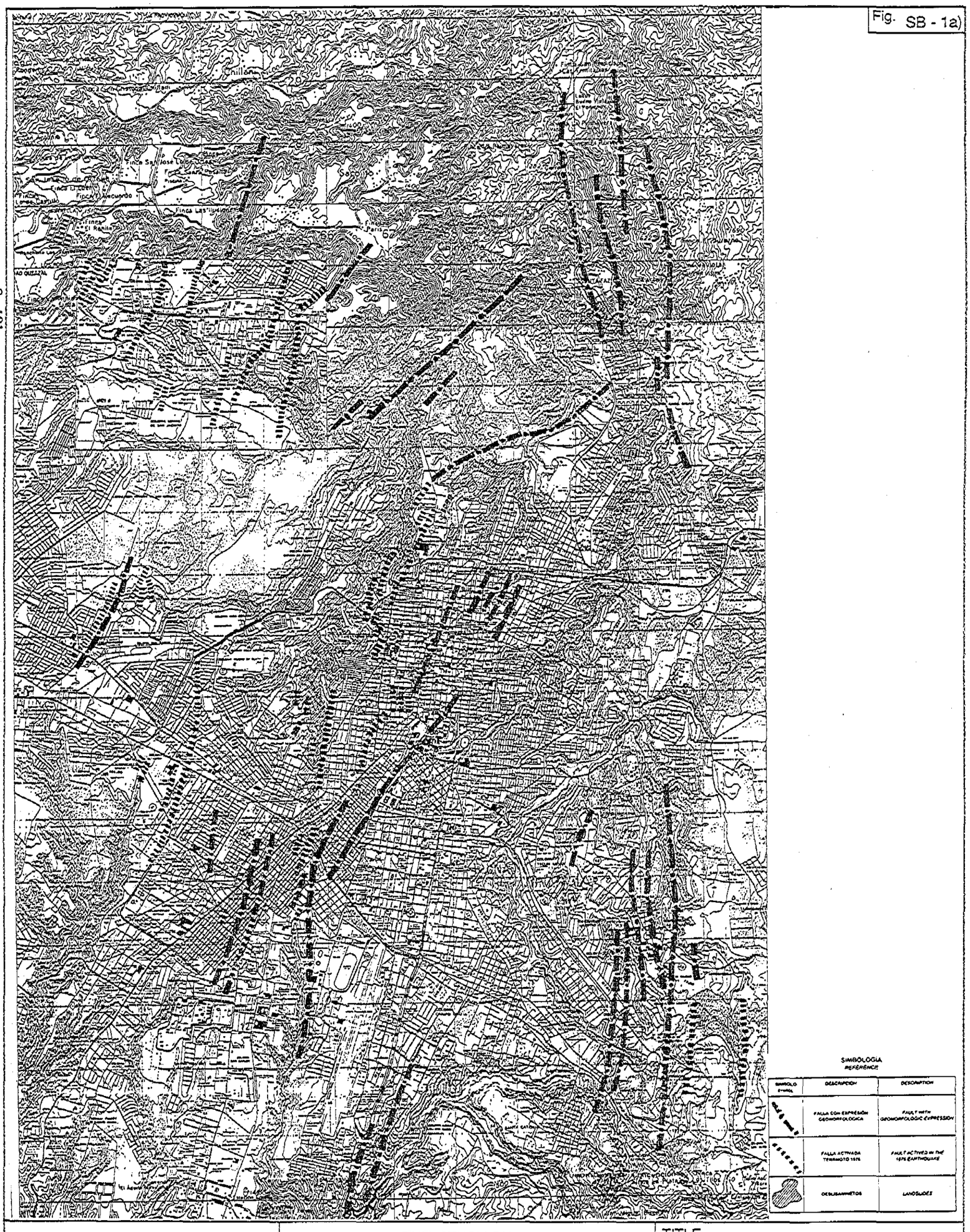
Fig. SB - 1a)

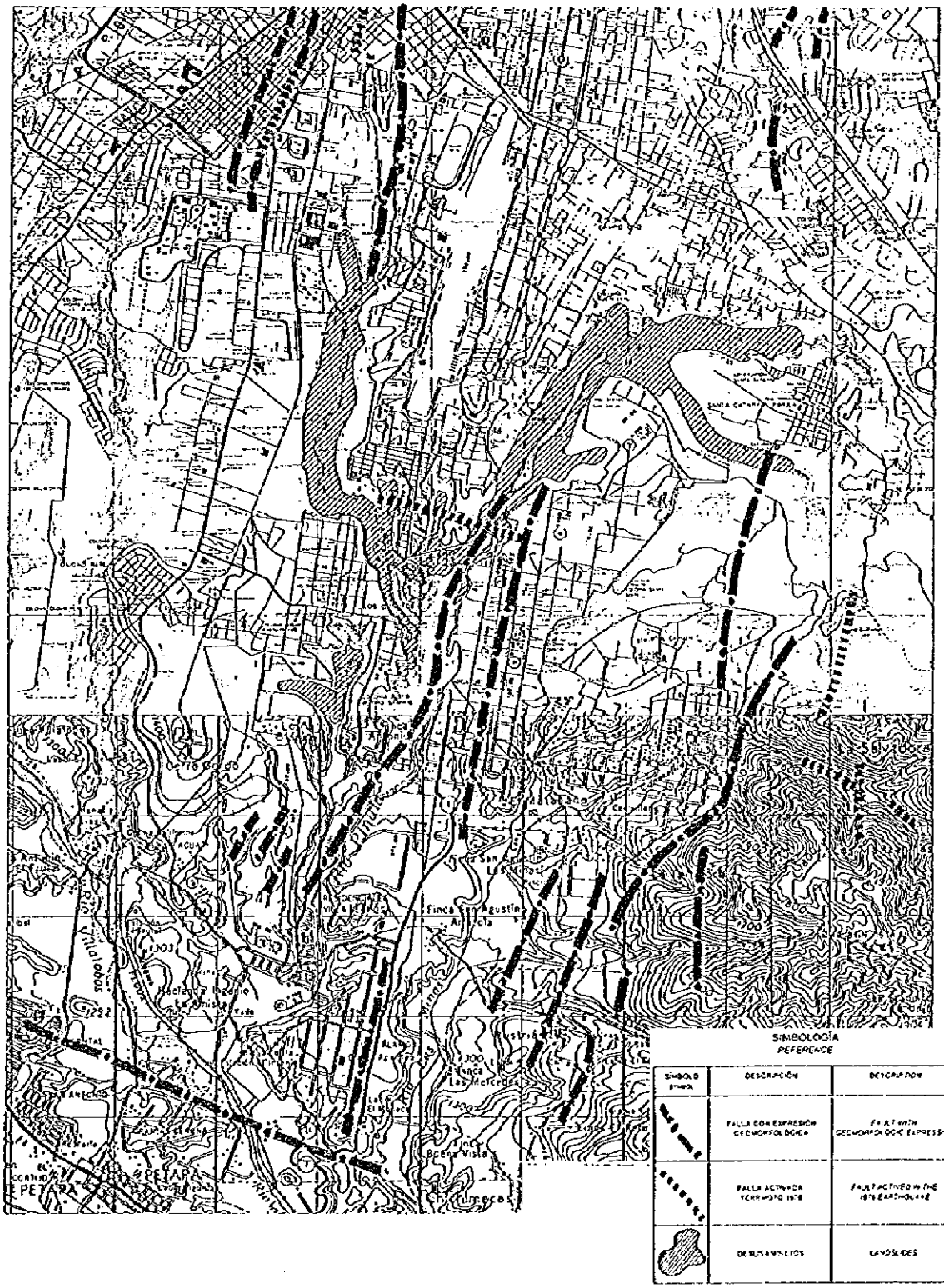


S - 101

S - 102

THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE LOCATION OF FAULTS AND POTENTIAL LAND SLIDE AREAS : CENTRAL REGION

Fig. SB - 1b)

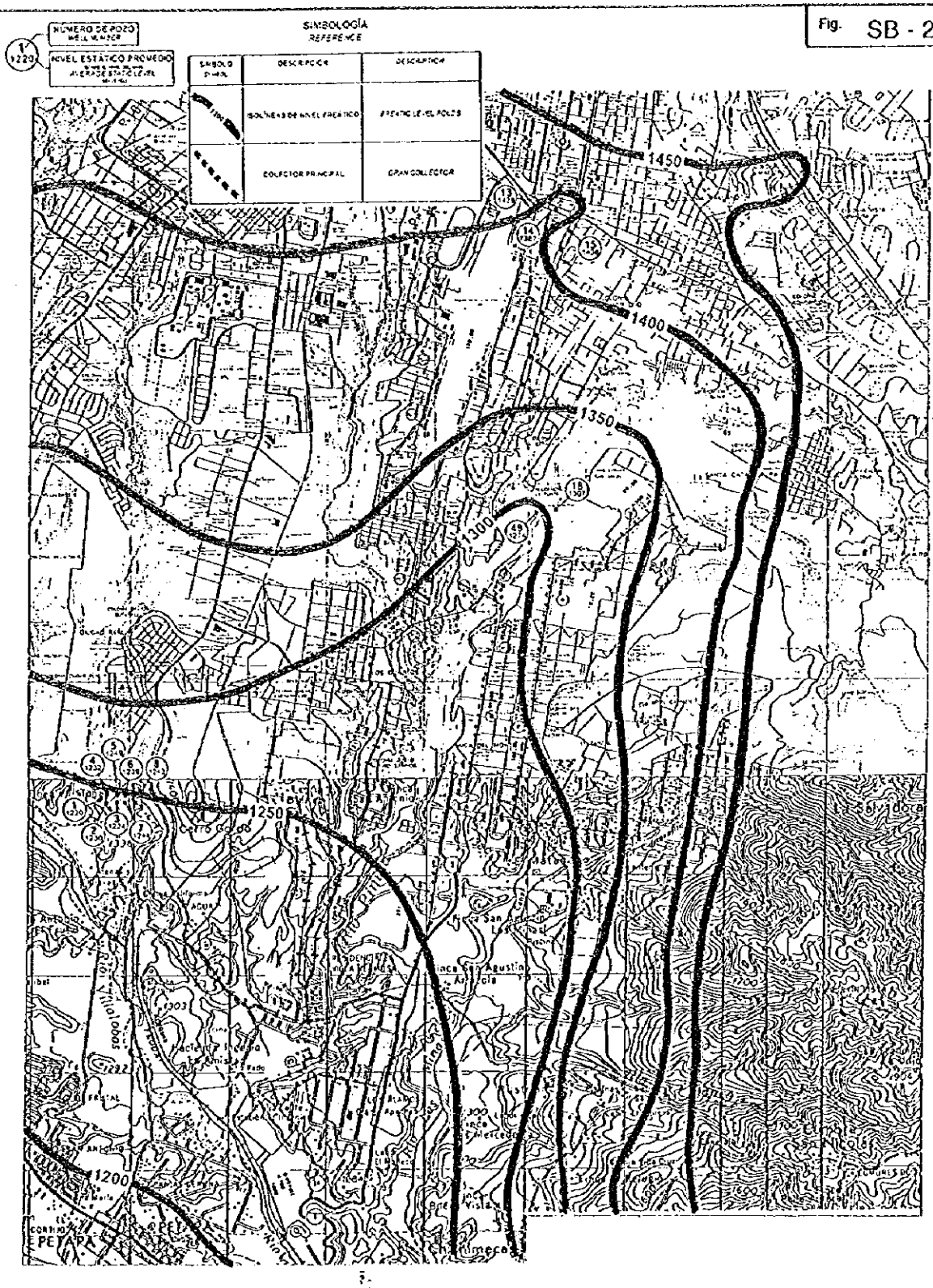


THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE LOCATION OF FAULTS AND POTENTIAL LAND SLIDE AREAS : SOUTH 3 REGION

Fig. SB - 2a)

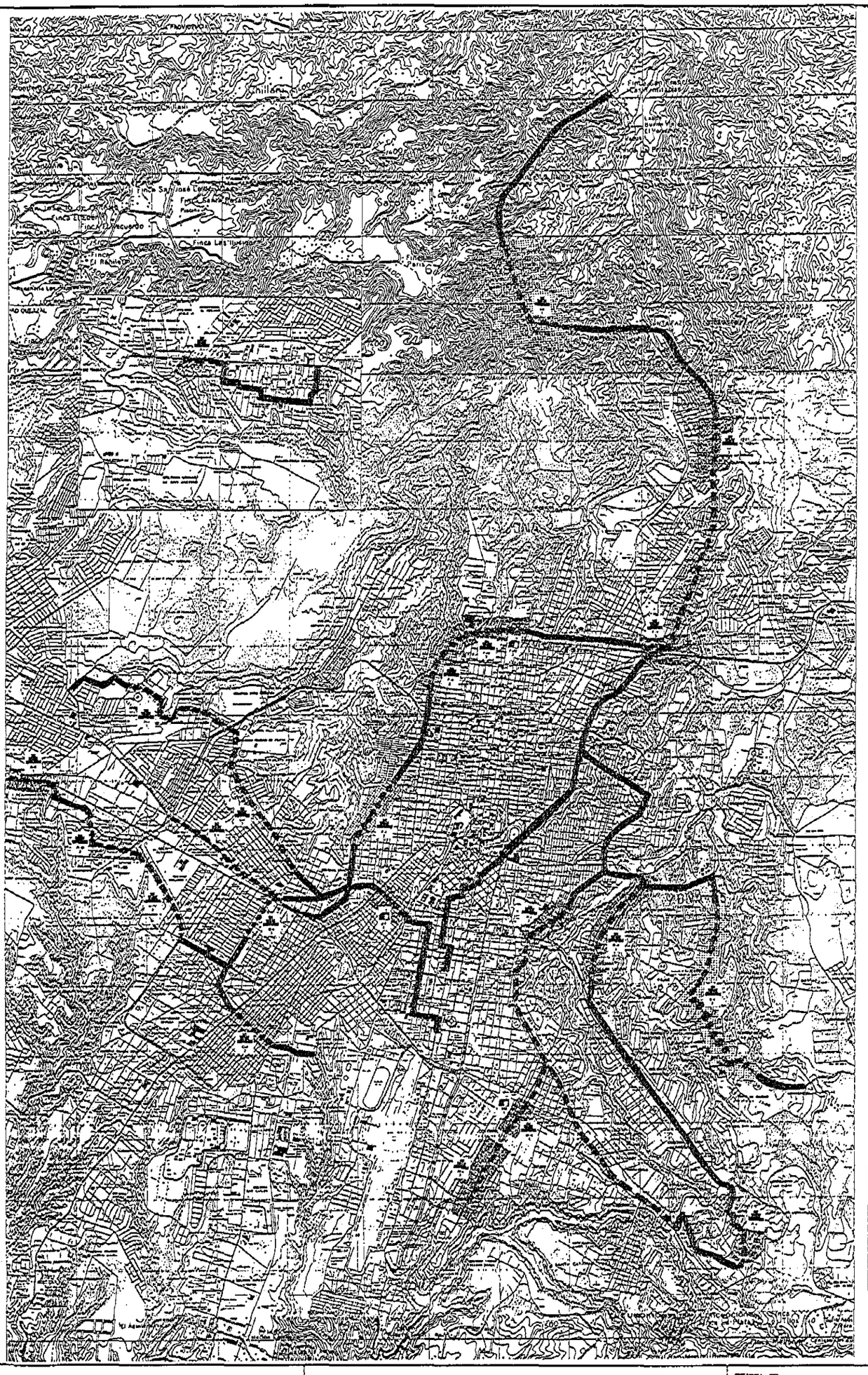
THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE LOCATION OF WATER WELLS AND FREATIC LEVELS : CENTRAL REGION

Fig. SB - 2b)



THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE LOCATION OF WATER WELLS AND FREATIC LEVELS : SOUTH 3 REGION

Fig. SB - 3a)

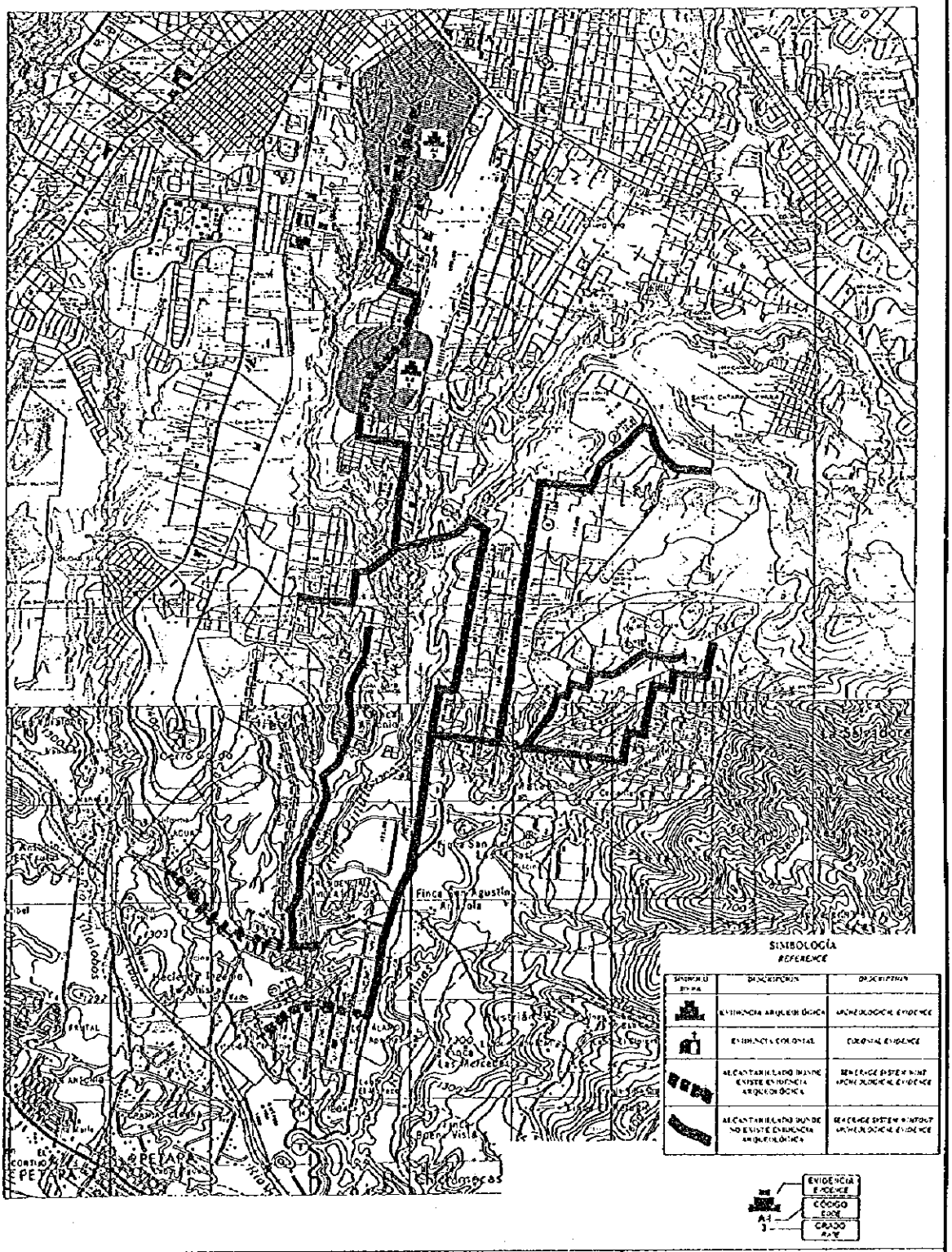


SIMBOLOGÍA
REFERENCE

	EVIDENCIA ARQUEOLOGICA	*ARCHEOLOGICAL EVIDENCE*
	EVIDENCIA COLONIAL	*COLONIAL EVIDENCE*
	ALCANTARILLADO DONDE EXISTE EVIDENCIA ARQUEOLOGICA	*SEWERAGE SYSTEM WHIT ARCHEOLOGICAL EVIDENCE*
	ALCANTARILLADO DONDE NO EXISTE EVIDENCIA ARQUEOLOGICA	*SEWERAGE SYSTEM WHITOUT ARCHEOLOGICAL EVIDENCE*

THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ARCHEOLOGICAL SITES : CENTRAL REGION

Fig. SB - 3b)



THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ARCHEOLOGICAL SITES : SOUTH 3 REGION

Fig. SC - 1

Region Central				
First Site:	North	South	East	West
10 m	MI	T	I	T
20 m	MI	SO	I	SO
30 m	T	SO	T	SO
60 m	SO	SO	SO	SO
75 m	SO	SO	SO	SO
Second Site:	North	South	East	West
10 m	I	MI	T	I
20 m	T	I	SO	T
30 m	SO	T	SO	SO
60 m	SO	SO	SO	SO
75 m	SO	SO	SO	SO
Third Site:	North	South	East	West
10 m	T	MI	I	T
20 m	SO	I	T	SO
30 m	SO	T	SO	SO
60 m	SO	SO	SO	SO
75 m	SO	SO	SO	SO

South 3 Region				
	North	South	East	West
10 m	MI	T	MI	SO
20 m	I	SO	T	SO
30 m	T	SO	SO	SO
60 m	SO	SO	SO	SO
75 m	SO	SO	SO	SO

I	Intense
MI	Middle Intense
T	Thin
SO	Without Odor

THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE ODOR DISPERSION : CENTRAL REGION AND SOUTH 3 REGION WWTP SITES

Fig. SC - 2

Central Region	# of unities
First point:	
1	0
2	0
3	7
4	0
5	0
6	0
7	0
8	0
9	0
Second Point:	
1	0
2	1
3	0
4	0
Third Point:	
1	0
2	0
3	0
4	0

South 3 Region Villa Hermosa	# of Unities
1	104
2	0
3	0
4	89
5	3
Treatment Plant	0
Riveras del Rio:	
1	2
2	0
3	103
4	7
Villalobos River	
1	2
2	0
3	0
4	4
Electric Line:	
1	8
destroyed house	112
3	3
4	0

Plant Site	North	South	East	West	Center
1			0		
2					0
3		0			
4		0			
5				0	
6				0	
7	0				
8	0				
9			0		

THE REPUBLIC OF GUATEMALA GUATEMALA MUNICIPAL WATER SUPPLY PUBLIC CORPORATION (EMPAGUA)	THE STUDY ON THE IMPROVEMENT OF WASTEWATER MANAGEMENT IN THE GUATEMALA METROPOLITAN AREA JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE INSECTS : CENTRAL REGION AND SOUTH 3 REGION WWTP SITES

Table SC-3a) Questionnaire for Social Survey (1/4)

Questionnaire Survey on Social Attitude to the Proposed Sanitation Project The Study on the Improvement of Wastewater Management Project in Guatemala Metropolitan Area

Sheet No. _____
Interviewer _____
Sector _____
Date _____

A	GENERAL DATA	
A1	Address	
A1.1	Avenue	A1.2 Block
A2	Age Group	
	A2.1 _____	from 0 to 5
	A2.2 _____	from 6 to 10
	A2.3 _____	from 11 to 15
	A2.4 _____	from 16 to 20
	A2.5 _____	from 21 to 25
	A2.6 _____	from 26 to 30
	A2.7 _____	older than 30
A3	Interviewed Person's Relation to Its Family	
	A3.1 _____	Father
	A3.2 _____	Mother
	A3.3 _____	Son
	A3.4 _____	Daughter
	A3.5 _____	Other
A4	Number of Family Members and How Many People Live at Home	_____
	A4.1 Age Range of Family Members	
	A _____	from 0 to 5
	B _____	from 6 to 10
	C _____	from 11 to 15
	D _____	from 16 to 20
	E _____	from 21 to 25
	F _____	from 26 to 30
	G _____	older than 30
A5	Does the Family Comes from the City	
	A _____	Yes
	B _____	No
A7	Time Living in the Present Location	
	A _____	Less than 1 year
	B _____	from 1 to 5 years
	C _____	more than 5 years

Table SC-3a) Questionnaire for Social Survey (2/4)

A8	Would You Like the Descendants to remain Living in the Present location ?			
	A _____ Yes			
	B _____ No			
A9	*Approximate Monthly Income of Family*			
	A _____ up to Q 250			
	B _____ Q 250 to Q 500			
	C _____ Q 501 to Q 750			
	D _____ Q 751 to Q 1,000			
	E _____ Q 1,001 to Q 1,250			
	F _____ Q 1,251 to Q 1,500			
	G _____ Q 1,501 to Q 1,750			
	H _____ Q 1,751 to Q 2,000			
	I _____ more than 2,000			
A10	Has Any of the Family Members Contracted the Following Diseases in the Last One Year ?			
	A10.1 _____ Cholera		_____ Times	
	A10.2 _____ Diarrhea		_____ Times	
	A10.3 _____ Amoebiasis		_____ Times	
	A10.4 _____ Hepatitis		_____ Times	
	A10.5 _____ Typhoid		_____ Times	
	A10.6 _____ *Dysentry*		_____ *Times*	
	A10.7 _____ Gastroenteritis		_____ Times	
B	**PROPERTY AND ACCESS TO UTILITIES**			
B1	Type of Property			
	B1.1 _____ "Covacha" Simple Cottage			
	B1.2 _____ "Palomar" Lower Grade			
	B1.3 _____ *"Popular" Average*			
	B1.4 _____ "Residencial" High Grade			
	B1.5 _____ "Comercio" Commerce or Industry			
B2	Status of Property			
	A _____ Own			
	B _____ Rent			
B3	Describe the Condition of the Following;			
B3.1	Roads	_____ Satisfactory	_____ Unsatisfactory	
B3.2	Drainage	_____ Satisfactory	_____ Unsatisfactory	
B3.3	Electricity	_____ Satisfactory	_____ Unsatisfactory	
B3.4	Water Supply	_____ Satisfactory	_____ Unsatisfactory	
B3.5	Wastewater Disposal	_____ Satisfactory	_____ Unsatisfactory	
B4	*In Your Opinion Name the Service Which Requires Immediate Provision / Improvement*			
	B4.1	Roads	_____	
	B4.2	Drainage	_____	
	B4.3	Electricity	_____	
	B4.4	Water Supply	_____	
	B4.5	Wastewater Disposal	_____	

Table SC-3a) Questionnaire for Social Survey (3/4)

C	**OPINION OF THE PROJECT**
C1	Based on the Information Provided to You, Would You be in Agreement with the Project Construction? _____ Yes _____ No _____ No Opinion
C2	Do You Consider that Environmental Conditions will Improve with the Project ? _____ Yes _____ No _____ No Opinion
C3 C3.1 C3.2	Point Out Two Reasons _____ _____
C4	Do You Consider that the Project will Benefit the Community ? _____ Yes _____ No _____ No Opinion
C5	If the Answer is YES, Why? _____
C6	Do You Consider that the Project will Adversely Affect the Community ? _____ Yes _____ No _____ No Opinion
C7	If the Answer is YES, Why? _____
D	**SOCIAL ORGANIZATION AND WILLINGNESS TO PARTICIPATE IN THE PROJECT**
D1	Do You Have Any Previous Experience of "Community Participation Program" such as "Food for Work" (Alimentos por Trabajo) and "Contribution by Assistance of Citizen" (Contribucion de Ayuda al Vecino) for Providing Infrastructure for Your Community? _____ Yes _____ No
D2	If Your Answer to QD1 is YES, What Kind of Activity Did You Participate? Choose Among those Specified Below: D2.1 Type of Infrastructure A _____ Water Supply B _____ Roads / Drainage C _____ Slope Protection D _____ Sanitation E _____ Others D2.2 Stage of Participation A _____ Conception of Project B _____ Facility Construction C _____ Operation and Maintenance D _____ Others (describe) D2.3 Type of Participation A _____ Voluntary Provision of Labor B _____ Provision of Labor in Exchange for Food C _____ Monetary Contribution D _____ Others (describe)
D3	Do You Favor a Community Participation Should Your Comunity be Provided with a New Sanitation System Which Has been Explained to you at the Beginning of the Interview? _____ Yes _____ No _____ No Opinion

Table SC-3a) Questionnaire for Social Survey (4/4)

D4	If Your Answer is YES for QD3, How Would You Like to Participate ? Choose Among those Specified Below: D4.1 Stage of Participation A _____ Conception of Participation Program B _____ Facility Construction C _____ Operation and Maintenance D _____ Others (describe) D4.2 Type of Participation A _____ Voluntary Provision of Labor B _____ Provision of Labor in Exchange for Food C _____ Monetary Contribution D _____ Others (describe)
D5	If Your answer to QD3 is NO, Please Let us Know the Reason _____ _____
D6	Is There Any Household Committee in Your Area? _____ Yes _____ No
D7	Would You Like to Participate in a Household Committee in Your Area or Other Areas? _____ Yes _____ No
D8	During Construction Process, Every Effort will be Taken to Reduce Inconveniences. However, there will be some inconveniences, such as traffic jam, dust, etc. Knowing that the Project will be beneficial for the Community in General What Precautions would you like to Recommend ? D8.1 _____ Prior Information on the Construction Period D8.2 _____ Others
D9	*The Dried Sludge from the Septic Tanks could be Reused as Fertilizer, Organic Nutrition, etc.* Would You Like to Use them ? _____ Yes _____ No
D10	If the Answer to QD9 is YES, What Kind of Use Would Do You Think of ? _____ _____
D11	Coming to a Conclusion, If you are in Agreement with the Project, Please Point Out an Important Reason for this. _____ _____
D12	If you are NOT in Agreement with the Project, Please Point Out Important Reasons for this. _____ _____
E	**Interviewer's Observations**
	_____ _____

Table SC-3b) Summary of Social Questionnaire Survey (1/5)

A. GENERAL DATA	Loma Blanca SECTOR 1		El Pilar SECTOR 2		Quintanal SECTOR 3		TOTAL	
	No.	%	No.	%	No.	%	No.	%
A2. PROFESION								
Housewife	31	62	23	46	33	66	87	58
Student	5	10	4	8	2	4	11	7
Worker	9	18	14	28	13	26	36	24
Merchant	3	6	7	14	2	4	12	8
Unemployeed	2	4	2	4	0	0	4	3
A2.1 Education Level								
Primary School	26	52	23	46	29	58	78	52
Illiterate	10	20	15	30	7	14	32	22
Junior High School	7	14	9	18	8	16	24	16
High School	5	10	3	6	6	12	14	9
College degree	2	4	0	0	0	0	2	1
A2.2 SEX								
Masculine	11	22	20	40	14	28	45	30
Femenine	39	78	30	60	36	72	105	70
A3. Interviewed person's relation to its family								
Father	8	16	14	28	9	18	31	21
Mother	26	52	25	50	28	56	79	53
Son	4	8	4	8	4	8	12	8
Daughter	8	16	5	10	5	10	18	12
Other	4	8	2	4	4	8	10	7
A4. Number of family members or how	270	100	282	100	296	100	848	100
many people live at home								
from 0 to 5	53	20	39	14	54	18	146	17
from 6 to 10	41	15	27	10	36	12	104	12
from 11 to 15	23	9	43	15	41	14	107	13
from 16 to 20	22	8	32	11	24	8	78	9
from 21 to 25	26	10	25	9	28	10	79	9
from 26 to 30	31	12	26	9	22	7	79	9
more than 30	74	27	90	32	91	31	255	30
A5. The family comes from the city								
Yes	27	54	39	78	28	56	94	63
Not	23	46	11	22	22	44	56	37
A6. Time living in the city								
Less than one year	17	34	3	6	1	2	21	14
Between 1 and 5 year	17	34	4	8	29	58	50	33
More than 5 years	16	32	43	86	20	40	79	53
A7. Would you like your descendants to remain								
living of this area								
Yes	44	88	41	82	49	98	134	89
Not	6	12	9	18	1	2	16	11
A8. Familly income								
Up to Q250	2	4	5	10	5	10	12	8
From Q251 to Q500	9	18	16	32	9	18	34	23
From Q501 to Q750	8	16	11	22	15	30	34	22
From Q751 to Q1,000	13	26	6	12	11	22	30	20
From Q1,001 to Q1,250	5	10	4	8	4	8	13	9
From Q1,251 to Q1,500	6	12	2	4	4	8	12	8
From Q1,501 to Q2,000	4	8	3	6	0	0	7	5
More than Q2,001	3	6	3	6	2	4	8	6
A9. Some of the family members got								
these illness during the year								

Table SC-3b) Summary of Social Questionnaire Survey (2/5)

A. GENERAL DATA	Loma Blanca SECTOR 1		El Pilar SECTOR 2		Quintanal SECTOR 3		TOTAL	
	No.	%	No.	%	No.	%	No.	%
(how often)								
Colera	2	13	3	23	16	84	21	14
Diarrhea	8	53	7	54	2	11	17	11
Amebiasis	4	27	3	23	0	0	7	5
Hepatitis	0	0	0	0	0	0	0	0
Typhoid fever	0	0	0	0	1	5	1	1
Dysentery	1	7	0	0	0	0	1	1
Gastroenteritis	0	0	0	0	0	0	0	0
B. ACCESS TO SERVICES AND PROPERTY								
B1. Real state type								
Shack	24	48	37	74	37	74	98	65
Dove Colonie	5	10	5	10	0	0	10	7
Popular housing	20	40	8	16	13	26	41	27
Residential Housing (medium class)	1	2	0	0	0	0	1	1
Residential Housing (high class)	0	0	0	0	0	0	0	0
Industry and commerce	0	0	0	0	0	0	0	0
B2. Kind of property								
Owned	36	72	37	74	14	28	87	58
Rent	12	24	8	16	1	2	21	14
Other	2	4	5	10	35	70	42	28
B3. Describe the following								
infraestructure conditions								
B3.1 Roads (street)								
Satisfactory	1	2	1	4	12	24	14	9
Unsatisfactory	49	98	49	96	38	76	136	91
B3.2 Sewerage								
Satisfactory	2	4	2	4	27	54	31	21
Unsatisfactory	48	96	48	96	23	46	119	79
B3.3 Electricity								
Satisfactory	21	42	36	72	31	62	88	59
Unsatisfactory	29	58	14	28	18	36	61	41
B3.4 Water supply								
Satisfactory	13	26	13	26	17	34	43	29
Unsatisfactory	37	74	37	74	33	66	107	71
B3.5 Wastewater								
Satisfactory	5	10	5	10	6	12	16	11
Unsatisfactory	45	90	45	90	41	82	131	87
B4. In your opinion, which of the following								
services need inmediate provision and								
implementation								
Roads (streets)	49	98	43	86	31	62	123	82
Sewerages	46	92	44	88	26	52	116	77
Electricity	30	60	17	34	12	24	59	39
Water Supply	38	76	29	58	30	60	97	65
Wastewater	43	86	39	74	36	72	118	79
B5. Where, do you get the resource								
Municipal Service	13	26	9	18	17	34	39	26
Pipe truck adquisition	4	8	1	2	6	12	11	7
Public faucet	26	52	12	24	25	50	63	45
Others	7	14	23	46	1	2	31	21
B6. How do you dispose wastewater								
Sanitary Well	43	86	29	58	8	16	80	53

Table SC-3b) Summary of Social Questionnaire Survey (3/5)

A. GENERAL DATA	Loma Blanca SECTOR 1		El Pilar SECTOR 2		Quintanal SECTOR 3		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Municipal Supply	2	4	2	4	36	72	40	27
On the street	5	10	19	38	4	8	28	19
Others	0	0	0	0	2	4	2	1
C. OPINION ABOUT THE PROJECT								
C1. Based on information handed to you								
would you in agreement about project								
construction								
Yes	50	100	50	100	50	100	150	100
Not	0	0	0	0	0	0	0	0
Without comment	0	0	0	0	0	0	0	0
C2. Do you consider that environmental								
conditions will improve with the project								
Yes	50	100	50	100	50	100	150	100
Not	0	0	0	0	0	0	0	0
Without comment	0	0	0	0	0	0	0	0
C3. Mention two reasons								
Health-hygiene	30	60	35	70	34	68	99	66
Comunitary Benefit	1	2	3	6	12	24	16	11
Eliminate contamination	5	10	4	8	12	4	11	7
Urbanization	1	2	0	0	0	0	1	1
Better quality life	1	2	4	8	0	0	5	3
Eliminate plague	5	10	0	0	0	0	5	3
Without answer	7	14	4	8	2	0	13	9
C4. Do you consider the project will benefit								
the community								
Yes	50	100	50	100	50	100	150	100
Not	0	0	0	0	0	0	0	0
Without comment	0	0	0	0	0	0	0	0
C5. If your answer is affirmative, give								
the reason								
Health-hygiene	13	33	28	67	33	66	74	49
Community Benefit	5	13	5	12	14	28	24	16
Eliminates contamination	6	15	2	5	2	4	10	7
Urbanization	10	26	2	5	1	2	13	9
Better quality life	5	13	5	12	0	0	10	7
Without comment	39	0	42	0	0	0	0	0
C6. Do you consider the project will affect								
community								
Yes	0	0	4	8	3	6	7	5
Not	50	100	41	82	44	88	135	90
Without comment	0	0	5	10	3	6	8	5
C7 If your answer is yes, point at								
two reasons								
The interviewed people agreed that								
the project will affect economically								
because they have to pay								
D. SOCIAL ORGANIZATION AND COLABORATIO								
ATTITUDE TO THE PROJECT								
D1. Have you have previous experience in								
in community works, like food as a payment,								
community services								
Yes	12	24	10	20	18	36	40	27

Table SC-3b) Summary of Social Questionnaire Survey (4/5)

A GENERAL DATA	Loma Blanca SECTOR 1		El Pilar SECTOR 2		Quintanal SECTOR 3		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Not	38	76	40	80	32	64	110	73
D2. If your answer was affirmative. Choose								
based on the following								
D2.1 Infraestructure Type								
Water supply	7	14	1	2	9	18	17	11
Roads/sewerages	2	4	6	12	13	26	21	14
Slope protection	4	8	0	0	0	0	4	3
Sanitary	0	0	2	4	8	16	10	7
Others (describe them)								
Electric								
D2.2 Paticipation Stage								
Project concept	3	6	0	0	2	4	5	3
Facilities construction	8	16	4	8	11	22	23	15
Maintenance and Operation	2	4	5	10	8	16	15	10
Others (describe them)	0	0	0	0	0	0	0	0
D2.3 Participation								
Voluntary work	9	18	5	10	17	34	31	21
Food work	0	0	3	6	0	0	3	2
Money colaboration	7	14	3	6	14	28	21	16
Others (describe them)	0	0	0	0	0	0	0	0
D3. Would you agree your community to								
have a system like the one mentioned								
before								
Yes	44	88	45	90	48	96	137	91
Not	2	4	1	2	0	0	3	2
Without comment	4	8	4	8	2	4	10	7
D4. If your last answer was affirmative								
point at the opcion you would like to								
participate								
D4.1 Participation stage								
Planning	4	8	4	8	1	2	9	6
Construction	12	24	17	34	19	38	38	23
Maintanace and operation	23	46	21	42	29	58	73	49
Others (describe them)	0	0	0	0	0	0	0	0
D4.2 Participation								
Temporal voluntary work	24	48	16	32	19	38	59	39
Food work	15	30	17	34	19	38	51	34
Money contribution	8	16	15	30	15	30	38	25
Others (describe them)	0	0	0	0	0	0	0	0
D5. If your answer to question 3 is affirmative								
point at two reasons								
Time	2	4	1	2	0	0	4	8
D6. Is there a commitee in your area								
Yes	32	64	6	12	38	76	76	51
Not	14	28	36	72	8	16	58	39
Does not know	4	8	8	16	4	8	16	11
D7. Would you like to participate in a neighbor								
commitee in your area or others								
Yes	31	62	33	66	27	54	91	61
Not	12	24	11	22	20	40	43	29
Without opinion	7	14	6	12	3	6	16	11
D8. During construction period, there will be								

Table SC-3b) Summary of Social Questionnaire Survey (5/5)

A. GENERAL DATA	Loma Blanca SECTOR 1		El Pilar SECTOR 2		Quintana SECTOR 3		TOTAL	
	No.	%	No.	%	No.	%	No.	%
some efforts to reduce some inconvenients								
to neighbors, however it is not possible								
to avoid: traffic, dust, etc... What								
recomendations would you give the commnunity,								
knowing that it is benefitial								
Information to neighbors								
Others (describe them)	48	96	50	100	50	100	148	99
Participation of everybody								
Signs to preven children accidents								
To make the work on time and be informed								
D9. The sludges from septic tanks, can be used								
for fertilizer. Would you like to use them.								
Yes	13	26	15	30	11	22	39	26
Not	34	78	32	64	38	76	104	69
Without opinion	3	6	3	6	1	2	7	5
D10. If your answer to question D9 is								
affirmative, which use would you advise								
D11. Wich is your conclusion about to support								
the project. Point at an important reason								
Health and hygiene	12	24	27	54	18	26	57	38
Community benefit	20	40	19	38	28	56	67	43
Less contamination	17	34	0	0	4	8	21	14
Urbanization	4	8	4	8	0	0	8	5
D12. If you are not in agreement with	53							
the project, point at the reasons								
de acuerdo a su respuesta:								

ANNEX SD METHODOLOGY FOR FIELD SURVEYS

SD1 Flow Rate Measurement

In order to establish the most appropriate points to make the flow measures, a field inspection was previously made in the following sites:

- Las Vacas River (downstream of Gran Collector)
- Las Vacas River (upstream of the confluence of Chinautla River)
- Chinautla River
- Tzalja River
- Las Vacas River (downstream of the proposed Central WWTP)
- Villalobos River (downstream of the proposed South 3 WWTP)

In some cases, it was impossible to measure only a single cross section, because of the lack of steady flow conditions previously mentioned. In those cases, the measurements in different branches of the river were taken and the results of water flow recorded. All the measurements were made with Flow-rate equipment, which estimates the flow based on a magnetic system of electrodes stimulated by the water flow, which transforms it in flow speed. The speed measurements were conducted on verticals at every meter in the cross section, with the sensibility in change of speed, across the section, as a complementary criteria (Annex SA10-13).

Two sets of measurements were taken, for three days, twice a day, in the sites mentioned before. The first measurements began on December 8th, and ended by December 14th 1995, and the second ones began on January 27th, and ended by February 1st 1996.

SD2 Sampling

Sampling of wastewater was made parallel to the flowrate measurements already described above. These were made in all the mentioned sites and in three additional sites, East and West of Amatitlan Lake and at Michatoya River (Lake Amatitlan Exit), where the Michatoya System gates are located. The techniques used in the sampling and preservation were those defined in the normal procedures. The samples were transported under refrigeration to the laboratory. Temperature and pH were measured on site.

SD3 Laboratory Analysis

Laboratory analysis required the different procedures described below:

Table SD-1 Analytical Methods Used for Water Quality Analyses

Parameter	Method	Principle	Reference
Chemical Oxygen Demand (COD)	Colorimetric with closed flow	Sample is reflected in closed essay tube, with a solution of potassium dichromate strongly acidified. Oxygen consumption is measured against standards at 600 nm employing an spectrophotometer.	SM, Page 5-9.
Biochemical Oxygen Demand (BOD_5)	Biochemical Oxygen Demand at 5 days (BOD_5) Winkler bottles 300 ml measuring dissolved oxygen by volumetry.	Sample is placed in a hermetic bottle where it is incubated for five days at controlled temperature of 120°C. The dissolved oxygen is determined at the beginning and at the end of the incubation using the same iodine method for analysis of dissolved oxygen-acid modification. When the consumption of oxygen is more than the level of saturation, a dilution is made.	SM, Pages 4-100, 101, 5-2, 3,4.
Total Solids	Oven dried at 103-105°C.	An aliquot of the sample is placed in a porcelain capsule and vaporized to dry.	SM, Pages 2-54.
Settleable solids	Imhoff cone	The cone of Imhoff is filled until the one liter mark. It is left to rest for an hour and then, the volume of sediments is measured employing the cone scale.	SM, Pages 2-57
Dissolved Solids	Filtration and drying in oven at 103 degrees.	An aliquot of the sample is filtered using Whitman 41 paper. An aliquot of the filtered solution is placed in a porcelain capsule previously weighed, and it is evaporated to dry.	SM, Pages 2-57.
Chlorides	Argentometric	An aliquot of the sample is titled with silver nitrate, using potassium as indicator.	SM, Pages 4-49.
Total Phosphorous	Digestion with sulfuric acid-nitric acid. Ascorbic acid method.	An aliquot of the sample is mixed with concentrated sulfuric and nitric acid and it is digested for 30 minutes. The mixture is neutralized and phosphorous is quantified using the ascorbic acid method.	SM, Pages 4-112, 4-115.
Total Nitrogen	Kjeldahl digestion with salicylic acid employing an electrode with selective membrane for analysis of liberated ammonia.	An aliquot of the sample is mixed with sulfuric and salicylic acids. It is digested for 30 minutes and ammonium liberated is analyzed with a selective electrode. The result represents the sum of ammonia, nitric and organic nitrogen.	

SM = STANDARD METHODS for the testing of water and wastewater. 16th. ed American Public Health Association, American Water Works Association and water Environment Federation. 1992.

SD4 Social Survey

The initial phase of the social study consisted in the investigation and inspection of the project areas. Planning and discussion of strategies were made with the consultors. With the gathered information, several questionnaire formats to interview the benefitted population were created and discussed with EMPAGUA.

The survey wanted to select, in every important sector, the following elements: Community and social structures, income, employment availability, education level, culture and health.

The number of questionnaires in the Metropolitan Area were 150, divided in 50 for each one of the three sectors: Loma Blanca, in zone 21; Quintanal in zone 6, and El Pilar in zone 14.

The people selected for carrying out the social survey were trained on interview techniques at the project area. This process was complemented with environmental analysis, and photos taken in some areas.

SD5 Sanitary Aspects

SD5.1 Odor

The odor dispersion was evaluated in all the possible sites of the plant location, in both Central and South 3 regions. Two different types of markers were used: concentrated pyridine and an environmental aromatizer. Two measurements were made, and the results for every site and region are shown in the appendix C12-(C1). Every measurement was made by placing the marker in a determined point on the ground, and qualitatively measuring the intensity of odor from all four cardinal points at distances of 10, 20, 30, 60 and 75 m from that point. The following qualitative scale was created: Very Intense(VI), Intense (I), Tenuous (T), No Odor (NO).

The test was duplicated for the environmental aromatizer.

It was observed that the wind pattern was not uniform at any of the sites tested, therefore, the present study is not considered to be significant in the odor's distribution pattern.

After seeing the results, it can be said that odor has not a significant impact outside a radius of 60m, having as center the studied area. Inside the influential radius, the impact is very high in the first 10 meters, high in the next 20 meters, and almost non-significant in the subsequent 30 meters.

SD5.2 Insects

To evaluate the population increase of some insects, derived from the plant operation during regular and irregular conditions, a population sampling of the domestic fly (Mosca domJstica) was made in sites with probability of propagation around the plant.

The fly population is significative in the South 3 Sector, far away from the site location of the plant

Twelve traps with significant results were located. In the Villa Hermosa Colony, two traps trapped 104 and 89 flies. The road to the house in ruins over the hill, with 112 units and another one in the "Riveras del Rio" colony, with 103 units. The conclusion is that the insect population is minimum, because 8 traps were clean. The population of insects in the urban settlements adjacent to site of the plant is significative.

In the Central Region, the most important results were in the first site, in an abandoned house close to the site, where 7 units were collected in one trap. In the second site (La Arenera) with 4 traps, only one unit got collected, and in the third site, at the convex of the meander, not even one unit was collected in 4 traps. That concludes that the presence of insects in not significative in this region.

As shown, the population of flies, is very significative in the South 3 Region, outside of the site of the plant. In that area, 12 tramps were located with significative results. In Villa Hermosa, 2 traps caught 104 and 89 flies; another one in a store close to a hen house, in the Rivera del Rio settlement, caught 103 units.

In the Central Region, the result is more interesting. The first site was in an abandoned house, close to the treatment plant site. There the trap collected 7 units. The second site, La Arenera, where 4 traps were put, only one of them collected one unit; finally, in the third site, the meander, there were no collected units.

The results of the study with twelve traps are shown in the appendix C12-(C2).

SD6 Cultural Evidences

Initially, a document search was done in institutions with libraries specialized in this topic, like the Anthropology and History Institute, Del Valle University; School of History of San Carlos University in Guatemala City; Geography and History Academy of Guatemala, Center for Regional Investigations of the South of Mid-America, and private libraries. With

the gathered information, a summary was written as a guide to check field data. In addition to this, a table with the different found evidences was made. It includes the following information:

CODE: Identification of every one of the areas inspected with prehispanic, colonial or artistic evidences.

DENOMINATION: Name given to the area presenting evidence of cultural heritage or name of artistic monument.

TYPE: The evidence is identified according to the following abbreviation:

ARCHAEOLOGICAL = Arq.
COLONIAL = Col.
ARTISTIC = Art.

GRADE: The importance of the evidence related with cultural heritage in the Guatemala City Valley is identified according to the following numerical classification:

1-Very Important Evidence

Areas with archaeological, colonial or artistic evidence with a well defined location, and still possible to conserve as part of the cultural heritage.

2-Important Evidence

Areas with archaeological, colonial or artistic evidence with an uncertain location, or partially lost due to housing development or public services infrastructure.

3-Important Evidence without specific location

Areas determined by bibliographic research, that in the past presented superficial evidence of prehispanic or colonial occupation, but were destroyed by housing construction or public services infrastructure in the Guatemala Valley.

ANNEX SE Terms of Reference (TOR) for Environmental Impact Assessment for the Feasibility Study (first stage) on the Improvement of Wastewater Management for the Guatemala Metropolitan Area

1. Purpose

Purpose of the environmental impact assessment is to satisfy requirement of the Law for the Protection and Improvement of Environment ('Ley 68-86') for the proposed Priority Project (first stage) in the Feasibility Study. The Priority Project will be in the Central and South 3 Regions identified in the Interim Report on the Wastewater Management Master Plan for Guatemala Metropolitan Area by the JICA Study Team (hereinafter called as the Engineer).

2. Scope of Works

The works shall be carried out and completed in accordance with the specifications presented here under and under the supervision of JICA Study Team. The works consists of conducting surveys, analysis and reporting to the satisfaction of the Engineer. The main tasks completing the works are identified and presented in this document.

3. Tasks

Task 1 Description of the Proposed Project :

The main objective and a full description of the Proposed Project shall be provided. Engineer will provide necessary details at the beginning of the works (tentative description) and will be finalized during the course of the Study.

Since the works are to be carried out in parallel with the Feasibility Study close coordination shall be maintained between the Engineer and Contractor.

Task 2 Description of the Environment :

Physical, biological and socio-cultural environment of the Project Area shall be described. Most of the information is already available, however, the following list (not exhaustive) need to be investigated and documented. They are:

- location of seismic faults (existing information is on 1:150,000 scale map and should be transferred to 1:15,000 scale map)
- geological characteristics
- groundwater levels (including the locations of deep water wells along the route of collector main)
- flora and fauna, etc.

Task 3 Review Initial Environmental Examination (IEE) :

The results of IEE shall be reviewed considering the details of Priority Project (first stage) to be finalized in the Feasibility Study. In the Master Plan stage significant impacts have been identified and agreed with CONAMA (National Commission for Environment).

Task 4 To assess the significant impacts identified in Task 3 :

a) pre-construction period

A map (1:15,000) showing the existing culturally important monuments shall be prepared in the Central and South 3 Regions, along the Main Collector route and the proposed wastewater treatment plant sites.

b) during construction period

Two significant impacts arising due to the surplus soil and vibration and noise due to the construction traffic are identified. Large amount of surplus soil is expected from the tunnel excavation. Locations for stock piling or permanent disposal and method of disposal shall be identified. In the wastewater treatment plant construction, large amount of cut and fill will be necessary. To mitigate the impacts due to soil loss and erosion, suitable methods of stock piling, methods of surplus soil disposal and method of embankment protection shall be proposed.

c) during operation period

The significant impacts identified during operation period are due to the following :

- change in water balance of Lake Amatitlan and main rivers in the Project Area (existing and at the completion of the Project)

  Existing daily data of river flows are almost 20 years old although intermittent measurements were made in various studies such as Groundwater Development Master Plan (JICA, 1986) and in the Wastewater Management Master Plan. Further surveys for flow rate measurement and water quality shall be conducted as described in the followings.

  Based on these information and experience in similar basins in Guatemala, a water balance shall be made for the Lake Amatitlan and main rivers in the Project Area for both cases of with and without the Project.

- pollutant load generation (existing and at the completion of the Project)

  Similar to the change in water balance, pollutant loads will be changed and shall be estimated considering the existing data and the water quality data to be obtained in this Study.

- generation of odor and insects in the vicinity of the treatment plant
  To mitigate the negative impacts due to odor and insect generation, appropriate measures shall be proposed considering the practices in the central American countries.

- wastewater sludge disposal
  It is proposed that, septage from sanitation facilities be treated at wastewater treatment plants together with wastewater sludge and treated sludge be disposed in the solid waste landfill site. Possibility of sludge reuse and the requirements (such as monitoring) shall be studied to minimize any negative impacts.

Task 5 Recommendations:

Recommendations for monitoring (water quality, sludge quality etc.) the impacts of the Project, both positive and negative, shall be proposed.

The Project Area lies in the seismically-active region. Large-scale structures such as tunnels, vertical shafts etc. are planned and recommendations

4. Surveys

4.1 Water Quality Surveys

4.1.1 Sampling and Flow Rate Measurement

Contractor shall provide all necessary personnel and necessary items such as equipment, transportation etc. for carrying out sampling. Sampling shall be carried out under the direction of the Engineer. Location of sampling are as follows:

1) Las Vacas River (downstream of the proposed Central Wastewater Treatment Plant)
2) Tzalja River (upstream of the proposed Central Wastewater Treatment Plant)
3) Chinautla River (upstream of the proposed Central Wastewater Treatment Plant)
4) Las Vacas River (upstream of the proposed Central Wastewater Treatment Plant)
5) Las Vacas River (downstream of the outfall of existing Gran Collector)
6) Villalobos River (downstream of the proposed South 3 Region) Wastewater Treatment Plant)
7) East part of the Lake Amatitlan
8) West part of the Lake Amatitlan

9) Michatoya River (exit of Lake Amatitlan)

4.1.2 Number of samples

Number of samples are as follows:

Number of days of sampling	=	six days per each location
Number of sample per day	=	one sample per day (for rivers composite sample shall be made from the samples taken during the two flow rate measurements in a day)
Total number of samples	=	9 locations * 6 day/location * 1 sample/day
	=	54 samples

Sampling days shall be three days in late November 1995 and three days in late January 1996.

For rivers which are either wide or have multiple channel flow, samples across section shall be mixed to obtain representative sample.

4.1.3 Analysis of Samples

Samples shall be analyzed at a well established laboratory. All analytical work shall be carried out according to the Standard Methods, 18th Edition, "APHA, AWWA and WEF" as followed in the Republic of Guatemala. Analytical methods used shall be reported together with results of analysis.

Samples shall be handled and analyzed according to the specifications of Standard Methods.

Parameters for analysis are as follows:

1) pH (at the site)
2) temperature (at the site)
3) BOD_5
4) COD
5) Suspended solids
6) Total nitrogen
7) Total phosphorous
8) Chloride

4.1.4 Flow Rate Measurement

Flow rate measurement shall be conducted at the following locations:

1) Las Vacas River (downstream of the proposed Central Wastewater Treatment Plant)
2) Tzalja River (upstream of the proposed Central Wastewater Treatment Plant)
3) Chinautla River (upstream of the proposed Central Wastewater Treatment Plant)
4) Las Vacas River (upstream of the proposed Central Wastewater Treatment Plant)
5) Las Vacas River (downstream of the outfall of existing Gran Collector)
6) Villalobos River (downstream of the proposed South 3 Region) Wastewater Treatment Plant)

4.1.5 Reporting of Results

The Contractor shall submit the results of the flow rate measurement and water quality analysis as soon as they become available in beginning of December and beginning of February.

4.2 Questionnaire Survey on the Social Attitude to the Proposed Project

Questionnaire Survey shall be conducted to measure/explore existing social attitudes/perception (peoples perception of the benefits/impacts of the Project especially the sanitation systems, willingness to participate in the Project (construction or operation), possibility of sludge reuse and any other major factor to be identified in Task 3). Results of the survey will be used for incorporating necessary measures for smooth implementation of the Project in the subsequent stages.

Sanitation systems are proposed for 39 areas in the Central and South 3 Regions. Out of them, three (3) areas shall be selected for conducting Questionnaire Survey. All of the Sanitation Areas will be indicated by the Engineer by December 1995. Selection of the three areas for survey and questionnaire format shall be agreed with the Engineer prior to conducting the survey.

Total number of samples shall be approximately 150 for the three areas to be selected. Survey shall be conducted from the middle of February to beginning of March.

5. Expertise and Assignment Schedule

Expertise required for conducting this assessment are as shown below and their total expected input is 7 person*month.

- Coordinator / Chief Environmental Expert
- Sewerage / Construction engineer
- Hydrologist / Water Quality Specialist
- Social Scientist
- Archaelogist
- Ecologist
- Geologist

6. Reporting

Draft Report shall be prepared in both English and Spanish and six (6) copies shall be submitted by March 10, 1996. Comments or amendments required by either CONAMA or the Engineer shall be incorporated in the Final Report and be submitted by April 13, 1996. Contractor's technical personnel shall be made available when required for representation to CONAMA.

All field records for water quality survey and questionnaire survey shall be submitted together with the Reports.