C-#85

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AQUIFER PERFORMANCE TEST AT TOWN OF HIGHLAND BEACH, FLORIDA OCTOBER 19-21, 1978

Palm Beach County

NOVEMBER 1978

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Environmental Engineers
Fort Lauderdale - Atlanta - Orlando - Clearwater
A CAMP DRESSER & MCKEE FIRM

RSBW 306-78-54

SUMMARY

An aquifer performance test was conducted in the Highland Beach west well field on October 19-21, 1978. On October 20-21, 1978, Well Number 4 was pumped at a constant rate of 322 gallons per minute for a period of 1,484 minutes. Water-level fluctuations were measured in two observation wells and the resulting data analyzed for aquifer coefficients. Delayed yield from storage in a water-table aquifer was used as the applicable theory with the resulting transmissivity being about 131,480 gpd/ft, the early storage coefficient being about 5.69×10^{-5}, the late storage coefficient being about 0.00646, and the delay index being about 873 minutes.

Tidal phenomena, passing railroad trains, and pumpage from Highland Beach Well Number 1 effected the water levels in the west field during the aquifer performance test.

The thickness of the shallow aquifer at the test site is not accurately known. When that thickness value becomes available, this test should be reevaluated by the South Florida Water Management District staff.

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ACKNOWLEDGEMENTS

Numerous individuals helped during the data collection phases of the aquifer performance test. Their help was greatly appreciated. Mr. Jack Fisher and Mr. Dan Cotter of the United States Geological Survey of the Miami office provided much needed help during the beginning of the pumping test when rapid water-level measurements were necessary. Of particular mention was the patience and help of Mr. Jesse Arney, operator of the Town of Highland Beach Utilities Department. Mr. Arney went beyond the call of duty in cooperating with all concerned.

The officer-in-charge of this study was Mr. Arthur W. Saarinen, Jr. Mr. Thomas A. Prickett was the overall Project Director assisted by Ms. Beverly L. Herzog. Mr. John L. Roberts served as Project Manager. Mr. Ernie C. Sturtz also assisted in the study.

INTRODUCTION

The South Florida Water Management District (SFWMD) required the Town of Highland Beach to conduct an aquifer performance test (APT) as a special condition to the town's consumptive use permit. The purpose of the APT requirement was to provide necessary aquifer coefficients for a determination of safe yield and related salt-water encroachment positions. Accordingly, such an APT was conducted in the town's western well field on October 19, 20, and 21, 1978. The APT was conducted in the town's western well field since this is the area where present pumpage takes place and where future well development is contemplated.

The APT consisted of five basic segments. The first segment pertained to accurately determining pumping rates from all of the wells involved (#4, 5, and 1), each by themselves and then in a combination of Wells Number 4 and 1 together. The second segment consisted of collecting information on barometric pressure records, tidal fluctuations, and nearby groundwater pumpage that conceivably would affect water levels during the total APT. The third segment consisted of measuring water-level fluctuations in wells of the western field during a period of no pumping. The fourth segment consisted of pumping Well Number 4 at the rate of 322 gallons per minute (gpm) and measuring the water-level fluctuations in Wells Number 4 and 5 and at an observation well located between Wells 4 and 5. The fifth and final segment of the APT involved measuring water levels during the recovery period when Well Number 4 was shut off.

The details of the APT follows along with a copy of the basic data. Also included in this report is an analysis of those data with the calculation of various aquifer coefficients desired by the SFWMD.

AQUIFER PERFORMANCE TEST, PROCEDURES, AND DATA

Highland Beach presently has two well fields. The east well field consists of three wells and the west well field has two. The east field is relatively near salt water canals (about 600 feet to the nearest canal) and therefore is susceptable to salt-water encroachment. This fact dictated that pumpage should be moved westward wherein two wells (numbers 4 and 5) were drilled at a distance of about 1600 feet from the nearest salt-water canal. Pumpage has recently been shifted to these two new western wells. The eastern well field is used only occasionally when either Well Number 4 or 5 needs maintenance.

Highland Beach has requested an increase in allowable pumpage from the SFWMD. That increased pumpage would come from Wells Number 4 and 5 and from additional wells drilled in the west field. The APT was therefore conducted in the west field.

Highland Beach is contemplating requesting an increase in allowable pumpage from the SFWMD. That increased pumpage would either come from Wells Number 4 and 5 or from an additional well drilled in the west field. The APT was therefore conducted in the west field.

The overall procedure for the APT therefore involved measuring water level fluctuations in the west field due to prescribed changes in pumpage rates from the wells there. These fluctuations and the subsequent analyses provide the means for determining aquifer properties of interest.

Three wells were used in the APT. Well Number 4 was used as the pumped well and Well Number 5 and a nearby 4-inch test well were used as observation wells. Logs of these wells are given in Appendix A of this report.

A. Calibration Of Pumping Rates.

Well Number 4 was chosen as the pumped well for the APT. First, the pumping rate from Well Number 4 was determined by shutting off all Highland Beach wells and then pumping number 4 alone into the treatment plant ground level reservoir. The dimensions of the treatment plant reservoir were known and several water level measurements, with time, were taken to give a pumping rate of 322 gpm. In addition, an in-line flow meter was calibrated to this flow rate so that further flow rates could be directly read from this meter.

Next, the flow of Well Number 1 was measured by the same method as above and indicated that well number 1, by itself, pumped 393 gpm.

It was expected that the ground plus elevated storage capacity of Highland Beach would not be adequate to maintain fire protection without, sometime during the APT, turning Well Number 1 on in addition to Number 4. To calibrate the the in-line flow meter and to assure that pumpage from one well would not effect the other (due to common piping connections at the treatment plant) both Wells 1 and 4 were calibrated, as above, when pumping together. This calibration run showed that Wells 1 and 4 running together did not discernibly affect one anothers individual pumping rate.

It should be mentioned that all Highland Beach wells pump their waters to the ground level reservoir beneath the treatment plant at atmospheric pressure. Water is then discharge from this open reservoir to the distribution system via separate transfer pumps. Therefore, changes in distribution system pressure in no way affects the pumping rates from the wells.

B. Water Levels Prior To Pumping.

All pumpage at Highland Beach was stopped at 8:00 PM on the evening of October 19, 1978. A Stevens Type F water level recorder was set up to record water levels in an existing 4-inch diameter, 105 foot deep test well located between Well Number 4 and 5. This 4-inch diameter observation well measured 135 feet north of Well Number 4 and 103 feet south of Well Number 5. All three wells are west of and on a line parallel with the Florida East Coast Railroad tracks.

The recorder operated overnight and provided the trend to water levels in the aquifer prior to pumping Well Number 4. The water level data taken from that recorder are given in Table 1.

During the morning of October 20,1978 additional nonpumping water levels were measured in Wells Number 4 and 5 to further establish prepumping aquifer conditions. Water levels in Wells 4 and 5 prior to pumping can be found in Tables 2 and 3 respectively. Water levels before pumping were plotted on semilog paper using 8 PM October 19, 1978 as the beginning time. The trend listed in Tables 2 and 3 came from that plot extended over the entire time of pumping of Well Number 4. The implication of this trend extention is that the prepumping water level fluctuations are solely attributable to recovery due to turning pumpage off in the west field.

C. Prodution Test Of Well Number 4.

Well Number 4 was turned on at 9:31:15 (9 hours, 31 minutes, and 15 seconds) AM EDST on October 20, 1978 at a constant pumping rate of 322 gpm for a period of 1484 minutes. At 1:30 PM on October 20, 1978 Well Number 1 was needed at that time and was turned on at the

t= 239 min

4" obs WELL

TABLE 1
WELL PRODUCTION TEST — TREND ANALYSIS

Engineer: Prickett--CDM   Test by: Prickett, Herzog
Sturtz, Arney
Owner: Highland Beach   Location: Observation well
Measuring point: 2.77' above cement slab at land surface
Measuring equipment: Stevens Type F recorder

Date	Hour	Time (min)	Water level depth (ft)	Recovery (ft)
10/19	8:00 pm	0	14.380	0
	10:00	120	14.250	0.130
	12:00	240	14.180	0.200
10/20	2:00 am	360	14.145	0.235
	4:00	480	14.107	0.273
	6:00	600	14.083	0.297
	7:45	705	14.073	0.307
	9:31	811	14.822	-.442

← Different Reference.

▲ lowest WT

Obs — pump well #7

TABLE 2
WELL PRODUCTION TEST — PUMPING

Engineer: Prickett--CDM Test by: Prickett, Herzog, Sturtz, Arney
Owner: Highland Beach Location: Pumping well (#4)
Measuring point: 1' 11½" above land surface
Measuring equipment: airline or steel tape (inches and feet) and chalk

Date	Hour	Time (min)	Water level Held (ft)	Water level Wet	Depth (ft)	Draw-down (ft)	Trend (ft)	Corrected drawdown (ft)	Remarks
.0/20	8:58 am	0	17	1' 4 7/8"	15.59				
	9:00	0	17	1' 4 5/8"	15.61	0			
	9:31:15	0							pump started
	9:48:30	17.25	17	5'	--				invalid readings) tape stuck
	9:51:00	19.75	22	--	--				
	10:08	37			27	11.39	0.003	11.393	airline
	10:17	46	20	--	--				tape wet, no readin
	10:34	63			27	11.39	0.007	11.397	airline
	11:10	99			27	11.39	0.011	11.401	airline
	11:56	145			27	11.39	0.017	11.407	airline
	12:57 pm	206			27	11.39	0.023	11.413	airline
	1:59	268			26½	10.89	0.030	10.920	airline
	3:08	337			27	11.39	0.035	11.425	airline
	4:06	395			26½	10.89	0.041	10.931	airline
	5:12	461			27	11.39	0.048	11.438	airline
	5:28	477			27	11.39	0.049	11.439	airline
	6:18	527			27	11.39	0.053	11.443	airline
	7:02	571			27	11.39	0.053	11.443	airline
	8:36	633			27	11.39	0.059	11.449	airline
	9:55	744			27	11.39	0.066	11.456	airline
	11:52	861			26½	10.89	0.075	10.965	airline
.0/21	2:09	998			27	11.39	0.082	11.472	airline
	3:55	1104			27½	11.89	0.087	11.977	airline
	5:33	1202			27½	11.89	0.091	11.981	airline
	7:08	1297			27½	11.89	0.097	11.987	airline
	9:01	1410			28	12.39	0.101	12.491	airline
	9:44	1453			27	11.39	0.103	11.493	airline

TABLE 3
WELL PRODUCTION TEST — PUMPING Obs well 238' to pumping well

Date: October 20, 1978 Engineer: Prickett--CDM Test by: Prickett, Herzog, Arney, Sturtz, Cotter

Owner: Highland Beach Location: Well #5
Measuring point: 1' 11½" above land surface Measuring equipment: steel tape & chalk

Hour	Time (min)	Held (ft)	Water level Wet	Depth (ft)	Draw-down (ft)	Trend (ft)	Corrected drawdown (ft)	Remarks
8:40 pm	0	18	3' 1¼"	14.90				
8:43	0	17	2' 1 3/4"	14.85				
	0	17	2' 1 3/4"	14.85				
	0	17	2' 2"	14.83				
	0	17	2' 3/4"	14.94				
	0	18	3' 1 3/4"	14.85				
9:02:40		17	2' 1 7/8"	14.84	0	0	0	
9:31:15					14.84			pump started 811 min recovery
9:32:30	1.25	17	1' 8"	15.33	0.49	0	0.49	
9:33:00	1.75	17	1' 6"	15.50	0.66	0	0.66	
9:34:00	2.75	17	1' 5 7/8"	15.51	0.67	0	0.67	
9:35:00	3.75	17	1' 5"	15.58	0.74	0	0.74	
9:36:00	4.75	17	1' 4 7/8"	15.59	0.75	0	0.75	
9:37:00	5.75	17						reading missed
9:38:00	6.75	17	1' 4½"	15.62	0.78	0.001	0.78	
9:39:00	7.75	17	1' 4 3/8"	15.64	0.80	0.001	0.80	
9:40:00	8.75	17	1' 4 3/8"	15.64	0.80	0.001	0.80	820 min Recovery
9:42:00	10.75	17	1' 4½"	15.62	0.78	0.002	0.78	
9:45:00	13.75	17	1' 3 3/4"	15.69	0.85	0.002	0.85	
9:54:00	22.75	17	1' 3¼"	15.73	0.89	0.003	0.89	
9:56:00	24.75	17	1' 3 3/8"	15.72	0.88	0.004	0.88	Dan Cotter read
10:01	29.75	17	1' 3¼"	15.73	0.89	0.004	0.89	
10:13	41.75	17	1' 3"	15.75	0.91	0.004	0.91	
10:27:00	55.75	17	1' 2 3/4"	15.77	0.93	0.006	0.94	
10:31:00	59.75	17	1' 2 3/4"	15.77	0.93	0.007	0.94	
10:40:00	68.75	17	1' 2½"	15.79	0.95	0.008	0.96	
10:50:00	78.75	17	1' 2 3/8"	15.80	0.96	0.009	0.97	
11:05:00	93.75	17	1' 2 3/8"	15.80	0.96	0.010	0.97	
11:54	143	17	1' 2 1/8"	15.80	0.96	0.016	0.98	
12:55 pm	204	17	1' 2¼"	15.81	0.97	0.023	0.99	
1:55	264	17	1' 2 3/8"	15.80	0.96	0.030	0.99	
3:05	334	17	1' 2 3/8"	15.80	0.96	0.035	1.00	
4:03	392	17	1' 2 7/16"	15.80	0.96	0.041	1.00	
5:06	455	17	1' 2 7/16"	15.80	0.96	0.047	1.01	
5:23	472	17	1' 1 7/8"	15.84	1.00	0.048	1.05	
6:18	527	17	1' 1 3/4"	15.85	1.01	0.053	1.06	
6:50	559	17	1' 1 3/8"	15.89	1.05	0.054	1.10	
8:32	629	17	1' 1 1/8"	15.91	1.07	0.059	1.13	
10:02	751	17	1/ 1 3/8"	15.89	1.05	0.066	1.12	
11:48	857	17	1' 1¼"	15.90	1.06	0.073	1.13	
2:06 am	995	17	1' 1½"	15.88	1.04	0.082	1.12	date change to 10/21
3:42	1091	17	1' 1 1/8"	15.91	1.07	0.086	1.16	
5:40	1209	17	1' ½"	15.96	1.12	0.092	1.21	
7:14	1303	17	1' 1/8"	15.99	1.15	0.097	1.25	
9:40	1449	17	10 3/4"	16.10	1.26	0.103	1.36	820+720 = 1540

constant rate of 393 gpm. Well Number 1 remained on at that rate until after the completion of the remainder of the total APT.

Table 4 gives values of the in-line flow-rate meter readings taken during the test. These readings are accurate only to the nearest 100 gallons since that is the smallest division that can be read. Small apparent variations in pumpage rate from this meter may not be meaningful. All wells are electric motor driven with free discharge at the treatment plant. Therefore, there is no reason to believe that pumpage rates significantly changed during the entire APT.

D. Water Level Fluctuations During The Pumping Of Well Number 4.

Pumping of Well Number 4 began at 9:31:15 AM Eastern Daylight Savings Time (9 hours, 31 minutes and 15 seconds) on October 21, 1978. Two watches were used while mwasuring water levels. One watch (#1) was used in measuring levels at Wells Number 4 and 5. The second watch (#2) was used solely at the 4-inch test well where the recorder was operating. Since split second timing was necessary to synchronize water level measurements, these two watches were necessary. As it turned out, the SFWMD requested a record of the original data collected during the test. Table 5 is the water level flucturation observed at the 4-inch observation well with the recorder and watch #2. The beginning of pumping on watch #2 was 9:31:00. If one focuses attention on the time after pumping started column for all wells, this difference in watch settings is not relevant.

The trend listed in Table 5 was constructed in the same manner as Tables 2 and 3.

TABLE 4
WELL PRODUCTION TEST – PUMPING RATES

715

Date: October 20,1978 Owner: Highland Beach Location: Well #4 Engineer: Prickett--CDM
Test by: Prickett, Herzog, Arney, Sturtz Measuring equipment: flow meter at water plant

Time since pumping began (minutes)	Meter reading (gallons)	Apparent pumpage (gallons)	Time interval (minutes)	Apparent pumping rate (gal/min)	Remarks
0	63979900	0			Pump #4 on at 9:31:15 a.m. October 20, 1978
15	63984450	4550	15	303	
30	63989100	4650	15	310	
45	63993500	4400	15	293	
60	63998000	4500	15	300	
75	64002600	4600	15	307	
90	64007200	4600	15	307	
105	64011700	4500	15	300	
120	64016200	4500	15	300	
218	64046000	29800	98	304	
		66100	218	303	Average
				322	Calibrated
239					Wells #1 and 4 on
278	64082000				
347	64133000	51000	69	739	
540	64277000	144000	193	746	
674	64377200	100200	134	748	
764	64444900	67700	90	752	
1007	64627200	182300	243	750	October 21, 1978
1225	64792000	164800	218	756	
1314	64859000	67000	89	753	
1441	64955000	96000	127	756	
		873000	1163	751	Average
				715	Calibrated

obs well 135' to pumping

TABLE 5
WELL PRODUCTION TEST — PUMPING

Engineer: Prickett--CDM Test by: Prickett, Herzog, Sturtz, Arney, Fisher, Cotter
Owner: Highland Beach Location: Observation well
Measuring point: 2.77' above cement slab (≈ ground surface)
Measuring equipment: Stevens Type F recorder

ate	Hour	Time (min)	Water level Held (ft)	Water level Wet	Water level Depth (ft)	Draw-down (ft)	Trend (ft)	Corrected drawdown (ft)	Remarks
)/20	8:45pm		18	3' 20"	14.83	0	0	0	steel tape measurement to set recorder
	9:31:00	0.0			14.822	0	0	0	
	:01				14.822			0	
	:02				14.838	0.015		0.015	
	:03				14.879	0.057		0.057	
	:04				14.950	0.128		0.128	
	:05			15.039	~~15.138~~	~~0.316~~	.217	0.316	
	:06	0.1		15.128	~~15.150~~	~~0.328~~	.306	0.328	
	:07				15.213	0.391		0.391	
	:08				15.267	0.445		0.445	
	:09				15.290	0.468		0.468	
	:10				15.300	0.478		0.478	
	:11				15.306	0.484		0.484	
	:12	0.2			15.325	0.503		0.503	
	:13				15.350	0.528		0.528	
	:14				15.381	0.559		0.559	
	:15				15.420	0.598		0.598	
	:16				15.456	0.634		0.634	
	:17				15.480	0.658		0.658	
	:18	0.3			15.496	0.674		0.674	
	:19				15.498	0.676		0.676	
	:20				15.500	0.678		0.678	
	:21				15.502	0.680		0.680	
	:22				15.506	0.684		0.684	
	:23				15.513	0.691		0.691	
	:24	0.4			15.521	0.699		0.699	
	:25				15.530	0.708		0.708	
	:26				15.535	0.713		0.713	
	:27				15.542	0.720		0.720	
	:28				15.549	0.727		0.727	
	:29				15.550	0.728		0.728	
	:30	0.5			15.556	0.734		0.734	
	:31				15.558	0.736		0.736	
	:32				15.567	0.745		0.745	
	:33				15.582	0.750		0.750	
	:34				15.592	0.760		0.760	
	:35				15.609	0.787		0.787	
	:36	0.6			15.618	0.796		0.796	
	:37				15.630	0.808		0.808	
	:38				15.640	0.818		0.818	
	:39				15.650	0.828		0.828	
	:40				15.658	0.836		0.836	
	:41				15.663	0.841		0.841	
	:42	0.7			15.668	0.846		0.846	
	:43				15.674	0.852		0.852	

TABLE 5 (CONTINUED)
WELL PRODUCTION TEST — PUMPING (Continued)

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Date	Hour	Time (min)	Water level Held (ft)	Water level Wet	Water level Depth (ft)	Draw-down (ft)	Trend (ft)	Corrected drawdown (ft)	Remarks
.0/20	9:31:44				15.680	0.858	0	0.858	
	:45				15.684	0.862		0.862	
	:46				15.692	0.870		0.870	
	:47				15.697	0.875		0.875	
	:48	0.8			15.701	0.879		0.879	
	:49				15.705	0.883		0.883	
	:50				15.709	0.887		0.887	
	:51				15.713	0.891		0.891	
	:52				15.719	0.897		0.897	
	:53				15.725	0.903		0.903	
	:54	0.9			15.730	0.908		0.908	
	:55				15.733	0.911		0.911	
	:56				15.742	0.920		0.920	
	:57				15.746	0.924		0.924	
	:58				15.750	0.928		0.928	
	:59				15.758	0.936		0.936	
	9:32	1.0			15.765	0.943		0.943	
		1.1			15.790	0.968		0.968	
		1.2			15.808	0.986		0.986	
		1.3			15.827	1.005		1.005	
		1.4			15.840	1.018		1.018	
		1.5			15.854	1.032		1.032	
		1.6			15.869	1.047		1.047	
		1.7			15.880	1.058		1.058	
		1.8			15.890	1.068		1.068	
		1.9			15.899	1.077		1.077	
	9:33	2.0			15.909	1.087		1.087	
		2.2			15.922	1.100		1.100	
		2.4			15.931	1.109		1.109	
		2.5			15.936	1.114		1.114	
		2.6			15.941	1.119		1.119	
		2.8			15.944	1.123		1.123	
	9:34	3.0			15.958	1.136		1.136	
	9:35	4			16.004	1.182		1.182	
	9:36	5			16.030	1.208		1.208	
	9:37	6			16.048	1.226	0.001	1.227	
	9:38	7			16.062	1.240	0.001	1.241	
	9:39	8			16.076	1.254	0.001	1.255	
	9:40	9			16.085	1.263	0.001	1.264	
	9:41	10			16.092	1.270	0.002	1.272	
	9:43	12			16.107	1.285	0.002	1.287	
	9:45	14			16.118	1.296	0.002	1.298	
	9:47	16			16.128	1.306	0.003	1.309	
	9:49	18			16.135	1.313	0.003	1.316	
	9:51	20			16.140	1.318	0.003	1.321	
	9:56	25			16.153	1.331	0.004	1.335	
	10:01	30			16.168	1.346	0.004	1.350	
	10:06	35			16.175	1.353	0.004	1.357	
	10:11	40			16.184	1.362	0.004	1.366	
	10:16	45			16.190	1.368	0.005	1.373	

TABLE 5 (CONCLUDED)
WELL PRODUCTION TEST — PUMPING (Concluded)

ıte	Hour	Time (min)	Water level Held (ft)	Wet	Depth (ft)	Draw-down (ft)	Trend (ft)	Corrected drawdown (ft)	Remarks
/20	10:21am	50			16.197	1.375	0.005	1.380	
	10:21:30	51					0.005		big train comes
	10:23:45	53					0.005		train leaves
	10:26	55			16.204	1.382	0.006	1.388	
	10:31	60			16.205	1.383	0.007	1.390	
	11:07	96	18	1' 9¼"	16.227	1.405	0.010	1.415	replaced chart after removing to read
	11:19	108			16.234	1.412	0.013	1.425	
	11:21	111			16.227	1.405	0.013	1.428	train stops on inside track
	11:23	113					0.013		engine alone passes
	11:31	120			16.233	1.411	0.014	1.425	
	11:32	121					0.014		another train passes part way
	11:34	123			16.227	1.405	0.014	1.419	second train stops
	11:37	126					0.015		train 3 passes (unseen)
	11:39	128					0.015		first train leaves
	11:40	129			16.249	1.427	0.015	1.442	-
	11:49	138					0.016		second train pulls out
	11:51	140			16.267	1.445	0.016	1.461	second train gone
	12:01 pm	150			16.248	1.426	0.017	1.443	
	12:59	208			16.243	1.421	0.023	1.444	
	1:30	239			16.225	1.403	0.027	1.430	pump 1 on
	2:01	270			16.211	1.389	0.030	1.419	breeze appears to move drum
	3:09	338			16.218	1.396	0.035	1.431	
	3:12	341					0.036		train passes for 2 min
	4:06	395					0.041		train passes for 5 sec
	4:11	400			16.235	1.413	0.042	1.445	
	5:08	457			16.254	1.432	0.047	1.479	
	6:17	526			16.273	1.451	0.053	1.504	
	7:03	572			16.284	1.462	0.054	1.516	
	8:25	654			16.298	1.476	0.060	1.536	
	9:58	747			16.310	1.488	0.066	1.554	
	11:40	849			16.311	1.489	0.072	1.561	
/21	2:00 am	989			16.311	1.489	0.081	1.570	big train scenario here
	3:46	1095			16.314	1.492	0.086	1.578	train approaches
	3:47:00	1096					0.086		start clock
	3:47:43	1097			16.253	1.431	0.086	1.517	43 sec-low point
	3:47:50	1097					0.086		second low, starts oscillating
	3:48:40	1098					0.086		train gone
	3:48:45	1098			16.354	1.532	0.086	1.618	top of rebound
	3:50	1099			16.320	1.498	0.086	1.584	
	5:42	1211			16.340	1.518	0.092	1.610	
	7:01	1290					0.097		heard big train from treatment plant
	7:16	1305			16.359	1.537	0.097	1.634	
	8:56	1405			16.382	1.560	0.102	1.662	
	9:44	1453			16.384	1.562	0.103	1.665	

Water-level fluctuations in Wells Number 4 and 5 during pumping of Well Number 4 are given in Tables 2 and 3.

Some difficulties in measuring water levels were encountered during the entire APT and concerned mainly those at Wells Number 4 and 5. Rapid measurements could not be taken in either one of these wells because of column pipe couplings blocking easy access. One had to be careful and feed the tape into the available space. Wetness of the casing and column pipe continually fouled accurate readings in the pumped well and occasionally in Well Number 5. There was no room through the pump base to lower anything other than an unweighted steel tape. Furthermore, the float used on the recorder in the 4-inch observation well had a characteristic damped sine-wave oscillation when water levels moved rapidly as when nearby locomotives and heavy truck traffic passed by. This oscillation was not present to any great extent during other times of the test.

Local train traffic affected water levels momentarily throughout the APT. The water levels listed in Tables 2,3, and 5 do not show this frequent occurrence. Heavy trucks passing on Route 811 also had momentary effects on water levels. In both of these cases, measurements were delayed until these disturbances passed.

E. Water Level Fluctuations During the Recovery Period After Pumping Stopped.

Well Number 4 was turned off at 10:15 AM EDST on October 21, 1978 and water levels were measured as they recovered. Tables 6,7, and 8 give water level measurements taken in Wells Number 4 and 5 and the

TABLE 6
WELL PRODUCTION TEST — RECOVERY

Date: October 21, 1978 Engineer: Prickett--CDM Test by: Prickett, Herzog, Arney
Owner: Highland Beach Location: #4 Measuring point: 1' 11½" above land surface
Measuring equipment: steel tape and chalk and 40' air line

Hour	Time (min)	Held (ft)	Water level Wet	Depth*	Drawdown (ft)	Remarks
10:15 am	0			27/19.75	0	test started
11:00	45			23/15.75	4.0	air line #4/
11:04	49					tape reading
11:48	93			23/15.75	4.0	
11:54	99	17	9 3/4"	16.19	3.56	
11:57	102	18	1' 11"	16.09	3.67	
12:18 pm	123	18	2' 3½"	15.71	4.04	
12:20	125	17	1' 3"	15.75	4.00	
12:21	126			23/15.75	4.00	
12:31	136	17	10½"	16.12	3.63	
1:05	170	17	1' 2 3/8"	15.80	3.95	
1:47	212	17	1' 3½"	15.71	4.04	322/4 = 80
2:14	239	17	1' 3 7/8"	15.68	4.07	T= 120,000 to 160,000

*depth figures assume airline meausrements are 7.25' high, which is the discrepancy noted between airline and tape measurements taken at the same time

TABLE 7
WELL PRODUCTION TEST — RECOVERY

Date: October 21, 1978 Engineer: Prickett--CDM Test by: Prickett, Herzog, Arney
Owner: Highland Beach Location: Well #5 Measuring point: 1' 11½" above land surface
Measuring equipment: steel tape (inches and feet) and chalk

Hour	Time (min)	Held (ft)	Water level Wet	Depth (ft)	Recovery (ft)	Remarks
10:10 am	0	17	1'	16.00	0	
10:15	0					pump off
10:17	2	17	1' 6¼"	15.48	0.52	
10:20	5.25	17	1' 6½"	15.46	0.54	
10:21	6	17	1' 7"	15.42	0.58	
10:23	8	17	1'	16.00	0	stuck tape
10:24	9	17	10"	16.17	-0.83	
10:25	10	18	2"	17.83	-1.83	questionable readings (tape may have stuck)
10:26	11	18	6 5/8"	17.45	-1.45	
10:27	12	18	1' ½"	16.96	-0.96	
10:28	13	18	5 3/4"	17.52	-1.52	
10:30	15	18	4 7/8"	17.59	-1.59	
10:31	16	18	6¼"	16.48	-0.48	
10:32	17	18	1' ½"	16.96	-0.96	
10:34	19	17	1' 4½"	15.625	0.375	
10:38	23	16	9"	15.25	0.75	
10:40	25	16	8"	15.33	0.67	
10:42	27	16	8 3/4"	15.27	0.73	
10:45	30	16	1' 1"	14.92	1.08	
10:46	31	16	10½"	15.12	0.88	
10:47	32	16	8 1/8"	15.32	0.68	
10:49	34	16	11½"	15.04	0.96	
10:55	40	16	11¼"	15.06	0.94	
10:59	44	16	7"	15.42	0.58	
11:15	60	16	11 3/4"	15.02	0.98	
11:25	70	16	1'	15.00	1.00	
11:35	80	16	1' 1/8"	14.99	1.01	
11:45	90	16	1' ¼"	14.96	1.04	
11:50	95	16	7¼"	15.40	0.60	
12:00 pm	105	16	1' 5/8"	14.95	1.05	
12:15	120	16	1' 3/4"	14.94	1.06	
12:32	137	17	2' 7/8"	14.93	1.07	
12:39	144	17	2' 7/8"	14.93	1.07	
1:25	190	16	1' ½"	14.06	1.04	
1:44	209	16	1' 1"	14.92	1.08	
2:24	249	16	1' 1 5/8"	14.86	1.14	
2:26	251	16	1' 1 3/4"	14.85	1.15	

Production Well

TABLE 8
WELL PRODUCTION TEST — RECOVERY ✓

Date: October 21, 1978 Engineer: Prickett--CDM Test by: Prickett, Herzog, Arney
Owner: Highland Beach Location: Observation Well ✓
Measuring point: 2.77' above cement slab (≈ 2.77' above land surface)
Measuring equipment: Stevens Type F Recorder

Hour (h:m:s)	Elapsed Time (min)	Water level depth (ft)	Recovery (ft)	DD	t/t'	Remarks
10:15 am	0	16.380	0			Well Number 4 off
10:15:05	0.0833	16.245	0.135	1.42	17,808	
:10	0.1667	15.992	0.338	1.17	8904	
:15	0.25	15.910	0.470	1.09	5936	
:20	0.33	15.796	0.584	0.974	4452	
:25	0.416	15.733	0.647	0.911	3562	
:30	0.50	15.675	0.705	0.853	2968	
:35	0.583	15.639	0.741	0.817	2544	
:40	0.667	15.600	0.780	0.778	2226	
:45	0.750	15.561	0.819	0.739	1979	
:50	0.833	15.536	0.844	0.714	1781	
:55	0.916	15.510	0.870	0.688	1619	
10:16:00	1	15.490	0.890	0.668	1484	
10:16:05	1.08	15.469	0.911	0.647	1370	
:10	1.17	15.452	0.928	0.63	1272	
:15	1.25	15.437	0.943	[illegible]	1187	
:20	1.33	15.419	0.961	0.597	1113	
:25	1.42	15.408	0.972	0.586	1048	
:30	1.50	15.397	0.983	[illegible]	989	
:35	1.58	15.390	0.990	[illegible]	937	
:40	1.67	15.380	1.000	[illegible]	890	
:45	1.75	15.370	1.010	0.548	848	
:50	1.83	15.361	1.019	0.539	809	
:55	1.92	15.352	1.028	[illegible]	774	
10:17:00	2	15.343	1.037	0.521	742	
10:17:20	2.33	15.312	1.068	0.49	636	
:30	2.50	15.300	1.080	0.478	594	
:45	2.75	15.286	1.094	0.464	540	
10:18:00	3	15.275	1.105	0.453	495	
10:19:15	4.25	15.228	1.152	0.406	349	
10:20	5	15.209	1.171	0.387	297	
10:21	6	15.187	1.193	[illegible]	247	
10:22	7	15.170	1.210	[illegible]	212	
10:23	8	15.153	1.227	0.331	186	
10:24	9	15.143	1.237	0.321	165	
10:25	10	15.134	1.246	0.312		10:45 train here, 12:30 train gone (min:sec)
10:28	13	15.118	1.262	?	114	
10:32	17	15.089	1.291	0.267	87	
10:37	22	15.068	1.312	0.246	67.5	
10:43	28	15.048	1.332	0.226	53	
10:49	34	15.034	1.346	0.212	43.6	
10:55	40	15.022	1.358	0.20	37.1	
11:09	54	15.001	1.379	1.179	27.5	
11:22	67	14.986	1.394	0.164	22.1	

1484 min
Ref = 14.822

TABLE 8 (CONCLUDED)
WELL PRODUCTION TEST — RECOVERY (Concluded)

Hour	Time (min)	Water level depth (ft)	Recovery (ft)	Remarks
11:32 am	77	14.975	1.405 0.153	19.27 train here 78:37
11:45	90	14.963	1.417 0.141	16.5
11:58	103	14.953	1.427 0.131	14.4
12:15 pm	120	14.940	1.440 0.118	12.4
12:39	144	14.926	1.454 0.104	10.3
1:03	168	14.912	1.468 0.09	8.8
1:25	190	14.900	1.480 0.078	7.8
1:40	205	14.890	1.490 0.068	7.2
1:59	224	14.879	1.501 0.057	6.6
2:09	234	14.872	1.508 0.05	6.3
2:09:45	234.75			train scenario (see Fig. 5)
2:25	250	14.866	1.514 0.044	end of test 5.9

4-inch diamter observation well respectively. Recovery measurements were taken for a period of about four hours at the completion of which was the end of the APT.

F. Inventory of Nearby Pumpage, Barometic Pressure, and Tidal Variations.

Water levels in the Highland Beach wells could possibly be affected by items other that their own pumpage. Information on nearby pumpage from other wells, barometric pressure changes, and tidal fluctuations were therefore collected.

The nearest groundwater pumpage found was at Boca Teeca Golf Course where 6 wells (350 gpm each) are operated 8 hours daily between 7 PM in the evening and 3 in the morning. The nearest of these wells is about 0.5 miles southwest of Well Number 4.

Other wells were found at Boca Raton Country Club, but these wells were not used due to moist conditions during the period October 19-21, 1978.

The next nearest pumpage is at Boca Raton, a distance of about 1.5 miles. This pumpage would not be expected to complicate a short term test such as this APT.

A tidal table is included in Appendix B to indicate ocean level change effects that have a bearing on the Highland Beach water levels.

Rather large barometric pressure changes were noted during the period of the APT. Appendix C includes hourly data on barometric pressures at West Palm Beach, Fort Lauderdale (International Airport), and Fort Lauderdale (Executive Airport) during the APT. A plot of pressures versus water levels during the APT reveals some apparent correlation--but it is believed to be only apparent (not real), as will be pointed out later.

ANALYSIS OF APT DATA

The hydrogeologic conditions at Highland Beach bring to mind several possible ways to interpret water-level fluctuations. According to the logs and well construction features in Appendix A, the classic delayed yield from storage theory probably best fits the conditions at Highland Beach in their west field. One could also árgue for such theories as leaky artesian, storage from confining layers, or vertical to horizontal permeability difference effects in a partially penetrating water-table system. However, the two-layer systems (fine sand-rock) with apparent high permeability contrast does not fit any of these later mentioned cases. The theory finally chosen for calculating aquifer coefficients was the delayed yield concept developed by Boulton (1963). The type-curve method by Prickett (1965) was used in the matching process of logarighmic plots of drawdown and recovery data.

A. Analysis Of Time-Drawdown Data

Logarithmic and semilogarithmic plots of time-drawdown data were constructed from the measurements given in Tables 2, 3, and 5. Plots of both uncorrected and corrected drawdowns were made.

Figures 1 and 2 show logarithmic plots of corrected time-drawdown data from the 4-inch diameter observation well and Well Number 5. Both plots give consistent results on all aquifer parameters calculated. The type curves available from theory, however, do not allow a choice of values of r/D any finer than the 0.1 and 0.2 values used. A closer agreement in parameters could have resulted if smaller r/D increment curves were available.

135

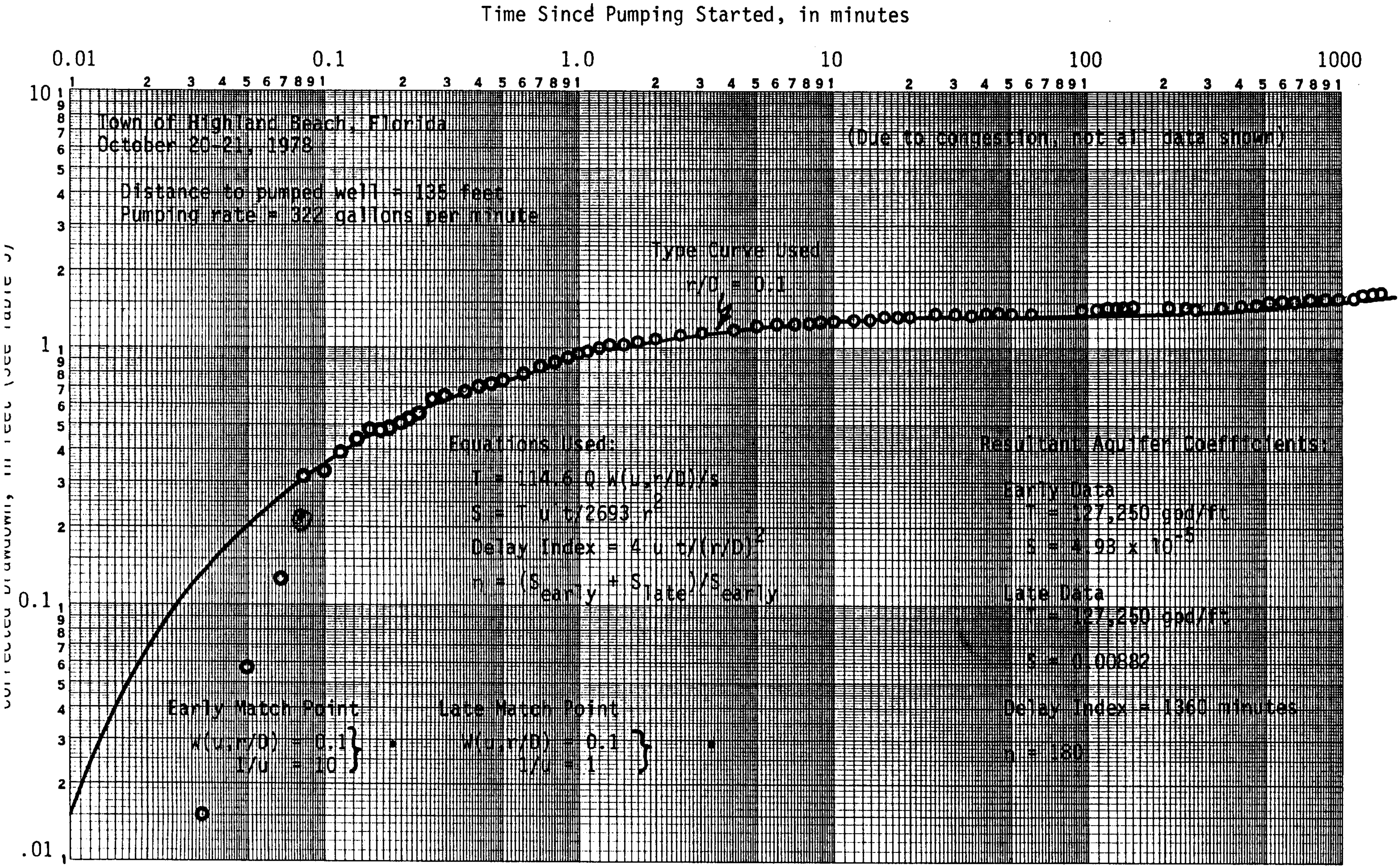

Figure 1. Time-drawdown graph for 4-inch diameter test well used as an observation well during pumping of Well Number 4

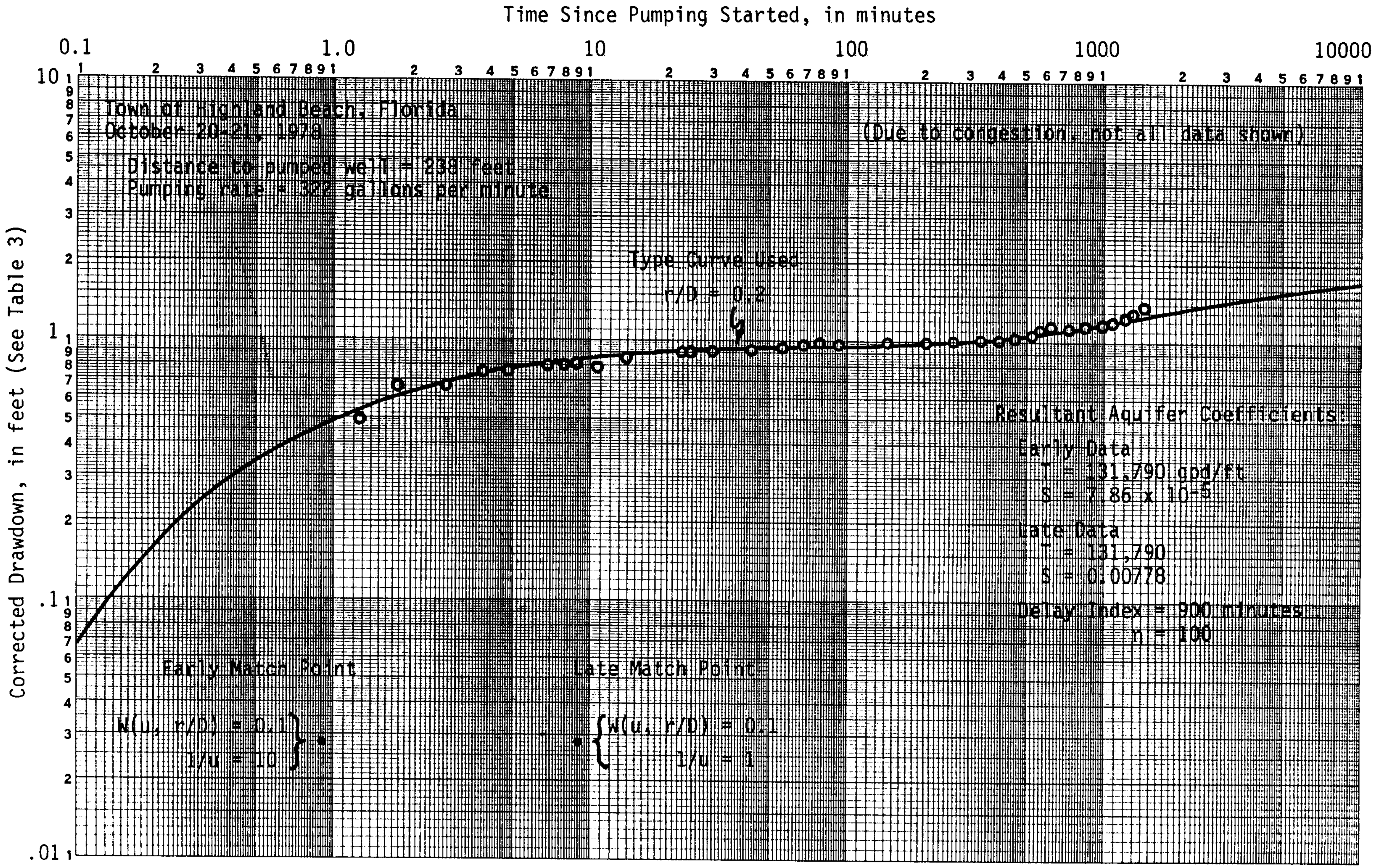

Figure 2. Time-drawdown graph for Well Number 5 used as an observation well during pumping of Well Number 4

One will note that the drawdown data prior to 0.1 minutes in Figure 1 are below the type curve. We believe this is delayed observation well response due to inertia, frictional loss in the casing, float damping, and storage of casing water effects.

One will also notice, in both Figure 1 and 2, that the drawdown data is rising slightly above the type curves near the end of the test, generally in the time region greater than 600 minutes after pumping started. We believe this deviation is due to the additional drawdown effects of Highland Beach Well Number 1.

In actuality, there are several small water-level fluctuations taking place in the observation wells that are not greatly apparent in Figures 1 and 2.

Figure 3 shows a semilogarithmic plot of time-drawdown data in the 4-inch observation well. This plot is shown at an enlarged scale to illustrate the deviations of interest. For purposes of discussion, we have labeled portions of the curves shown in Figure by the letter A through D. Curve A is a straight line wherein Jacob's modified nonequilibrium formula was used to calculate early time-drawdown data unaffected by delayed yield (see Cooper and Jacob, 1946). The oscillations around this straight line apparently are due to the float characteristics. Note that the resultant transmissivity and early storage coefficient reasonably matches those calculated in Figure 2.

Curve B (the dashed curve) represents the average time-drawdown data around which water levels fluctuate due evidently to tidal phenomena. First, note that there is an apparent sinusoidal variation

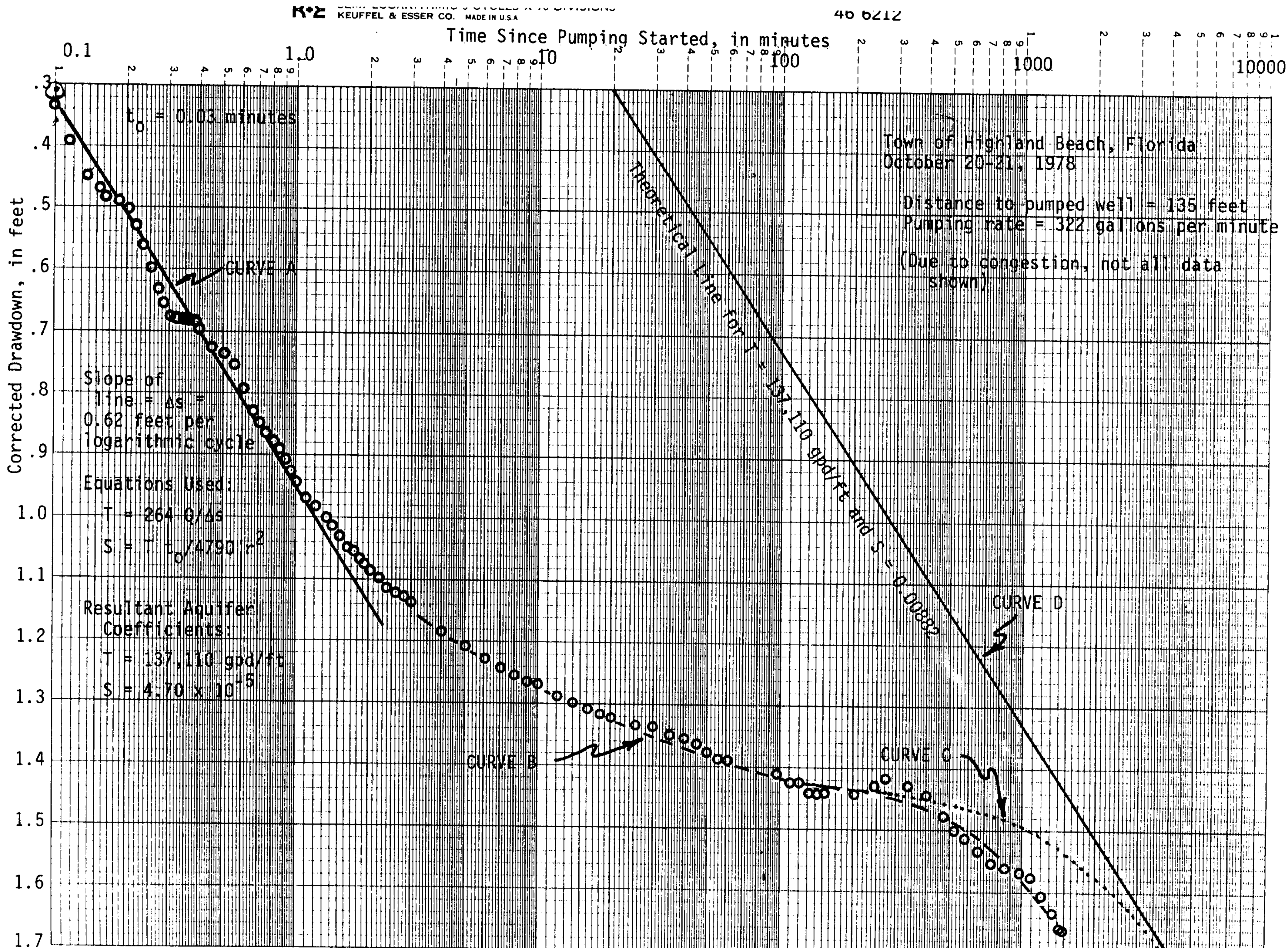

Figure 3. Time drawdown graph for

around the average Curve B in the time range greater than about 150 minutes. The maximum deviations from the average (Curve B) occur at about 300, 760, 1050, and 1400 minutes. The high and low tides, as shown in Appendix B, have time differences that are in synchronization with the Figure 3 variations about the average. The lag time (see Todd, 1959) of the water-level fluctuation behind the tide fluctuations was calculated to be about 26.5 hours, using an effective distance to the tidal source (approximate centroid of canals, intercoastal and ocean system) of about 3800 feet from the observation well, and the transmissivity and late storage coefficient of Figure 1. The range of tidal fluctuations at the observation well (about 0.05 feet) was in the proper range using the same above coefficients and realizing that the nearest tidal effects are coming from canals as close as 1,600 feet away.

Upon examination of the barometric pressure readings (see Appendix C), one may expect that there may be some barometric efficiency effects causing the oscillating deviations about the average Curve B line of Figure 3. This is not the case. Plots of barometric pressure changes were plotted against the deviations and, although there is some correlation, the fluctuations are about 2 hours out of phase. Barometric pressure changes cause immediate water level changes in observation wells in artesian cases and no changes in water-table cases. Thus the atmospheric pressure changes are not directly the cause of the oscillations noted.

Barometric pressure changes, however, are known to affect the height of ocean tides. There may thus be some indirect pressure change effects on the observation well water levels via their effects on ocean tides (see Vacher, 1978).

Curve D illustrates the line parallel to which the type curve of Figure 1 would approach. Curve C illustrates, beginning at about 250 minutes, where the approximate time-drawdown curve should have gone in the absence of pumping from Highland Beach Well Number 1. The vertical difference between Curves B and C represents the effects due to Well Number 1. An analysis of the difference between Curves B and C indicates that the canal system near Well Number 1 is also involved. Separating canal related effect (at least as a partial image well type of constant head boundary analysis) near Well Number 1 complicates the analysis.

A final word is necessary concerning the effects of partial penetration in the analyses. According to the construction features of the wells involved in Appendix A, Wells Number 4 and 5 have 20 feet of strainer, the bottoms of which are set at 104 feet below land surface. The 4-inch observation well is believed to be open hole construction from a depth of 45 feet to the bottom at 105 feet below land. Little is know about the thickness of the shallow aquifer at Highland Beach. However, based upon Schroeder, et al. (1954), we have assumed an aquifer thickness of about 220 feet. This would make Wells Number 4 and 5 partially penetrating to the extent of about 9 percent and the 4-inch observation well at about 30%.

Despite these small penetrations, distortions in the magnitudes of drawdowns at the observation wells were not apparent (essentially the same T and S). All wells terminating at the same depth may be the reason why this is so. It would be possible to analyze this test on the basis of partially penetrating wells in a water-table aquifer. However, one would then face the complicating two-layer sand and rock situation.

B. Analysis Of Time-Recovery Data.

Well Number 4 was shut off at 10:15 AM EDST on October 21, 1978. Recovery of water levels were plotted from Tables 6, 7, and 8 on both logarithmic and semilogarithmic paper. One such plot is shown in Figure 4. Uncorrected recovery (the difference in the water level at the end of pumping and the water levels thereafter) were used in this illustration. Not a great deal of difference in calculated aquifer properties is noted from this plot as would be calculted from corrected (for trend) recovery. The deviation of recovery above the chosen r/D=0.1 type curve after about 100 minutes is due to the continuing tidal effects which were rising in this time interval also.

C. Railroad Traffic Nearby APT Site.

Water levels in all wells in the Highland Beach well field are affected by passing trains on several tracks east of the well field. Numerous trains passed throughout the APT with resulting short term effects. Figure 5 illustrates typically one of the water level

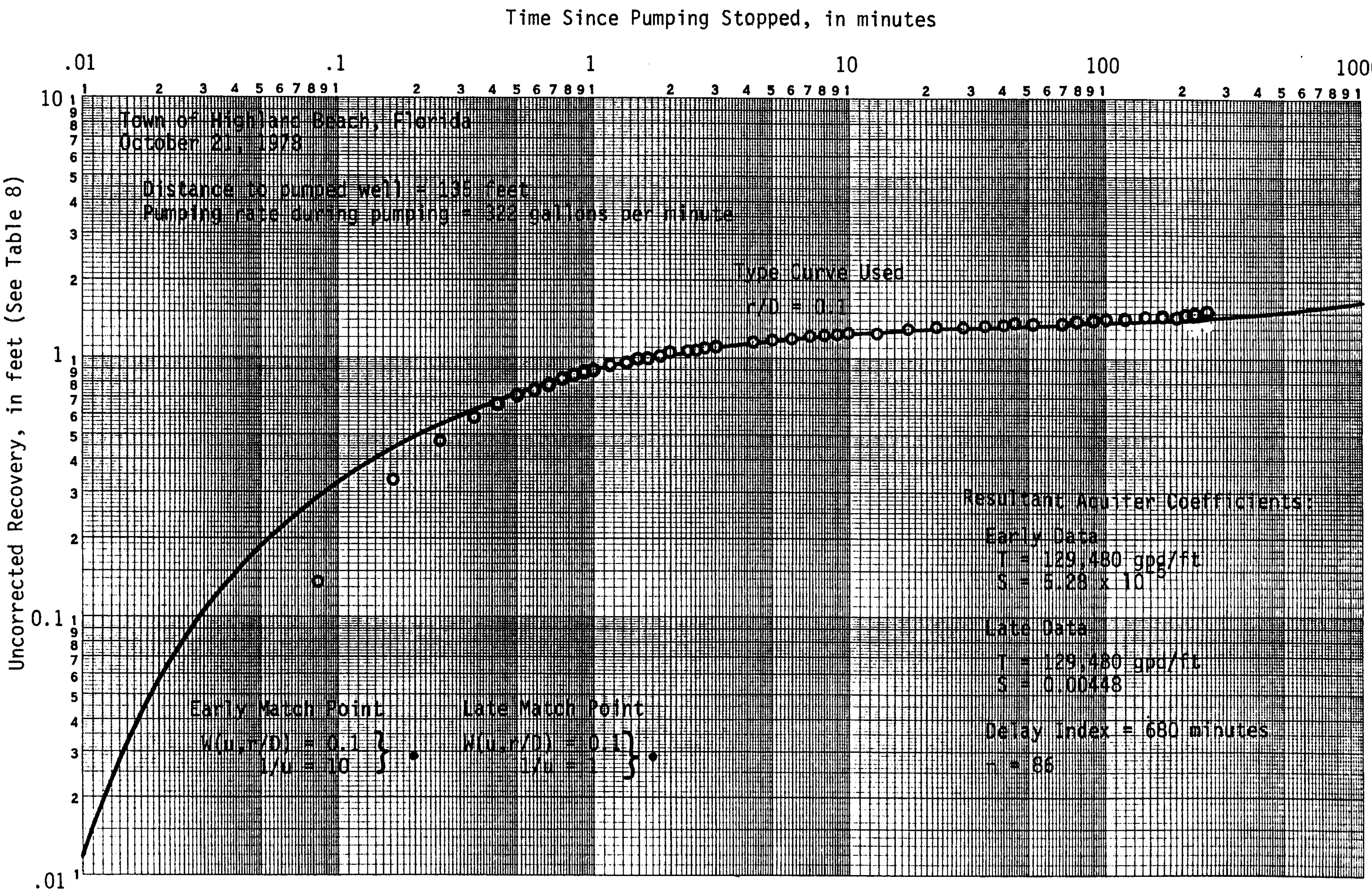

Figure 4. Time-recovery graph for 4-inch diameter test well used as an observation well after pumping at Well Number 4 stopped

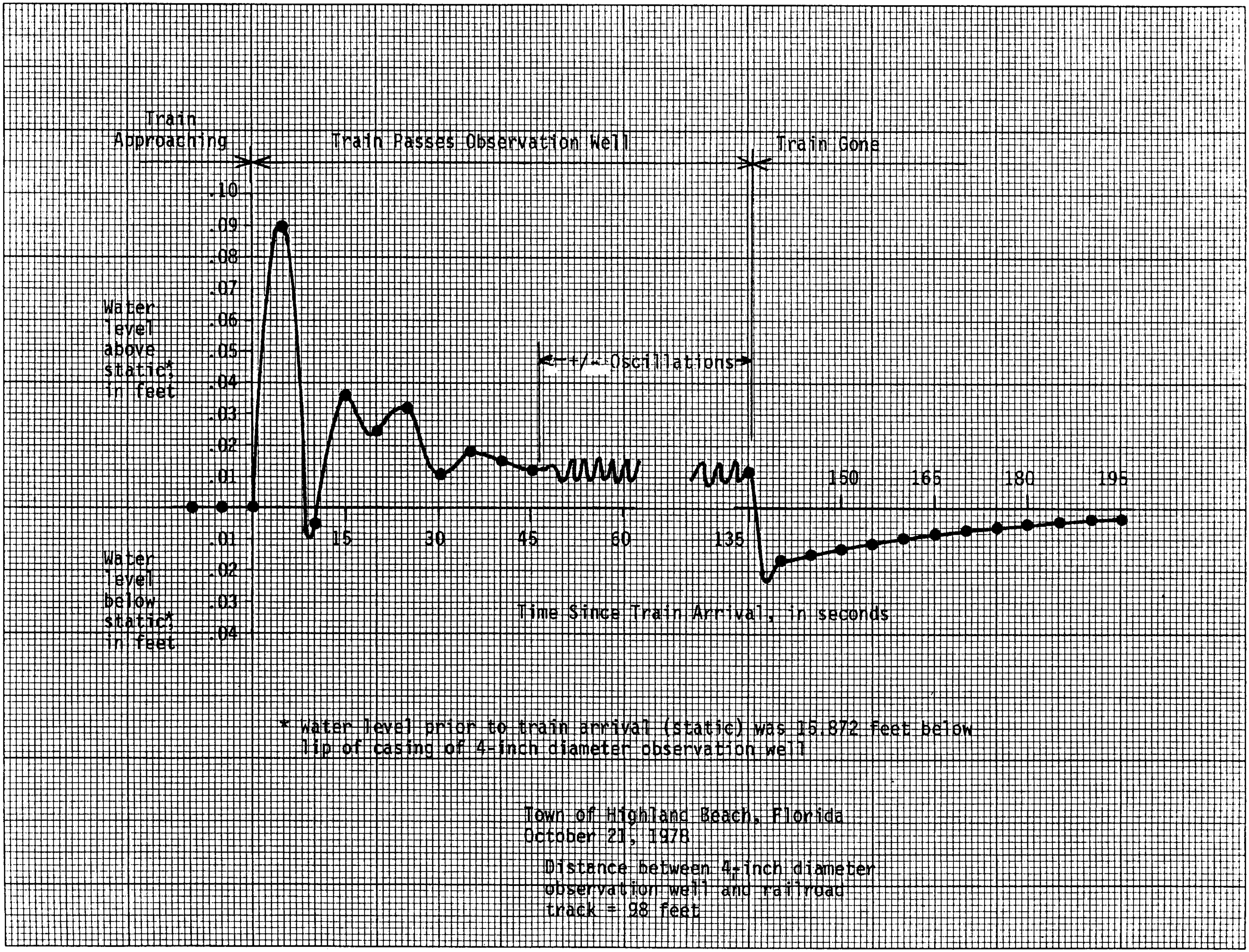

Figure 5. Typical water level fluctuations due passing train traffic at 2:09 AM October 21, 1978

fluctuations due to a passing train during the recovery portion of the APT at about 2:09 PM on October 21, 1978.

Figure 5 is a classical example of an artesian aquifer response near a railroad with a passing train. The only unusual added characteristic of the water level response is the damped oscillations of the float-counterweight-recorder system. One should make special note of oscillations being greater as water levels rise as opposed to when they fall.

The water levels of Tables 2, 3, 5, 6, 7, and 8 contain data taken only when trains were not present, with one exception as noted near the 129 minute mark in the pumping portion of the APT.

The long-term implication of the Florida East Coast Railroad upon salt-water encroachment should be investigated.

D. Summary Of Calculated Aquifer Coefficients And Final Discussion Of Results.

Table 9 lists the aquifer coefficients calculated. We did not list hydraulic conductivity as one of the coefficients, as we feel the aquifer thickness is not adequately defined. If one assumes the 220 foot thickness mentioned previously and the average transmissivity of 131,480 gpd/ft of Table 9,the hydraulic conductivity calculates to be about 600 gpd/ft^2, a rather low value. Not knowing the actual aquifer thickness severely hampers an analysis of the entire test and the basis of any partially penetrating theory. When this information becomes available, the test should be reevaluated.

The average delay index of 873 minutes fits with a scenario of the water table varying within very fine to fine sand and is

Table 9 Summary of Aquifer Coefficients

Data From Well Number	Transmissivity (gpd/ft)	Early Storage Coefficient	Late Storage Coefficient	Delay Index (minutes)	η	Type of Analysis
4-inch	127,250	4.93×10^{-5}	0.00882	1360	180	Time-drawdown (log-log plot)
5	131,790	7.86×10^{-5}	0.00778	900	100	Time-drawdown (log-log plot)
4-inch	137,110	4.70×10^{-5}	---	---	---	Time-drawdown (semilog plot)
4-inch	129,480	5.28×10^{-5}	0.00448	680	86	Time-recovery (log-log plot)
5	131,790	----	0.00475	550	---	Time-recovery (log-log plot)
	$\overline{131,480}$	$\overline{5.69 \times 10^{-5}}$	$\overline{0.00646}$	$\overline{873}$	$\overline{122}$	AVERAGE OF ABOVE

Town of Highland Beach, Florida
Aquifer Performance Test of October 19-21, 1978

apparently a reasonable number for the Highland Beach situation (See Figure 4.30 of Walton, 1970). The ratio of storage coefficients η is above Boulton's cutoff value and thus uncomplicates the use of his type curves.

Finally, the early and late storage coefficients seem to be typical for the situation. It would have been a help to have an observation well in the sand water-table deposits at a shallow depth (less than 40 foot depth). This would have allowed a better definition of the late storage coefficient.

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APPENDIX A.

Well Logs

ORING · CORE DRILLING · TEST DRILL

'ALSAY DRILLING, Inc.

WATER — WELLS

A NAME TO REMEMBER

INDUSTRIAL—PUMPS—RESIDENTIAL

OX 1226 · LAKE WORTH, FLORIDA 33460

May 11, 1971

HIGHLAND BEACH DRILLING LOG 4" TEST WELL

DEPTH	DESCRIPTION
0 - 5	Top Soil
5 - 10	Brown Sand
10 - 15	Brown Sand
15 - 20	Brown Sand
20 - 25	White sand some shell
25 - 30	White sand some shell
30 - 35	White sand some shell
35 - 40	White Layers rock
40 - 45	" " "
45 - 50	" " "
50 - 55	" " "
55 - 60	" " "
60 - 65	" " "
65 - 70	" " "
70 - 75	" " "
75 - 80	" " "
80 - 85	" " "
85 - 90	" " "
90 - 95	" " "
95 -100	" " "
100 -105	" " "

An interview with the well driller indicates that no record exists for the construction features of this well---however, the driller believes the casing length is about 40 feet in length below land surface and that the remaining is open hole.

SOIL BORING CORE DRILLING TEST DRILLING
ALSAY DRILLING, Inc.
WATER WELLS
A NAME TO REMEMBER
INDUSTRIAL — PUMPS — RESIDENTIAL
P. O. BOX 1226 LAKE WORTH, FLORIDA 3346

DRILLING LOG HIGHLAND BEACH

8" WELL #4
5/28/71

DEPTH	DESCRIPTION
0- 5	Top soil, white sand
5-10	Brownish sand
10-15	Brownish sand
15-20	Brownish sand
20-25	Brownish sand
25-30	Brownish sand
30-35	White layers rock
35-40	White layers rock
40-45	" " " "
45-50	" " " "
50-55	" " " "
55-60	" " " "
60-65	" " " "
65-70	" " " "
70-75	" " " "
75-80	" " " "
80-85	" " " "
85-90	" " " "
90-95	" " " "
95-100	" " " "
100-104	" " " "

NOTE: Casing installed to 54' depth and 20' well screen added.

An interview by T.A. Prickett with the drilling company indicates that 85 feet of casing and 20 feet of strainer is installed in this well. The above information was an estimate by the driller at the time the well was drilled and does not match the final construction. The size of the strainer is unknown.

CORE DRILLING

[TEST] BORING

ALSAY DRILLING, Inc.

WATER — WELLS

A NAME TO REMEMBER

INDUSTRIAL — PUMPS — RESIDENTIAL

O. BOX 1226 — LAKE WORTH, FLORIDA 33460

DRILLING LOG HIGHALND BEACH *wells 4 & 5*

8" WELL #5
5/28/71

DEPTH	DESCRIPTION
0-5	Top Soil, white sand
5-10	Brownish sand
10-15	Brownish sand
15-20	Brownish sand
20-25	Brownish sand
25-30	Brownish sand
30-35	White layers rock
35-40	White layers rock
40-45	" " " "
45-50	" " " "
50-55	" " " "
55-60	" " " "
60-65	" " " "
65-70	" " " "
70-75	" " " "
75-80	" " " "
80-85	" " " "
85-90	" " " "
90-95	" " " "
95-100	" " " "
100-104	

NOTE: Casing installed to 54' depth and 20' well screen added.

An interview by T.A. Prickett with the drilling company indicates that 85 feet of casing and 20 feet of strainer is installed in this well. The above information was an estimate by the driller at the time the well was drilled and does not match the final construction. The size of the strainer is unknown.

APPENDIX B.

Ocean Tide
Table

No.	PLACE	POSITION		DIFFERENCES				RANGES		Mean Tide Level
		Lat.	Long.	Time		Height		Mean	Spring	
				High water	Low water	High water	Low water			
		° '	° '	h. m.	h. m.	feet	feet	feet	feet	feet
	FLORIDA									
	Nassau Sound and Fort George River	N.	W.	on MAYPORT, p.108						
	Time meridian, 75°W.									
2839	Nassau Sound------------------------	30 31	81 27	-0 03	+0 06	+0.9	0.0	5.4	6.3	2.7
2841	Amelia City, South Amelia River-----	30 35	81 28	+0 54	+1 03	+1.1	0.0	5.6	6.6	2.8
2843	Nassauville, Nassau River-----------	30 34	81 31	+1 04	+1 37	+0.3	0.0	4.8	5.6	2.4
2845	Mink Creek entrance, Nassau River---	30 32	81 34	+1 58	+2 32	-0.6	0.0	3.9	4.6	1.9
2847	Halfmoon Island, highway bridge-----	30 34	81 36	+3 00	+3 21	-1.0	0.0	3.5	4.1	1.7
2849	Sawpit Creek entrance---------------	30 31	81 27	-0 02	+0 30	+0.5	0.0	5.0	5.8	2.5
2851	Fort George Island, Fort George R---	30 26	81 26	+0 29	+0 39	+0.3	0.0	4.8	5.6	2.4
	St. Johns River									
2853	South Jetty-------------------------	30 24	81 23	-0 23	-0 17	+0.4	0.0	4.9	5.7	2.4
2855	MAYPORT-----------------------------	30 24	81 26	Daily predictions				4.5	5.3	2.3
2857	Pablo Creek bascule bridge----------	30 19	81 26	+1 39	+1 15	*0.64	*0.64	2.9	3.4	1.4
2859	Fulton------------------------------	30 23	81 30	+0 29	+0 42	-1.1	0.0	3.4	4.0	1.7
2861	Dame Point--------------------------	30 23	81 33	+0 46	+0 55	*0.67	*0.67	3.0	3.5	1.5
2863	Phoenix Park (Cummers Mill)---------	30 23	81 38	+0 58	+1 25	*0.44	*0.44	2.0	2.3	1.0
2865	Jacksonville (Dredge Depot)---------	30 21	81 37	+1 24	+1 50	*0.44	*0.44	2.0	2.3	1.0
2867	Jacksonville (RR. bridge)-----------	30 19	81 40	+2 06	+2 13	*0.27	*0.27	1.2	1.4	0.6
2869	Ortega River entrance---------------	30 17	81 42	+2 27	+2 50	*0.20	*0.20	0.9	1.1	0.5
2871	Orange Park-------------------------	30 10	81 42	+3 49	+4 14	*0.16	*0.16	0.7	0.8	0.3
2873	Green Cove Springs------------------	30 00	81 40	+5 26	+6 13	*0.18	*0.18	0.8	0.9	0.4
2875	East Tocoi--------------------------	29 51	81 34	+6 47	+7 18	*0.22	*0.22	1.0	1.2	0.5
2877	Bridgeport--------------------------	29 45	81 34	+6 58	+7 32	*0.24	*0.24	1.1	1.3	0.5
2879	Palatka-----------------------------	29 39	81 38	+7 26	+8 21	*0.27	*0.27	1.2	1.4	0.6
2881	Welaka------------------------------	29 29	81 40	+7 46	+8 25	*0.11	*0.11	0.5	0.6	0.2
	FLORIDA, East Coast									
2883	Atlantic Beach----------------------	30 20	81 24	-0 25	-0 18	+0.7	0.0	5.2	6.0	2.6
2885	St. Augustine Inlet-----------------	29 53	81 17	-0 21	-0 01	0.0	0.0	4.5	5.3	2.2
2887	St. Augustine-----------------------	29 54	81 18	+0 14	+0 43	-0.3	0.0	4.2	5.0	2.1
2889	Daytona Beach (ocean)---------------	29 14	81 00	-0 33	-0 32	-0.4	0.0	4.1	4.9	2.0
				on MIAMI HBR. ENT., p.112						
2891	Ponce de Leon Inlet-----------------	29 04	80 55	+0 06	+0 20	-0.2	0.0	2.3	2.7	1.2
2893	Cape Canaveral----------------------	28 26	80 34	-0 41	-0 41	+1.0	0.0	3.5	4.1	1.8
2894	Sebastian Inlet---------------------	27 52	80 27	-0 23	-0 31	-0.3	0.0	2.2	2.6	1.1
2895	Fort Pierce Inlet (breakwater)------	27 28	80 17	-0 14	-0 18	+0.1	0.0	2.6	3.0	1.3
2897	Fort Pierce (City Dock)-------------	27 27	80 19	+1 51	+2 11	*0.28	*0.28	0.7	0.8	0.3
2899	St. Lucie Inlet (jetty)-------------	27 10	80 09	-0 20	-0 21	+0.1	0.0	2.6	3.0	1.3
2900	Sewall Point, St. Lucie River-------	27 11	80 12	+1 34	+2 33	*0.40	*0.40	1.0	1.2	0.5
2901	Jupiter Inlet (near lighthouse)-----	26 57	80 05	+0 51	+1 09	*0.80	*0.80	2.0	2.4	1.0
2902	Anchorage Point, Loxahatchee River--	26 57	80 06	+1 43	+2 19	*0.72	*0.72	1.8	2.2	0.9
2903	Tequesta, Loxahatchee River---------	26 58	80 06	+1 40	+2 15	*0.72	*0.72	1.8	2.2	0.9
2904	North Fork, Loxahatchee River-------	26 57	80 07	+1 43	+2 27	*0.72	*0.72	1.8	2.2	0.9
2905	Port of Palm Beach, Lake Worth------	26 46	80 03	0 00	+0 12	+0.1	0.0	2.6	3.1	1.3
2907	Palm Beach (ocean)------------------	26 43	80 02	-0 21	-0 18	+0.3	0.0	2.8	3.3	1.4
2909	Hillsboro Inlet---------------------	26 15	80 05	+0 13	+0 36	-0.2	0.0	2.3	2.7	1.2
	Port Lauderdale									
2911	Bahia Mar Yacht Club----------	26 07	80 06	+0 28	+0 32	-0.2	0.0	2.3	2.8	1.1
2913	Andrews Ave. bridge, New River-	26 07	80 09	+1 06	+1 28	-0.7	0.0	1.8	2.2	0.9
	Port Everglades									
2915	Entrance (jetties)--------------	26 06	80 07	+0 02	+0 02	0.0	0.0	2.5	3.0	1.2
2916	South entrance (canal)----------	26 05	80 07	+0 46	+0 42	-0.2	0.0	2.3	2.8	1.1
2917	Sunny Isles, Biscayne Creek---------	25 56	80 08	+2 23	+2 27	-0.7	0.0	1.8	2.2	0.9
2918	Indian Creek------------------------	25 52	80 09	+1 36	+1 50	-0.4	0.0	2.1	2.5	1.1
2919	Miami Beach-------------------------	25 46	80 08	0 00	0 00	0.0	0.0	2.5	3.0	1.3
2921	MIAMI HARBOR ENTRANCE---------------	25 46	80 08	Daily predictions				2.5	3.0	1.3

*Ratio.

TIMES AND HEIGHTS OF HIGH AND LOW WATERS

OCTOBER

DAY	TIME h.m.	HT. ft.	DAY	TIME h.m.	HT. ft.
1	0103	0.3	16	0139	-0.1
SU	0717	3.1	M	0756	3.5
	1324	0.3		1405	0.2
	1930	3.0		2007	3.4
2	0141	0.2	17	0221	-0.1
M	0754	3.2	TU	0839	3.5
	1403	0.3		1448	0.3
	2007	3.1		2051	3.3
3	0217	0.1	18	0305	0.0
TU	0834	3.2	W	0923	3.4
	1443	0.3		1533	0.4
	2044	3.1		2132	3.1
4	0257	0.1	19	0347	0.1
W	0915	3.3	TH	1007	3.3
	1522	0.4		1616	0.5
	2124	3.1		2215	3.0
5	0338	0.1	20	0429	0.3
TH	0957	3.2	F	1050	3.1
	1606	0.4		1658	0.7
	2207	3.0		2257	2.8
6	0424	0.1	21	0514	0.5
F	1045	3.2	SA	1135	2.9
	1653	0.5		1748	0.8
	2255	3.0		2346	2.7
7	0514	0.2	22	0601	0.7
SA	1138	3.1	SU	1225	2.8
	1748	0.6		1839	1.0
	2351	2.9			
8	0610	0.3	23	0039	2.5
SU	1239	3.0	M	0655	0.8
	1849	0.7		1321	2.7
				1937	1.0
9	0055	2.8	24	0139	2.5
M	0716	0.4	TU	0753	0.9
	1344	2.9		1419	2.6
	1958	0.7		2035	1.0
10	0206	2.8	25	0242	2.5
TU	0828	0.5	W	0854	0.9
	1453	2.9		1516	2.6
	2108	0.6		2133	0.9
11	0319	2.9	26	0342	2.6
W	0937	0.4	TH	0952	0.9
	1558	3.0		1607	2.7
	2214	0.5		2223	0.8
12	0427	3.1	27	0435	2.7
TH	1043	0.3	F	1043	0.8
	1657	3.1		1654	2.8
	2312	0.3		2307	0.6
13	0526	3.2	28	0523	2.9
F	1139	0.2	SA	1131	0.7
	1750	3.3		1736	2.9
				2349	0.4
14	0005	0.1	29	0605	3.0
SA	0621	3.4	SU	1213	0.5
	1232	0.2		1818	3.0
	1840	3.3			
15	0053	0.0	30	0029	0.3
SU	0709	3.5	M	0648	3.2
	1320	0.1		1256	0.4
	1925	3.4		1856	3.1
			31	0109	0.1
			TU	0728	3.3
				1336	0.4
				1935	3.2

NOVEMBER

DAY	TIME h.m.	HT. ft.	DAY	TIME h.m.	HT. ft.
1	0150	0.0	16	0237	0.0
W	0811	3.4	TH	0900	3.2
	1418	0.3		1508	0.4
	2018	3.2		2105	2.9
2	0232	-0.1	17	0318	0.1
TH	0855	3.4	F	0941	3.1
	1502	0.3		1549	0.5
	2102	3.2		2144	2.8
3	0318	-0.1	18	0357	0.2
F	0941	3.4	SA	1021	3.0
	1549	0.4		1630	0.6
	2149	3.2		2226	2.7
4	0405	0.0	19	0440	0.4
SA	1029	3.3	SU	1103	2.8
	1640	0.4		1714	0.7
	2242	3.1		2311	2.5
5	0500	0.1	20	0522	0.5
SU	1124	3.2	M	1147	2.7
	1735	0.5		1801	0.7
	2340	3.0			
6	0558	0.3	21	0002	2.4
M	1223	3.1	TU	0610	0.6
	1839	0.5		1236	2.6
				1852	0.8
7	0047	2.9	22	0055	2.3
TU	0704	0.4	W	0705	0.7
	1328	3.0		1326	2.5
	1945	0.5		1945	0.8
8	0158	2.9	23	0157	2.3
W	0813	0.5	TH	0805	0.8
	1434	3.0		1420	2.5
	2053	0.5		2043	0.7
9	0308	2.9	24	0257	2.4
TH	0922	0.5	F	0903	0.8
	1538	3.0		1513	2.5
	2157	0.3		2135	0.6
10	0414	3.0	25	0353	2.5
F	1027	0.4	SA	0958	0.7
	1636	3.0		1606	2.6
	2254	0.2		2225	0.4
11	0513	3.1	26	0444	2.7
SA	1123	0.4	SU	1051	0.6
	1728	3.1		1653	2.7
	2345	0.1		2311	0.2
12	0605	3.2	27	0533	2.9
SU	1214	0.3	M	1139	0.4
	1818	3.1		1739	2.8
				2357	0.0
13	0033	0.0	28	0618	3.0
M	0653	3.3	TU	1225	0.3
	1302	0.3		1825	2.9
	1903	3.1			
14	0117	-0.1	29	0040	-0.2
TU	0737	3.3	W	0703	3.2
	1346	0.3		1311	0.2
	1945	3.1		1911	3.0
15	0158	-0.1	30	0126	-0.3
W	0819	3.3	TH	0750	3.3
	1427	0.3		1357	0.1
	2025	3.0		1957	3.1

DECEMBER

DAY	TIME h.m.	HT. ft.	DAY	TIME h.m.	HT. ft.
1	0212	-0.4	16	0253	-0.1
F	0836	3.3	SA	0916	2.8
	1445	0.0		1525	0.2
	2045	3.1		2120	2.5
2	0302	-0.4	17	0331	-0.1
SA	0925	3.3	SU	0952	2.7
	1536	0.0		1602	0.3
	2136	3.0		2200	2.4
3	0352	-0.3	18	0411	0.0
SU	1016	3.2	M	1029	2.6
	1628	0.0		1642	0.3
	2232	3.0		2242	2.3
4	0447	-0.2	19	0450	0.2
M	1109	3.1	TU	1111	2.5
	1724	0.1		1725	0.3
	2330	2.9		2327	2.2
5	0546	-0.1	20	0534	0.3
TU	1207	3.0	W	1154	2.4
	1823	0.1		1809	0.3
6	0035	2.7	21	0015	2.1
W	0648	0.1	TH	0622	0.4
	1308	2.8		1236	2.3
	1928	0.1		1857	0.3
7	0142	2.7	22	0108	2.1
TH	0755	0.2	F	0713	0.4
	1411	2.7		1327	2.2
	2033	0.1		1950	0.3
8	0252	2.7	23	0209	2.1
F	0903	0.3	SA	0813	0.5
	1513	2.7		1419	2.2
	2134	0.0		2044	0.2
9	0356	2.7	24	0306	2.2
SA	1006	0.3	SU	0911	0.4
	1611	2.7		1514	2.2
	2233	0.0		2140	0.0
10	0457	2.8	25	0404	2.3
SU	1104	0.3	M	1009	0.3
	1707	2.7		1610	2.3
	2326	-0.1		2233	-0.2
11	0549	2.8	26	0500	2.5
M	1157	0.3	TU	1105	0.2
	1755	2.7		1704	2.5
				2323	-0.4
12	0012	-0.2	27	0551	2.7
TU	0635	2.9	W	1157	0.0
	1243	0.2		1755	2.6
	1840	2.7			
13	0056	-0.2	28	0016	-0.6
W	0720	2.9	TH	0642	2.9
	1326	0.2		1248	-0.1
	1921	2.6		1847	2.7
14	0135	-0.2	29	0106	-0.7
TH	0800	2.9	F	0730	3.0
	1407	0.2		1338	-0.3
	2002	2.6		1939	2.8
15	0216	-0.2	30	0156	-0.8
F	0839	2.8	SA	0820	3.1
	1446	0.2		1428	-0.4
	2040	2.5		2031	2.9
			31	0247	-0.8
			SU	0910	3.1
				1520	-0.5
				2125	2.9

TIME MERIDIAN 75° W. 0000 IS MIDNIGHT. 1200 IS NOON.
HEIGHTS ARE RECKONED FROM THE DATUM OF SOUNDINGS ON CHARTS OF THE LOCALITY WHICH IS MEAN LOW WATER.

APPENDIX C.

Barometric
Pressures
at
West Palm Beach
Ft. Lauderdale (International)
Ft. Lauderdale (Executive)

NATIONAL WEATHER SERVICE

SURFACE WEATHER OBSERVATIONS

DATE: OCT 19 1978 — TO CONVERT LST TO GMT ADD 5 hrs.

TYPE (1)	TIME (LST) (2)	SKY AND CEILING (Hundreds of Feet) (3)	VISIBILITY (Miles) SURFACE (4)	VISIBILITY TOWER (4a)	WEATHER AND OBSTRUCTIONS TO VISION (5)	SEA LEVEL PRESS. (Mbs.) (6)	TEMP (°F) (7)	DEW PT. (°F) (8)	WIND DIRECTION (9)	WIND SPEED (Kts.) (10)	WIND CHARACTER (11)	ALTIMETER SETTING (Ins.) (12)	REMARKS AND SUPPLEMENTAL CODED DATA (13)	(14)
R	0054	25 Scr E100 Bkn 250 Bkn	12			179	73	62	06	08		006	810 1172 82	KT
	72203 70608 69021 17923 11572 17810 63173 48273 ①													KT
R	0153	38 Scr E100 Bkn 250 Bkn	12			176	73	62	07	10		005		KT
R	0256	40 Scr 100 Scr E250 Bkn	12			173	72	61	07	09		004		KT
R	0353	100 Scr E250 Bkn	12			173	67	62	28	06		004	Few Cu 608 1171	KT
R	0453	100 Scr E250 Bkn	12			173	64	61	30	05		004	Few Cu	KT
R	0553	E100 Bkn 250 Bkn	12			173	65	61	29	05		004	Few Sc	KT
L	0622	M30 Bkn 100 Bkn 250 Ovc	10						29	06		005		KT
R	0653	30 SCT E100 BKN 250 BKN	10			173	67	63	35	09		004	RW N 102 1171 63	US
–	—												RADAT 20140	—
–	–	72203 73509 66052 17319 31571 17102 63166 48263 ①												US
R	0753	M35 BKN 100 BKN	7		RW-	176	73	65	08	14G24		005	RB50	US
R	0853	M45 BKN 100 OVC	10			176	73	69	31	04		005	RE30	US
R	0953	35 SCT M60 BKN 300 OVC	10			179	73	68	34	05		006	30702 1171	US
R	1053	35 SCT M65 BKN 300 OVC	10			176	80	68	07	12		005		US
R	1153	35 SCT E60 BKN 300 BKN	10			173	80	67	08	16G21		004		US
R	1253	35 SCT E100 BKN 300 OVC	10			159	81	68	08	15		000	82002 1171 63	US
–	–	72203 80815 64028 15927 11671 20820 63152 70250											20002 48263 ①	US
R	1353	30 SCT E110 BKN 300 BKN	10			152	83	64	09	15G20		998		US
R	1452	30 SCT E120 BKN	15			152	83	67	07	13		998		//
R	1552	E120 BKN	15			149	80	68	08	14		997	Few TCU N 810 1270	//
R	1656	30 SCT 120 SCT	15			146	79	68	09	13		996		//
R	1752	25 SCT E120 BKN	15			146	77	67	08	V3		996		//
R	1858	25 SCT 120 SCT	15			152	76	67	08	19		998	302 1270 83	//
	—												RADAT 20136	//
		72203 40819 74011 15224 22570 19302 63146											48363 ① * 20002	//
RS	1958	M25 BKN 120 BKN	12			152	76	67	08	22		998	PK WND 0834/59	//
R	2058	E25 BKN 120 BKN 300 OVC	10		RW-	163	76	66	08	14		001	RE WND 0828/10 RB32	WK
R	2153	M26 BKN 120 BKN 300 OVC	10		R-	163	76	65	07	17		001	11000 1171	WK
RS	2253	M55 BKN	10			159	76	64	09	12		000	RE10	US
R	2353	M75 OVC-	10			159	76	62	08	12		000		US

A synoptic observation, in WMO code format FMI1D, is entered on line following related aviation observation.

FMI1D: IIIII NddH VVwwW PPPTT NhCLhCMCH TdTd... 6PoPoPoPo 7RRR... 8NsChs 9SpSpspsp 2R24R24R24R24 3P... 4TxTxTnTn

☆ U.S. GPO:1977-0-765-085/1111

SURFACE WEATHER OBSERVATIONS — NATIONAL WEATHER SERVICE

DATE: OCT 19 1978 — To convert LST to GMT ADD 5 hrs

TIME (L.S.T.) 16	STATION PRESSURE (Ins.) 17	DRY BULB (°F) 18	WET BULB (°F) 19	REL. HUMIDITY (%) 20	TOTAL SKY COVER 21	LOWEST LAYER AMT. 22	LOWEST LAYER TYPE 23	LOWEST LAYER HEIGHT 24	SECOND LAYER AMT. 25	SECOND LAYER TYPE 26	SECOND LAYER HEIGHT 27	SUMMATION TOTAL 28	THIRD LAYER AMT. 29	THIRD LAYER TYPE 30	THIRD LAYER HEIGHT 31	SUMMATION TOTAL 32	FOURTH LAYER AMT. 33	FOURTH LAYER TYPE 34	FOURTH LAYER HEIGHT 35	TOTAL OPAQUE SKY COVER 36	PRESSURE TENDENCY 37	NET BAR. CHANGE (Ins.) 38	SUNSHINE (Min.) 39	PRECIPITATION (Ins.) 40	HR.
0054	30.040			69	9	1	Cu	25	7	Ac	E100	7	2	Ci	250	9				8	8	.030			00-01
0153	30.030			64	9															7					01-02
0256	30.020			69	8															6					02-03
0353	30.015			84	7	0	Cu	30	4	Ac	100	4	3	Ci	E250	7				4	6	.025			03-04
0453	30.015			90	6															4					04-05
0553	30.020			87	9								3							8					05-06
0653	30.010			87	9	4	Cu	30	2	Ac	E100	6	2	Ci	250	9				7	1	.005			06-07
0753	30.030			76	9															8			/	T	07-08
0853	30.030			88	10															10				.02	08-09
0953	30.040			85	10	2	Cu	35	4	Ac	M60	6	4	Ci	300	10				9	3	.020			09-10
1053	30.030			67	10															9					10-11
1153	30.020			64	9															8					11-12
1253	29.980			64	10	1	Cu	35	5	Ac	E100	6	4	Ci	300	10				8	8	.060			12-13
1353	29.960			63	9															7					13-14
1452	29.960			54	9															9					14-15
1552	29.950			67	6	0	Cu	35	6	Ac	E120	6								6	8	.030			15-16
1656	29.940			69	5															5					16-17
1752	29.940			72	7															7					17-18
1854	29.956			74	5	3	Cu	25	2	Ac	120	5								5	3	.005			18-19
1958	29.966			74	8															7					19-20
2056	29.955			71	10															9				T	20-21
2153	29.975			69	10	7	Cu	M20	2	Ac	120	9	1	Ci	300	10				10	1	.030		T	21-22
2253	29.980			67	9															9				T	22-23
2353	29.980			62	10															10					23-24

SYNOPTIC OBSERVATIONS

TIME (G.M.T.) 41	TIME (L.S.T.) 42	NO. 43	PRECIP. (Ins.) 44	SNOW FALL (Ins.) 45	SNOW DEPTH (Ins.) 46	MAX. TEMP. (°F) 47	MIN. TEMP. (°F) 48	PRECIP. ORIGIN 49	STATE OF GRND. 50	51	52	53	54	55	SOIL TEMP. 56	57	58
	MID. TO 0051	X	0	0	X	73	73	X	X						X		
	0051	1	0	0	0	75	73										
	0652	2	0	0	0	73	63										
	1252	3	.02	0	0	82	67										
	1850	4	0	0	0	83	76										
	MID.	X	T	0	0	76	75	X	X						X		

STATION PRESSURE COMPUTATIONS

TIME (L.S.T.) 59	0054	0653	1253	1854
ATT. THERM. 60				
OBSRVD. BAR. 61				
TOTAL CORR. 62				
STA. PRESS. 63	30.040	30.020	29.980	29.955
BAROGRAPH 64	30.040	30.020	29.980	29.945
BAR. CORR. 65	±0	±0	±0	+.010

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

24-HR. MAX. TEMP. (°F) 66	24-HR. MIN. TEMP. (°F) 67	24-HR. PRECIP. WATER EQUIV. (Ins.) 68	24-HR. SNOWFALL UNMELTED (Ins.) 69	SNOW DEPTH (Ins.) 70	PEAK WIND SPEED (Kts.) 71	PEAK WIND DIRECTION 72	PEAK WIND TIME (L.S.T.) 73	THICKNESS OF ICE ON WATER (Ins.) 74	FROZEN GROUND LAYER TOP 75	FROZEN GROUND LAYER BASE 76	RIVER GAGE 77	SKY COVER SUNRISE TO SUNSET 78	SKY COVER MIDNIGHT TO MIDNIGHT 79	WATER EQUIV. (Ins.) 80	81
83	63	.02	0	0	34	E	1958E					9	8		

WEATHER & OBSTRUCTIONS TO VISION

TYPE 82	BEGAN 83	ENDED 84	TYPE 85	BEGAN 86	ENDED 87
RW-	0750	0830			
RW-	2032	2103			
R-	2103	2210			

90. REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

TIME: SUNRISE SUNSET

TOTAL SUNSHINE (MIN.) | PERCENT OF POSSIBLE SUNSHINE | CHARACTER OF SUNRISE | CHARACTER OF SUNSET

FASTEST OBSERVED 1-MINUTE WIND SPEED 35 M.P.H. OR FASTEST MILE M.P.H. ASSOCIATED DIRECTION 08 TIME 1958E

TIME CHECK: 0038E 21' Slow / 1023E 22' Slow /

PALM BEACH 82-63-.07

MF1-10B

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

SURFACE WEATHER OBSERVATIONS

WEST PALM BEACH, FLA

DATE OCT 20 1978

TO CONVERT LST TO GMT ADD ___ hrs.

TYPE (1)	TIME (LST) (2)	SKY AND CEILING (Hundreds of Feet) (3)	VISIBILITY (Miles) SURFACE (4)	TOWER (4a)	WEATHER AND OBSTRUCTIONS TO VISION (5)	SEA LEVEL PRESS. (Mbs.) (6)	TEMP. (°F) (7)	DEW PT. (°F) (8)	WIND DIRECTION (00-36) (9)	SPEED (Kts.) (10)	CHARACTER (11)	ALTIMETER SETTING (Ins.) (12)	REMARKS AND SUPPLEMENTAL CODED DATA (13)	(14)
R	0053	E90 BKN	10			156	75	63	08	12		999	80500 1070 83	JS
—	—	72203 50812 66018 15624 50970 17805 63149 70030											20002 48363 ⓪	JS
R	0153	100 SCT	10			152	74	64	07	13		998		JS
R	0253	E100 BKN	10			149	74	64	07	08		997		JS
R	0353	30 SCT E100 BKN 160 BKN	10			146	74	64	07	11		996	710 1170	JS
R	0453	30 SCT 100 SCT E160 OVC	10			146	74	64	06	08		996	BINOVC W	JS
R	0553	E160 BKN	10			146	73	65	06	08		996		JS
R	0653	E160 BKN	10			152	74	64	06	07		998	307 1070 73 20002 RADAT 2414	JS
—	—	72203 70607 66021 15223 70470 18307 63146 20002 48373 ⓪												JS
R	0754	20 SCT E35 BKN 50 BKN	10			156	77	64	04	12		999		[illegible]
R	0855	20 SCT E50 BKN	10			163	80	66	05	16		001		[illegible]
R	0955	20 SCT 100 SCT	12			163	81	65	04	14		001	110 1170	[illegible]
R	1052	25 SCT 50 SCT	12			163	81	65	05	14	G22	001		WT
R	1155	25 SCT	12			159	82	66	05	17		000		[illegible]
R	1252	25 SCT 80 SCT	12			156	82	65	04	15		997	808 1170 73	CCS
—	—	72203 20415 69011 15628 11570 18808 63149 48473 ⓪												[illegible]
R	1355	30 SCT 300 SCT	12			149	82	64	04	15		997		CCS
R	1454	30 SCT 300 SCT	12			146	82	64	04	16		996		WK
R	1552	30 SCT 300 SCT	12			146	80	63	04	18		996	608 1101	CCS
R	1655	30 SCT	12			149	79	63	04	15		997		WK
R	1752	30 SCT	12			149	77	62	05	12		997		WK
R	1852	CLR	12			152	76	62	05	12		998	*207 1100 84	CCS
—	—												RADAT 20133 * Few CU	—
—	—	72203 10512 69010 15224 11500 17207 63146 48473 0 ⓪												[illegible]
R	1953	CLR	12			156	75	63	05	12		999	Few CU	WK
R	2054	CLR	12			163	73	62	06	07		001	Few CU	RJT
R	2153	40 SCT	12			166	74	63	06	09		002	212 1500	RJT
R	2253	CLR	12			166	68	62	31	05		002		JS
R	2353	30 SCT	10			166	67	62	32	04		002		JS

A synoptic observation, in WMO code (former FM11E), is entered on line following related airways observation.

PM11D: IIIII NddH VVwwW PPPTT $N_hC_LhC_MC_H$ $T_dT_d$app $6P_oP_oP_oP_o$ 7RRRs $8N_sCh h_s$ 9SpSpspsp $2R_{24}R_{24}R_{24}R_{24}$ $3P_wP_wH_wH_w$ $d_wd_wP_wH_wH_w$ $4T_sT_sT_sT_s$

☆ U.S. GPO:1977-0-765-008/1111

SURFACE WEATHER OBSERVATIONS — NATIONAL WEATHER SERVICE

DATE: OCT 20 1978 — To convert LST to GMT ADD 5 hrs

TIME (L.S.T.) 16	STATION PRESSURE (Ins.) 17	DRY BULB (°F) 18	WET BULB (°F) 19	REL. HUMIDITY (%) 20	TOTAL SKY COVER 21	Lowest layer AMT. 22	Lowest layer TYPE 23	Lowest layer HEIGHT 24	Second layer AMT 25	Second layer TYPE 26	Second layer HEIGHT 27	SUMMATION TOTAL 28	Third layer AMT. 29	Third layer TYPE 30	Third layer HEIGHT 31	SUMMATION TOTAL 32	Fourth layer AMT 33	Fourth layer TYPE 34	Fourth layer HEIGHT 35	TOTAL OPAQUE SKY COVER 36	PRESSURE TENDENCY 37	NET 3HR. CHANGE (Ins.) 38	SUNSHINE (Min.) 39	PRECIPITATION (Ins.) 40	HR.
0053	29.970			68	6	6	Ac	E90												6	9	.015			00-01
0153	29.960			71	4															4					01-02
0253	29.950			71	6															6					02-03
0353	29.940			71	9	1	Cu	30	5	Ac	E100	6	3	Ac	160	9				9	7	.030			03-04
0453	29.940			71	10															9					04-05
0553	29.940			76	7															7					05-06
0653	29.960			71	9	9	Ac	E60												9	3	.020			06-07
0754	29.970			65	8															8					07-08
0855	29.[illegible]			63	7															7					08-09
0955	29.[illegible]			59	3	2	Cu	20	1	Ac	100	3								3	1	.030			09-10
1052	29.[illegible]			54	3															3					10-11
1155	29.9[illegible]			59	3															3					11-12
1252	29.965			57	2	1	Cu	25	1	Ac	80	2								2	8	.025			12-13
1355	29.945			55	3															2					13-14
1454	29.9[illegible]			55	3															2					14-15
1552	29.940			56	3	2	Cu	30	1	Ci	300	3								2	6	.025			15-16
1655	29.950			58	2															2					16-17
1752	29.9[illegible]			60	2															2					17-18
1852	29.910			62	0	0	Cu	30												0	2	.020			18-19
1952	29.970			67	0															0					19-20
2054	29.985			69	0															0					20-21
2153	29.995			69	3	3	Sc	40												3	2	.035			21-22
2253	30.010			81	0															0					22-23
2353	30.000			84	2															2					23-24

SYNOPTIC OBSERVATIONS

TIME (G.M.T.) 41	TIME (L.S.T.) 42	NO. 43	PRECIP. (Ins.) 44	SNOW FALL (Ins.) 45	SNOW DEPTH (Ins.) 46	MAX. TEMP. (°F) 47	MIN. TEMP. (°F) 48	PRECIP. ORIGIN 49	STATE OF GRND. 50	51	52	53	54	55	SOIL TEMP. 56	57	58
	MID. TO 0052	X	0	0	X	76	75	X	X						X		
	0052	1	T	0	0	76	75										
	0652	2	0	0	0	75	73										
	1251	3	0	0	0	84	74										
	1851	4	0	0	0	82	76										
	MID.	X	0	0	0	76	66	X	X						X		

STATION PRESSURE COMPUTATIONS

TIME (L.S.T.) 59	0053	0653	1250	1850
ATT. THERM. 60				
OBSRVD. BAR. 61				
TOTAL CORR. 62				
STA. PRESS. 63	29.970	29.960	29.965	29.910
BAROGRAPH 64	29.960	29.950	29.960	29.950
BAR. CORR. 65	+.010	+.010	+.005	+.010

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

24-HR. MAX. TEMP. (°F) 66	24-HR. MIN. TEMP. (°F) 67	24-HR. PRECIP. WATER EQUIV. (Ins.) 68	24-HR. SNOWFALL UNMLTD (Ins.) 69	SNOW DEPTH (Ins.) 70	Peak wind SPEED (Kts.) 71	Peak wind DIRECTION 72	Peak wind TIME (L.S.T.) 73	THICKNESS OF ICE ON WATER (Ins.) 74	Frozen ground layer TOP 75	Frozen ground layer BASE 76	RIVER GAGE 77	Sky cover SUNRISE TO SUNSET 78	Sky cover MIDNIGHT TO MIDNIGHT 79	WATER EQUIV. (Ins.) 80	81
84	66	0	0	0	24	NE	1558E					4	4		

WEATHER & OBSTRUCTIONS TO VISION

TYPE 82	BEGAN 83	ENDED 84	TYPE 85	BEGAN 87	ENDED 88

90. REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

TIME: SUNRISE SUNSET

TOTAL SUNSHINE (MIN.) | PERCENT OF POSSIBLE SUNSHINE | CHARACTER OF SUNRISE | CHARACTER OF SUNSET

FASTEST OBSERVED 1-MINUTE WIND SPEED 21 M.P.H. OR FASTEST MILE M.P.H. ASSOCIATED DIRECTION 04 TIME 1552E

TIME CHECK: 0020E 19' slow

Town of Palm Beach 83/74 No Precip

MF1-10B

U.S. GPO:1977-0-785-008/1131

NATIONAL WEATHER SERVICE

SURFACE WEATHER OBSERVATIONS

DATE OCT 21 1978 — TO CONVERT LST TO GMT ADD 5 hrs.

TYPE (1)	TIME (LST) (2)	SKY AND CEILING (Hundreds of Feet) (3)	VISIBILITY (Miles) SURFACE (4)	TOWER (4a)	WEATHER AND OBSTRUCTIONS TO VISION (5)	SEA LEVEL PRESS. (Mbs.) (6)	TEMP. (°F) (7)	DEW PT. (°F) (8)	WIND DIRECTION (10's Deg.) (9)	SPEED (Kts.) (10)	CHARACTER (11)	ALTIMETER SETTING (Ins.) (12)	REMARKS AND SUPPLEMENTAL CODED DATA (13)	(14)
R	0053	M40 BKN	10			166	69	65	35	07		002	10207 1200 94 RH08E…	JS
-	-	72203 73507 66251 166	21	72	600 181	02	6	31	59	79710		0	.20007 48466 ⓓ	JS
R	0153	M40 OVC	8		RW-	163	68	64	36 (02?)	03 (15?)		001	RB45	JS
R	0253	M45 OVC	8		RW-	163	67	65	04	09		001		JS
R	0353	M45 BKN	10			159	67	64	32	07		000	RE10 80717 1400	JS
R	0453	45SCT E100 BKN 250BKN	10			163	67	63	34	03		001		JS
R	0553	35SCT 100 SCT 300 SCT	10			163	66	66	16	03		001		JS
R	0652	20SCT E40BKN 100BKN	10		RW-	169	67	62	02	03		003	31017 1870 65 20024*	WK
/	/	72203 70203 66808 1691	9	6857	0 17310	631	63		71710	20024		48465 ⓓ	RB50 *RB45E0245	WK
R	0752	20SCT 100SCT 300SCT	10			173	72	65	35	06		004	CB NNE RE05	WK
R	0852	25SCT 100SCT	12			176	77	67	02	09		005	TCU NE	WK
R	0955	25SCT 100SCT	12			183	78	67	04	10		007	31400 1170	WK
R	1055	25SCT 100SCT	12			183	80	66	07	15		007		WK
R	1154	30SCT 100SCT	12			179	81	66	08	15		006		MS
R	1254	30SCT 100SCT	12			173	82	66	07	15		004	81000 1170 65	MS
/	/	72203 30715 69028 17328	31570		19810	631	66	7	060	20024		48	2650	MS
R	1352	30SCT	12			169	82	61	07	16		003		WK
R	1454	30SCT	12			166	81	64	08	16	G22	002	TCU NW N	MG
R	1553	30SCT 280SCT	12			166	81	66	09	15		002	CB DSNT NW N 607 190	DCT
R	1652	30SCT 280SCT	12			166	79	65	06	14		002		AN
R	1752	30SCT 280SCT	12			169	76	64	09	10		003		AN
R	1852	30SCT 280SCT	12			169	76	65	06	11		003	203 1103*RADAT 20131 *62	MS
/	/													/
/	/	72203 20611 69030 16924	21503		18203	631	63		20004			48	3659	FG
R	1952	30SCT 280SCT	12			176	76	65	07	13		005		MS
R	2057	30SCT	12			179	76	65	08	18		006		AN
R	2154	30SCT	12			179	76	65	08	14		006	110 1100	AN
R	2252	30SCT	12			179	76	65	09	15		006		BN
R	2352	30SCT	15			176	76	65	09	14		005		JS

A synoptic observation, in WMO code format FM11D, is entered on line following related aviation observation.

FM11D: IIiii Nddff VVwwW PPPTT NhCLhCMCH TdTdapp 6PoPoPoPo 7RRRs 8NsChhs 9SpSpspsp 2R24R24R24R24 3PwPwHwHw 4dwdwPwHwHw 6TsTsTsTs

U.S. GPO:1977-0-788-006/1333

SURFACE WEATHER OBSERVATIONS — U.S. DEPARTMENT OF COMMERCE, NOAA, NATIONAL WEATHER SERVICE

STATION: WEST PALM BEACH, FLA — DATE: OCT 21 1978 — To convert LST to GMT ADD ... hrs

Time (L.S.T.)	Station Pressure (ins.)	Dry Bulb (°F)	Wet Bulb (°F)	Rel. Humidity (%)	Total Sky Cover	Lowest Layer Amt.	Lowest Layer Type	Lowest Layer Height	Second Layer Amt.	Second Layer Type	Second Layer Height	Summation Total	Third Layer Amt.	Third Layer Type	Third Layer Height	Summation Total	Fourth Layer Amt.	Fourth Layer Type	Fourth Layer Height	Total Opaque Sky Cover	Pressure Tendency	Net 3-hr. Change (ins.)	Sunshine (min.)	Precipitation (ins.)
0053	30.000			87	4	9	Cu	M40																
0153	29.990			87	10															9	1	.005		.07
0253	29.990			93	10															10				T
0353	29.980			91	9	9	Sc	M45												10				.17
0453	29.990			87	7															9	8	.020		T
0553	29.990			87	3															6				
0652	30.010			84	9	3	Cu	20	4	Sc	E40	7	2	AC	100	9				2				
0752	30.020			79	5															9	3	.030		T
0852	30.030			72	3															3				T
0955	30.050			69	3	2	Cu	25	1	AC	100	3								3				
1055	30.050			63	4															3	3	.040		
1154	30.040			61	4															4				
1254	30.030			59	4	4	Cu	30	0	AC	100	4								4				
1352	30.010			59	4															4	8	.030		
1454	30.000			57	4															4				
1553	30.000			61	4	3	Cu	30	1	Ci	280	4								4				
1652	30.000			63	4															4	6	.020		
1752	30.010			67	3															4				
1852	30.010			69	3	3	Cu	30	0	Ci	280	3								3				
1952	30.035			69	3															3	2	.010		
2052	30.035			69	3															3				
2151	30.040			69	3	3	Cu	30												3				
2252	30.040			69	4															3	1	.030		
2353	30.030			69	1															4				
																				1				

SYNOPTIC OBSERVATIONS

Time (G.M.T.)	Time (L.S.T.)	No.	Precip. (ins.)	Snow Fall (ins.)	Snow Depth (ins.)	Max. Temp. (°F)	Min. Temp. (°F)	Precip. Origin	State of Grnd.	51	52	53	54	55	Soil Temp.	57	58
	MID. TO 0052	X	.07	0	X	69	67	X	X						X		
	0052	1	.07	0	0	76	66								X		
	0650	2	.12	0	0	70	65										
	1250	3	T	0	0	82	67										
	1850	4	0	0	0	82	76										
	MID.	X	0	0	0	76	75	X	X						X		

STATION PRESSURE COMPUTATIONS

Time (L.S.T.)	0053	0652	1251	1851
Att. Therm.				
Obsvd. Bar.				
Total Corr.				
Sta. Press.	30.000	30.010	30.0[illegible]	30.010
Barograph	29.990	30.000	30.0[illegible]	30.010
Bar. Corr.	+.010	+.010	±0	±0

SUMMARY OF DAY (MIDNIGHT TO MIDNIGHT)

24-Hr. Max. Temp. (°F)	24-Hr. Min. Temp. (°F)	24-Hr. Precip. Water Equiv. (ins.)	24-Hr. Snowfall Unmltd (ins.)	Snow Depth (ins.)	Peak Wind Speed (Kts.)	Peak Wind Direction	Peak Wind Time (L.S.T.)	Thickness of Ice on Water (ins.)	Frozen Ground Layer Top	Frozen Ground Layer Base	River Gage	Sky Cover Sunrise to Sunset	Sky Cover Midnight to Midnight	Water Equiv. (ins.)	81
82	65	.24	0	0	22	E	1452E					4	5		

WEATHER & OBSTRUCTIONS TO VISION

Type	Began	Ended	Type	Began	Ended
RW-	0008	0030			
RW-	0145	0310			
RW-	0650	0705			

90. REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

TIME: SUNRISE — SUNSET

TOTAL SUNSHINE (MIN.) — PERCENT OF POSSIBLE SUNSHINE — CHARACTER OF SUNRISE — CHARACTER OF SUNSET

FASTEST OBSERVED 1-MINUTE WIND SPEED 21 M.P.H. OR FASTEST MILE M.P.H. ASSOCIATED DIRECTION 08 TIME 2057 E

TIME CHECK: 0034E 10 Sec / 0855E 3' slo /

MF1-10B

☆ U.S. GPO:1977-0-783-000/1131

To convert LST to GMT add 5 hrs. Time in Column 2 is: GMT ✓ LST

SURFACE WEATHER OBSERVATIONS

(Abridged for use at designated Card Stations)

U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL WEATHER SERVICE

STATION: FT. LAUDERDALE, FLA

DATE: OCTOBER 19, 1978

Type (1)	Time (2)	Sky and Ceiling (3)	Visibility Surface (4)	Weather and Obstructions to Vision (5)	Temp (7)	Dew Pt. (8)	Wind Direction (9)	Wind Speed (10)	Altimeter Setting (12)	Remarks and Supplemental Coded Data (13)	Total Sky Cover	Opaque Sky Cover	Initials
R	0047	30 SCT	10		76	59	09	10	009		1	1	DN
R	0147	CLR	10		76	59	09	10	009		0	0	DN
R	0247	CLR	12		75	57	08	13	009		0	0	[illegible]
R	0350	CLR	10		75	57	09	12	007		0	0	[illegible]
R	0417	CLR	10		75	60	09	10	006		0	0	[illegible]
R	0552	CLR	10		75	60	09	10	006		0	0	[illegible]
R	0650	CLR	10		74	60	09	10	005		0	0	[illegible]
R	0748	CLR	10		70	62	32	03	004		0	8	KH
R	0847	CLR	10		70	63	33	03	004		0	0	[illegible]
R	0947	CLR	10		70	64	36	08	003		0	0	[illegible]
R	1047	CLR	10		74	65	36	05	005		3	0	[illegible]
R	1147	25 SCT 150 SCT	8		70	65	32	08	004		0	0	AW
R	1247	200 SCT	8		73	68	33	08	005		5	5	IV
R	1347	200 - SCT	7		78	68	34	08	005	TCU N-E	3	2	IV
~~S~~	~~1442~~	~~E25 BKN 200 BKN~~									3	1	IV
SL	1415	25 SCT E100 BKN 200 BKN	7		80	68	36	07	006	RWU NE SE			
R	1447	25 SCT E100 BKN	7	R	80	69	36	10	006	RWU S RB49	7	7	FE
S	1500	25 SCT E70 BKN	7	R	79	69	05	10	005	RWU N AND S WSHET ØØ	7	7	FE
R	1547	30 SCT E70 BKN	10		79	72	10	15	005	RE10 RWU W	8	8	DN
R	1647	30 SCT E70 BKN	10		82	72	11	15	003		8	8	DN
R	1747	30 SCT E70 BKN 200 OVC	10		81	69	10	12	001	BINOVC W	7	7	AM
R	1847	30 SCT E70 BKN 200 OVC	10		81	66	09	07	999	BINOVC E RWU NNE AND SE	10	10	DN
R	1948	25 SCT E45 BKN 120 OVC	10		77	67	04	05	999	RB10 E26 RWU SW	10	10	DN
R	2047	25 SCT E45 BKN 120 OVC	10	R-	78	71	23	04	996	BINOVC N RB 47	9	9	H
R	2147	25 SCT E45 BKN 120 BKN	10		78	71	[illegible]	[illegible]	995	RE 05	10	9	JC
R	2248	25 SCT E 120 BKN	10	~~R~~	78	71	12	10	997	RB 22 RE 43	9	8	JC
R	2347	E 120 BKN	10		77	71	14	05	997		9	8	KR
											8	8	[illegible]

STATION PRESSURE COMPUTATIONS

SUMMARY OF DAY (Midnight to Midnight)

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

~~ATIS 0751/4C02~~

~~ATIS R75 45/445 3~~

WBAN-10C (12-77)

SURFACE WEATHER OBSERVATIONS

(Abridged for use at designated Civil Stations)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

STATION: Ft. Lauderdale Fla.

DATE: OCTOBER 20, 1978

To convert LST to GMT ADD 5 hrs. Time in Column 2 is: GMT ✓ LST

Type (1)	Time (2)	Sky and Ceiling (hundreds of feet) (3)	Visibility Surface (4)	Visibility Tower (4a)	Weather and Obstructions to Vision (5)	Sea Level Press. (mb) (6)	Temp (°F) (7)	Dew Pt. (°F) (8)	Wind Direction (9)	Wind Speed (kts) (10)	Wind Character (11)	Altim. Setting (ins.) (12)	Remarks and Supplemental Coded Data (13)	Station Pressure (ins.) (14)	Dry Bulb (°F) (15)	Wet Bulb (°F) (16)	Total Sky Cover (17)	Total Opaque Sky Cover (18)	Observer's Initials (19)
R	0047	M30 BKN 120 OVC	10		R-		75	70	06	12		999	RB30 RWUE				10	10	KR
S	0118	6SCT E25 OVC	3		R		74	70	09	10		000	VSBY E 1 [illegible]				10	10	KR
R	0147	M5 BKN 40 OVC	3		R		72	70	09	13		001					10	10	RR
S	0200	5 SCT E25 BKN	5		R		73	71	09	12		001					9	9	[illegible]
R	0247	5 SCT E45 OVC	5		R-		73	71	09	07		000					10	10	[illegible]
R	0347	20 SCT E50 OVC	7				75	71	13	06		999	RE40				10	10	[illegible]
R	0445	20 SCT E50 OVC	7				78	68	12	10		999					10	10	VH
R	0545	20 SCT E50 OVC	7				77	68	10	12		999	RB12 E25				10	10	VH
R	0647	E50 OVC	8				77	67	09	12		997					10	10	[illegible]
R	0747	M32 OVC	8				76	68	09	12		997					10	10	IV
R	0847	20 SCT E50 BKN	8				76	67	09	10		996					7	7	VH
R	0950	M100 OVC	8				77	65	09	10		994					10	10	IV
R	1047	E150 BKN	10				77	66	06	10		997					7	7	FR
R	1147	E150 BKN	10				77	66	06	12		996					6	6	DN
R	1247	E100 BKN	10				79	66	08	10		999					6	6	DN
R	1347	E80 BKN	10				80	66	05	10		999					6	6	DN
R	1447	25 SCT 100 SCT	10				82	67	05	13		001					5	5	FR
R	1547	25 SCT 100 SCT	10				83	67	05	13		001					4	4	FR
R	1647	25 SCT 100 SCT	10				84	66	04	15		001					4	4	FR
R	1747	25 SCT 150 SCT	10				84	66	04	12		998					3	3	DN
R	1847	25 SCT 150 SCT	10				84	65	06	14		996					2	2	DN
R	1953	25 SCT 160 SCT	10				84	65	06	14		995					2	2	HH
R	2048	25 SCT 200 SCT	10				83	63	06	15		995					2	2	HH
R	2148	25 SCT 200 SCT	10				82	65	06	15		996					2	2	RR
R	2250	25 SCT 200 SCT	10				80	63	06	15		996					3	3	HH
R	2347	25 SCT	10				79	61	08	10		998					3	3	HS

Time (L.S.T.)	No.	Precip. (ins.)	Snow Fall (ins.)	Snow Depth (ins.)	Max. Temp. (°F)	Min. Temp. (°F)
MID. TO	X					
	1					
	2					
	3					
	4					
MID.	X					

STATION PRESSURE COMPUTATIONS

TIME (L.S.T.)				
ATT. THERM.				
OBSERVD. BAR.				
TOTAL CORR.				
STA. PRESS.				
BAROGRAPH				
BAR. CORR.				

SUMMARY OF DAY (Midnight to Midnight)

24-Hr. Max. Temp. (°F)	24-Hr. Min. Temp. (°F)	24-Hr. Precip. Water Equiv. (ins.)	24-Hr. Snow Fall (ins.)	1200 GMT Snow Depth (ins.)

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

CLR CRD [illegible]

WBAN-10C (12-77) SUPERSEDES WBAN-10C (10-75)

☆ U.S. GPO 1977-O-765-013 7106

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

SURFACE WEATHER OBSERVATIONS

(Abridged for use at designated Civil Stations)

STATION: FT. LAUDERDALE, INT'L

DATE: 10-21-78

To convert LST to GMT add 4 hrs. Time in Column 2 is: GMT ✓ LST ___

Type (1)	Time (2)	Sky and ceiling (hundreds of feet) (3)	Visibility surface (4)	Visibility tower (4a)	Weather and obstructions to vision (5)	Sea level press. (mb.) (6)	Temp (°F) (7)	Dew pt. (°F) (8)	Wind direction (9)	Wind speed (kts) (10)	Wind character (11)	Altim. setting (ins.) (12)	Remarks and supplemental coded data (13)	Station pressure (ins.) (14)	Dry bulb (°F) (15)	Wet bulb (°F) (16)	Total sky cover (17)	Total opaque sky cover (18)	Observer's initials (19)
R	0047	25SCT	10				73	64	08	10		000					3	3	HS
R	0147	25 SCT	10				78	64	09	10		000					2	2	RR
R	0250	25 SCT	10				78	63	09	10		000					2	2	NH
R	0347	25 SCT	10				78	63	10	10		001					3	3	[illegible]
R	0450	25SCT	10				78	64	10	12		002					4	4	VH
R	0547	25SCT	10				75	63	08	06		002					3	3	[illegible]
R	0647	25SCT	10				76	63	09	10		999					3	3	[illegible]
R	0747	25 SCT	10				76	64	09	08		998					4	4	[illegible]
R	0847	25 SCT	10				72	64	04	04		998					4	4	[illegible]
R	0946	25SCT	10				73	65	36	10		001					4	4	VH
R	1045	25SCT	10				71	65	02	08		002					4	4	VH
R	1147	25SCT	10				70	65	02	08		002					4	4	DN
R	1247	25 SCT	10				74	66	01	05		004					4	4	DN
E	1347	25 SCT	10				82	67	07	12		006					4	3	[illegible]
R	1447	25 SCT	10				83	66	09	10		006					5	5	DN
R	1547	25 SCT	10				85	64	10	15		007	TCU W-N				2	2	DN
R	1647	25 SCT	10				84	64	11	12		005					2	2	DN
R	1747	25 SCT	10				84	65	09	14		004					3	3	DN
R	1847	25 SCT	10				84	65	09	16		002					3	3	DN
R	1947	25 SCT	10				84	65	09	15		002	TCU N				3	3	HS
R	2050	25 SCT	12				82	65	05	10		001					3	3	[illegible]
R	2148	25 SCT	12				81	66	09	12		002	CB N				2	2	[illegible]
R	2250	25 SCT	12				80	65	09	10		002					3	3	[illegible]
R	2347	25SCT	10				80	65	08	12G18		002					3	3	[illegible]

STATION PRESSURE COMPUTATIONS

SUMMARY OF DAY (Midnight to Midnight)

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

SURFACE WEATHER OBSERVATIONS

STATION: FORT LAUDERDALE, FLORIDA (EXECUTIVE AIRPORT)

DATE: 10-19-78

To convert L.S.T. to GMT ADD 45 hrs. SUBTRACT ____ hrs.

Type	Time (GMT)	Sky and Ceiling	Visibility Surface	Visibility Tower	Weather and Obstructions to Vision	Sea Level Press.	Temp.	Dew Pt.	Wind Direction	Wind Speed	Wind Character	Altim. Setting	Remarks and Supplemental Coded Data	Station Pressure	Dry Bulb	Wet Bulb	Total Sky Cover	Total Opaque Sky Cover	Observer's Initials
R	0047	35 SCT	10						08	12		009					1	1	MA
R	0147	CLR	10						08	10		009					0	0	MA
R	0247	250 - SCT	10						08	10		009	LAST				2	1	MA
R	1045	25 SCT E200 BKN	10						00	00		005					7	6	KT
R	1151	25 SCT 200 SCT	6		H				33	05		005	TCU NE-E				5	4	KT
R	1246	25 SCT 200 SCT	6		H				33	06		005	TCU NE-SE				5	5	KT
R	1357	25 SCT 200 SCT	7						02	07		007	TCU ALQDS				5	5	KT
R	1459	25 SCT 200 SCT	7						02	07		007	TCU ALQDS				5	5	ES
R	1554	25 SCT E70 BKN 200 BKN	10						10	12		005					7	7	EM
R	1648	25 SCT 80 SCT E200 BKN	10						10	12		004					8	6	KT
R	1750	25 SCT E80 BKN 200 OVC	10						12	06		002	RWU NE SML BINOVC W				10	9	SA
R	1845	E25 [illegible] 80 BKN 200 OVC	4R		RW				05	06		000					10	10	SA
R	1949	25 SCT E80 BKN 200 OVC	6		RW				09	06		998	VSBY SE 4				10	10	WE
R	2050	25 SCT E80 BKN 200 OVC	6		H				00	00		996					10	10	WT
R	2147	25 SCT E80 BKN	7						08	05		996					7	7	MA
R	2249	25 SCT 80 SCT	7						08	04		996	TCU E RWU SE				5	3	WT
R	2348	25 SCT 80 SCT	7						09	06		997					4	3	WT

Time (L.S.T.)	No.	Precip. (in.)	Snowfall (in.)	Snow Depth (in.)	Max. Temp. (°F)	Min. Temp. (°F)
MID. TO	X					
	1					
	2					
	3					
	4					
MID.	X					

STATION PRESSURE COMPUTATIONS

TIME (L.S.T.)				
ATT. THERM.				
OBSERVD. BAR.				
TOTAL CORR.				
STA. PRESS.				
BAROGRAPH				
BAR. CORR.				

SUMMARY OF DAY (Midnight to Midnight)

24-HR. MAX. TEMP. (°F)	24-HR. MIN. TEMP. (°F)	24-HR. PRECIP. WATER EQUIV. (in.)	24-HR. SNOWFALL UNMLTD. (in.)	1200 GMT SNOW (in.)

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

ASI #1 3003
ASI #2 3005
DIFF .02
PMP 3004
TIME CK 1051:30

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

SURFACE WEATHER OBSERVATIONS

STATION: FORT LAUDERDALE, FLORIDA (EXECUTIVE AIRPORT)

DATE: 10-20-78

To convert LST to GMT: ADD 5 hrs. SUBTRACT ______ hrs.

Type (1)	Time (EST) (2)	Sky and Ceiling (3)	Visibility Surface (4)	Visibility Tower (4a)	Weather and Obstructions to Vision (5)	Sea Level Press. (6)	Temp (7)	Dew Pt (8)	Wind Direction (9)	Wind Speed (10)	Wind Character (11)	Altim. Setting (12)	Remarks and Supplemental Coded Data (13)	Station Pressure (14)	Dry Bulb (15)	Wet Bulb (16)	Total Sky Cover (17)	Total Opaque Sky Cover (18)	Observer's Initials (19)
R	0050	25SCT 100SCT	7						08	07		998					4	3	WT
R	0147	E10BKN 50OVC	7						11	05		000	RWU E				10	10	WT
S	0205	15SCT E50BKN	7						10	05		000	RWU NE				6	5	WT
R	0257	15SCT E60BKN	7						09	06		999	Last.				6	5	WT
R	1053	20SCT E180BKN	10						05	05		997					9	8	PJ
R	1147	E4Ø BKN	10						05	03		997					8	8	EM
R	1248	E8Ø BKN	10						02	03		999					7	7	EM
R	1359	E80BKN	10						06	06		002					7	7	PJ
R	1451	30SCT E80BKN	10						05	10		002					6	6	SA
R	1548	3ØSCT 8ØSCT	10						06	10		002					5	5	EM
R	1653	3ØSCT E15Ø BKN	12						06	10		001					7	7	EM
R	1747	30SCT 150SCT	10						06	12		000					3	2	MA
R	1845	30SCT 150SCT	10						05	12		997					3	2	SA
R	1950	30SCT 250SCT	10						06	12		996					2	2	MA
R	2047	30SCT	10						06	10		996					2	2	MA
R	2149	30SCT	10						05	10		995					3	3	RB
R	2252	30SCT	10						06	12		996					3	3	RB
R	2353	30SCT	10						06	12		998					3	3	RB

Time (L.S.T.)	No.	Precip. (in.)	Snow Fall (in.)	Snow Depth (in.)	Max. Temp. (°F)	Min. Temp. (°F)
Mid. to	X					
	1					
	2					
	3					
	4					
Mid.	X					

STATION PRESSURE COMPUTATIONS

Time (L.S.T.)				
Att. Therm.				
Observd. Bar.				
Total Corr.				
Sta. Press.				
Barograph				
Bar. Corr.				

SUMMARY OF DAY (Midnight to Midnight)

24-Hr. Max. Temp. (°F)	24-Hr. Min. Temp. (°F)	24-Hr. Precip. Water Equiv. (in.)	24-Hr. Snow Fall Unm. To. (in.)	Snow Depth (in.)

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

ALT H 2997
" L 2986
NGF .01

PMP 2997

Tired 1100

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

SURFACE WEATHER OBSERVATIONS

STATION: FORT LAUDERDALE, FLORIDA (EXECUTIVE AIRPORT)

DATE: 10-21-78

To convert LST to GMT ADD 4 hrs. SUBTRACT ____ hrs.

Type (1)	Time (LST) (2)	Sky and Ceiling (Hundreds of feet) (3)	Visibility Surface (4)	Visibility Tower (4a)	Weather and Obstructions to Vision (5)	Sea Level Press. (mb.) (6)	Temp (°F) (7)	Dew Pt (°F) (8)	Wind Direc. (9)	Wind Speed (Kts.) (10)	Wind Character (11)	Altim. Setting (Ins.) (12)	Remarks and Supplemental Coded Data (13)	Station Pressure (Ins.) (17)	Dry Bulb (°F) (18)	Wet Bulb (°F) (19)	Total Sky Cover (21)	Total Opaque Sky Cover (22)	Observer's Initials (23)
R	0052	30SCT	10	X					06	08		998					3	3	RB
R	0149	30SCT	10						08	08		998					4	4	RB
R	0351	30SCT	10						04	04		000	LAST				3	3	RB
R	1053	20 SCT 40 SCT	10						00	00		002					2	2	EM
R	1153	20 SCT 200SCT	10						00	00		003					3	2	SA
R	1250	2ØSCT 2ØØSCT	10						00	00		004					3	3	EM
R	1347	30SCT	10						05	05		006					4	4	MA
R	1449	E 3Ø BKN	10						08	10		006					7	7	WE
R	1548	3ØSCT	12						08	11		006					3	3	EM
R	1649	30 SCT	10						08	10		006					3	3	SA
R	1750	30SCT	10						09	09		003					3	3	WE
R	1844	30SCT	10						10	12		003					4	4	WE
R	1950	30SCT	10						08	12		001					4	4	WE
R	2049	30SCT	10						07	10		001					4	4	WE
R	2151	30SCT	10						07	10		001					4	3	SR
R	2254	30SCT	10						06	08		002					3	2	SR
R	2355	30SCT	10						06	07		002					4	3	OR

STATION PRESSURE COMPUTATIONS

SUMMARY OF DAY (Midnight to Midnight)

REMARKS, NOTES AND MISCELLANEOUS PHENOMENA

ASI 1 000
2 002
DIFF 2
CMP 001
TIME 1056

U.S. GOVERNMENT PRINTING OFFICE