UIC TECHNICAL ADVISORY
COMMITTEE

The City of Fort Lauderdale
Injection Well Program

April 9, 1985

Hazen and Sawyer, P.C.
Engineers

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Fort Lauderdale Injection Well Program Status

In March 1984 the Fort Lauderdale injection wells commenced operation. The pertinent features of each well are summarized below:

	Dia. Inches	Total Depth - Feet
Well No. 1	24	3,520
Well No. 2	24	3,525
Well No. 3	24	4,010
Well No. 4 (Future)	--	--
Well No. 5 (Original Test Well)	24	3,480

The hydraulic characteristics of each individual well (flow versus wellhead pressure) are plotted on Exhibit A. Operating techniques are discussed in later sections.

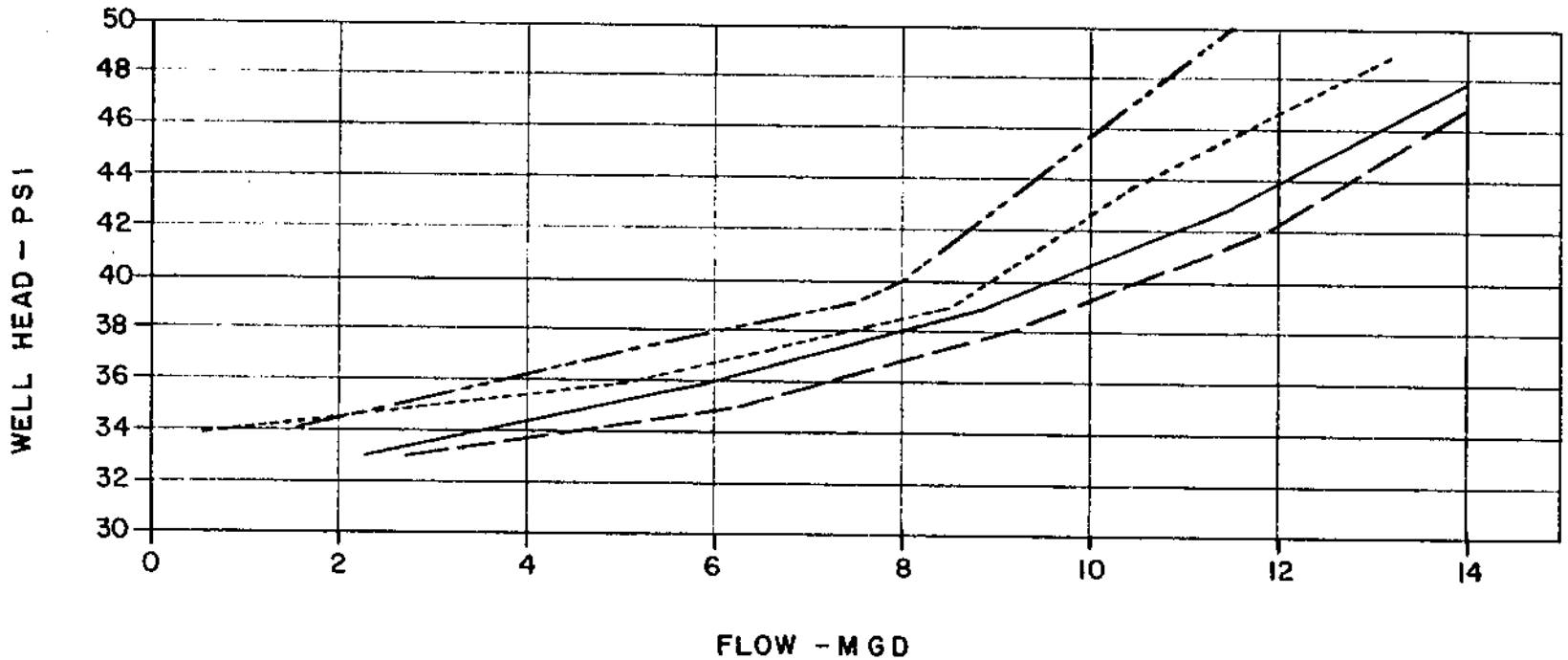
Contract 100-H, the last construction contract for the G.T. Lohmeyer WWTP and effluent disposal system is to bid shortly. Plans and specifications are being printed for DER review. Key effluent disposal system items to be included in this contract are listed below.

A. Bottom hole test pressure survey over the entire well flow range (0-25 mgd) for each injection well.

B. Television survey of each well.

C. Injection well backflush system.

These items should be complete over the next 12 months.



WELL No. 1
WELL No. 2
WELL No. 3
WELL No. 5

FORT LAUDERDALE, FLORIDA
INJECTION WELLS
HYDRAULIC CHARACTERISTICS

EXHIBIT A

Additional Testing on Fort Lauderdale Injection Wells

Bottom Hole Test Pressure

The Contractor shall perform a bottom hole pressure test on each of the four existing injection wells. The Contractor shall employ the services of a company specializing in furnishing and operating the necessary equipment. The equipment shall consist of a pressure gauge and surface recording system capable of accurately measuring and detecting pressure changes of as little as 0.01 psi (pounds per square inch) such as Lynes RES-300 or Geophysical Research Corporation EPA-520 system. The pressure gauge shall be lowered into the hole to a depth of approximately 2825 feet below ground level.

At this time, the gradual opening of the well inlet valve shall be initiated to effect a flow variation into the well. Pressure readings shall be taken corresponding to the influent flows. Pressure-flow readings shall be made over the entire well operating range (0-25 mgd).

The Contractor should be aware that the wells are under pressure and that a wireline stripper assembly and any other equipment necessary to keep any flow from the wells under control at all times must be used. The Contractor shall include the equipment rental, operation charges, wireline rental or service charges, and the cost of all necessary equipment to control well pressure in his cost for each test.

Television Survey

The Contractor shall have a television survey performed on each of the four existing injection wells. The survey shall have a level of clarity acceptable to the Engineer. The survey shall be conducted from the top of the 24-inch diameter casing to the bottom of the borehole. The depth of the wells are: Well 1 - 3520 feet, Well 2 - 3525 feet, Well 3 - 4010 feet and Well 5 - 3480 feet. The Contractor should be aware that the wells are under pressure and that a wireline stipper assembly and any other equipment necessary to keep any flow from the wells under control at all times must be used. Under no conditions shall be wells be allowed to flow.

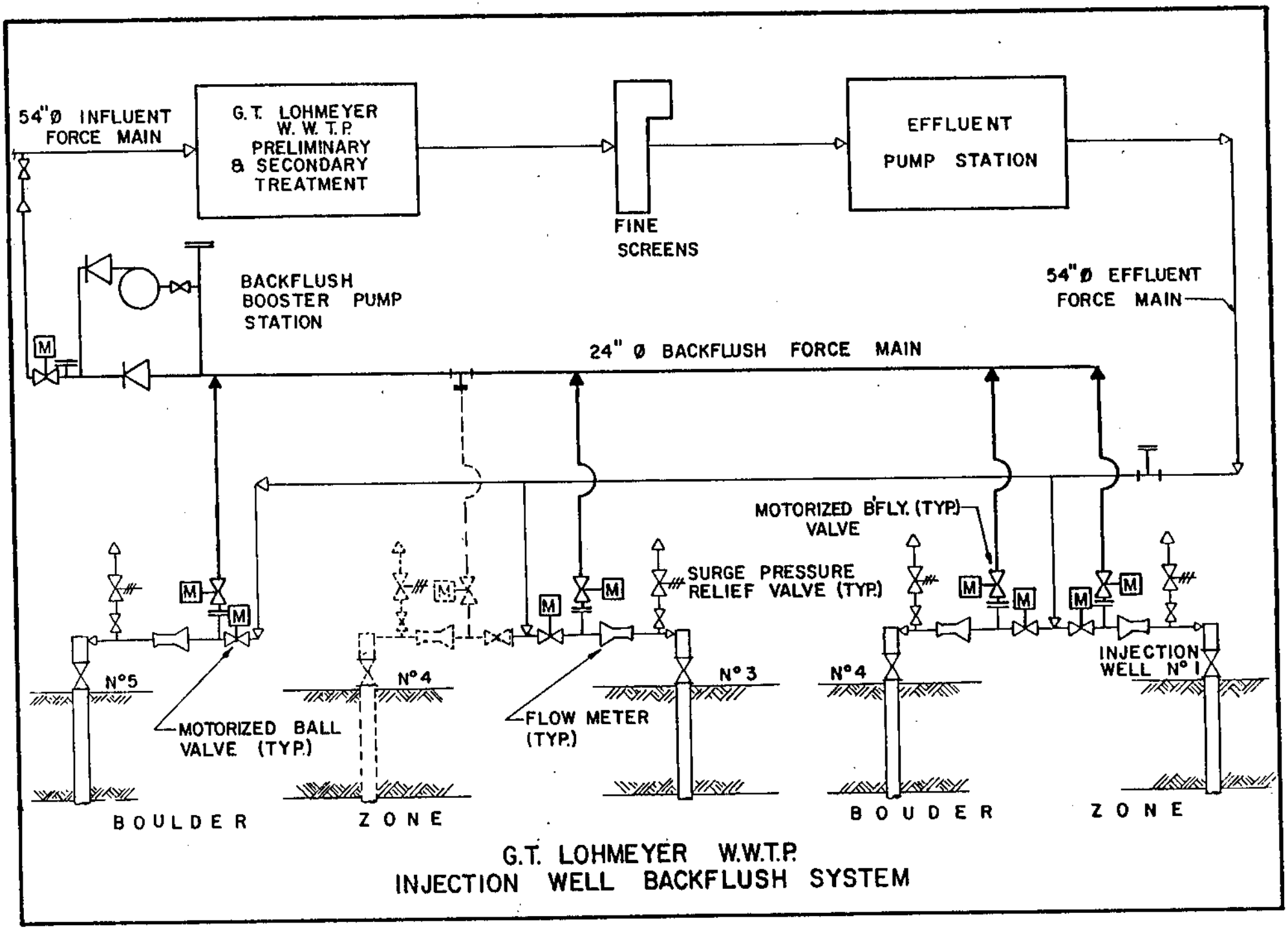
The television camera shall be centralized within the borehole. Included in the price for the television survey shall be the cost of nine copies of the video tapes in the cost of each survey.

If the picture clarity is not acceptable to the Engineer, the Contractor shall make arrangements to pump 164,000 gallons of clear water into the well and repeat the testing as specified. The Contractor shall be reimbursed for this work as outlined in the proposal.

Injection Well Backflush System

The UIC Technical Advisory Committee had agreed upon a backflush system for the Fort Lauderdale well system. A flow diagram is shown on Exhibit B. This arrangement allows any individual well to be taken out of operation and isolated. The remaining three wells will continue accepting treated effluent. The isolated injection well will be allowed to back flow. The returning effluent from the well will be piped to the wastewater plant influent. Backflushing each injection once or twice a month (2-4 hours) will extend the ultimate life of the well. Normally a well will backflush from 10-13 mgd due to the existing static pressure (fresh water versus salt water) of the Boulder Zone. A booster pump has been added which can increase the backflow rate of an individual injection well to 15 mgd. This should provide adequate velocity in the well casing to carry solids to the surface. Normally, wells will be backflushed in the early morning hours during periods of low flow at the G.T. Lohmeyer Plant.

In October 1984, plant flows averaged 22 mgd. Solids quantities to the Boulder Zone in all four wells totalled 60 tons during this period. While the organic content of these solids should continue to degrade, the inorganic portion will remain in the Boulder Zone. Over 20 years each individual well can expect to receive some 3,600 tons ± of solids. Backflushing coupled with periodic rehabilitation work will be required to keep the system operating. The backflush system is a simple method to help extend well life.



G.T. LOHMEYER W.W.T.P.
INJECTION WELL BACKFLUSH SYSTEM

EXHIBIT B

HAZEN AND SAWYER, P.C.
ENGINEERS

5950 WASHINGTON STREET · HOLLYWOOD, FLORIDA 33023 · (305) 987-0066
(305) 625-4101

April 8, 1985

MEMORANDUM

TO: P.E. Robinson

FROM: G.W. Bors

SUBJECT: Interim Wellfield Monitoring System
Fort Lauderdale, Florida

As part of the G.T. Lohmeyer WWTP expansion, a distributed digital monitoring and control system was furnished and installed by Johnson Controls, Inc. in the fall of 1984 to serve the treatment plant as well as the injection well system. Among its functions, the system is capable of continuous monitoring of individual injection well flows and pressures as well as providing various reporting calculations (sum, average, maximum, minimum, etc.). This system is now providing the required reporting data to local and state agencies.

To bridge the gap between start-up of the injection wells in late March, 1984 and start-up of the Johnson Controls system in December, 1984, an Apple II+ personal computer was installed by Hazen and Sawyer at the wellfield control building to continuously monitor and record individual injection well pressures and flows.

Key features are summarized below:

(1) Individual well pressures and flows are updated approximately once per second and displayed on the CRT monitor.

(2) At preset but user-adjustable time increments (initially set to 10 minutes) the system will automatically write the current data to a diskette as well as to a data logger (printer). Recorded data includes: date, time, individual well flows and individual well pressures.

(3) Diskette containing data was replaced weekly and returned to our office for data analysis and monthly report generation.

(4) Since the data is in standard Apple format, the capability to perform virtually any type of special analysis is available.

(5) The monthly reports included: average daily flow down each well, total monthly flow down each day, maximum day, minimum day, flow and pressure recorded at each well during the month.

Safeguards included automatic restart and log-on after power interruption well well as continuous hard copy (printout) should the data disk fill up prior to replacement. A sample of report printouts is attached.

GWB/rw

INJECTION WELL MONITORING SYSTEM - FORT LAUDERDALE, FLORIDA

OCTOBER 1984

WELL NO. 1

DATE	FLOW - MGD			PRESSURE - PSI		
	MAXIMUM	MINIMUM	TOTAL	MAXIMUM	MINIMUM	AVERAGE
10/01/84	9.70	0.70	5.69	45.00	32.00	37.50
10/02/84	10.80	1.30	7.27	43.00	33.00	37.30
10/03/84	15.10	0.50	6.89	51.00	32.00	36.64
10/04/84	26.90	0.00	7.00	76.00	32.00	36.10
10/05/84	10.20	3.20	6.97	41.00	33.00	36.83
10/06/84	13.60	0.00	6.64	40.00	33.00	35.70
10/07/84	9.20	1.50	6.63	40.00	32.00	36.16
10/08/84	15.10	1.10	6.76	50.00	32.00	36.55
10/09/84	11.30	3.20	6.95	43.00	33.00	36.60
10/10/84	9.50	3.80	6.81	41.00	33.00	37.38
10/11/84	12.80	3.10	6.95	46.00	35.00	38.13
10/12/84	8.80	1.00	6.76	40.00	33.00	37.80
10/13/84	7.90	3.10	6.53	39.00	34.00	37.40
10/14/84	8.60	3.80	6.65	40.00	35.00	37.41
10/15/84	9.60	3.70	6.70	41.00	34.00	37.68
10/16/84	8.80	3.80	6.80	40.00	0.00	37.41
10/17/84	8.90	3.20	6.81	40.00	0.00	37.33
10/18/84	8.80	3.60	6.67	40.00	34.00	37.55
10/19/84	8.80	3.20	6.55	40.00	0.00	35.77
10/20/84	8.70	4.50	6.76	40.00	35.00	37.57
10/21/84	8.80	3.10	6.54	40.00	34.00	37.22
10/22/84	9.70	3.10	6.75	41.00	34.00	37.70
10/23/84	9.20	1.30	6.69	45.00	34.00	37.85
10/24/84	9.60	3.30	6.71	41.00	34.00	37.65
10/25/84	9.10	3.50	6.63	41.00	34.00	37.47
10/26/84	9.60	3.60	6.85	41.00	34.00	37.72
10/27/84	8.80	4.10	6.72	40.00	34.00	37.52
10/28/84	8.80	3.80	6.55	40.00	34.00	37.23
10/29/84	9.10	3.90	6.56	41.00	35.00	37.51
10/30/84	9.50	4.00	6.73	41.00	35.00	36.70
10/31/84	13.70	1.40	6.57	53.00	29.00	37.17

INJECTION WELL MONITORING SYSTEM - FORT LAUDERDALE, FLORIDA

OCTOBER 1984

WELL NO. 2

DATE	FLOW - MGD			PRESSURE - PSI		
	MAXIMUM	MINIMUM	TOTAL	MAXIMUM	MINIMUM	AVERAGE
10/01/84	9.70	0.00	5.40	44.00	32.00	37.00
10/02/84	10.60	0.00	6.89	42.00	32.00	36.50
10/03/84	15.20	0.00	6.47	51.00	32.00	36.06
10/04/84	25.40	0.00	6.70	76.00	32.00	34.90
10/05/84	9.80	2.70	6.61	40.00	33.00	36.24
10/06/84	10.10	0.00	6.22	39.00	34.00	34.07
10/07/84	9.10	0.00	6.23	39.00	31.00	35.31
10/08/84	15.00	0.00	6.36	50.00	31.00	35.76
10/09/84	11.10	2.60	6.58	41.00	32.00	35.86
10/10/84	9.20	3.20	6.44	41.00	0.00	36.86
10/11/84	12.10	2.50	6.58	46.00	34.00	37.96
10/12/84	8.60	0.00	6.35	40.00	33.00	37.67
10/13/84	7.40	2.30	6.12	39.00	34.00	37.24
10/14/84	8.30	3.40	6.70	40.00	34.00	37.32
10/15/84	9.00	3.20	6.65	41.00	34.00	37.51
10/16/84	8.30	3.20	6.34	40.00	0.00	37.20
10/17/84	8.50	2.60	6.43	40.00	0.00	37.18
10/18/84	8.30	3.00	6.29	40.00	34.00	37.34
10/19/84	8.60	2.60	6.15	40.00	0.00	35.66
10/20/84	8.30	4.10	6.38	40.00	35.00	37.46
10/21/84	8.40	2.40	6.15	40.00	33.00	37.19
10/22/84	9.30	2.60	6.38	41.00	34.00	37.54
10/23/84	9.00	0.00	6.31	43.00	33.00	37.56
10/24/84	9.50	2.70	6.33	41.00	34.00	37.54
10/25/84	9.00	2.90	6.29	41.00	34.00	37.37
10/26/84	9.20	3.00	6.47	41.00	34.00	37.51
10/27/84	8.50	3.60	6.34	40.00	34.00	37.43
10/28/84	8.50	3.30	6.16	40.00	34.00	37.07
10/29/84	8.80	3.40	6.16	41.00	34.00	37.35
10/30/84	9.10	3.30	6.31	41.00	34.00	36.50
10/31/84	13.60	0.00	6.16	47.00	33.00	37.10

INJECTION WELL MONITORING SYSTEM - FORT LAUDERDALE, FLORIDA

OCTOBER 1984

WELL NO. 3

DATE	FLOW - MGD			PRESSURE - PSI		
	MAXIMUM	MINIMUM	TOTAL	MAXIMUM	MINIMUM	AVERAGE
10/01/84	7.90	0.00	3.71	44.00	32.00	37.00
10/02/84	9.00	0.00	4.58	42.00	32.00	36.60
10/03/84	13.70	0.00	4.46	51.00	32.00	36.40
10/04/84	24.70	0.00	4.40	77.00	26.00	37.00
10/05/84	7.70	0.00	4.15	40.00	33.00	36.50
10/06/84	11.30	0.00	3.83	39.00	33.00	34.50
10/07/84	6.90	0.00	3.68	39.00	32.00	35.97
10/08/84	13.40	0.00	3.97	51.00	32.00	36.35
10/09/84	9.20	0.00	4.14	43.00	33.00	36.87
10/10/84	7.30	0.00	4.03	41.00	34.00	37.61
10/11/84	10.80	0.00	4.23	46.00	34.00	37.87
10/12/84	6.60	0.00	4.00	40.00	33.00	37.64
10/13/84	5.50	0.00	3.70	39.00	34.00	37.19
10/14/84	6.30	0.00	4.05	40.00	35.00	37.32
10/15/84	7.10	0.00	4.55	40.00	34.00	37.45
10/16/84	6.50	0.00	4.06	40.00	0.00	36.90
10/17/84	6.60	0.00	4.11	40.00	0.00	37.06
10/18/84	6.50	0.00	3.93	40.00	34.00	37.31
10/19/84	6.50	0.00	3.78	40.00	0.00	35.54
10/20/84	6.60	0.00	3.98	40.00	34.00	37.27
10/21/84	6.60	0.00	3.78	40.00	33.00	37.03
10/22/84	7.40	0.00	3.96	41.00	34.00	37.47
10/23/84	7.10	0.00	3.99	43.00	33.00	37.46
10/24/84	7.50	0.00	3.99	41.00	33.00	37.40
10/25/84	7.10	0.00	3.90	40.00	34.00	37.26
10/26/84	7.70	0.00	4.16	41.00	34.00	37.51
10/27/84	6.80	0.00	3.99	40.00	34.00	37.33
10/28/84	6.70	0.00	3.80	40.00	34.00	37.07
10/29/84	7.10	0.00	3.75	41.00	34.00	37.22
10/30/84	7.20	0.00	3.82	41.00	34.00	36.40
10/31/84	12.20	0.00	3.88	47.00	32.00	37.04

INJECTION WELL MONITORING SYSTEM - FORT LAUDERDALE, FLORIDA

OCTOBER 1984

WELL NO. 5

DATE	FLOW - MGD			PRESSURE - PSI		
	MAXIMUM	MINIMUM	TOTAL	MAXIMUM	MINIMUM	AVERAGE
10/01/84	7.70	0.00	3.24	41.00	32.00	37.00
10/02/84	8.50	0.00	5.56	43.00	32.00	37.00
10/03/84	12.10	0.00	5.23	52.00	32.00	36.76
10/04/84	24.70	0.00	5.40	79.00	25.00	37.30
10/05/84	7.60	2.20	5.32	41.00	33.00	36.88
10/06/84	30.10	0.00	5.08	40.00	34.00	34.70
10/07/84	7.20	1.00	5.02	39.00	32.00	35.99
10/08/84	12.00	0.00	5.12	51.00	32.00	36.42
10/09/84	8.90	2.40	5.29	43.00	33.00	36.90
10/10/84	7.70	2.90	5.18	41.00	34.00	37.53
10/11/84	9.80	2.50	5.29	46.00	34.00	37.76
10/12/84	7.10	0.00	5.15	40.00	33.00	37.50
10/13/84	6.30	2.10	4.95	39.00	34.00	37.04
10/14/84	6.90	3.10	5.05	40.00	34.00	37.20
10/15/84	7.50	2.40	5.00	40.00	34.00	37.32
10/16/84	6.90	2.70	5.10	40.00	0.00	35.00
10/17/84	6.90	2.40	5.19	40.00	0.00	36.88
10/18/84	7.00	2.50	5.07	40.00	33.00	37.10
10/19/84	7.10	2.20	4.96	40.00	0.00	35.44
10/20/84	6.90	3.20	5.15	39.00	34.00	37.14
10/21/84	6.70	2.30	4.99	40.00	33.00	36.93
10/22/84	7.60	2.10	5.13	41.00	34.00	37.28
10/23/84	9.20	0.00	5.09	43.00	33.00	37.39
10/24/84	7.40	2.10	5.10	41.00	33.00	37.25
10/25/84	7.50	2.50	5.07	40.00	33.00	37.05
10/26/84	7.60	2.40	5.25	41.00	33.00	37.38
10/27/84	6.90	3.00	5.16	40.00	33.00	37.17
10/28/84	6.70	2.90	5.02	40.00	34.00	36.85
10/29/84	7.30	3.00	5.01	41.00	33.00	37.10
10/30/84	7.30	3.00	5.14	41.00	33.00	36.10
10/31/84	10.80	0.00	5.01	49.00	33.00	36.50

INJECTION WELL MONITORING SYSTEM - FORT LAUDERDALE, FLORIDA

OCTOBER 1984

DATE	TOTAL FLOW-MG	EFFLUENT TSS-mg/l	TOTAL SOLIDS - lbs. WELL 1	WELL 2	WELL 3	WELL 5	TOTAL
10/01/84	18.04	17.00	806.73	765.61	526.00	459.37	2557.71
10/02/84	24.30	21.00	1273.27	1206.71	802.14	973.78	4255.90
10/03/84	23.05	10.00	574.63	539.60	371.96	436.18	1922.37
10/04/84	23.50	20.00	1167.60	1117.56	733.92	900.72	3919.80
10/05/84	23.05	15.00	871.95	826.91	519.17	665.53	2883.56
10/06/84	21.77	16.00	866.04	830.00	511.08	677.88	2904.99
10/07/84	21.56	15.00	829.41	779.37	460.37	628.00	2697.16
10/08/84	22.21	15.00	845.68	795.64	496.65	640.51	2778.47
10/09/84	22.96	12.00	695.56	658.53	414.33	529.42	2297.84
10/10/84	22.46	18.00	1022.32	966.77	604.98	777.62	3371.70
10/11/84	23.05	17.00	985.37	932.91	599.73	750.02	3268.03
10/12/84	22.26	17.00	958.43	900.30	567.12	730.17	3156.02
10/13/84	21.30	16.00	871.36	816.65	493.73	660.53	2842.27
10/14/84	22.45	21.00	1164.68	1173.44	709.32	884.46	3931.89
10/15/84	22.90	24.00	1341.07	1331.06	910.73	1000.80	4583.66
10/16/84	22.30	26.00	1474.51	1374.77	880.37	1105.88	4835.53
10/17/84	22.54	25.00	1419.89	1340.66	856.94	1082.12	4699.59
10/18/84	21.96	25.00	1390.70	1311.47	819.41	1057.10	4578.66
10/19/84	21.44	28.00	1529.56	1436.15	882.71	1158.26	5006.67
10/20/84	22.27	26.00	1465.84	1383.44	863.02	1116.73	4829.03
10/21/84	21.46	40.00	2181.74	2051.64	1261.01	1664.66	7159.06
10/22/84	22.22	-----	0.00	0.00	0.00	0.00	0.00
10/23/84	22.08	31.00	1729.63	1631.39	1031.57	1315.97	5708.56
10/24/84	22.13	26.00	1455.00	1372.60	865.19	1105.88	4798.67
10/25/84	21.89	30.00	1658.83	1573.76	975.78	1268.51	5476.88
10/26/84	22.73	29.00	1656.74	1564.83	1006.14	1269.77	5497.48
10/27/84	22.21	25.00	1401.12	1321.89	831.92	1075.86	4630.79
10/28/84	21.53	21.00	1147.17	1078.86	665.53	879.20	3770.76
10/29/84	21.48	22.00	1203.63	1130.24	688.05	919.23	3941.15
10/30/84	22.00	24.00	1347.08	1263.01	764.61	1028.82	4403.52
10/31/84	21.62	28.00	1534.23	1438.48	906.06	1169.94	5048.70
TOTALS -	686.72		36889.74	34914.24	22019.52	27932.91	121756.41