipal towns of San Juan Sacatepéquez and San Pedro Sacatepéquez in the Department of Guatemala, agriculture, especially horticulture, is predominant.

The surrounding areas of Almolonga in Quetzaltenango are the most productive vegetable growing areas. The crops are sent to more profitable markets in Guatemala City, or exported.

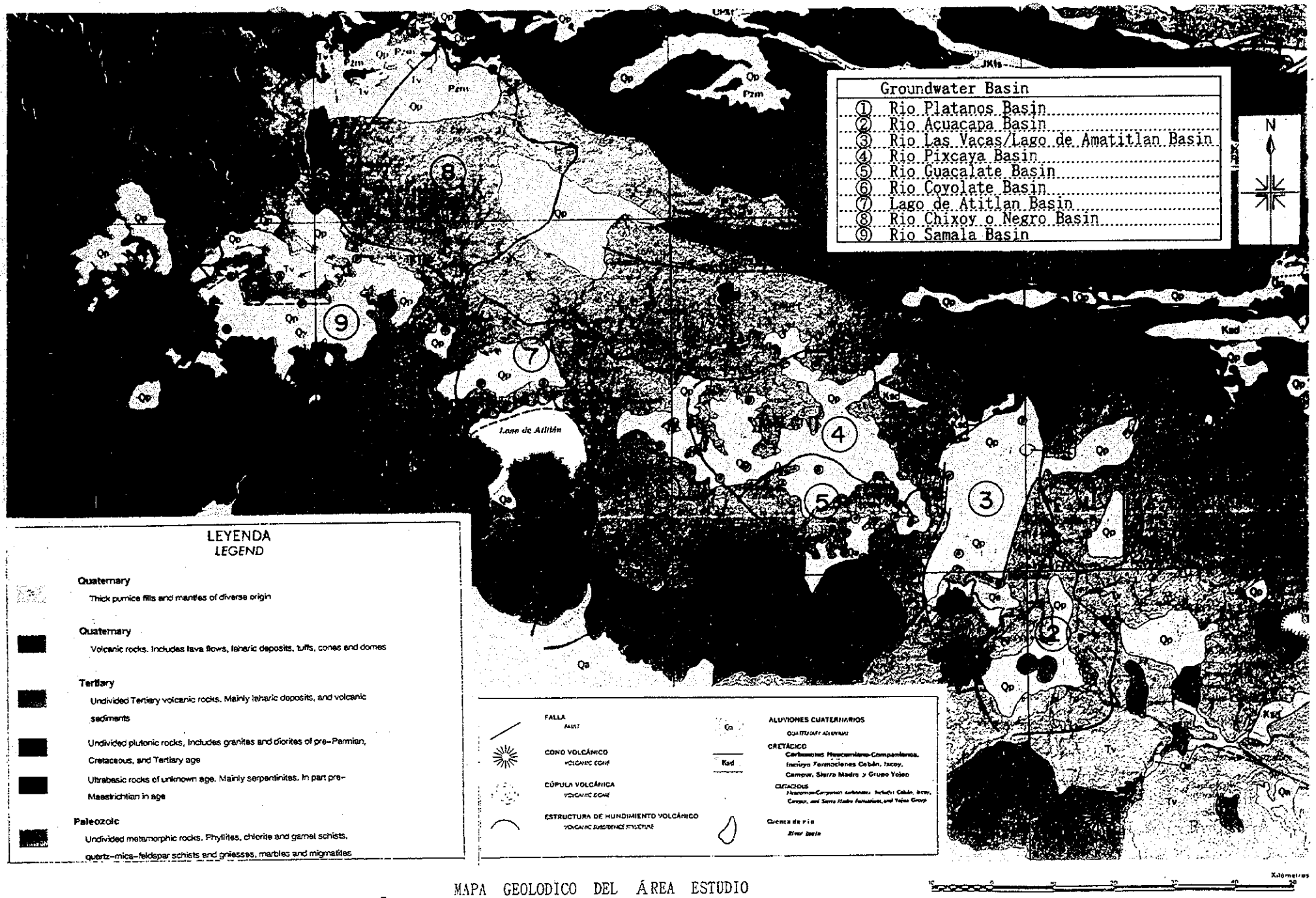
Coffee, another valuable product, is cultivated in large plantations around the municipalities of Colomba, Flores Costa Cuca and Génova.

The high and steep slopes constrain the expansion of agriculture in areas like Huitán, Palestina de los Altos, Santa Catarina Ixtahuacán etc., where only small farms exist.

The total urbanization of most of the towns in the Study Area is not possible due to geographic influences; mountain ranges predominate the Study Area topography. However, owing to tradition, the people of the Central Plateau Area continue to expand their cultivated areas.

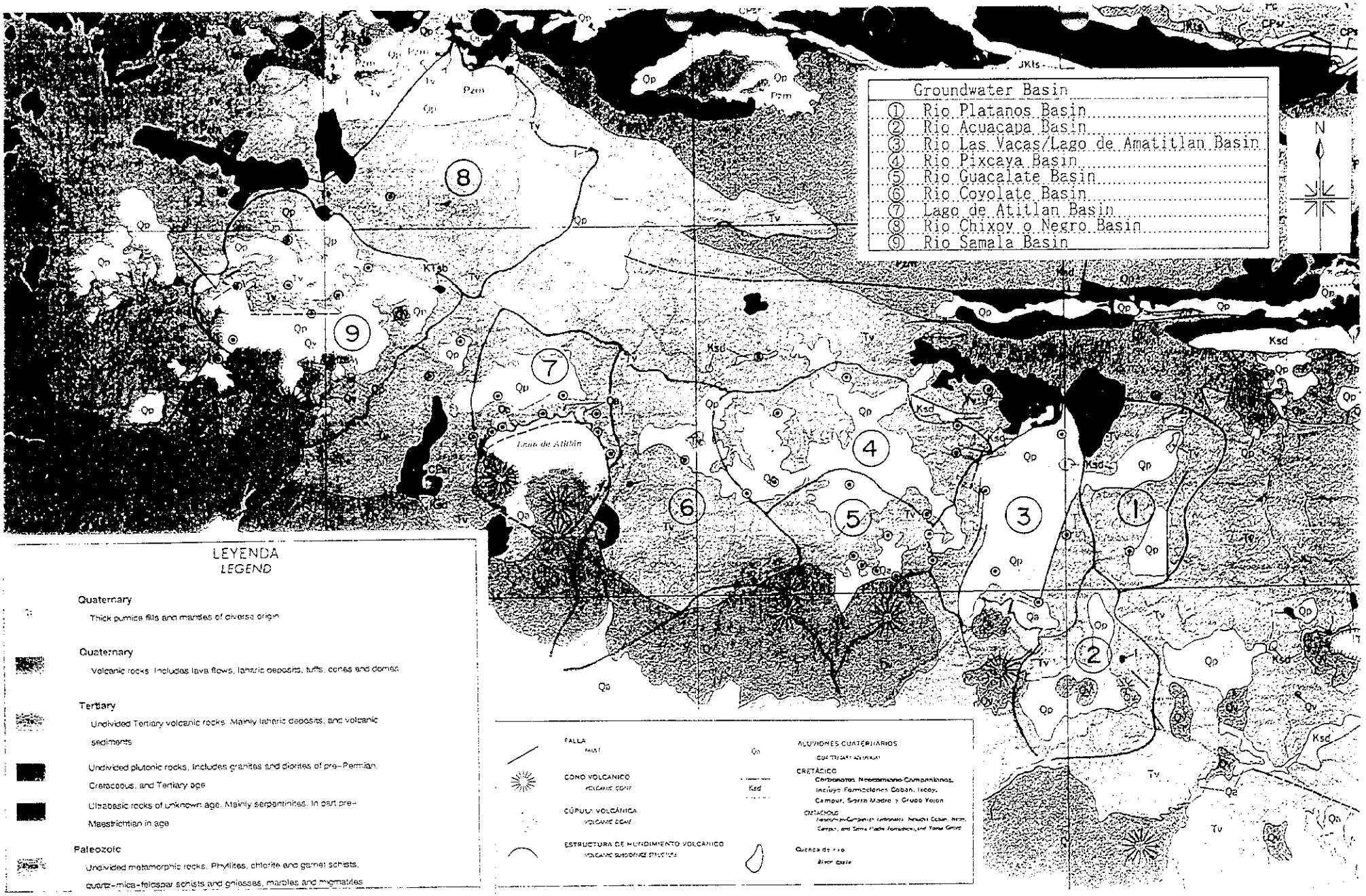
Table 2.1.1 Land use

Department	Cultivated Area		Pasture and Shrub Area		Forest Area		Wetland Area		Others		Total km²
	km²	%	km²	%	km²	%	km²	%	km²	%	
Guatemala	1,285	38.0	707	21.6	19	1.2	115	40.4	-	-	2,126
Sacatepéquez	134	3.9	266	8.1	65	4.0	-	-	-	-	465
Chimaltenango	520	15.4	915	27.9	522	32.4	-	-	22	24.4	1,979
Sololá	481	14.2	135	4.1	276	17.1	167	58.6	33	36.7	1,092
Totonicapán	348	10.3	454	13.9	228	14.2	-	-	-	-	1.030
Quetzaltenango	615	18.2	797	24.4	501	31.1	3	1.0	35	38.9	1.951
Total	3,383	100.0	3,274	100.0	1,611	100.0	285	100.0	90	100.0	8,643
%	39.2		37.9		18.6		3.3		1.0		100.0



MAPA GEOLODICO DEL ÁREA ESTUDIO

Fig. 2.1.1 **Geological Map in the Study Area**



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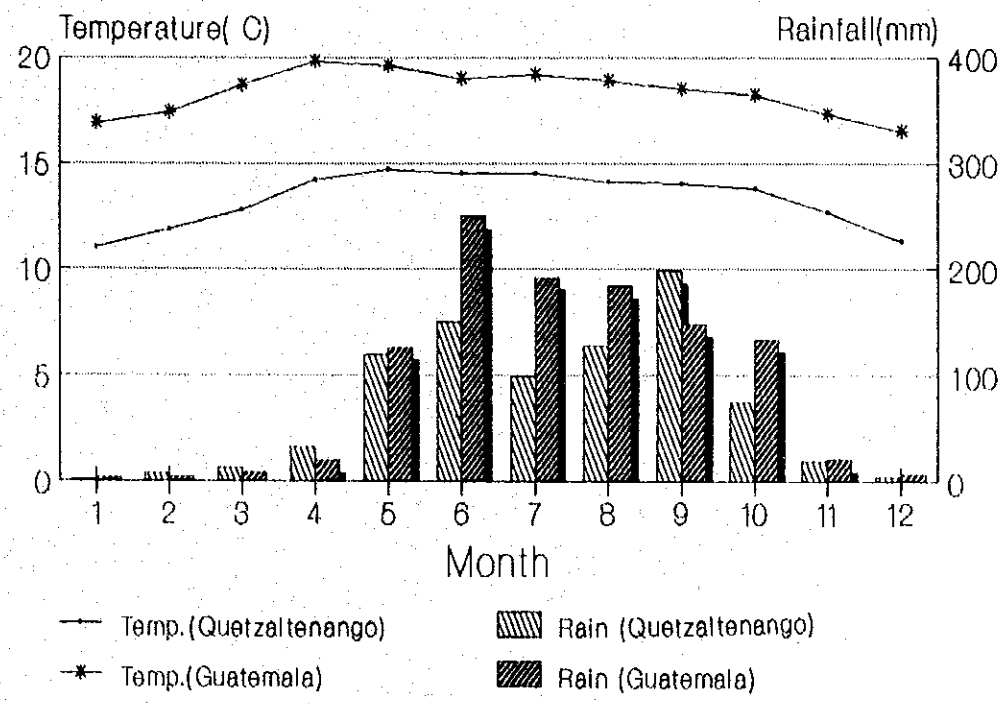

Fig. 2.1.2 Monthly Rainfall

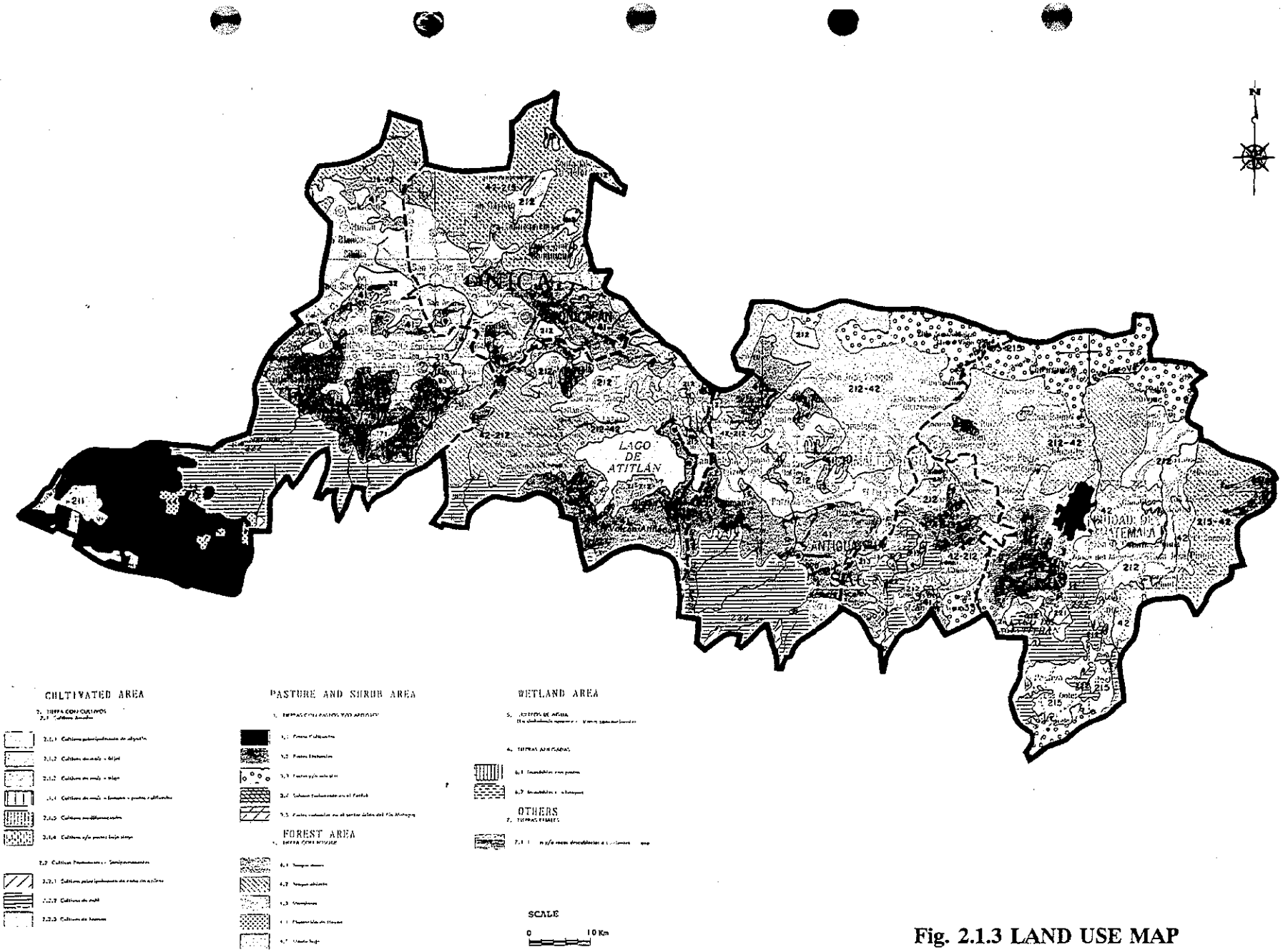

Fig. 2.1.3 LAND USE MAP

2.2 Socioeconomic Conditions

2.2.1 Municipal Administrative Unit

The municipalities were established with a view to consolidate a democratic system and decentralize public services. The central government grants them autonomy and, in compliance with the Constitution, contributes 8% (10% from 1995) of the national budget.

The municipalities were defined as "A unit of individuals characterized by a permanent relation of vicinity and established on a specific territory, organized by public law, with institutions committed to the common welfare of the residents in the district". The members of the municipal governments are of two types: members elected by the people (mayors, trustees and councilors) and the public officials appointed by the Municipal Council: secretary, treasurer, and civil officials. With the exception of the mayor, the number of members of the municipal administration is determined according to the category of municipality and its total population. The municipalities are headed by the mayor who takes part in the Departmental and Regional Development Councils in order to coordinate the municipal and central government policies.

The duties of the municipalities, by the Municipal Code (Decree 58-88), are based on municipal autonomy and policies, plans and programs of the local government in line with those of the State. The purpose of the municipalities is to provide and administer public services; to establish, maintain, improve, and regulate these services as well as to guarantee fair rates and charges.

The main areas of activity are: sanitation (water supply and sewerage), road infrastructure (urban road system and transportation), preservation and development of the environment (markets, solid waste collection, green areas, and wholesale meat markets), and urban development (planning of the municipalities and capital city).

The Municipal Code divides the municipalities into four categories: the first category covers the Department capitals and towns with a population over 100,000 inhabitants; the second category covers towns over 20,000 and harbors; the third category covers towns with a population between 10,000 and 20,000; and the fourth category covers towns with a population under 10,000. However, these four categories were abolished by a Constitutional Amendment of 1994.

The main institutions supporting municipal development are INFOM and the National Association of Municipalities (ANAM).

INFOM was established in 1957 to improve the progress of

municipalities, providing technical and financial assistance to the 329 municipalities which are not located in the metropolitan area.

The main duties of INFOM are:

- Technical assistance, consisting of planning and financing public works and services, organization of municipal finances, advising the preparation of budgets, training of administrative and technical personnel, etc.

- Financial assistance through awarding of credit, and the administration of transfer payments from the government.

- Administrative assistance: collection of funds, organization of water services, development of municipal public services

Since 1982, INFOM has established regional offices for the purpose of providing better services to the municipalities, being more aware of their needs and able to respond in a better way to municipal demands.

ANAM duties are: to protect municipal autonomy, to promote the coordination of municipal programs with national program guidelines, and to provide technical assistance to the municipalities.

2.2.2 Population

(1) Population

The information on population presented in this section was provided by the National Institute of Statistics (INE), INFOM, and the Municipalities.

Based on the National Census taken in 1964, 1973 and 1981, the 1994 population is estimated at 10,322,000, 1.7 times larger than the 1981 population. The population of Guatemala City is estimated at 1,150,000, 11.2% of the national population.

The 6 Departments that make up the Study Area: Guatemala (excluding Guatemala City), Sacatepéquez, Chimaltenango, Sololá, Totonicapán, and Quetzaltenango, account for 27.2% of the national population, as shown in Table 2.2.1.

(2) Current Urban-Rural Population

Guatemala can not be described as a country undergoing urbanization. However, it must be pointed out that the population in areas regarded as "urban" in Guatemala is increasing. The slow growth rate of the urban population in the past, however, leads to the conclusion that Guatemala will remain a predominantly rural country in the foreseeable future.

Internal migration is observed to have a stronger influence at the municipal level than at the Departmental level. The overall effect of migration in each Department is controlled by the different socioeconomic conditions of the municipalities.

Studies on Guatemala indicate urban population increase, but not from urbanization. In Guatemala, urban population growth, in terms of density and volume, is not a result of development. Moreover, the categorization of several areas as urban zones is not a precise description as they are not equipped with the basic infrastructure of an urban environment.

Guatemala is considered monocentric. A large proportion of the urban population and the country's total population is concentrated in the Department of Guatemala (46% of the urban population according to a 1994 estimate), particularly in the municipality of Guatemala and surrounding municipalities that make up the urban area of Guatemala City.

Urban population growth is mainly observed in the areas surrounding Guatemala City and the capital cities of the Departments, but not in the remaining municipalities of the Study Area where only a slight population increase is indicated.

The total population of the Study Area is 2,802,613. More than 37.1% live in the Department of Guatemala, 21.4% in Quetzaltenango, 13.3% in Chimaltenango, 11.6% in Totonicapán, 9.5% in Sololá, and 7.1% in Sacatepéquez (see Table 2.2.2). The average density is 317 persons/km^2. More than 70% of the population in the Study Area live mainly on agriculture: producing corn, beans, coffee, wheat, potatoes, tomatoes, etc.

2.2.3 Economic Characteristics

Agriculture is the most productive sector in Guatemala. It accounts for 25% of the country's GNP. It is also most important to the people living in the Central Plateau area, since it generates jobs and income for approximately 68% of the inhabitants.

Exportable products mainly consist of coffee and cotton, whereas corn, black beans, wheat, and, on a smaller scale, vegetables and fruits, etc., are consumed domestically.

The primary economic activity of the indigenous population, in the majority of the municipalities, is subsistence agriculture. Most of the non-indigenous population is engaged in either subsistence agriculture or industrial activities.

Commercial and agricultural industries, and other industries are owned almost exclusively by a small

percentage of the non-indigenous population. Three out of four households live below the poverty line. Extreme poverty is concentrated in rural areas, particularly in the western highlands. These areas are densely populated, contain most of Guatemala's indigenous communities and have the highest concentration of mini-farms and landless people.

There are no basic data on the economic situation of the municipalities in the Study Area, except for the information received from the visited municipalities, which is summarized in Table 2.2.3.

The smaller municipal cities are usually located far from the large urban areas, and rely economically on agriculture. Most of the industries are located in Guatemala City and, to a smaller extent, in Quetzaltenango City.

Data on the socioeconomic conditions of the municipalities were provided by the public officials of the surveyed municipalities, and reviewed by comparing them with the existing data of SEGEPLAN and the housing survey data of INE.

The following general information was obtained from the surveyed municipalities.

- The number of persons per family generally varies from 4 to 9, average of 5.8.

- Most families have more than one source of income.

- The average number of working persons per family is 1.4 (Housing Survey Data).

- Most of the people rely on agricultural activities, and the incomes are classified as follows:

  a) High income (over Q1,000/month) 3%
  b) Medium Income (between Q1,000 and Q500/month) 37%
  c) Low Income (below Q500/month) 60%

- The monthly average income in the 54 surveyed municipalities is about Q560, but almost 60% of the families have a lower income.

- Monthly water charge ranges from Q0.25 to Q15.00.

2.2.4 Infrastructure

(a) Roads

Guatemala is highly dependent upon its road system which carries 95% of internal freight plus an even higher percentage of passengers.

More than three quarters of roads serving villages (tertiary roads) are in an inadequate or deteriorating condition. Most are unpaved and are usually passable only in the dry season, which put considerable restrictions on the rural poor who sometimes have to walk an entire day to reach the closest market or health clinic.

The Rural Roads Program Unit, part of the General Road Directorate (Direccion General de Caminos, DGC), has extremely limited financial resources, lacks clear priorities, insufficient equipment, and has a high turnover of personnel who, after training, leave for the more lucrative private sector.

As a result, the DGC does not have the capacity to expand its current program of construction, rehabilitation and maintenance of roads. Thus, there is a considerable need to explore new decentralized methods of financing and implementing road projects, through municipalities and local committees, with the help of private contractors and NGOs.

The Study Area is mostly rural, where paved roads are limited to the trunk roads and to the central parts of the municipal capitals. Inadequate road maintenance is conspicuous along the municipal roads. This is due to limited grants from the central government for the construction and maintenance of infrastructure.

(b) Electricity

Electric power generation and supply services in Guatemala are controlled by the Instituto Nacional de Electrificación (INDE). The electrical service in the Departments of Guatemala, Sacatepéquez and Escuintla is provided by the Empresa Electrica de Guatemala S.A. (EEGSA).

The total capacity of electricity generation in Guatemala in 1992 was 976 MW, approximately 50% hydro and 50% thermal power, while the total generated energy in 1992 was 2,427,436 MWh indicating a low operation rate of less than 30% (hydropower: 42%, thermal power: 15%).

About 65% of the generated electricity is supplied to the Departments of Guatemala, Sacatepéquez and Escuintla by EEGSA. While more than 80% of households in these areas receive electricity, the coverage of the electricity service in other Departments is very low .

The percentage of the households with electricity in the Study Area is comparatively higher than in other Departments, although, mostly limited to the urban areas of the municipalities.

The monthly power rates paid by most of the beneficiaries are rather high, ranging from Q15 to Q30, when compared to other public charges such as water rates.

(c) Telecommunications

The telecommunications service in Guatemala has been rendered by Empresa Guatemalteca de Telecomunicaciones (GUATEL) since 1966.

International telegrams, telex, and telephone services are available in almost all of the major cities in the Republic. However, the telecommunication service is still generally poor even though the system has been considerably expanded in the past 5 years .

The total number of telephone subscribers in the Republic as of the end of 1992 was 214,409, of which 80% live in Guatemala City.

The telephone system in the Study Area is generally better developed than in other areas. Whereas the number of the house connections per 1,000 persons in other areas is 4.5, the ratio in the Study Area ranges from 4.8 to 12.1. Exceptions are Totonicapán, which has only 1.2 connections per 1,000 persons, and Guatemala City, which has 159.5.

(d) Sewer system

About 80% of the municipalities in the Study Area have sewer systems, but 60 to 80% of the households connected to the systems are in the urban areas.

However, many of the systems are often incomplete, e.g., there is a drainage system but there is no sewage treatment plant. Collected sewage and stormwater drain directly into streams, rivers, or lakes and contaminate these waters.

Areas where houses are not connected to the main sewer lines are insanitary and therefore need consideration. The introduction of small scale sewage treatment facilities (individual or community based systems) is a lot better than connecting these houses, particularly those in isolated rural areas, to the main sewer lines.

A sewage treatment plant was constructed and completed at the end of 1994 in the municipality of Sololá, bringing with it a reduction in the levels of pollution in Lake Atitlán. In addition to this type of plant in the urban areas, simple purifiers should be installed in the rural areas.

2.2.5 Position of Women

Throughout Latin America the male has been traditionally considered to be superior. This trait, "machismo", is still strong even in the so called developed areas, and has considerable influence on women's place in the society. The rural areas of the Study Area are densely populated with indigenous people still maintaining traditional life styles. The low status of indigenous people, coupled with "machismo" are a double burden to the indigenous women.

The women's situation in the Study Area is discussed in the following pages.

(a) Education

In Guatemala, women's development and education is very different from men's. At home, the girl is expected to behave very much differently from the boy. The family assigns girls many tasks and responsibilities, mainly to serve the fathers and brothers. This discriminative formation continues at school, where girls are assigned different tasks and chores from those assigned to boys, reinforcing behavior patterns and attitudes that clearly separate women's role from men's.

Discrimination in terms of access to education and opportunities has often got to do with income disparity, social and ethnic origins, and most of all with sex, producing high rates of illiteracy.

Illiteracy, sex and area (1990)

	Older than 7	Older than 15	Urban	Rural
Female	59.9	63.7	12.4	47.4
Male	40.1	36.3	6.6	33.6

Among indigenous women, the figure reaches 75%, and in some communities it is as high as 90%.

Access to education is very low for women in general. According to figures from the National Institute of Statistics (1987), only 42% of the female population finish elementary school, 9% complete secondary school, and only 1% of Guatemalan women enroll in university studies.

Interviews showed that the ratio of females to males attending secondary school in the Study Area is roughly 2:3. Clear examples of discrimination can be seen in most school texts, especially at elementary level, where men's role seems to be appreciated more than the women's, who are seen as being passive. Contents, language, educational materials and school communication emphasize traditional

roles and stereotypes based on sex.

However, the government decided in May 1994, that all discriminative expressions in textbooks and printed matter should be deleted. The ONAM (Women's National Office) had been lobbying for this action for the past three years.

According to families, especially in the rural area, very small importance is given to girls' school attendance, assigning them to housework and agricultural activities, a pattern that continues from generation to generation (Table 2.2.11).

As mentioned in Section 5, Education, a significantly higher percentage of the children in the Study Area who drop out of schools are girls.

In summary, education emphasizes strong differences according to three main factors: gender, ethnicity, and social stratum. Women in the study area are bound by these three factors and most of them are left in the educational conditions of the past.

(b) Health

Health conditions nationwide are generally bad, but they are particularly a problem for women, considering the importance of their roles as bearers and raisers of children.

Although the data may not accurately show it, women's health conditions, particularly those from indigenous rural communities, have seriously deteriorated due to lack of proper nutrition and education, insanitary housing conditions and deficient health services.

The average number of children per family in Guatemala (5.6 children) is one of the highest in Latin America and is largely influenced by education. Illiterates or those with poor education have around twice as many children as those with secondary education. In the rural area, the average number of children per family is 7.

Thirty years ago, the government promoted family planning nationwide through APROFAM and recommended 4 as the maximum number of children per family. The program is gradually bringing forth good results in the rural sector of the Study Area where the number has decreased to 7 from 10 or 12. The number is slightly lower in the urban areas.

Families in Guatemala usually live together, up to three generations of families, sometimes including relatives. This maybe another reason for the decrease in family size. There are exceptional cases however, such as a woman with 25 children and another who had 16 before she turned 32 years of age. The high numbers are a result of the

established traditional role of women, that is, to give birth to many children, particularly baby boys.

The birth rate is highest among women in the 15 - 24 age group. Half of the female population of Guatemala have their first child before turning 20 years old.

In the Study Area, women usually marry at the age of 18, some as early as 13 or 14, having their first child at 15.

The maternal mortality rate is 2.48 per 1,000 live births, mainly influenced by complications during pregnancy, hemorrhages, childbirth and post-natal complications. Childbirth deaths are also influenced by the mothers' past medical history, e.g. abortions. Health services complicate matters also as only 30% of childbirth in Guatemala are assisted by physicians and nurses, while the remaining percentage rely on professional or untrained midwives. Malnutrition and mother-infant relationship are also aggravating factors.

Maternal Mortality Rates
(per 100,000 live births)

Guatemala	248
Mexico	87
Costa Rica	26

Maternal Mortality Rates
in the Study Area
(per 100,000 live births), 1991

Guatemala	70
Chimaltenango	200
Sacatepéquez	130
Sololá	210
Totonicapán	120
Quetzaltenango	70

Malnutrition has always affected poor women, particularly so during pregnancy and lactation when additional nutrients are necessary.

Other problems directly affecting women's health are cancer, sexually transmitted diseases, and occupational hazards.

Women are also observed to suffer more mentally due to stress and pressure from their dual role. The women and children are often the victims of family violence, being abused and mistreated physically as well as psychologically.

Women working in the informal sector put themselves under precarious conditions, in terms of safety and hygiene. They are exposed to accidents with no social welfare

coverage.

Health services are deficient too, and not easily accessible to the dispersed rural population. Further, there remains strong cultural resistance to use modern medical practices, as well as logistical problems.

(c) Work

Underdeveloped countries are usually unable to generate enough jobs to involve the entire working age population. In addition, males are usually given preference for the positions that are available.

According to a study on population carried out in Guatemala in 1987 by the National Institute of Statistics (INE), of the economically active population of 2,740,100, 76% were men and 24% women.

The three important elements why women have very low participation in the PEA (economically active population) are: a) discriminatory socio-cultural factors at the time of hiring; b) unreliable data collection system; and c) the low education level and occupations available to women.

In terms of economic activity, women are mostly employed in commercial and service jobs (32% and 31%, respectively) due to low qualification levels. Next is manufacturing and agriculture (19% and 14%), even though the latter is considered as men's work. Although a particular village has started hiring women for some agricultural work usually carried out by men, the women still get paid half of the men's wages.

In the analysis of the situation of women in terms of employment, it is important to examine their participation in the Public Sector: 30% of the 110,757 public employees in the Finance section are women. In other sectors, only 6 to 21% are women.

In the Study Area many elementary school teachers and nurses are women. The number of women working in other public sectors, mainly municipal offices, was observed to be increasing recently.

In the informal sector (self-employed work, domestic work, family work), where the working force is mostly made up of women (60%), underemployment (visible and invisible) is prevalent: over 45 hours/week and very low salaries.

Women are well qualified in traditional work such as sewing, weaving, cosmetology, cooking and baking. Like women in the informal sector, these works are basically an extension of household chores, and are very low paying.

In the indigenous societies in the Study Area, almost all women still wear traditional clothes which they usually

make themselves. They also pass their weaving and sewing skills, among others, to their children, as they find it a necessity in their communities.

Because these skills take a long time to master, they are usually taught from a very early age (10 - 14 years old). Difficult living conditions force them to work from an early age as well, in many cases forcing them to drop out of school and end their educations.

Aside from working for a living, women also have to tend to household chores and their children.

In agricultural areas, such as the Study Area, women are required to help the men in addition to housekeeping.

(d) Women's Movements

As mentioned in the previous sections, women's position needs to be improved. Consequently, several women's movements have been set up, such as APROFAM (Asociacion Pro-Bienestar de la Familia en Guatemala - Guatemalan Family Welfare Association), ONAM (Oficina Nacional de la Mujer - Women's National Office) and many other private groups. Some of the members belong to indigenous communities, who have even become head of some sections.

APROFAM started out with family assistance programs protecting women's health, especially mothers. It is now in its 30th year after achieving much success in family planning.

ONAM started about 13 years ago as a unit of the Ministry of Labor and Social Welfare mainly organized to uphold women's rights and to fight against discrimination.

In the political field, however, only 6 out of the 116 members of parliament are women, and three are presently serving as ministers.

2.2.6 Education

The educational system in Guatemala comprises four levels: preparatory, elementary, secondary (middle and diversified) and college.

Preparatory school: from one to three academic years, for children aged 4 to 6.

Elementary school: six school years, for ages 7 to 12(14). Elementary education is compulsory.

Secondary school: a) "Ciclo Basico" which is like junior high school, three years, b) diversified, 2 to 3 school years, for ages 13 to 19 years old. Public school education (elementary and secondary) is free.

College (Nivel Superior): 5 to 6 academic years to get a college degree (Licenciatura). Recently there has been an increase in short term courses (3 years).

However, the educational level in Guatemala is among the lowest in Latin America, particularly when compared to other countries with similar income levels. In 1992, 82.5% of children between the ages 7 to 12 were enrolled in elementary schools (boys: 88.0%, and girls: 76.8%).

Number of pupils sharply decreases from the first to the sixth grade. Less than half the children (42.3%) complete sixth grade. Only 27% of children aged 5 and 6 are in school (Table 2.2.12), the worst of all Central American countries.

The problem is particularly acute in rural areas where the population is largely indigenous. Only 49 out of 100 girls are in school, compared to 74 out of 100 in urban areas. In 1992, it was estimated that 30% of the urban population and 70% of the rural population were illiterate. In some poorer rural areas, illiteracy reaches 76%.

Improving education is especially challenging given the ethnic complexity of the society, one of the most diverse in Latin America. About half (48%) of the population is indigenous, descendants of the Mayas. There are over 21 separate indigenous groups, each with their own language.

Although most of the indigenous population speaks one of three major indigenous languages (Quiché, Kakchiquel and Kekchí), the majority continues to speak little Spanish which makes it difficult for them to take advantage of educational and health programs.

The demographic structure also offers formidable challenges to education, particularly for women and children. Almost half (46%) of the population is under 15 years of age. Many of these children live in geographically dispersed and ethnically unique communities.

Preparatory programs are critical to improve school retention because many children of indigenous families reach elementary school age having a considerable disadvantage due to their inability to speak Spanish. Since only 21% of the schools in Guatemala offer bilingual education, many children from indigenous communities either do not attend school or, if they do, they fail and often drop out eventually.

In terms of extra-curricular activities, a clear concept of the personal development and qualification process for work, life and social togetherness does not seem to exist in Guatemala.

A large part of the population is comprised of indigenous

peoples, most of whom inhabit the rural areas of all Departments in the Study Area, except for Guatemala. Almost all results mentioned above, therefore, relate to the educational situation of the Study Area. Additional figures presented below are based on the interviews conducted in the Study Area.

From 80 to 85% of children generally start elementary school at the age of seven, but there are some who do not start until they are ten. Some 20 to 50%, mostly girls, are forced to leave school by the 3rd or 4th grade, mainly because of financial difficulties.

Some children, however, return to school after an interval of several years. Sometimes, children aged fifteen, and in a few cases even seventeen, are still in elementary school. Generally, fourteen is the maximum age for elementary education.

All municipalities have at least one elementary school. But the secondary schools are very few and concentrated mainly in the urban areas. The number of children varies extremely by municipality (3 to 90% of girls (average 39%), 5 to 90% of boys (average 53%)). The number of students entering universities is much lower, around 1% for females and about 10% for males. Indigenous people have recently started attending universities, and some of them return to their home town after graduation to become school teachers.

2.2.7 Sanitary Conditions and Health

(a) Environmental sanitation

The UN Economic Commission for Latin America and the Caribbean (ECLAC) estimated that 78% of households in Guatemala have neither potable water nor latrines. However, this figure decreased to 43.5% by 1992-1993.

All of the municipalities in the Study Area are supplied to an extent with potable water through house connections in the urban area, and mostly by communal taps in the rural areas. However, the coverage of water supply still remains low at 62.2% in the Study Area. This figure is a little higher than the national average however.

The main causes of Guatemala's high infant mortality rate are diarrhea and parasitic infections, both of which are related to inadequate water supply and sanitation. Communicable diseases and illnesses associated with poor sanitary conditions are the leading causes of death for adults over 45.

The absence of a national water and sanitation authority in Guatemala has caused fragmentation of the sector. Despite efforts at coordinating water policies, which culminated in the creation of the Permanent Committee for the Coordination of Potable Water and Sewerage (COPECAS), there

is still no clear direction in the water and sanitation sector.

The urban sector has poor policies and lacks the ability to plan and implement programs, and manage day-to-day operations. Water programs in rural areas are characterized by a lack of formal coordination, particularly with respect to strategies, appropriate technologies, tariff policies, and by insufficient emphasis on community participation and hygiene education.

The Departments that do not have adequate potable water supplies tend to have poor sanitation systems (Peten, Jutiapa, Chiquimula, Jalapa, etc.).

However, a high percentage of households in almost all the municipalities of the Study Area, except Génova, have sanitation systems (80.2 - 92.0%); the water supply percentage is not so high, however.

(b) Water quality of the existing water supply systems and shallow wells

Using simple analytical methods, several water quality parameters were checked on samples taken from spring water, household taps, and from shallow wells.

Although pH was within the acceptable range, it was generally slightly lower than the standard level.

Coliform and other forms of bacteria, serious impact factors for drinking water, were detected in many places.

The INFOM laboratory occasionally checks water quality and bacterial contamination.

Except for only a few municipalities, water is supplied without treatment, resulting in bacterial contamination. Bacteria was detected even in treated water, probably due to insufficient chlorine or hypochlorite.

INFOM advises the operators of the treatment plants on water treatment methods, especially in places where cholera has been found. However, the advice is usually followed once and rarely followed up regardless of the knowledge that diarrhea and other intestinal infections result from poor water treatment measures. The implementation of water treatment measures is usually hampered by financial reasons.

(c) Health and diseases

The annual health budget is high (8.5% of the national budget - 1990) and the adult and infant mortality rates have decreased to half what they were 15 years ago. Yet, many diseases, especially infant and maternal, are still widespread, thereby making the mortality rate still high by

international standards.

Health services offered are concentrated exclusively in urban areas. Services from the Ministry of Public Health and Social Welfare cover 25% of the population, IGSS covers 15% and the private sector 14%.

Health institutions	Number
Hospitals	148
Health centers with beds	32
Health centers without beds	188
Consultation offices	35
Clinics and others	3,458
Beds	1.1 per 1000 persons

In the Study Area, government support for health care facilities is very poor. Six (6) public and forty six (46) private hospitals exist in the forty eight (48) municipalities visited. These hospitals were located only in the larger towns. All municipalities had at least one health center or clinic.

In comparison to other Central American countries, Guatemala has the highest number of people not covered by health services.

Comparison with Central American Countries, citizens without health care (millions), 1992 (PNUD)

Guatemala	6.1
El Salvador	2.2
Honduras	1.3
Nicaragua	0.6
Costa Rica	0.6
Panamá	0.5

Diseases that are most common are: acute respiratory infections, severe diarrhea, malaria, and malnutrition. Deaths due to intestinal infections seem also high, although data are insufficient. In the Departments in the Study Area, the distribution pattern of diseases, except malaria, is similar to the national distribution pattern, but levels are generally higher in the Study Area.

Child mortality in 1989 was 57/1,000, with diarrhea related diseases, severe respiratory infections, and perinatal diseases being the main causes (with 30%, 23%, and 20%, respectively), in addition to malnutrition. In indigenous groups, child mortality is even higher.

(d) Nutrition

Malnutrition in Guatemala population, particularly among children, is very high. In 1990, 4% of children under 5 years old suffered severe malnutrition, and observations indicate that conditions could grow worse. Children,

especially in rural areas and the very young in indigenous communities, are underweight. The malnutrition rate among children aged between 6 - 9 years, is 37%.

Malnutrition is mainly caused by low consumption of protein, calories, vitamin A and iron deficiency.

Diets vary between urban and rural areas, and between income levels: in rural areas and particularly in the lower income group, a higher dependency on corn and beans is found.

On the other hand, in the urban areas, higher income earners consume more meat, dairy products, eggs and fruit. However, daily energy consumption in the urban and higher income groups is only slightly higher than in others.

The varying regional dietary habits, in general, reflect the socioeconomic conditions of the population, that is, production, availability and access to food, and cultural customs. Acute poverty prevails in rural areas and central highlands. This is manifest in their diet which consists mainly of beans and maize.

People in the highland region, located in the Study Area, consume daily more vegetables and protein than other regions, having a considerably lower energy intake. The dietary habits of the central region, also in the Study Area, are typical of Guatemala.

In both areas, mortalities during pregnancy due to malnutrition and dehydration, and infant and maternal death during childbirth are higher than average. Main causes are considered to be low daily energy intake and the limited variety of foods.

Table 2.2.1 Total Population and Growth Rate by Departments

No.	Department	Population (Census)			Population (Estimation)	Annual Growth Rate (%)		
		1964	1973	1981	1994	73/64	81/73	94/81
	Country	4,287,997	5,160,221	6,054,227	10,322,011	2.08	2.02	4.19
	Guatemala City	572,671	700,504	754,243	1,150,452	2.26	0.93	3.30
I	Guatemala (*)	238,187	407,682	556,949	1,039,953	6.15	3.98	4.92
II	Sacatepequez	80,942	99,988	121,127	198,273	2.38	2.43	3.86
III	Chimaltenango	163,153	194,735	230,059	373,258	1.99	2.11	3.79
IV	Solola	107,822	127,268	154,249	266,756	1.86	2.43	4.30
V	Totonicapan	141,772	166,809	204,419	325,940	1.82	2.57	3.65
VI	Quetzaltenango	270,916	312,787	366,949	598,433	1.61	2.02	3.83
	Total Municipalities	1,002,792	1,309,269	1,633,752	2,802,613	3.01	2.81	4.24

(*) Excluding Guatemala City

Source: 1964, 1973, 1981, National Institute of Statistics (INE)
1994, estimated by INE and arranged by the Study Team

Table 2.2.2 Urban-Rural Population, Density by Department (1994)

No.	Department	Area (km2)	Population			Density (p/km2)
			Urban	Rural	Total	
	Guatemala City	228	1,150,452	0	1,150,452	5,046
I	Guatemala (*)	2,118	744,947	295,006	1,039,953	491
II	Sacatepequez	465	148,001	50,272	198,273	426
III	Chimaltenango	1,981	149,314	223,944	373,258	188
IV	Solola	1,142	98,820	167,936	266,756	234
V	Totonicapan	1,050	50,756	275,184	325,940	310
VI	Quetzaltenango	2,090	232,325	366,108	598,433	286
	Total	8,846	1,424,163	1,378,450	2,802,613	317

(*) Excluding Guatemala City

Source: National Institute of Statistics (INE)

Table 2.1.1.5. ECONOMIC CONDITIONS BY MUNICIPALITY (1)

GUATEMALA

NO	MUNICIPALITY	CAT.	INCOME BY LEVEL (Q) High >10000	Middl. 1000 Q	Low <500 Q	MONTHLY FAMILY INCOME (Q) Income	Expend.	MAIN INCOME BY SECTOR Sector	%	MUNICIPALITY BY DISTRIBUTION Received 1992	To receiv. 1994	POPULAT. (1994) Num.Hoad	HOUSING Number	P/Hous.	WATER SERV. CHARGE Q/M	NO. OF CONNEC.	METER	TOTAL WATER CHARGE Q/M	SERV. HOURS (day)	OPERAT. & MAINTEN. COST (Quets/Month) Electr.	Others	REMARKS
1	Santa Catarina Pinula *	3	4	24	72	944	1888	Commercial Service	17 28	794.843	.454.844	6.276	1.525	5.5	3.50	1.788		5.100	12.0	13.500	Included in Elec.	Financial capacity
2	San Jose Pinula *	3	25	25	50	388	888	Agricult. Commercial	30 25	545.453	.188.879	11.237	1.656	6.1	1.00	1.557	No	1.557	3.0	13.000		Fin. Cap. & w/ to pay Q & M
3	San Jose del Golfo *	4				458	456	Agricult.		426.943	788.398	2.878	356	5.9	5.00	330		1.650	12.0	6.000		Economically poor
4	Palencia	3								713.913	.314.977	5.734	958	6.0								
5	Chinautla *	3								698.158	.854.342	7.161	488	5.1	2.00							Economically poor
6	San Pedro Ayampuc *	3								497.152	915.737	5.588	958	6.6	3.00	548	No	1.626	24/s 14day	6.000		Financial invest. W/ to pay
7	Mixco *	3	10	68	38	1388	1288	Service Others	48 68	1.822.582	1.943.158	19.888	3.696	5.3	10.00	2.586	No	26.888	8-4h each days	15.988		Financial capacity
8	San Pedro Sacatepequez *	3						Agricult. Industry		751.735	.184.842	7.552	1.328	5.6	1.50			0	20.0	3.988	888	Economically poor W/ to pay
9	San Juan Sacatepequez *	3						Floricult. Agricult.		685.777	.194.788	10.841	1.888	5.8	2.00	1.625	No	3.258	5.0	5.348	2.574	W/ to pay
10	San Raymundo *	3		10	98	348	388	Agricult. Others	85 18	586.245	932.652	4.747	858	5.5	6.88	835	425	4.958	3.0			Economically poor
11	Chuarrancho *	3								428.655	758.552	5.581	1.885	5.6	18.88	256	No	1.888				Economically poor
12	Fraijanes	3								487.922	898.728	4.312	818	5.2				0				
13	Amatitlan	2								878.378	.615.752	38.582	6.588	6.8				0				
14	Villa Nueva *	3	10	28	68	1588	1288	Manufac. Commercial	48 38	.338.434	.418.878	37.432	6.487	5.8	15.88	5.847	Few	44.785	24.0	128.888	12.888	Financial capacity Electr. prob. appl.
15	Villa Canales *	2								.838.887	.892.858	5.574	1.812	5.5	1.58			0	21.0	6.888		Financial capacity. No request for well
16	San Miguel Petapa	4								682.582	.277.528	7.348	1.288	6.5				0				

Source : Arranged by the Study Team from Data provided by the Municipalities and INFOM

SACATEPEQUEZ

NO	MUNICIPALITY	CAT.	INCOME BY LEVEL (Q) High >10000	Middl. 1000 Q	Low <500 Q	MONTHLY FAMILY INCOME (Q) Income	Expend.	MAIN INCOME BY SECTOR Sector	%	MUNICIPALITY BY DISTRIBUTION Received 1992	To receiv. 1994	POPULAT. (1994) Num.Hoad	HOUSING Number	P/Hous.	WATER SERV. CHARGE Q/M	NO. OF CONNEC.	METER	TOTAL WATER CHARGE Q/M	SERV. HOURS (day)	OPERAT. & MAINTEN. COST (Quets/Month) Electr.	Others	REMARKS
1	Antigua Guatemala	1	15	48	45	3888	2588	Agricult. Commercial	58 32	1.598.187	1.143.765	21.823	3.546	5.3	12.58	5.888	5.488	58.588				
2	Jocotenango *	4								481.157	849.417	12.721	2.214	5.8	4.58	1.258	1.758	5.858	Jov/E:12 M/A 7			?
3	Pastores	4								458.885	848.884	3.897	882	5.6								
4	Sumpango	3								588.848	.884.978	14.315	2.388	6.2								
5	Sto. Domingo Xenacoj	4								348.333	835.718	5.854	858	6.7								
6	Santiago Sacatepequez	3								483.818	883.887	8.322	1.458	5.8								
7	San Bartolome Milpas Altas *	4	1	8	88	858	588	Agricult. Commercial	88 18	858.888	.188.728	3.347	588	5.7	7.88	758	Yes	5.258	18.88	3.888	788	W/ to pay Q & M
8	San Lucas Sacatepequez	4								688.888	.148.881	8.787	1.488	7.8								
9	Santa Lucia Milpas Altas *	4	13	35	52	1588	1288	Agricult. Manuf.	35 65	718.258	.228.825	3.738	788	5.3	5.8 65% 1.8 35%	788	8.88%	3.788	3.58	4.888	3.718	Economically poor
10	Magdalena Milpas Altas *	4		28	88	588	588	Agricult. Manuf.	88 28	248.588	543.754	4.421	788	5.3	8.88	558	No	3.388	3 (78%) 1 (28%)	18.888	3.158	Economically poor
11	Santa Maria de Jesus *	4		28	88	888	488	Agricult. Commercial	98 2	417.582	718.121	11.187	2.888	5.8	18.88	748	Few	7.488	1.58	3.158	2.848	Economically poor W/ to pay
12	Ciudad Vieja *	3						Agricult. Others	78 28	838.588	855.225	14.758	2.488	6.1	5.88	2.288	2.388	15.588	19 (28%) 24 (78%)	84.345	3.888	Financial capacity
13	San Miguel Dueñas	4								537.148	918.954	4.832	758	5.3								
14	San Juan Alotenango	3								484.838	811.438	3.782	1.588	6.1								
15	San Antonio Aguas Calientes *	4		28	72	588	588	Agricult. Others	88 28	431.488	778.358	4.888	888	5.7	1.88	488	Yes	688	24.88		588	Economically poor
16	Santa Catarina Barahona	4								482.341	884.438	2.295	358	6.4								

Source : Arranged by the Study Team from Data provided by the Municipalities and INFOM

Table 2.2.3 ECONOMIC CONDITIONS BY MUNICIPALITY (2)

CHIMALTENANGO

NO	MUNICIPALITY	CAT.	INCOME BY LEVEL (%) High >10000	Middl. 1000 Q	Low <999 Q	MONTHLY FAMILY INCOME (Q) Income	Expend.	MAIN INCOME BY SECTOR Sector	%	MUNICIPALITY AS DISTRIBUTION Received 1993	% receiv. 1994	POPULAT. (1994) Mun.Head	HOUSING Number	P/Hous.	WATER SERV. CHARGE Q/M	NO. OF CONNEC.	METER	TOTAL WATER CHARGE Q/M	SERV. HOURS (day)	OPERAT. & MAINTEN. COST (Quets/Month) Electr.	Others	REMARKS
1	Chimaltenango	1								920.473	720.880	25.887	3.944	6.5								
2	San Jose Poaquil *	3			100	250	250	Agricult.	80	497.893	915.445	3.850	700	5.5	0.69	845	Ye	720	24.0		1.200	Economically poor W/ to pay
3	San Martin Jilotepeque *	3	5	25	70	500	500	Agricult. Others	75 25	935.367	1.015.013	5.402	1.200	4.5	2.50	1.300	Ye	3.250	5.5	3.000	7.100	Economically poor W/ to pay
4	San Juan Comalapa *	2	7	5	93	850	500	Agricult. Commercial	90 10	535.114	1.171.575	14.710	2.529	5.6	2.00	1.154	1.154	2.320	3h(60%) 5h(40%)	3.000	6.040	Economically poor
5	Santa Apolonia	4								479.589	885.389	4.252										
6	Tecpan Guatemala	2								731.943	1.348.184	8.481	1.280	6.6								
7	Patzun *	3		30	70	500	500	Agricult. Commercial	90 10	551.415	1.018.372	13.887	2.293	6.7	4.68	1.134	1.134	4.536	3h/each days			Economically poor W/ to pay
8	San Miguel Pochuta	3								456.925	850.845	4.146										
9	Patzicia *	3	10	60	40	700	700	Agricult. Commercial	80 20	493.324	908.777	11.587	1.620	6.6	0.25	687	Ye	884	2.0		6.000	Economically poor W/ to pay
10	Santa Cruz Balanya	4								362.995	667.885	4.658										
11	Acatenango	3								446.550	822.453	3.807										
12	San Pedro Yepocapa	3								436.662	807.615	8.568										
13	San Andres Itzapa	3								447.883	824.365	15.894										
14	Parramos									385.157	709.411	5.645										
15	Zaragoza *	3	5	20	75	700	650	Agricult. Livestock	75 15	420.750	774.991	7.821	1.588	5.2	2.00	1.300	253	4.500	3.5	15.000	1.000	W/ to pay
16	El Tejar *	4	7	40	53	800	600	Brick fac. Others	80 20	717.737	1.322.681	7.499	1.700	6.2	10.00 15.00	526 164	1.040	9.360 1.560	15.0	12.000	1.700	Public faucet = 50 Industry = 150 (10%)

Source : Arranged by the Study Team from Data provided by the Municipalities and INFOM

SOLOLA

NO	MUNICIPALITY	CAT.	INCOME BY LEVEL (%) High >10000	Middl. 1000 Q	Low <999 Q	MONTHLY FAMILY INCOME (Q) Income	Expend.	MAIN INCOME BY SECTOR Sector	%	MUNICIPALITY AS DISTRIBUTION Received 1993	% receiv. 1994	POPULAT. (1994) Mun.Head	HOUSING Number	P/Hous.	WATER SERV. CHARGE Q/M	NO. OF CONNEC.	METER	TOTAL WATER CHARGE Q/M	SERV. HOURS (day)	OPERAT. & MAINTEN. COST (Quets/Month) Electr.	Others	REMARKS
1	Solola *	1	5	35	60	800	600	Agricult. Commercial	80 20	855.220	1.225.307	15.254	2.900	5.5	0.25	1.449	1.449	4.700	3(60%) 1(40%)		2.500	W/ to pay
2	San Jose Chacaya	4								384.374	715.245	272										
3	Santa Maria Visitacion	4								371.241	691.762	1.116										
4	Santa Lucia Utatlan *	4			100	500	500	Agricult. Handcrafts	80 20	518.208	964.503	2.176	345	6.3	2.00	143	505	447	1h/each days		700	Economically poor Public canouls.
5	Nahuala *	2		10	90	450	450	Agricult. Manufac.	75 25	744.918	1.372.965	6.223	787	6.0	0.25	559		138	4- 5h			Economically poor
6	Santa Catarina Ixtahuacan *	2			100	300	300	Agricult.	80	592.996	1.089.342	3.289	500	6.6	1.00	450	Ye	450	24.0		800	Economically poor
7	Santa Clara La Laguna *	4		10	90	300	300	Agricult. Commercial	80 20	359.148	661.525	4.194	600	7.0	0.50	300	Ye	300				
8	Concepcion	4		10	82	300	825	Agricult.	80	334.755	616.598	1.304	250	5.2	1.00	120	120	120				
9	San Andres Semetabaj *	4	25	35	40	800	600	Agricult. Services	35 65	397.343	731.677	1.780	350	5.0	0.50	250	Ye	175	6.0		420	Economically poor
10	Panajachel	4								630.266	1.209.583	7.793	1.560	5.0	0.50	1.550	1.550	9.300				
11	Santa Catarina Palopo *	4		5	95	450	600	Agricult. Commercial	60 40	345.278	635.978	1.684	300	5.6	1.00	220	Ye	220	2.0			Poor economy for operation & maintan.
12	San Antonio Palopo *	4		5	95	450	450	Agricult. Handcrafts	35 65	533.953	985.814	2.470	440	5.6	1.00	300	Ye	300	4.0			Poor econ.for O & M Tourism dev./infra.
13	San Lucas Toliman	3								549.835	1.012.757	11.822										
14	Santa Cruz La Laguna *	4		10	90	600	600	Agricult. Manufac.	50 50	249.250	462.477	796	135	5.5	1.00	170	Ye	170				
15	San Pablo La Laguna *	4		10	90	350	350			402.592	741.472	5.916	680	7.4	0.50	500	Ye	250				
16	San Marcos La Laguna *	4			100	500	600	Agricult. Services	80 20	368.140	678.688	1.375	320	4.3	0.30	216	Ye	95				
17	San Juan La Laguna *	4		25	75	250	250	Agricult. Manufac.	30 50	351.277	647.027	2.875	550	5.0	0.50	550	Fav	275				
18	San Pedro La Laguna			20	80	300	300	Agricult. Commercial	40 50	385.943	674.941	8.634	1.300	6.6	1.00	1.050	Fav	1.050				
19	Santiago Atitlan									527.847	985.193	22.658										

Source : Arranged by the Study Team from Data provided by the Municipalities and INFOM

Table 2.1.1.5. ECONOMIC CONDITIONS BY MUNICIPALITY (3)

TOTONICAPAN

NO	MUNICIPALITY	CAT.	INCOME BY LEVEL (%) High >10000	Middl. 10000	Low -5000	MONTHLY FAMILY INCOME (Q) Income	Expend.	MAIN INCOME BY SECTOR Sector	%	MUNICIPALITY AS DISTRIBUTOR Received 1993	To receiv. 1994	POPULAT. (1994) Num.Hand	HOUSING Number	P/Hous.	WATER SERV. CHARGE Q/M	No. OF CONNEC.	METER	TOTAL WATER CHARGE Q/M	SERV. HOURS (day)	OPERAT. & MAINTEN. COST (Quetz/Month) Electr.	Others	REMARKS
1	Totonicapan	1								1.053.356	1.156.918	24.737										
2	San Cristobal Totonicapan									521.819	560.678	7.894										
3	San Francisco El Alto *	2		51	50	500	500	Commercial 50 Agricult. 40		636.794	672.873	8.550	1.200	6.9	0.50	500	?	350	2.5		700	Poor economy Public counsels.
4	San Andres Xecul *	3		49	50	500	500	Agricult. 50 Handcraf. 50		610.676	674.723	3.748	500	6.7	0.50	500	No	300	1.5		3.500	Poor economy for ground & paint.
5	Momostenango *			49	50	500	500	Commercial 50 Handcraf. 50		1.353.823	1.473.543	30.350	1.620	6.7	3.00	600	?	1.800	2.5	1.500	500	V/ to pay the O & M
6	Santa Maria Chiquimula	2								716.559	776.099	3.225										
7	Santa Lucia La Reforma	4								467.577	501.244	610										
8	San Bartolo Aguas Calientes	4			100	300		Commercial 90 Agricult. 5		535.781	581.414	1.885			1.00	425		425				

Source : Arranged by the Study Team from Data provided by the Municipalities and INFOM

QUETZALTENANGO

NO	MUNICIPALITY	CAT.	INCOME BY LEVEL (%) High >10000	Middl. 10000	Low -5000	MONTHLY FAMILY INCOME (Q) Income	Expend.	MAIN INCOME BY SECTOR Sector	%	MUNICIPALITY AS DISTRIBUTOR Received 1993	To receiv. 1994	POPULAT. (1994) Num.Hand	HOUSING Number	P/Hous.	WATER SERV. CHARGE Q/M	No. OF CONNEC.	METER	TOTAL WATER CHARGE Q/M	SERV. HOURS (day)	OPERAT. & MAINTEN. COST (Quetz/Month) Electr.	Others	REMARKS
1	Quetzaltenango	1								3.165.956	3.429.167	100.963										
2	Salcaja	3	15	50	35	1.200	1.100	Commercial 50 Manufact. 30		591.193	650.114	12.692	2.300	5.5	6.00	1.000	1.000	11.000				
3	Olintepeque *	3	5	35	60	450	450	Agricult. 50 Commercial 50		631.000	704.837	6.050	730	5.4	5.00	300	No	1.200	2.5	1.150	1.000	Economically poor
4	San Carlos Sija *	3		50	50	450	450	Agricult. 60 Commercial 25		577.134	653.935	3.264	600	5.5	1.00	450	?	450	2.0		?	Economically poor Can not pay O & M
5	Sibilia	4								415.851	771.587	1.181										
6	Cabricon	4		5	95	550	500	Industry 50 Agricult. 25		458.947	851.767	1.727	200	6.5	5.00	200	No	1.000				
7	Cajola *	4		5	95	300	300	Agricult. 80		381.758	702.157	3.843	550	5.5	0.50	400	No	200	5.0		1.000	Economically poor
8	San Miguel Sigüila	4								374.751	630.264	1.940										
9	San Juan Ostuncalco	2								591.455	1.106.206	13.615										
10	San Mateo	4				700	600	Commercial 50 Agricult. 40		486.977	895.982	2.004			1.50	595	595	894				
11	Concepcion Chiquirichapa *	4		20	80	360	360	Agricult. 90 Manufact. 10		459.017	839.899	5.078	997	5.5	1.00	800	Not in use	650	3.0		700	Economically poor V/ to pay ?
12	San Martin Sacatepequez *	3			100	300	300	Agricult. 80		462.914	852.859	3.191	515	6.2	0.63	?		500			500	Economically poor Can not pay O & M
13	Almolonga *	4	15	15	70	500	350	Agricult. 70 Non.A con. 30		559.441	1.195.859	10.686	2.200	6.7	3.00 6.00	1.400 815	Yes	4.200 1.150	6.0	28.000	3.500	
14	Castel	3		10	70	500	400	Commercial 40 Manufact. 30		506.599	933.102	3.351			0.25		No					
15	Huitan *	4		40	60	550	535	Agricult. 90 Others 10		339.599	599.170	1.911	300	6.4	0.50	241	?	181	6.0		542	Economically poor Can not pay O & M
16	Zunil	4								437.116	805.196	6.663										
17	Colomba *	3								611.269	125.950	5.315	1.139	5.5								
18	San Francisco La Union *	4		40	60	350	300	Commercial 90 Agricult. 10		371.313	683.931	1.797	253	6.7	5.00	100	?	500	3h/a. 5 days	700	850	Economically poor V/ to pay ?
19	El Palmar	3								470.259	877.418	4.979										
20	Coatepeque	2	3	47	50	600	700	Commercial 45 Agricult. 25		1.271.447	1.347.450	32.187	5.441	5.9	2.05 7.00	5.441	5.441					
21	Genova *	2		70	30	500	500	Agricult. 50 Service 25		670.205	650.202	2.800	700	5.4	0.50	150	Not in use	215	5.5		1.270	V/ to pay
22	Flores Costa Cuca *	3			100	300	200	Agricult. 80 Others 10		485.758	855.281	3.577	705	5.9	0.75	300	300	225	15 min. to 1h		850	Economically poor
23	La Esperanza	4								662.572	1.183.572	3.679										
24	Palestina *	4		20	80	300	300	Agricult.		425.122	751.210	3.150	500	6.3	10.00	100	100	1.000	24.0	1.000	700	Water sufficiency

Source : Arranged by the Study Team from Data provided by the Municipalities and INFOM