AIRBORNE THERMAL INFRARED SURVEY
FALL 1977
ST. LUCIE PLANT
QUARTER III FLIGHT
August 9, 1977

Prepared for

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SECTION I

REGULATORY PURPOSE

The thermal infrared surveys performed by Texas Instruments for Florida Power & Light Company (FPL) are designed to demonstrate compliance with the requirements of the facility NPDES Permit and the facility Environmental Technical Specifications. The specific regulatory requirements are as follows:

- NPDES Permit FL0002208 Special Conditions B., b., sentence 1 and 2.

  The discharge into the Atlantic Ocean shall not cause a temperature rise in excess of 0.8°C (1.5°F) above ambient surface temperature outside a 162 hectacres (400 acre) zone of mixing during the months of June through September, nor 2.2°C (4°F) rise during the remaining months. In addition, the surface temperature conditions within the zone of mixing will not exceed a rise of 3.1°C (5.5°F) over ambient temperature nor a maximum temperature of 33.9°C (93°F) as an instantaneous maximum at any point.

- St. Lucie Unit No. 1 Technical Specifications, Appendix B, Limiting Conditions, 2.1.1, Specification, paragraph 1.

  The thermal discharge of St. Lucie Unit No. 1 into the Atlantic Ocean shall be limited to a maximum release temperature of 111°F and shall not cause a temperature rise in excess of 1.5°F above ambient surface temperature outside a 400 acre zone of mixing during the months of June through September, nor a 4°F rise during the remaining months. In addition, the surface temperature conditions within the zone of mixing shall not exceed a rise of 5.5°F over ambient temperature nor a maximum temperature of 93°F as an instantaneous maximum at any point.

In accordance with the last sentence of the St. Lucie plant NPDES Permit, Special Conditions B., b., FPL submitted to the EPA Regional Administrator on November 21, 1974, a proposed thermal monitoring program to satisfy the NPDES Permit and Environmental Technical Specifications monitoring requirements, which included the surface area temperature limitation. The thermal infrared survey performed for FPL and reported in this document complies with all the regulatory and monitoring program criteria relating to

the thermal infrared imagery requirements. In addition, the four required flight patterns were to be performed approximately on a quarterly basis in order to obtain a representation of seasonal effects due to wind, temperature and currents on the St. Lucie plant plume. The four flights are to be represented in separate reports as Quarter I through Quarter IV Flights.*

*Environmental Technical Specifications, St. Lucie Plant Unit No. 1 Technical Specifications, Appendix B,3.1.A.6.

SECTION II

FACILITY DESCRIPTION

A. PLANT LOCATION

The plant is located on Hutchinson Island in St. Lucie County, about halfway between the cities of Fort Pierce and Stuart on the east coast of Florida (see Figure II-1). The site is approximately 120 highway miles north of Miami, 225 miles south of Jacksonville and 150 miles east of Tampa. Lake Okeechobee is approximately 35 miles to the southwest.

Hutchinson Island is approximately 22 miles long by 1 mile wide at its maximum width. The Atlantic Ocean lies to the east, and the Indian River separates the island from the mainland to the west. Indian River is not a river in the usual sense. It is a long, thin, tidal lagoon stretching down the southeastern coast of Florida between the mainland and a series of offshore islands. The river is approximately 7200 feet wide at the plant site.

Hutchinson Island is generally flat. Much of it consists of swamp covered with dense vegetation characteristic of Florida coastal mangrove swamps. From the ocean shore the land rises slightly in a dune or ridge to approximately 15 feet above mean low water.

The plant is located on 1132 acres near the midpoint of the island. The plant occupies approximately 300 acres adjacent to Big Mud Creek, an inlet off the Indian River, and across State Road A-1-A from the ocean shore.

B. GENERATING UNIT DESCRIPTION

St. Lucie Unit No. 1 is a nuclear unit of pressurized water design. The reactor heat from the reactor's primary system coolant loops is transferred to a secondary coolant system in two steam generators.

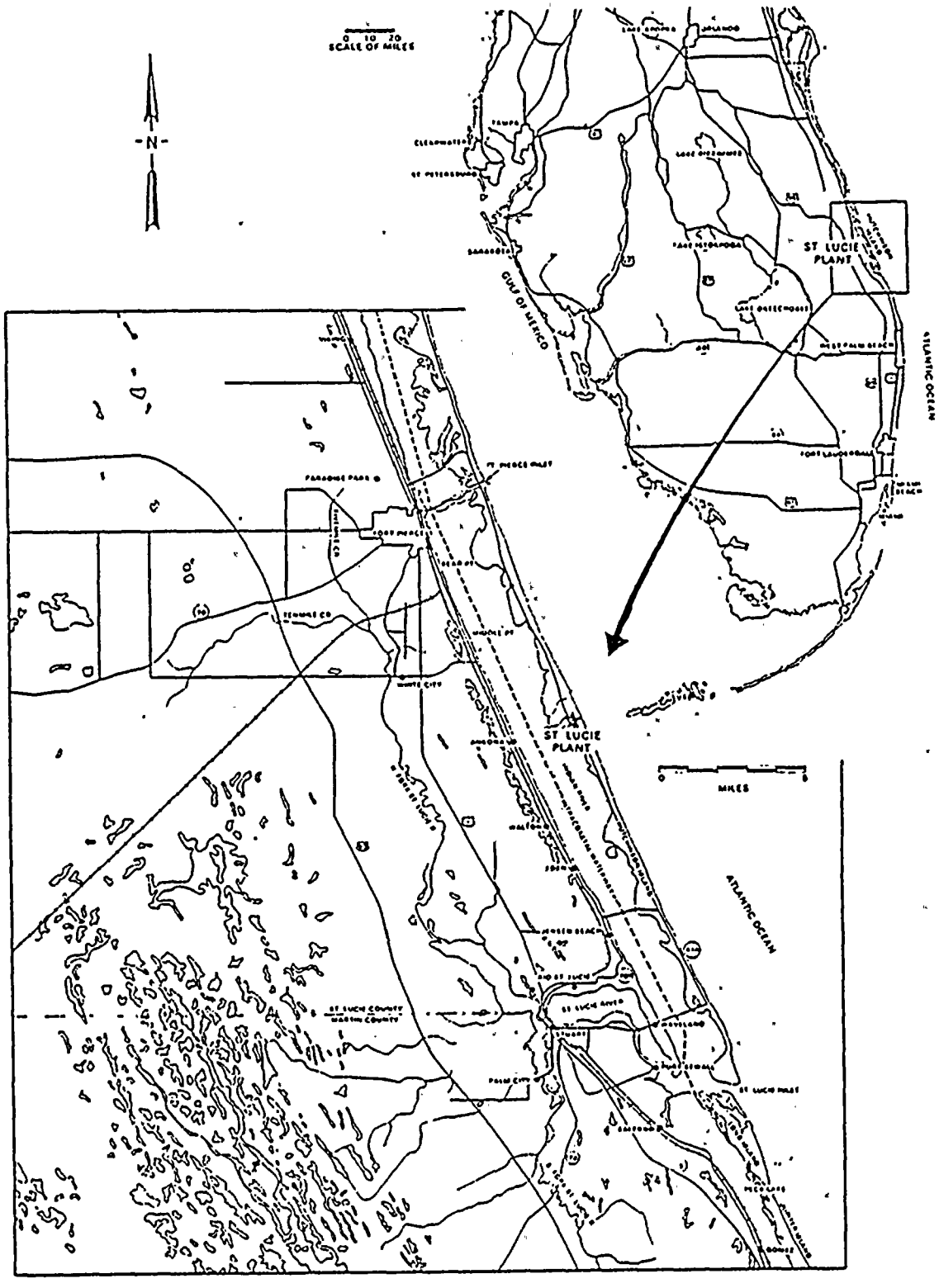


Figure II-1. Site Location Map

The water in the secondary system is converted to steam to drive the turbine-generator and the secondary coolant steam is condensed in a condenser cooled by water from the Atlantic Ocean.

C. COOLING WATER SYSTEM CHARACTERISTICS - ST. LUCIE UNIT NO. 1

The condenser cooling water system is a once-through system with intake and discharge in the Atlantic Ocean. Design flow is 530,000 gpm (1180 cfs) with a maximum and normal temperature rise across the condenser of 24°F. The major components of the system includes (1) two intake lines, (2) one discharge line, (3) an intake canal, and (4) a discharge canal. Figure II-2 presents a general plan view of the system.

The intake is located 1200 feet offshore and about 2400 feet south of the discharge structure. As shown in Figure II-2, the top of the intake is situated approximately 8 feet below the water surface at mean low water (MLW). Horizontal intake velocities approaches 1 fps.

From the ocean intake point, water is drawn through two buried pipelines (ID 10.5 feet) at 6 fps to the intake canal. This 300-foot wide canal begins 450 feet west of the shoreline and carries the cooling water some 5000 feet to the plant intake structure at approximately 0.3 to 0.5 fps.

The plant intake structure consists of four bays, each containing one coarse screen, traveling screen and one circulating water pump. Approach velocities to each bay is less than 1 fps. From this structure, the water flows through a buried pipeline to the condenser at about 7 fps.

The heated water leaving the condenser flows through a buried pipeline for 500 feet to the discharge canal. This open canal is 200 feet wide and extends approximately 1735 feet to a point 400 feet west of the shoreline. There, the discharged water is carried in a 12-foot diameter concrete pipe buried under the beach and ocean floor out to the ocean discharge structure, located 1200 feet out from the shoreline.

The ocean discharge structure, shown in Figure II-2, consists of a short transition section and a Y-type, high-velocity jet discharge; each port is 7.5-feet in diameter. Ocean depth at the discharge point is -18 feet (MLW). The centerline of the discharge ports is 30 feet below the water surface. Exit velocity of the discharge water from each port is 13 fps. The design is a high-momentum type, which produces a relatively high degree of entrainment of ambient water, thus enhancing the diluting characteristics of the outfall.

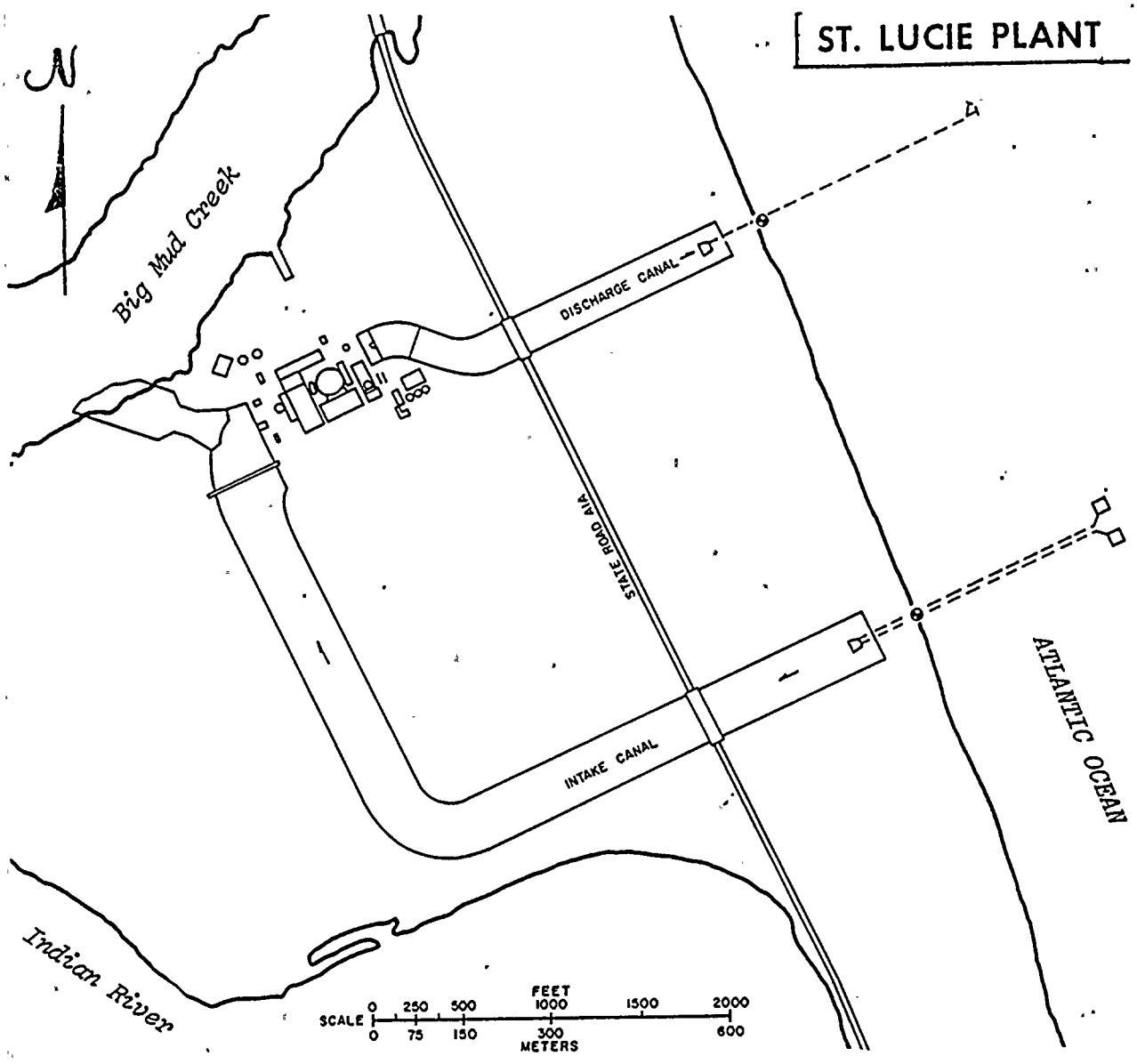


Figure II-2. Plant Intake and Discharge System

SECTION III

GENERAL INTRODUCTION TO THERMAL INFRARED IMAGERY TECHNIQUES

A. INTRODUCTION

Thermal infrared imagery in the 8- to 14-micrometer portion of the electromagnetic spectrum is collected in the Atlantic Ocean area of the St. Lucie Plant intake and discharge. The survey provides surface thermal data compiled from more than 1,000,000 points per square mile.

All plume data are taken within 1 minute, allowing illustration of the thermal mixing pattern and other areas of warm water in a near-synoptic manner. Ambient surface temperatures are observed by ground personnel during the period of airborne data collection and used for the purpose of calibrating the computer-printed temperature maps.

Surface thermal data are developed into a series of computer printed maps; each computer map of the discharge area is then optically changed to a scale of 1 inch = 500 feet. Also, an overlay map of the discharge area is presented at a scale of either 1 inch = 1000 feet or 1 inch = 1250 feet. Additionally, computer printouts of enlarged areas, included in Appendix B, are used for calibration purposes.

B. DATA COLLECTION

Infrared imagery is produced by a series of scan lines perpendicular to the flight direction and is similar in appearance to strip photography. Relative radiometric temperature differences are represented by the imaged grey tones as illustrated in Plates IV-1 through IV-6. Light tones, as they appear on the positive print of infrared imagery, represent higher radiometric temperatures. Dark image tones correspond to lower radiometric temperatures.

A Texas Instruments RS-310D airborne infrared scanning system is used to collect the thermal infrared data over the St. Lucie plant. This

system records data in the 8- to 14-micrometer portion of the electromagnetic spectrum, and temperature reference sources are located within the field-of-view of the scanner system to allow temperature calibration of the image tones for map compilation.

At the start of each scan, the detector is focused first on a hot calibrated radiation source and then on a cold calibrated source. These two sources thus provide verification of calibration of temperature and system gain on each scan line. To aid in analyzing data, the two radiation sources usually are set near the highest and lowest radiation expected from the water to be measured.

As a further aid to produce clear, usable data from these scans, the detector voltage is digitized each 1/2000 radian of scan angle (0.0286). The resulting computer tape has one scan line per record on the tape with 1890 points digitized on that tape for each record (scan line). The digitized information, which includes the calibration sources, is recorded on a special high-speed digital tape recorder. This is a special tape not directly usable on a standard computer due to its format and its high packing density. Therefore, the areas of interest is copied from the special tape onto a standard computer tape (9 track 800 BPI) by slowing the special tape to 1/16 of original speed and employing programs in a TI 980 computer used especially for this purpose.

A map is formed by printing a series of scan lines (computer records) along a computer page. Each digitized point is a measure of the radiation from the surface as modified by the atmosphere between the surface and the scanner. Since infrared radiation will not pass through water, the radiation power is a function of the surface only; no radiation can come from below the surface.

Other involved factors are:

1) Radiation efficiency of water

2) Angle of water surface to the scanner

3) Difference between temperature of surface molecules and temperature of water 1 to 6 inches below the surface, where it can be measured by a thermometer

4) Atmospheric loss or absorption

5) Difference in atmospheric path length

Factor 1) is small, about 0.98 percent, and is calibrated out through the use of ground measurements. Factor 2) is also small and is averaged out in the computer; it is seen as $\pm 0.3^{\circ}F$ when looking at waves. Factor 3) is small but is also calibrated out through use of ground temperature measurements.

Factor 4) is variable, depending on water vapor, water droplets in the air, and temperature of the droplets; most could be calibrated through the use of ground measurements. Factor 5) is a function of scan angle and is small for the 30° off-axis scan angles used in the calibrated scanner, therefore no correction is made for this factor.

C. CALIBRATION

It is possible to have sufficiently calibrated information by using only the calibrated sources and flying one extremely low pass with the normal higher pass. However, when possible, final calibration of the data is done by using water bodies in the areas of measurement as hot and cold calibration sources. At the St. Lucie plant site, the intake and discharge canals provide two sources for this calibration.

For final calibration, two areas are used: the intake canal and the discharge canal. A computer printout is made of each area and 400 digitized elements are averaged to obtain the average value of the radiation number received in the area. Using average radiation numbers derived for the intake canal and the discharge canal, the computer reads from the computer tape and prints out a map of the surface water temperature over the

entire area covered by the tape. Using the mathematics of the scanner, aircraft height, and aircraft speed, the map is scaled to fit existing maps.

D. PROCESSING TECHNIQUES AND DATA PRESENTATION FORMAT

The recorded airborne thermal infrared data is prepared in two formats: qualitative image presentations and quantitative isothermal maps.

The qualitative data included in this report illustrates the qualitative, near-synoptic view of surface-temperature variations of the survey area depicted as image tones. These grey-tone maps have some panoramic distortion on the sides, making a scale change-out on the sides of the "heat picture".

The plane's altitude is used to determine the computer's printout for the temperature point areas from a linear relationship with the mapping scales. To make a computer printout of temperature, flight data is sampled along the x direction (across flight path) and along the y direction (along flight path) in a ratio of samples to produce the same map scale in both x and y directions. At the same time, the panoramic distortion is removed in the x direction. Therefore, the resulting map is reasonably distortion-free, and the map can either be enlarged or compressed optically to any desired scale. Isotherm lines are drawn directly on the printed temperature map and an isotherm line map traces off of these lines.

The digital number of radiation for each point is multiplied by a scale factor that produces a scale of numbers in degrees Fahrenheit or Centigrade as desired. An offset number is then applied to make one of the areas printout as the zero reference. It is easier to visualize a plume if it is referenced against a zero background rather than printing the actual temperature as read from a thermometer. The scaling factor used to produce Fahrenheight degrees and the offset factor to produce a zero reference area in the printout are derived from a calibration printout of enlarged areas

which show the intake canal, discharge canal, and a reference ocean area. This calibration printout is adjusted to follow closely the delta temperatures as measured in the canals from the ground.

SECTION IV

RESULTS

FLIGHT PASS 8/9/77, TIME 1025

This flight pass consists of a coverage along the coast in a north-south direction. The northern limit of the printout is the Fort Pierce Inlet with the southern boundry extending approximately 3 miles south of the Forth Pierce Inlet. Plate IV-1 is the grey toned image of the flight pass.

The following parameters were measured during the over flight:

Wind - 6 mph at 150°

Ambient air temperature over land - 83.1°F

Tide @ 1035 low tide

Discharge canal elevation - 10.20 feet above MLW

Plant delta T (combined condenser) - 23.56°F

Discharge flow - 489,500

Reactor power-100%

Gross power generated - 825 megawatts

Intake surface canal temperature (taken at east end of canal) - 83.3°F

Discharge surface temperature - 106.1°F

Temperature difference between canals - 22.8°F

Calibration: The flight pass data of 1036 was used to calibrate the 1025 calibration printout. The ground measurements showed a temperature differential of 22.8°F between canals. The calibration printout which is included as Attachment E shows a temperature differential between the canals of 22.82°F.

SUMMARY OF FINDINGS

The 1025 flight pass was flown from Fort Pierce Inlet down the coast line to within 2 miles of the St. Luice Nuclear Power Plant. The excess temperatures are shown in°F and ambient temperature (83.3°F). is shown

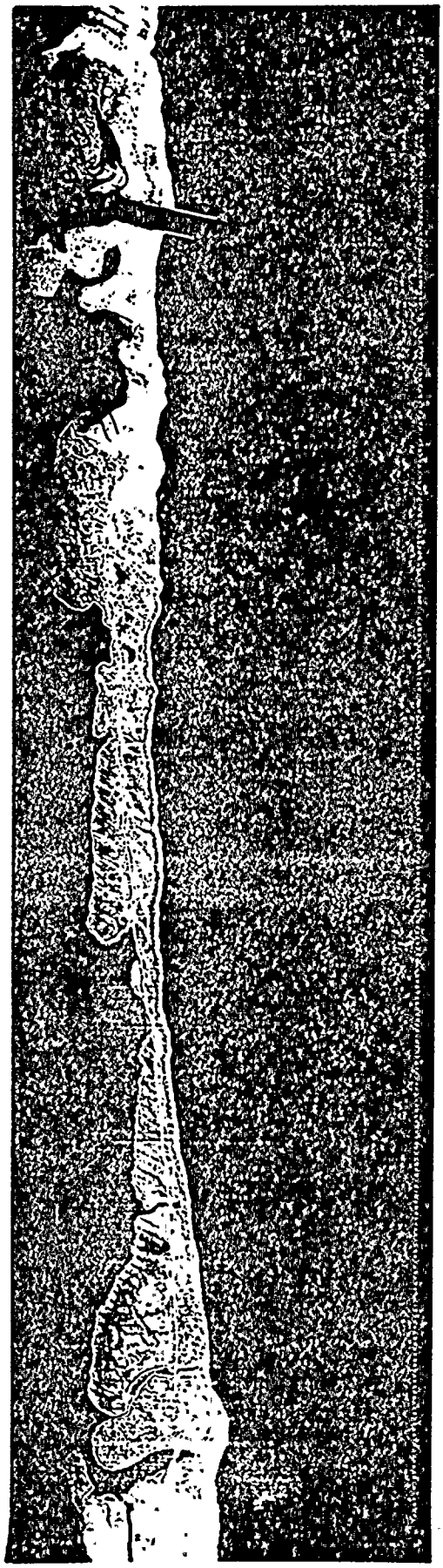


Plate IV-1. Flight Pass, 8/9/77, Time 1025

as a blank on the computer printout and was referenced from the nuclear power plant's intake canal. The near shore (Atlantic side) showed that the excess temperatures ranged between 3.0°F to 5.0°F. Fort Pierce Inlet showed excess temperatures ranging from 2.0°F to 3.0°F. The computer printout showed that the excess temperatures decreased from near shore to ambient temperature 7000 feet into the Atlantic Ocean.

There appeared to be no plume influence from the nuclear power plant covering this flight pass.

FLIGHT PASS 8/9/77, TIME 1029

The flight pass consists of a coverage along the coast in a north-south direction. The northern limit is approximately 5-1/2 miles north of the St. Lucie Inlet and the southern limit of the flight is approximately 2 1/3 miles south of the St. Lucie Inlet. Plate IV-2 is the grey toned image of the flight pass.

The following parameters were measured during the over flight:

Wind - 6 mph at 150°
Tide @ 1035 low tide
Discharge canal elevation - 10.20 feet above MLW
Plant delta T (combined condenser) - 23.56°F
Discharge flow - 489,500
Reactor power - 100%
Gross power generated - 825 megawatts
Intake surface canal temperature (taken at east end of canal) - 83.3°F
Temperature difference between canals - 22.8°F

Calibration: The flight pass data of 1036 was used to calibrate the 1029 pass. The ground measurements showed a 22.8°F temperature differential between canals. The calibration printout, which is included as Attachment E, shows a temperature difference between the canals of 22.82°F.

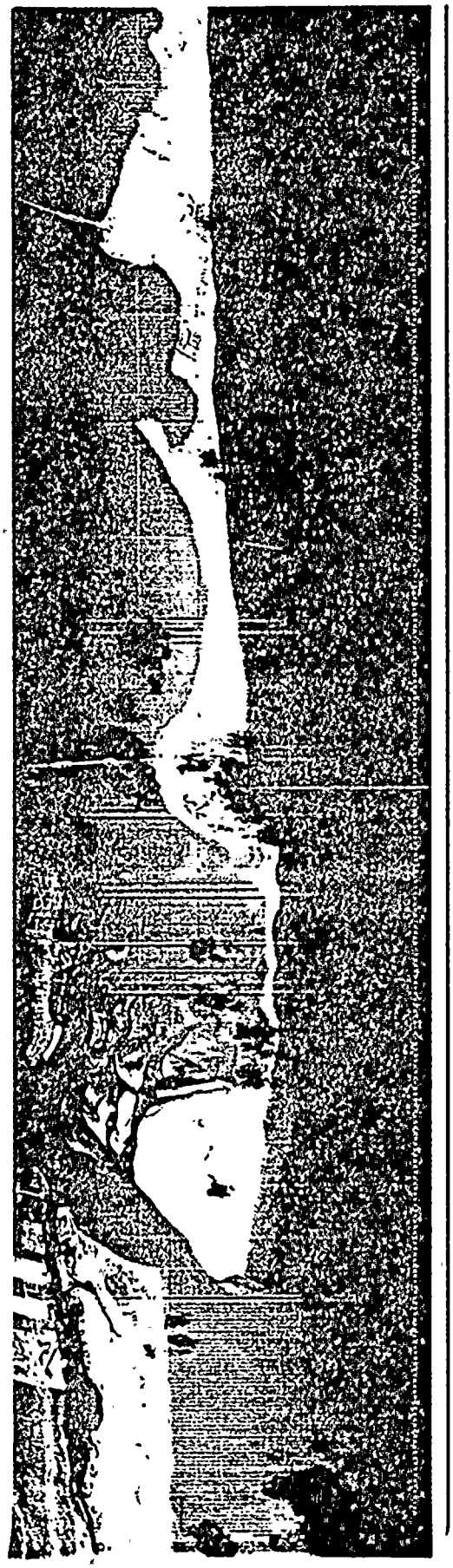


Plate IV-2. Flight Pass, 8/9/77, Time 1029

SUMMARY OF FINDINGS

The 1029 flight pass started approximately 4 3/4 miles south of the nuclear power plant and flew approximately 2 1/3 miles south of the St. Lucie Inlet. The 1029 flight pass computer printout of the lower portion of the Hutchinson Island starting approximately 9 miles south of the nuclear power plant shows the excess temperatures of the Indian River, Atlantic Ocean and the St. Lucie Inlet. The Indian River had a range from 6.0°F to 9.0°F in excess temperatures. Ambient temperature (83.3°F) was chosen from the nuclear power plant's intake canal as its reference.

Approximately 2 1/3 miles north of St. Lucie Inlet, the Indian River had excess temperatures ranging from 6.0°F to 8.0°F, and approximately 4 2/3 miles north of the St. Lucie Inlet, the Indian River had ranges from 7.0°F to 9.0°F in excess temperatures.

The near shore at the Atlantic Ocean side had ranges of 5.0°F to 7.0°F in excess temperatures from the St. Lucie Inlet to approximately 4 3/4 miles north of the St. Lucie Inlet with excess temperatures decreasing further from the shore.

St. Lucie Inlet had excess temperatures ranging from 6.0°F to 7.0°F.

The computer printout from the 1029 flight pass appeared to have had no influence from the nuclear power plant.

FLIGHT PASS 8/9/77, TIME 1036

This flight pass shows both the plant area and the Atlantic Ocean in front of the plant at mid-morning. The pass covered the essential portion of the plume and both the intake canal and the discharge canal were used in calibration. Plate IV-3 is a grey toned image of the mid-morning flight pass.

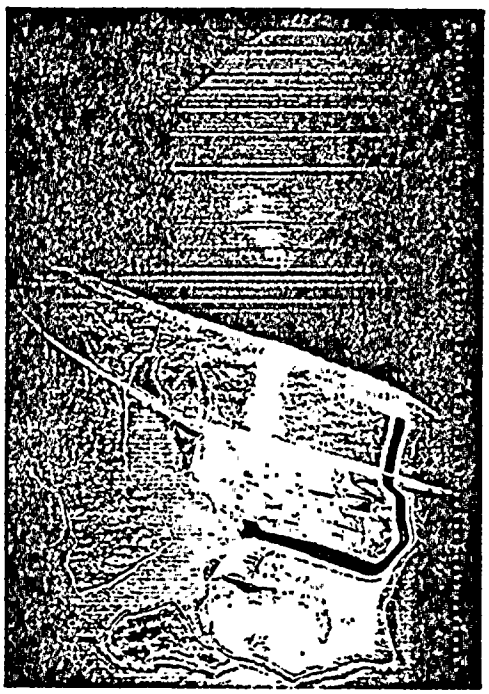


Plate IV-3. Flight Pass, 8/9/77, Time 1036

The following parameters were measured during the over flight:

Wind - 6 mph @ 150°

Ambient air temperature over land - 83.1°F

Tide @ 1035 low tide

Discharge flow - 489,500

Reactor power - 100%

Gross power generated - 825 megawatts

Intake surface canal temperature (taken at east end of canal) - 83.3°F

Discharge surface temperature - 106.1°F

Temperature difference between canals - 22.8°F

Calibration: The ground measurements showed a temperature differential of 22.8°F between canals. The calibration printout, which showed a differential of 22.82°F between the canals, is included as Attachment E.

SUMMARY OF FINDINGS

Temperature distributions measures off shore at the St. Lucie plant are presented as Plate IV-4 and Attachment C

The maximum surface temperature within the plume was 88.3°F, (5.0°F above ambient) covering an area of 0.21 acre. The 1.5°F isotherm was shown to cover a large area of 269 acres which was probably due to the effects of the 150 degree wind direction. Each temperature point on the printout (Attachment C) was approximately 0.122 acre.

Temperature isotherms and their respective areas for various temperatures above ambient (ΔT) are listed as follows:

ΔT Isotherm (°F)	Area (acres)
5.0	0.21
4.0	2.69
3.0	16.3
2.0	227
1.5	269

FLIGHT PASS 8/9/77, TIME 1508

This flight pass shows the Atlantic Ocean area and the shore line in front of the plant at mid-afternoon. The pass covers the essential portion of the plume and the shoreline. Plate IV-5 is a grey toned image of the mid-day flight pass.

The following parameters were measured during the over flight:

Wind - 10 mph @ 130°
Ambient air temperature over land - 84:6°F
Tide @ 1702 high tide
Discharge canal elevation - 12.00 feet above MLW
Plant delta T (combined condenser) - 23.55°F
Discharge flow - 489,000
Reactor power at - 99.80%
Gross power generated - 823 megawatts
Intake surface canal temperature (taken at east end of canal) - 83.3°F
Discharge surface canal temperature - 106.4°F
Temperature differences between canals - 23.1°F

Calibration: The ground measurements showed a 23.1°F temperature difference between canals. The calibration printout which is included as Attachment E, has a temperature difference between the canals of 23.09°.

SUMMARY OF FINDINGS

Temperature distributions measures off shore at the St. Lucie plant are presented as Plate IV-6 and Attachment D.

The maximum surface temperature within the plume was 87.3°F (4.0°F above ambient) covering an area of 0.24 acre. The 1.5°F isotherm was shown to cover an area of 19.5 acres. Each temperature point on the printout (Attachment D) was approximately 0.122 acre.

Plate IV-5. Flight Pass, 8/9/77, Time 1508

Temperature isotherms and their respective areas for various temperatures above ambient (ΔT) are listed as follows:

ΔT Isotherm ($^{\circ}F$)	Area (Acres)
4.0	0.24
3.0	2.69
2.0	14.7
1.5	19.5

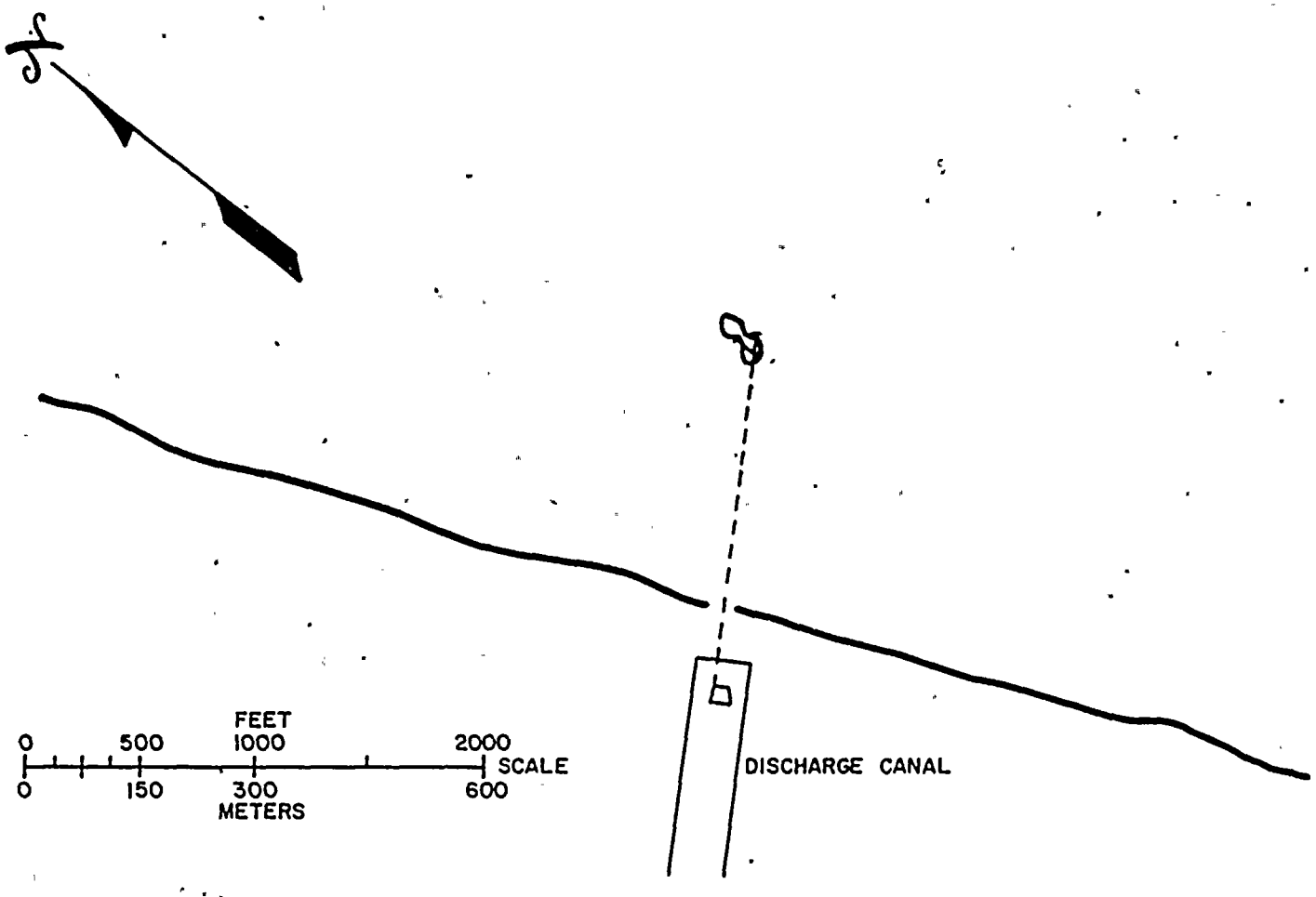
FLIGHT PASS 1508

Flight Pass 1508 had an offset temperature measured by the scanner. This is a normal occurrence caused by the cool moist air between the scanner and the ground. This offset is calibrated through the use of ground temperature measurements. Since the scanner looks through a longer path at side angles than at center angles, the offset is slightly greater at side angles than at center angles. Flight pass 1508 had a difference between center angle (0^{o}) and side angle (33^{o}) of $1^{o}F$. The exact factor of $1^{o}F$ was determined by using data from the flight at 90^{o} angles. Therefore, a correction factor was applied by adding a factor of cosecant-1 to the computed values for each angle. One pass showed the radiation power as a constant along a flight path, and the crossing path showed the variation of radiation power with scan angle.

Plate IV-4. Isotherms, Flight Pass, 8/9/77, Time 1036

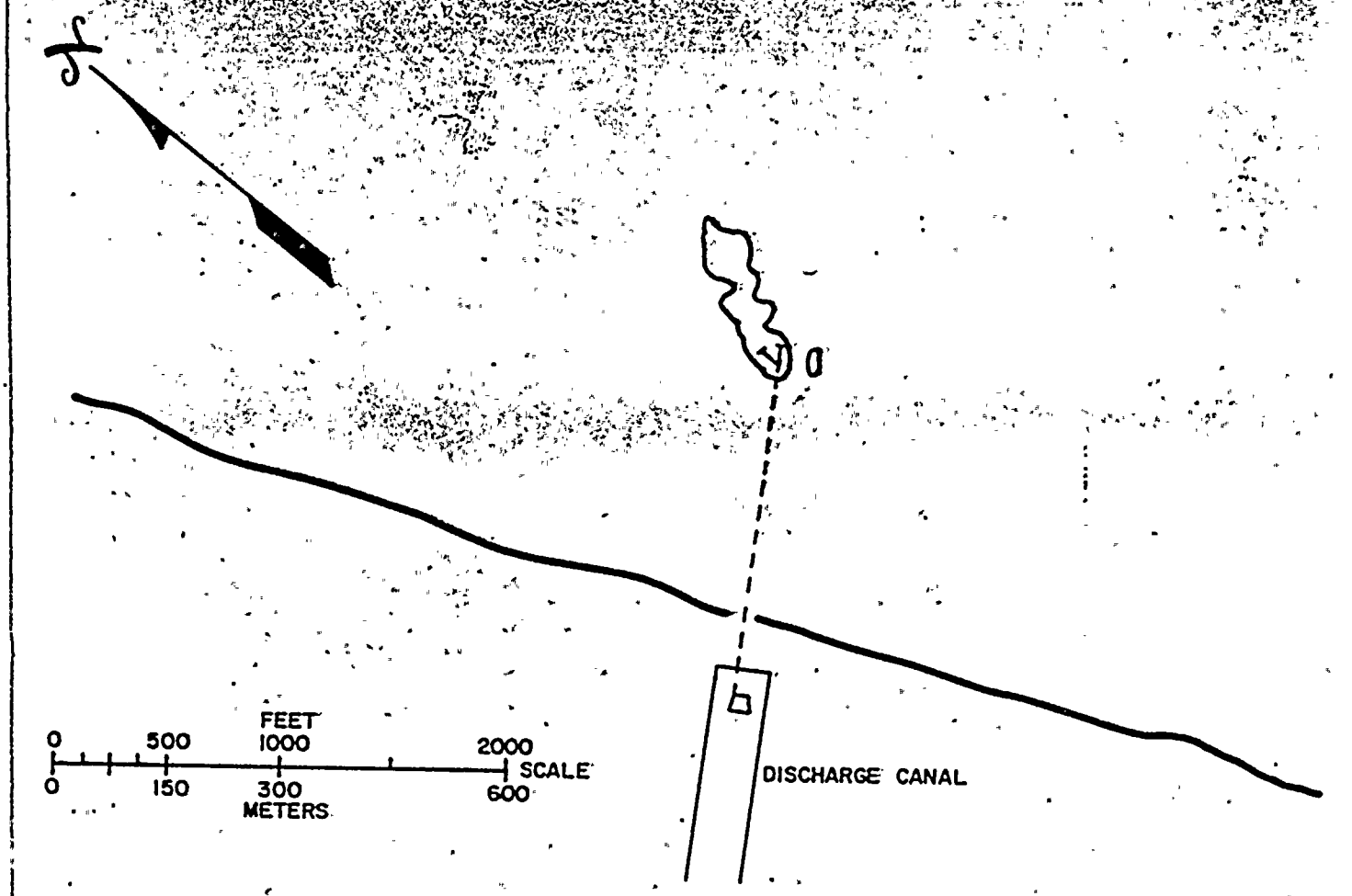
ST. LUCIE PLANT ISOTHERMS PLATE IV-4 E
FLIGHT PASS 8/9/77, TIME 10:36

REACTOR POWER 100.00%
DISCHARGE FLOW 489,500 GPM
WIND 150° 6MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F
DISCHARGE CANAL 106.1°F 5.0°F
LOW TIDE
MAX. PLUME 5°F
ACRE 0.21



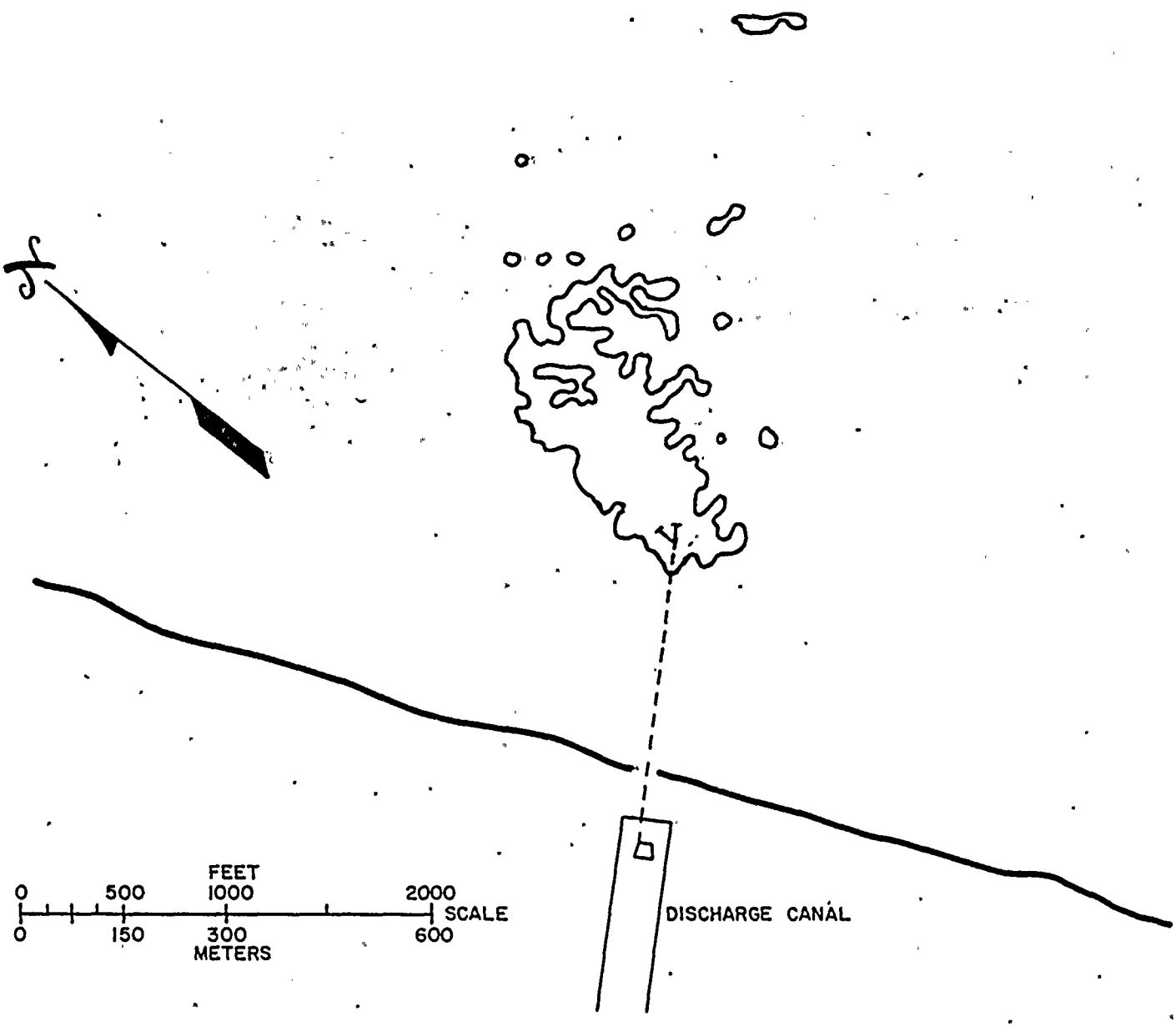
ST. LUCIE PLANT ISOTHERMS PLATE IV-4 D
FLIGHT PASS 8/9/77, TIME 10:36

REACTOR POWER 100.00%
DISCHARGE FLOW 489,500 GPM
WIND 150° 6MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F 4.0°F
DISCHARGE CANAL 106.1°F
LOW TIDE
MAX. PLUME 5°F
ACRES 2.69



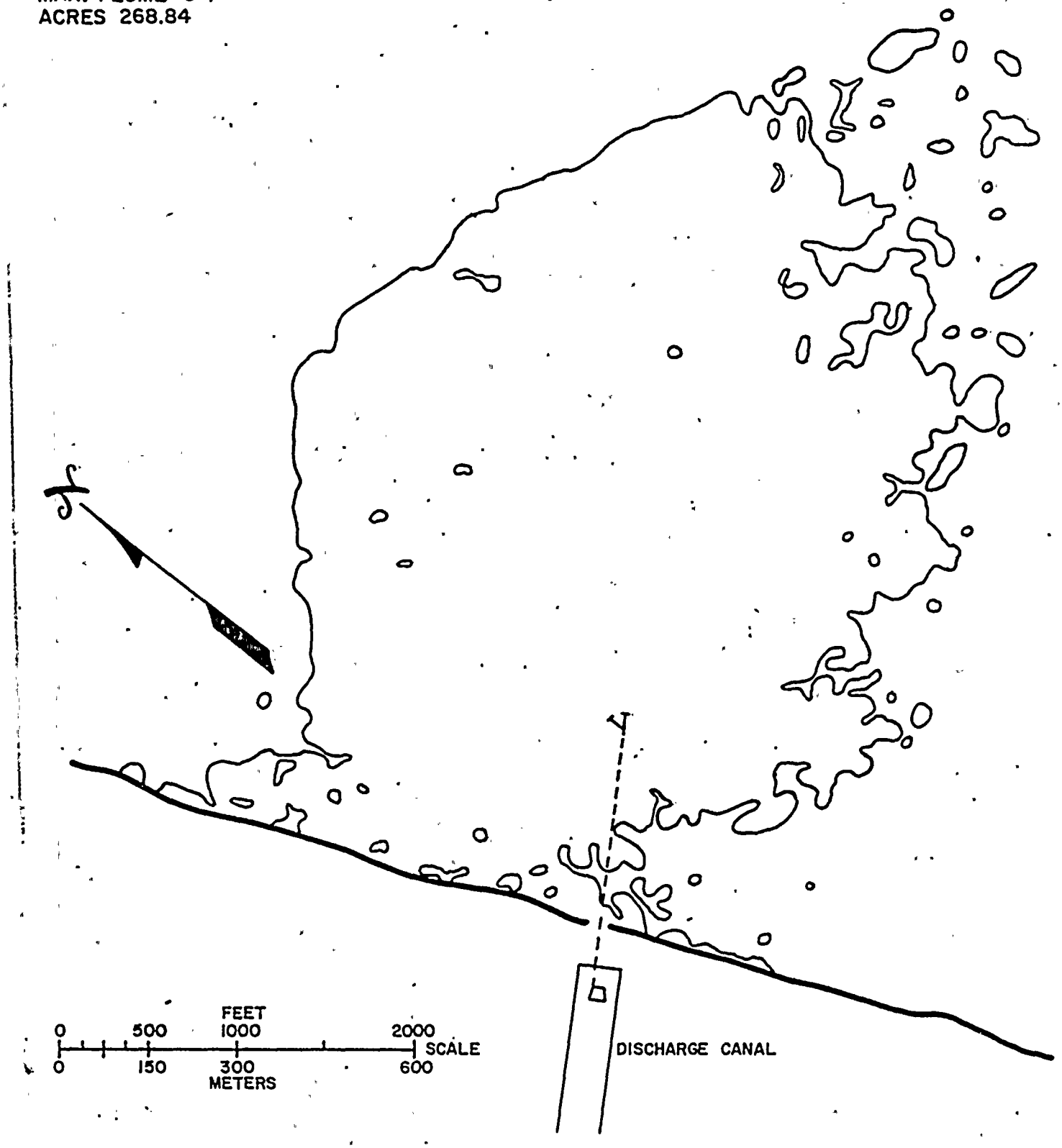
ST. LUCIE PLANT ISOTHERMS PLATE IV-4 C
FLIGHT PASS 8/9/77, TIME 10:36

REACTOR POWER 100.00%
DISCHARGE FLOW 489,500 GPM
WIND 150° 6MPH
3.0°F
AMBIENT TEMP. INTAKE CANAL 83.3°F
DISCHARGE CANAL 106.1°F
LOW TIDE
MAX. PLUME 5°F
ACRES 16.32



ST. LUCIE PLANT ISOTHERMS — PLATE IV-4 A
FLIGHT PASS 8/9/77, TIME 10:36

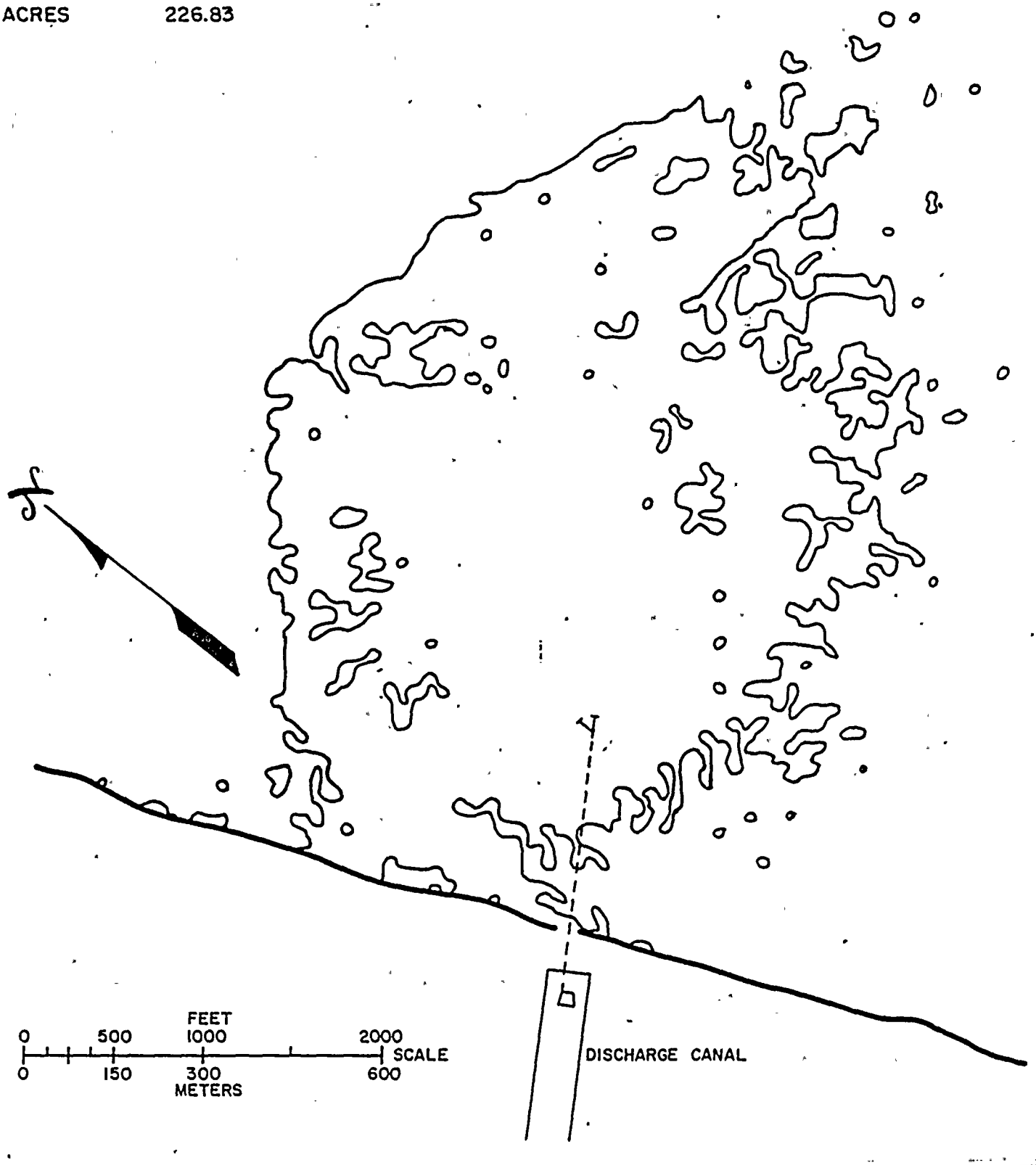
REACTOR POWER 100.00%
DISCHARGE FLOW 489,500 GPM
WIND 150° 6MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F
DISCHARGE CANAL 106.1°F
LOW TIDE
MAX. PLUME 5°F
ACRES 268.84



ST. LUCIE PLANT ISOTHERMS PLATE IV-4 B
FLIGHT PASS 8/9/77, TIME 10:36

REACTOR POWER 100.00%
DISCHARGE FLOW 489,500 GPM
WIND 150° 6MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F
DISCHARGE CANAL 106.1°F
LOW TIDE
MAX. PLUME 5°
ACRES 226.83

2.0°F



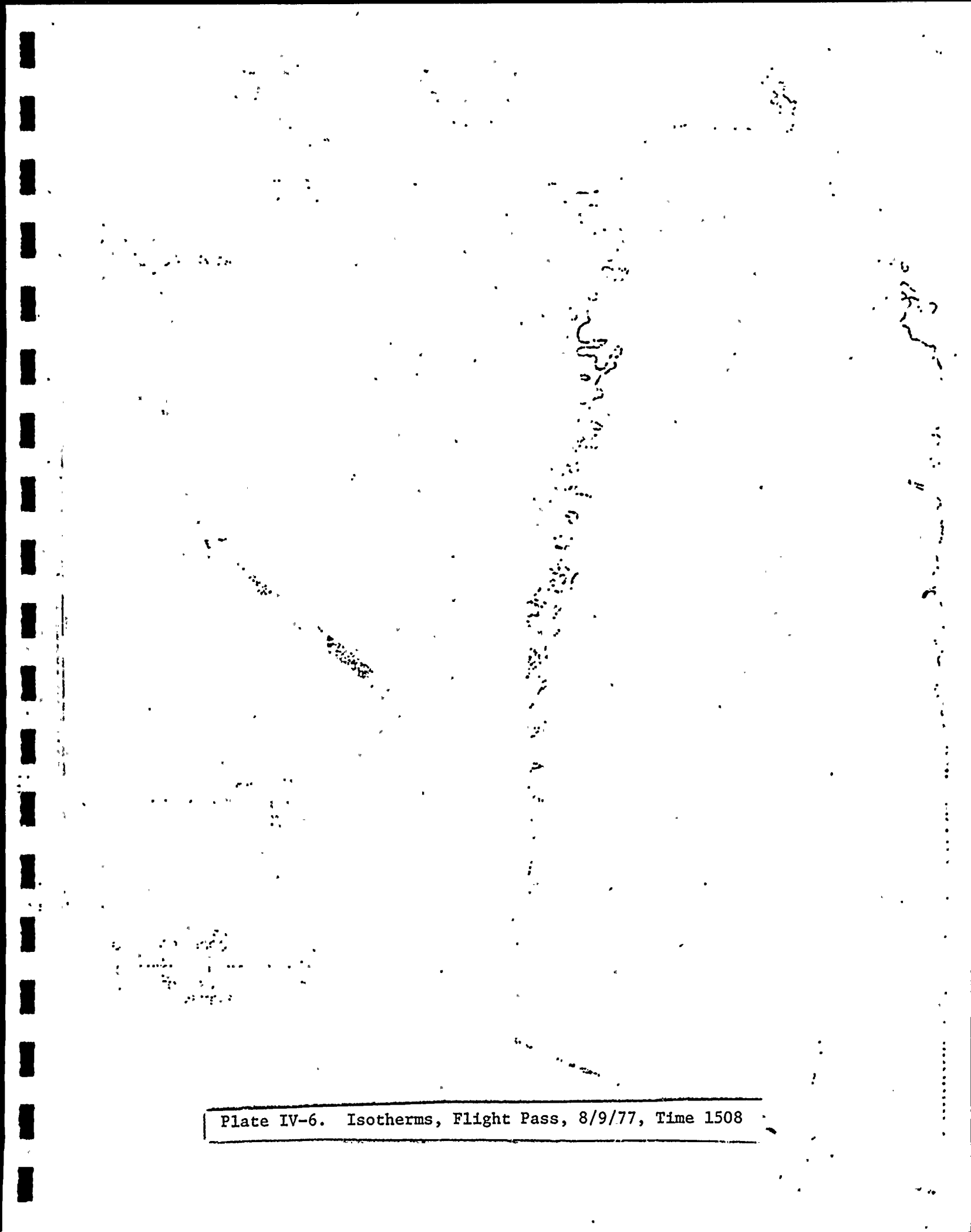
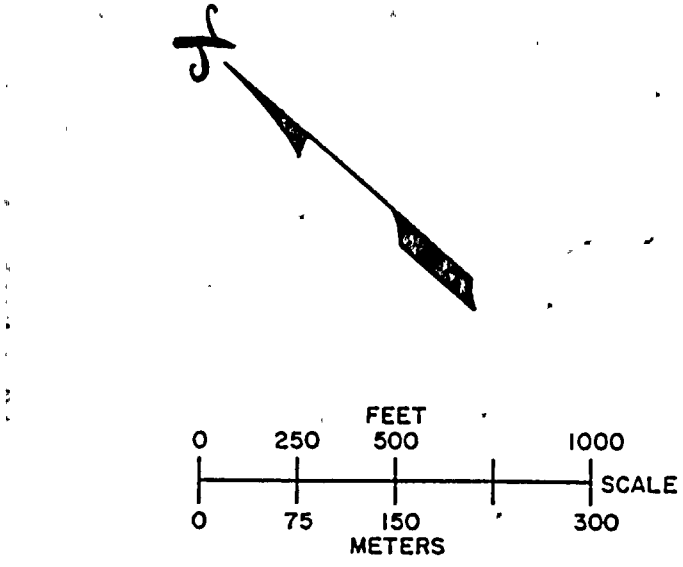


Plate IV-6. Isotherms, Flight Pass, 8/9/77, Time 1508

ST. LUCIE PLANT ISOTHERMS PLATE IV-6 A
FLIGHT PASS 8/9/77, TIME 15:08

REACTOR POWER 99.80%
DISCHARGE FLOW 489,000 GPM
WIND 130° 10MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F
DISCHARGE CANAL 106.4°F
HIGH TIDE
MAX. PLUME 4°F
ACRES 19.47

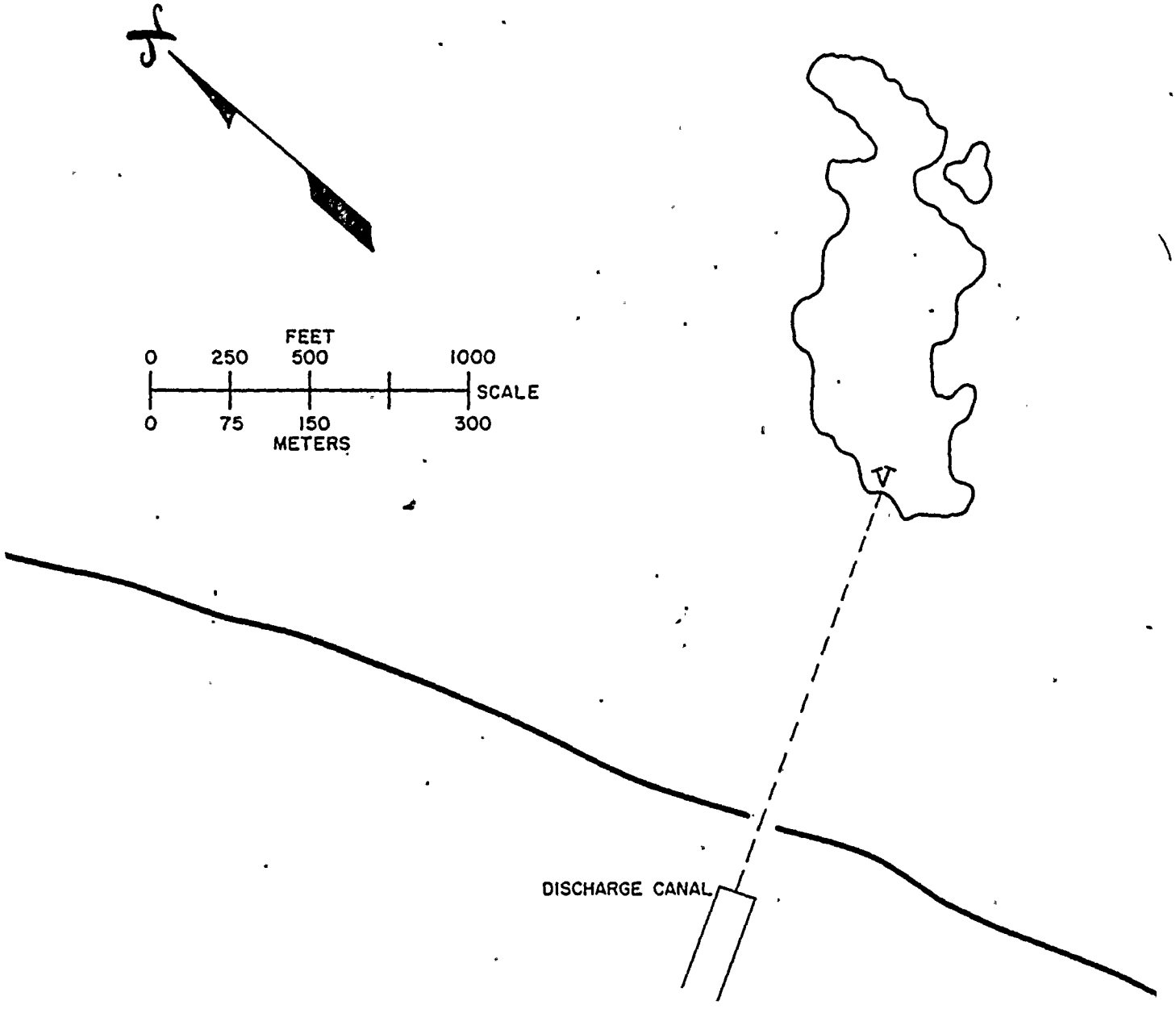
1.5°F



ST. LUCIE PLANT ISOTHERMS PLATE IV-6 B
FLIGHT PASS 8/9/77, TIME 15:08

REACTOR POWER 99.80%
DISCHARGE FLOW 489,000 GPM
WIND 130° 10MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F
DISCHARGE CANAL 106.4°F
HIGH TIDE
MAX. PLUME 4°F
ACRES 14.47

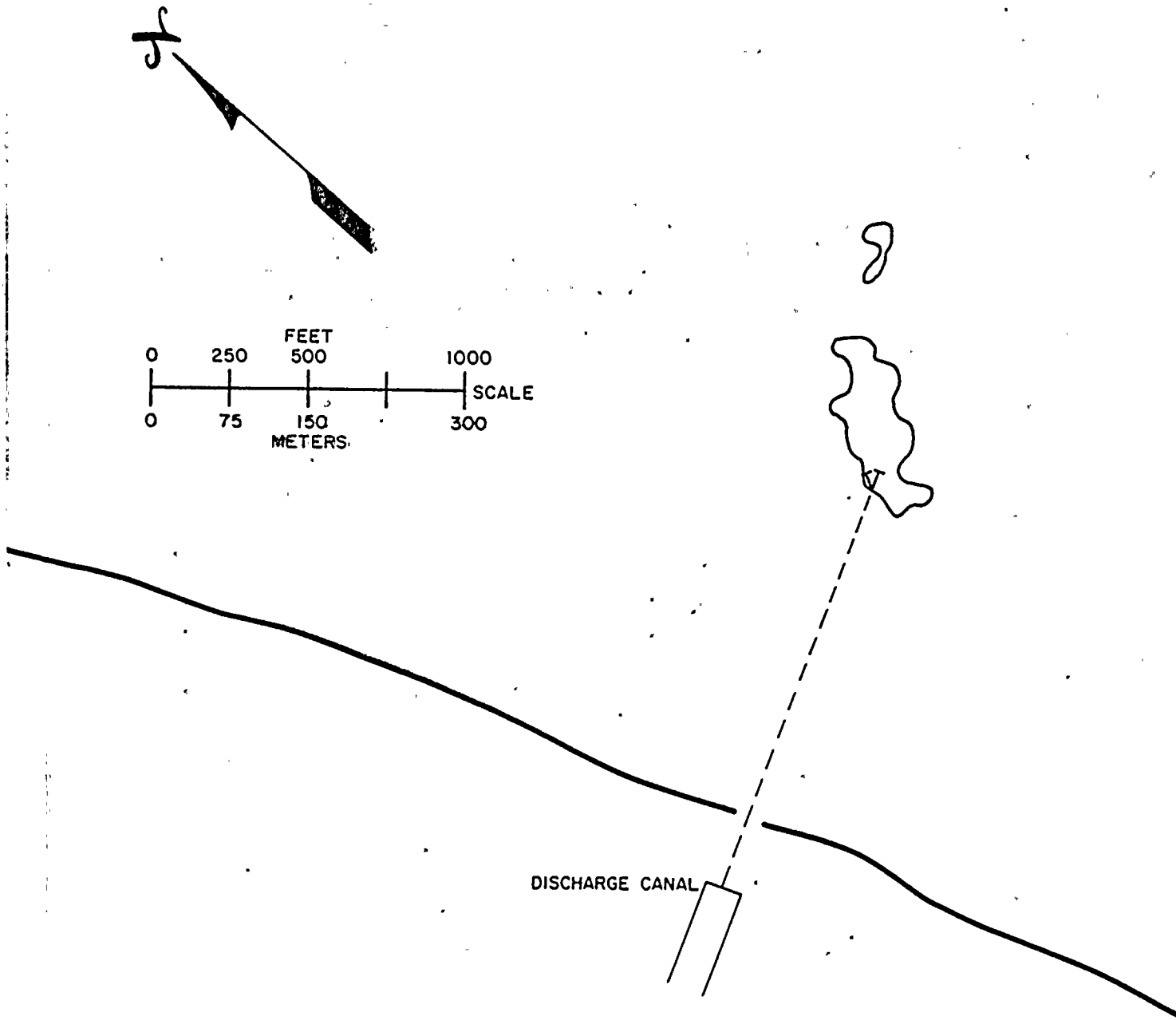
2.0°F



ST. LUCIE PLANT ISOTHERMS PLATE IV-6 C
FLIGHT PASS 8/9/77, TIME 15:08

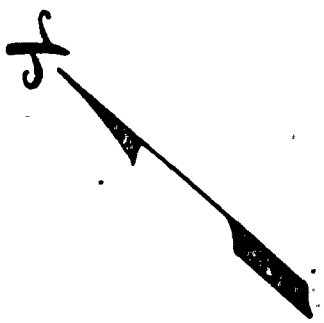
REACTOR POWER 99.80%
DISCHARGE FLOW 489,000 GPM
WIND 130° 10MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F
DISCHARGE CANAL 106.4°F
HIGH TIDE
MAX. PLUME 4°F
ACRES 2.69

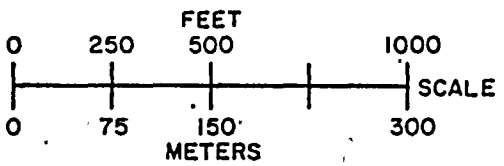
3.0°F

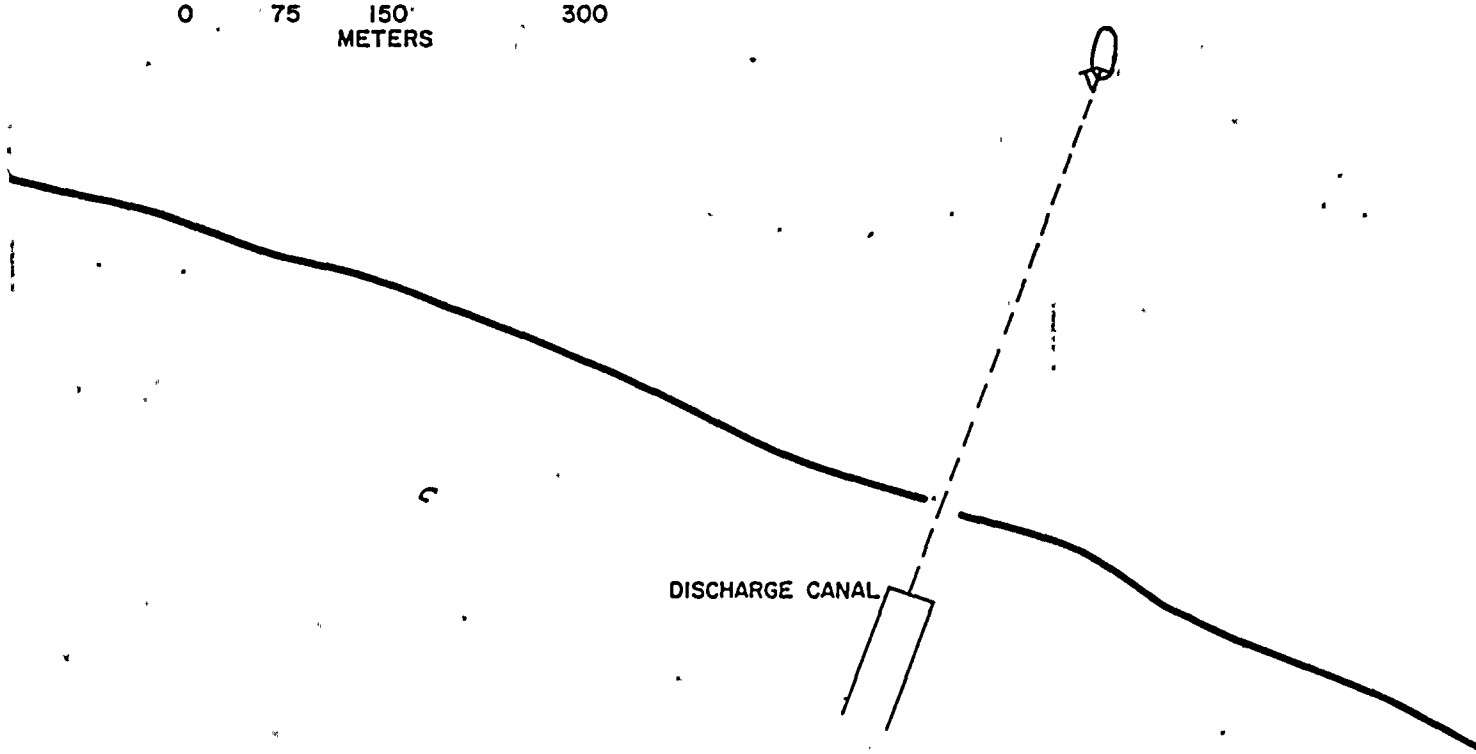


ST. LUCIE PLANT ISOTHERMS PLATE IV-6 D
FLIGHT PASS 8/9/77, TIME 15:08

REACTOR POWER 99.80%
DISCHARGE FLOW 489,000 GPM
WIND 130° 10MPH
AMBIENT TEMP. INTAKE CANAL 83.3°F 4.0°F
DISCHARGE CANAL 106.4°F
HIGH TIDE
MAX. PLUME 4°F
ACRE 0.24







SECTION V

DISCUSSION

The imagery taken during the 9 August 1977 morning flight pass showed to have wind direction effect. The hot water appeared to rise to the surface quickly and then diffused along the surface effected by the wind, at least as much as by water currents.

The imagery taken during the 9 August 1977 afternoon flight pass showed to have contained a small plume area. The hot water appeared to dissipate much more rapidly due to the possibility of high tide conditions.

Table V-1 shows the excess temperatures ΔT isotherms with their given areas at high and low tide.

TABLE V-1. Excess Temperatures ΔT Isotherm

Flight Pass		Flight Pass	
8/9/77 1036		8/9/77 1508	
Reactor power 100%		Reactor Power 99.80%	
Low Tide @ 1035		High Tide @ 1702	
ΔT Isotherms (°F)	Area (Acres)	ΔT Isotherms (°F)	Area (Acres)
5.0	0.21	4.0	0.24
4.0	2.69	3.0	2.69
3.0	16.3	2.0	14.7
2.0	227	1.5	19.5
1.5	269		

APPENDIX A

FLIGHT LOGS

FLIGHT LOG St. Lucie

DATE 8-9-77

TAKE OFF TIME 1012

TAKE OFF WIND

CLOUD N/A Humidity 71%

ENGINE START TIME

TAKE OFF TIME 1012

TAKE OFF PLACE Stewart Airport

CAL SOURCES

RUN #	TIME		TAPE		FILM		HEAD	ALT	V	COMMENTS
	ON	OFF	ON	OFF	ON	OFF				
1	1022		1570	2038				4500	150	
2	1025		2038	2400				4500	150	
3	1029		2400	2790				4500	150	
4	*		2790	2928				4500	150	* False Start
4	*		2928	3420				4500	150	* False Start
4	1036		3420	6000			150°	4500	150	
5	1105		6000	7570				4500	150	
6	1115		7570	7998				4500	150	
7	1119		2998	8322				4500	150	
										Pictures False Color IR
										1 Stop Underexposed

TI-24266

FLIGHT LOG St. Lucie

DATE 8-9-77

TAKE OFF TIME 1628

TAKE OFF WIND 100° 10/13 kt

CLOUD N/A

ENGINE START TIME N/A

TAKE OFF TIME 1628

TAKE OFF PLACE Stewart Airport

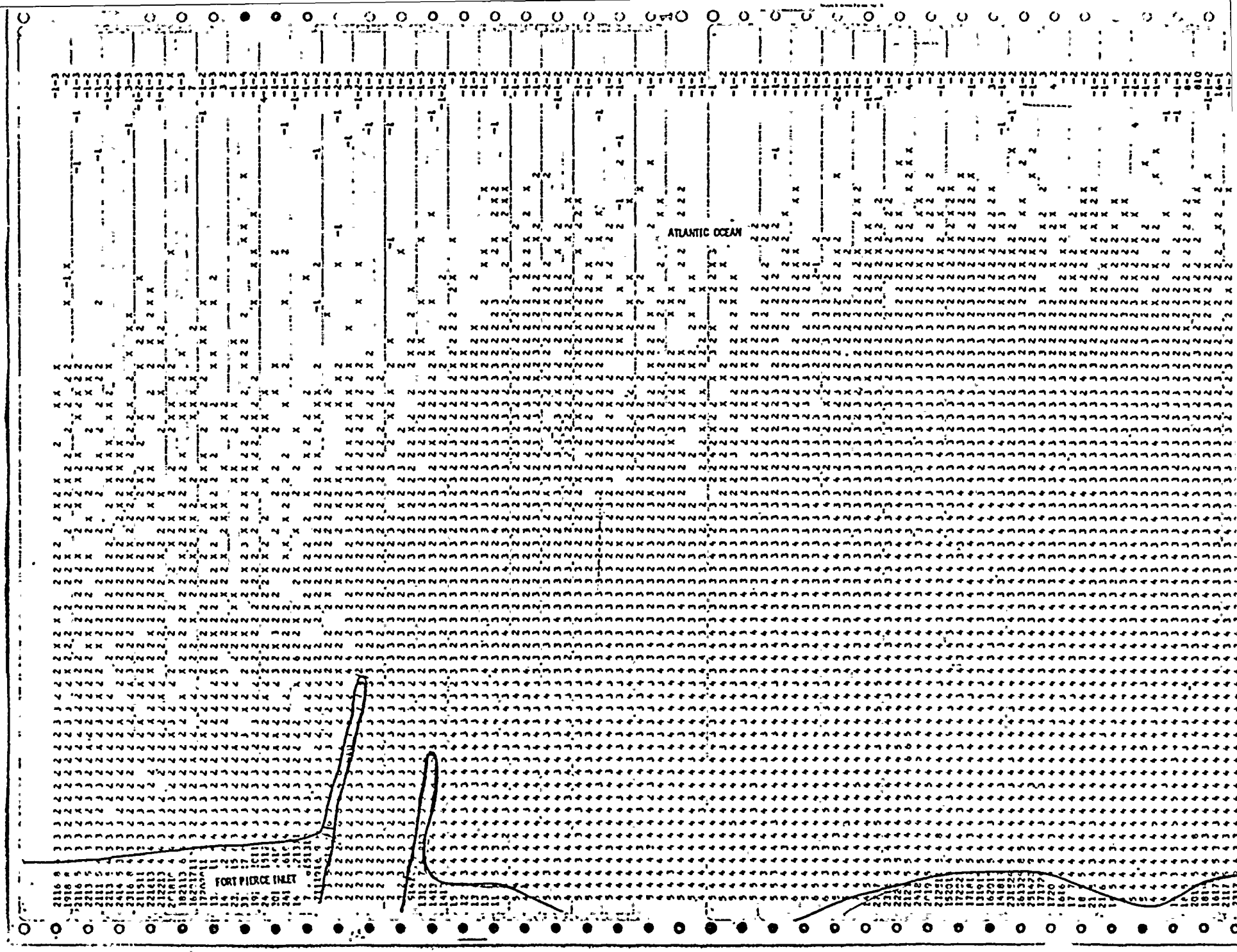
CAL SOURCES 30/50

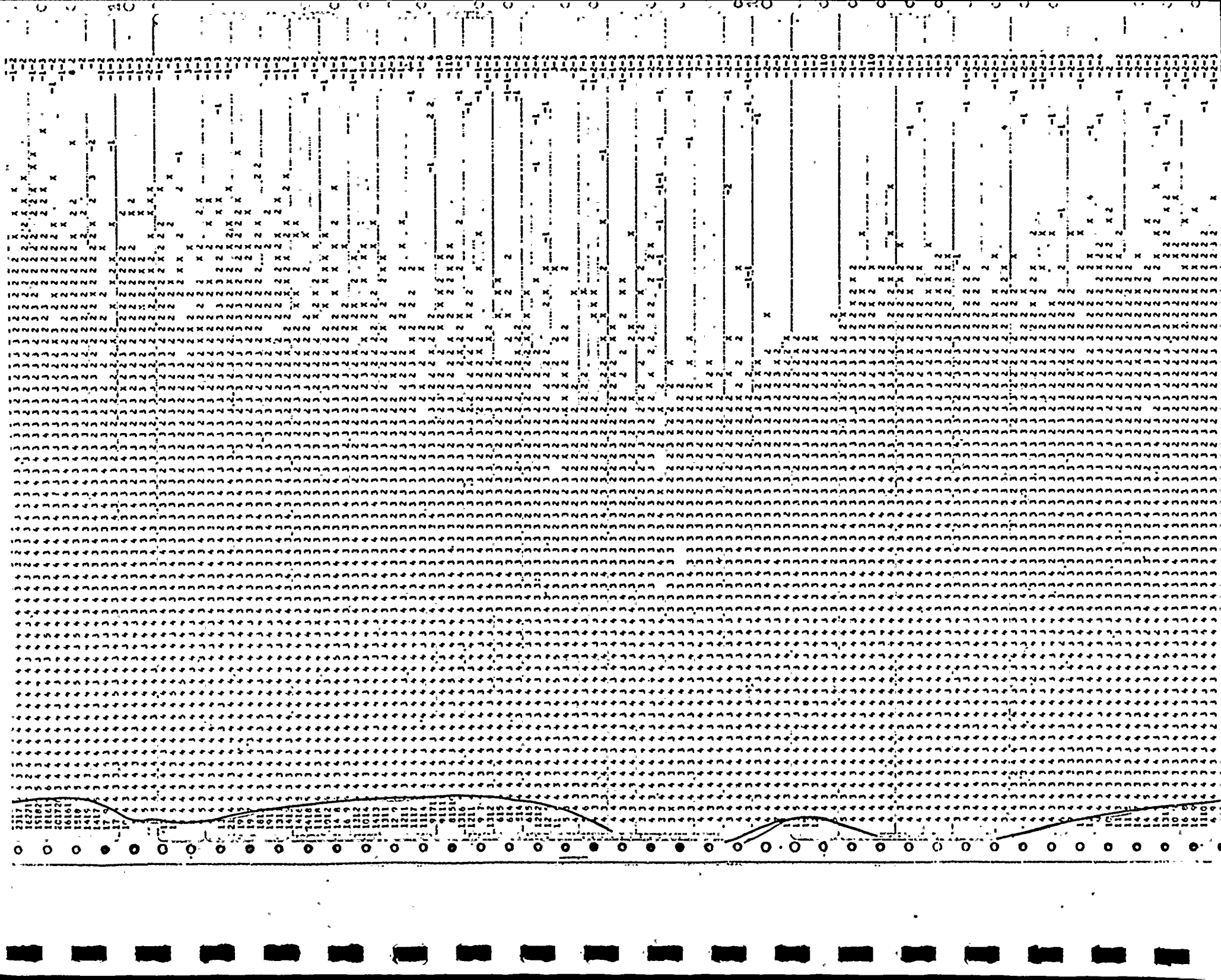
'UN #	TIME		TAPE		FILM		HEAD	ALT	V	COMMENTS
	ON	OFF	ON	OFF	ON	OFF			(Kt)	
			100	800				2400	130	1/400 @ F8
1	1444		800	1479			060	4500	150	Plant
2	1450		1479	1907			235	4500	150	Ft. Pierce
3	1508		1907	2500			265	4500	150	Plant
4	1515		2500	3018			060	4500	150	Plant
5	1521		3018	3612			235	4500	150	St: Lucie Inlet
6	1525						55	4500	150	St. Lucie Inlet

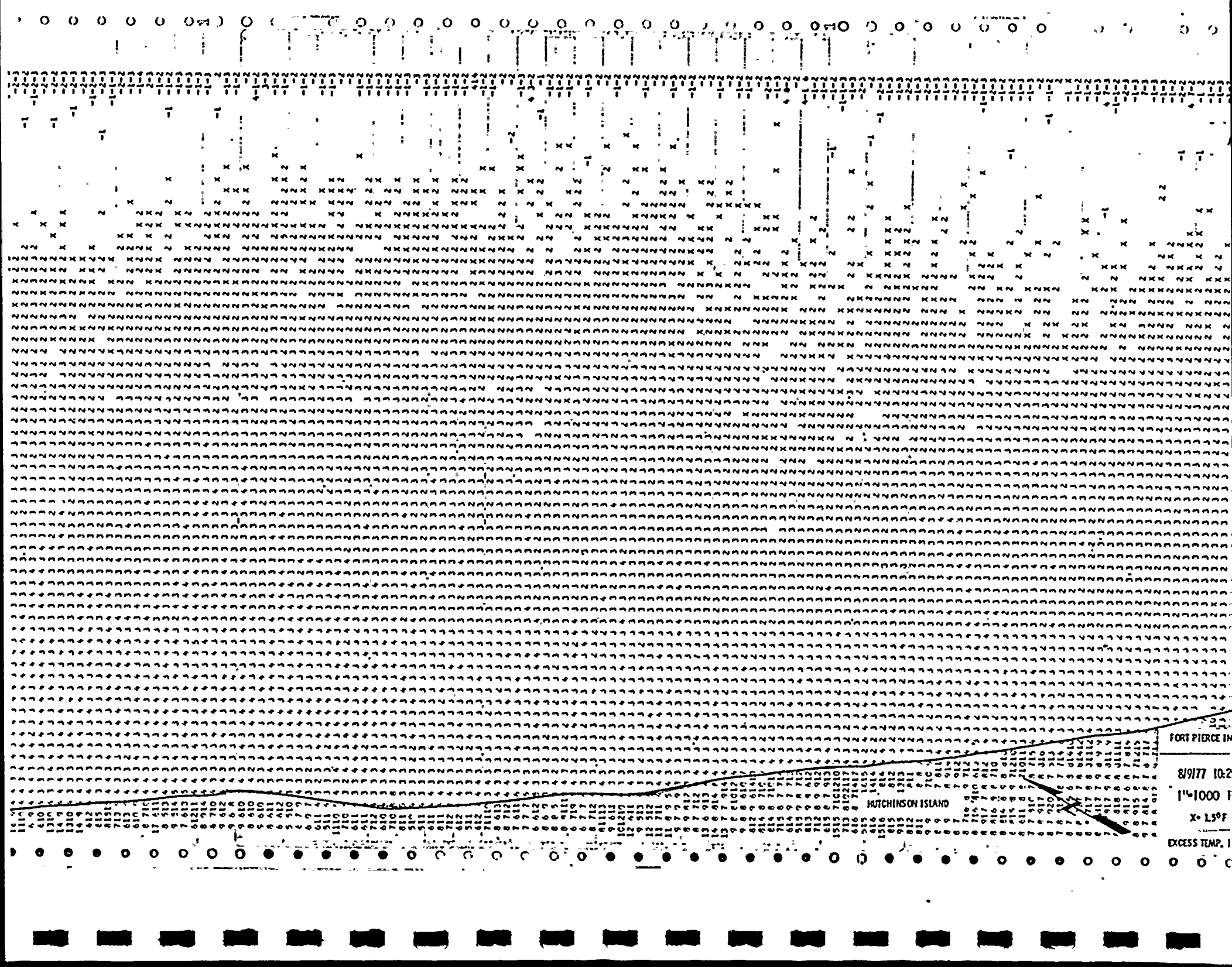
I-24266

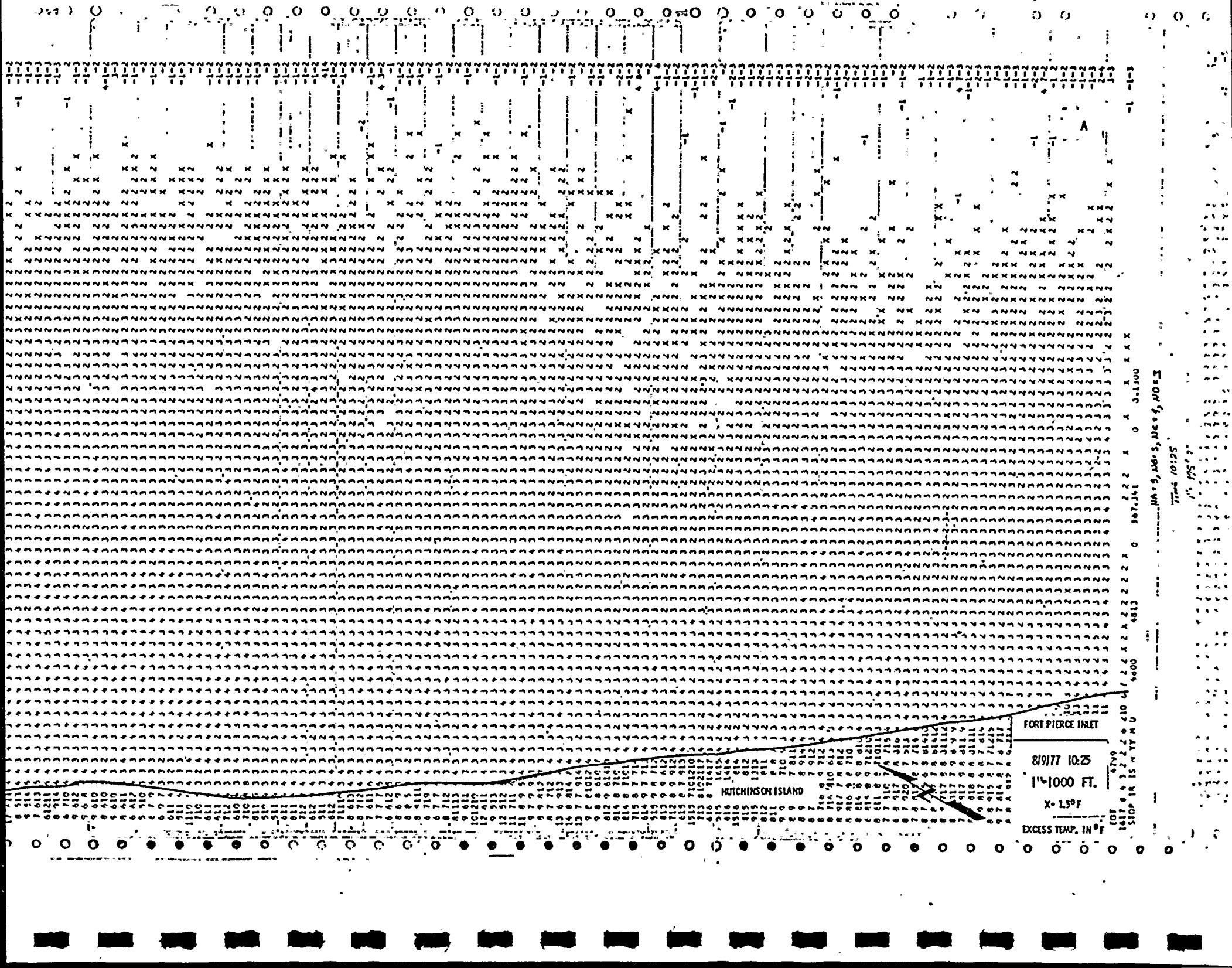
APPENDIX B

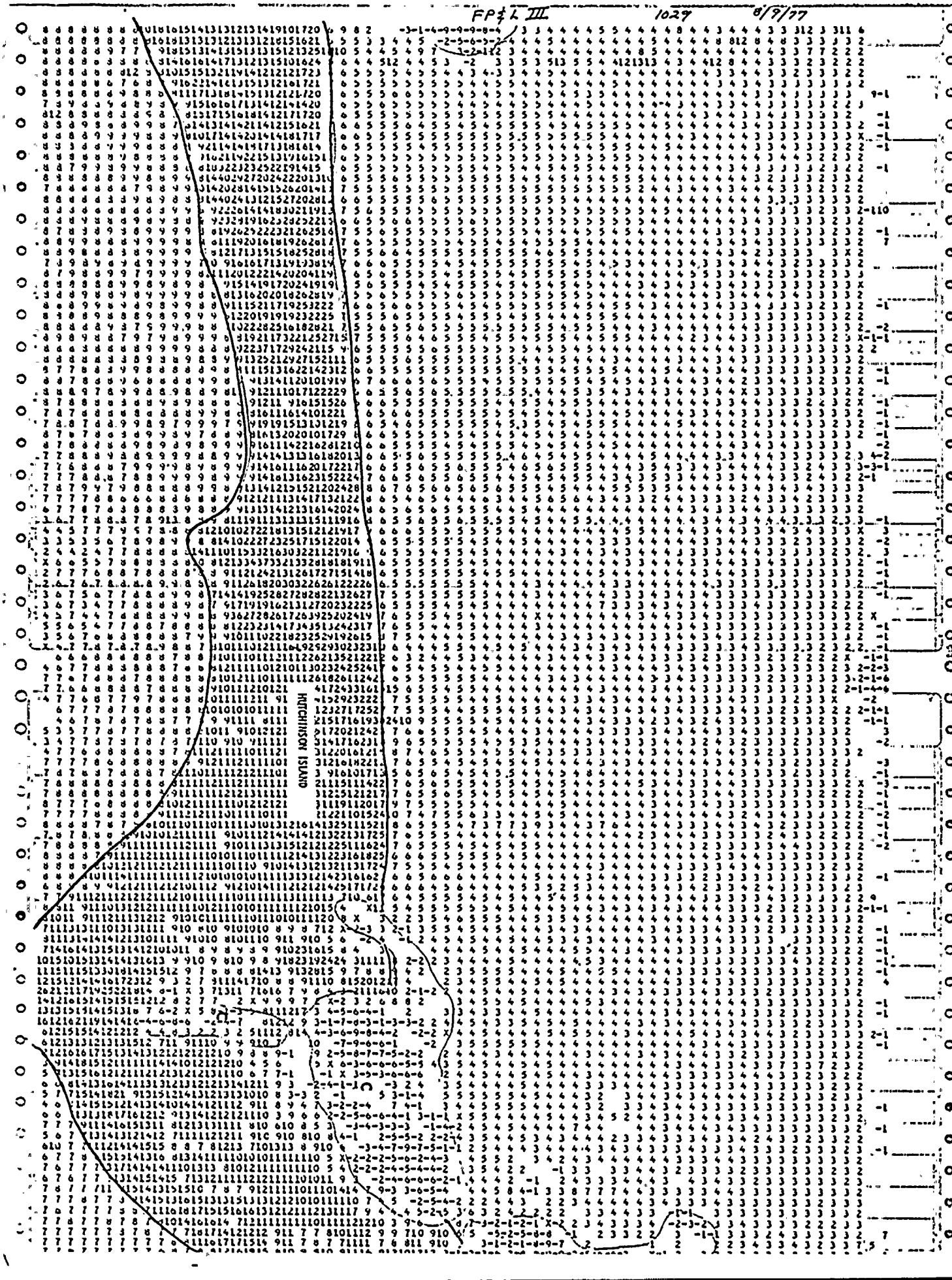
DATA PRINTOUTS
ATTACHMENTS
A - E

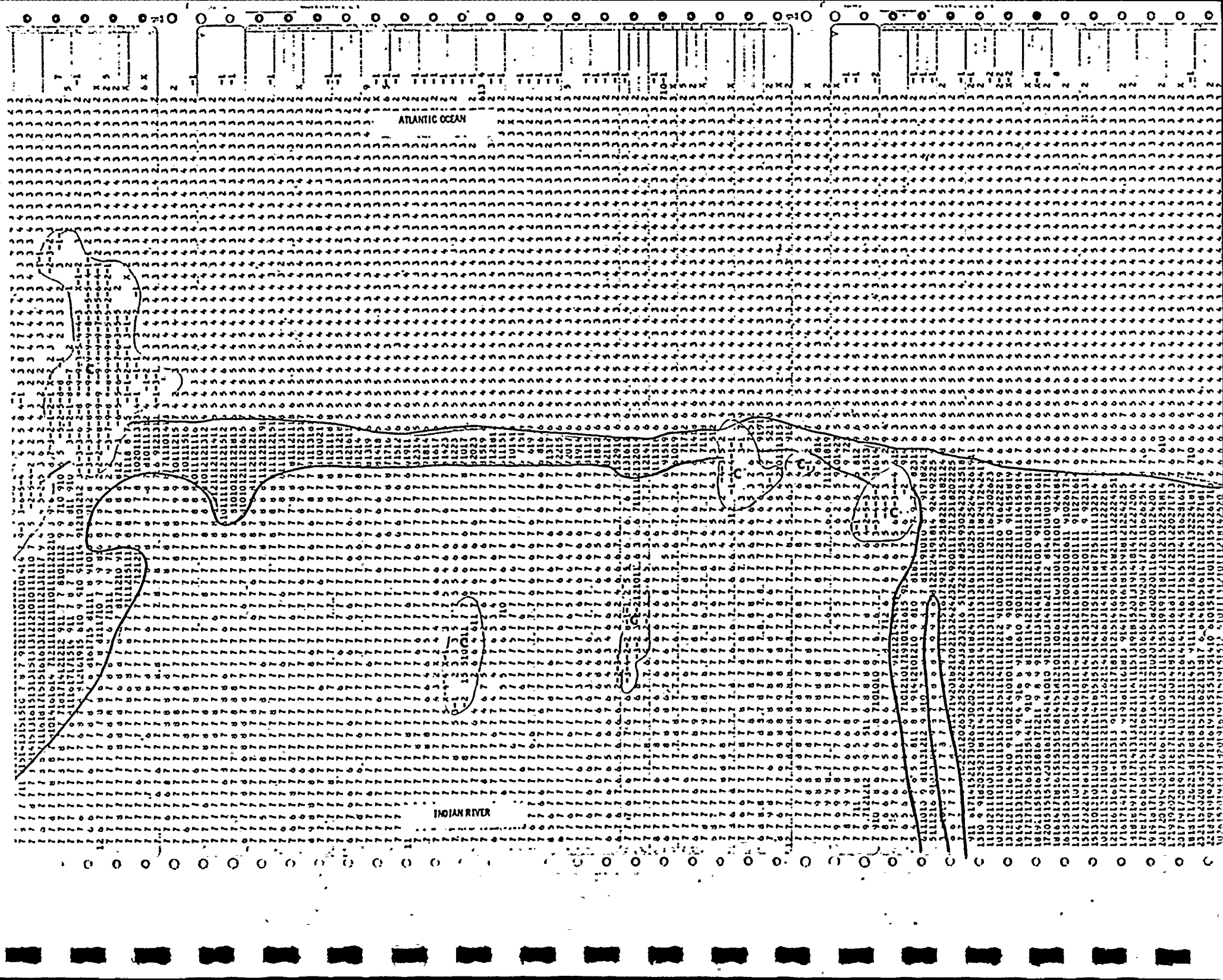

ATLANTIC OCEAN
FORT PIERCE INLET

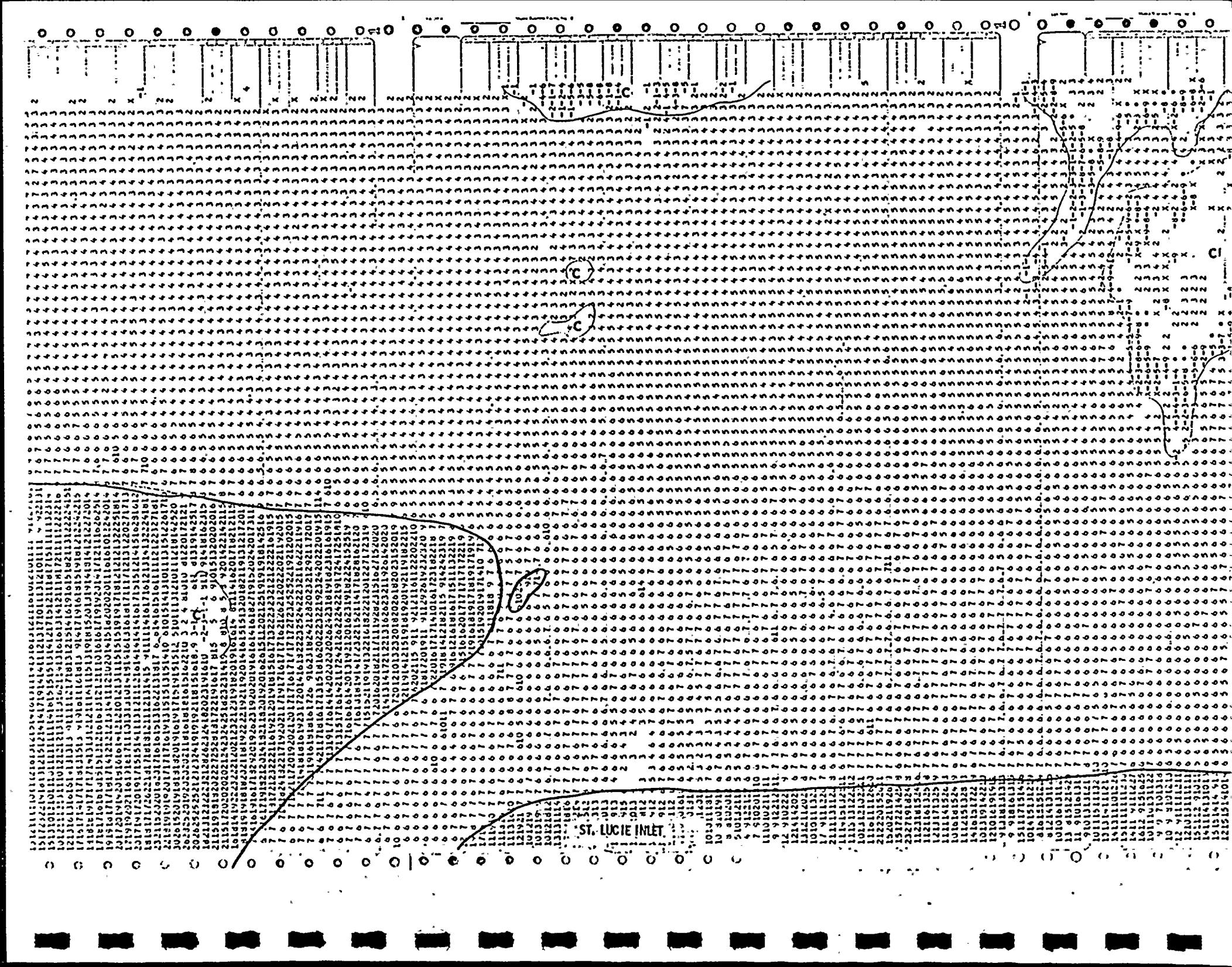


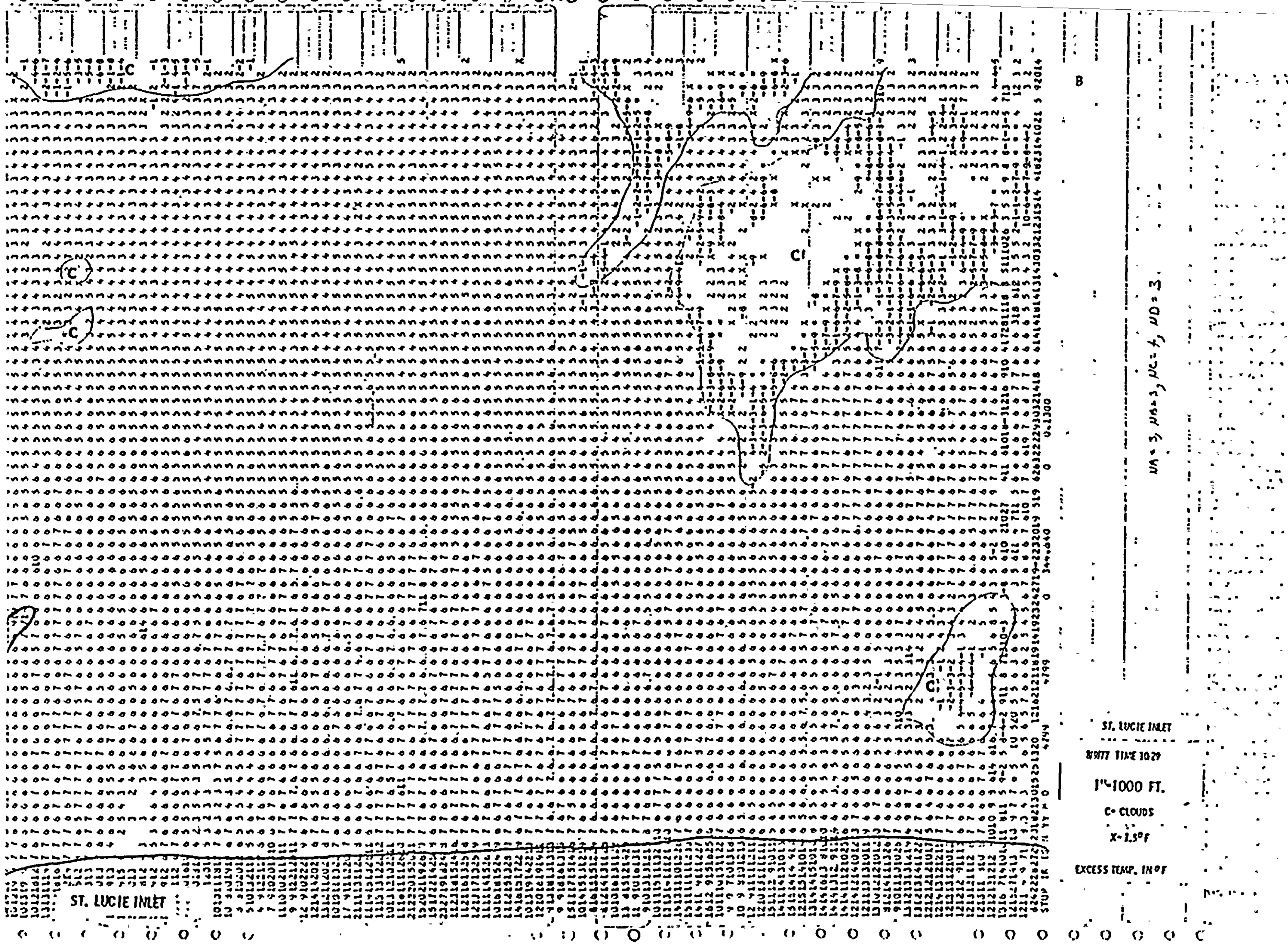

FORT PIERCE IN
8/9/77 10:2
1"=1000 F
X= 1.5°F
EXCESS TEMP. I
HUTCHINSON ISLAND

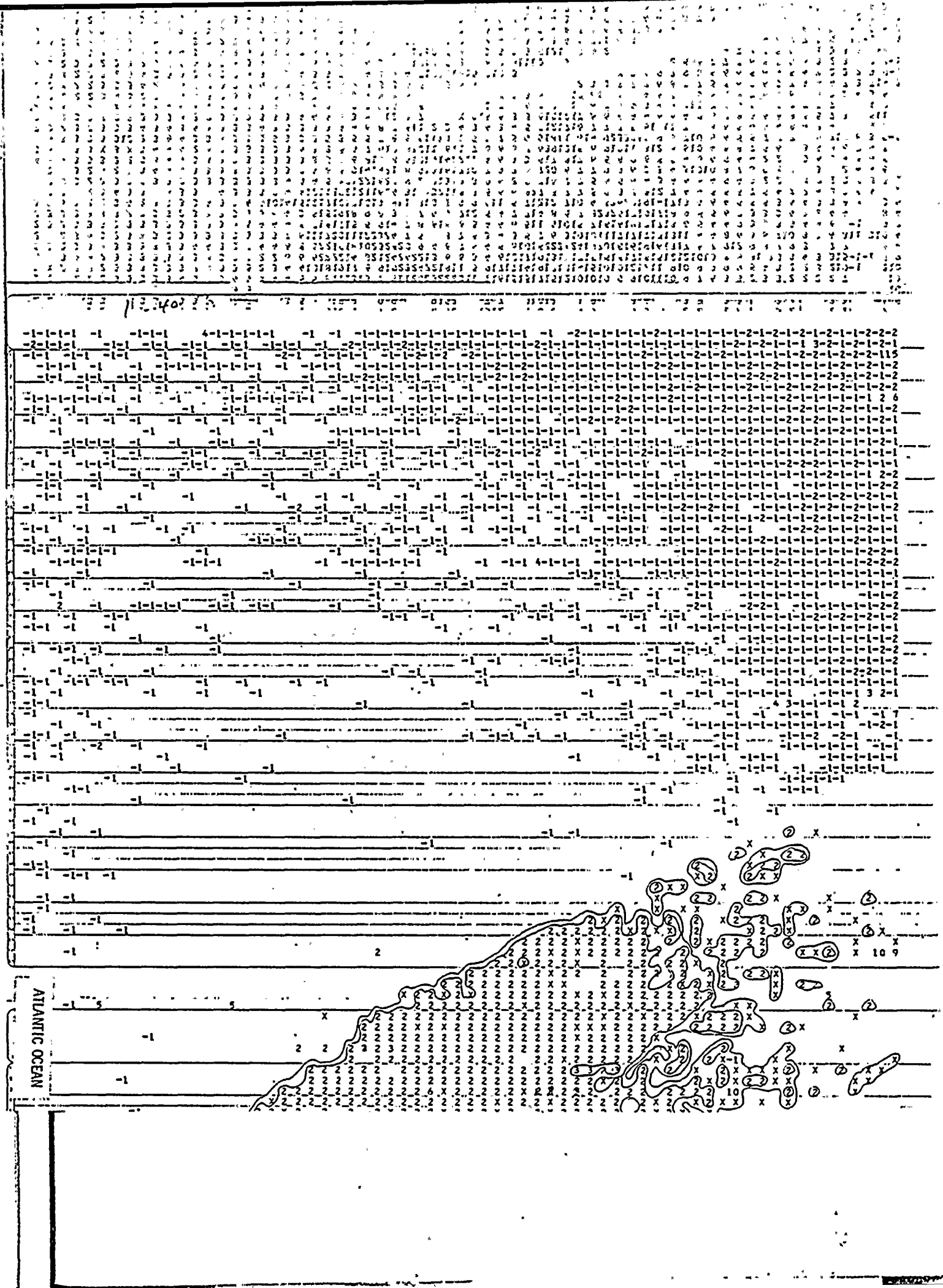

A
FORT PIERCE INLET
8/9/77 10:25
1"=1000 FT.
X- 1.5°F
EXCESS TEMP. IN °F
HUTCHINSON ISLAND


FP & L III
1029
8/9/77
HUTCHINSON ISLAND

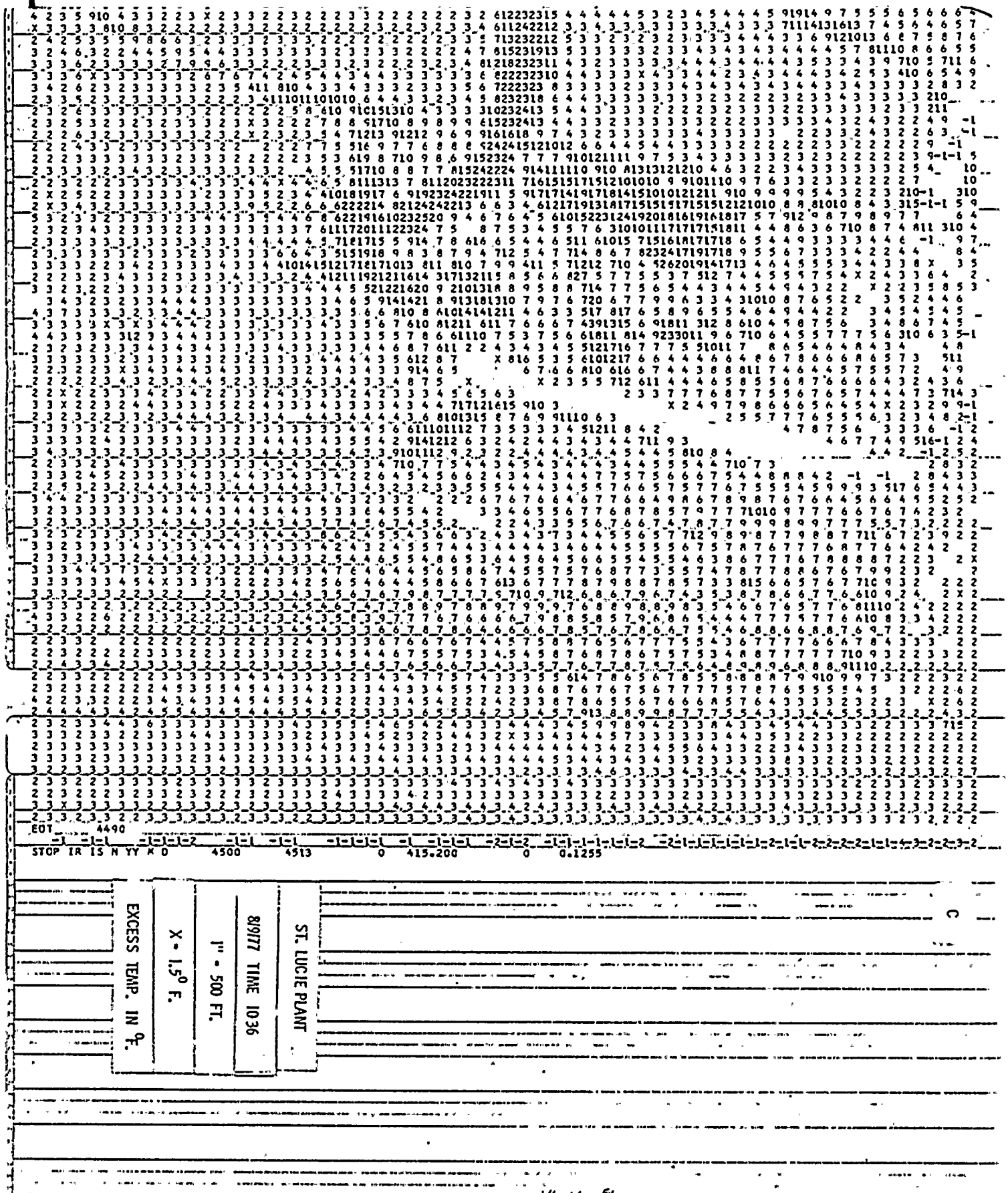

ATLANTIC OCEAN
INDIAN RIVER

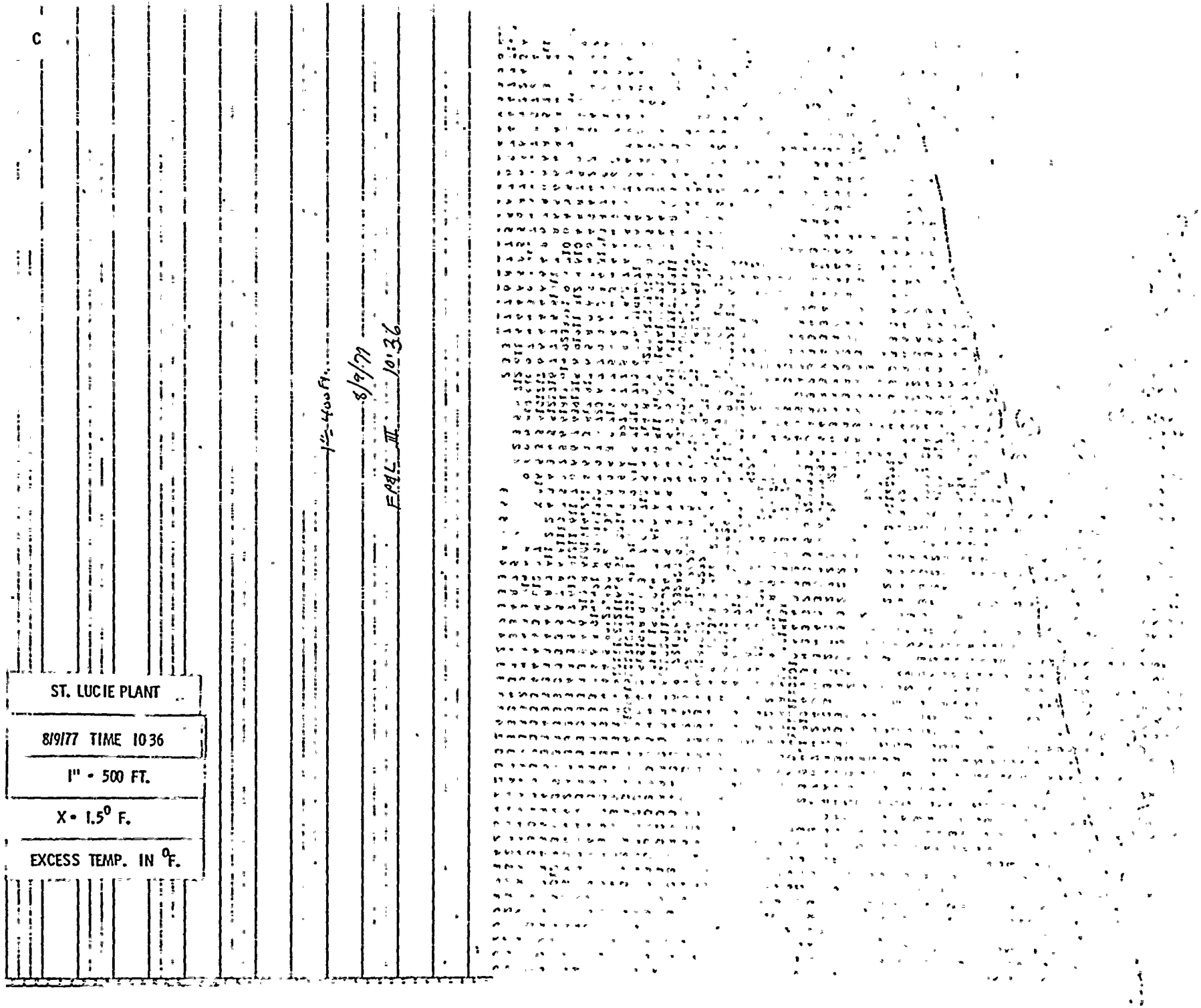

C
C
C
C
C
ST. LUCIE INLET


ST. LUCIE INLET
1" = 1000 FT.
C = CLOUDS
X = 1.5°F
EXCESS TEMP. IN °F
B
C


ATLANTIC OCEAN

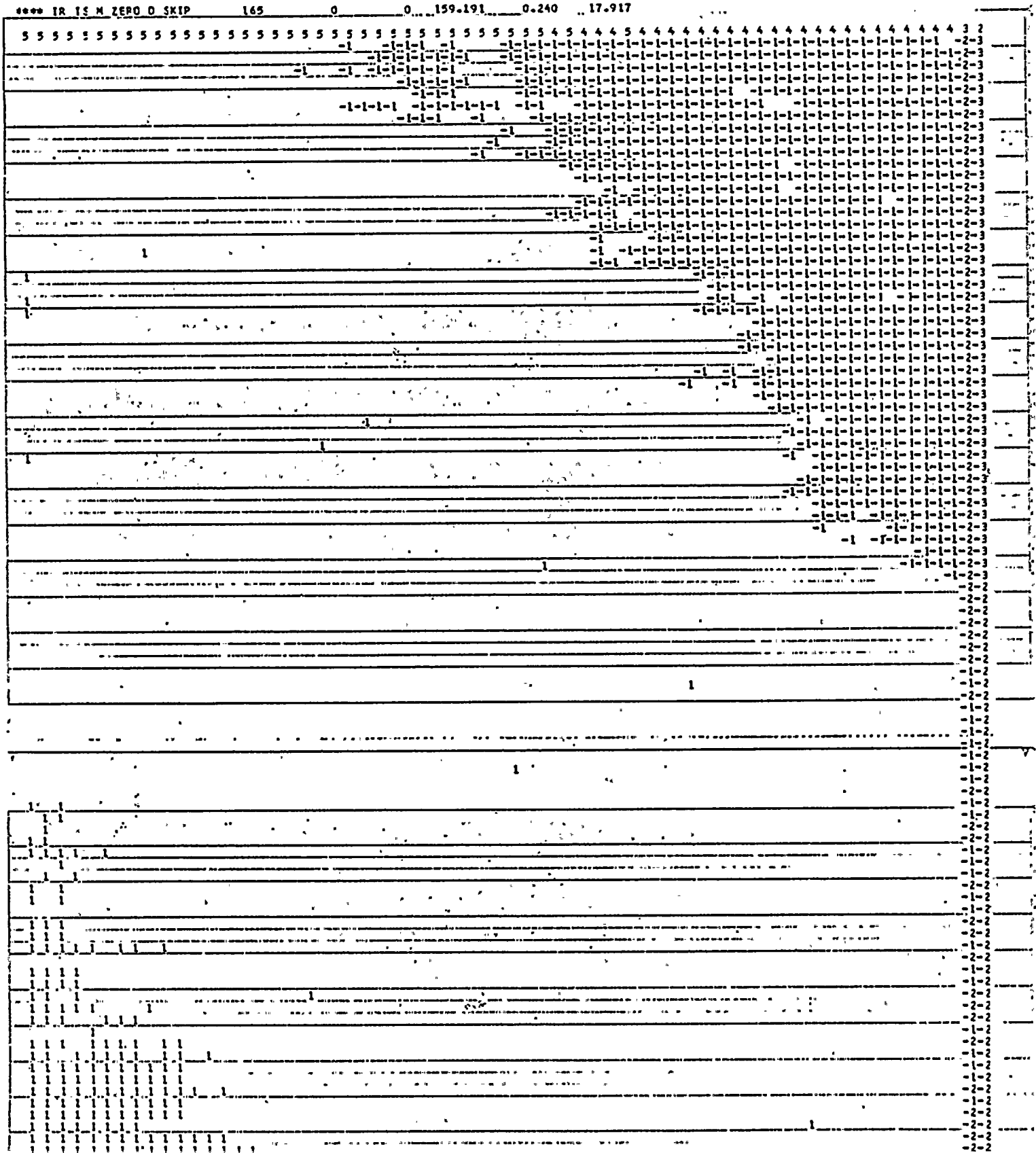

OCEAN

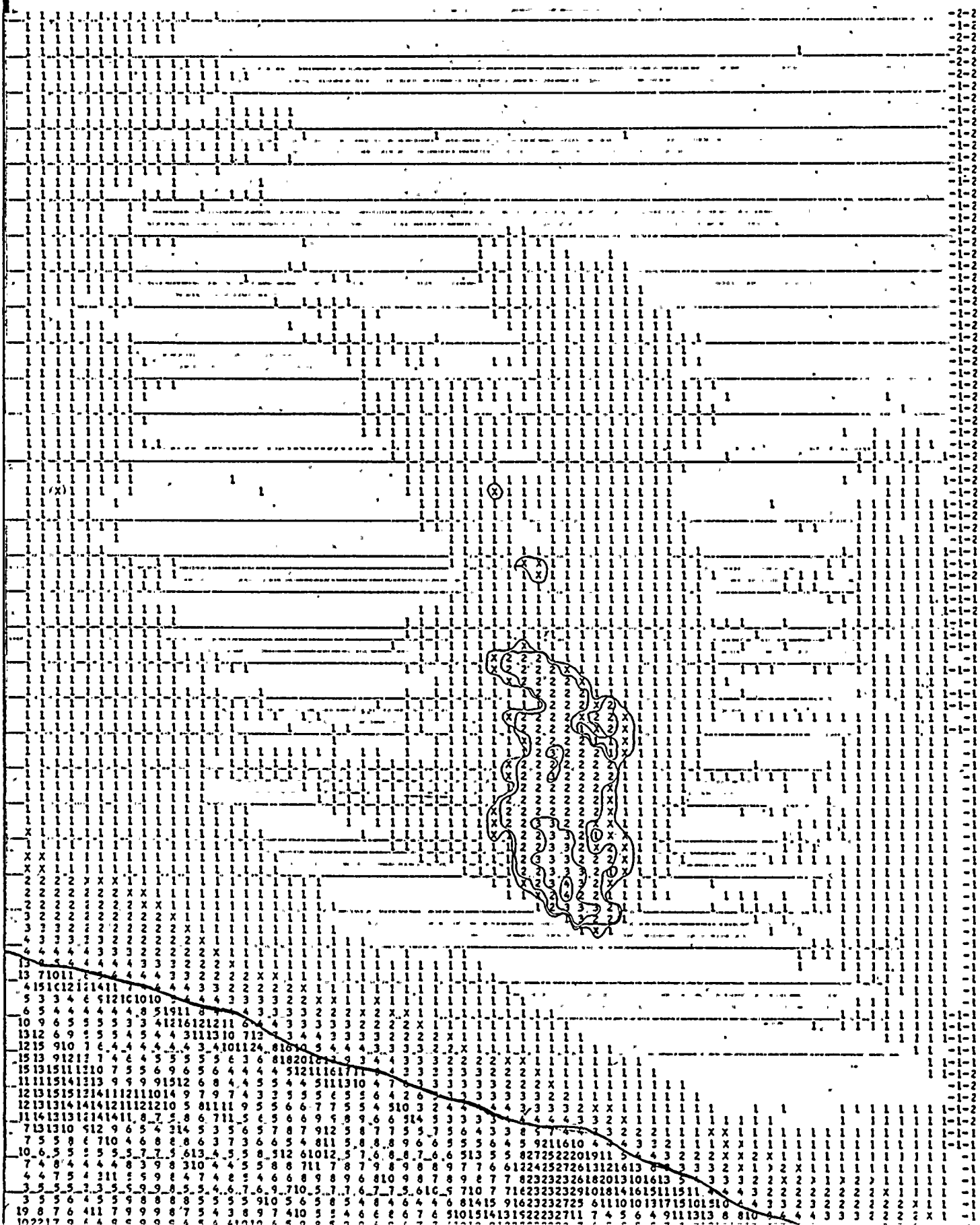

EOT 4490
STOP IR IS N YY K D 4500 4513 0 415.200 0 0.1255
ST. LUCIE PLANT
8/9/77 TIME 1036
1" = 500 FT.
X = 1.5° F.
EXCESS TEMP. IN °F.
1"=400 FT.

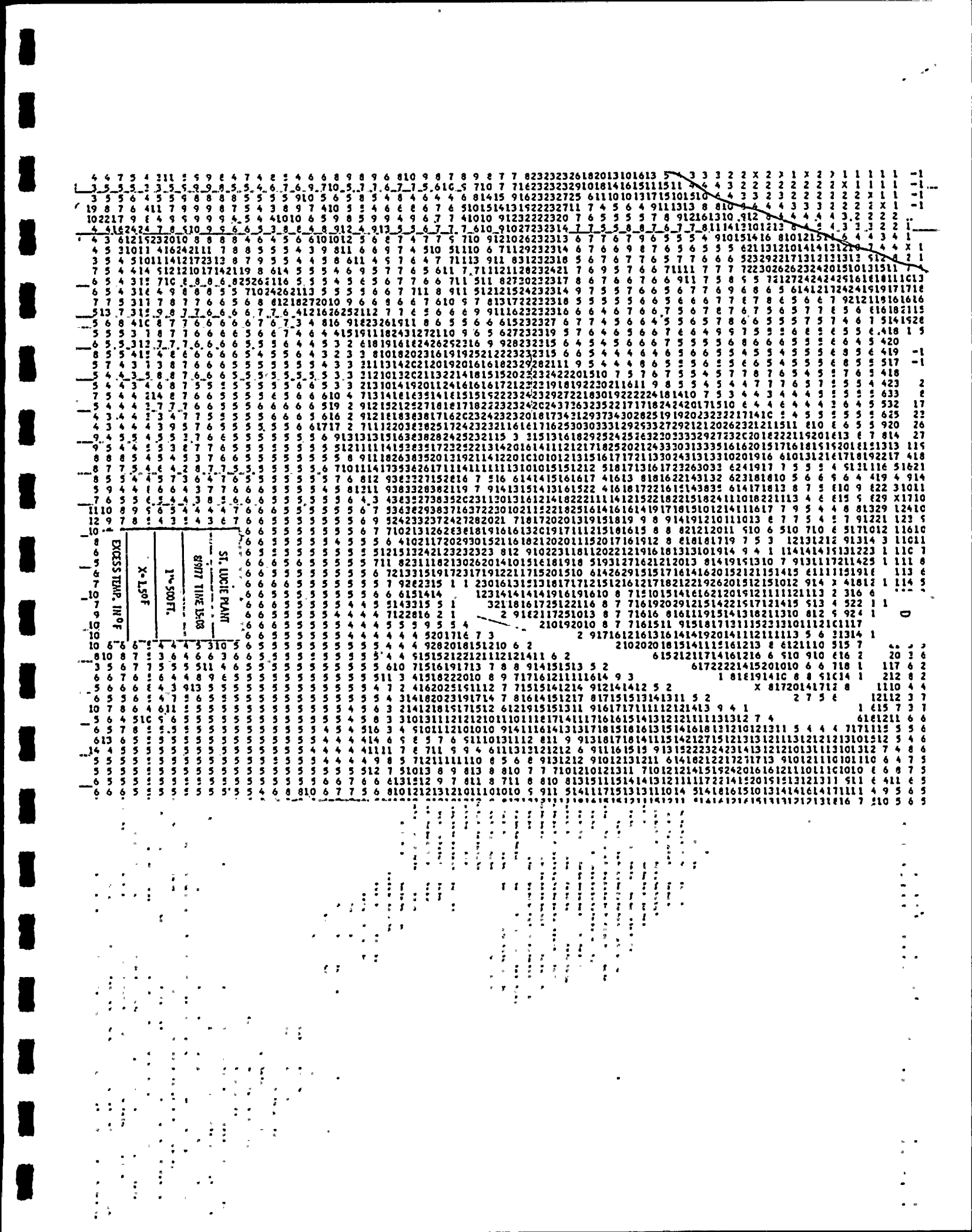

C
1"=400 ft.
8/9/77
EAGLE III - 1036
ST. LUCIE PLANT
8/9/77 TIME 1036
1" = 500 FT.
X = 1.5° F.
EXCESS TEMP. IN °F.

CATE 8/ 5/77 TIME 15:08 FLORIDA POWER AND LIGHT

**** IR IS M ZERO O SKIP 165 0 0 159.191 0.240 17.917

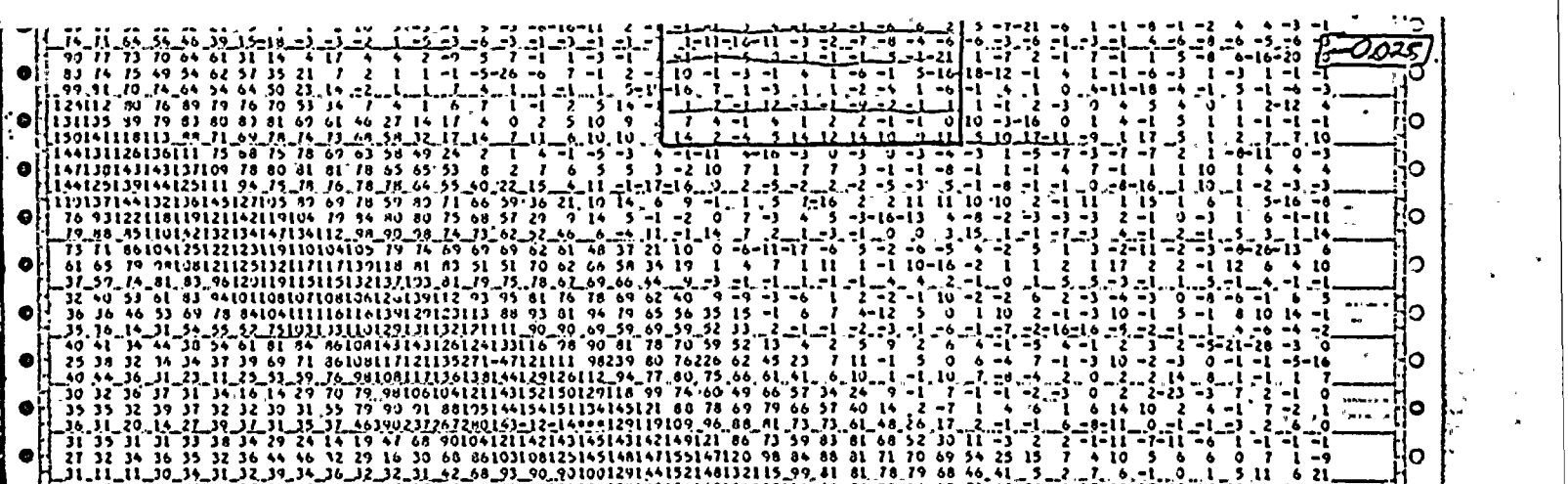


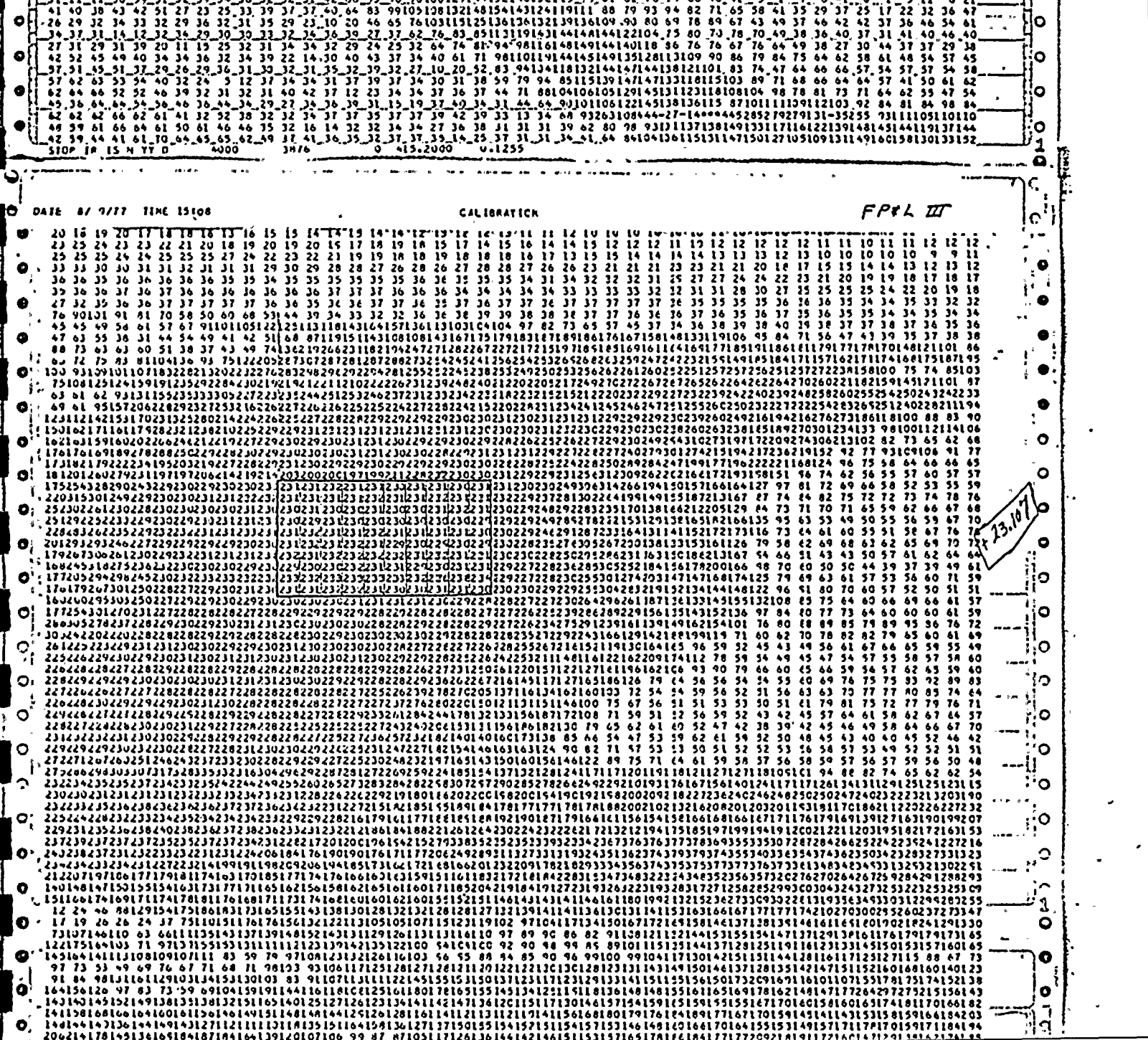


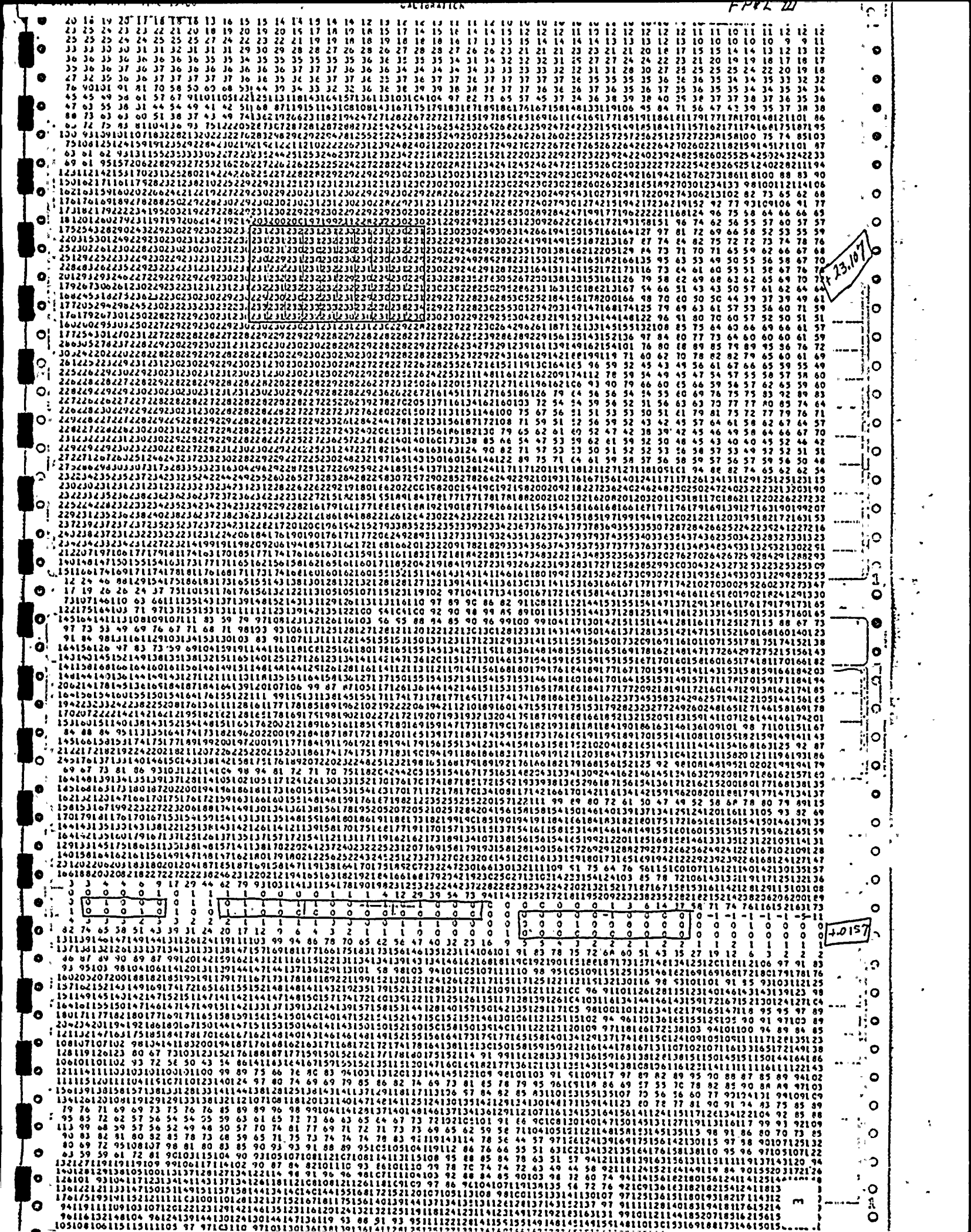

EXCESS TEMP. IN °F
X-1.5°F
1"~500 FT.
8/9/77 TIME 15:03
ST. LUCIE PLANT

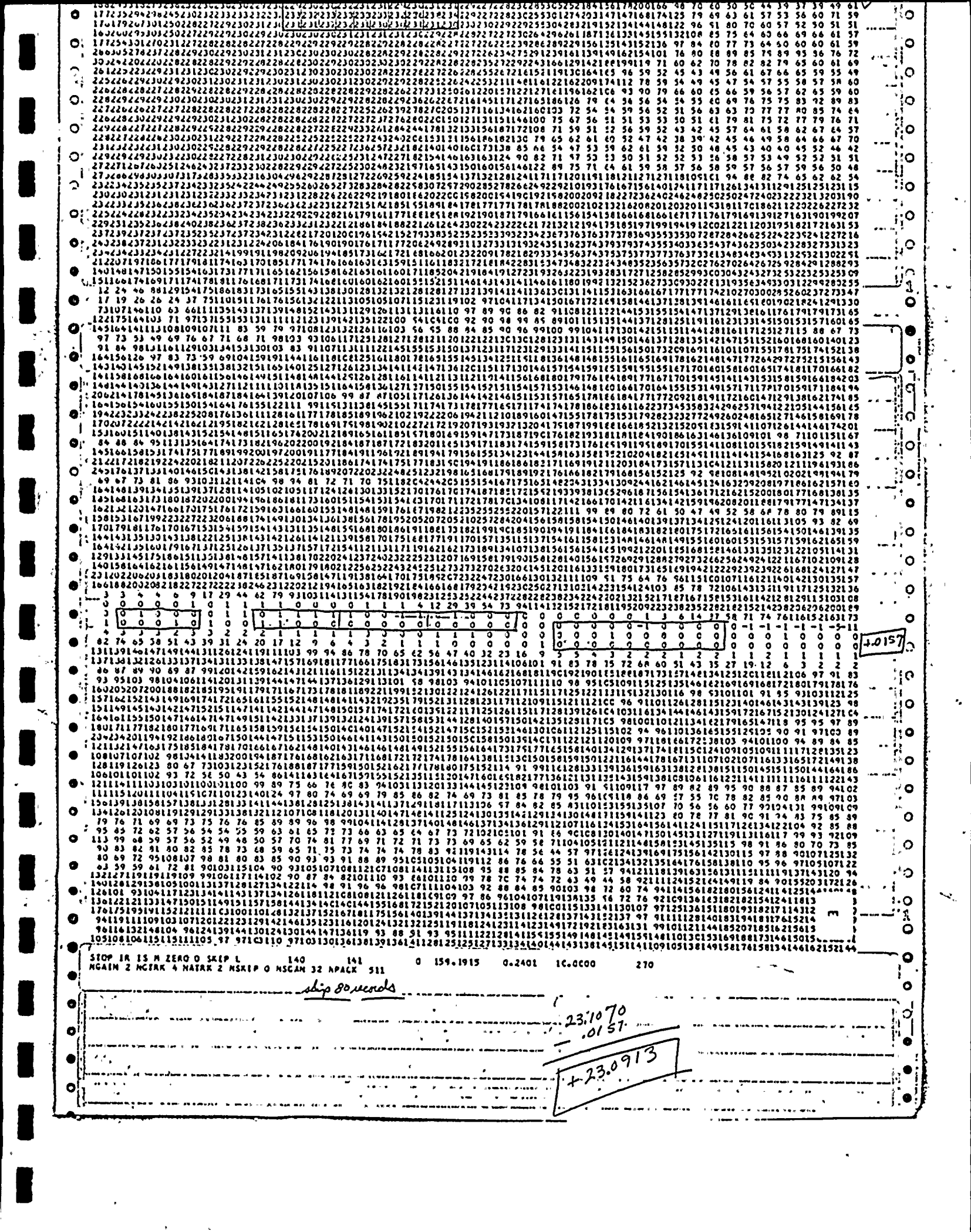
DISCHARGE CANAL M K J 2900 2959 927 FPRL III +22.79 TIME 10:36 CALIBRATION

INTAKE CANAL M K J 3817 3876 350 -0.025 -0.025


ε=0.025


DATE 8/ 9/77 TIME 15:08
CALIBRATION
FP&L III
ε= 23.107


+23.107
+0.0157



STOP IR IS M ZERO O SKIP L 140 141 0 159.1915 0.2401 10.0000 270
NGAIN 2 NCRK 4 NATRK 2 NSKIP 0 NSCAN 32 NPACK 511

ship 80 records

23.1070
.0157
+23.0913