1.3 Carrying out the Impact Test

After preparation of the test area, impact test using the Type In Concrete Test Hammer at 5 or at better 10 points of the prepared area is carried out for each test. The rebound number, R, is registered on the scale of the concrete test hammer. Take the mean value of R of the 5 to 10 hammer readings. In taking the mean, all the individual readings of the test hammer must be taken into account; only obvious off-shots are to be eliminated and to be replaced by a further impact test. Obvious off-shots are those test hammer readings that deviate from the mean of the others by more than 5 units. Experience shows that they occur when the impact hits an aggregate particle or a pore lying close to the surface.

1.4 Value of the Concrete Comprehensive Strength Zm in N/mm^2

The most likely value of Zm for each value of R is derived using the graph showing the relation of the cylinder compressive with the rebound number R. (See handbook: Operating Instructions for Concrete Test Hammer Type N)

2. Results

The testing points, selected 28 points, are shown in Fig. D.1. The results of concrete compressive test indicated that the structures have sufficient strength.

The test results are shown in the followings:

CONCRETE TEST HAMMER

NAME OF FACILITY: 1-SETTLING BASIN #1 DATE OF TESTING: 9/10/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	45	45.5	42	49.5	42
COMPRESSIVE STRENGTH (kg/cm2)	469.20	479.40	426.36	540.60	426.36

TEST NO.	6	7	8	9	10
HAMMER READING	46.5	46.5	46.5	41	45.5
COMPRESSIVE STRENGTH (kg/cm2)	494.70	494.70	494.70	408.00	479.40

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	49	50	50.5	44.5	47
COMPRESSIVE STRENGTH (kg/cm2)	495.72	513.06	521.73	423.3	464.1

TEST NO.	6	7	8	9	10
HAMMER READING	48.5	48.5	49.5	47.5	48.5
COMPRESSIVE STRENGTH (kg/cm2)	488.07	488.07	504.39	472.26	488.07

1. TOP

AVERAGE HAMMER READING : 45
AVERAGE COMPRESSIVE STRENGTH : 471.342 kg/cm2

2. SIDE

AVERAGE HAMMER READING : 48.35
AVERAGE COMPRESSIVE STRENGTH : 485.826 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 2-SLOPING WALL @ SB #1   DATE OF TESTING: 9/10/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. SLOPE

TEST NO.	1	2	3	4	5
HAMMER READING	44	42	42	40	46
COMPRESSIVE STRENGTH (kg/cm2)	443.70	413.10	413.10	382.50	474.30

TEST NO.	6	7	8	9	10
HAMMER READING	40	39	39.5	46	46
COMPRESSIVE STRENGTH (kg/cm2)	382.50	367.20	377.40	474.30	474.30

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

TEST NO.	6	7	8	9	10
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

1. SLOPE
   AVERAGE HAMMER READING : 42.45
   AVERAGE COMPRESSIVE STRENGTH : 420.24 kg/cm2
2. SIDE
   AVERAGE HAMMER READING :
   AVERAGE COMPRESSIVE STRENGTH : kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 3-OPEN CHANNEL (SB #1)   DATE OF TESTING: 9/10/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	38	39	38	40	42
COMPRESSIVE STRENGTH (kg/cm2)	365.16	377.40	365.16	394.74	426.36

TEST NO.	6	7	8	9	10
HAMMER READING	38	39.5	38	36	41
COMPRESSIVE STRENGTH (kg/cm2)	365.16	385.56	365.16	334.56	408.00

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	40	46	44	43.5	41
COMPRESSIVE STRENGTH (kg/cm2)	350.88	446.76	415.14	406.98	367.2

TEST NO.					
HAMMER READING	43	49	47	44.5	40
COMPRESSIVE STRENGTH (kg/cm2)	398.82	495.72	464.1	423.3	350.88

1. TOP
   AVERAGE HAMMER READING : 38.95
   AVERAGE COMPRESSIVE STRENGTH : 378.726 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 43.8
   AVERAGE COMPRESSIVE STRENGTH : 411.978 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 4-OPEN CHANNEL (SB #1) DATE OF TESTING: 9/10/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	40	38	38	42	41
COMPRESSIVE STRENGTH (kg/cm2)	394.74	365.16	365.16	426.36	408.00

TEST NO.	6	7	8	9	10
HAMMER READING	40.5	41	42	42	38
COMPRESSIVE STRENGTH (kg/cm2)	397.80	408.00	426.36	426.36	365.16

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	40	47	46	40.5	46
COMPRESSIVE STRENGTH (kg/cm2)	350.88	464.1	446.76	359.04	446.76

TEST NO.	6	7	8	9	10
HAMMER READING	46	39.5	43	48	48.5
COMPRESSIVE STRENGTH (kg/cm2)	446.76	343.74	398.82	480.42	488.07

1. TOP

AVERAGE HAMMER READING : 40.25
AVERAGE COMPRESSIVE STRENGTH : 398.31 kg/cm2

2. SIDE

AVERAGE HAMMER READING : 44.45
AVERAGE COMPRESSIVE STRENGTH : 422.535 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 5-CONN. CHANNEL (SB #1-SB #2)　　DATE OF TESTING: 9/10/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	42	38	39	41	44
COMPRESSIVE STRENGTH (kg/cm2)	426.36	365.16	377.40	408.00	456.96

TEST NO.	6	7	8	9	10
HAMMER READING	42	40	44	38	38
COMPRESSIVE STRENGTH (kg/cm2)	426.36	394.74	456.96	365.16	365.16

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	42	42	44	45	45.5
COMPRESSIVE STRENGTH (kg/cm2)	383.52	383.52	415.14	431.46	439.11

TEST NO.	6	7	8	9	10
HAMMER READING	45	42.5	43	48	41.5
COMPRESSIVE STRENGTH (kg/cm2)	431.46	391.17	398.82	480.42	375.36

1. TOP
   AVERAGE HAMMER READING : 40.6
   AVERAGE COMPRESSIVE STRENGTH : 404.226 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 43.85
   AVERAGE COMPRESSIVE STRENGTH : 412.998 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 6-CHANNEL (SB #2) DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	45	41	40	39	44
COMPRESSIVE STRENGTH (kg/cm2)	469.20	408.00	394.74	377.40	456.96

TEST NO.	6	7	8	9	10
HAMMER READING	42	43	41	41	39
COMPRESSIVE STRENGTH (kg/cm2)	426.36	440.64	408.00	408.00	377.40

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	41	40	39	39	43
COMPRESSIVE STRENGTH (kg/cm2)	367.2	350.88	336.6	336.6	398.82

TEST NO.	6	7	8	9	10
HAMMER READING	44	41	41	40.5	42
COMPRESSIVE STRENGTH (kg/cm2)	415.14	367.2	367.2	359.04	383.52

1. TOP

AVERAGE HAMMER READING : 41.5
AVERAGE COMPRESSIVE STRENGTH : 416.67 kg/cm2

2. SIDE

AVERAGE HAMMER READING : 41.05
AVERAGE COMPRESSIVE STRENGTH : 368.22 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 7-CHANNEL (SB #2)   DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. SLOPE

TEST NO.	1	2	3	4	5
HAMMER READING	40	44	42	50	48
COMPRESSIVE STRENGTH (kg/cm2)	382.50	443.70	413.10	540.60	504.90

TEST NO.	6	7	8	9	10
HAMMER READING	41	49	44	42	43
COMPRESSIVE STRENGTH (kg/cm2)	397.80	525.30	443.70	413.10	428.40

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

TEST NO.	6	7	8	9	10
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

1. SLOPE
   AVERAGE HAMMER READING : 44.3
   AVERAGE COMPRESSIVE STRENGTH : 449.31 kg/cm2
2. SIDE
   AVERAGE HAMMER READING :
   AVERAGE COMPRESSIVE STRENGTH : kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 8-ACCELATOR　　　　DATE OF TESTING:　　9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	46.5	48	46.5	50.5	46
COMPRESSIVE STRENGTH (kg/cm2)	494.70	520.20	494.70	558.96	484.50

TEST NO.	6	7	8	9	10
HAMMER READING	48.5	50.5	47	52	47
COMPRESSIVE STRENGTH (kg/cm2)	530.40	558.96	504.90	581.40	504.90

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	46	46	46	51	48
COMPRESSIVE STRENGTH (kg/cm2)	446.76	446.76	446.76	530.4	480.42

TEST NO.	6	7	8	9	10
HAMMER READING	50	50	50.5	48	47
COMPRESSIVE STRENGTH (kg/cm2)	513.06	513.06	521.73	480.42	464.10

1. TOP
   AVERAGE HAMMER READING : 48.25
   AVERAGE COMPRESSIVE STRENGTH : 523.362 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 48.25
   AVERAGE COMPRESSIVE STRENGTH : 484.347 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 9-ACCELATOR DATE OF TESTING: 9/11/91

STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	48	46	42	45	44
COMPRESSIVE STRENGTH (kg/cm2)	520.20	484.50	426.36	469.20	456.96

TEST NO.	6	7	8	9	10
HAMMER READING	44	44	40	43	46
COMPRESSIVE STRENGTH (kg/cm2)	456.96	456.96	394.74	440.64	484.50

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	48	46	43	45.5	49
COMPRESSIVE STRENGTH (kg/cm2)	480.42	446.76	398.82	439.11	495.72

TEST NO.	6	7	8	9	10
HAMMER READING	49	43	49	49	43
COMPRESSIVE STRENGTH (kg/cm2)	495.72	398.82	495.72	495.72	398.82

1. TOP
   AVERAGE HAMMER READING : 44.2
   AVERAGE COMPRESSIVE STRENGTH : 459.102 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 46.45
   AVERAGE COMPRESSIVE STRENGTH : 454.563 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 10-FILTRATION PLANT NO. 1 DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	46	44	50	48	47
COMPRESSIVE STRENGTH (kg/cm2)	484.50	456.96	550.80	520.20	504.90

TEST NO.	6	7	8	9	10
HAMMER READING	47	47	50	44	48
COMPRESSIVE STRENGTH (kg/cm2)	504.90	504.90	550.80	456.96	520.20

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	48	47	44	44	42
COMPRESSIVE STRENGTH (kg/cm2)	480.42	464.1	415.14	415.14	383.52

TEST NO.	6	7	8	9	10
HAMMER READING	51	45	49	47	42
COMPRESSIVE STRENGTH (kg/cm2)	530.40	431.46	495.72	464.10	383.52

1. TOP
   AVERAGE HAMMER READING : 47.1
   AVERAGE COMPRESSIVE STRENGTH : 505.512 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 45.9
   AVERAGE COMPRESSIVE STRENGTH : 446.352 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 11-FILTRATION PLANT NO. 1 DATE OF TESTING: 9/11
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	52	51.5	50	50	52
COMPRESSIVE STRENGTH (kg/cm2)	581.40	573.24	550.80	550.80	581.40

TEST NO.	6	7	8	9	10
HAMMER READING	51	52	49	55	50
COMPRESSIVE STRENGTH (kg/cm2)	566.10	581.40	535.50	612.00	550.80

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	50	49.5	46	53	48
COMPRESSIVE STRENGTH (kg/cm2)	513.06	504.39	446.76	564.06	480.42

TEST NO.	6	7	8	9	10
HAMMER READING	48	46	46	46.5	50
COMPRESSIVE STRENGTH (kg/cm2)	480.42	446.76	446.76	455.43	513.06

1. TOP
   AVERAGE HAMMER READING : 51.25
   AVERAGE COMPRESSIVE STRENGTH : 568.344 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 48.3
   AVERAGE COMPRESSIVE STRENGTH : 485.112 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 12-WASH WATER RECOVERY BASIN DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER: WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	42	41	39	40	40
COMPRESSIVE STRENGTH (kg/cm2)	426.36	408.00	377.40	394.74	394.74

TEST NO.	6	7	8	9	10
HAMMER READING	40	41	38	39	43
COMPRESSIVE STRENGTH (kg/cm2)	394.74	408.00	365.16	377.40	440.64

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	38	39	39	39	40
COMPRESSIVE STRENGTH (kg/cm2)	320.28	336.6	336.6	336.6	350.88

TEST NO.	6	7	8	9	10
HAMMER READING	41	40	41	40	40
COMPRESSIVE STRENGTH (kg/cm2)	367.20	350.88	367.20	350.88	350.88

1. TOP
   AVERAGE HAMMER READING : 40.3
   AVERAGE COMPRESSIVE STRENGTH : 398.718 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 39.7
   AVERAGE COMPRESSIVE STRENGTH : 346.8 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 13-WASH WATER TANK NO. 2 DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	43	41	37	40	37
COMPRESSIVE STRENGTH (kg/cm2)	440.64	408.00	346.80	394.74	346.80

TEST NO.	6	7	8	9	10
HAMMER READING	38	41	40	40.5	41
COMPRESSIVE STRENGTH (kg/cm2)	365.16	408.00	394.74	397.80	408.00

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	39	39	41	40	42
COMPRESSIVE STRENGTH (kg/cm2)	336.6	336.6	367.2	350.88	383.52

TEST NO.	6	7	8	9	10
HAMMER READING	42	41	38	39	38
COMPRESSIVE STRENGTH (kg/cm2)	383.52	367.20	320.28	336.60	320.28

1. TOP
   AVERAGE HAMMER READING : 39.85
   AVERAGE COMPRESSIVE STRENGTH : 391.068 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 39.9
   AVERAGE COMPRESSIVE STRENGTH : 350.268 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 14-PUMPING STATION DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

TEST NO.	6	7	8	9	10
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	50	46	51	49	43
COMPRESSIVE STRENGTH (kg/cm2)	513.06	446.76	530.4	495.72	398.82

TEST NO.	6	7	8	9	10
HAMMER READING	44.5	43	43	46	49
COMPRESSIVE STRENGTH (kg/cm2)	423.30	398.82	398.82	446.76	495.72

1. TOP
   AVERAGE HAMMER READING :
   AVERAGE COMPRESSIVE STRENGTH : kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 46.25
   AVERAGE COMPRESSIVE STRENGTH : 449.718 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 15-PUMPING STATION   DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

TEST NO.	6	7	8	9	10
HAMMER READING					
COMPRESSIVE STRENGTH (kg/cm2)					

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	45	50	44	46	52
COMPRESSIVE STRENGTH (kg/cm2)	431.46	513.06	415.14	446.76	546.72

TEST NO.	6	7	8	9	10
HAMMER READING	51	51	51.5	52	50
COMPRESSIVE STRENGTH (kg/cm2)	530.40	530.40	538.56	546.72	513.06

1. TOP
   AVERAGE HAMMER READING :
   AVERAGE COMPRESSIVE STRENGTH :   kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 49.25
   AVERAGE COMPRESSIVE STRENGTH : 501.228 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 16-EXISTING 50 MG RESERVOIR DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	44	48	46	51	49
COMPRESSIVE STRENGTH (kg/cm2)	456.96	520.20	484.50	566.10	535.50

TEST NO.	6	7	8	9	10
HAMMER 0	49	45	51	43.5	46
COMPRESSIVE STRENGTH (kg/cm2)	535.50	469.20	566.10	448.80	484.50

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	47	48	47	50	46
COMPRESSIVE STRENGTH (kg/cm2)	464.1	480.42	464.1	513.06	446.76

TEST NO.	6	7	8	9	10
HAMMER READING	48	46	49	46	50
COMPRESSIVE STRENGTH (kg/cm2)	480.42	446.76	495.72	446.76	513.06

1. TOP

AVERAGE HAMMER READING 47.25
AVERAGE COMPRESSIVE STRENGTH 506.736 kg/cm2

2. SIDE

AVERAGE HAMMER READING 47.7
AVERAGE COMPRESSIVE STRENGTH 475.116 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 17-EXISTING 50 MG RESERVOIR DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER: WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	46	46	43	40	45.5
COMPRESSIVE STRENGTH (kg/cm2)	484.50	484.50	440.64	394.74	479.40

TEST NO.	6	7	8	9	10
HAMMER READING	45	44.5	45	43	40
COMPRESSIVE STRENGTH (kg/cm2)	469.20	459.00	469.20	440.64	394.74

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	48	46	43	48	43
COMPRESSIVE STRENGTH (kg/cm2)	480.42	446.76	398.82	480.42	398.82

TEST NO.	6	7	8	9	10
HAMMER READING	42	46	43	40	43
COMPRESSIVE STRENGTH (kg/cm2)	383.52	446.76	398.82	350.88	398.82

1. TOP
   - AVERAGE HAMMER READING : 43.8
   - AVERAGE COMPRESSIVE STRENGTH : 451.656 kg/cm2
2. SIDE
   - AVERAGE HAMMER READING : 44.2
   - AVERAGE COMPRESSIVE STRENGTH : 418.404 kg/cm2

*
REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 18-PARSHALL FLUME DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	39	43	45	37	39.5
COMPRESSIVE STRENGTH (kg/cm2)	377.40	440.64	469.20	346.80	385.56

TEST NO.	6	7	8	9	10
HAMMER READING	44	38	40.5	39	40
COMPRESSIVE STRENGTH (kg/cm2)	456.96	365.16	397.80	377.40	394.74

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	36.5	35.5	42	36.5	38
COMPRESSIVE STRENGTH (kg/cm2)	298.35	283.05	383.52	298.35	320.28

TEST NO.	6	7	8	9	10
HAMMER READING	39	43	42	40	38
COMPRESSIVE STRENGTH (kg/cm2)	336.6	398.82	383.52	350.88	320.28

1. TOP
   - AVERAGE HAMMER READING : 40.5
   - AVERAGE COMPRESSIVE STRENGTH: 401.166 kg/cm2
2. SIDE
   - AVERAGE HAMMER READING : 39.05
   - AVERAGE COMPRESSIVE STRENGTH: 337.365 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 19-SEDIMENTATION NO. 2 DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	38	43	40	39	44
COMPRESSIVE STRENGTH (kg/cm2)	365.16	440.64	394.74	377.40	456.96

TEST NO.	6	7	8	9	10
HAMMER READING	40	41	40	43	45
COMPRESSIVE STRENGTH (kg/cm2)	394.74	408.00	394.74	440.64	469.20

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	40.5	39	38	38	38
COMPRESSIVE STRENGTH (kg/cm2)	359.04	336.6	320.28	320.28	320.28

TEST NO.	6	7	8	9	10
HAMMER READING	40.5	40	40	40.5	42
COMPRESSIVE STRENGTH (kg/cm2)	359.04	350.88	350.88	359.04	383.52

1. TOP .
   AVERAGE HAMMER READING : 41.3
   AVERAGE COMPRESSIVE STRENGTH: 414.222 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 39.65
   AVERAGE COMPRESSIVE STRENGTH: 345.984 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 20-SEDIMENTATION NO. 2 DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	48	48	42	50	42
COMPRESSIVE *STRENGTH (kg/cm2)	520.20	520.20	426.36	550.80	426.36

TEST NO.	6	7	8	9	10
HAMMER READING	50	46	50	48	45
COMPRESSIVE STRENGTH (kg/cm2)	550.80	484.50	550.80	520.20	469.20

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	50	42.5	44	44	50
COMPRESSIVE STRENGTH (kg/cm2)	513.06	391.17	415.14	415.14	513.06

TEST NO.	6	7	8	9	10
HAMMER READING	46	48	50	50	42
COMPRESSIVE STRENGTH (kg/cm2)	446.76	480.42	513.06	513.06	383.52

1. TOP
   AVERAGE HAMMER READING : 46.9
   AVERAGE COMPRESSIVE STRENGTH: 501.942 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 46.65
   AVERAGE COMPRESSIVE STRENGTH: 458.439 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY :21-PARSHALL FLUME NO. 2 DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	40	40	33	35	42
COMPRESSIVE STRENGTH (kg/cm2)	394.74	394.74	290.70	318.24	426.36

TEST NO.	6	7	8	9	10
HAMMER READING	40	35	35	36	35.5
COMPRESSIVE STRENGTH (kg/cm2)	394.74	318.24	318.24	334.56	326.40

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	42.5	44	38	39	42
COMPRESSIVE STRENGTH (kg/cm2)	391.17	415.14	320.28	336.6	383.52

TEST NO.	6	7	8	9	10
HAMMER READING	44.5	44.5	42.5	45.5	40
COMPRESSIVE STRENGTH (kg/cm2)	423.3	423.3	391.17	439.11	350.88

1. TOP
   - AVERAGE HAMMER READING : 37.15
   - AVERAGE COMPRESSIVE STRENGTH: 351.696 kg/cm2
2. SIDE
   - AVERAGE HAMMER READING : 42.25
   - AVERAGE COMPRESSIVE STRENGTH: 387.447 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 22-SEDIMENTATION BASIN NO. 1 DATE OF TESTING: 9/11/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	43	46	41	40	46.5
COMPRESSIVE STRENGTH (kg/cm2)	440.64	484.50	408.00	394.74	494.70

TEST NO.	6	7	8	9	10
HAMMER READING	41	45	41	42	41
COMPRESSIVE STRENGTH (kg/cm2)	408.00	469.20	408.00	426.36	408.00

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	44.5	49	49	49	47
COMPRESSIVE STRENGTH (kg/cm2)	423.3	495.72	495.72	495.72	464.1

TEST NO.	6	7	8	9	10
HAMMER READING	45	51	48	44.5	49.5
COMPRESSIVE STRENGTH (kg/cm2)	431.46	530.4	480.42	423.3	504.39

1. TOP
   AVERAGE HAMMER READING : 42.65
   AVERAGE COMPRESSIVE STRENGTH: 434.214 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 47.65
   AVERAGE COMPRESSIVE STRENGTH: 474.453 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 23-SEDIMENTATION BASIN NO. 1 DATE OF TESTING: 9/12/91
STRUCTURAL MEMBER: WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	43	41.5	38.5	39.5	39.5
COMPRESSIVE STRENGTH (kg/cm2)	440.64	418.20	369.24	385.56	385.56

TEST NO.	6	7	8	9	10
HAMMER READING	40	43	40	45	43
COMPRESSIVE STRENGTH (kg/cm2)	394.74	440.64	394.74	469.20	440.64

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	46.5	46	44	43	43
COMPRESSIVE STRENGTH (kg/cm2)	455.43	446.76	415.14	398.82	398.82

TEST NO.	6	7	8	9	10
HAMMER READING	48.5	44.5	46.5	48.5	41
COMPRESSIVE STRENGTH (kg/cm2)	488.07	423.3	455.43	488.07	367.2

1. TOP
   AVERAGE HAMMER READING : 41.3
   AVERAGE COMPRESSIVE STRENGTH: 413.916 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 45.15
   AVERAGE COMPRESSIVE STRENGTH: 433.704 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 24-DISTRIBUTION CHANNEL (FP # 2) DATE OF TESTING: 9/12/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	38	38	41	40	38
COMPRESSIVE STRENGTH (kg/cm2)	365.16	365.16	408.00	394.74	365.16

TEST NO.	6	7	8	9	10
HAMMER READING	37	39	38	41	40
COMPRESSIVE STRENGTH (kg/cm2)	346.80	377.40	365.16	408.00	394.74

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	38	46	43	48	38
COMPRESSIVE STRENGTH (kg/cm2)	320.28	446.76	398.82	480.42	320.28

TEST NO.	6	7	8	9	10
HAMMER READING	41	43.5	47	41	46.5
COMPRESSIVE STRENGTH (kg/cm2)	367.2	406.98	464.1	367.2	455.43

1. TOP
   AVERAGE HAMMER READING : 39
   AVERAGE COMPRESSIVE STRENGTH: 379.032 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 43.2
   AVERAGE COMPRESSIVE STRENGTH: 402.747 kg/cm2

*
REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 25-DISTRIBUTION CHANNEL (FP # 2) DATE OF TESTING: 9/12/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	39	41	45	38.5	39
COMPRESSIVE STRENGTH (kg/cm2)	377.40	408.00	469.20	369.24	377.40

TEST NO.	6	7	8	9	10
HAMMER READING	40.5	41	38	41	40.5
COMPRESSIVE STRENGTH (kg/cm2)	397.80	408.00	365.16	408.00	397.80

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	48	40.5	44	44.5	46
COMPRESSIVE STRENGTH (kg/cm2)	480.42	359.04	415.14	423.3	446.76

TEST NO.	6	7	8	9	10
HAMMER READING	40	43.5	44	44.5	45
COMPRESSIVE STRENGTH (kg/cm2)	350.88	406.98	415.14	423.3	431.46

1. TOP
   AVERAGE HAMMER READING : 40.35
   AVERAGE COMPRESSIVE STRENGTH: 397.8 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 44
   AVERAGE COMPRESSIVE STRENGTH: 415.242 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 26-FILTRATION PLANT NO. 2   DATE OF TESTING: 9/12/91
STRUCTURAL MEMBER: WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	51.5	54	50	54	53
COMPRESSIVE STRENGTH (kg/cm2)	573.24	612.00	550.80	612.00	601.80

TEST NO.	6	7	8	9	10
HAMMER READING	53	50	50.5	50	53
COMPRESSIVE STRENGTH (kg/cm2)	601.80	550.80	558.96	550.80	601.80

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	50	52.5	55	51.5	55
COMPRESSIVE STRENGTH (kg/cm2)	513.06	555.39	597.72	538.56	597.72

TEST NO.	6	7	8	9	10
HAMMER READING	49	54	52.5	52	52.5
COMPRESSIVE STRENGTH (kg/cm2)	495.72	581.4	555.39	546.72	555.39

1. TOP
   - AVERAGE HAMMER READING : 52.05
   - AVERAGE COMPRESSIVE STRENGTH: 581.4 kg/cm2
2. SIDE
   - AVERAGE HAMMER READING : 52.4
   - AVERAGE COMPRESSIVE STRENGTH: 553.707 kg/cm2

REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 27-FILTRATION PLANT NO. 2 DATE OF TESTING: 9/12/91
STRUCTURAL MEMBER: WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	50	49	49	50	52
COMPRESSIVE STRENGTH (kg/cm2)	550.80	535.50	535.50	550.80	581.40

TEST NO.	6	7	8	9	10
HAMMER READING	48.5	49.5	51	46	48
COMPRESSIVE STRENGTH (kg/cm2)	530.40	540.60	566.10	484.50	520.20

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	50	54	52	53	51
COMPRESSIVE STRENGTH (kg/cm2)	513.06	581.4	546.72	564.06	530.4

TEST NO.	6	7	8	9	10
HAMMER READING	49	53	55	54	53
COMPRESSIVE STRENGTH (kg/cm2)	495.72	564.06	597.72	581.4	564.06

1. TOP
   AVERAGE HAMMER READING : 49.3
   AVERAGE COMPRESSIVE STRENGTH: 539.58 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 52.4
   AVERAGE COMPRESSIVE STRENGTH: 553.86 kg/cm2

*
REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

CONCRETE TEST HAMMER

NAME OF FACILITY: 28-WASHING WATER TANK DATE OF TESTING: 9/12/91
STRUCTURAL MEMBER:WALL

TEST RESULTS:

A. TOP

TEST NO.	1	2	3	4	5
HAMMER READING	46	39	39	40	38
COMPRESSIVE STRENGTH (kg/cm2)	484.50	377.40	377.40	394.74	365.16

TEST NO.	6	7	8	9	10
HAMMER READING	44	42	42	40	39.5
COMPRESSIVE STRENGTH (kg/cm2)	456.96	426.36	426.36	394.74	385.56

B. SIDE

TEST NO.	1	2	3	4	5
HAMMER READING	49	48	45	49	49
COMPRESSIVE STRENGTH (kg/cm2)	495.72	480.42	431.46	495.72	495.72

TEST NO.	6	7	8	9	10
HAMMER READING	42	42.5	46	45	50
COMPRESSIVE STRENGTH (kg/cm2)	383.52	391.17	446.76	431.46	513.06

1. TOP
   AVERAGE HAMMER READING : 40.95
   AVERAGE COMPRESSIVE STRENGTH: 408.918 kg/cm2
2. SIDE
   AVERAGE HAMMER READING : 46.55
   AVERAGE COMPRESSIVE STRENGTH: 456.501 kg/cm2

*
REMARKS:

TESTED BY:

ALFREDO V. FELIX JR.

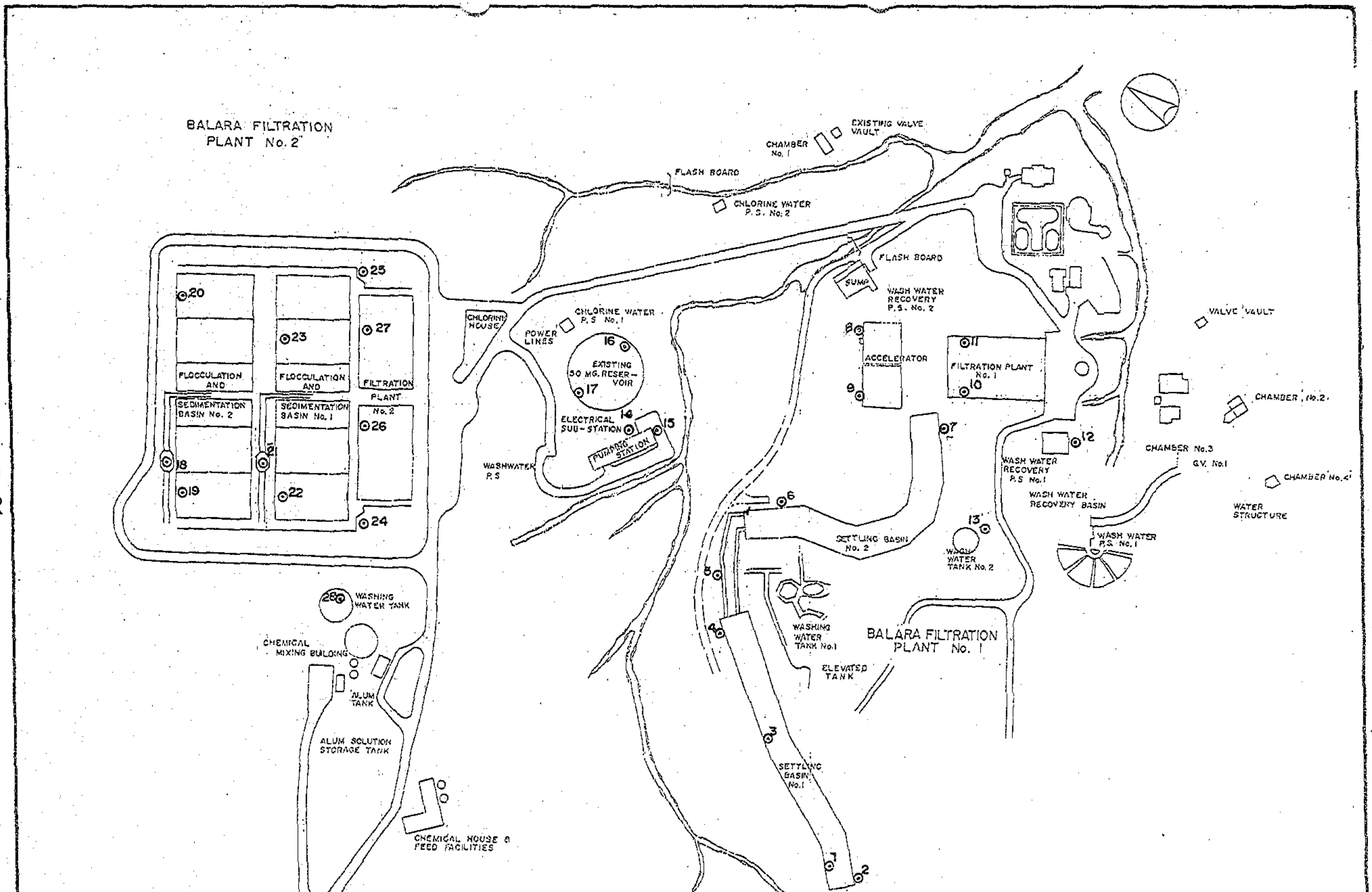

FIG. D.1
TESTING POINTS FOR COMPRESSIVE STRENGTH

APPENDIX E MECHANICAL EQUIPMENT LIST

The Study Team conducted an investigation of the mechanical equipment including quanty, specifications, and operating conditions.

Results of investigation are listed as follows:

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 1

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. RAPID MIXER for Sedimentation Basin No.1	1	VERTICAL TURBINE (LIGHTIN MIXERS) MOTOR - 7.5 kW (LINCOLN ELECT. CO.) REDUCTION SPEED = 1750/16.8 = 104 rpm IMPELLER SIZE: LENGTH - 2.350 m SHAFT DIAMETER - 65 mm IMPELLER DIAMETER- 450 mm SIZE OF BLADE - 175 mm x 220 mm NO. OF BLADE - 4	OPERATIONAL - NEEDS SHAFT ALIGNMENT ACTUAL OPERATING SPEED - 105 rpm YEAR INSTALLED - 1981
2. FLOCCULATOR for Sedimentation Basin No.1	12	VERTICAL TURBINE (LIGHTIN MIXERS) MOTOR - 1.5 kW (CHARLES & HUNTING) OUTPUT SPEED -13.7 to 34.2 rpm IMPELLER SIZE: LENGTH - 2.794 m SHAFT DIAMETER - 50.4 mm IMPELLER DIAMETER-838 mm SIZE OF BLADE -528 mm x 210 mm NO. OF BLADE - 4	ALL ARE OPERATIONAL EXCEPT UNIT NO. 12 WHICH HAS NO MOTOR ACTUAL OPERATING SPEED: UNIT NO. 1 - 17 rpm 2 - 15 rpm 3 - 23 rpm 4 - 12 rpm 5 - 15 rpm 6 - 21 rpm 7 - 20 rpm 8 - 20 rpm 9 - 22 rpm 10- 12 rpm 11- 12.5 rpm 12- - YEAR INSTALLED - 1981
3. RAPID MIXER for Sedimentation Basin No.2	1	VERTICAL TURBINE (LIGHTIN MIXERS) MOTOR - 7.5 kW (LINCOLN ELECT. CO.) REDUCTION SPEED = 1750/16.8 = 104 rpm IMPELLER SIZE: LENGTH - 2.350 m SHAFT DIAMETER - 65 mm IMPELLER DIAMETER- 450 mm SIZE OF BLADE - 175 mm x 220 mm NO. OF BLADE - 4	OPERATIONAL - NEEDS SHAFT ALIGNMENT ACTUAL OPERATING SPEED - 104 rpm YEAR INSTALLED - 1981
4. FLOCCULATOR for Sedimentation Basin No.2	12	VERTICAL TURBINE (LIGHTIN MIXERS) MOTOR - 1.5 kW (CHARLES & HUNTING) OUTPUT SPEED - 13.7 to 34.2 rpm IMPELLER SIZE: LENGTH - 2.794 m SHAFT DIAMETER -50.4 mm IMPELLER DIAMETER- 838 mm SIZE OF BLADE - 528 mm x 210 mm NO. OF BLADE - 4	ALL ARE OPERATIONAL EXCEPT UNIT NOS. 6, 8, AND 12 WHICH HAS NO MOTOR ACTUAL OPERATING SPEED: UNIT NO. 1 - 16 rpm 2 - 20 rpm 3 - 14 rpm 4 - 13 rpm 5 - 14 rpm 6 - - 7 - 15 rpm

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 1

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
			8 - - 9 - 14 rpm 10- 22 rpm 11- 20 rpm 12- - YEAR INSTALLED - 1981
5. SLUICE GATE for Sedimentation Basin No.1 & 2	7	MANUAL OPERATED WITH SLUICE GATE GUIDE SIZE - 2.0 m x 2.04 m	ALL ARE OPERATIONAL YEAR INSTALLED -1935
6. DRAIN VALVE for Sedimentation Basin No.1 & 2	6	MANUAL OPERATED WITH HANDWHEEL GATE VALVE SIZE - I.D. = 600 mm LENGTH = 330mm	ALL ARE OPERATIONAL BUT NOT SMOOTHLY. WATER LEAKS YEAR INSTALLED - 1935
7. DRAIN VALVE for channels at Sedimentation Basin No. 1 & 2	4	MANUAL OPERATED WITH HANDWHEEL GATE VALVE SIZE - I.D. = 250 mm LENGTH = 340 mm	ALL ARE OPERATIONAL BUT NOT SMOOTHLY. WATER LEAKS YEAR INSTALLED - 1935
8. ACCELATOR	2	VERTICAL TURBINE (FOOTE-BROS.) SLURRY CIRCULATION MOTOR - 18.6 kW (U.S. ELCT. MOTOR) SIZE - 29.0 m X 29.0 m REDUCTION SPEED: = 49.5/31.4 = 1.5 rpm	OPERATIONAL ACTUAL OPERATING SPEED UNIT NO. 1 - 1.18 rpm UNIT NO. 2 - 1.46 rpm YEAR INSTALLED -MOTOR AND VARIABLE SPEED GEAR-1981 -REDUCTION GEAR AND WORM GEAR-1958
9. AIR COMPRESSOR for the pneumatic control of sludge extraction valve at Accelator	1	RECIPROCATING (WORTHINGTON) MOTOR - 1.5 kW (BRITISH THOMPSON) AIR RECEIVER TANK CAPACITY = 227 l WORKING PRESSURE = 14 kg/cm 2	OPERATIONAL YEAR INSTALLED-1958
10.SLUDGE EXTRACTION VALVE of Accelator	4	PNEUMATIC DIAPHRAGM VALVE SIZE - O.D. = 180 mm LENGTH = 180 mm	OPERATIONAL FOR ACCELATOR BASIN NO. 1, NOT OPERATIONAL FOR ACCELATOR BASIN NO. 2 YEAR INSTALLED-1958
11.MANUAL SLUDGE EXTRACTION VALVE of accelator			
a. MAIN GATE VALVE	2	MANUAL OPERATED WITH SLUICE GATE GUIDE SIZE - O.D. = 500 mm LENGTH = 400 mm	OPERATIONAL YEAR INSTALLED-1958
b. QUICK OPEN VALVE	2	MANUAL OPERATED SIZE - O.D. = 260 mm LENGTH = 240 mm	OPERATIONAL YEAR INSTALLED-1958
12.INFLOW GATE VALVE for accelator basin	2	MANUAL OPERATED WITH HANDWHEEL SIZE - I.D. = 1.07 m	OPERATIONAL YEAR INSTALLED-1958

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 1

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
13.SLUICE GATE between Sedimentation Basins, Accelator & Filter	2	MANUAL OPERATED WITH SLUICE GATE GUIDE SIZE = 2.0 m x 2.08 m	OPERATIONAL YEAR INSTALLED-1935
14.HYDRAULIC CONTROL			
a. PUMP	2	CENTRIFUGAL - TURBINE TYPE (COKER) MOTOR - 5.5 kW (LINCOLN) CAPACITY - HEAD -	OPERATIONAL UNIT NO. 1 SERVES AS STAND-BY UNIT YEAR INSTALLED-1981
b. AIR COMPRESSOR	2	RECIPROCATING (INGERSOLL-RAND) MOTOR - 0.37 kW (LESSON) CAPACITY - WORKING PRESSURE -	OPERATIONAL UNIT NO. 1 SERVES AS STAND-BY UNIT YEAR INSTALLED-1981
c. PRESSURED WATER TANK	1	SIZE - LENGTH - 2.55 m DIAMETER - 1.10 m CAPACITY - 2.42 m 3	OPERATIONAL YEAR INSTALLED-1958
15.PNEUMATIC CONTROL			
a. AIR COMPRESSOR	2	RECIPROCATING (INGERSOLL-RAND) MOTOR - 3.7 kW (BALDOR) AIR RECEIVER TANK CAPACITY = 303 l WORKING PRESSURE=14 kg/cm 2	UNIT NO. 2 IS OPERATIONAL UNIT NO. 1 WHICH SERVES AS STAND BY UNIT IS NOT OPERATIONAL, AIR DRYER IS MISSING. YEAR INSTALLED-1981
b. AIR DRYER	1	THERMAL MASS (INGERSOLL RAND) DRYER - 0.2 kW	OPERATIONAL YEAR INSTALLED-1981
16.INFLUENT SLUICE GATE for filter	10	HYDRAULIC OPERATED SIZE - 600mm DIA.	OPERATIONAL - WATER LEAKS YEAR INSTALLED-1935
17.WASH DRAIN SLUICE GATE for filter	10	HYDRAULIC OPERATED SIZE - 1.200mm W X 600mmH	OPERATIONAL - WATER LEAKS YEAR INSTALLED-1935
18.FILTER DRAIN VALVE	16	MANUAL OPERATED GATE VALVE SIZE - O.D. = 180 mm LENGTH = 270 mm	OPERATIONAL YEAR INSTALLED-1935
	4	HYDRAULIC OPERATED GATE VALVE SIZE - O.D. = 305 mm LENGTH = 280 mm	OPERATIONAL - TWO FILTER DRAIN VALVES SERVES FOR THE SWIMMING POOL YEAR INSTALLED-1935
19.WASHWATER VALVE for filter	10	HYDRAULIC OPERATED (DE ZURIK) BUTTERFLY VALVE SIZE - O.D. = 800 mm LENGTH = 195 mm	OPERATIONAL YEAR INSTALLED-1981

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 1

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
20.EFFLUENT VALVE from filter	10	HYDRAULIC OPERATED BUTTERFLY VALVE (BIF) SIZE - O.D. = 450 mm LENGTH = 200 mm	OPERATIONAL YEAR INSTALLED-1981
21.SURFACE WASH VALVE for filter	10	HYDRAULIC OPERATED BUTTERFLY VALVE (BIF) SIZE - O.D. = 457mm LENGTH = 220MM	OPERATIONAL YEAR INSTALLED-1981
22.EFFLUENT MAIN GATE VALVE	1	MANUAL OPERATED (MICHIGAN & F. CO.) SIZE - I.D. = 1.220 m LENGTH = 750 mm	OPERATIONAL YEAR INSTALLED-1935
23.MAIN BACKWASH VALVE	1	HYDRAULIC OPERATED BUTTERFLY VALVE (BIF) SIZE - O.D. = 800 mm LENGTH = 300 mm	OPERATIONAL YEAR INSTALLED-1981
24.MAIN SURFACE WASH VALVE	1	HYDRAULIC OPERATED BUTTERFLY VALVE (BIF) SIZE - O.D. = 457 mm LENGTH = 250 mm	OPERATIONAL YEAR INSTALLED-1981
25.RECOVERY PUMP	2	CENTRIFUGAL-VOLUTE TYPE Pump No. 1 MOTOR-45 kW (U.S. ELECT. MOTOR) CAPACITY- HEAD-	OPERATIONAL WATER LEAKS AT THE BEARING SIDE OF THE PUMP YEAR INSTALLED-1981 (SECOND HAND)
		Pump No. 2 (FEATI) MOTOR-37.3 kW (BROWN BOVERI) CAPACITY- HEAD-	OPERATIONAL WATER LEAKS AT THE BEARING SIDE OF THE PUMP YEAR INSTALLED-1981 (SECOND HAND)
26.WASHWATER PUMP	3	CENTRIFUGAL-VOLUTE TYPE Pump No. 1 MOTOR-45 kW (G.E.) CAPACITY-110 l/sec. HEAD-33.5 m	OPERATIONAL WATER LEAKS AT THE BEARING SIDE OF THE PUMP YEAR INSTALLED-1949
		Pump No. 2 (KUBOTA) MOTOR-49 kW (MEIDENSHA) CAPACITY-177 l/sec HEAD-21 m	OPERATIONAL YEAR INSTALLED-1981 (SECOND HAND)
		Pump No.3 MOTOR-45 kW (G.E.) CAPACITY-110 l/sec HEAD-33.5 m	OPERATIONAL SERVES AS THE STAND-BY UNIT. WATER LEAKS AT THE BEARING SIDE OF THE PUMP. YEAR INSTALLED-1949

FN:EQUIPLIST.WK1

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 2

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. FLOCULLATOR for flocculation basin no. 1 (SOUTH)	6	CROSS-FLOW (MITSUBISHI KAKOKI KAISH LTD.) MOTOR-3.7 kW (MITSUBISHI ELECT.) REDUCTION SPEED 900/128.6=7 rpm PADDLE SIZE: - PADDLE NO. 1 - 4 PADDLES DIAMETER OF PADDLE-2.72 m WOODEN PADDLE-60 X 90 X 3010 mm NO. OF PADDLE-3 PCS/ ARM X 4 ARMS - PADDLE NO. 2 - 4 PADDLES DIAMETER OF PADDLE-3.54 m WOODEN PADDLE-60 X 100 X 3070 mm NO. OF PADDLE-2 PCS/ ARM X 4 ARMS - PADDLE NO. 3 - 4 PADDLES DIAMETER OF PADDLE-3.6 m WOODEN PADDLE-45 X 150 X 3150 mm NO. OF PADDLE-1 PC/ ARM X 4 ARMS	FLOCCULATOR· NO. 1-NOT OPERATIONAL DUE TO PADDLE REPAIR NO. 2-NOT OPERATIONAL DUE TO SEVERE WATER LEAKAGE (FLOODED) AT THE GEAR DRIVE CHANNEL. NO. 3-OPERATIONAL NO. 4-NOT OPERATIONAL DUE TO SEVERE WATER LEAKAGE (FLOODED) AT THE GEAR DRIVE CHANNEL. NO. 5-OPERATIONAL NO. 6-OPERATIONAL ALL GEAR DRIVE CHANNEL ARE LEAKING AT THE GEAR SHAFT SECTION. ACTUAL OPERATING SPEED. UNIT NO. 3,5 & 6 = 7 rpm YEAR INSTALLED-1965
2. FLOCCULATOR for flocculator basin no. 2 (NORTH)	6	CROSS-FLOW MOTOR-3.7 kW (FUJI ELECT. CO.) REDUCTION SPEED - PADDLE SIZE:	NO. 7-NOT OPERATIONAL DUE TO A DEFECTIVE (BROKEN) DRIVING GEARS NO. 8-NOT OPERATIONAL DUE TO A DEFECTIVE DRIVING CHAIN NO. 9-OPERATIONAL NO. 10-OPERATIONAL NO. 11-OPERATIONAL NO. 12-OPERATIONAL ALL GEAR DRIVE CHANNEL ARE LEAKING AT THE GEAR SHAFT SECTION. ACTUAL OPERATING SPEED UNIT NO. 9, 10 & 11 -6.5 rpm NO. 12 - 11 rpm YEAR INSTALLED - 1968
3. FLOCCULATION & SEDIMENTATION BASINS NO. 1 &2 VALVES			
a. MAIN INFLUENT SLUICE GATE	2	MANUALLY OPERATED SIZE -1.93 X 1.93 m	OPERATIONAL YEAR INSTALLED-1965
b. INFLUENT SLUICE GATE	24	MANUALLY OPERATED SIZE -1.35 X 1.35 m	OPERATIONAL BUT SOME CRACKS ON FOUNDATION YEAR INSTALLED-1965/1968
c. EFFLUENT SLUICE GATE	36	MANUALLY OPERATED SIZE -1.35 X 1.35 m	OPERATIONAL YEAR INSTALLED-1965/1968

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 2

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
d. DRAIN SLUICE GATE	12	MANUALLY OPERATED SIZE -1.10 X 1.10 m	OPERATIONAL SPINDLE SUPPORT ARE CORRODED YEAR INSTALLED-1965/1968
4. FLUSHING PUMP for North & South basin	2	CENTRIFUGAL-VOLUTE TYPE MOTOR-18.7 kW (G.E.) CAPACITY- HEAD-	OPERATIONAL YEAR INSTALLED-1965/1968
5. INFLUENT SLUICE GATE for Filter	20	HYDRAULIC OPERATED (MAEZAWA KURIMOTO) SIZE - WIDTH - 920 mm (36 in.) HEIGHT - 760 mm (30 in.)	OPERATIONAL - WATER LEAKS YEAR INSTALLED-1958/1970
6. WASH DRAIN SLUICE GATE for filter	20	HYDRAULIC OPERATED (KURIMOTO) SIZE - WIDTH - 1220mm (48 in.) HEIGHT - 610 mm (24 in.)	OPERATIONAL - WATER LEAKS YEAR INSTALLED-1958/1970
7. FILTER DRAIN VALVE for Filter	20	HYDRAULIC OPERATED GATE VALVE SIZE -O.D.=300 mm LENGTH=350 mm	OPERATIONAL YEAR INSTALLED-1958/1970
8. EFFLUENT VALVE for filter	20	HYDRAULIC OPERATED (BIF) BUTTERFLY VALVE SIZE: O.D.-570mm LENGTH-200 mm	OPERATIONAL YEAR INSTALLED-1980
9. EFFLUENT CONTROL VALVE from filter	20	HYDRAULIC OPERATED BUTTERFLY VALVE SIZE: O.D.-570 mm	OPERATIONAL YEAR INSTALLED-1958/1970
10.WASHWATER VALVE for filter	20	BUTTERFLY VALVE SIZE: O.D.-1.00 mm LENGTH-300 mm	OPERATIONAL YEAR INSTALLED-1981
11.SURFACE WASH VALVE for filter	20	HYDRAULIC OPERATED (BIF) BUTTERFLY VALVE SIZE: O.D.-457 mm LENGTH-220 mm	OPERATIONAL YEAR INSTALLED-1981
12.HYDRAULIC CONTROL			
a) pump	2	CENTRIFUGAL-TURBINE TYPE (COKER) MOTOR-5.5 kW (LINCOLN) CAPACITY- HEAD-	2-OPERATIONAL 1-STAND-BY YEAR INSTALLED-1981
b) Air compressor	2	RECIPROCATING (INGERSOLL-RAND) MOTOR-0.37 kW (LINCOLN) CAPACITY-	2-OPERATIONAL 1-STAND-BY YEAR INSTALLED-1981

NAME OF PLANT: PLANT NO. 2

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
c) pressured water tank	2	SIZE: LENGTH=3.48 m DIAMETER=1.40 m CAPACITY-5.4 m3 (APPROX)	2-OPERATIONAL 1-STAND-BY YEAR INSTALLED-1981
13.PNEUMATIC CONTROL a) Air compressor	2	RECIPROCATING (DANCOMAIR) MOTOR- kW AIR RECEIVER TANK CAPACITY = 1.048 m3/min WORKING PRESSURE=10 kg/cm2	2-OPERATIONAL 1-STAND-BY YEAR INSTALLED-1989
b) air dryer	2	THERMAL MASS (INGERSOLLRAND) DRYER-0.2 kW	2-OPERATIONAL 1-STAND-BY YEAR INSTALLED-1981
14.MAIN BACKWASH VALVE	1	HYDRAULIC OPERATED BUTTERFLY VALVE (BIF) SIZE: O.D.-1.00 m LENGTH-390 mm	OPERATIONAL YEAR INSTALLED-1967
15.MAIN SURFACE WASH VALVE	1	HYDRAULIC OPERATED BUTTERFLY VALVE (BIF) SIZE: O.D.-457 mm LENGTH-200 mm	OPERATIONAL YEAR INSTALLED-1981
16.WASHWATER PUMP	3	CENTRIFUGAL-VOLUTE TYPE UNIT NO. 1 (AURORA) MOTOR-94 kW (LINCOLN) CAPACITY- HEAD- UNIT NO. 2 MOTOR-45 kW (US ELECT.) CAPACITY- HEAD- UNIT NO. 3 MOTOR-49 kW (MEIDENSHA) CAPACITY- HEAD-	OPERATIONAL YEAR INSTALLED-1958 OPERATIONAL WATER LEAKS AT THE BEARING SIDE OF THE PUMP YEAR INSTALLED-1958 NOT OPERATIONAL MOTOR WAS REMOVED YEAR INSTALLED-1958
17.RECOVERY PUMP	3	CENTRIFUGAL-VOLUTE TYPE UNIT NO. 1 (AURORA) MOTOR-45 kW (LINCOLN) CAPACITY- HEAD- UNIT NO. 2 (AURORA) MOTOR-45 kW (LINCOLN) CAPACITY- HEAD- UNIT NO. 3 (AURORA) MOTOR-45 kW (LINCOLN) CAPACITY- HEAD-	OPERATIONAL YEAR INSTALLED-1981 OPERATIONAL YEAR INSTALLED-1981 OPERATIONAL YEAR INSTALLED-1981

FN:LIST2.WK1

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: CHEMICAL AND CHLORINATION HOUSE

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
I. CHEMICAL HOUSE			
1. ALUM			
a. ROTODIP	6	VARIABLE SPEED TRANSMISSION (BIF) MOTOR-0.25 kW (G.E.) SPEED-1725 rpm TANK SIZE: 650 mm-LENGTH 560 mm-WIDTH 600 mm-HEIGHT NO. OF SCOOP WHEEL - 8 DIAMETER OF SCOOP WHEEL-600 mm KNOB SETTING (DURANT-DIGITAL INSTRUMENT) RATIO-10:1	5-OPERATIONAL, BUT NOT SMOOTH & ACCURATE 1-NOT OPERATIONAL YEAR INSTALLED-1981
2. POLYMER			
a. PUMP	5	PLUNGER TYPE (WALLACE AND TIERNAN - PENNWALT) MOTOR-0.37 kW (DOERR) CAPACITY- HEAD-	4-OPERATIONAL BUT NOT ACCURATE 1-NOT OPERATIONAL - NO MOTOR PUMP STROKE SETTING: PUMP NO. 1 - 50% NO. 2 - STAND-BY UNIT NO. 3 - 40% NO. 4 - 40% YEAR INSTALLED-1981
b. MIXER	4	VERTICAL TYPE (CLEVELAND) SIZE - MOTOR - 1.12 kW (BALDOR)	OPERATIONAL YEAR INSTALLED-1981
c. MIXING TANK	4	VERTICAL TANK SIZE-1.70 X 2.00 m CAPACITY-4.5 m3	OPERATIONAL YEAR INSTALLED-1981
3. FLOURIDATION			
a. GRAVIMETRIC FEEDER	3	VERTICAL-COMPACT TYPE (WALLACE-THERMAN-PENNWALT) MOTOR-0.20 kW (BALDOR) CAPACITY-	NOT OPERATIONAL DUE TO SOME MANAGEMENT PROBLEM FOR THE OPERATION OF THE SYSTEM. YEAR INSTALLED-1981
b. MIXER	6	MOTOR-0.20 kW (GOULD) 2-MIXER FOR EVERY ONE UNIT NO. OF BLADES PER UNIT=3 BLADES SIZE=100 mm, DIAMETER SHAFT SIZE=800 mm, LENGTH =20 mm, DIAMETER	
c. DUST COLLECTOR BLOWER	3	VANE AXIAL TYPE (TORIT) MOTOR-0.37 kW (LESSON) CAPACITY-	

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: CHEMICAL AND CHLORINATION HOUSE

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
d. EXHAUST FAN	3	PROPELLER TYPE-WITH GRAVITY TYPE SHUTTER MOTOR-0.25 kW (G.E.) rpm-825 FAN DIAMETER-600 mm NO. OF BLADES-4 CAPACITY-	3-UNITS WERE INSTALLED 1- UNIT IS MISSING YEAR INSTALLED-1981
II.CHLORINE HOUSE			
1. BOOSTER PUMP	3	CENTRIFUGAL-TURBINE TYPE (INDENG) MOTOR-15 kW (WEG.) CAPACITY- HEAD-	2-OPERATIONAL 1-STAND-BY STAND-BY UNIT HAS NO MOTOR YEAR INSTALLED-1981
2. CHLORINATOR	4	MANUAL TYPE GAS DISPENSER VACUUM REGULATION-INTERNAL (FISCHER AND PORTER) EJECTOR SIZE-76.2 mm CAPACITY-160 kg/h	ALL ARE OPERATIONAL BUT NO ACCURATE 2-OPERATIONAL 2-STAND-BY VACUUM AND GAS PRESSURE GAUGE FOR UNIT NOS. 2,3 & 4 ARE NOT WORKING YEAR INSTALLED-1981
3. EVAPORATOR	2	VERTICAL TYPE (FISCHER & PORTER) ELECTRIC IMMERSION HEATER-15 kW (WATLOW) CHAMBER SIZE: DIAMETER-571.5 mm LENGTH - 1.213 m CAPACITY-160 kg/h	2-OPERATIONAL BUT REDUCED CAPACITY 1-STAND-BY YEAR INSTALLED-1981
4. EXPANSION TANK	2	CIRCULAR TANK SIZE: O.D.-200 mm LENGTH-1.050 M CAPACITY-330 l	OPERATIONAL YEAR INSTALLED-1981
5. CHLORINE LEAK DETECTOR	2	WALL MOUNTED TYPE-CHLORALERT (FISCHER & PORTER)	2-OPERATIONAL YEAR INSTALLED-1981
6. LIQUID CHLORINE TANK	2	CIRCULAR STEEL TANK-REFILLABLE SIZE: DIAMETER-750 mm LENGTH - 1.70 m CAPACITY-750 l APROXIMATE GROSS TANK WEIGHT WITH FILL - 1600 kg	1-OPERATIONAL 1-STAND-BY (FILLED)
7. CHAIN HOIST	1	ELECTRIC OPERATED (KITO) W/ LIFTING CHAIN & GEAR TROLLEY MOTOR- kW CAPACITY-3 TON LIFTING SPEED-4.8 m/min.	OPERATIONAL YEAR INSTALLED-1981
8. EXHAUST FAN	1	PROPELLER TYPE-WITH GRAVITY TYPE SHUTTER MOTOR-0.25 kW (G.E.) rpm-825 FAN DIAMETER-600 mm NO. OF BLADES-4 CAPACITY-	OPERATIONAL YEAR INSTALLED-1981

FN:CHEMLIST.WK1

APPENDIX E MECHANICAL EQUIPMENT LIST

NAME OF PLANT: AQUEDUCT NO. 2 OPEN-CHANNEL

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. SLUICE GATE	5	MANUALLY OPERATED WITH STEEL PEDESTAL, SPINDLE AND HANDWHEEL SIZES: 4 - UNITS WIDTH-1.80 m HEIGHT- m 1 - UNIT WIDTH-1.65 m HEIGHT- m	ALL ARE PARTIALLY OPEN 1-UNIT HAS COMPLETE ACCESSORIES FO MANUAL OPERATION 4-UNITS HAS NO COMPLETE ACCESSORIE FOR MANUAL OPERATION. WITH TEMPO-RARY SUPPORTS FOR AN OPENING. YEAR INSTALLED-1958

FN:AQUELIST.WK1

APPENDIX F ELECTRICAL EQUIPMENT LIST

The Study Team conducted an investigation of the electrical equipment including quantity, specifications, and operating conditions.

Results of investigation are listed as follows:

APPENDIX F ELECTRICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 1

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. MCC FOR SETTLING BASIN NO. 1 EQUIPMENT	1	ONE SURFACE TYPE FOR INDOOR USE. RATING 480V, 600A, 3PH-4W SIZE 1525W X 2300H X 500 D APPROX.	WORKING BUT DEFORMED, CORRODED
2. LIGHTING PANEL FOR SETTLING BASIN NO. 1 (NSB-1)	1	WALL MOUNTED TYPE FOR INDOOR USE. RATING 240/120V, 100A, 3PH-4W 8 BRANCH CIRCUITS SIZE 450W X 600H X 170D APPROX.	WORKING BUT DISCOLORED
3. TRANSFOMER FOR LIGHTING	1	DRY TYPE FOR INDOOR USE 3PH, 6KVA, 480/240-120V	WORKING IN GOOD CONDITION
4. MCC FOR SETTLING BASIN NO. 2 EQUIPMENT	1	ONE SURFACE TYPE FOR INDOOR USE. RATING 480V, 600A, 3PH-4W SIZE 1525W X 2300H X 500 D APPROX.	WORKING BUT DEFORMED, CORRODED
5. LIGHTING PANEL FOR SETTLING BASIN NO. 2	1	WALL MOUNTED TYPE FOR INDOOR USE. RATING 240/120V, 100A, 3PH-4W 8 BRANCH CIRCUITS SIZE 450W X 600H X 170D APPROX.	WORKING BUT DISCOLORED
6. TRANSFORMER FOR LIGHTING	1	DRY TYPE FOR INDOOR USE. 3 HP, 6KVA, 480/240-120V	WORKING IN GOOD CONDITION
7. MCC FOR ACCELATOR	1	OPEN TYPE, SELF-STANDING RATING 480V, 100A, 3PH-3W SIZE 1200W X 2300H APPROX.	WORKING BUT MALFUNCTION AND OLD TYPE
8. DISTRIBUTION PANEL FOR FILTER BLDG. (NF-1)	1	WALL MOUNTED TYPE FOR INDOOR USE. RATING 480V, 225A, 3PH-4WH-4W SIZE 600W X 1050H X 210D APPROX.	WORKING SLIGHT CORROSION ON THE SURFACE
9. LIGTHING PANEL FOR FILTER BLDG. (NF-1)	1	WALL MOUNTED TYPE FOR INDOOR USE. RATING 240/120V, 100A, 3PH-4W 15 BRANCH CIRCUITS SIZE 470W X 750H X 170D APPROX.	WORKING BUT CORRODED AND DISCOLORED
10. TRANSFORMER FOR LIGHTING	1	DRY TYPE FOR INDOOR USE. 3 HP, 15KVA, 480/240-120V 3 HP, 15KVA, 480/240-120V	WORKING GOOD CONDITION
11. MCC FOR WASHWATER PUMP NO. 1 (MMW-1)	1	ONE SURFACE TYPE FOR INDOOR USE. RATING 480V, 600A, 3PH-4W SIZE 2540W X 2300H X 510D APPROX.	WORKING DAMAGED EMERGENCY CIRCUIT AND MALFUNCTIONING
12. MCC FOR UP BOOSTER PUMPS (MMW-2)	1	ONE SURFACE TYPE FOR INDOOR USE. RATING 480V, 600A, 3PH-4W SIZE 2400W X 2300H X 600D APPROX.	WORKING IN GOOD CONDITION
13. DISTRIBUTION PANEL (DP-1)	1	WALL MOUNTED TYPE FOR INDOOR USE. RATING 240/120V, 100A, 3PH-4W 14 BRANCH CIRCUITS	WORKING FRONT DOOR COVER IS MISSING AND NOT SAFE.

APPENDIX F ELECTRICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 1

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
14. CONVERT SWITCH BOX FOR GENERATOR	1	WALL MOUNTED TYPE FOR INDOOR USE. RATING 600V, 600A, DTKS SIZE 1000W X 1500H, 300D APPROX.	GOOD CONDITION WORK DURING EMERGENCY.
15. DIESEL GENERATOR	1	500 KW AIR-COOLING TYPE 480V	DITTO
16. MCC FOR WASHWATER RECOVERY PUMP NO. 1 (MWR-1)	1	ONE SURFACE TYPE FOR INDOOR USE. RATING 480V, 600A, 3PH-4W SIZE 1520W X 2300H X 510D APPROX.	WORKING BUT REAR DOOR AND MAIN BREAKER ARE MISSING, REDUCED VOLTAGE STARTER.
17. LIGHTING PANEL FOR REC. PUMP HSE. NO. 1 (NPWR-1)	1	WALL MOUNTED TYPE FOR INDOOR USE. RATING 240/120V, 100A, 3PH-4W SIZE 420W X 550H X 170D APPROX.	WORKING BUT DISCOLORED, DAMAGED DOOR LOCK
18. TRANSFORMER FOR LIGHTING	1	DRY TYPE FOR INDOOR USE 3PH 6KVA, 480/240-120V	WORKING GOOD CONDITION

APPENDIX F ELECTRICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 2

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. MCC FOR FLOCCULATORS & FLUSHING PUMPS (MCC-BF)	1	ONE SURFACE TYPE FOR INDOOR USE RATING 480V, 600A, 3PH-4W SIZE 2500W X 2300H X 500D APPROX.	WORKING, BUT DISCOLORED AND DEFORMED CONTROL SCHEME FOR FLOCCULATOR MALFUNCTION.
2. DISTRIBUTION PANEL (DP-3) FOR LTG. & CONTROL PNL SOURCE	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 480V, 225A, 3PH-3W SIZE 620W X 1050H X 210D	WORKING, BUT AGED AND CORRODED
3. MAIN SWITCH BOX	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 3P, 400A, F300A KS SIZE 550W X 1100H X 250 D	WORKING SLIGHT CORROSION
4. LIGHTING PANEL (NF-3) FOR FILTER BLDG.	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 240/120V, 100A, 3PH-4W 12 BRANCH CIRCUITS SIZE 470W X 710 H X 170D	WORKING, BUT AGED AND CORRODED
5. LIGHTING PANEL (NF-4) FOR FILTER BLDG.	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 240/120V, 100A, 3PH-4W 12 BRANCH CIRCUITS SIZE 470W X 710 H X 170D	DITTO
6. TRANSFORMER FOR LTG. PNL (NF-3)	1	DRY TYPE FOR INDOOR USE 3PH 15KVA 480/240-120V	WORKING GOOD CONDITION
7. TRANSFORMER FOR LTG. PNL (NF-4)	1	DRY TYPE FOR INDOOR USE 3PH 15KVA 480/240-120V	DITTO
8. MCC FOR WASHWATER PUMPS NO. 2		CONSISTS OF PANELS BELOW	
8-1 INCOMING PANEL	1	ENCLOSED TYPE SIZE 880W X 2300H X 610D APPROX.	WORKING BUT AGED VARIATION
8-2 UNIT NO. 1 PANEL	1	ENCLOSED TYPE REDUCED VOLTAGE STARTER FOR 45 KW SIZE 880W X 2300H X 610D APPROX.	DITTO
8-3 UNIT NO. 2 PANEL	1	-DITTO-	DITTO
8-4 UNIT NO. 3 PANEL	1	-DITTO-	DAMAGED, TO BE ABANDONED
8-5 UNIT NO. 3 PANEL	1	ENCLOSED TYPE REDUCED VOLTAGE STARTER FOR 45 KW SIZE 880W X 2300H X 610D APPROX.	WORKING
9. LIGHTING PANEL (NPW-2) FOR W.W. PUMP HOUSE NO. 2	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 240V, 100A, 1PH-2W 8 BRANCH CIRCUITS SIZE 470W X 620H X 170D APPROX.	WORKING GOOD CONDITION
10. MCC FOR WASHWATER RECOVERY	1	ONE SURFACE TYPE FOR INDOOR USE	WORKING, BUT

APPENDIX F ELECTRICAL EQUIPMENT LIST

NAME OF PLANT: PLANT NO. 2

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
PUMP NO. 2 (NMWR-2)		RATING 480V, 600A, 3PH-4W SIZE 1525W X 2300H X 510D APPROX.	MAIN BREAKER IS MISSING, DEFORMED
11.TRANSFORMER FOR LTG. PNL (NPWR-2)	1	DRY TYPE 3PH 9KVA 480/240-120V	WORKING GOOD CONDITION
12.LIGHTING PANEL (NPWR-2)	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 240/120V, 100A, 3PH-3W 8 BRANCH CIRCUITS	WORKING GOOD CONDITION
13.MCC FOR POLYELECTROLYTE MIXER	1	ONE SURFACE TYPE FOR INDOOR USE RATING 480V, 600A, 3PH-3W SIZE 1100W X 2300H X 510D APPROX.	WORKING GOOD CONDITION
14.TRANSFORMER FOR LTG. PNL (NCHP-1)	1	DRY TYPE 3PH 5KVA 480/240-120V	WORKING GOOD CONDITION
15.LIGHTING PANEL (NCHP-1) FOR POLYELECTROLYTE PUMPS & LTG.	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 240/120V, 100A, 3PH-4W SIZE 470W X 870H X 170D APPROX.	WORKING, BUT CONTROL SCHEME FOR POLYELECTROLYTE PUMPS NEED TO BE MODIFIED
16.LIGHTING PANEL (NCHP-2) FOR ROTO DIP FEEDERS & LTG.	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 240/120V, 100A, 3PH-4W 20 BRANCH CIRCUITS SIZE 470W X 870H X 170D APPROX.	WORKING, BUT CONTROL SCHEME FOR ROTODIP FEEDER NEED TO BE MODIFIED
17.DISTRIBUTION PANEL (DP-4) FOR CHLORINE EQUIPMENT	1	WALL MOUNTED TYPE FOR INDOOR USE RATING 240V, 225A, 3PH-3W SIZE 800W X 1400H X 220D APPROX.	WORKING GOOD CONDITION
18.STARTER FOR BOOSTER PUMP NO. 1	1	WALL MOUNTED TYPE FOR INDOOR USE SIZE 310W X 760H X260D APPROX.	NOT WORKING, DAMAGED
19.STARTER FOR BOOSTER PUMP NO. 2	1	-DITTO-	AGED AND CORRODED
20.STARTER FOR BOOSTER PUMP NO. 3	1	-DITTO-	DITTO

FN:ELECTLIST.WK1

APPENDIX F ELECTRICAL EQUIPMENT LIST

NAME OF PLANT: SUBSTATION

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. INCOMING 34.5 kV O/H DISTRIBUTION LINE	1	(1) 3 PH 3 WIRE SYSTEM (2) WOODEN POLE 24 PCS (3) LINE DISTANCE 1200 m APPROX.	AGED AND DETERIORATING
2. NO. 1 SUBSTATION	1	(1) FUSE DISCONNECT SWITCH 3 SETS (2) LIGHTNING ARRESTER 3 SETS (3) TRANSFORMER 1 SET OIL IMMERSED TYPE 3 PH, 3750/4687 kVA, 60Hz 34.4 kV/2.4 kV (4) TRANSFORMER 3 SETS OIL IMMERSED TYPE 1 PH, 167 kVA 60 Hz 2.4 kV/480v (5) METALCLAD SWITCHGEAR 2 SETS (6) CAPACITORS 3 PH, 480V, 20kVAR 4 SETS (7) LOW VOLTAGE DISTRIBUTION PANEL 4 SETS (8) STRUCTURE 1 LOT (9) FENCE 1 LOT	WORKING W/OUT ANY TROUBLE
3. NO. 2 SUBSTATION	1	(1) FUSE DISCONNECT SWITCH 3 SETS (2) LIGHTNING ARRESTER 3 SETS (3) TRANSFORMER 3 SETS OIL IMMERSED TYPE 1 PH, 100kVA, 60Hz 20 kV/480-240V (4) FENCE 1 LOT	WORKING W/OUT ANY TROUBLE
4. NO. 3 SUBSTATION	1	(1) FUSE DISCONNECT SWITCH 6 SETS (2) LIGHTNING ARRESTER 6 SETS (3) TRANSFORMER 3 SETS OIL IMMERSED TYPE 1 PH, 250kVA, 60 Hz 20kV/480-240 V (4) TRANSFORMER 3 SETS OIL IMMERSED TYPE	WORKING W/OUT ANY TROUBLE

APPENDIX F ELECTRICAL EQUIPMENT LIST

NAME OF PLANT: SUBSTATION

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
		1 PH, 167 kVA, 60 Hz 20 kV/240-120V	
		(5) FENCE 1 LOT	
5. OTHERS	1	(1) DIGITAL MULTIMETER	
		(2) EARTH TESTER	
		(3) CLIP-ON AC POWERMETER	
		(4) INSULATION TESTER	
		(5) DC VOLTAGE/CURRENT STANDARD	
		(6) PNEUMATIC PRESSURE STANDARD	
		(7) AIR SUPPLY UNIT	
		(8) DIGITAL MANOMETER	
		(9) DIGITAL THERMOMETER	

SUBSTATION.WK1

APPENDIX G INSTRUMENTATION LIST

The Study Team conducted an investigation of the instrumentation items including quantity, specifications, and operating conditions.

Results of investigation are listed as follows:

APPENDIX G INSTRUMENTATION LIST

NAME OF PLANT: PLANT NO. 1

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. LA MESA RAW WATER FLOW-AQUEDUCT NO. 1	1	VENTURI METER 3-VALVE MANIFOLD DIRECT READING MANOMETER	SUBMERGED CONDITION, NOT WORKING
2. LA MESA RAW WATER FLOW-AQUEDUCT NO. 2	1	VENTURI METER 3-VALVE MANIFOLD DIRECT READING MANOMETER	-DITTO-
3. ACCELATOR NO. 1 INFLUENT FLOW	1	ORIFICE PLATE, 3-VALVE MANIFOLD d/p CELL T:0-2090mm H20 FS:4-20 mA, FR/FQ:0-100ML/D	NOT WORKING
4. ACCELATOR NO. 2 INFLUENT FLOW	1	DITTO	NOT WORKING
5. FILTER NO. 1 INFLUENT LEVEL	1	PURGING LT:0-1.0m AUTO/MAN SET STATION	WORKING
6. FILTER NO. 1 FILTER RATE OF FLOW	10	d/p CELL FT:0-300mm H20 PNEV. FS:0.2-1.0 kg/cm2 FI/T & FI:0-65 ML/D	MANUAL OPERATED
7. FILTER NO. 1 LOSS OF HEAD	10	d/p CELL LT:0-4m LI:0-4m	WORKING
8. FILTER NO. 1 WASHWATER FLOW	1	ORIFICE PLATE, 3-VALVE MANIFOLD d/p CELL FT:0-2885mm H20 PNEV. FS:0-220ML/D LARGE FI:0-220M/D	NOT WORKING
9. FILTER NO. 1 SURFACE WASH FLOW	1	ORIFICE PLATE, 3-VALVE MANIFOLD FI: DIRECT READING MANOMETER 0-50ML/D	NOT WORKING
10.WASHWATER TANK LEVEL NO. 1	1	ELECTRONIC LT:0-1.5m LR:0-1.5m	NOT WORKING
11.WASHWATER RECOVERY FLOW	1	PROPELLER METER P/I CONVERTER:4-20mA FR/FQ	NOT WORKING
12.EFFLUENT FLOW (AQUEDUCT "C")	1	OPEN FLOW PROPELLER METER:27.3-450m3/D P/I CONVERTER:4-20mA FR/FQ:0-400ML/D CURRENT REPEATER:4-20mA FI X 2:0-800ML/D	NOT WORKING
13.EFFLUENT FLOW (AQUEDUCT "D")	1	DITTO	NOT WORKING
14.EFFLUENT FLOW (TOTAL FLOW) NO. 1	1	SUMMATOR:4-20mA LARGE INDICATOR:0-800ML/D	NOT WORKING

APPENDIX G INSTRUMENTATION LIST

NAME OF PLANT: PLANT NO. 2

NAME OF EQUIPMENT	QUANTITY	SPECIFICATIONS	CONDITION
1. LA MESA RAW WATER FLOW-AQUEDUCT NO. 3	1	VENTURI METER 3-VALVE MANIFOLD DIRECT READING MANOMETER	NOT WORKING
2. INFLUENT FLOW NO. 1	1	PARSHAL FLUME FLOAT TYPE FT:4-20mA FR/FQ:0-600ML/D	NOT WORKING
3. INFLUENT FLOW NO. 2	1	DITTO	NOT WORKING
4. FILTER NO. 2 INFLUENT LEVEL NO. 1	1	PNEUMATIC LT:0-1.5 m	WORKING
5. FILTER NO. 2 INFLUENT LEVEL NO. 2	1	DITTO	WORKING
6. FILTER NO.2 FILTER RATE OF FLOW	20	d/p CELL FT:0-2246mmH20 PNEU. FS:0.2-1.0kg/cm2 FI/T & FI:0-65ML/D	MANUAL OPERATED
7. FILTER NO.2 LOSS OF HEAD	20	d/p CELL FT:0-4m LI:0-4m	WORKING
8. FILTER NO.2 WASHWATER RATE OF FLOW	1	ORIFICE PLATE, 3-VALVE MANIFOLD d/p CELL FT:0-2885mm H20 PNEU. FS:0-220ML/D LARGE FI NO. 1:0-220ML/D LARGE FI NO.2: DITTO	WORKING
9. FILTER NO.2 SURFACE WASH FLOW	1	ORIFICE PLATE, 3-VALVE MANIFOLD FI: DIRECT READING MANOMETER 0-50ML/D	NOT WORKING
10. WASHWATER TANK LEVEL NO. 2	1	ELECTRONIC LT:0-2.0 m LR:0-2.0M	NOT WORKING
11. WASHWATER RECOVERY FLOW	1	PROPELLER METER P/I CONVERTER:4-20mA FR/FQ:0-35ML/D	NOT WORKING
12. EFFLUENT FLOW (AQUEDUCT "A")	1	VENTURI METER d/p CELL FT:0-4657mmH20 ELECTRICAL FS:4-20mA FR/FQ:0-750ML/D CURRENT REPEATER:4-20mA FI:0-750ML/D	NOT WORKING
13. EFFLUENT FLOW (AQUEDUCT "B")	1	DITTO	NOT WORKING
14. EFFLUENT FLOW (TOTAL FLOW) NO. 2	1	SUMMATOR:4-20mA LARGE INDICATOR:1500ML/D	NOT WORKING
15. ALUM STORAGE TANK LEVEL	5	USING MANOMETER	NOT WORKING

APPENDIX H PERFORMANCE TEST ON CHEMICAL DOSING FACILITIES

The Study Team conducted a performance test of the existing chemical dosing facilities including alum dosing and polymer dosing facilities.

1. Findings

1.1 Alum

Alum as measured by Rotodips is supplied by gravity and the pressure in the pipelines is not enough to supply the applied capacity. Results of our performance test indicate within allowable error. Only the pipeline for Accelator is 5% less than required supply. Therefore, no replacement/relaying of pipeline is required.

1.2 Polymer

Results of test shows 17 to 207% increases of polymer solution at dosing points compared with supply. It is considered these increases were caused by dilution of water at chemical house. This test shall be implemented without dilution water.

2. Investigation

Procedures are shown hereafter (see Figs. H.1 and H.2):

(1) Inflow rate described in the following results indicates the operating capacity of the Plant, which is measured by MWSS using those flow meters installed along Aqueducts #1, #2, and #3. This is applied to calculate required dosages of alum and polymer.

(2) Alum discharge is estimated by applying the calibration curve for Rotodip (table provided by manufacturer of Rotodip) and manually set values on Rotodip. The results are shown as Expected Dosage hereunder.

(3) Actual alum dosing amount by Rotodip is measured at two points: one just after Rotodip and another dosing point at graduated cylinder.

(4) Polymer discharge is estimated in the same manner as the Rotodip by applying the calibration curve supplied by manufacturer of polymer dosing pump and at using manually set valves.

(5) Actual polymer dosing amount is measured in two ways namely:
1) By level decreasing ratio at polymer storage tank
2) By taking actual dosing amount using graduated cylinder.

3. Test Results

3.1 Inflow

Plant No. 1 Settling Basin 1 & 2 :	98.2 MGD	=	371,800 m^3/D
Plant No. 1 Accelator:	40 MGD	=	151,400 m^3/D
Plant No. 2 North & South:	271.7 MGD	=	1,028,700 m^3/D

3.2 Alum

3.2.1 Dosing Rate

Dosing rate determined by jar test : 28 mg/l = 28 g/m^3

3.2.2 Required Alum Dosage

1) Plant No. 1 Settling Basin 1 & 2 (per basin)

$$\frac{371,800 \text{ m}^3/\text{D} \times 28 \text{ g/m}^3}{24 \times 1.32 \times 1000 \times 2 \times 0.5} = 328.6 \text{ l/h}$$

2) Plant No. 1 Accelator

$$\frac{151,400\ m^3/D \times 8\ g/m^3}{24 \times 1.32 \times 1000 \times 0.5} = 76.5\ l/h$$

3) Plant No. 2 North & South Line (per line)

$$\frac{1,028,700\ m^3/D \times 28\ g/m^3}{24 \times 1.32 \times 1000 \times 2 \times 0.5} = 909.2\ l/h$$

3.2.3 Settling of Rotadip (1 knob settling = 5.95 l/hr)

	Rotadip	Setting Expected Dosage
1)	Plant No. 1 Settling Basin - 1 I.SB-1	61 X 5.95 = 363.0 l/h
2)	Plant No. 1 Settling Basin - 2 I.SB-2	55 X 5.95 = 327.3 l/h
3)	Plant No. 1 Accelator (I.Acc)	15 X 5.95 = 89.3 l/h
4)	Plant No. 2 North (II-N)	151 X 5.95 = 898.5 l/h
5)	Plant No. 2 South (II-S)	139 X 5.95 = 827.1 l/h

3.2.4 Actual Measurement (by totalizer of Rotadip)

1)	I.SB-1	332 l/h
2)	I.SB-2	336 l/h
3)	I.Acc	74 l/h
4)	II-N	928 l/h
5)	II-S	920 l/h

3.2.5 Actual Measurement Rotadip (by manual sampling)

1) I.SB-1 $\frac{(0.94 + 0.98)l \times 3600}{2 \times 10\ sec} = 345.6\ l/h$

2) I.SB-2 $\frac{(1.01 + 0.99)l \times 3600}{2 \times 10} = 360\ l/h$

3) I.ACC $\frac{(1.15 + 0.82)l \times 3600}{(40 + 30)\ sec} = 101.3\ l/h$

4) II-N $\frac{(0.81 + 0.85)l \times 3600}{2 \times 3\ sec} = 996\ l/h$

5) II-S $\frac{(1.13 + 0.88)l \times 3600}{(5+3)\ sec} = 904.5\ l/h$

3.2.6 Actual Dosing at Dosing Point

1) I.SB-1 $\frac{(1.08 + 1.07)l \times 3600}{2 \times 10\ sec} = 387\ l/h\ (+12\%)$

2) I.SB-2 $\frac{(1.14 + 1.11)l \times 3600}{2 \times 10} = 405\ l/h\ (+13\%)$

3) I.ACC a) $\frac{(0.465 + 0.42)l \times 3600}{2 \times 30\ sec} = 53.1\ l/h$

b) $\frac{(0.36 + 0.36)l \times 3600}{2 \times 30\ sec} = 43.2\ l/h$

a) + b) 53.1 + 43.2 = 96.3 l/h (-5%)

4) II-N $\frac{8.68 \times 3,600}{30\ sec} = 1,042\ l/h\ (+4\%)$

5) II-S $\frac{(0.72 + 0.72)l \times 3600}{2 \times 2\ sec} = 1,296\ l/h\ (+43\%)$

3.3 POLYMER

3.3.1 Dosing Rate

Polymer - Cationic (Nalco: 2.75 % solution)

Plant No. 1 - 0.2 mg/l

Plant No. 2 - 0.1 mg/l

3.3.2 Required Polymer Dosage

1) Plant No. 1 Settling Basin 1 & 2 (I.SB-1.2)

$$\frac{371{,}800\ m^3D \times 0.2\ g/m^3}{24 \times 0.0275 \times 1000} = 112.7\ l/h$$

2) Plant No. 2 North & South (II-N,S)

$$\frac{1{,}028{,}700\ m^3/D \times 0.1\ g/m^3}{24 \times 0.0275 \times 1000 \times 2} = 77.9\ l/h \text{ (per line)}$$

3.3.3 Setting of Pump (Dial of Pump)

1.	I.SB - 1 & 2	50%	3.485 l/min = 209.1 l/h
2.	II-N	40%	2.69 l/min = 161.4 l/h
3.	II-S	40%	2.69 l/min = 161.4 l/h

3.3.4 Actual Measurement (by tank level)

$$\frac{1.7\ m^2 \times \pi}{4} = 2.27\ m^2$$

1) I.SB $\dfrac{2.27\ m^2 \times 0.107m \times 1000}{2.667\ h} = 91.1\ l/h$

2) II-N $\frac{2.27m^2 \times 0.09m \times 1000}{2.667\ h} = 76.6\ l/h$

3) II-S $\frac{2.27m^2 \times 0.095\ m \times 1000}{2.667\ h} = 80.9\ l/h$

3.3.5 Actual Dosing at Dosing Point

1) I.SB - 1 $\frac{(0.23 + 0.23)\ l \times 3600}{2 \times 15\ sec} = 55.2\ l/h$

2) I.SB - 2 $\frac{(0.43 + 0.42) l \times 3600}{2 \times 30\ sec} = 51\ l/h$

1)+ 2) 55.2 + 51 = 106.2 l/h (+17%)

3) II-N $\frac{(0.99+0.97) l \times 3600}{2 \times 15\ sec} = 235.2\ l/h$ (+207%)

4) II-S $\frac{(0.7+0.7) l \times 3600}{2 \times 15\ sec} = 168.0\ l/h$ (+108%)

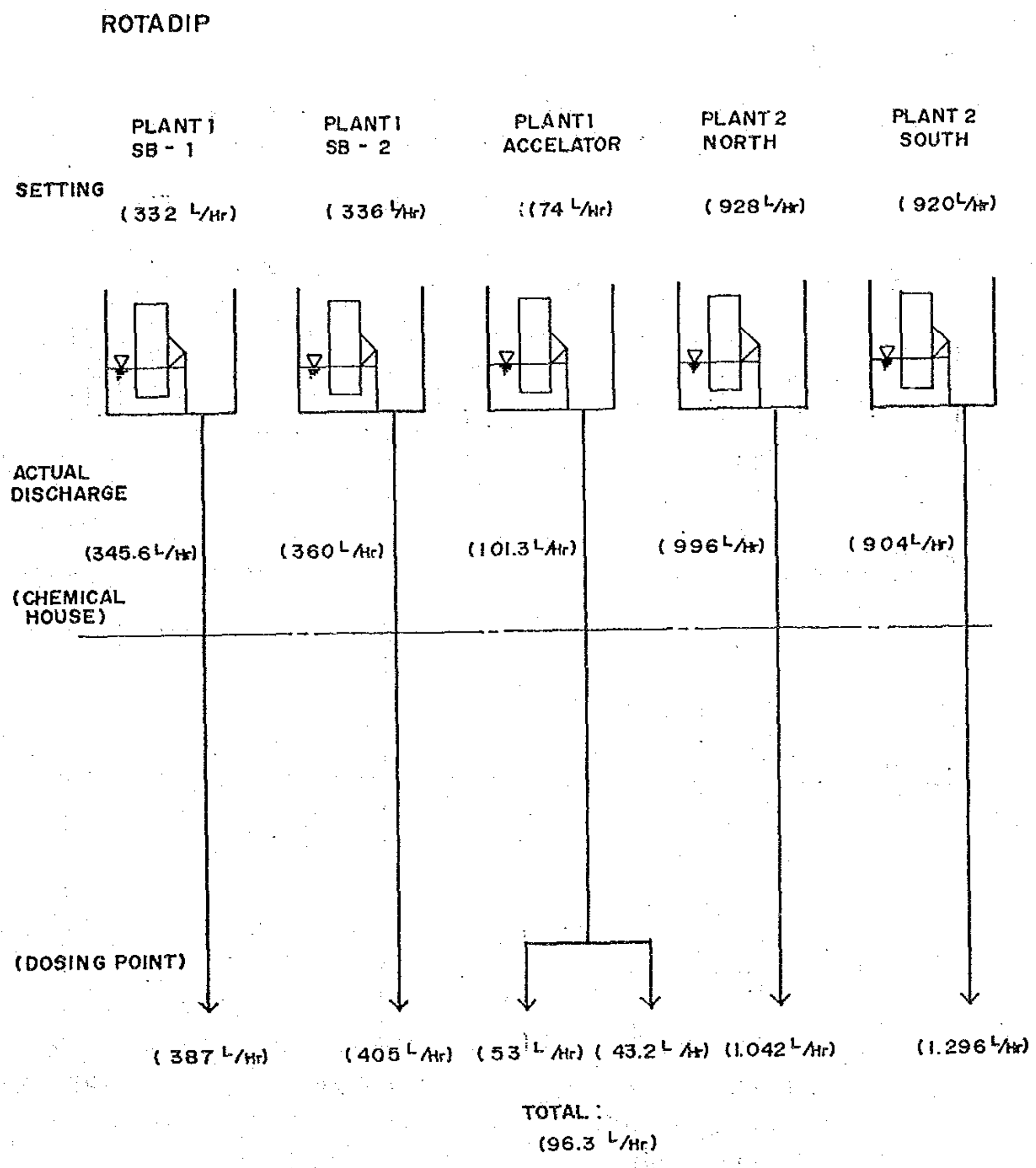

Fig. H.1
ALUM DOSING FACILITIES
DOSING TEST

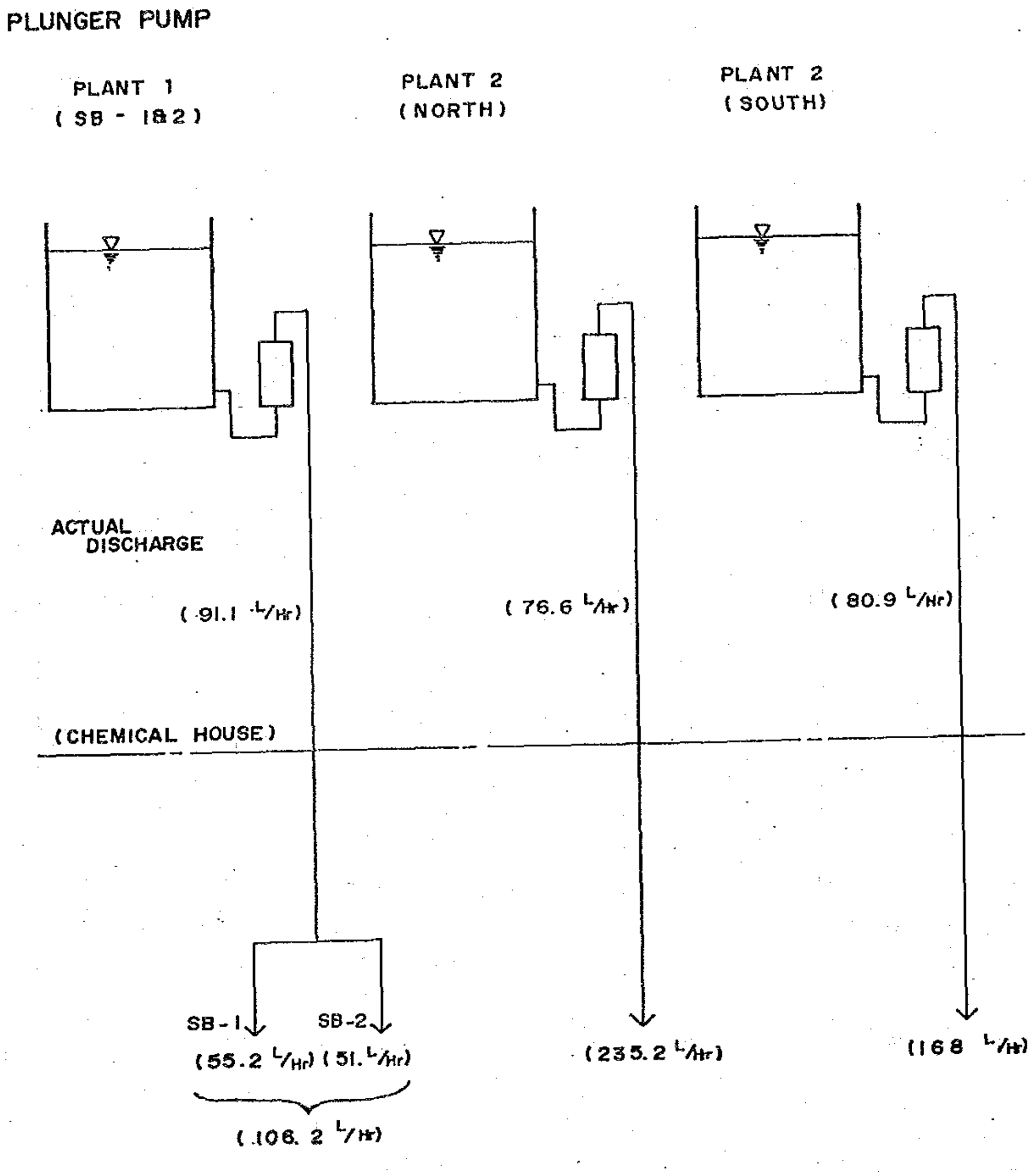

Fig. H.2
POLYMER DOSING FACILITIES
DOSING TEST

APPENDIX I CHLORINE PIPELINE LEAKAGE TEST

The Study Team conducted chlorine pipeline leakage tests, comparing discharged flow rates measured at chlorine house and flow rates at dosing points by using a portable ultrasonic flow meter (see Fig. I.1).

1. Findings

The test results include some error since the portable type flow meter is less accurate than the fixed type. The difference of flow rate between the chlorine house and the dosing point is more than 20%, therefore the following pipelines are highly recommended to be replaced.

1) Pre Chlorination for Plant No. 2 - Accelator,
2) Intermediate Chlorination for Plant No. 2
   - Inlet channel of filter (East Wing) , and
3) Ditto - (West Wing)

2. Test Records

Following are testing results:

2.1 Pre Chlorination

2.1.1 Plant No. 1 - Aqueduct No. 1

1) Chlorination House
11.9 - 13.6 m^3/Hr   4'39"/m^3 = 12.9 m^3/Hr

2) Dosing Point
10.7 - 13.5 m^3/Hr   4'32"/m^3 = 13.2 m^3/Hr (+2%)

2.1.2 Plant No. 1 - Accelator

1) Chlorination House

4.1 - 7.0 m^3/Hr.   10'7"/m^3 = 5.8 m^3/Hr

2) Dosing Point

20'30"   = 2.9 m^3/Hr (-50%)

2.1.3 Plant No. 2 - Receiving Well

1) Chlorination House

23.7 - 27.3 m^3/Hr   2'25"/m^3 = 24.8 m^3/Hr

2) Dosing Point

25.5 - 27.3 m^3/Hr   2'13"/m^3 = 27.1 m^3/Hr (+9%)

2.2 Intermediate Chlorination

2.2.1 Plant No. 1 - Inlet Channel of Filter

1) Chlorination House

15.3 - 16.4 m^3/Hr   3'44"/m^3 = 16.1 m^3/Hr

2) Dosing Point

14.3 - 15.8 m^3/Hr   3'59"/m^3 = 15.1 m^3/Hr (-6%)

2.2.2 Plant No. 2 - Inlet Channel of Filter (East Wing)

1) Chlorination House

20.3 - 21.2 m^3/Hr   2'51"/m^3 = 21.1 m^3/Hr

2) Dosing Point

13 - 18.7 m^3/Hr   4'0"/m^3 = 15 m^3/Hr (-29%)

2.2.3 Plant No. 2 - Inlet Channel of Filter (West Wing)

1) Chlorination House

13.2 - 13.7 m^3/Hr 4'27"/m^3 = 13.5 m^3/Hr

2) Dosing Point

1.9 - 2.2 m^3/Hr = 2 m^3/Hr (-85%)

2.3 Post Chlorination

2.3.1 Plant No. 1 - Effluent Channel

1) Chlorination House

18.8 - 19.6 m^3/Hr 3'08"/m^3 = 19.1 m^3/Hr

2) Dosing Point

18.7 - 19.3 m^3/Hr 3'12"/m^3 = 18.8 m^3/Hr (-2%)

2.3.2 Plant No. 2 - Aqueduct 84" (West Wing)

1) Chlorination House

24 24.8 m^3/Hr = 24 m^3/Hr

2) Dosing Point

21 - 32 m^3/Hr 2'10"/m^3 = 27.7 m^3/Hr

2.3.3 Plant No. 2 - Aqueduct 72"

1) Chlorination House

13.5 - 14.7 m^3/Hr = 13.6 m^3/Hr

2) Dosing Point

No Suitable Place for Measuring

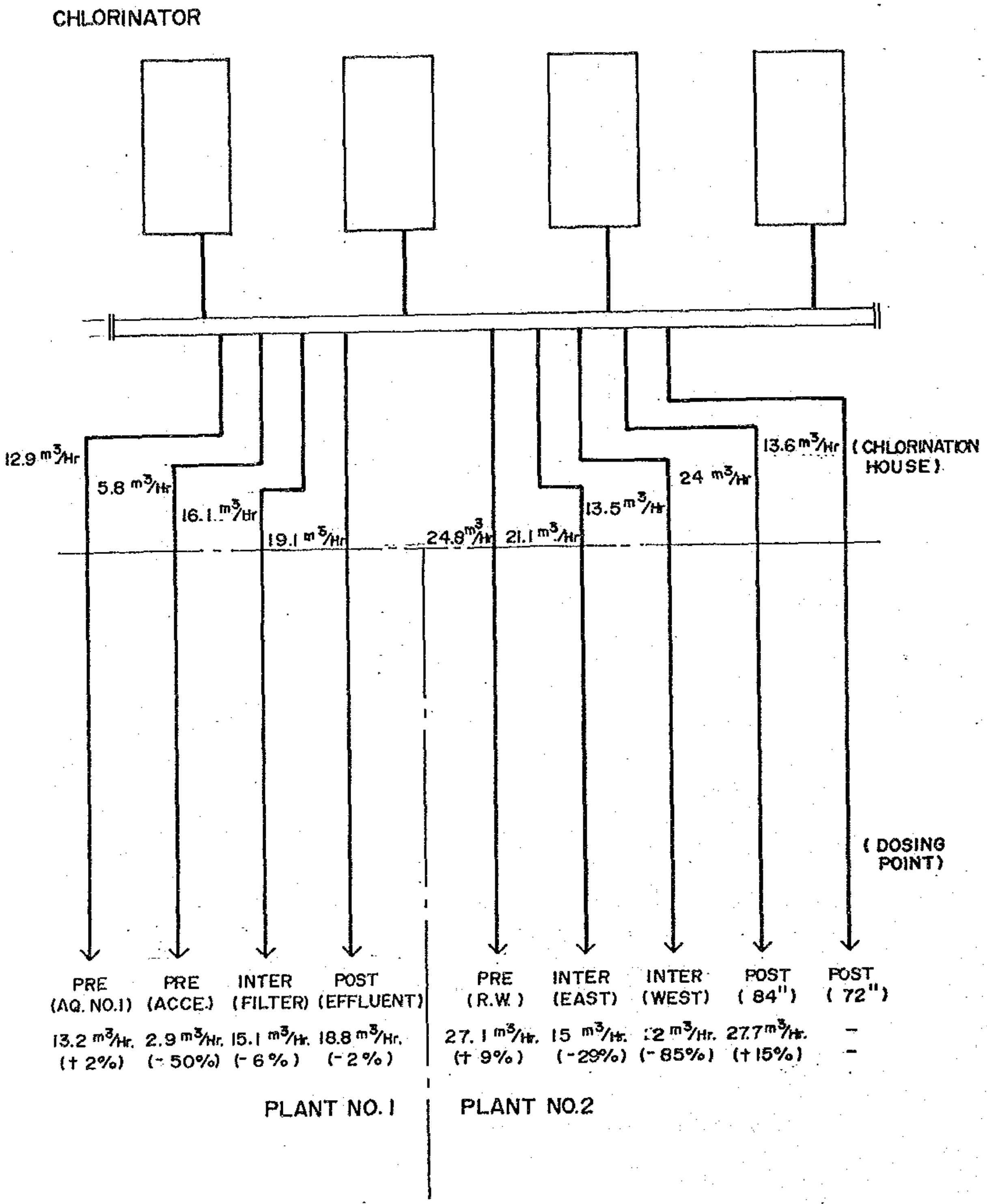

Fig. I.1
CHLORINATION FACILITIES
LEAKAGE TEST

APPENDIX J PROCESS WATER QUALITY ANALYSIS

The Study Team conducted an investigation on the process water quality of the existing Balara Plant to evaluate the performance of each process such as coagulation, flocculation, sedimentation, filtration, and chlorination. The investigation covered water quality analysis in pH, conductivity, alkalinity, and turbidity. Chlorination is discussed in detail in the following APPENDIX H, DISTRIBUTED WATER QUALITY ANALYSIS.

1. Findings

According to the investigation results, the existing process treated raw water of varied quality during the investigation from 22th September to 22nd October, 1991 as follows:

RAW WATER QUALITY

pH	7.01 to 7.46		(see Table J.1)
Conductivity	104.9 to 168.6	μS/cm	(see Table J.2)
Alkalinity	45.2 to 66.1	mg/l	(see Table J.3)
Turbidity	9.9 to 62.2	mg/l	(see Table J.4)

Test results indicated that raw water included sufficient alkalinity to achieve a good coagulation, even pH value were slightly higher in some duration than the optimal range for the application of liquid alum as coagulant. It is preferable if polymer could be applied properly in addition to liquid alum.

However, the process involves some problems in the finished water quality. In cases of high turbidity during the rainy season, treatment results in turbidity exceed 5 mg/l of the National Standard for Drinking Water. Data on finished water quality are as follows:

FINISHED WATER QUALITY

pH	6.46 to 7.30		(see Table J.1)
Conductivity	115.5 to 150.6	μS/cm	(see Table J.2)
Alkalinity	32.4 to 61.2	mg/l	(see Table J.3)
Turbidity	2.0 to 12.8	mg/l	(see Table J.4)

These insufficient results are attributable to the following:

(1) Insufficient operation of the facilities including coagulant dosage, poor chemical mixing and coagulation, inadequate flocculation, insufficient backwash of the filter beds,

(2) Overloading of the superannuated facilities, and

(3) Structural defects caused by the previous upgrading project.

2. Procedures

Procedures are shown below:

(1) Sampling Points

In selecting sampling points, the Study Team used the MWSS points to allow comparison with available data of MWSS. The sampling points are identified as raw water, treated water, influent water, filtered water, and, finished water, details are as shown follows:

Raw water:
Sample without any treatment collected at Aqueducts influent to the Plant
Treated water:
Sample after coagulation and flocculation collected at inlet of sedimentation basin
Influent water:
Sample after sedimentation collected at channel between outlet of sedimentation basin and filter bed
Filtered water:
Sample after filtration collected at sampling faucet installed at effluent pipe of filter
Finished water:
Sample after chlorination collected at faucet installed at distribution line in the premises of the Balara Plant

(2) Monitoring Frequency

As shown in the attached data, monitoring was conducted once a week.

(3) Analytical Method

Analytical method applied in the study are shown in Table J.5, compared with MWSS methods.

TABLE J.1 PROCESS WATER QUALITY ANALYSIS, pH

PLANT No.1 SEDIMENTATION BASIN 1

LOCATION	SEPT.20	SEPT.27	OCT.4	OCT.11	OCT.18	OCT.22
RAW	7.17	7.33	7.43	7.34	7.39	7.46
TREATED	6.61	6.84	7.21	7.29	7.26	7.30
INFLUENT	6.56	6.84	7.10	7.13	7.24	7.30
FILTERED	6.63	6.86	7.12	7.24	7.27	7.25
FINISHED	6.46	6.77	7.04	7.18	7.17	7.20

PLANT No.1 SEDIMENTATION BASIN 2

LOCATION	SEPT.20	SEPT.27	OCT.4	OCT.11	OCT.18	OCT.22
RAW	7.17	7.33	7.43	7.34	7.39	7.46
TREATED	6.55	6.81	7.18	7.18	7.30	7.32
INFLUENT	6.46	6.89	7.12	6.82	7.27	7.30
FILTERED	6.63	6.86	7.12	7.24	7.27	7.25
FINISHED	6.46	6.77	7.04	7.18	7.17	7.20

PLANT No.2

LOCATION	SEPT.20	SEPT.27	OCT.4	OCT.11	OCT.18	OCT.22
RAW	7.01	7.08	7.42	7.37	7.24	7.36
TREATED	6.55	6.96	7.23	7.30	7.28	7.32
INFLUENT	6.49	6.94	7.20	7.03	7.25	7.30
FILTERED	6.62	6.92	7.16	7.14	7.21	7.47
FINISHED	6.47	6.81	7.00	7.12	7.30	7.17

(All tables: columns SEPT.20 – OCT.22 under the heading DATE.)

TABLE J.2 PROCESS WATER QUALITY ANALYSIS, CONDUCTIVITY

PLANT No. 1 SEDIMENTATION BASIN 1 (uS/cm)

LOCATION	DATE SEPT. 20	SEPT. 27	OCT. 4	OCT. 11	OCT. 18	OCT. 22
RAW	108.1	126.6	128.1	168.6	152.4	151.7
TREATED	116.7	131.7	132.8	148.1	153.1	151.7
INFLUENT	116.4	126.2	132.1	150.8	152.8	151.1
FILTERED	114.7	126.0	131.3	148.0	152.2	151.1
FINISHED	115.5	131.3	132.6	146.0	150.6	148.2

PLANT No. 1 SEDIMENTATION BASIN 2 (uS/cm)

LOCATION	DATE SEPT. 20	SEPT. 27	OCT. 4	OCT. 11	OCT. 18	OCT. 22
RAW	108.1	126.6	128.1	168.6	152.4	151.7
TREATED	115.3	142.0	132.9	132.9	153.1	150.7
INFLUENT	116.3	126.5	131.6	154.7	152.5	150.6
FILTERED	114.7	126.0	131.3	148.0	152.2	151.1
FINISHED	115.5	131.3	132.6	146.0	150.6	148.2

PLANT No. 2 (uS/cm)

LOCATION	DATE SEPT. 20	SEPT. 27	OCT. 4	OCT. 11	OCT. 18	OCT. 22
RAW	104.9	117.0	149.4	135.7	135.1	142.5
TREATED	115.3	133.2	139.9	132.1	135.4	136.6
INFLUENT	113.4	133.0	141.7	133.1	135.8	136.5
FILTERED	115.3	132.8	140.8	133.4	136.2	136.5
FINISHED	115.7	133.8	148.4	145.5	149.4	149.3

TABLE J.3 PROCESS WATER QUALITY ANALYSIS, ALKALINITY

PLANT No.1 SEDMENTATION BASIN 1 (mg/l)

LOCATION	SEPT.20	SEPT.27	DATE OCT.4	OCT.11	OCT.18	OCT.22
RAW	48.0	56.0	58.0	66.0	66.1	66.0
TREATED	33.0	46.0	49.7	61.0	61.9	62.0
INFLUENT	32.4	45.2	48.8	57.0	62.2	63.0
FILTERED	32.0	45.9	48.0	60.2	56.7	63.5
FINISHED	32.6	44.2	46.0	58.0	60.4	61.2

PLANT No.1 SEDMENTATION BASIN 2 (mg/l)

LOCATION	SEPT.20	SEPT.27	DATE OCT.4	OCT.11	OCT.18	OCT.22
RAW	48.0	56.0	58.0	66.0	66.1	66.0
TREATED	33.0	46.8	49.2	49.2	62.6	63.0
INFLUENT	33.4	45.0	48.2	47.8	62.8	63.8
FILTERED	32.0	45.9	48.0	60.2	56.7	63.5
FINISHED	32.6	44.2	46.0	58.0	60.4	61.2

PLANT No.2 (mg/l)

LOCATION	SEPT.20	SEPT.27	DATE OCT.4	OCT.11	OCT.18	OCT.22
RAW	45.2	50.0	57.0	59.0	58.8	62.5
TREATED	33.1	49.3	51.4	52.5	56.8	57.4
INFLUENT	33.2	49.4	52.4	51.4	55.0	58.0
FILTERED	33.8	50.0	51.4	51.5	55.9	57.2
FINISHED	32.4	48.0	53.2	58.0	59.3	60.3

TABLE J.4 PROCESS WATER QUALITY ANALYSIS, TURBIDITY

PLANT No. 1 SEDIMENTATION BASIN 1 (mg/l)

LOCATION	SEPT. 20	SEPT. 27	DATE OCT. 4	OCT. 11	OCT. 18	OCT. 22
RAW	54.4	30.0	28.5	19.3	12.3	11.9
TREATED	33.3	20.2	38.5	14.9	18.5	18.5
INFLUENT	23.7	14.2	9.9	27.7	11.9	12.3
FILTERED	12.2	4.2	5.9	4.3	5.4	2.6
FINISHED	10.2	5.9	4.0	3.4	2.5	2.3

PLANT No. 1 SEDIMENTATION BASIN 2 (mg/l)

LOCATION	SEPT. 20	SEPT. 27	DATE OCT. 4	OCT. 11	OCT. 18	OCT. 22
RAW	54.4	30.0	28.5	19.3	12.3	11.9
TREATED	30.8	27.7	34.7	34.7	46.2	29.3
INFLUENT	19.4	14.6	10.9	37.0	19.3	27.0
FILTERED	12.2	4.2	5.9	4.3	5.4	2.6
FINISHED	10.2	5.9	4.0	3.4	2.5	2.3

PLANT No. 2 (mg/l)

LOCATION	SEPT. 20	SEPT. 27	DATE OCT. 4	OCT. 11	OCT. 18	OCT. 22
RAW	62.2	42.4	254.1	16.6	9.2	9.9
TREATED	16.7	12.0	5.8	10.9	9.8	9.2
INFLUENT	19.1	17.7	10.3	13.4	10.8	8.6
FILTERED	10.0	22.3	0.5	5.1	2.8	3.1
FINISHED	12.8	13.9	5.4	2.8	2.0	2.9

TABLE J.5 COMPARISON OF ANALYSIS METHOD

NOS.	Items	TESTING METHOD			
		MWSS		JICA STUDY TEAM	
1	p H	pH meter(Horizon Modele 5995)		pH meter	3)
2	TASTE	Threshold Teste Method		Threshold Teste Method	3)
3	COLOR	Color Comparator(Taylor Water Analyzer)		Color Comparator	4)
4	ODOR	Threshold Odor Method		Threshold Odor Method	3)
5	TURBIDITY	Hellige Turbidity meter		HACH Turbidity meter	3)
6	ALKALINITY	Titration Method(403)	1)	Titration Method	3)
7	BICARBONATES	Calculations Method(403)	1)	Calculations Method	3)
8	ACIDITY	Titration Method(402)	1)	Titration Method	3)
9	FREE CO2	Calculations Method(402)	1)	Calculations Method	3)
10	CHLORIDES	Titration Method(407A)	1)	Titration Method	3)
11	IRON	Field Test(Taylor Water Analyzer)	2)	O-Phenanthroline Method	4)
12	HARDNESS(TOTAL)	Titration Method(314B)	1)	Titration Method	3)
13	HARDNESS(Ca)			Titration Method	3)
14	HARDNESS(Mg)			Titration Method	3)
15	KMnO4 CONSUMPTION			Iodine Method	4)
16	NITRATE NITROGEN			Salicyate Method	4)
17	NITRITE NITROGEN			GR Method	4)
18	AMMONIA NITROGEN			Tillman's Modification	4)

1) STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER(1985)
2) LABORATORY MANUAL FOR CHEMICAL AND BACTERIAL ANALYSIS OF WATER AND SEWAGE(1943)
3) ANALYSIS STANDARD METHOD OF JAPAN (JWWA)
4) USE SHIBATA WATER ANALYSIS KIT

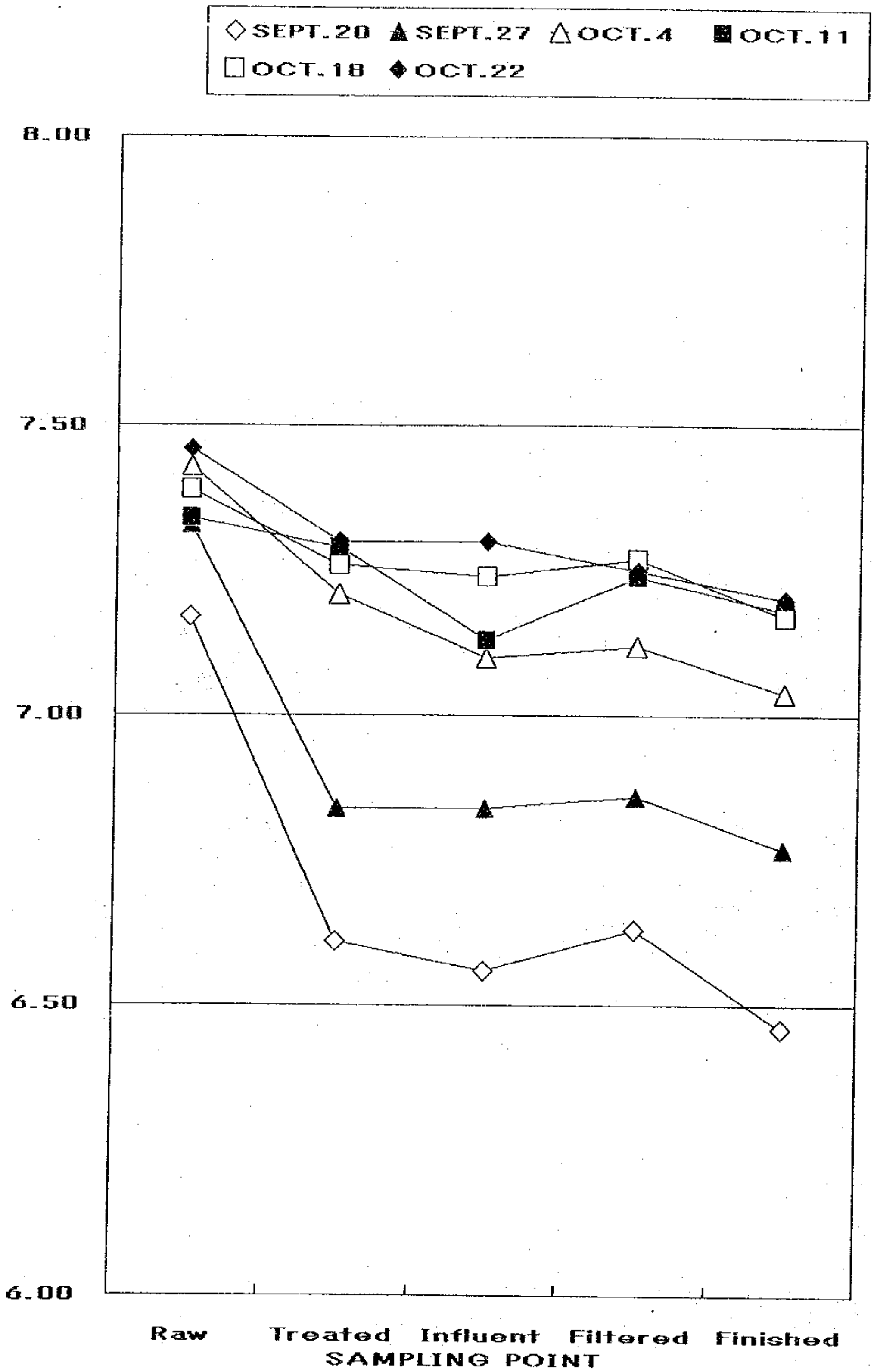

Fig. J.1 pH IN PLANT NO. 1 (1)

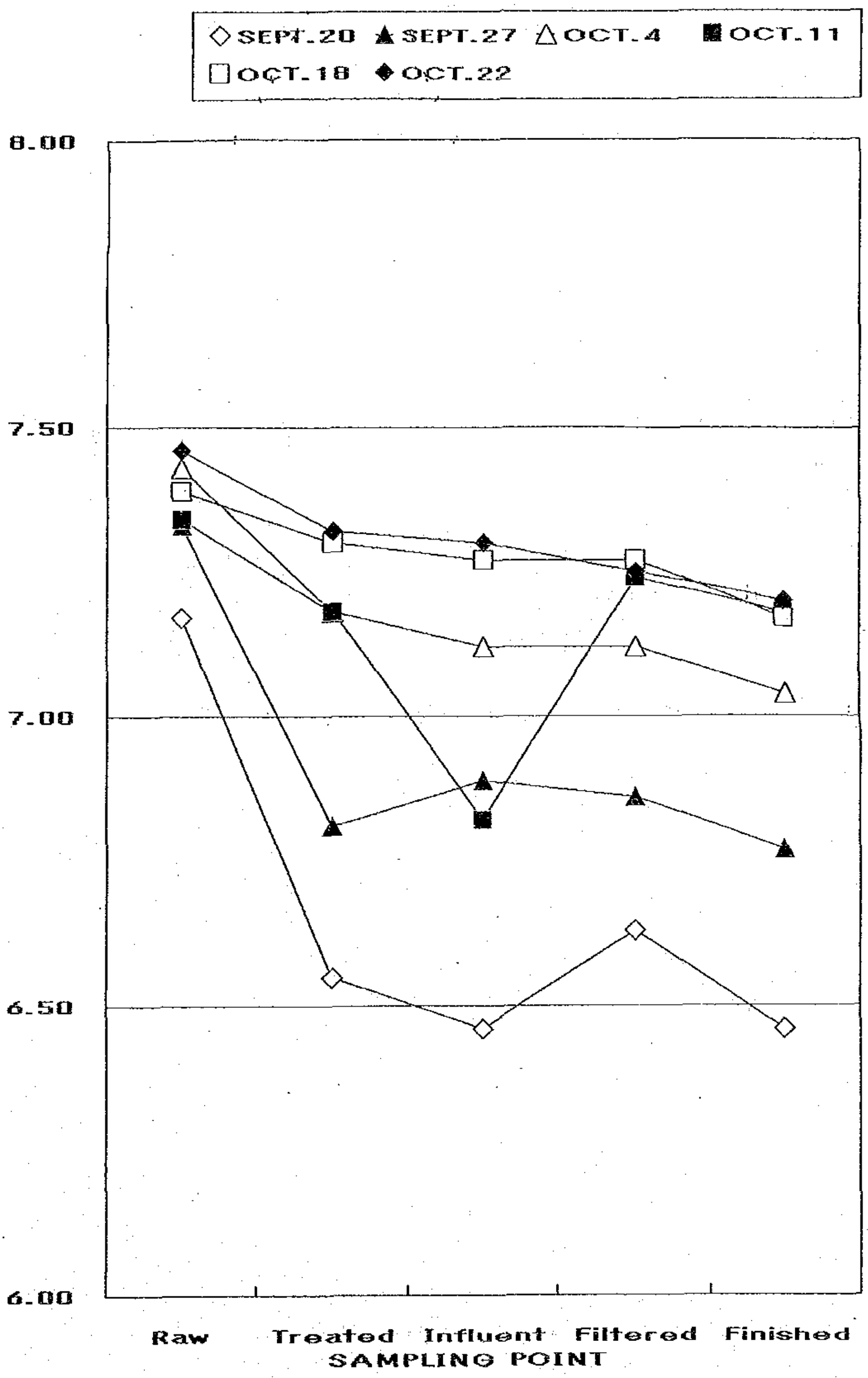

Fig. J.2 pH IN PLANT NO. 1 (2)

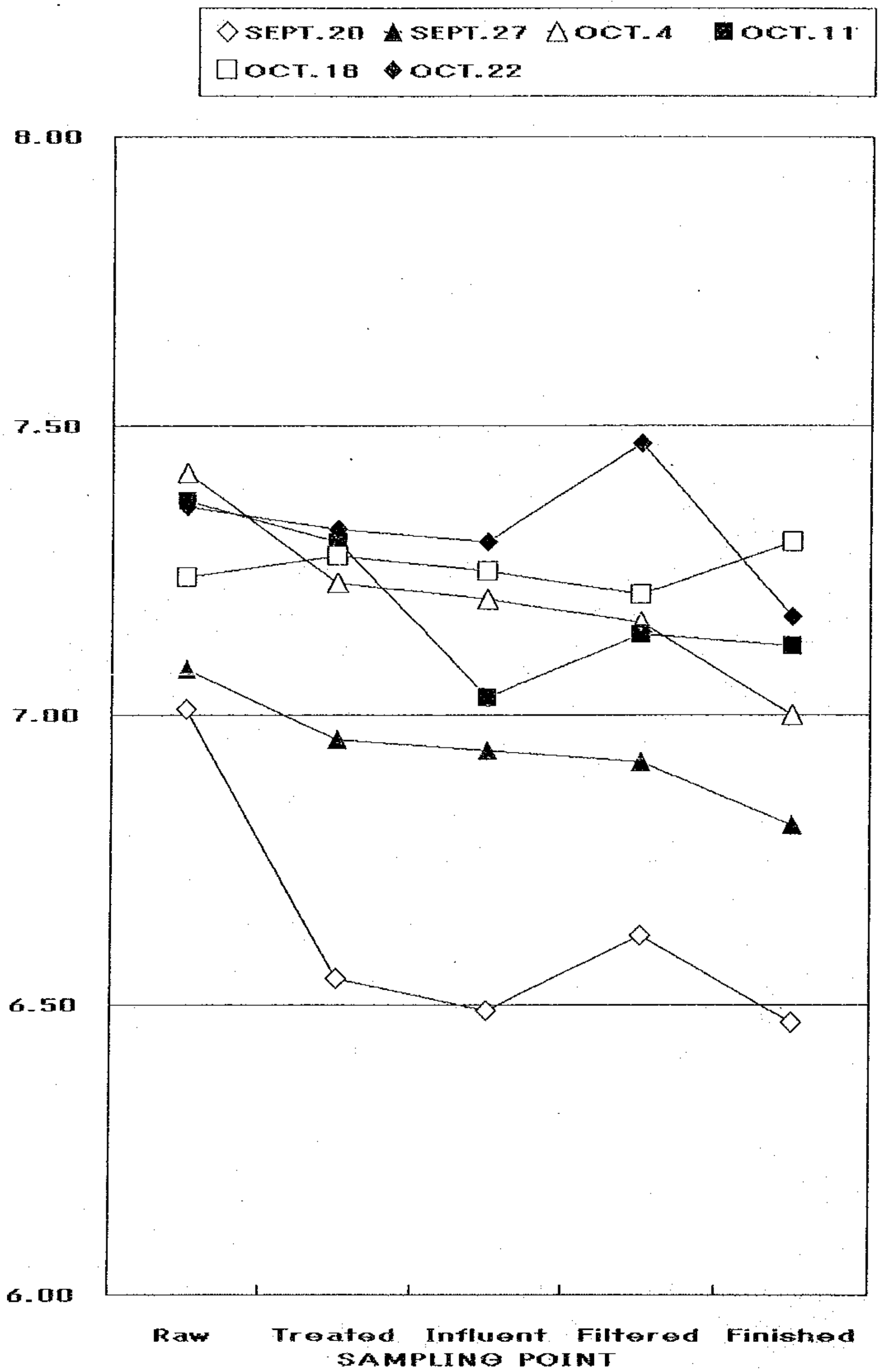

Fig. J.3 pH IN PLANT NO. 2

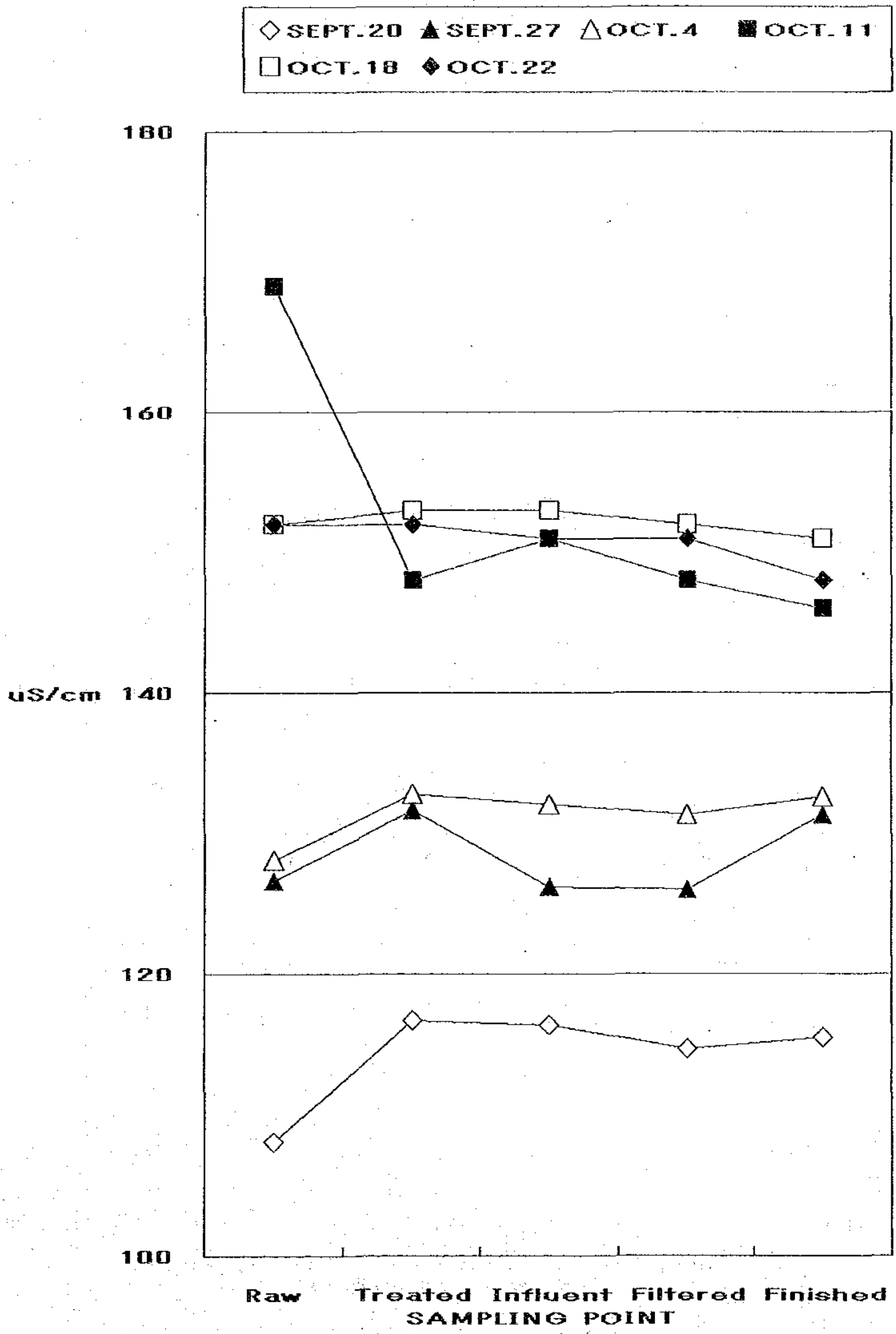

Fig. J.4 CONDUCTIVITY IN PLANT NO. 1 (1)

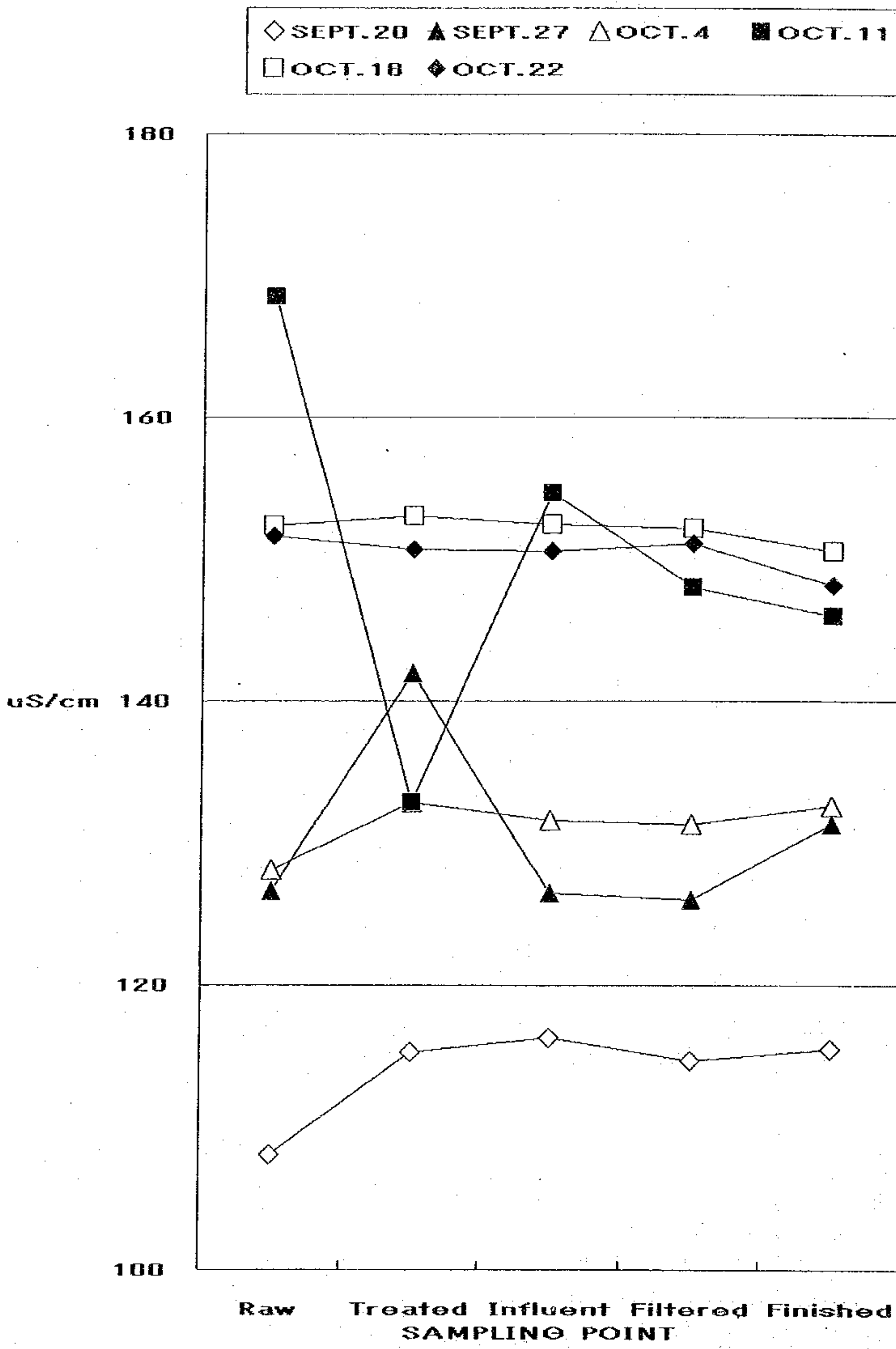

FIG. J.5 CONDUCTIVITY IN PLANT NO. 1 (2)

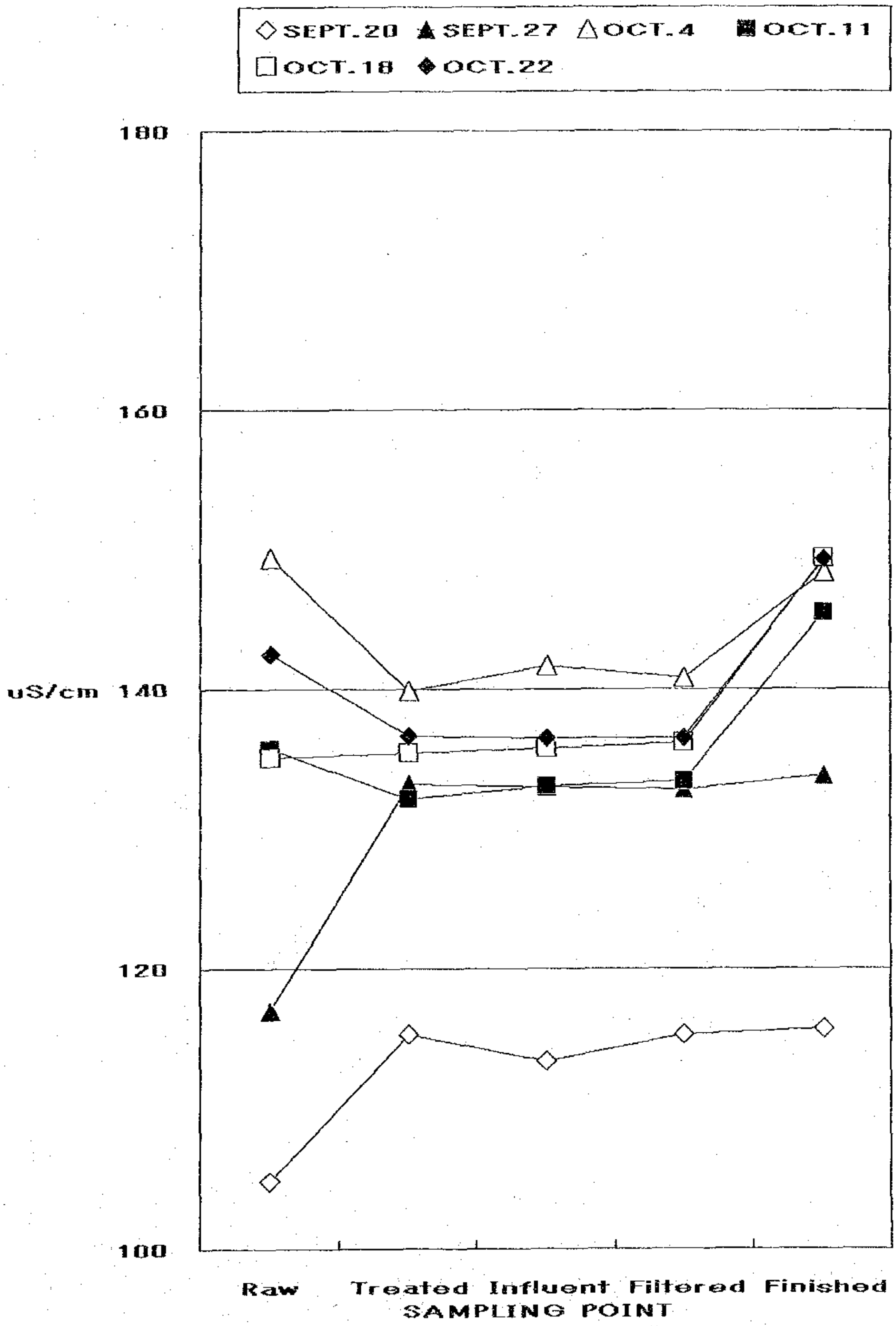

Fig. J.6 CONDUCTIVITY IN PLANT NO. 2

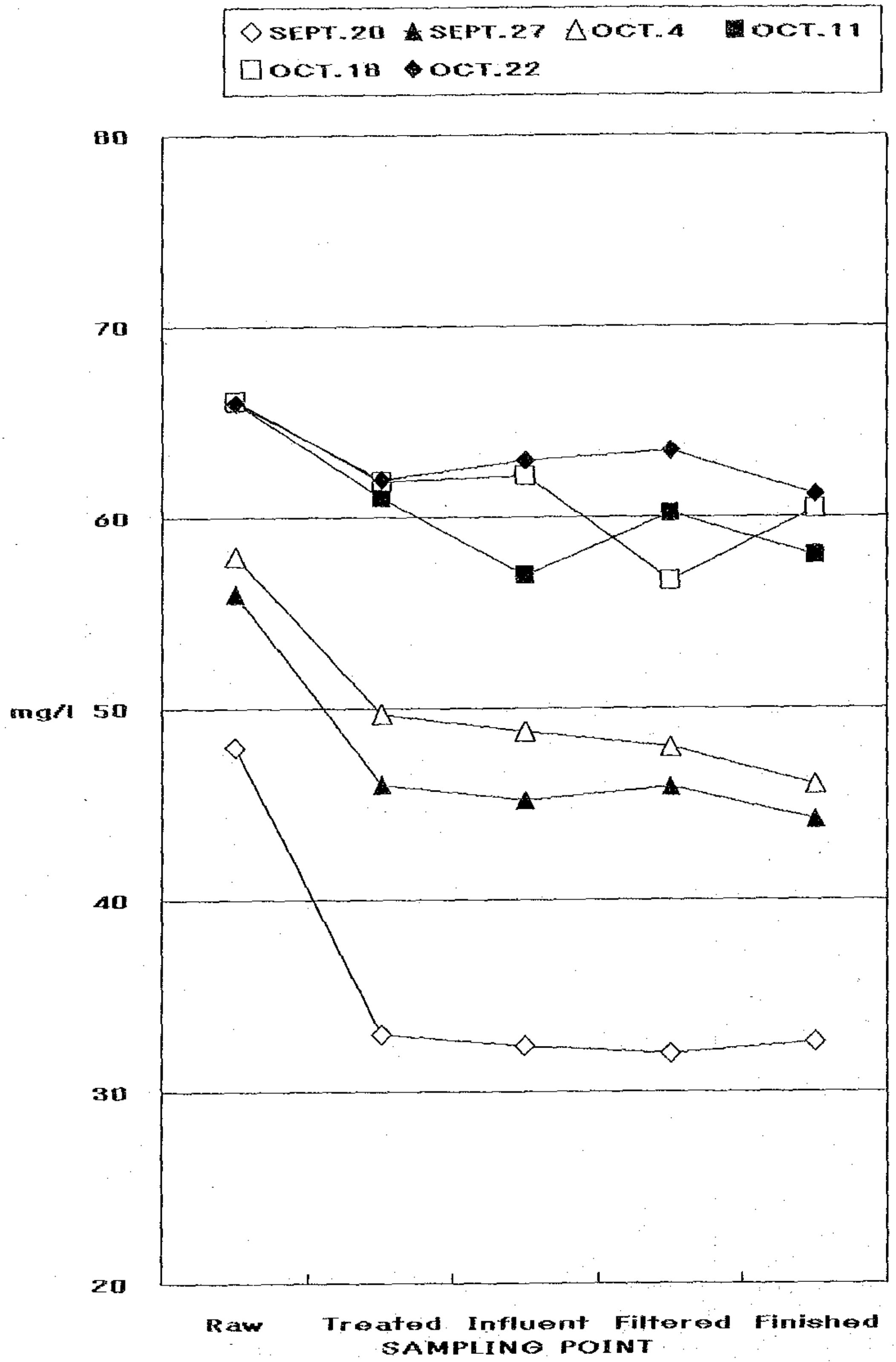

Fig. J.7 ALKALINITY IN PLANT NO. 1 (1)

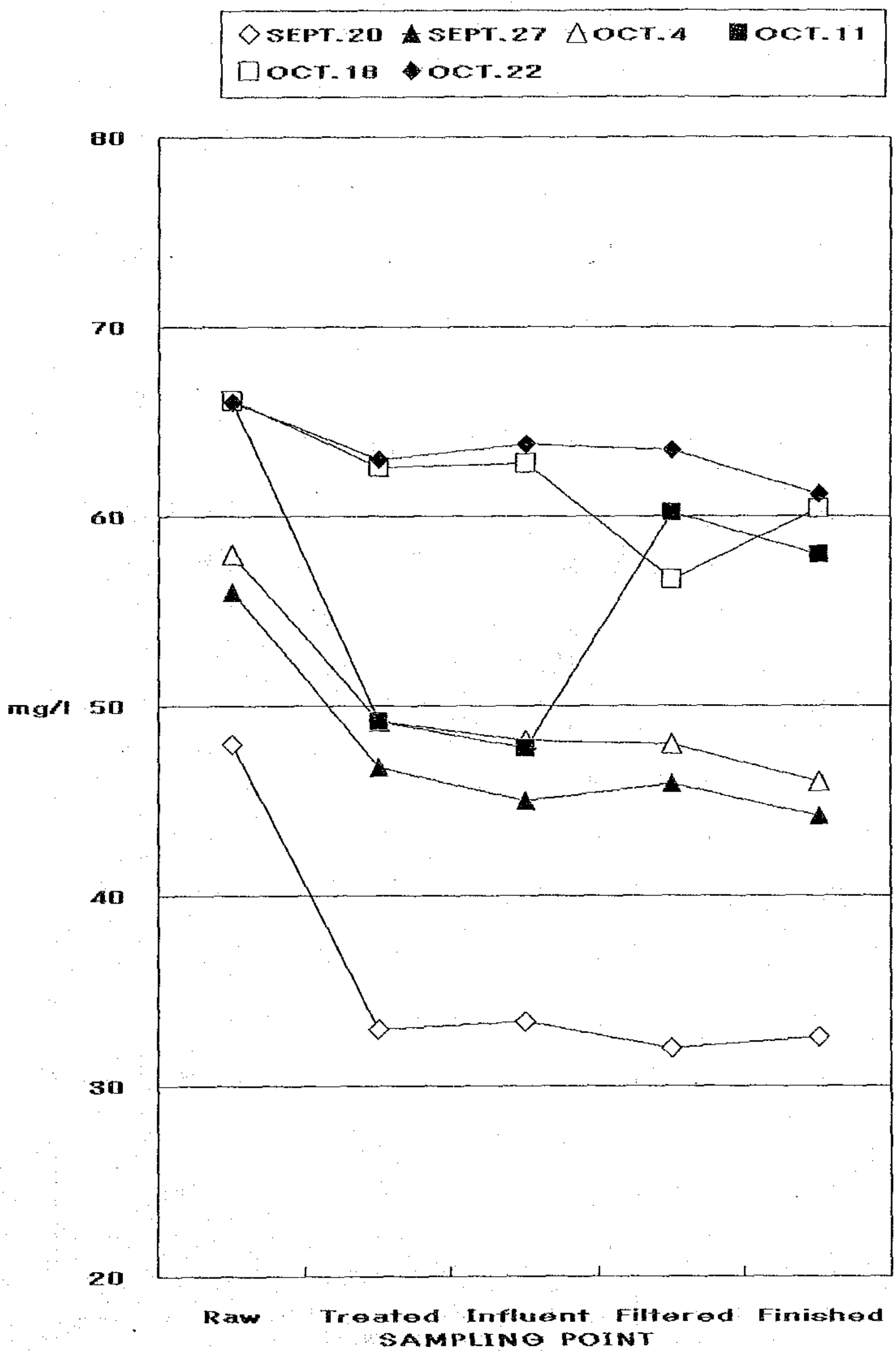

Fig. J.8 ALKALINITY IN PLANT NO. 1 (2)

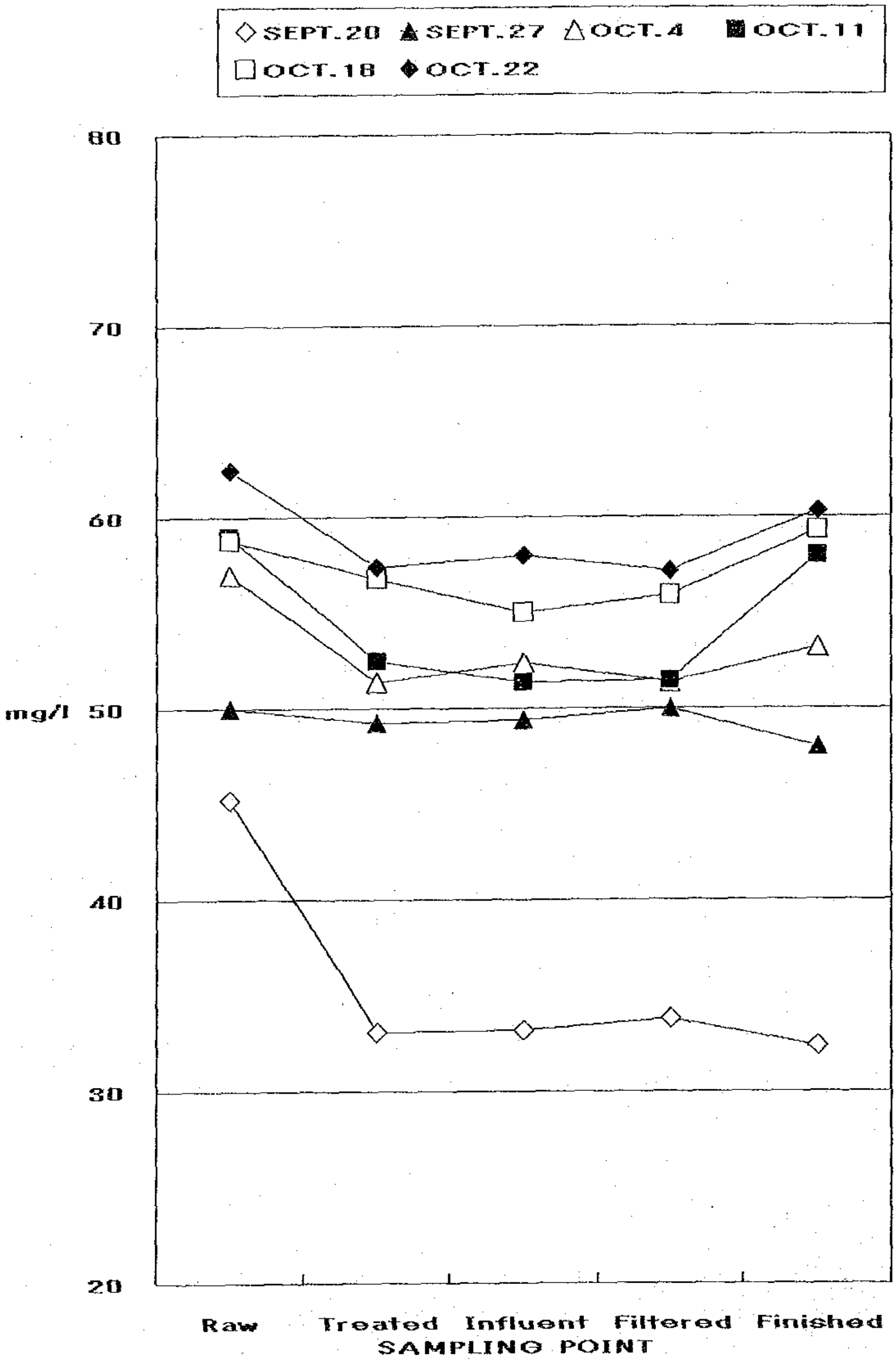

Fig. J.9 ALKALINITY IN PLANT NO. 2

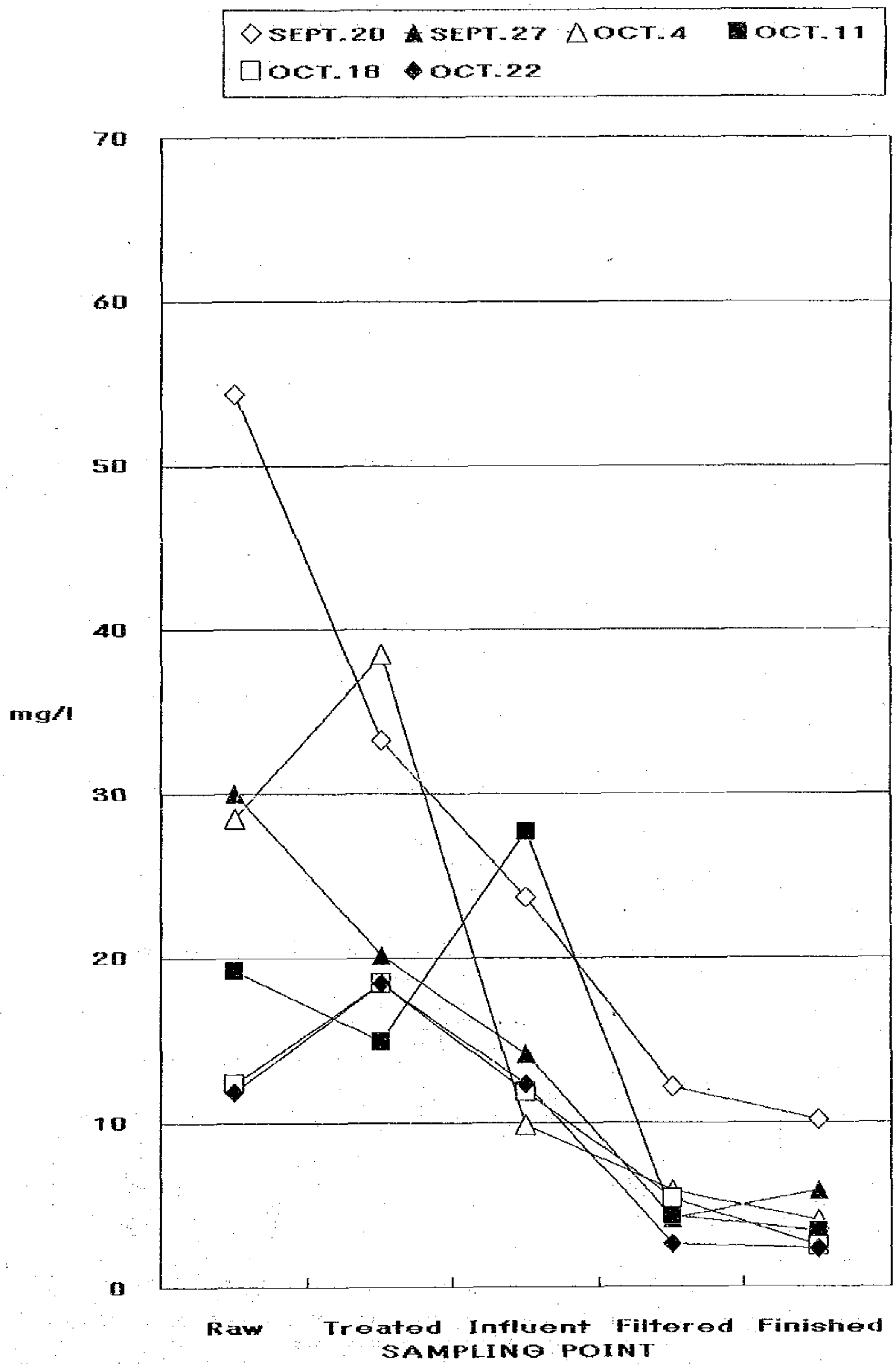

Fig. J.10 TURBIDITY IN PLANT NO. 1 (1)

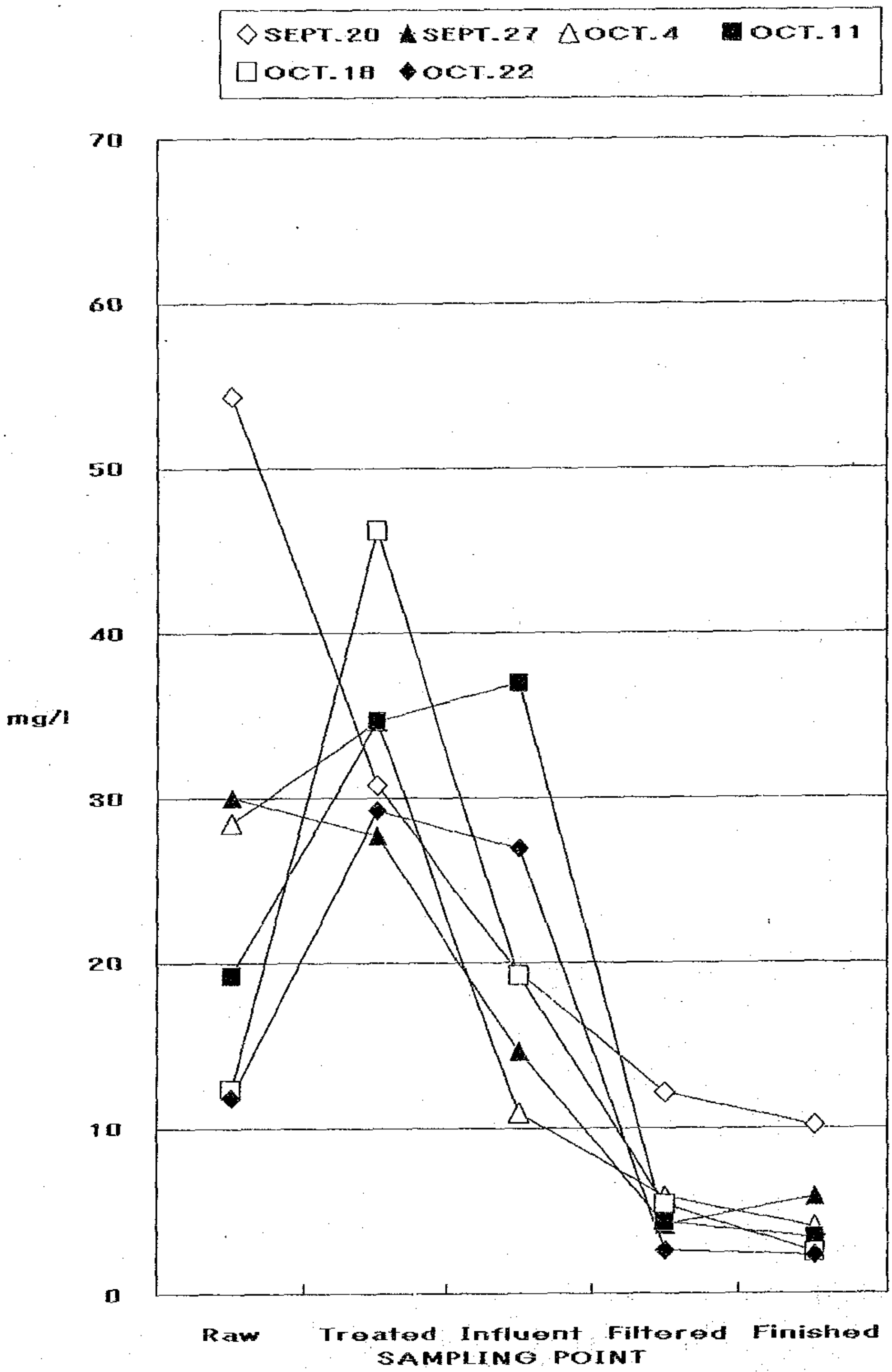

Fig. J.11 TURBIDITY IN PLANT NO. 1 (2)

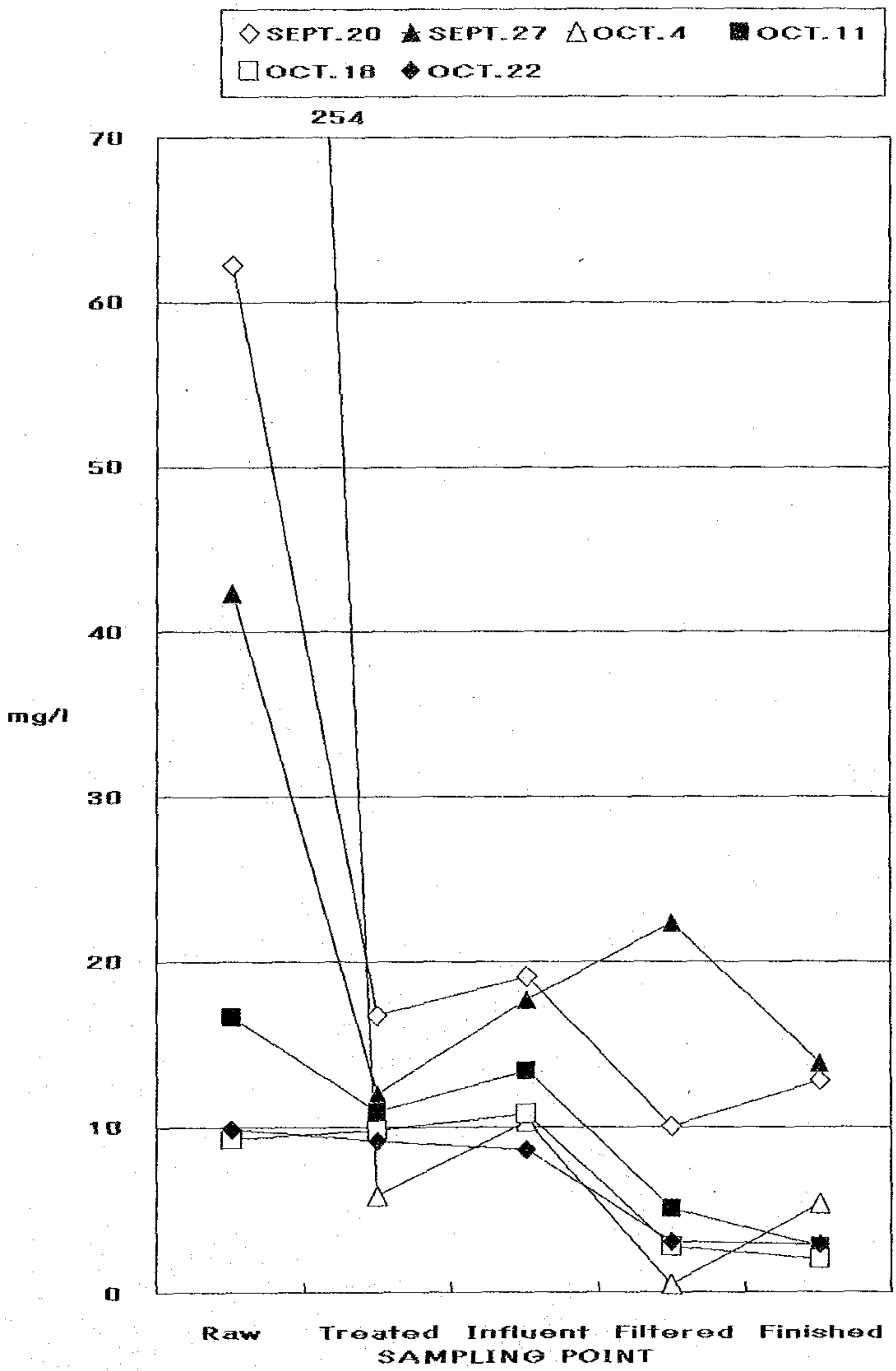

Fig. J.12 TURBIDITY IN PLANT NO. 2

APPENDIX K DISTRIBUTED WATER QUALITY ANALYSIS

The Study Team conducted a series of distributed water quality analysis in the Balara water supply system in order to clarify the report entitled "ANGAT WATER SUPPLY OPTIMIZATION PROJECT" which reported that some 111 cases recognized zero residual chlorine from representative sampling points.

1. Findings

Table K.1 presents a summery of findings as monitored by the Study Team. A detail data is shown in page K-6 through K-45.

TABLE K.1 SUMMARY OF DISTRIBUTED WATER QUALITY IN BALARA SERVICE AREA

NO.	DISTRICT		Temp. (°C)	Res. Chlorine (mg/l)	Turbidity (mg/l)	pH	Conductivity (uS/cm)	Coliform (count/ml)
I	QUEZON CITY	MAX	31.5	1.3	14.5	7.24	164.6	15
		MIN	26.4	0.0	2.0	6.30	119.3	ND
		AVE	28.4	0.4	6.3	6.82	135.5	<1
II	SAN JUAN-MANDALUYONG	MAX	29.5	1.2	15.2	7.16	150.2	ND
		MIN	26.0	0.0	2.3	6.51	118.8	ND
		AVE	27.5	0.5	6.8	6.82	132.5	ND
III	MANILA	MAX	31.4	1.2	10.2	7.02	154.0	ND
		MIN	26.8	0.0	2.9	6.50	123.1	ND
		AVE	27.7	0.2	6.1	6.77	135.8	ND
IV	MAKATI	MAX	30.0	1.3	29.3	7.23	153.7	ND
		MIN	26.3	0.1	2.9	6.30	123.3	ND
		AVE	27.6	0.7	7.2	6.83	134.9	ND

The monitored results showed that residual chlorine was sufficiently detected to be ranging from an average of 0.20 to 0.70 in all parts of the study area. This is stressed further depending on the proximity of the sampling point from the trunk main where high residual chlorine levels were monitored.

However there are some service pipelines which have been monitored to contain only traces of residual chlorine. Such a situation occasionally occurs due to changes in the distribution pressure. Almost all of the trace level of residual chlorine was monitored in areas where there is low water pressure and the service pipelines are antiquated, specifically the Makati and Manila areas. In Marikina and Pasig, where numerous construction developments are taking place, some areas were observed to be low in residual chlorine due to the shortage of water supply.

Also it has been noted that power interruptions in the Balara plant drastically affects the residual chlorine concentration in the distribution lines. Booster pumps for the chlorinators are inoperational during power failures. At such time ,residual chlorine was detected to be zero at areas near the Plant.

Sample collection procedures from faucets demand special attention. It could cause erroneous results especially in turbidity, color, and residual chlorine if the faucet is not allowed to flush stagnant water from the service line. The flushing time needs usually 2 to 5 min. When the water temperature begins to drop, sample collection can start.

A cross check of results in residual chlorine of MWSS field work, as shown in Table K.2 and K.3 (Nos.in the Table is referred to the MWSS identification No.), indicated that the results by The Study Team is generally lower level than that of MWSS. This was derived from a MWSS residual chlorine analysis kit of which color comparator is obsolete and not clear.

Accordingly, it is evident that chlorination itself is carried out perfectly through the trunk main, a marked improvement as compared to 1989, which is a direct benefit derived from the "Manila Water Supply Rehabilitation Projects I and II ". Other qualitative factors analyzed in the activity including turbidity, pH, conductivity, and coliform, turbidity indicated values over that of the National Standard for Drinking Water.