Insufficient profiles and records of test pump-up are kept on file as general information for each well. The normal production amount is computed on the basis of this discharge data

4.3 Sample Study

Data Base for Well Operation

The total number of existing wells maintained by EMPAGUA is 57 and this is not a large amount in regards to keeping and controlling well data. However, Emergency I and II and other groundwater development projects planned by EMPAGUA will, increase the well number, and a computer filing system will eventually become necessary.

As a sample study of micro-computer utilization, all information for wells was arranged on a disk data-base.

The outline of the flow chart for this programing system and printed list are as shown in Fig. 4-1, Fig. 4-2.

4.4 Future Plan of Data Maintenance and its Utilization

Computer utilization for the O/M data should be expanded and modified.

Required periodic data such as hydrology will be input to the same file system.

Another recommendation is programming for the maintenance of mechanical parts of pumps, engines, etc. The necessity for this is mentioned in Chapter I.

Sample Output from Computer

Item 1	(Parts name) Item 2	Place & Responsi-bility	Modify		
			Purchased No.	Spending No.	Stock Storage No.
1. Pumps					
(1) Bore hole	-	-	-	-	-
(2) Submersible pumps	-	-	-	-	-
. . .					
(All required items)					

PROGRAM: PARTS LIST (for maintenance)

OBJECT: Situation: EMPAGUA has 2 workshops for the maintenance of well systems as follows:

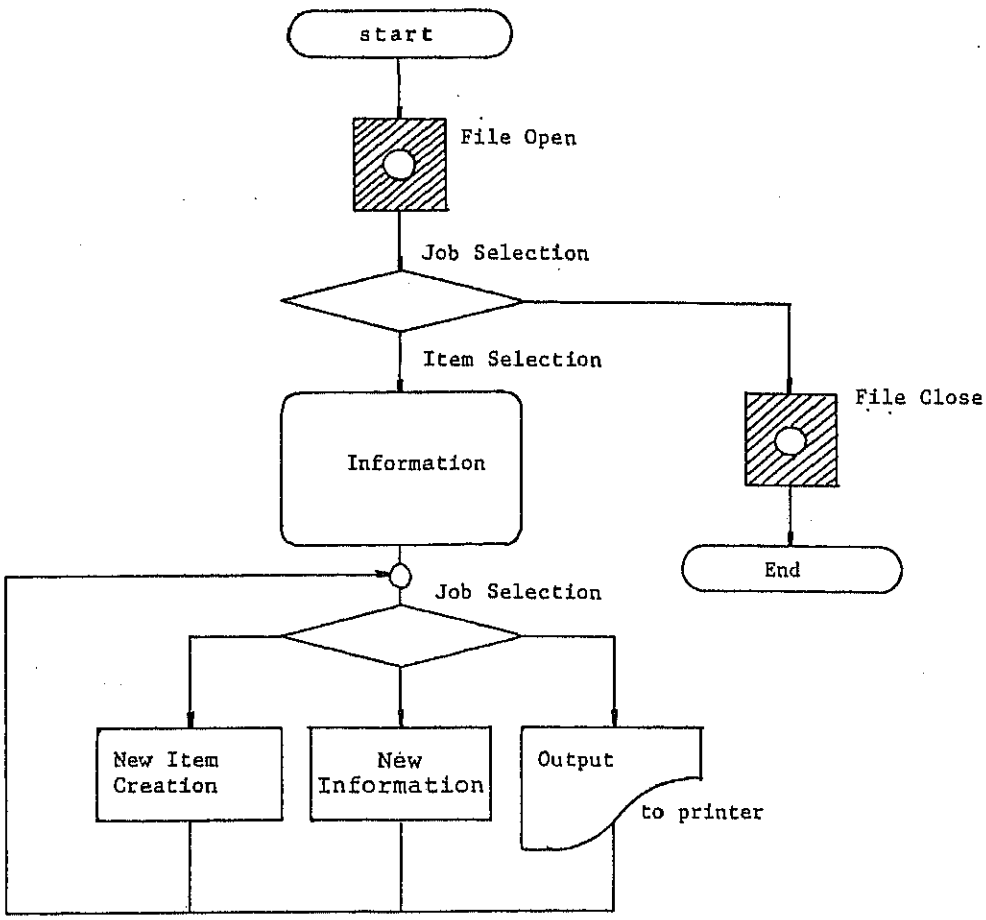
Parts of pumps and other equipment for repairing or replacement are kept without any control, and this situation leads to waste. This PARTS LIST is to arrange the required parts for all maintenance.

INPUT DATA: All parts items should be arranged item-wise.

Until the O/M workshop is completed this list should indicate the place and who has responsibility.

WORKS: These data will be reported by each section on a weekly basis for example, and if storage is the minumum, "caution" should be indicated to prompt action.

MAIN FLOW: (Outline)



OUTPUT: Existing itemized data such as monthly expenditure, purchases, stored numbers.

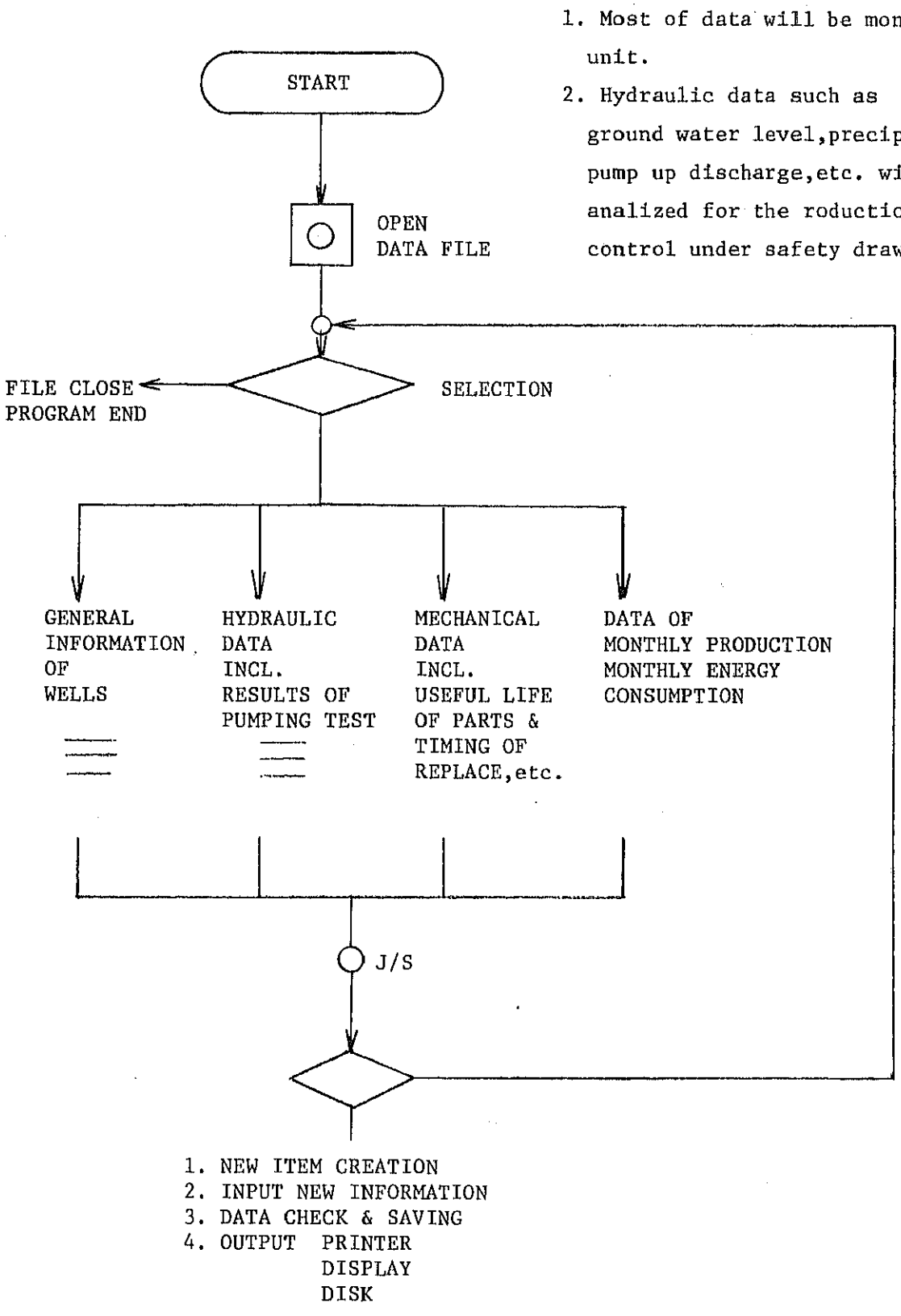


FIG. 4-1 FLOW CHART OF WELL DATA BASE

INFORMACION DE POZOS DE EMPAGUA:
86/03/03
11:45:37

FIG. 4-2 WELL INFORMATION

REG. No: 1 JOCOTALES

No.....:1	ALTITUD:.....:1450
FECHA.....:1982	PROFUNDIDAD..:1250.36
DIRECCION....:15 Av. y 3 C.	NIVEL.....:1364.66
ZONA POSTAL..:6	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:1.89
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:34-E

REG. No: 2 PROYECTO 4-3

No.....:2	ALTITUD:.....:1467.60
FECHA.....:1982	PROFUNDIDAD..:1193.28
DIRECCION....:16 Av. merc. CANDELA	NIVEL.....:1300.26
ZONA POSTAL..:6	DIAMETRO.....:12
DESTINO.....:DISTRIBUCION	CAUDAL.....:63.09
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:32-E

REG. No: 3 PROYECTO 4-3 RECONST

No.....:3	ALTITUD:.....:1478.12
FECHA.....:1980	PROFUNDIDAD..:1241.60
DIRECCION....:Cos.fut-bol pry. 4-3	NIVEL.....:1309.87
ZONA POSTAL..:6	DIAMETRO.....:10
DESTINO.....:DISTRIBUCION	CAUDAL.....:25.24
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:33-E

REG. No: 4 CIUDAD NUEVA

No.....:4	ALTITUD:.....:1450.58
FECHA.....:1982	PROFUNDIDAD..:1231.13
DIRECCION....:16 Av. 21 C."B"	NIVEL.....:1281.42
ZONA POSTAL..:6	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:5.05
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:31-E

REG. No: 5 LAS VICTORIAS

No.....:5	ALTITUD:.....:1471.00
FECHA.....:1982	PROFUNDIDAD..:1196.68
DIRECCION....:23 Av. y 1 C.	NIVEL.....:1411.56
ZONA POSTAL..:6	DIAMETRO.....:10
DESTINO.....:DISTRIBUCION	CAUDAL.....:6.31
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:22-E

REG. No: 6 PROYECTO 4-4

No.....:6	ALTITUD:.....:1451.43
FECHA.....:1982	PROFUNDIDAD..:1177.11
DIRECCION....:16 Av. y 18 C.	NIVEL.....:1286.84
ZONA POSTAL..:6	DIAMETRO.....:12
DESTINO.....:DISTRIBUCION	CAUDAL.....:28.39

USO.....:POTABLE
PERFIL LIT...:SI
NOTAS.....:30-E

REG. No: 7 PROYECTO 4-10

No.....:7
FECHA.....:1982
DIRECCION....:19 Av. final 23 C. f
ZONA POSTAL..:6
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1453.30
PROFUNDIDAD..:1165.26
NIVEL.....:1282.92
DIAMETRO.....:12
CAUDAL.....:63.09
PERFIL LIT...:SI
NOTAS.....:29-E

REG. No: 8 JOCOTALES II

No.....:8
FECHA.....:1982
DIRECCION....:21 C."C" y 23 Av.
ZONA POSTAL..:6
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1450.00
PROFUNDIDAD..:1175.68
NIVEL.....:1282.93
DIAMETRO.....:10
CAUDAL.....:63.09
PERFIL LIT...:SI
NOTAS.....:28-E

REG. No: 9 SAN ANTONIO

No.....:9
FECHA.....:1982
DIRECCION....:24 Av."A" y 17 C.
ZONA POSTAL..:6
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1282.93
PROFUNDIDAD..:1191.88
NIVEL.....:1393.05
DIAMETRO.....:10
CAUDAL.....:12.62
PERFIL LIT...:SI
NOTAS.....:26-E

REG. No: 10 PUENTE BELICE

No.....:10
FECHA.....:1982
DIRECCION....:ROTONDA C.ATLANTIDA
ZONA POSTAL..:18
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1482.14
PROFUNDIDAD..:1207.82
NIVEL.....:1402.89
DIAMETRO.....:10
CAUDAL.....:14.20
PERFIL LIT...:SI
NOTAS.....:25-E

REG. No: 11 CALZADA JOSE MILLA

No.....:11
FECHA.....:1982
DIRECCION....:23 Av. y Clz. J. MIL
ZONA POSTAL..:6
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1467.60
PROFUNDIDAD..:1193.28
NIVEL.....:1393.23
DIAMETRO.....:10
CAUDAL.....:19.06
PERFIL LIT...:SI
NOTAS.....:27-E

REG. No: 12 PARQUE NAVIDAD

No.....:12
FECHA.....:1969
DIRECCION....:2 C. 19 y 20 Av.
ZONA POSTAL..:6
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1472.52
PROFUNDIDAD..:1167.72
NIVEL.....:1431.21
DIAMETRO.....:8
CAUDAL.....:27.87
PERFIL LIT...:SI
NOTAS.....:23-E

REG. No: 13 PRIMERA Y PRIMERA

No.....:13	ALTITUD:.....:1497.80
FECHA.....:1968	PROFUNDIDAD..:1267.37
DIRECCION....:1a. C. y 1a. Av.	NIVEL.....:1444.46
ZONA POSTAL..:2	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:15.77
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:35-E

REG. No: 14 TALLERES MUNICIPALES

No.....:14	ALTITUD:.....:1495.39
FECHA.....:1968	PROFUNDIDAD..:1264.95
DIRECCION....:1a. C. y 3a.Av.	NIVEL.....:1440.53
ZONA POSTAL..:2	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:18.42
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:36-E

REG. No: 15 PARQUE COLON

No.....:15	ALTITUD:.....:1487.79
FECHA.....:NO	PROFUNDIDAD..:1286.62
DIRECCION....:12 Av. 8 y 9 C.	NIVEL.....:1454.26
ZONA POSTAL..:1	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:31.55
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:38-E

REG. No: 16 SANTO DOMINGO

No.....:16	ALTITUD:.....:1489.08
FECHA.....:1969	PROFUNDIDAD..:1350.09
DIRECCION....:12 Av. 10 y 11 C.	NIVEL.....:1457.08
ZONA POSTAL..:1	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:44.16
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:37-E

REG. No: 17 JARDINES DE LA ASUNC

No.....:17	ALTITUD:.....:1478.60
FECHA.....:1982	PROFUNDIDAD..:1204.28
DIRECCION....:Bld. CIPRESALES 15 C	NIVEL.....:1428.92
ZONA POSTAL..:5	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:28.39
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:21-E

REG. No: 18 CIUDAD VIEJA I

No.....:18	ALTITUD:.....:1499.03
FECHA.....:1970	PROFUNDIDAD..:1294.23
DIRECCION....:PARQUE HASTEDT	NIVEL.....:1451.79
ZONA POSTAL..:10	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:20.19
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:17-E

REG. No: 19 CIUDAD VIEJA II

No.....:19	ALTITUD:.....:1504.30

FECHA.....:1978
DIRECCION....:2 Av. 7 C.
ZONA POSTAL..:10
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
PROFUNDIDAD..:1290.94
NIVEL.....:1438.40
DIAMETRO.....:8
CAUDAL.....:6.31
PERFIL LIT...:SI
NOTAS.....:18-E

REG. No: 20 DIAGONAL VI

No.....:20
FECHA.....:----
DIRECCION....:10 Av. Diag. 6
ZONA POSTAL..:10
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1501.96
PROFUNDIDAD..:1279.46
NIVEL.....:1450.45
DIAMETRO.....:8
CAUDAL.....:31.55
PERFIL LIT...:NO
NOTAS.....:19-E

REG. No: 21 COLONIA EL MAESTRO

No.....:21
FECHA.....:----
DIRECCION....:B.V.HERMOSA 17/18 Av
ZONA POSTAL..:15
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1500
PROFUNDIDAD..:1286.64
NIVEL.....:1449.40
DIAMETRO.....:8
CAUDAL.....:31.55
PERFIL LIT...:SI
NOTAS.....:20-E

REG. No: 22 ESC. J.A. SALAZAR

No.....:22
FECHA.....:1978
DIRECCION....:19 C. 13/14 Av.
ZONA POSTAL..:10
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1507
PROFUNDIDAD..:1311.93
NIVEL.....:1450.61
DIAMETRO.....:8
CAUDAL.....:31.55
PERFIL LIT...:SI
NOTAS.....:12-E

REG. No: 23 REFORMA

No.....:23
FECHA.....:1973
DIRECCION....:Av. REFORMA 11/12 C.
ZONA POSTAL..:9
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1505.00
PROFUNDIDAD..:1276.40
NIVEL.....:1452.27
DIAMETRO.....:8
CAUDAL.....:12.62
PERFIL LIT...:NO
NOTAS.....:13-E

REG. No: 24 ARCOS I

No.....:24
FECHA.....:1976
DIRECCION....:Bld. TECUN UMAN 6 Av
ZONA POSTAL..:9
DESTINO.....:DISTRIBUCION
USO.....:POTABLE
ALTITUD:.....:1501.50
PROFUNDIDAD..:1318.62
NIVEL.....:1442.34
DIAMETRO.....:8
CAUDAL.....:25.24
PERFIL LIT...:SI
NOTAS.....:15-E

REG. No: 25 ARCOS II

No.....:25
FECHA.....:1978
DIRECCION....:Bld. TECUN UMAN 7 Av
ZONA POSTAL..:9
ALTITUD:.....:1502.00
PROFUNDIDAD..:1319.12
NIVEL.....:1441.65
DIAMETRO.....:8

DESTINO.....:DISTRIBUCION	CAUDAL.....:12.62
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:14-E

REG. No: 26 LA CASTELLANA

No.....:26	ALTITUD:.....:1510
FECHA.....:1976	PROFUNDIDAD..:1319.12
DIRECCION....:Av. CASTELLANA 18 C.	NIVEL.....:1457.57
ZONA POSTAL..:9	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:5.05
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:16-E

REG. No: 27 FILTROS BRIGADA II

No.....:27	ALTITUD:.....:1590.34
FECHA.....:1970	PROFUNDIDAD..:1300.78
DIRECCION....:E/761.82 N/1619.95	NIVEL.....:1544.01
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:31.55
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:40-E

REG. No: 28 FILTROS BRIGADA I

No.....:28	ALTITUD:.....:1589.11
FECHA.....:1970	PROFUNDIDAD..:1273.34
DIRECCION....:E/761.74 N/1619.94	NIVEL.....:1529.37
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:31.55
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:39-E

REG. No: 29 PLANTA BRIGADA II

No.....:29	ALTITUD:.....:1610.87
FECHA.....:1968	PROFUNDIDAD..:1427.99
DIRECCION....:E/761.82 N/1619.95	NIVEL.....:1529.79
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:11.36
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:42-E

REG. No: 30 PLANTA BRIGADA I

No.....:30	ALTITUD:.....:1610.98
FECHA.....:1968	PROFUNDIDAD..:1397.62
DIRECCION....:E/761.02 N/1620.36	NIVEL.....:1526.26
ZONA POSTAL..:7M	DIAMETRO.....:6
DESTINO.....:DISTRIBUCION	CAUDAL.....:20.13
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:41/E

REG. No: 31 PLANTA BRIGADA III

No.....:31	ALTITUD:.....:1615.44
FECHA.....:1965	PROFUNDIDAD..:1463.04
DIRECCION....:E/761.17 N/1620.36	NIVEL.....:1536.19
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:12.62
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:43-E

REG. No: 32 BRIGADA IV

No.....:32	ALTITUD.....:1607.52
FECHA.....:1965	PROFUNDIDAD..:1241.76
DIRECCION....:Clz. SAN JUAN Y 47 A	NIVEL.....:1528.27
ZONA POSTAL..:7M	DIAMETRO.....:6
DESTINO.....:DISTRIBUCION	CAUDAL.....:7.44
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:44-E

REG. No: 33 PLANTA BRIGADA VI

No.....:33	ALTITUD.....:1615.03
FECHA.....:----	PROFUNDIDAD..:----
DIRECCION....:E/761.08 N/1620.39	NIVEL.....:----
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:----
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:1-73/2

REG. No: 34 PLANTA BRIGADA V

No.....:34	ALTITUD.....:1614.72
FECHA.....:----	PROFUNDIDAD..:----
DIRECCION....:E/761.06 N/1620.29	NIVEL.....:----
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:----
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:1-72/2

REG. No: 35 FLORIDA

No.....:35	ALTITUD.....:1607.63
FECHA.....:1970	PROFUNDIDAD..:1328.
DIRECCION....:11 Av. Y 17 C.	NIVEL.....:1566.48
ZONA POSTAL..:19	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:12.62
USO.....:POTABLE	PERFIL LIT...:SI
	NOTAS.....:45-E

REG. No: 36 BELEM II

No.....:36	ALTITUD.....:1657.77
FECHA.....:1968	PROFUNDIDAD..:1410.88
DIRECCION....:Plt. BOMBEO BELEM	NIVEL.....:1591.93
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:6.31
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:47-E

REG. No: 37 BELEM I

No.....:37	ALTITUD.....:1659.49
FECHA.....:1968	PROFUNDIDAD..:1414.13
DIRECCION....:Plt. BOMBEO BELEM	NIVEL.....:1597.92
ZONA POSTAL..:7M	DIAMETRO.....:8
DESTINO.....:DISTRIBUCION	CAUDAL.....:28.39
USO.....:POTABLE	PERFIL LIT...:NO
	NOTAS.....:46-E

REG. No: 38 BELEM III

No.....:	38	ALTITUD:.....:	1659.38
FECHA.....:	1970	PROFUNDIDAD..:	1400.3
DIRECCION....:	Plt. BOMBEO BELEM	NIVEL.....:	1585.62
ZONA POSTAL..:	7M	DIAMETRO.....:	15
DESTINO.....:	DISTRIBUCION	CAUDAL.....:	31.55
USO.....:	POTABLE	PERFIL LIT...:	NO
		NOTAS.....:	48-E

REG. No: 39 LAS AMERICAS

No.....:	136	ALTITUD:.....:	1490
FECHA.....:	1976	PROFUNDIDAD..:	1304.07
DIRECCION....:	Av. AMERICAS 2 C.	NIVEL.....:	1434.83
ZONA POSTAL..:	13	DIAMETRO.....:	8
DESTINO.....:	DISTRIBUCION	CAUDAL.....:	15.77
USO.....:	POTABLE	PERFIL LIT...:	SI
		NOTAS.....:	11-E

REG. No: 40 HINCAPIE

No.....:	137	ALTITUD:.....:	1320
FECHA.....:	1978	PROFUNDIDAD..:	1106.64
DIRECCION....:	Plt BOMBEO HINCAPIE	NIVEL.....:	1319.92
ZONA POSTAL..:	14	DIAMETRO.....:	8
DESTINO.....:	DISTRIBUCION	CAUDAL.....:	31.55
USO.....:	POTABLE	PERFIL LIT...:	SI
		NOTAS.....:	10-E

REG. No: 41 OJO DE AGUA II

No.....:	138	ALTITUD:.....:	1300
FECHA.....:	1976	PROFUNDIDAD..:	1025.68
DIRECCION....:	Plt. B. OJO DE AGUA	NIVEL.....:	1294.51
ZONA POSTAL..:	12	DIAMETRO.....:	12
DESTINO.....:	DISTRIBUCION	CAUDAL.....:	151.4
USO.....:	POTABLE	PERFIL LIT...:	SI
		NOTAS.....:	9-E

REG. No: 42 OJO DE AGUA I

No.....:	139	ALTITUD:.....:	1300
FECHA.....:	1976	PROFUNDIDAD..:	1025.68
DIRECCION....:	Plt. B. OJO DE AGUA	NIVEL.....:	1299.09
ZONA POSTAL..:	12	DIAMETRO.....:	12
DESTINO.....:	DISTRIBUCION	CAUDAL.....:	151.4
USO.....:	POTABLE	PERFIL LIT...:	SI
		NOTAS.....:	8-E

REG. No: 43 DIAMANTE II

No.....:	140	ALTITUD:.....:	1300
FECHA.....:	1969	PROFUNDIDAD..:	1178.08
DIRECCION....:	P.DIAMANTE S M PETAP	NIVEL.....:	1292.38
ZONA POSTAL..:	12	DIAMETRO.....:	16
DESTINO.....:	P.Bomb.O.de Agu	CAUDAL.....:	50.47
USO.....:	POTABLE	PERFIL LIT...:	NO
		NOTAS.....:	6-E

REG. No: 44 DIAMANTE I

No.....:	141	ALTITUD:.....:	1248.55
FECHA.....:	1969	PROFUNDIDAD..:	1126.63
DIRECCION....:	P.DIAMANTE S M PETAP	NIVEL.....:	1240.93

ZONA POSTAL..:12
DESTINO.....:P.Bomb.O.de Agu
USO.....:POTABLE

DIAMETRO.....:12
CAUDAL.....:50.47
PERFIL LIT...:si
NOTAS.....:7-E

REG. No: 45 DIAMANTE VI

No.....:142
FECHA.....:1969
DIRECCION....:P.DIAMANTE S M P
ZONA POSTAL..:12
DESTINO.....:P.Bomb.O.de AGU
USO.....:POTABLE

ALTITUD:.....:1248.17
PROFUNDIDAD..:973.85
NIVEL.....:1228.05
DIAMETRO.....:12
CAUDAL.....:63.09
PERFIL LIT...:SI
NOTAS.....:1-E

REG. No: 46 DIAMANTE III

No.....:143
FECHA.....:1969
DIRECCION....:P.DIAMANTE S M P
ZONA POSTAL..:12
DESTINO.....:P.B.OJO DE AGUA
USO.....:POTABLE

ALTITUD:.....:1248.17
PROFUNDIDAD..:1089.67
NIVEL.....:1240.55
DIAMETRO.....:12
CAUDAL.....:90.85
PERFIL LIT...:SI
NOTAS.....:5-E

REG. No: 47 DIAMANTE VIII

No.....:144
FECHA.....:1976
DIRECCION....:P.DIAMANTE S M P
ZONA POSTAL..:12
DESTINO.....:P.B.OJO DE AGUA
USO.....:POTABLE

ALTITUD:.....:1320.00
PROFUNDIDAD..:1045.68
NIVEL.....:1300.49
DIAMETRO.....:12
CAUDAL.....:88.33
PERFIL LIT...:SI
NOTAS.....:4-E

REG. No: 48 DIAMANTE V

No.....:145
FECHA.....:1970
DIRECCION....:P.DIAMANTE S M P
ZONA POSTAL..:12
DESTINO.....:P.B.OJO DE AGUA
USO.....:POTABLE

ALTITUD:.....:1240.00
PROFUNDIDAD..:929.10
NIVEL.....:1232.38
DIAMETRO.....:16
CAUDAL.....:189.2
PERFIL LIT...:SI
NOTAS.....:2-E

REG. No: 49 DIAMANTE VII

No.....:146
FECHA.....:1976
DIRECCION....:P.DIAMANTE S M P
ZONA POSTAL..:12
DESTINO.....:P.B.OJO DE AGUA
USO.....:NINGUNO

ALTITUD:.....:1300.00
PROFUNDIDAD..:995.20
NIVEL.....:1287.50
DIAMETRO.....:12
CAUDAL.....:88.3
PERFIL LIT...:SI
NOTAS.....:3-E

REG. No: 50 MOLINO I

No.....:147
FECHA.....:1967
DIRECCION....:P.MOLINO.MIXCO
ZONA POSTAL..:11
DESTINO.....:CONDUCCION
USO.....:POTABLE

ALTITUD:.....:1600.33
PROFUNDIDAD..:1508.89
NIVEL.....:1588.14
DIAMETRO.....:8
CAUDAL.....:11.36
PERFIL LIT...:--

NOTAS.....:50-E

REG. No: 51 MOLINO III

No.....:148
FECHA.....:1970
DIRECCION....:P.MOLINO.MIXCO
ZONA POSTAL..:11
DESTINO.....:CONDUCCION
USO.....:POTABLE

ALTITUD:.....:1608.74
PROFUNDIDAD..:1306.99
NIVEL.....:1582.33
DIAMETRO.....:8
CAUDAL.....:12.62
PERFIL LIT...:SI
NOTAS.....:52-E

REG. No: 52 MOLINO RANEY

No.....:149
FECHA.....:1967
DIRECCION....:P.MOLINO MIXCO
ZONA POSTAL..:11
DESTINO.....:CONDUCCION
USO.....:POTABLE

ALTITUD:.....:1605
PROFUNDIDAD..:1574.52
NIVEL.....:1577.57
DIAMETRO.....:8
CAUDAL.....:9.46
PERFIL LIT...:--
NOTAS.....:E-49

REG. No: 53 MOLINO II

No.....:150
FECHA.....:----
DIRECCION....:P.MOLINO.MIXCO
ZONA POSTAL..:11
DESTINO.....:CONDUCCION
USO.....:POTABLE

ALTITUD:.....:1657.00
PROFUNDIDAD..:1550.32
NIVEL.....:1644.81
DIAMETRO.....:8
CAUDAL.....:11.36
PERFIL LIT...:--
NOTAS.....:E-51

REG. No: 54 EL ROSARIO

No.....:277
FECHA.....:----
DIRECCION....:E/773.26 N/1624.06
ZONA POSTAL..:18
DESTINO.....:DISTRIBUCION
USO.....:POTABLE

ALTITUD:.....:1500.00
PROFUNDIDAD..:----
NIVEL.....:----
DIAMETRO.....:--
CAUDAL.....:3.15
PERFIL LIT...:NO
NOTAS.....:I-76/2

REG. No: 55 JUANA DE ARCO

No.....:278
FECHA.....:1982
DIRECCION....:E.B. JUANA DE ARCO
ZONA POSTAL..:18
DESTINO.....:DISTRIBUCION
USO.....:POTABLE

ALTITUD:.....:1515.90
PROFUNDIDAD..:1241.58
NIVEL.....:1354.36
DIAMETRO.....:8
CAUDAL.....:22.08
PERFIL LIT...:SI
NOTAS.....:24-E

REG. No: 56 SANTA LUISA

No.....:279
FECHA.....:1978
DIRECCION....:P.S.LUISA ACATAN
ZONA POSTAL..:17
DESTINO.....:DISTRIBUCION
USO.....:POTABLE

ALTITUD:.....:1560.00
PROFUNDIDAD..:1346.64
NIVEL.....:1509.10
DIAMETRO.....:8
CAUDAL.....:9.46
PERFIL LIT...:SI
NOTAS.....:53-E

REG. No: 57

Annex 1

PUMPING TEST CALCULATION

1. FILTROS II

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	12.90	1.41	9.1×10^{-3}	6.6×10^{-5}
II	15.75	2.11	7.4×10^{-3}	5.4×10^{-5}
III	18.90	4.22	4.5×10^{-3}	3.2×10^{-5}
IV	22.05	7.03	3.1×10^{-3}	2.2×10^{-5}
V	25.20	13.36	1.9×10^{-3}	1.4×10^{-5}

2. CIUDAD VIEJA I

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	5.05	21.79	2.3×10^{-4}	1.7×10^{-6}
II	6.31	33.04	1.9×10^{-4}	1.4×10^{-6}
III	7.57	44.29	1.7×10^{-4}	1.3×10^{-6}
IV	8.20	88.95	9.2×10^{-5}	6.9×10^{-7}
V	9.46	140.27	6.7×10^{-5}	5.0×10^{-7}

3. DIAMANTE VI

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	25.74	51.32	5.0×10^{-4}	2.1×10^{-6}
II	27.38	86.57	3.2×10^{-4}	1.3×10^{-6}

4. J.A. SALAZAR

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	14.19	16.17	8.8×10^{-4}	9.0×10^{-6}
II	17.35	30.93	5.6×10^{-4}	5.7×10^{-6}
III	18.86	44.78	4.2×10^{-4}	4.3×10^{-6}
IV	20.57	84.15	2.4×10^{-4}	2.4×10^{-6}

5. LAS MERCEDES

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	43.65	1.40	3.1×10^{-2}	1.7×10^{-3}
II	50.53	1.40	3.6×10^{-2}	2.0×10^{-3}
III	50.78	2.09	2.4×10^{-2}	1.3×10^{-3}

6. OJO DE AGUA I

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	75.32	0.07	1.1	9.0×10^{-3}
II	88.57	1.48	6.0×10^{-2}	4.9×10^{-4}
III	100.87	1.48	6.8×10^{-2}	5.6×10^{-4}
IV	114.12	2.18	5.2×10^{-2}	4.3×10^{-4}
V	126.55	3.58	3.5×10^{-2}	2.8×10^{-4}
VI	132.22	4.99	2.6×10^{-2}	2.1×10^{-4}

7. PARQUE COLON

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	19.24	5.79	3.3×10^{-3}	2.8×10^{-5}
II	22.08	7.90	2.8×10^{-3}	2.3×10^{-5}

8. LAS AMERICAS

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	7.25	3.51	2.1×10^{-3}	2.2×10^{-5}
II	8.20	6.32	1.3×10^{-3}	1.4×10^{-5}
III	11.04	9.84	1.1×10^{-3}	1.2×10^{-5}
IV	14.13	16.17	8.7×10^{-4}	9.3×10^{-6}

9. JOCOTALES II

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	14.19	0	-	-
II	17.35	0	-	-
III	17.35	0	-	-

10. PROYECTO 4-10

	DISCHARGE (lt/sec)	DRAW DOWN (m)	SPECIFIC CAPACITY (m^3/sec/m)	YIELD FACTOR (m/sec)
I	44.73	1.41	3.2×10^{-2}	6.8×10^{-4}
II	47.94	1.41	3.4×10^{-2}	7.2×10^{-4}
III	52.04	1.41	3.7×10^{-2}	7.8×10^{-4}
IV	61.76	2.11	2.9×10^{-2}	6.2×10^{-4}

TABULATION SHEET OF DRAWDOWN PUMPING TEST

1. FILTROS II

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
15:29	0	0	0	76.83	0	
30	1	10"	12.9	79.65	2.81	
31	2	"	"	79.65	2.81	
32	3	"	"	78.24	1.41	I
33	4	"	"	78.24	1.41	
34	5	"	"	78.24	1.41	
35	6	"	"	78.24	1.41	
36	7	"	"	78.24	1.41	
37	8	15"	15.75	78.24	1.41	
38	9	"	"	78.94	2.11	II
39	10	"	"	78.94	2.11	
40	11	"	"	78.94	2.11	
41	12	22"	18.90	80.35	3.52	
42	13	"	"	80.35	3.52	
43	14	"	"	80.35	3.52	
44	15	"	"	80.35	3.52	
45	16	"	"	81.05	4.22	III
46	17	"	"	81.05	4.22	
47	18	"	"	81.05	4.22	
48	19	"	"	81.05	4.22	
49	20	"	"	81.05	4.22	
50	21	"	"	81.05	4.22	
51	22	31"	22.05	81.76	4.93	
52	23	"	"	81.76	4.93	
53	24	"	"	81.76	4.93	
54	25	"	"	81.76	4.93	
55	26	"	"	82.46	5.63	
56	27	"	"	82.46	5.63	
57	28	"	"	82.46	5.63	
58	29	"	"	82.46	5.63	
59	30	"	"	83.16	6.33	IV
16:00	31	"	"	83.16	6.33	
01	32	"	"	83.16	6.33	
02	33	"	"	83.16	6.33	
03	34	"	"	83.16	6.33	
04	35	"	"	83.16	6.33	
05	36	"	"	83.16	6.33	
06	37	"	"	83.16	6.33	
07	38	"	"	83.16	6.33	
08	39	"	"	83.16	6.33	
16:09	40	31"	22.05	83.16	6.33	
10	41	"	"	83.16	6.33	IV
15	46	"	"	83.86	7.03	
20	51	"	"	83.86	7.03	
21	52	40"	25.2	85.97	9.14	
22	53	"	"	86.67	9.85	
23	54	"	"	88.08	11.25	
24	55	"	"	88.08	11.25	
25	56	"	"	88.08	11.25	V
30	61	"	"	88.08	11.25	
35	66	"	"	88.08	11.95	
40	71	"	"	89.49	12.66	
45	76	"	"	90.19	13.36	
50	81	"	"	90.19	13.36	

2. CIUDAD VIEJA I

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
15:00	0	0	0	53.73	0	
01	1	11"	5.05	64.98	11.25	
02	2	"	"	63.57	9.84	
03	3	"	"	64.98	11.25	
04	4	"	"	66.38	12.65	
05	5	"	"	66.38	12.65	I
06	6	"	"	67.79	14.06	
11	11	"	"	70.60	16.87	
16	16	"	"	72.71	18.98	
21	21	"	"	74.82	21.09	
26	26	"	"	75.52	21.79	
30	30	"	"	75.52	21.79	
31	31	17"	6.31	77.63	23.90	
32	32	"	"	78.33	24.60	
33	33	"	"	80.44	26.71	
34	34	"	"	80.44	26.71	
35	35	"	"	80.44	26.71	
36	36	"	"	81.85	28.12	
37	37	"	"	82.55	28.82	
38	38	"	"	82.55	28.82	
39	39	"	"	83.25	29.52	II
40	40	"	"	83.25	29.52	
41	41	"	"	83.25	29.52	
42	42	"	"	83.25	29.52	
43	43	"	"	83.25	29.25	
44	44	"	"	83.96	30.23	
45	45	"	"	83.96	30.23	
50	50	"	"	85.36	31.63	
55	55	"	"	86.07	32.34	
16:00	60	"	"	86.77	33.04	
01	61	26"	7.57	87.47	33.74	
02	62	"	"	88.88	35.15	
03	63	"	"	89.58	35.85	
04	64	"	"	90.99	37.26	
05	65	"	"	92.39	38.66	III
06	66	"	"	92.39	38.66	
07	67	"	"	93.10	39.37	
08	68	"	"	93.80	40.07	
09	69	"	"	93.80	40.07	
10	70	"	"	94.50	40.77	
16:11	71	26"	7.57"	94.50	40.77	
12	72	"	"	94.50	40.77	
13	73	"	"	95.91	42.18	
14	74	"	"	95.91	42.18	III
15	75	"	"	95.91	42.18	
20	80	"	"	96.61	42.88	
25	85	"	"	97.31	43.58	
30	90	"	"	98.02	44.29	
31	91	30"	8.20	99.42	45.69	
35	95	"	"	101.53	47.80	
40	100	"	"	102.94	49.21	
45	105	"	"	105.05	51.32	
17:25	145	"	"	122.99	69.26	
40	160	"	"	123.70	69.97	
50	160	"	"	125.10	71.37	
18:00	180	"	"	125.80	72.07	
30	210	"	"	127.21	73.48	IV
19:00	240	"	"	130.02	76.29	
30	270	"	"	130.73	77.00	
20:00	300	"	"	132.13	78.40	
22:00	420	"	"	134.24	80.51	
24:00	540	"	"	135.65	81.92	
2:00	660	"	"	137.76	84.03	
4:00	780	"	"	140.57	86.84	
8:00	1020	"	"	142.68	88.95	
9:00	1080	40"	9.46	146.19	92.46	
10	1090	"	"	158.85	105.12	
30	1110	"	"	169.39	115.66	
40	1120	"	"	173.61	119.88	
50	1130	"	"	177.83	124.10	
10:00	1140	"	"	181.34	127.61	V
10	1150	"	"	186.26	132.53	
20	1160	"	"	189.78	136.05	
30	1170	"	"	191.89	138.16	
40	1180	"	"	194.00	140.27	
50	1190	"	"	194.70	140.97	
11:00	1200	"	"	194.0	140.27	

3. DIAMANTE VI

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
10:40	0	0	0	20.00	0	
41	1	6"	25.74	35.46	15.46	
42	2	"	"	38.97	18.98	
43	3	"	"	42.49	22.50	
44	4	"	"	45.30	25.31	
45	5	"	"	48.82	28.82	
46	6	"	"	50.22	30.23	
47	7	"	"	52.33	32.33	
48	8	"	"	54.44	34.45	
49	9	"	"	55.14	35.15	I
50	10	"	"	56.55	36.56	
55	15	"	"	60.77	40.77	
11:00	20	"	"	63.58	43.59	
05	25	"	"	66.39	46.40	
10	30	"	"	67.80	47.80	
15	35	"	"	69.20	49.20	
20	40	"	"	69.91	49.92	
25	45	"	"	70.61	50.62	
30	50	"	"	71.31	51.32	
31	51	7"	27.32	72.72	52.73	
32	52	"	"	72.72	52.73	
33	53	"	"	74.12	54.13	
34	54	"	"	75.53	55.53	
35	55	"	"	76.23	56.24	
40	60	"	"	76.94	56.94	
45	65	"	"	77.64	57.65	
12:00	80	"	"	84.77	64.78	
15	95	"	"	88.28	68.29	
30	105	"	"	88.99	68.99	
45	120	"	"	88.99	68.99	II
13:00	135	"	"	90.39	70.40	
15	150	"	"	91.80	71.81	
30	165	"	"	93.20	73.21	
45	180	"	"	93.91	73.91	
14:00	195	"	"	96.02	76.02	
15	210	"	"	96.72	76.73	
45	240	"	"	100.23	80.24	
16:15	270	"	"	100.23	80.24	
45	300	"	"	100.95	80.94	
17:15	330	"	"	100.94	80.94	
45	360	"	"	103.75	83.76	
18:15	390	7"	27.32	106.56	86.57	
45	420	"	"	106.56	86.57	
19:15	450	"	"	106.56	86.57	

4. J. A. Salazar

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSERVATION
18:41	0	0	0	56.30	0	
42	1	12	14.19	57.01	0.71	
43	2	"	"	73.17	16.87	
44	3	"	"	70.36	14.04	
45	4	"	"	71.07	14.77	
46	5	"	"	71.07	14.77	I
47	6	"	"	71.07	14.77	
52	11	"	"	71.07	14.77	
57	16	"	"	72.47	16.17	
19:02	21	"	"	72.47	16.17	
07	26	"	"	72.47	16.17	
12	31	"	"	72.47	16.17	
13	32	18.5"	17.35	77.39	21.09	
14	33	"	"	79.50	23.20	
15	34	"	"	81.61	25.31	
16	35	"	"	81.61	25.31	
17	36	"	"	82.31	26.01	
18	37	"	"	82.31	26.01	II
23	42	"	"	84.42	28.12	
28	47	"	"	84.42	28.12	
33	52	"	"	85.13	28.83	
38	56	"	"	86.53	30.23	
43	62	"	"	87.23	30.93	
44	63	22"	18.86	90.05	33.75	
45	64	"	"	91.45	35.15	
46	65	"	"	91.45	35.15	
47	66	"	"	94.76	38.46	
48	67	"	"	94.76	38.46	
49	68	"	"	94.76	38.46	III
54	73	"	"	98.27	41.97	
59	78	"	"	99.68	43.38	
20:04	83	"	"	100.38	44.08	
09	88	22"	18.86	100.38	44.08	
14	93	"	"	101.08	44.78	
17	98	"	"	101.08	44.78	
20:18	99	26.5"	20.57	103.30	49.00	
19	100	"	"	108.82	52.53	
20	101	"	"	110.22	53.92	IV
21	102	"	"	112.33	56.03	
22	103	"	"	113.74	57.44	
20:23	104	26.5"	20.57	115.85	59.55	
28	109	"	"	122.88	66.58	
33	114	"	"	124.98	68.68	
38	119	"	"	127.80	71.50	
48	129	"	"	129.91	73.61	IV
53	134	"	"	129.91	73.61	
21:53	194	"	"	136.94	80.64	
22:53	254	"	"	137.64	81.34	
23.53	314	"	"	139.04	82.74	
24.53	374	"	"	140.45	84.15	

5. Las Mercedes

TIME	(min)	DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION	TIME	(min)	DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
18:31	0	0	0	0.69	0								
32	1	32"	43.65	1.40	0.71								
33	2	"	"	1.40	0.71	I							
34	3	"	"	1.40	0.71								
35	4	"	"	1.40	0.71								
36	5	"	"	1.40	0.71								
37	6	42"	50.53	1.40	0.71								
38	7	"	"	1.40	0.71								
39	8	"	"	1.40	0.71	II							
40	9	"	"	1.40	0.71								
41	10	"	"	1.40	0.71								
42	11	"	"	1.40	0.71								
43	12	"	"	1.40	0.71								
44	13	42.5	50.78	1.40	0.71								
45	14	"	"	1.40	0.71								
46	15	"	"	1.40	0.71								
47	16	"	"	1.40	0.71								
48	17	"	"	1.40	0.71								
49	18	"	"	1.40	0.71	III							
53	22	"	"	1.40	0.71								
58	27	"	"	2.09	1.41								
19:03	32	"	"	2.09	1.41								
08	37	"	"	2.09	1.41								
13	42	"	"	2.09	1.41								
18	47	"	"	2.09	1.41								

6. OJO DE AGUA I

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSERVATION
16:53	0	0	0	0	0	
54	1	14"	75.32	0.77	0.77	
55	2	"	"	0.77	0.77	
56	3	"	"	0.77	0.77	I
56	4	"	"	0.77	0.07	
58	5	"	"	0.07	0.07	
17:03	10	"	"	0.07	0.07	
08	15	"	"	0.07	0.07	
09	16	20"	88.57	1.48	1.48	
10	17	"	"	1.48	1.48	
11	18	"	"	1.48	1.48	II
12	19	"	"	1.48	1.48	
13	20	"	"	1.48	1.48	
18	25	"	"	1.48	1.48	
23	30	26.5"	100.87	1.48	1.48	
24	31	"	"	1.48	1.48	
25	32	"	"	1.48	1.48	
26	33	"	"	1.48	1.48	III
27	34	"	"	1.48	1.48	
28	35	"	"	1.48	1.48	
33	40	"	"	1.48	1.48	
38	45	34"	114.12	2.18	2.18	
39	46	"	"	2.18	2.18	
40	47	"	"	2.18	2.18	
41	48	"	"	2.18	2.18	IV
42	49	"	"	2.18	2.18	
43	50	"	"	2.18	2.18	
48	55	"	"	2.18	2.18	
17:53	60	42"	126.55	2.88	2.88	
54	61	"	"	2.88	2.88	
55	62	"	"	3.58	3.58	
56	63	"	"	3.58	3.58	V
57	64	"	"	3.58	3.58	
18:03	70	"	"	3.58	3.58	
08	75	"	"	3.58	3.58	
13	80	"	"	3.58	3.58	
14	81	46"	132.22	4.99	4.99	
15	82	"	"	4.99	4.99	VI
16	83	"	"	4.99	4.99	
18:17	83	46"	132.22	4.99	4.99	
18	84	"	"	4.99	4.99	
19	85	"	"	4.99	4.99	
24	90	"	"	4.99	4.99	VI
29	95	"	"	4.99	4.99	
34	100	"	"	4.99	4.99	
19:04	130	"	"	4.99	4.99	

7. PARQUE COLON

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION	TIME (min)	DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
11:34	0	6"	19.24	53.64	0							
35	1	"	"	59.43	5.79							
36	2	"	"	59.43	5.79							
37	3	"	"	59.43	5.79							
38	4	"	"	59.43	5.79							
39	5	"	"	59.43	5.79	I						
40	6	"	"	59.43	5.79							
45	7	"	"	59.43	5.79							
50	12	"	"	59.43	5.79							
55	17	"	"	59.43	5.79							
12:00	22	"	"	59.43	5.79							
04	26	"	"	59.43	5.79							
05	27	8"	22.08	60.84	7.20							
06	28	"	"	60.84	7.20							
07	29	"	"	60.84	7.20							
08	30	"	"	60.84	7.20							
09	31	"	"	60.84	7.20							
10	32	"	"	60.84	7.20							
15	37	"	"	60.84	7.20							
20	42	"	"	60.84	7.20	II						
25	47	"	"	60.84	7.20							
30	52	"	"	60.84	7.20							
35	57	"	"	60.84	7.20							
40	62	"	"	60.84	7.20							
20:40	122	"	"	60.84	7.20							
21:40	182	"	"	61.54	7.90							
22:40	242	"	"	61.54	7.90							

8. LAS AMERICAS

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
5:24	0	7"	7.25	68.68	0	
25	1	"	"	72.90	4.22	
26	2	"	"	72.90	4.22	
27	3	"	"	72.19	3.51	
28	4	"	"	71.49	2.81	
29	5	"	"	71.49	2.81	I
30	6	"	"	71.49	2.81	
35	11	"	"	71.49	2.81	
40	16	"	"	71.49	2.81	
45	21	"	"	72.19	3.51	
50	26	"	"	72.19	3.51	
54	30	9.5	8.20	72.90	4.22	
55	31	"	"	73.59	4.91	
56	32	"	"	73.59	4.91	
57	33	"	"	73.59	4.91	
58	34	"	"	73.59	4.91	
59	35	"	"	73.59	4.91	II
18:00	36	"	"	73.30	5.62	
05	41	"	"	75.00	6.32	
10	46	"	"	75.00	6.32	
15	51	"	"	75.00	6.32	
20	56	"	"	75.00	6.32	
24	60	17.5"	11.04	75.00	6.32	
25	61	"	"	75.00	6.32	
26	62	"	"	75.71	7.03	
27	63	"	"	76.41	7.73	
28	64	"	"	77.11	8.43	
29	65	"	"	77.11	8.43	III
30	66	"	"	77.11	8.43	
35	71	"	"	78.52	9.84	
40	76	"	"	78.52	9.84	
40	76	"	"	78.52	9.84	
45	81	"	"	78.52	9.84	
50	86	"	"	78.52	9.84	
18:54	90	28.5"	14.13	79.22	10.54	
55	91	"	"	81.33	12.65	
56	92	"	"	82.03	13.35	IV
57	93	"	"	82.03	13.35	
58	94	"	"	82.03	13.35	
59	95	"	"	82.74	14.06	
19:00	96	28.5"	14.13	82.74	14.06	
05	101	"	"	84.14	15.46	IV
10	106	"	"	84.14	15.46	
15	111	"	"	84.85	16.17	

9. JOCOTALES II

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION	TIME (min)	DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
9:44	0	0	0	167.65	0							
45	1	13"	14.19	167.65	0							
46	2	"	"	167.65	0							
47	3	"	"	167.65	0							
48	4	"	"	167.65	0							
49	5	"	"	167.65	0	I						
50	6	"	"	167.65	0							
55	11	"	"	167.65	0							
10:00	16	"	"	167.65	0							
05	21	"	"	167.65	0							
10	26	"	"	167.65	0							
14	30	18.5"	17.35	167.65	0							
15	31	"	"	167.65	0							
16	32	"	"	167.65	0							
17	33	"	"	167.65	0							
18	34	"	"	167.65	0							
19	35	"	"	167.65	0							
20	36	"	"	167.65	0							
25	41	"	"	167.65	0							
30	46	"	"	167.65	0							
35	51	"	"	167.65	0							
40	56	"	"	167.65	0							
45	61	"	"	167.65	0	II						
55	71	"	"	167.65	0							
11:05	81	"	"	167.65	0							
15	91	"	"	167.65	0							
25	101	"	"	167.65	0							
35	111	"	"	167.65	0							
45	121	"	"	167.65	0							
12:00	136	"	"	167.65	0							
13:00	196	"	"	167.65	0							
14:00	256	"	"	167.65	0							
15:00	316	"	"	167.65	0							
17:00	436	"	"	167.65	0							
19:00	556	"	"	167.65	0							

10. PROYECTO 4-10

TIME (min)		DISCHARGE LECTURE	DISCHARGE l/sec	WATER LEVEL	DRAW DOWN (m)	OBSER-VATION
12:00	0	0	0	171.00	0	
01	1	20"	44.73	171.71	0.71	
02	2	"	"	171.71	0.71	
03	3	"	"	171.71	0.71	
04	4	"	"	171.71	0.71	
05	5	"	"	171.71	0.71	
06	6	"	"	172.41	1.41	
07	7	"	"	172.41	1.41	I
08	8	"	"	172.41	1.41	
09	9	"	"	172.41	1.41	
10	10	"	"	172.41	1.41	
11	11	"	"	172.41	1.41	
16	16	"	"	172.41	1.41	
21	21	"	"	172.41	1.41	
26	26	"	"	172.41	1.41	
31	31	23"	47.94	172.41	1.41	
32	32	"	"	172.41	1.41	
33	33	"	"	172.41	1.41	
34	34	"	"	172.41	1.41	
35	35	"	"	172.41	1.41	II
36	36	"	"	172.41	1.41	
41	41	"	"	172.41	1.41	
46	46	"	"	172.41	1.41	
51	51	"	"	172.41	1.41	
56	56	"	"	172.41	1.41	
57	57	27.5"	52.04	172.41	1.41	
58	58	"	"	172.41	1.41	
59	59	"	"	172.41	1.41	III
13:00	60	"	"	172.41	1.41	
01	61	"	"	172.41	1.41	
06	66	"	"	172.41	1.41	
11	71	33.5"	56.84	172.41	1.41	
12	72	"	"	172.41	1.41	
13	73	"	"	172.41	1.41	
14	74	"	"	172.41	1.41	
15	75	"	"	172.41	1.41	IV
16	76	"	"	172.41	1.41	
21	81	"	"	172.41	1.41	
26	86	"	"	172.41	1.41	
31	91	"	"	172.41	1.41	
36	96	33.5"	56.84	172.41	1.41	
41	101	"	"	172.41	1.41	IV
51	111	"	"	172.41	1.41	
52	112	40"	61.76	172.41	1.41	
53	113	"	"	173.11	2.11	
54	114	"	"	173.11	2.11	
55	115	"	"	173.11	2.11	
56	116	"	"	173.11	2.11	
57	117	"	"	173.11	2.11	
58	118	"	"	173.11	2.11	
59	119	"	"	173.11	2.11	
14:00	120	"	"	173.11	2.11	V
15:00	180	"	"	173.11	2.11	
16:00	240	"	"	173.11	2.11	
17:00	300	"	"	173.11	2.11	
18:00	360	"	"	173.11	2.11	
19:00	420	"	"	173.11	2.11	
20:00	480	"	"	173.11	2.11	
21:00	540	"	"	173.11	2.11	
22:00	600	"	"	173.11	2.11	

APPENDIX VI

PROJECT JUSTIFICATION

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APPENDIX VI

PROJECT JUSTIFICATION

1. Introduction

The Project is to increase water supply to Guatemala City consumers through the development of new wells (1 m^3/s) and the rehabilitation of a portion of existing wells (0.382 m^3/s). Rehabilitation works are to take place during the first year of the Project enabling increased water supply and revenue collection from the second year of the Project. Construction of new wells is to take place from the second year through the fourth year, further increasing water supply and revenue collection in a gradual manner.

Financial costs of the Project consist of initial investment costs, replacement costs corresponding to items (such as pumps) with shorter life than the Project life, and operation and maintenance costs. Details are shown in the Project implementation plan.

Financial benefits of the Project consist of revenues obtained from sale of water. The EMPAGUA water revenue system includes three revenue sources, namely, water titles or "paja", fixed monthly charges, and charges for excess consumption. A "paja" is the basic measure of water title equivalent to 60 m^3/month of water, but water titles are also sold as fractions and multiples of "paja". A consumer buying a water title is conferred, on perpetuity, the right to receive every month a fixed amount of water specific to the title. For this fixed amount of water, the consumer pays a fixed monthly charge. If monthly water consumption exceeds the fixed amount specified in the title, the consumer pays a fee for each cubic meter consumed. Since the unit price of excess water consumption is higher than the unit price corresponding to fixed monthly charges, a consumer can minimize payment of excess consumption charges by purchasing additional water titles.

In this Project, revenues from water titles are estimated on the basis of newly developed wells only.

2. Financial Evaluation

The purpose of financial evaluation is to determine the financial viability of the Project. Measures of financial viability include the net present value and the rate of return. The net present value is calculated by first subtracting total expenditures from gross revenues for each year of the Project and then converting the resultant net cash flow into present values using the investment borrowing rate as the discount factor. The sum of these annual present values is the net present value. A positive net present value shows that the rate of return on the investment is greater than the borrowing rate, thus indicating financial feasibility of the Project.

The rate of return is defined as the interest rate at which the net present value is zero. The rate of return is calculated by determining the net present value with various interest rates until a zero value is obtained. The rate of return is interpreted as the interest rate that the Project can afford to pay if borrowed funds are to be used for its implementation. Therefore, if the rate of return is greater than the borrowing rate of interest, the Project is judged financially feasible.

The financial evaluation of the Project will follow the steps indicated below.

Assumptions for Revenue Estimation

Revenue Estimation

Evaluation Results and Sensitivity Analysis

3. Assumptions for Revenue Estimation

Historically recorded EMPAGUA data are used when needed to specify assumptions for revenue estimation.

(1) The Project is to start in 1987 with detailed design and rehabilitaiton works, and the assumed project life is 30 years.

(2) Increased water supply and revenue collection from rehabilitated wells will start in 1988.

(3) Construction works for new wells will begin in 1988 and will end in 1990.

(4) Water from newly developed wells under the Project is ready for distribution to consumers at a ratio of 1/3 in 1989, 1/3 in 1990 and 1/3 in 1991.

(5) Net water production increases yearly from 64.0% of gross production in 1985 to 76.0% in 1995 as a result of reductions in distribution losses from 25 to 20%, illicit connections and wastage from 7% to 1%, and public consumption from 4% to 3%. The yearly increase in net water production is indicated below.

Year	%
1985	64.0
1986	64.8
1987	65.7
1988	66.8
1989	67.9
1990	69.0
1991	70.3
1992	71.7
1993	73.2
1994	74.6
1995	76.0

(6) Titles (pajas) corresponding to water obtained in a given year are sold during the following year, when water is ready for distribution to consumers.

(7) The number of saleable titles (pajas) is estimated on the basis of 70% of net water production in order to allow for a 30% Excess Consumption.

(8) Titles (pajas) are distributed among service categories as follows based on historical consumption pattern registered at EMPAGUA.

Marginal (20 m^3/month)	5%
Economical (30 m^3/month)	56%
Normal (60 m^3/month)	28%
Intermediate (60-300 m^3/month)	8%
High Consumption (over 300 m^3/month)	3%

(9) Consumers pay for titles (pajas) in one payment or in monthly payments over 1 to 5 years according to the proportions indicated below.

	Marginal	Economical	Normal	Intermed.	High Cons.
One payment	40%	40%	40%	100%	100%
Time payment					
1 year	3%	3%	10%	-	-
2 years	10%	10%	10%	-	-
3 years	8%	8%	10%	-	-
4 years	9%	9%	7%	-	-
5 years	30%	30%	23%	-	-

(10) Revenues come from sale of titles as well as from charges for Fixed Consumption and Excess Consumption. The basic measure for water titles is the "paja" equivalent to 60 m^3/month but consumers can buy titles corresponding to multiples or fractions of "paja". Water titles confer buyers the right to receive on perpetuity a fixed monthly amount of water for which consumers pay a fixed monthly charge. If monthly water consumption exceeds the fixed amount permitted by the title, consumers pay a fee for each cubic meter consumed.

(11) Revenues from titles (pajas) are estimated on the basis of water production from new wells (1 m^3/s), while revenues from Fixed Consumption and Excess Consumption are estimated on the basis of water production from new wells plus rehabilitated wells (1.382 m^3/s).

(12) Costs of titles and water rates used for revenue estimation are presented below.

a) Costs of titles (pajas) in Quetzal.

	Marginal 1/3 Paja ($20m^3$/month)	Economical 1/2 Paja ($30m^3$/month)	Normal 1 Paja ($60m^3$/month)	Intermediate 1-5 Pajas ($60-300m^3$/month)	High Consumption Over 5 Pajas (over $300m^3$/month)
One payment	350	600	1,050	1,050 per Paja	1,050 per Paja
Time payment					
1 year	385	660	1,155	-	-
2 years	420	720	1,260	-	-
3 years	455	780	1,365	-	-
4 years	490	840	1,470	-	-
5 years	525	900	1,575	-	-

b) Water rates

Service category	Fixed Consumption Quetzal/month	Excess Consumption Quetzal/m^3
Marginal	2.00	0.25
Economical	5.25	0.80
Normal	14.50	0.90
Intermediate	21.00	1.10
High Consumption	24.00	1.10

(13) Revenues from Excess Consumption are estimated three ways:

a) 30% of revenues from Fixed Consumption,

b) 30% of saleable water, in terms of volume, estimated at 0.80 Quetzal/m^3, and

c) assumed Excess Consumption of 7 and 10 m^3/month/connection estimated at 0.80 Quetzal/m^3, taking as a basis the EMPAGUA data of 5.6 m^3/month/connection.

Note: For b) and c), charges of Q.0.80/m^3 for Excess Consumption were chosen since, according to EMPAGUA records, approximately 60% of revenues from Excess Consumption corresponded to the Economical Service category. Then, Excess Consumption of the other service categories was assumed to average out to Q0.80/m^3 on grounds that Normal, Intermediate, and High Consumption service categories are financially able to purchase more titles as a means to reduce Excess Consumption charges.

(14) Bad debts are assumed to be 10% of yearly revenues from Fixed and Excess Consumption, and 3% of revenues from water titles.

(15) Late accounts are estimated to be the equivalent of one-fourth (three months) of yearly revenues.

4. Revenue Estimation

Revenues were estimated as follows.

(1) Computation of gross water production
(2) Computation of net water production
(3) Computation of water volume saleable as titles
(4) Computation of number of pajas or water titles
(5) Computation of number of service connections
(6) Estimation of revenues from titles
(7) Estimation of revenues from Fixed Consumption
(8) Estimation of revenes from Excess Consumption
(9) Estimation of total revenues

Details of revenue estimation can be seen in Tables 6.4-1, 6.4-2, 6.4-3, 6.4-4, 6.4-5 and 6.4-6.

5. Evaluation Results and Sensitivity Analysis

The Project financial evaluation was conducted using the costs estimated in the corresponding Cost Estimation section and the revenues estimated in the Revenue Estimation section. Details of financial evaluation are presented in Tables 6.5-1, 6.5-2, 6.5-3, 6.5-4, 6.5-5, 6.5-6 and 6.5-7

The Project financial internal rate of return is 13.1% for the basic case corresponding to Excess Consumption estimated as 10 m^3/month/connection. The case assumed to represent present EMPAGUA situation with an Excess Consumption of 7 m^3/month/connection results in 5.7% financial internal rate of return.

Changing total revenues to those corresponding to Excess Consumption estimated as 30% of Fixed Consumption revenues (minimum revenues), and 30% of net water production (maximum revenues), the resulting financial internal rates of return are undefined and 23.4%, respectively.

The financial internal rates of return (FIRR) and the net present values (NPV) with a 12% discount rate obtained under various assumptions are summarized below.

Cases	FIRR	NPV (12%)
	(%)	(1,000 Q)
Basic Case	13.09	1,546
Present Situation	5.71	-7,585
Minimum Revenues	undefined	undefined
Maximum Revenues	23.41	18,252

Sensitivity analysis provides a means to examine the changes that occur in the rate of return in response to changing circumstances, usually worsening conditions. Results of sensitivity analysis in reference to the basic case are summarized below.

Cases	FIRR (%)	NPV (12%) (1,000 Q)
Basic Case	13.09	1,546
10% lower Total Revenues	7.51	-5,994
10% higher Invest. and Replac. Costs	11.07	-1,460
Worst Case (10% lower Total Rev. and 10% higher Inv. & Repl. Costs)	5.90	-9,000

6. Summary

Under assumed conditions for revenue and cost estimations, the basic case results in 13% FIRR and positive NPV (12%) indicating that the Project is financially viable if the borrowing rate (discount rate) is lower than 13%.

Sensitivity analysis indicates the Project is more sensitive to variations in revenues than to changes in costs. A 10% decrease in revenues causes FIRR to drop to 7.5% from 13.1% of the basic case while a 10% increase in investment and replacement costs causes only a small drop in the FIRR (from 13.1% to 11.1%). Assuming a simultaneous 10% decrease in revenues and a 10% increase in costs, the FIRR drops to 5.9% from 13.1% of the basic case.

The Project sensitivity to variations in revenues implies the need for a careful management of revenues from Excess Consumption which, in turn, implies the need for meters in good working conditions.

The following Table shows the relationships between Excess Consumption, the corresponding proportions of net water production accounted for, and the resulting FIRR.

Case	Excess Consumption m^3/month/connection	Net Water Production %	FIRR %
Present Situation	7	85	5.71
Basic Case	10	90	13.09
Maximum Revenues	15	100	23.41

TABLE 6.4-1 EMERGENCY I WATER PRODUCTION FROM NEW WELLS ($1m^3/s$)

Year	Gross Production		NP/GP	Net Production		Water for Titles 70% of NP		Titles (Pajas)	Service Connections
	m^3/s	m^3/year	%	m^3/s	m^3/year	m^3/s	m^3/year		
1987	-	-	65.7	-	-	-	-	-	-
88	-	-	66.8	-	-	-	-	-	-
89	0.333	10,501,488	67.9	0.226	7,130,510	0.158	4,991,357	6,932	11,508
90	0.667	21,034,512	69.0	0.460	14,513,813	0.322	10,159,669	14,111	23,425
91	1.000	31,536,000	70.3	0.703	22,169,808	0.492	15,518,865	21,554	35,780
92			71.7	0.717	22,611,312	0.502	15,827,918	21,983	36,491
93			73.2	0.732	23,084,352	0.512	16,159,046	22,443	37,255
94			74.6	0.746	23,525,856	0.522	16,468,099	22,872	37,968
95			76.0	0.760	23,967,360	0.532	16,777,152	23,302	38,681
2016	1.000	31,536,000	76.0	0.760	23,967,360	0.532	16,777,152	23,302	38,681

TABLE 6.4-2 EMERGENCY I WATER PRODUCTION FROM NEW AND REHABILITATED WELLS (1.382m ^{3}/s)

Year	Gross Production		NP/GP	Net Production		Water for Titles 70% of NP		Titles (Pajas)	Service Connections
	m^3/s	m^3/year	%	m^3/s	m^3/year	m^3/s	m^3/year		
1987	-	-	65.7	-	-	-	-	-	-
88	0.382	12,046,752	66.8	0.255	8,047,230	0.179	5,633,061	7,824	12,987
89	0.715	22,548,240	67.9	0.485	15,310,254	0.340	10,717,178	14,885	24,709
90	1.049	33,081,264	69.0	0.724	22,826,072	0.507	15,978,250	22,192	36,839
91	1.382	43,582,752	70.3	0.972	30,638,674	0.680	21,447,071	29,788	49,447
92			71.7	0.991	31,248,832	0.694	21,874,182	30,381	50,432
93			73.2	1.012	31,902,574	0.708	22,331,801	31,016	51,487
94			74.6	1.031	32,512,732	0.722	22,758,912	31,610	52,472
95			76.0	1.050	33,122,891	0.735	23,186,023	32,203	53,457
2016	1.382	43,582,752	76.0	1.050	33,122,891	0.735	23,186,023	32,203	53,457

TABLE 6.4-3 ESTIMATED REVENUES FROM SALE OF TITLES CORRESPONDING TO 70% OF 1m ^{3}/s

((Unit: Quetzal)

Year	Marginal	Economical	Normal	Intermediate	High Consumption	Title Revenues
1987	-	-	-	-	-	-
88	-	-	-	-	-	-
89	145,950	1,863,600	814,800	581,700	218,400	3,624,450
90	162,785	2,083,380	1,068,270	603,750	225,750	4,143,935
91	212,100	2,718,180	1,352,295	624,750	235,200	5,142,525
92	104,965	1,343,460	808,710	36,750	13,650	2,307,535
93	142,800	1,822,020	803,775	38,850	13,650	2,821,095
94	264,215	3,384,840	1,277,115	35,700	13,650	4,975,520
95	233,310	2,993,700	1,039,290	35,700	13,650	4,315,150
96	184,800	2,362,800	812,910	-	-	3,360,510
97	17,710	233,220	88,830	-	-	339,760
98	16,240	206,040	75,390	-	-	297,670
99	13,440	165,720	57,330	-	-	236,490
2000	9,975	130,500	44,100	-	-	184,575
Total	1,508,290	19,307,460	8,242,815	1,957,200	733,950	31,749,715

TABLE 6.4-4 ESTIMATED REVENUES FROM FIXED CONSUMPTION BASED ON 70% OF 1.382m 3/s

((Unit: Quetzal)

Year	Gross Revenues 1/	Late Accounts 2/	Yearly Revenues 3/	Bad Debt 4/	Fixed Cons. Revenues 5/
1987	-	-	-	-	-
88	1,186,824	296,706	890,118	89,012	801,106
89	2,257,716	564,429	1,989,993	198,999	1,790,994
90	3,366,066	841,516	3,088,979	308,898	2,780,081
91	4,518,336	1,129,584	4,230,268	423,027	3,807,241
92	4,608,204	1,152,051	4,585,737	458,574	4,127,163
93	4,704,522	1,176,130	4,680,443	468,044	4,212,399
94	4,794,618	1,198,564	4,772,094	477,209	4,294,885
95	4,884,522	1,221,130	4,862,046	486,205	4,375,841
96	4,884,522	1,221,130	4,884,522	488,452	4,396,070
2016	4,884,522	1,221,130	4,884,522	488,452	4,396,070

1/ Gross Revenues = Number of service connections x corresponding water rates

2/ Late Accounts = 0.25 Gross Revenues

3/ Yearly Revenues = Gross Revenues - Late Accounts of the year + Late Accounts of previous year

4/ Bad Debt = 0.10 Yearly Revenues

5/ Fixed Consumption Revenues = Yearly Revenues - Bad Debt

TABLE 6.4-5 **Estimated Revenues from Excess Consumption**

Year	Method (a)[1] Fixed Cons. Rev. Q	Method (a)[1] Excess Cons. Rev. Q	Method (b)[2] 30% of Net Prod. m^3/yr	Method (b)[2] Excess Cons. Rev. Q	Method (c)[3] $7m^3/mo./$ Conn. m^3/yr	Method (c)[3] Excess Cons. Rev. Q	Method (c)[3] $10m^3/mo./$ Conn. m^3/yr	Method (c)[3] Excess Cons. Rev. Q
1987								
8	801,106	240,332	2,414,169	1,931,335	1,090,908	872,726	1,558,440	1,246,752
9	1,790,994	537,298	4,593,076	3,674,461	2,075,556	1,660,445	2,965,080	2,372,064
1990	2,780,081	834,024	6,847,822	5,478,258	3,094,476	2,475,581	4,420,680	3,536,544
1	3,807,241	1,142,172	9,191,603	7,353,282	4,153,548	3,322,838	5,933,640	4,746,912
2	4,127,163	1,238,149	9,374,650	7,499,720	4,236,288	3,389,030	6,051,840	4,841,472
3	4,212,399	1,263,720	9,570,773	7,656,618	4,324,908	3,459,926	6,178,440	4,942,752
4	4,294,885	1,288,466	9,753,820	7,803,056	4,407,648	3,526,118	6,296,640	5,037,312
5	4,375,841	1,312,752	9,936,868	7,949,494	4,490,388	3,592,310	6,414,840	5,131,872
6	4,396,070	1,318,821						
2016	4,396,070	1,318,821	9,936,868	7,949,494	4,490,388	3,592,310	6,414,840	5,131,872

1 Method (a): Excess Cons. Rev. = 0.3 Fixed Consumption Revenues

2 Method (b): Excess Cons. Rev. = 0.3 of Net Prod. x Q 0.80/m^3

3 Method (c): Excess Cons. Rev. = 7 and 10 m^3/month/connection x Q 0.80/m^3

TABLE 6.4-6 **Estimated Total Revenues from Titles, Fixed Consumption, and Three Methods of Computing Excess Consumption**

Unit: 1,000Q

Year	Title Revenues	Fixed Cons. Rev.	Excess Cons. Rev.				Total Revenues			
			(a)	(b)	(c)	(c')	(a)	(b)	(c)	(c')
1987										
8		801	216	1,738	786	1,122	1,017	2,539	1,587	1,923
9	3,516	1,791	483	3,307	1,494	2,135	5,790	8,614	6,801	7,442
1990	4,020	2,780	751	4,930	2,228	3,183	7,551	11,730	9,028	9,983
1	4,988	3,807	1,028	6,618	2,991	4,272	9,823	15,413	11,786	13,067
2	2,238	4,127	1,114	6,750	3,050	4,357	7,479	13,115	9,415	10,722
3	2,736	4,212	1,138	6,891	3,114	4,449	8,086	13,839	10,062	11,397
4	4,826	4,295	1,159	7,023	3,173	4,533	10,280	16,144	12,294	13,654
5	4,186	4,376	1,182	7,154	3,233	4,619	9,744	15,716	11,795	13,181
6	3,260	4,396	1,187				8,843	14,810	10,889	12,275
7	330	4,396	1,187				5,913	11,880	7,959	9,345
8	289						5,872	11,839	7,918	9,304
9	229						5,812	11,779	7,858	9,244
2000	179						5,762	11,729	7,808	9,194
1	0						5,583	11,550	7,629	9,015
2016		4,396	1,187	7,154	3,233	4,619	5,583	11,550	7,629	9,015

(a) Excess Cons. Rev. = 0.3 Fixed Cons. Rev.
(b) Excess cons. Rev. = 0.3 of Net Production x Q 0.80/m^3/
(c), (c') Excess Cons. Rev. = 7 and 10m^3/month/connection x Q 0.80/m^3

TABLE 6.5-1 FINANCIAL INTERNAL RATE OF RETURN FOR THE GROUNDWATER DEVELOPMENT PROJECT IN GUATEMALA CITY (BASIC CASE)

(1000 Q)

NO.	YEAR	COSTS INVESTMENT AND REPLACEMENT	COSTS OPERATION AND MAINTENANCE	TOTAL COSTS	BENEFITS	BENEFITS -COSTS	DISCOUNT FACTOR (12.00%)	NET PRESENT VALUE	DISCOUNT FACTOR (13.09%)	NET PRESENT VALUE
1	1987	3981	0	3981	0	-3981	1.000	-3981	1.000	-3981
2	1988	10090	513	10603	1923	-8680	0.893	-7750	0.884	-7675
3	1989	11750	2493	14243	7442	-6801	0.797	-5422	0.782	-5318
4	1990	9888	4843	14731	9983	-4748	0.712	-3380	0.691	-3283
5	1991	0	6857	6857	13067	6210	0.636	3947	0.611	3797
6	1992	0	6857	6857	10722	3865	0.567	2193	0.541	2089
7	1993	12	6857	6869	11397	4528	0.507	2294	0.478	2165
8	1994	0	6857	6857	13654	6797	0.452	3075	0.423	2873
9	1995	0	6857	6857	13181	6324	0.404	2554	0.374	2364
10	1996	317	6857	7174	12275	5101	0.361	1839	0.331	1686
11	1997	332	6857	7189	9345	2156	0.322	694	0.292	630
12	1998	294	6857	7151	9304	2153	0.287	619	0.258	556
13	1999	0	6857	6857	9244	2387	0.257	613	0.229	545
14	2000	0	6857	6857	9194	2337	0.229	536	0.202	472
15	2001	0	6857	6857	9015	2158	0.205	442	0.179	386
16	2002	0	6857	6857	9015	2158	0.183	394	0.158	341
17	2003	97	6344	6441	9015	2574	0.163	420	0.140	360
18	2004	602	6344	6946	9015	2069	0.146	301	0.124	256
19	2005	711	6344	7055	9015	1960	0.130	255	0.109	214
20	2006	934	6344	7278	9015	1737	0.116	202	0.097	168
21	2007	0	6344	6344	9015	2671	0.104	277	0.085	228
22	2008	12	6344	6356	9015	2659	0.093	246	0.076	201
23	2009	0	6344	6344	9015	2671	0.083	221	0.067	178
24	2010	0	6344	6344	9015	2671	0.074	197	0.059	158
25	2011	0	6344	6344	9015	2671	0.066	176	0.052	139
26	2012	317	6344	6661	9015	2354	0.059	138	0.046	109
27	2013	344	6344	6688	9015	2327	0.053	122	0.041	95
28	2014	282	6344	6626	9015	2389	0.047	112	0.036	86
29	2015	0	6344	6344	9015	2671	0.042	112	0.032	85
30	2016	0	6344	6344	9015	2671	0.037	100	0.028	75
	TOTAL	39963	178949	218912	274971	56059		1546		-0

TABLE 6.5-2 FINANCIAL INTERNAL RATE OF RETURN FOR THE GROUNDWATER DEVELOPMENT PROJECT IN GUATEMALA CITY (PRESENT SITUATION)

(1000 Q)

NO.	YEAR	COSTS INVESTMENT AND REPLACEMENT	COSTS OPERATION AND MAINTENANCE	TOTAL COSTS	BENEFITS	BENEFITS -COSTS	DISCOUNT FACTOR (12.00%)	NET PRESENT VALUE	DISCOUNT FACTOR (5.71%)	NET PRESENT VALUE
1	1987	3981	0	3981	0	-3981	1.000	-3981	1.000	-3981
2	1988	10090	513	10603	1587	-9016	0.893	-8050	0.946	-8529
3	1989	11750	2493	14243	6801	-7442	0.797	-5933	0.895	-6659
4	1990	9888	4843	14731	9028	-5703	0.712	-4059	0.846	-4827
5	1991	0	6857	6857	11786	4929	0.636	3132	0.801	3947
6	1992	0	6857	6857	9415	2558	0.567	1451	0.757	1938
7	1993	12	6857	6869	10062	3193	0.507	1618	0.717	2288
8	1994	0	6857	6857	12294	5437	0.452	2459	0.678	3685
9	1995	0	6857	6857	11795	4938	0.404	1994	0.641	3166
10	1996	317	6857	7174	10889	3715	0.361	1340	0.606	2253
11	1997	332	6857	7189	7959	770	0.322	248	0.574	442
12	1998	294	6857	7151	7918	767	0.287	220	0.543	416
13	1999	0	6857	6857	7858	1001	0.257	257	0.513	514
14	2000	0	6857	6857	7808	951	0.229	218	0.486	462
15	2001	0	6857	6857	7629	772	0.205	158	0.459	355
16	2002	0	6857	6857	7629	772	0.183	141	0.435	335
17	2003	97	6344	6441	7629	1188	0.163	194	0.411	488
18	2004	602	6344	6946	7629	683	0.146	99	0.389	266
19	2005	711	6344	7055	7629	574	0.130	75	0.368	211
20	2006	934	6344	7278	7629	351	0.116	41	0.348	122
21	2007	0	6344	6344	7629	1285	0.104	133	0.329	423
22	2008	12	6344	6356	7629	1273	0.093	118	0.311	396
23	2009	0	6344	6344	7629	1285	0.083	106	0.295	378
24	2010	0	6344	6344	7629	1285	0.074	95	0.279	358
25	2011	0	6344	6344	7629	1285	0.066	85	0.264	339
26	2012	317	6344	6661	7629	968	0.059	57	0.249	241
27	2013	344	6344	6688	7629	941	0.053	49	0.236	222
28	2014	282	6344	6626	7629	1003	0.047	47	0.223	224
29	2015	0	6344	6344	7629	1285	0.042	54	0.211	271
30	2016	0	6344	6344	7629	1285	0.037	48	0.200	257
	TOTAL	39963	178949	218912	237264	18352		-7585		0

TABLE 6.5-3 FINANCIAL INTERNAL RATE OF RETURN FOR THE GROUNDWATER DEVELOPMENT PROJECT IN GUATEMALA CITY (MINIMUM REVENUES)

(1000 Q)

NO.	YEAR	COSTS INVESTMENT AND REPLACEMENT	COSTS OPERATION AND MAINTENANCE	TOTAL COSTS	BENEFITS	BENEFITS -COSTS	DISCOUNT FACTOR (5.00%)	NET PRESENT VALUE	DISCOUNT FACTOR (12.00%)	NET PRESENT VALUE
1	1987	3981	0	3981	0	-3981	1.000	-3981	1.000	-3981
2	1988	10090	513	10603	1017	-9586	0.952	-9130	0.893	-8559
3	1989	11750	2493	14243	5790	-8453	0.907	-7667	0.797	-6739
4	1990	9888	4843	14731	7551	-7180	0.864	-6202	0.712	-5111
5	1991	0	6857	6857	9823	2966	0.823	2440	0.636	1885
6	1992	0	6857	6857	7479	622	0.784	487	0.567	353
7	1993	12	6857	6869	8086	1217	0.746	908	0.507	617
8	1994	0	6857	6857	10280	3423	0.711	2433	0.452	1548
9	1995	0	6857	6857	9744	2887	0.677	1954	0.404	1166
10	1996	317	6857	7174	8843	1669	0.645	1076	0.361	602
11	1997	332	6857	7189	5913	-1276	0.614	-783	0.322	-411
12	1998	294	6857	7151	5872	-1279	0.585	-748	0.287	-368
13	1999	0	6857	6857	5812	-1045	0.557	-582	0.257	-268
14	2000	0	6857	6857	5762	-1095	0.530	-581	0.229	-251
15	2001	0	6857	6857	5583	-1274	0.505	-643	0.205	-261
16	2002	0	6857	6857	5583	-1274	0.481	-613	0.183	-233
17	2003	97	6344	6441	5583	-858	0.458	-393	0.163	-140
18	2004	602	6344	6946	5583	-1363	0.436	-595	0.146	-199
19	2005	711	6344	7055	5583	-1472	0.416	-612	0.130	-191
20	2006	934	6344	7278	5583	-1695	0.396	-671	0.116	-197
21	2007	0	6344	6344	5583	-761	0.377	-287	0.104	-79
22	2008	12	6344	6356	5583	-773	0.359	-277	0.093	-72
23	2009	0	6344	6344	5583	-761	0.342	-260	0.083	-63
24	2010	0	6344	6344	5583	-761	0.326	-248	0.074	-56
25	2011	0	6344	6344	5583	-761	0.310	-236	0.066	-50
26	2012	317	6344	6661	5583	-1078	0.295	-318	0.059	-63
27	2013	344	6344	6688	5583	-1105	0.281	-311	0.053	-58
28	2014	282	6344	6626	5583	-1043	0.268	-279	0.047	-49
29	2015	0	6344	6344	5583	-761	0.255	-194	0.042	-32
30	2016	0	6344	6344	5583	-761	0.243	-185	0.037	-28
	TOTAL	39963	178949	218912	181300	-37612		-26498		-21287

TABLE 6.5-4 FINANCIAL INTERNAL RATE OF RETURN FOR THE GROUNDWATER DEVELOPMENT PROJECT IN GUATEMALA CITY (MAXIMUM REVENUES)

(1000 Q)

NO.	YEAR	COSTS INVESTMENT AND REPLACEMENT	COSTS OPERATION AND MAINTENANCE	TOTAL COSTS	BENEFITS	BENEFITS -COSTS	DISCOUNT FACTOR (12.00%)	NET PRESENT VALUE	DISCOUNT FACTOR (23.41%)	NET PRESENT VALUE
1	1987	3981	0	3981	0	-3981	1.000	-3981	1.000	-3981
2	1988	10090	513	10603	2539	-8064	0.893	-7200	0.810	-6534
3	1989	11750	2493	14243	8614	-5629	0.797	-4487	0.657	-3696
4	1990	9888	4843	14731	11730	-3001	0.712	-2136	0.532	-1597
5	1991	0	6857	6857	15413	8556	0.636	5437	0.431	3689
6	1992	0	6857	6857	13115	6258	0.567	3551	0.349	2186
7	1993	12	6857	6869	13839	6970	0.507	3531	0.283	1973
8	1994	0	6857	6857	16144	9287	0.452	4201	0.229	2130
9	1995	0	6857	6857	15716	8859	0.404	3578	0.186	1646
10	1996	317	6857	7174	14810	7636	0.361	2754	0.151	1150
11	1997	332	6857	7189	11880	4691	0.322	1510	0.122	572
12	1998	294	6857	7151	11839	4688	0.287	1348	0.099	464
13	1999	0	6857	6857	11779	4922	0.257	1263	0.080	394
14	2000	0	6857	6857	11729	4872	0.229	1117	0.065	316
15	2001	0	6857	6857	11550	4693	0.205	960	0.053	247
16	2002	0	6857	6857	11550	4693	0.183	857	0.043	200
17	2003	97	6344	6441	11550	5109	0.163	833	0.035	176
18	2004	602	6344	6946	11550	4604	0.146	671	0.028	129
19	2005	711	6344	7055	11550	4495	0.130	585	0.023	102
20	2006	934	6344	7278	11550	4272	0.116	496	0.018	79
21	2007	0	6344	6344	11550	5206	0.104	540	0.015	78
22	2008	12	6344	6356	11550	5194	0.093	481	0.012	63
23	2009	0	6344	6344	11550	5206	0.083	430	0.010	51
24	2010	0	6344	6344	11550	5206	0.074	384	0.008	41
25	2011	0	6344	6344	11550	5206	0.066	343	0.006	33
26	2012	317	6344	6661	11550	4889	0.059	288	0.005	25
27	2013	344	6344	6688	11550	4862	0.053	255	0.004	20
28	2014	282	6344	6626	11550	4924	0.047	231	0.003	17
29	2015	0	6344	6344	11550	5206	0.042	218	0.003	14
30	2016	0	6344	6344	11550	5206	0.037	195	0.002	12
	TOTAL	39963	178949	218912	343947	125035		18252		-0

TABLE 6.5-5 FINANCIAL INTERNAL RATE OF RETURN FOR THE GROUNDWATER DEVELOPMENT PROJECT IN GUATEMALA CITY (10% LOWER REVENUES)

(1000 Q)

NO.	YEAR	COSTS INVESTMENT AND REPLACEMENT	COSTS OPERATION AND MAINTENANCE	TOTAL COSTS	BENEFITS	BENEFITS -COSTS	DISCOUNT FACTOR (12.00%)	NET PRESENT VALUE	DISCOUNT FACTOR (7.51%)	NET PRESENT VALUE
1	1987	3981	0	3981	0	-3981	1.000	-3981	1.000	-3981
2	1988	10090	513	10603	1731	-8872	0.893	-7921	0.930	-8252
3	1989	11750	2493	14243	6698	-7545	0.797	-6015	0.865	-6528
4	1990	9888	4843	14731	8985	-5746	0.712	-4090	0.805	-4624
5	1991	0	6857	6857	11760	4903	0.636	3116	0.749	3670
6	1992	0	6857	6857	9650	2793	0.567	1585	0.696	1945
7	1993	12	6857	6869	10257	3388	0.507	1716	0.648	2194
8	1994	0	6857	6857	12289	5432	0.452	2457	0.602	3272
9	1995	0	6857	6857	11863	5006	0.404	2022	0.560	2805
10	1996	317	6857	7174	11048	3874	0.361	1397	0.521	2019
11	1997	332	6857	7189	8411	1222	0.322	393	0.485	592
12	1998	294	6857	7151	8374	1223	0.287	352	0.451	552
13	1999	0	6857	6857	8320	1463	0.257	376	0.419	614
14	2000	0	6857	6857	8275	1418	0.229	325	0.390	553
15	2001	0	6857	6857	8114	1257	0.205	257	0.363	456
16	2002	0	6857	6857	8114	1257	0.183	230	0.338	424
17	2003	97	6344	6441	8114	1673	0.163	273	0.314	525
18	2004	602	6344	6946	8114	1168	0.146	170	0.292	341
19	2005	711	6344	7055	8114	1059	0.130	138	0.272	288
20	2006	934	6344	7278	8114	836	0.116	97	0.253	211
21	2007	0	6344	6344	8114	1770	0.104	183	0.235	416
22	2008	12	6344	6356	8114	1758	0.093	163	0.219	384
23	2009	0	6344	6344	8114	1770	0.083	146	0.203	360
24	2010	0	6344	6344	8114	1770	0.074	131	0.189	335
25	2011	0	6344	6344	8114	1770	0.066	117	0.176	311
26	2012	317	6344	6661	8114	1453	0.059	85	0.164	238
27	2013	344	6344	6688	8114	1426	0.053	75	0.152	217
28	2014	282	6344	6626	8114	1488	0.047	70	0.142	211
29	2015	0	6344	6344	8114	1770	0.042	74	0.132	233
30	2016	0	6344	6344	8114	1770	0.037	66	0.123	217
	TOTAL	39963	178949	218912	247485	28573		-5994		-0

TABLE 6.5-6 FINANCIAL INTERNAL RATE OF RETURN FOR THE GROUNDWATER DEVELOPMENT PROJECT IN GUATEMALA CITY (10% HIGHER INV. & REP.)

(1000 Q)

NO.	YEAR	COSTS INVESTMENT AND REPLACEMENT	COSTS OPERATION AND MAINTENANCE	TOTAL COSTS	BENEFITS	BENEFITS -COSTS	DISCOUNT FACTOR (12.00%)	NET PRESENT VALUE	DISCOUNT FACTOR (11.07%)	NET PRESENT VALUE
1	1987	4379	0	4379	0	-4379	1.000	-4379	1.000	-4379
2	1988	11099	513	11612	1923	-9689	0.893	-8651	0.900	-8723
3	1989	12925	2493	15418	7442	-7976	0.797	-6358	0.811	-6465
4	1990	10877	4843	15720	9983	-5737	0.712	-4083	0.730	-4187
5	1991	0	6857	6857	13067	6210	0.636	3947	0.657	4080
6	1992	0	6857	6857	10722	3865	0.567	2193	0.592	2286
7	1993	13	6857	6870	11397	4527	0.507	2294	0.533	2411
8	1994	0	6857	6857	13654	6797	0.452	3075	0.480	3259
9	1995	0	6857	6857	13181	6324	0.404	2554	0.432	2730
10	1996	349	6857	7206	12275	5069	0.361	1828	0.389	1970
11	1997	365	6857	7222	9345	2123	0.322	684	0.350	743
12	1998	323	6857	7180	9304	2124	0.287	611	0.315	669
13	1999	0	6857	6857	9244	2387	0.257	613	0.284	677
14	2000	0	6857	6857	9194	2337	0.229	536	0.255	597
15	2001	0	6857	6857	9015	2158	0.205	442	0.230	496
16	2002	0	6857	6857	9015	2158	0.183	394	0.207	447
17	2003	107	6344	6451	9015	2564	0.163	418	0.186	478
18	2004	662	6344	7006	9015	2009	0.146	293	0.168	337
19	2005	782	6344	7126	9015	1889	0.130	246	0.151	285
20	2006	1027	6344	7371	9015	1644	0.116	191	0.136	224
21	2007	0	6344	6344	9015	2671	0.104	277	0.122	327
22	2008	13	6344	6357	9015	2658	0.093	246	0.110	293
23	2009	0	6344	6344	9015	2671	0.083	221	0.099	265
24	2010	0	6344	6344	9015	2671	0.074	197	0.089	239
25	2011	0	6344	6344	9015	2671	0.066	176	0.080	215
26	2012	349	6344	6693	9015	2322	0.059	137	0.072	168
27	2013	378	6344	6722	9015	2293	0.053	120	0.065	150
28	2014	310	6344	6654	9015	2361	0.047	111	0.059	139
29	2015	0	6344	6344	9015	2671	0.042	112	0.053	141
30	2016	0	6344	6344	9015	2671	0.037	100	0.048	127
	TOTAL	43958	178949	222907	274971	52064		-1460		-0

TABLE 6.5-7 FINANCIAL INTERNAL RATE OF RETURN FOR THE GROUNDWATER DEVELOPMENT PROJECT IN GUATEMALA CITY (WORST CASE)

(1000 Q)

NO.	YEAR	COSTS INVESTMENT AND REPLACEMENT	COSTS OPERATION AND MAINTENANCE	TOTAL COSTS	BENEFITS	BENEFITS -COSTS	DISCOUNT FACTOR (12.00%)	NET PRESENT VALUE	DISCOUNT FACTOR (5.90%)	NET PRESENT VALUE
1	1987	4379	0	4379	0	-4379	1.000	-4379	1.000	-4379
2	1988	11099	513	11612	1731	-9881	0.893	-8822	0.944	-9331
3	1989	12925	2493	15418	6698	-8720	0.797	-6952	0.892	-7776
4	1990	10877	4843	15720	8985	-6735	0.712	-4794	0.842	-5671
5	1991	0	6857	6857	11760	4903	0.636	3116	0.795	3899
6	1992	0	6857	6857	9650	2793	0.567	1585	0.751	2097
7	1993	13	6857	6870	10257	3387	0.507	1716	0.709	2402
8	1994	0	6857	6857	12289	5432	0.452	2457	0.670	3637
9	1995	0	6857	6857	11863	5006	0.404	2022	0.632	3165
10	1996	349	6857	7206	11048	3842	0.361	1385	0.597	2294
11	1997	365	6857	7222	8411	1189	0.322	383	0.564	670
12	1998	323	6857	7180	8374	1194	0.287	343	0.532	636
13	1999	0	6857	6857	8320	1463	0.257	376	0.503	735
14	2000	0	6857	6857	8275	1418	0.229	325	0.475	673
15	2001	0	6857	6857	8114	1257	0.205	257	0.448	563
16	2002	0	6857	6857	8114	1257	0.183	230	0.423	532
17	2003	107	6344	6451	8114	1663	0.163	271	0.400	665
18	2004	662	6344	7006	8114	1108	0.146	161	0.377	418
19	2005	782	6344	7126	8114	988	0.130	128	0.356	352
20	2006	1027	6344	7371	8114	743	0.116	86	0.337	250
21	2007	0	6344	6344	8114	1770	0.104	183	0.318	563
22	2008	13	6344	6357	8114	1757	0.093	163	0.300	527
23	2009	0	6344	6344	8114	1770	0.083	146	0.283	502
24	2010	0	6344	6344	8114	1770	0.074	131	0.268	474
25	2011	0	6344	6344	8114	1770	0.066	117	0.253	447
26	2012	349	6344	6693	8114	1421	0.059	84	0.239	339
27	2013	378	6344	6722	8114	1392	0.053	73	0.225	314
28	2014	310	6344	6654	8114	1460	0.047	68	0.213	311
29	2015	0	6344	6344	8114	1770	0.042	74	0.201	356
30	2016	0	6344	6344	8114	1770	0.037	66	0.190	336
	TOTAL	43958	178949	222907	247485	24578		-9000		-0

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