FINAL REPORT - POSTOPERATIONAL
HYDROTHERMAL SURVEYS, JUNE 1976 - NOVEMBER 1977
FOR
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK

SEPTEMBER 1978

Stone & Webster Engineering Corporation
Boston, Massachusetts

TABLE OF CONTENTS

SUMMARY

This report summarizes and compiles the six James A. FitzPatrick Nuclear Power Plant (JAFNPP) Postoperational Hydrothermal Surveys contracted by the Power Authority of the State of New York. The hydrothermal surveys were performed over a 2-year period during 1976 and 1977, following full-power operation of the JAFNPP, to meet the requirements of the National Pollutant Discharge Elimination System Permit (NPDES-Permit No. NY0020109), and the JAFNPP Environmental Technical Specifications of the Nuclear Regulatory Commission (NRC-Docket No. 50-333).

The primary objectives of these surveys were:

1. To determine the three-dimensional thermal patterns in the JAFNPP discharge area produced by the joint operation of Nine Mile Point Unit 1 (NMP-1) and the JAFNPP plant, and

2. To determine the diffuser performance of the JAFNPP based on steady-state dye concentrations existing in Lake Ontario after releasing dye into the JAFNPP circulating water system.

These studies were scheduled during periods that would represent seasonal variations and critical lake conditions, such as low water levels, high ambient temperature, and various lake current speed and direction. Water levels in Lake Ontario are regulated. The highest levels are normally reached in late spring and the lowest levels in late fall and early winter. The thermal regime of Lake Ontario is known to be characterized by:

1. vertical circulation periods during the fall and spring;

2. temperature stratification of the deep-water mass during the summer;

3. vertically isothermal temperatures throughout the open-water mass during the late fall, winter, and early spring;

4. inverse temperature stratification in sheltered or ice-covered areas of the lake during the winter; and

5. vertically isothermal temperature throughout the shallow portions of the lake during the summer.

The vertical circulation periods during the spring and fall are primarily convectional; they occur when surface temperatures cool towards 39.2°F in the fall and warm towards the same temperature in the spring. These phenomena are commonly referred to as the spring and fall turnover.

Summer stratification is the classic development of three thermally distinct layers referred to as the epilimnion, the thermocline, and the hypolimnion.

Isothermal conditions throughout the open-water mass during the winter are maintained by mechanical mixing induced by winds and currents.

Inverse or winter stratification is characterized by a top-to-bottom warming trend, with temperatures approaching 32°F at or near the surface and 39°F near the bottom.

Isothermal conditions in the shallow areas of the lake during the summer are maintained by mechanical mixing induced by winds and currents. Similar thermal qualities are found in the epilimnion layer of the deep-water mass.

In addition to isothermal conditions, winds are also responsible for two other phenomena that are unique to the nearshore regions of the lake. These are commonly referred to as upwelling and thermal bars. Upwelling is caused by offshore winds displacing surface waters away from the shore regions, allowing denser subsurface water to rise to the surface. Thermal bars separate the sheltered or ice-covered waters (inverse temperature stratification) from the open waters (isothermal conditions) during the colder months of the year.

The study area extended 5,000 feet either side of the diffuser along the shore and 5,000 feet offshore. Water depths in the study area are less than 100 feet. Data collected during each survey consisted of:

1. nearfield and farfield temperature and dye concentrations;

2. current speed and direction;

3. wind speed and direction; and

4. plant load, intake, and discharge temperatures.

Lake levels during the survey were measured at the site or were provided by the Lake Survey Center (NOAA), Detroit, Michigan.

The surveys were performed during April, June, August, October, and November. These time periods are indicative of conditions during late winter to early spring, late spring to early summer, summer, fall, and late fall to early winter.

Attempts were made in November and December 1976 to sample late fall and early winter conditions. The November 19 survey was terminated because of an unscheduled plant outage. The December 15 survey was also unsuccessful because repeated attempts to install in situ instrumentation and deploy off-boat temperature and dye fixtures failed due to severe lake conditions characterized by 6- to 10-foot swells and 15- to 25-mph winds from the south to southwest. Because of the risks and costs associated with winter surveys on Lake Ontario, it was recommended that no further attempts be made during this season.

To compensate for these cancellations, additional efforts during 1977 resulted in successful surveys during April and November, periods that exhibited thermal properties representative of winter and late fall conditions.

The first of these surveys was conducted on April 13 and 14, 1977 (late winter to early spring). Ambient temperatures were approximately 35°F at the surface. In the offshore regions of the study, a slight top-to-bottom warming trend (less than 1°F) occurred within the upper 15 feet of the water column. This exemplifies nearly isothermal conditions induced by the mechanical mixing of strong winds (12 to 28 mph during the survey period) that typify winter conditions over exposed ice-free areas of the lake. In the calmer near-shore regions, the warming trend increased to between 1° and 2°F with depth. During these periods of inverse temperature stratification, the temperature rise isotherms were more pronounced at the surface due to entrainment of warmer subsurface water into the discharge. Another important observation during the survey was the phenomenon commonly referred to as a "sinking plume," which was caused by the cooling of the thermal discharge to temperatures at which the plume exhibits reater densities than the ambient receiving water body.

The second of these surveys was conducted on November 2, 1977 (late fall to early winter). Ambient temperatures were about 52°F at the surface. During this survey a slight top-to-bottom cooling trend (0.3°F or less) occurred within the upper 15 feet of the water column. These temperatures were also indicative of an isothermal water body being maintained by wind-induced mixing in the survey area (average wind speed 14 mph during the survey).

The survey conducted on June 4 and 13, 1976 (late spring to early summer) also yielded significant results. Ambient temperatures ranged from the mid-forties to the low fifties. A slight top-to-bottom cooling trend occurred in the upper 15 feet of the water column. As before, isothermal conditions existed in the study area. During this survey period, winds from the southeast at an average speed of 12 mph induced upwelling during the late morning sampling period on June 13. This phenomenon was indicated by cooler (by about 1.5°F) nearshore temperatures. The upwelling continued throughout the afternoon until thermal equilibrium with depth and distance offshore was reached. Ambient temperatures in the study area fell from the low fifties (51°F) in the morning to the mid-forties (46.5°F) in the late afternoon negating the normal diurnal rise caused by solar heating.

The June 14, 1977 survey ambient temperatures (about 53°F) at the surface were similar to those for June 1976. Winds, however, were from the east at an average speed of 9 mph and there was no upwelling. In the nearshore regions, water temperatures were 3°F warmer at the surface than at the 15-foot depth; offshore regions displayed only a 1°F difference. Since the nearshore regions were protected by land to the east, they responded more noticeably to solar heating at the surface. The less protected offshore regions displayed a more homogeneous temperature profile common to wind-exposed lake areas. On days when solar heating warms the surface layers of the receiving water body, as occurred in the June 14, 1977 survey, entrainment of cooler water from below by the discharge jet can result in lower than ambient temperature at the surface.

During the summer survey on August 19 and 20, 1976 ambient temperatures ranged from the high sixties to low seventies at the surface; temperatures at 15-foot depths were 0.5° to 3.5°F cooler. These effects were attributed to solar heating and wind speeds of less than 6 mph. This temperature distribution is considered to be a good example of a thermal gradient beginning to form in the absence of wind-induced mixing.

The October 7 and 8, 1976 fall survey measured ambient lake temperatures in the low sixties at the surface. During the October 7 morning sampling period, offshore temperatures were isothermal in the upper 15 feet of the water column; nearshore temperatures for the same zone were about 1.5°F warmer at the surface. During the afternoon, solar heating caused surface and subsurface temperature differences to increase to 3°F nearshore and to 1.5°F offshore. On October 8, 5- to 15-mph winds from the northwest in the study area induced mechanical mixing, which caused ambient temperatures to cool as much as 3°F. Lake temperatures were 60°F throughout the upper 15 feet of the water column.

The results of the six postoperational hydrothermal surveys indicate that isothermal conditions prevail in the study area throughout most of the year due to the mechanical mixing of winds, the relative shallowness of the water, and the absence of an ice cover. Short-term modifications can be attributed to solar heating on calm days and upwelling during periods of offshore winds. Sinking plumes can be observed when ambient water temperatures are below 39.2°F. A negative temperature rise at the surface can be observed when solar heating warms only the surface layers of the receiving water body or during winter upwelling periods. Finally, temperature rise isotherms are more pronounced at the surface during periods of summer upwelling.

In summary, a representative sampling was made of the varying hydrographic and hydrothermal conditions on Lake Ontario in the vicinity of the JAFNPP diffuser. The data collected are presented in chronological sequence in Sections I through VI of this report.

I-JUNE 1976 SURVEY

TABLE OF CONTENTS

I-JUNE 1976 SURVEY

LIST OF TABLES

I-JUNE 1976 SURVEY

LIST OF FIGURES

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

I-JUNE 1976 SURVEY

I.1 SUMMARY

The first postoperational hydrothermal survey of the JAFNPP was conducted on June 4 and 13, 1976. The NMP-1 station was in operation during the survey.

The primary objectives of this survey were:

1. To determine the three-dimensional thermal patterns in the discharge area produced by the joint operation of the NMP-1 and the JAFNPP, and

2. To determine the diffuser performance based on dye concentrations existing in the lake after releasing dye into the plant circulating water system.

These objectives were set forth so as to fulfill the requirements of the National Pollutant Discharge Elimination System Permit (Permit No. NY0020109), administered by the U.S. Environmental Protection Agency; the JAFNPP Environmental Technical Specifications (Docket No. 50-333), administered by the U.S. Nuclear Regulatory Commission; and the New York State Department of Environmental Conservation's standards and requirements.

The June 1976 postoperational survey was originally scheduled for June 4 and 5, 1976; however, an unscheduled reduction in plant load at 1048 hours on June 4, 1976 required a continuation of the survey on June 13, 1976. The time which elapsed between June 4 and June 13 was necessary to allow for a gradual resumption in plant load and the establishment of steady-state conditions in Lake Ontario.

I.2 METHOD OF DATA ACQUISITION

Aquatec, Inc., of South Burlington, Vermont was contracted to perform the temperature and dye surveys of the JAFNPP discharge area. A report entitled "First Operational Hydrothermal Survey, June 4 and 13, 1976, James A. FitzPatrick Nuclear Power Plant," which describes all aspects of data acquisition and reduction, was provided by Aquatec.

Raytheon Company, Oceanographic & Environmental Services, of Portsmouth, Rhode Island was subcontracted by Aquatec to perform in situ data collection consisting of current speed and direction, lake temperature, and lake level during the temperature and dye surveys.

Niagara Mohawk Power Corporation, operator of NMP Unit 1, and the Power Authority of the State of New York, owner of the JAFNPP, maintain a meteorological tower at the site which records wind speed and direction at an elevation of 30 feet. Meteorological data for the dates of the survey are listed in Section I.3.1.

Operating conditions are continuously monitored at the plant. Section I.3.3 lists the plant operating conditions at the time of the survey.

I.3 CONDITIONS DURING THE SURVEY

I.3.1 Meteorological Conditions

Daylight during the June 4 and 13, 1976 surveys occurred between approximately 0437 and 1946 hours and 0430 and 1951 hours, respectively.

The wind speed and direction for the survey hours on June 4, 1976 are given in Table I-1. During the intensive sampling period between 0657 and 0818 on June 4, 1976, the 30-foot wind at the NMP-1 site meteorological tower was insignificant.

The wind speed and direction for the survey hours on June 13, 1976 are given in Table I-2. During the intensive sampling period between 0638 and 1623 on June 13, 1976, the wind at 30 feet was from the southeast at an average speed of about 12 mph.

I.3.2 Lake Conditions

An in situ tower, located 2,000 feet east of the centerline of the JAFNPP diffuser and 1,000 feet offshore, as shown in the figures, continuously recorded lake current speed and direction, lake temperature, and lake level during the survey period. The in situ tower was constructed and maintained by the Raytheon Company. In situ data are presented in the Aquatec report and discussed in Section I.4.2 of this report.

I.3.3 Plant Operating Conditions

The JAFNPP load and intake and discharge temperatures and average plant temperature rise are listed in Tables I-3 and I-4 for the surveys on June 4 and 13, 1976, respectively. The plant load is determined from hourly computer output at the JAFNPP. The plant load for the survey hours between 0657 an 0818 on June 4, 1976 remained relatively constant at approximately 780 MWe gross until the unscheduled reduction in plant load occurred at 1048. At this time the June 4, 1976 portion of the survey was terminated. The plant load during the survey remained relatively constant at approximately 781 MWe gross.

The NMP Unit 1 station load remained relatively constant at approximately 604 MWe gross and 594 MWe gross for the survey hours 0657 and between 0818 on June 4, 1976 and between 0638 and 1623 on June 13, 1976, respectively.

The JAFNPP intake and discharge temperatures are based on readings taken in the intake and discharge shaft of the ciruclating water system during the survey, as described in Section II-C of the Aquatec report.

A cooling trend shown by the intake temperature between 0600 and 1600 on June 13, 1976 (Table I-4) is caused by upwelling resulting from strong offshore winds. This cooling trend is overridden at approximately 1600 on June 13, 1976 by the shoreward motion of a warm water mass. The position and nature of this well-defined warm water mass is shown for two time periods in Figures I-21 and I-22.

I.4 SURVEY RESULTS

I.4.1 Temperature and Dye Studies

Temperature and dye concentration patterns, illustrating the thermal effect and diffuser performance, respectively, of the joint operation of both the NMP Unit 1 and the JAFNPP discharge, are presented for nearfield and farfield areas. Dye contour illustrations include tables to convert dye concentrations to dilution factors.

The nearfield study area consists of transects 10 through 22, as shown in Figures I-1 through I-44, except Figures I-13, I-21, I-35, and I-40. Temperature data were taken at depths of 1, 2, 6, 10, and 15 feet and dye concentration data at depths of 2, 6, and 10 feet. Transects 11 through 22 are 2,500 feet long; transect 10 is 3,000 feet long. The tracking speed of the survey boat was from 8 to 10 feet per second (fps) with a data sampling interval of one data record per second. Offshore extensions of the nearfield study area are provided for selected runs on June 13, 1976.

The farfield study area consists of transects 4 through 26, as shown in Figures I-13, I-21, I-35, and I-40. Temperature and dye data were taken at a depth of 1.5 feet. The study area extends 5,000 feet either side of the diffuser along the shore and 5,000 feet offshore. The tracking speed of the survey boat was from 20 to 25 fps with a data sampling interval of one data record per second.

During each of the nearfield and farfield runs described in the following sections, vertical profiles of both temperature and dye were taken at 27 designated stations in addition to the horizontal transect work. Vertical profiles for the June 1976 survey are shown in Figures 4 through 29 of the Aquatec report.

The dye concentration in the discharge shaft of the circulating water system was determined to be 7.8 parts per billion (ppb). This result was calculated by diluting the Rhodamine WT dye release rate of 1.47 pounds per hour with the total circulating water flow rate of 835 cfs. The circulating water flow rate is based on an Aquatec, Inc. report entitled "Pumphouse Dye Study" completed in October 1975, using a dye dilution technique to determine the flow rate within an accuracy of 2.59 percent.

I.4.1.1 June 4, 1976 Temperature Patterns (nearfield)

Between 0657 and 0818 on June 4, 1976 only one nearfield run was completed along the appropriate transects because of the unscheduled reduction in plant load.

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures I-1, I-2, I-3, I-4, and I-5, respectively, during the nearfield sampling period from 0657 to 0818.

Figure I-6 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 53.3°F was calculated by averaging the temperatures in the diffuser vicinity along transect 19. The maximum temperature rise above ambient at the 1-foot depth was observed to be 2.3°F. This value is based on an averaging of data along 33.3 feet of transect.

I.4.1.2 June 13, 1976 Temperature Patterns

Between 0638 and 1623 on June 13, 1976, three nearfield and two farfield runs were completed along the appropriate transects.

I.4.1.2.1 Sampling Period from 0638 to 0801 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures I-7, I-8, I-9, I-10, and I-11, respectively, during the nearfield sampling period from 0638 to 0801.

Figure I-12 represents the temperature rise above ambient at a 1-foot depth. The ambient water temperature of 51.7°F was calculated by averaging the temperatures in the diffuser vicinity along transect 20. The maximum temperature rise above ambient at the 1-foot depth was observed to be 0.8°F.

I.4.1.2.2 Sampling Period from 0833 to 1003 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure I-13 during the farfield sampling period from 0833 to 1003.

I.4.1.2.3 Sampling Period from 1032 to 1152 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures I-14, I-15, I-16, I-17, and I-18 respectively, during the nearfield sampling period from 1032 to 1152. Figure I-19 illustrates an offshore extension of the isotherms at a 2-foot depth.

Figure I-20 represents the temperature rise above ambient at a 1-foot depth. The ambient water temperature of 48.5°F was calculated by averaging the temperatures in the diffuser vicinity along transect 20. The maximum temperature rise above ambient at the 1-foot depth was observed to be 1.6°F.

I.4.1.2.4 Sampling Period from 1252 to 1416 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure I-21 during the farfield sampling period from 1252 to 1416.

I.4.1.2.5 Sampling Period from 1446 to 1623 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures I-22, I-23, I-24, I-25, and I-26, respectively, during the nearfield sampling period from 1446 to 1623. Figure I-27 illustrates an offshore extension of the isotherms at a 2-foot depth.

Figure I-28 represents the temperature rise above ambient at a 1-foot depth. The ambient water temperature of 47.3°F was calculated by averaging the temperatures in the diffuser vicinity along transect 21. The maximum temperature rise above ambient at the 1-foot depth was observed to be 2.3°F.

I.4.1.3 June 4, 1976 Dye Concentration Patterns

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures I-29, I-30, and I-31, respectively, during the nearfield sampling period from 0657 to 0818.

I.4.1.4 June 13, 1976 Dye Concentration Patterns

Between 0638 and 1623 on June 13, 1976, three nearfield and two farfield runs were completed along the appropriate transects.

I.4.1.4.1 Sampling Period from 0638 to 0801 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures I-32, I-33, I-34, respectively, during the nearfield sampling period from 0638 to 0801.

The maximum dye concentration at the 2-foot depth was observed to be 0.91 ppb.

I.4.1.4.2 Sampling Period from 0833 to 1003 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure I-35 during the farfield sampling period from 0833 to 1003.

The maximum dye concentration at the 1.5-foot depth was observed to be 0.66 ppb.

I.4.1.4.3 Sampling Period from 1032 to 1152 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures I-36, I-37, and I-38, respectively, during the nearfield sampling period from 1032 to 1152. Figure I-39 illustrates an offshore extension of dye contours at a 2-foot depth.

The maximum dye concentration at the 2-foot depth was observed to be 1.13 ppb.

I.4.1.4.4 Sampling Period from 1252 to 1416 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure I-40 during the farfield sampling from 1252 to 1416.

The maximum dye concentration at the 1.5-foot depth was observed to be 0.80 ppb.

I.4.1.4.5 Sampling Period from 1446 to 1623 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures I-41, I-42, and I-43, respectively, during the nearfield sampling period from 1446 to 1623. Figure I-44 illustrates an offshore extension of the dye contours at a 2-foot depth.

The maximum dye concentration at the 2-foot depth was observed to be 1.06 ppb.

I.4.2 In Situ Data

In situ data collection, consisting of current speed and direction, lake temperature, and lake level, was made by the Raytheon Company. The information is provided in the Aquatec report.

A summary of the average current speed and magnitude at the 10-foot depth is represented in each figure by a vector and associated magnitude at the in situ tower. The lake levels for both the June 4 and June 13, 1976 survey were observed to fluctuate between 248.4 and 248.6 feet USLS (United States lake Survey 1935 Datum).

TABLE I-1

WIND SPEED AND DIRECTION FOR JUNE 4, 1976

Time	Data Taken at Elevation of 30 Ft Direction (Deg True)	 Speed (mph)
0500	300	0
0600*	080	0
0700*	075	1
0800*	050	2
0900*	345	3
1000	340	3

* Survey Period

TABLE I-2

WIND SPEED AND DIRECTION FOR JUNE 13, 1976

Time	Data taken at 30-ft elevation Direction (Deg true)	Speed (mph)
0500	120	10
0600*	130	12
0700*	130	10
0800*	145	9
0900*	140	12
1000*	155	11
1100*	165	12
1200*	160	11
1300*	150	13
1400*	155	11
1500*	145	11
1600*	155	10
1700*	155	9
1800	160	10

* Survey Period

TABLE I-3

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON JUNE 3 AND 4, 1976 FOR THE JAFNPP

Time	Average Plant Load (MWe)	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Plant Temperature Rise (°F)
		June 3, 1976		
1700-1800	777	54.0	83.5	29.5
1800-1900	777	55.0	84.0	29.0
1900-2000	776	56.0	85.0	29.0
2000-2100	777	56.0	85.0	29.0
2100-2200	777	56.5	85.0	28.5
2200-2300	777	56.0	84.0	28.0
2300-0000	778	53.5	82.5	29.0
		June 4, 1976		
0000-0100	779	52.5	81.5	29.0
0100-0200	779	52.0	81.0	29.0
0200-0300	779	52.0	80.5	28.5
0300-0400	780	51.5	80.0	28.5
0400-0500	780	52.5	81.5	29.0
0500-0600	779	52.5	81.0	28.5
0600-0700*	780	53.0	81.5	28.5
0700-0800*	779	52.0	81.0	29.0
0800-0900*	777	52.0	81.0	29.0
1000-1100	622	-	-	-
**				
1100-1200	0	-	-	-

* Survey Period

** Unscheduled reduction in plant load at 1048

TABLE I-4

PL NT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON JUNE 12 AND 13, 1976 FOR THE JAFNPP

Time	Average Plant Load (MWe)	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Plant Temperature Rise (°F)
		June 12, 1976		
1800-1900	776	57.5	87.0	29.5
1900-2000	778	57.5	86.5	29.0
2000-2100	778	57.0	85.5	28.5
2200-2300	779	55.5	84.0	28.5
2300-2400	779	54.0	83.0	29.0
		June 13, 1976		
0000-0100	779	54.0	82.0	28.0
0100-0200	780	52.0	81.0	29.0
0200-0300	780	51.5	80.0	28.5
0300-0400	781	51.0	80.0	29.0
0400-0500	780	51.0	80.0	29.0
0500-0600	781	51.0	80.0	29.0
0600-0700*	780	50.0	79.0	29.0
0700-0800*	782	49.5	78.5	29.0
0800-0900*	781	48.0	77.5	29.5
0900-1000*	781	47.5	76.0	28.5
1100-1200*	782	46.5	75.5	29.0
1200-1300*	781	46.5	75.0	28.5
1300-1400*	781	46.0	74.5	28.5
1400-1500*	781	46.0	74.5	28.5
1500-1600*	780	45.5	74.0	28.5
1600-1700*	781	47.0	75.0	28.0
1700-1800	780	52.0	80.0	28.0
1800-1900	778	55.0	82.5	27.5
1900-2000	778	55.0	83.5	28.5

* Survey Period

TABLE I-5

DEGREE OF THERMAL STRATIFICATION IN INTAKE REGION
FOR JUNE 4 AND 13, 1976

Time	Average Water Temperature (°F) for Top 2 Ft of Water Column at Intake Region	Average Water Temperature (°F) for Bottom 2 Ft of Water Column at Intake Region	Thermal Stratification (°F) at Intake Region
		June 4, 1976	
1145	54.4	51.4	3.0
		June 13, 1976	
0740	49.9	46.9	3.0
0939	47.6	45.1	2.5
1122	46.8	44.7	2.1
1337	46.8	44.0	2.8
1539	45.4	43.7	1.7

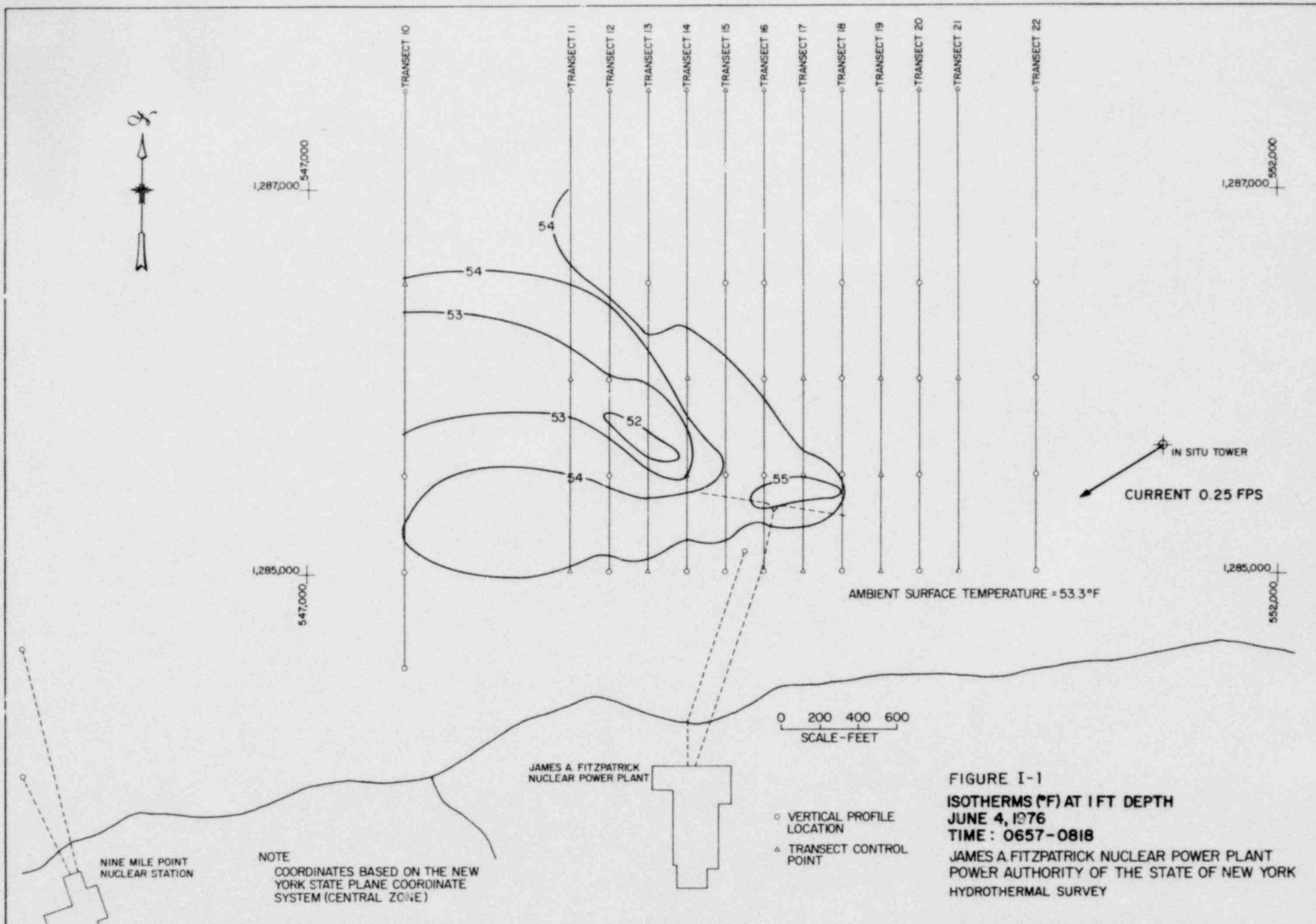


FIGURE I-1

ISOTHERMS (°F) AT 1 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

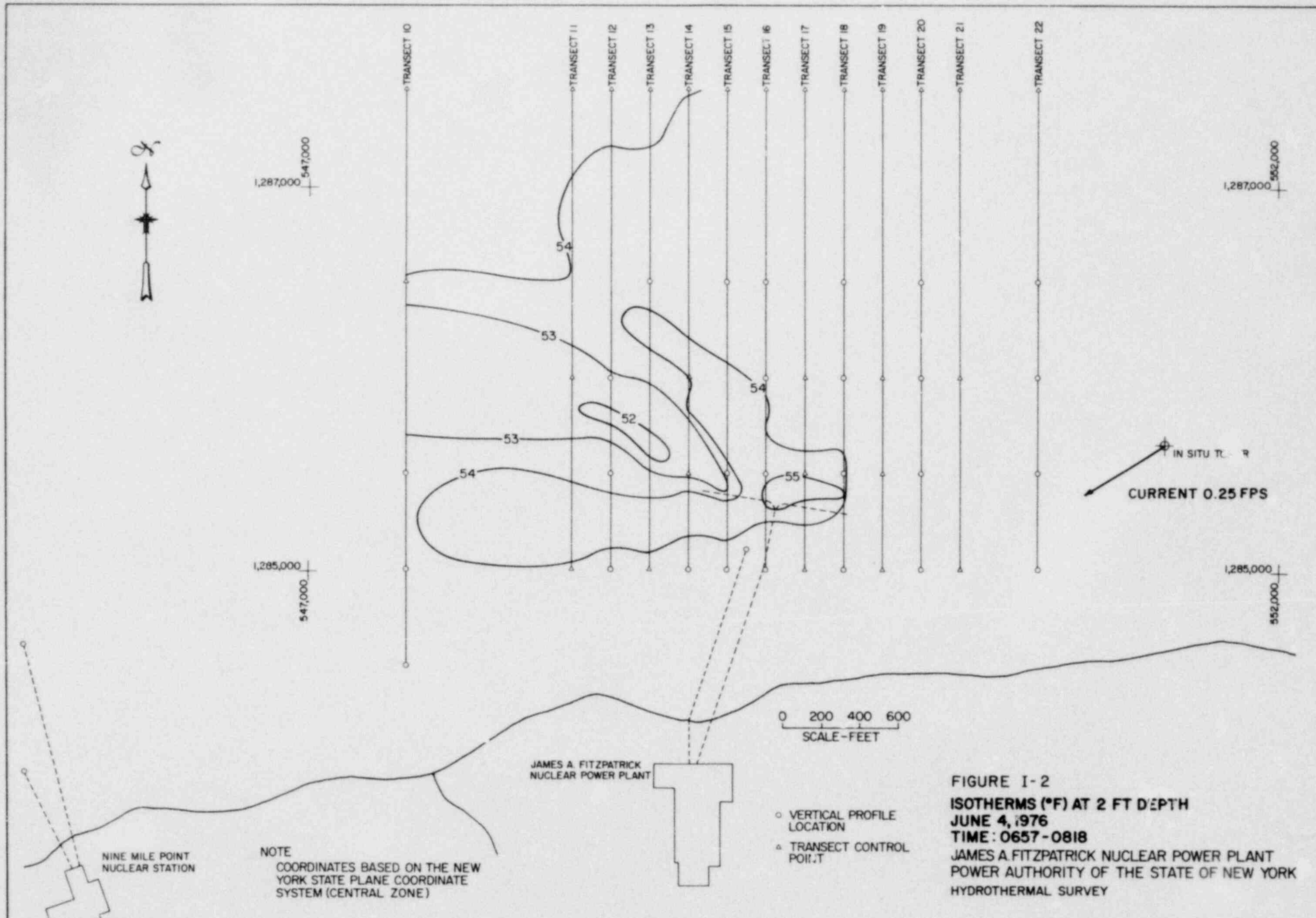


FIGURE I-2

ISOTHERMS (°F) AT 2 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

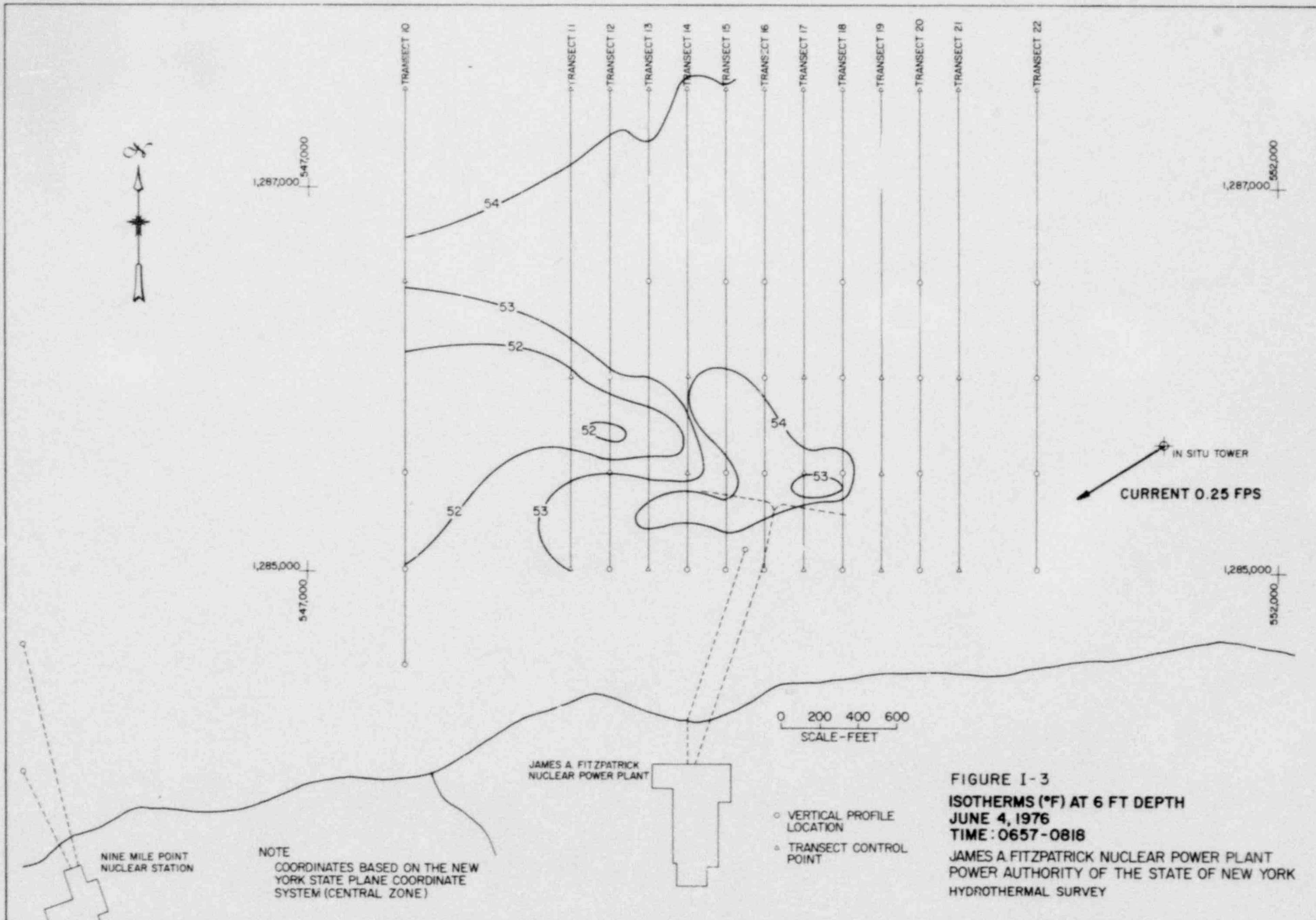


FIGURE I-3

ISOTHERMS (°F) AT 6 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

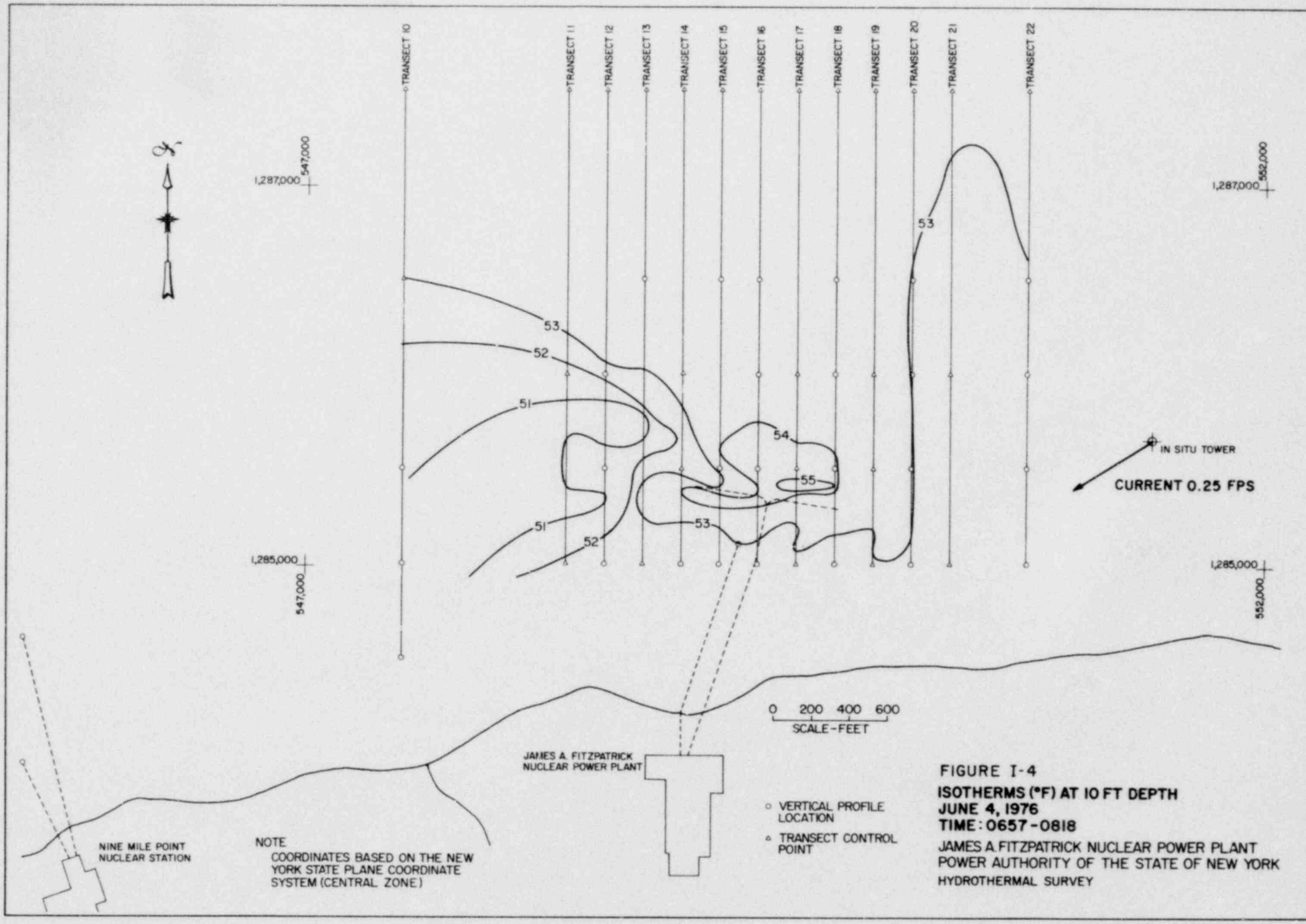


FIGURE I-4

ISOTHERMS (°F) AT 10 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

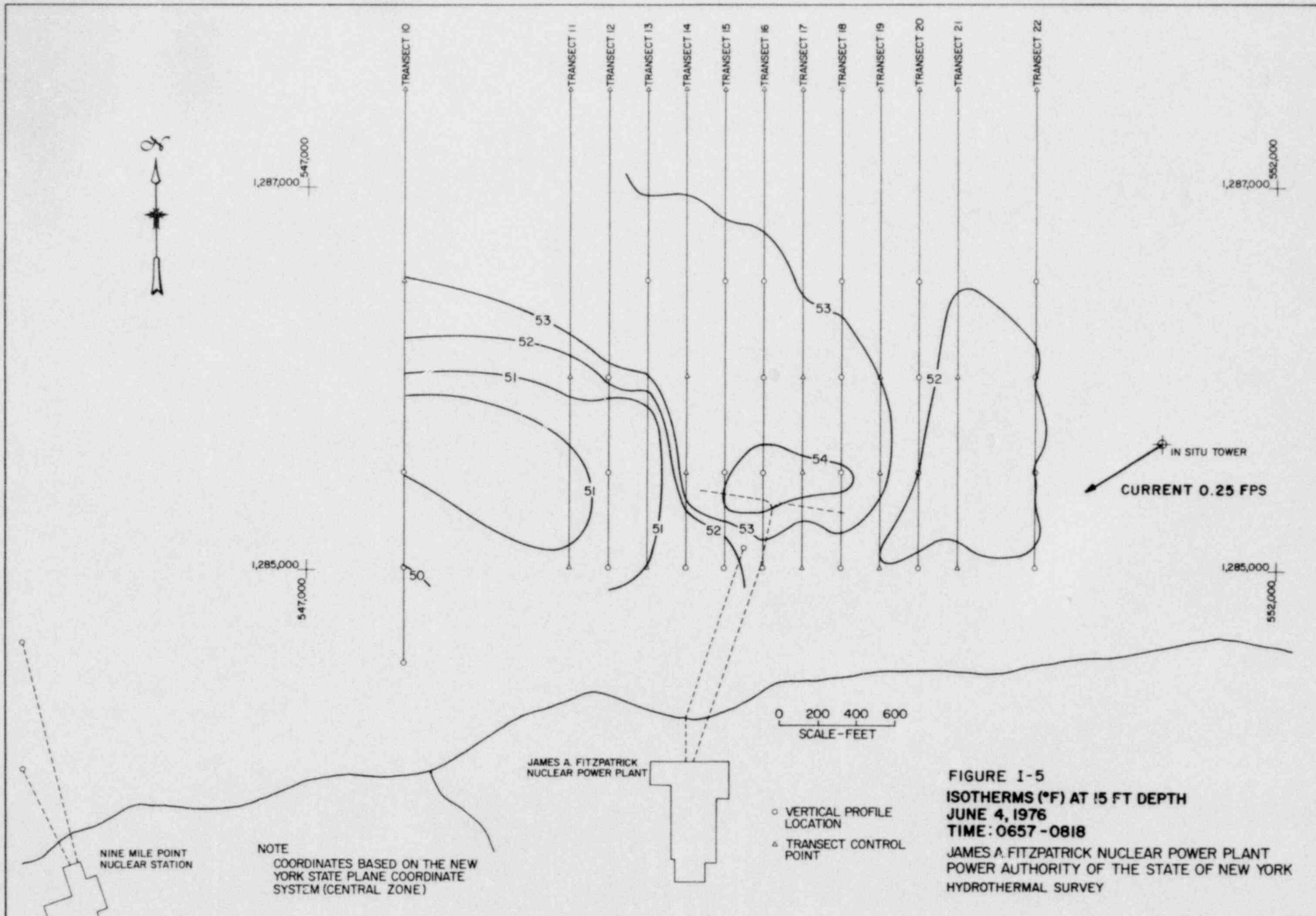


FIGURE I-5

ISOTHERMS (°F) AT 15 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

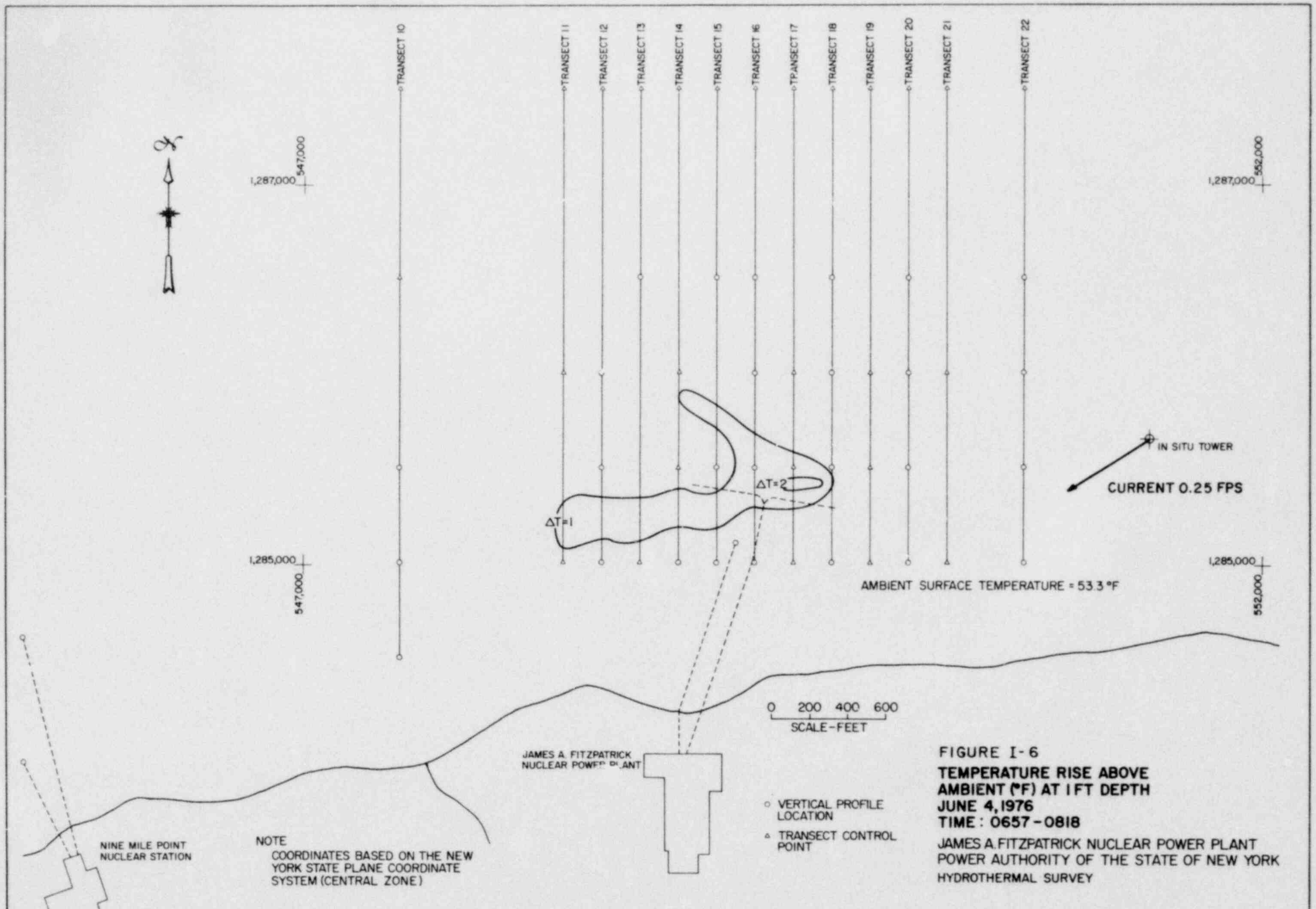


FIGURE I-6

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

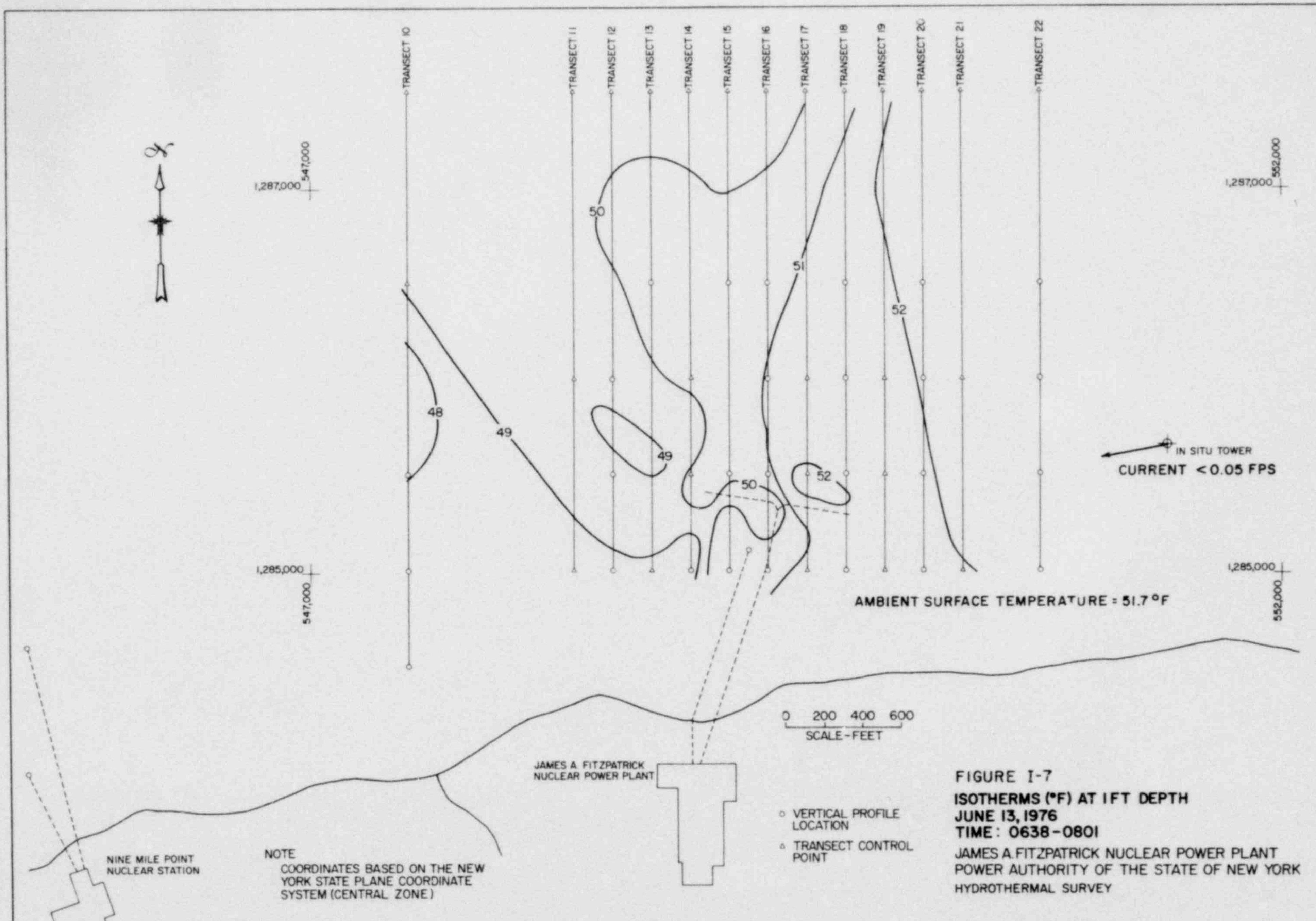


FIGURE I-7
ISOTHERMS (°F) AT 1 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

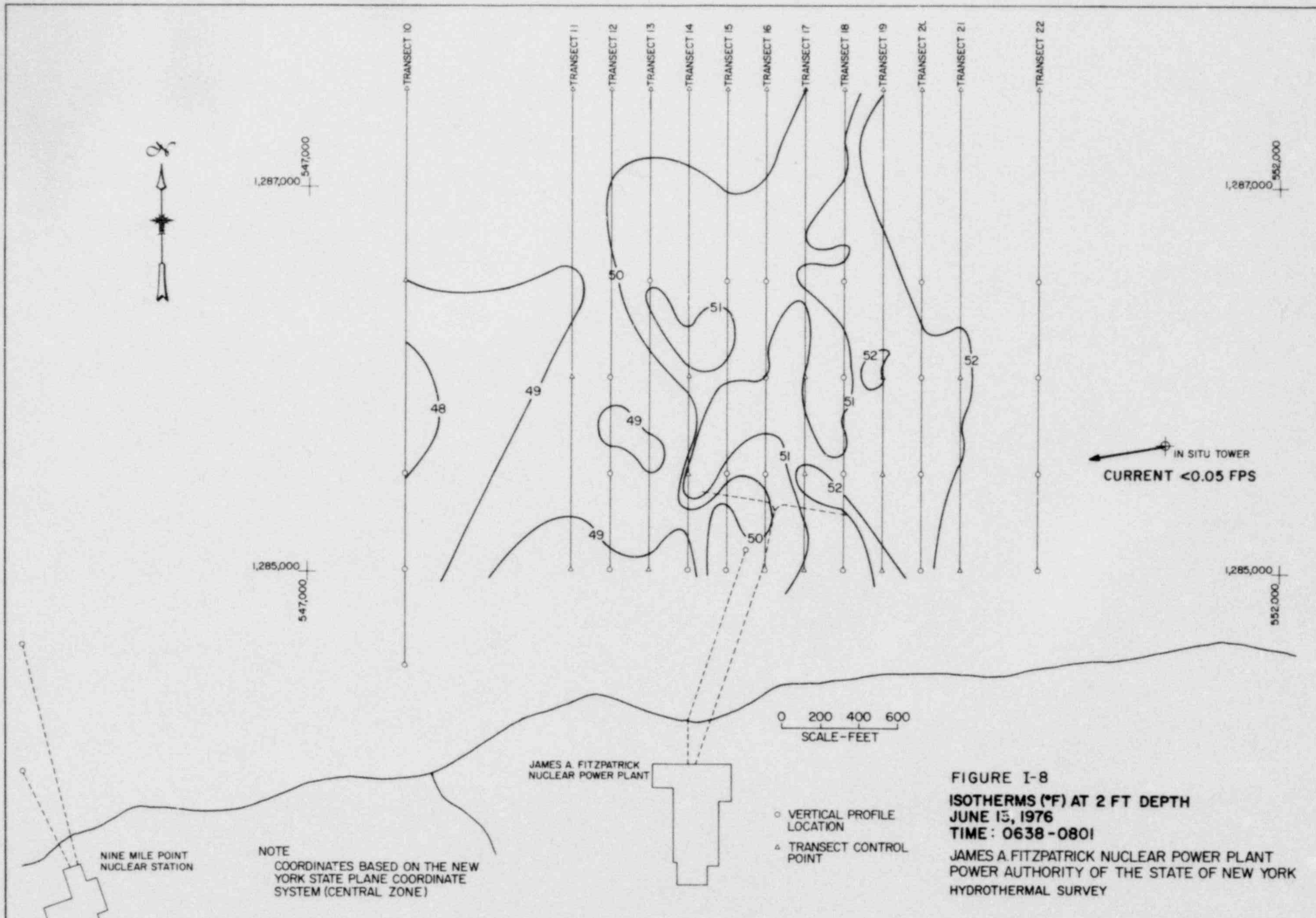


FIGURE I-8

ISOTHERMS (°F) AT 2 FT DEPTH
JUNE 15, 1976
TIME: 0638-0801

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

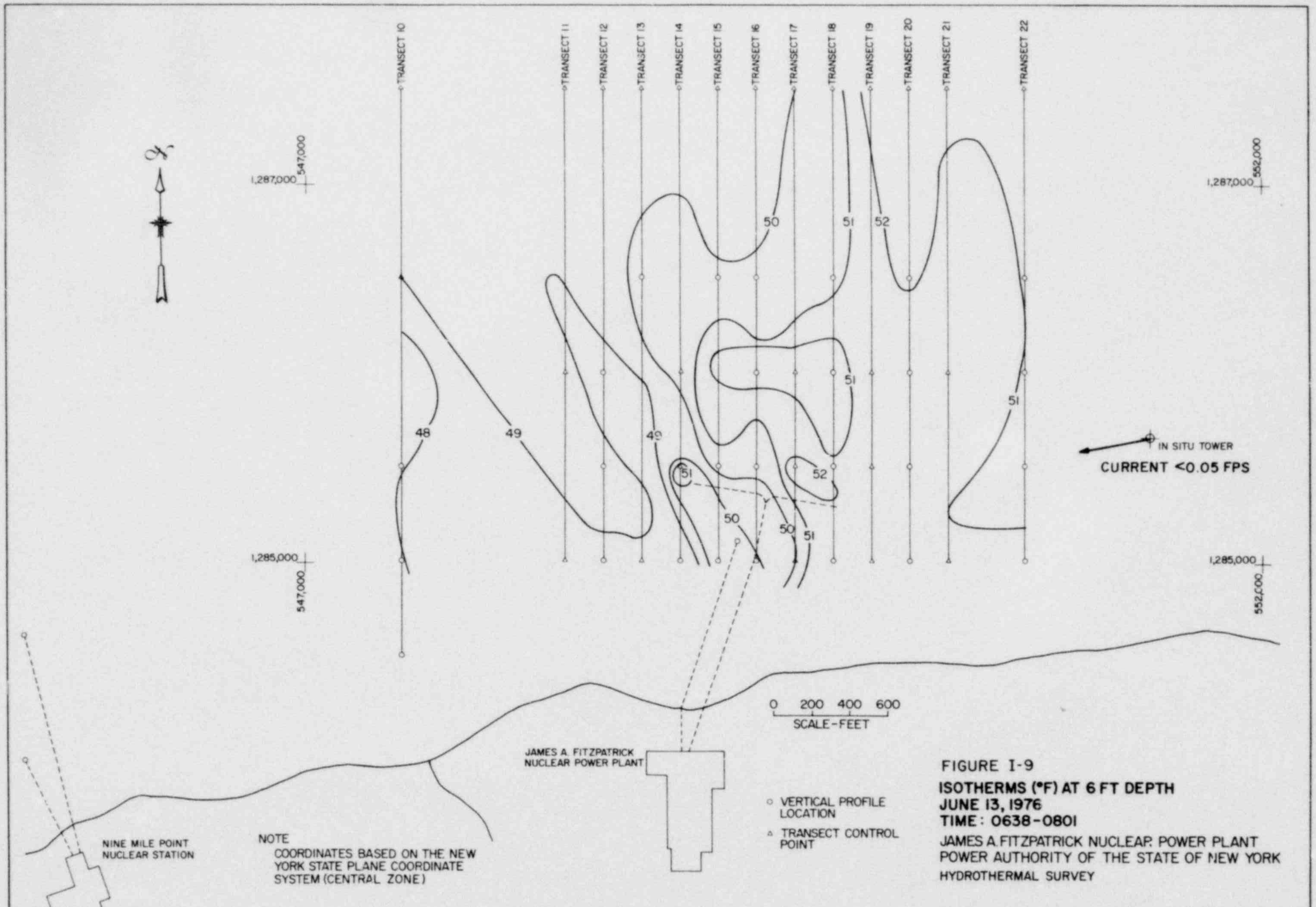


FIGURE I-9

ISOTHERMS (°F) AT 6 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

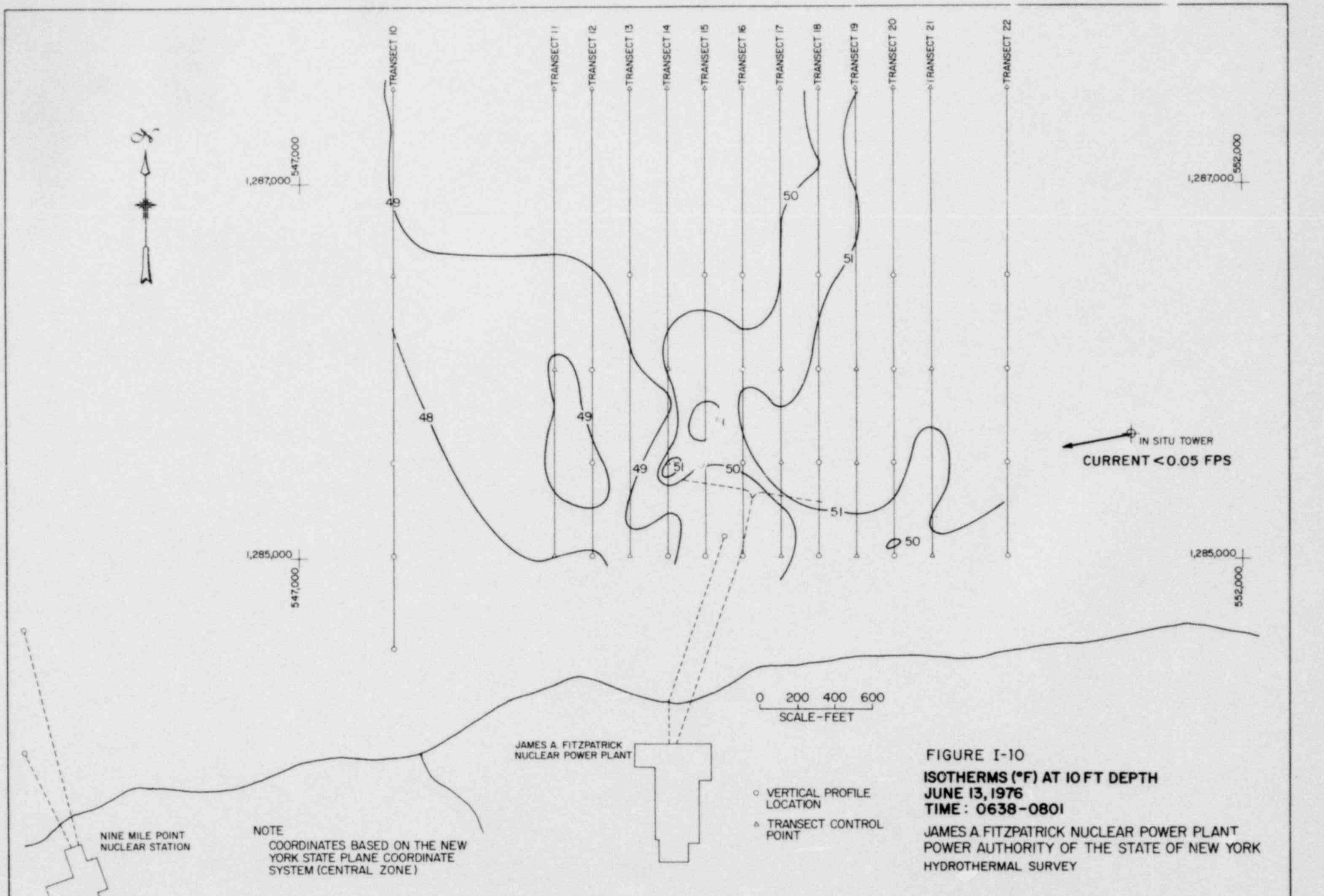


FIGURE I-10

ISOTHERMS (°F) AT 10 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

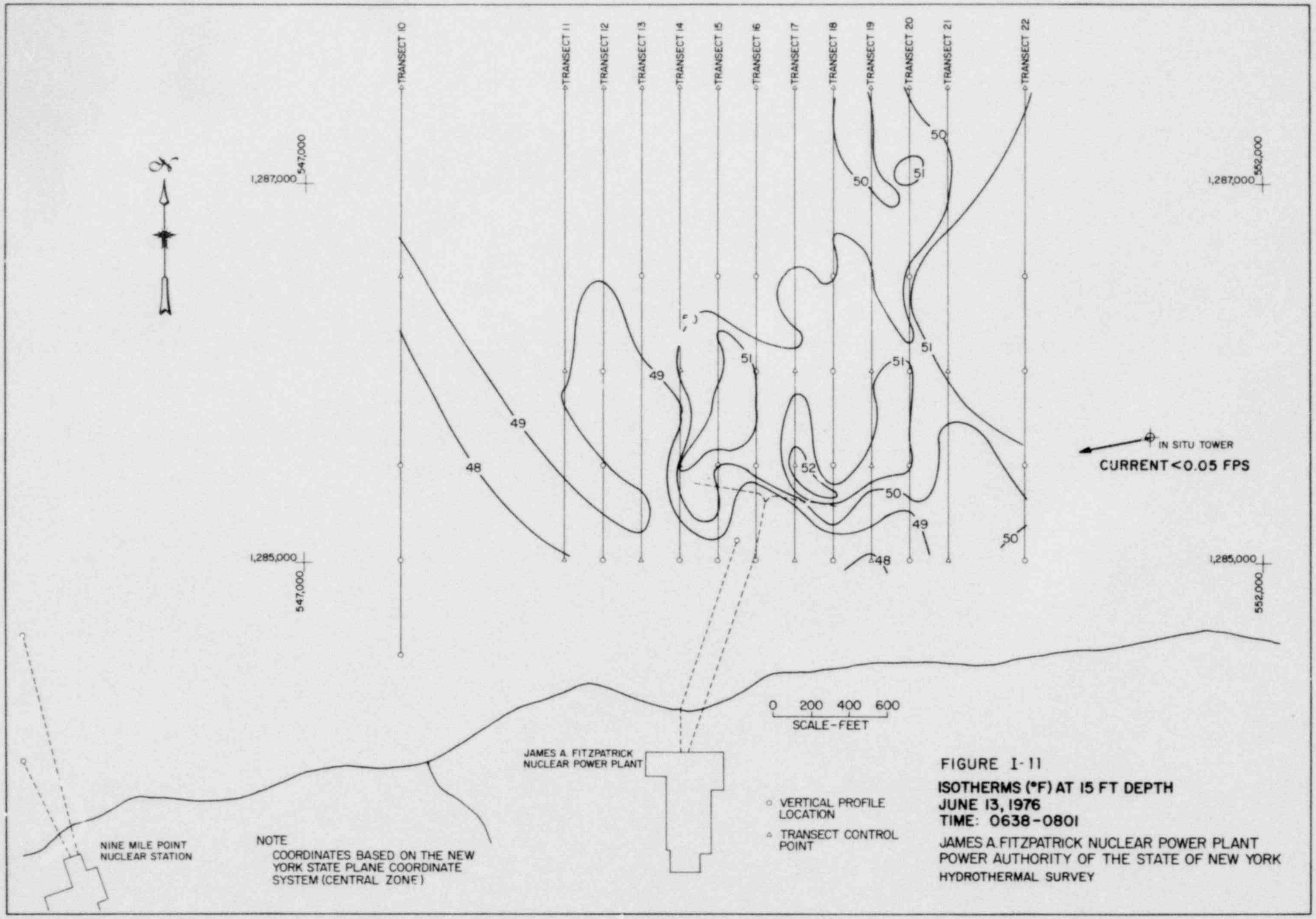
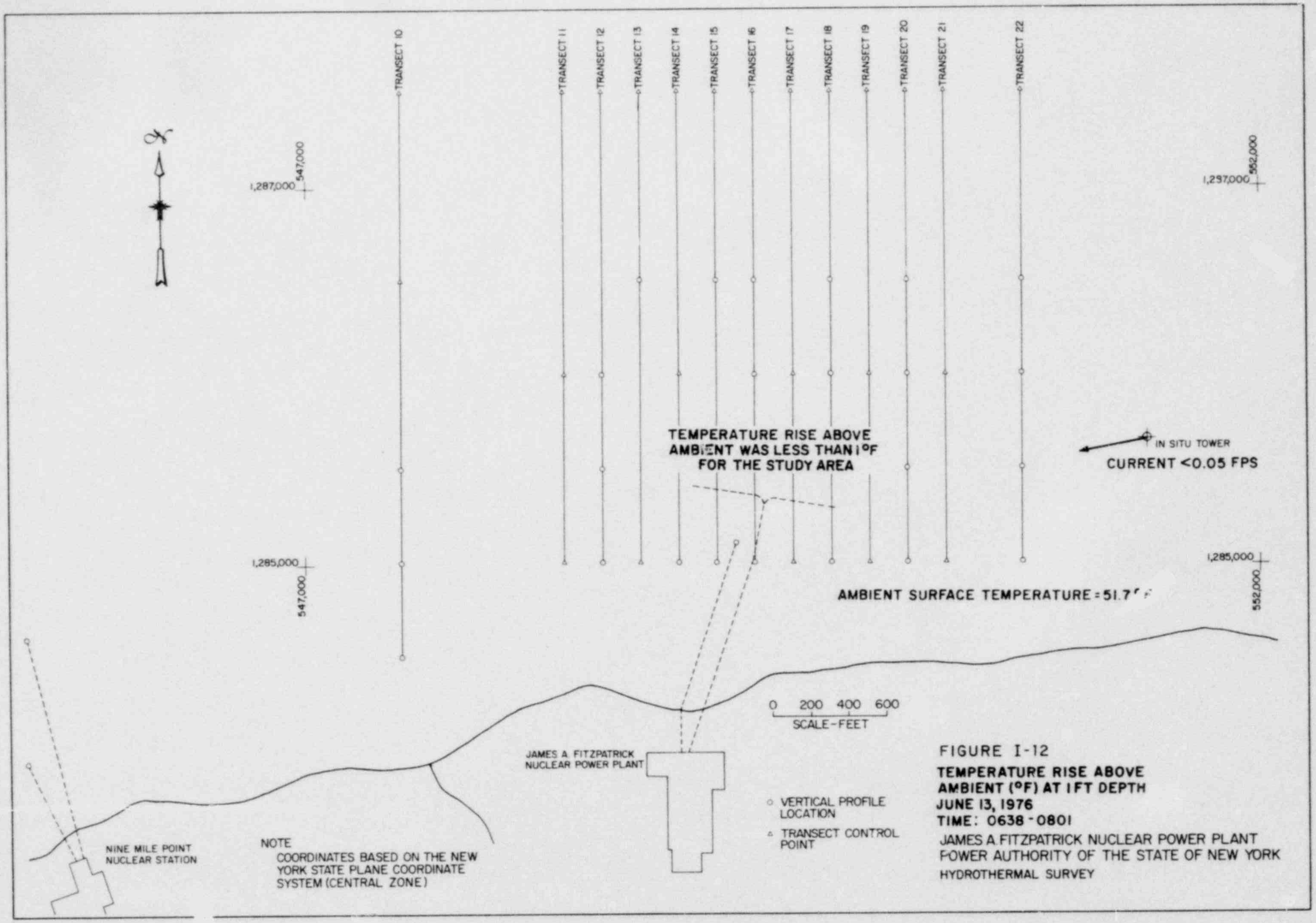


FIGURE I-11

ISOTHERMS (°F) AT 15 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

○ VERTICAL PROFILE LOCATION
△ TRANSECT CONTROL POINT

FIGURE I-12
TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

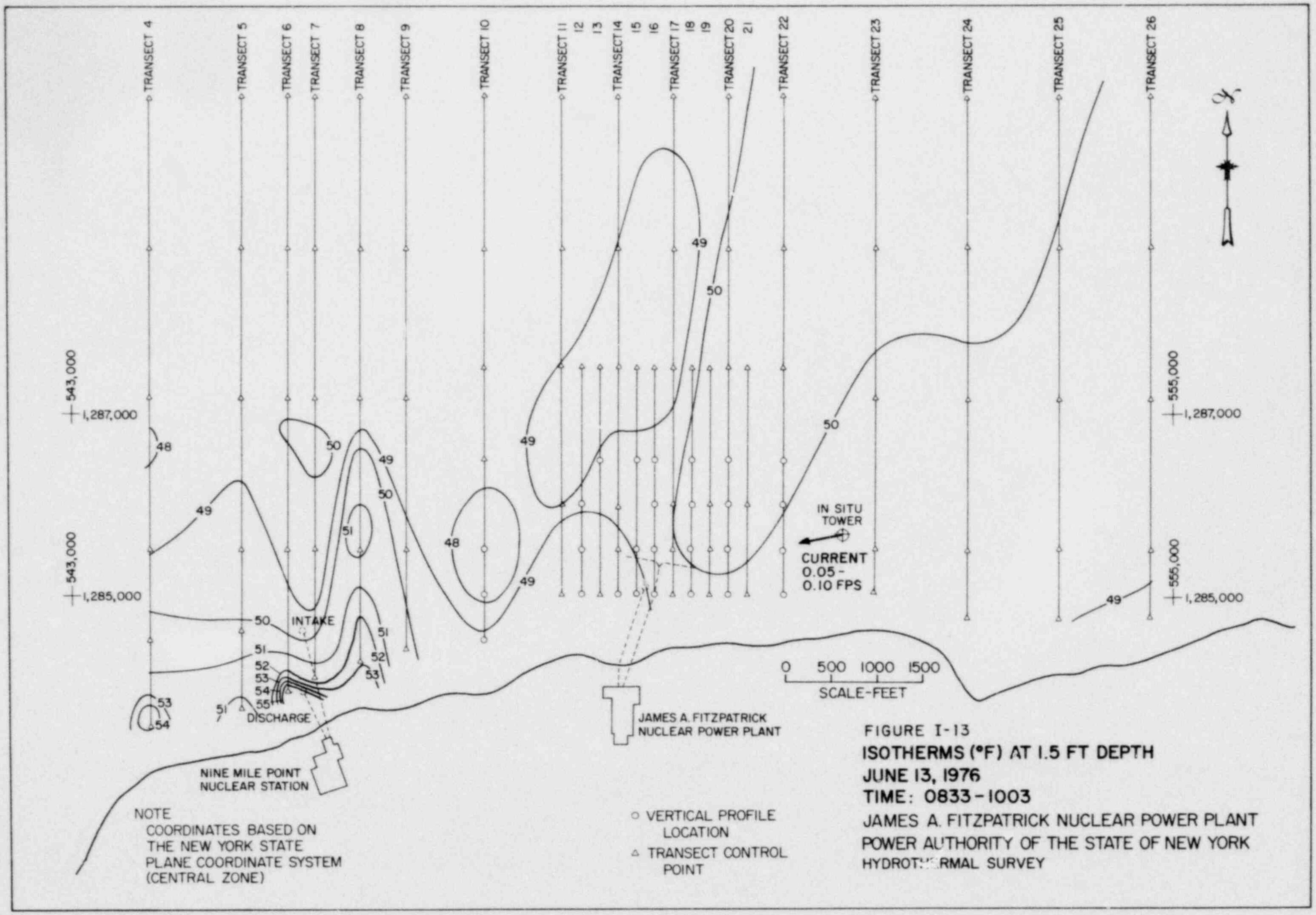


FIGURE I-13

ISOTHERMS (°F) AT 1.5 FT DEPTH
JUNE 13, 1976
TIME: 0833-1003

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

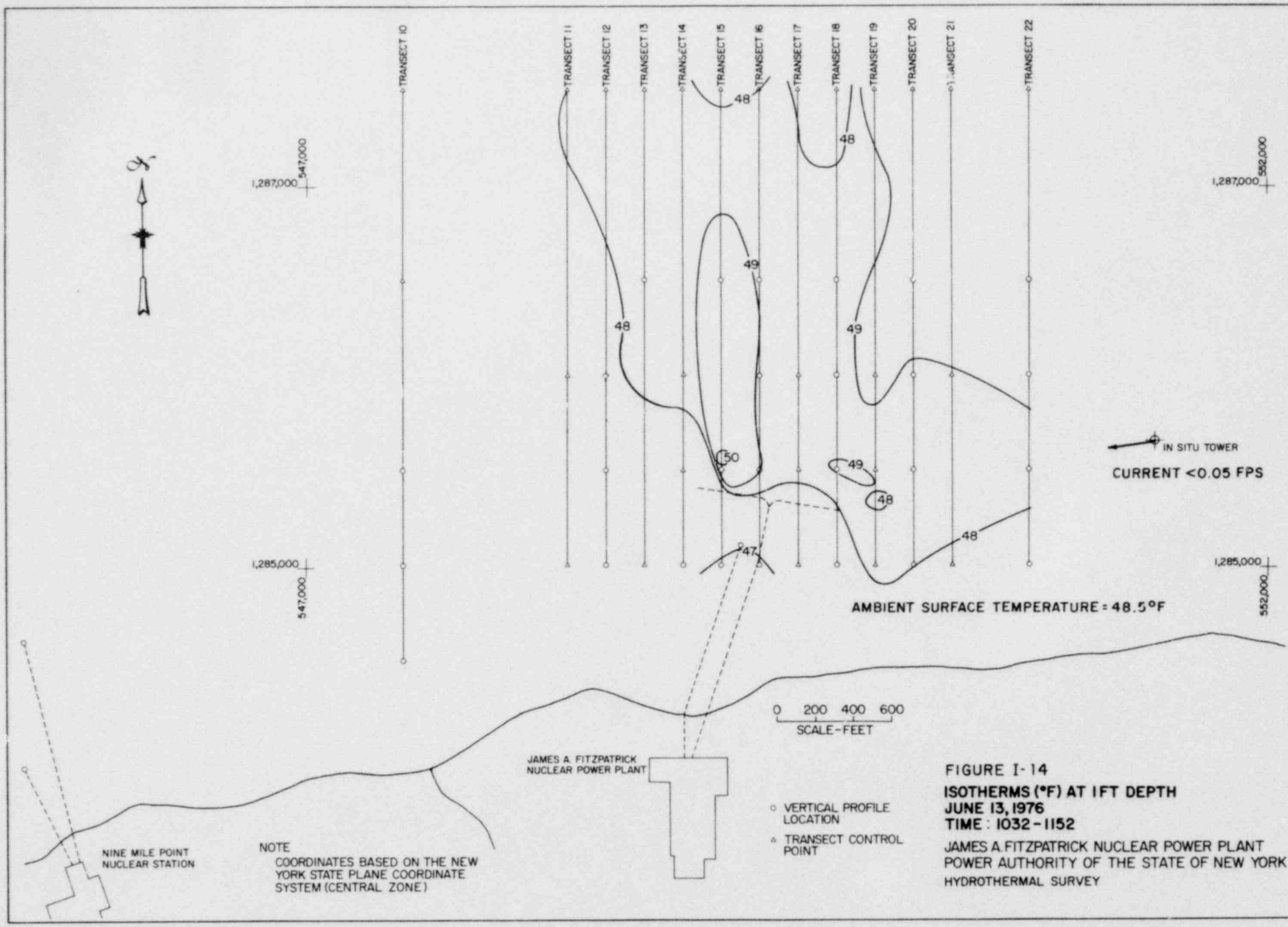


FIGURE I-14

ISOTHERMS (°F) AT 1 FT DEPTH
JUNE 13, 1976
TIME: 1032-1152

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

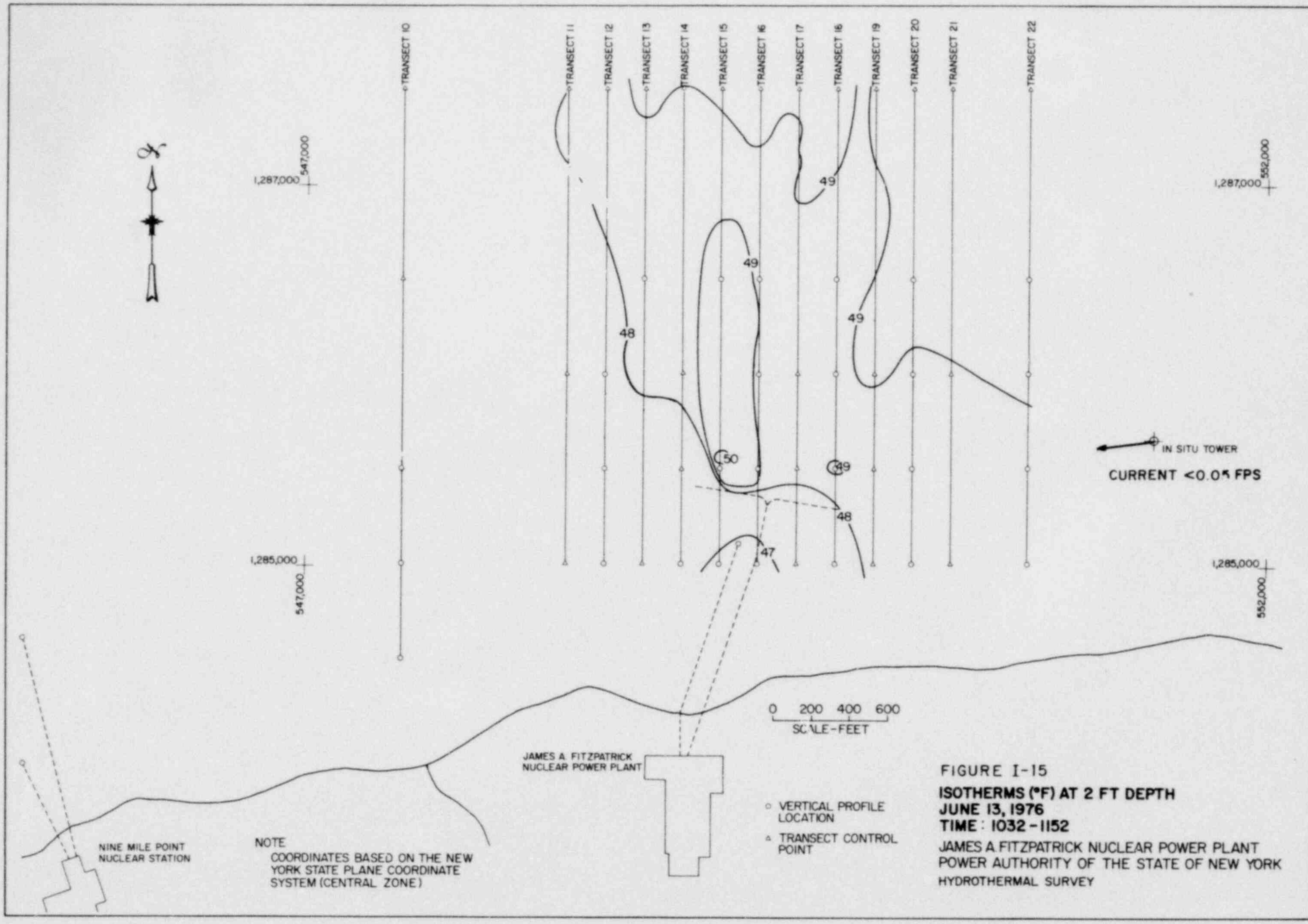


FIGURE I-15

ISOTHERMS (°F) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1032-1152

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

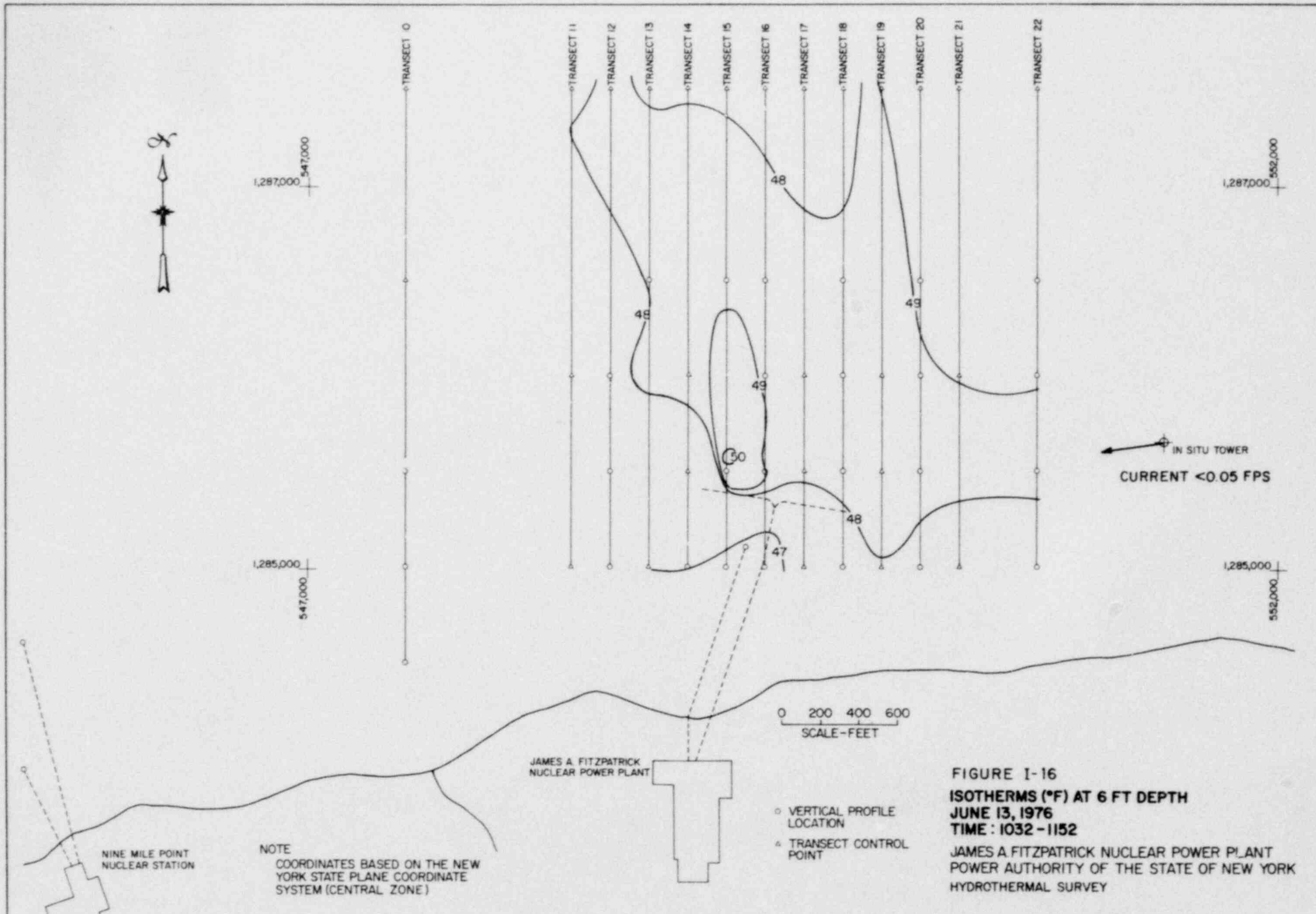


FIGURE I-16

ISOTHERMS (°F) AT 6 FT DEPTH
JUNE 13, 1976
TIME : 1032 - 1152

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

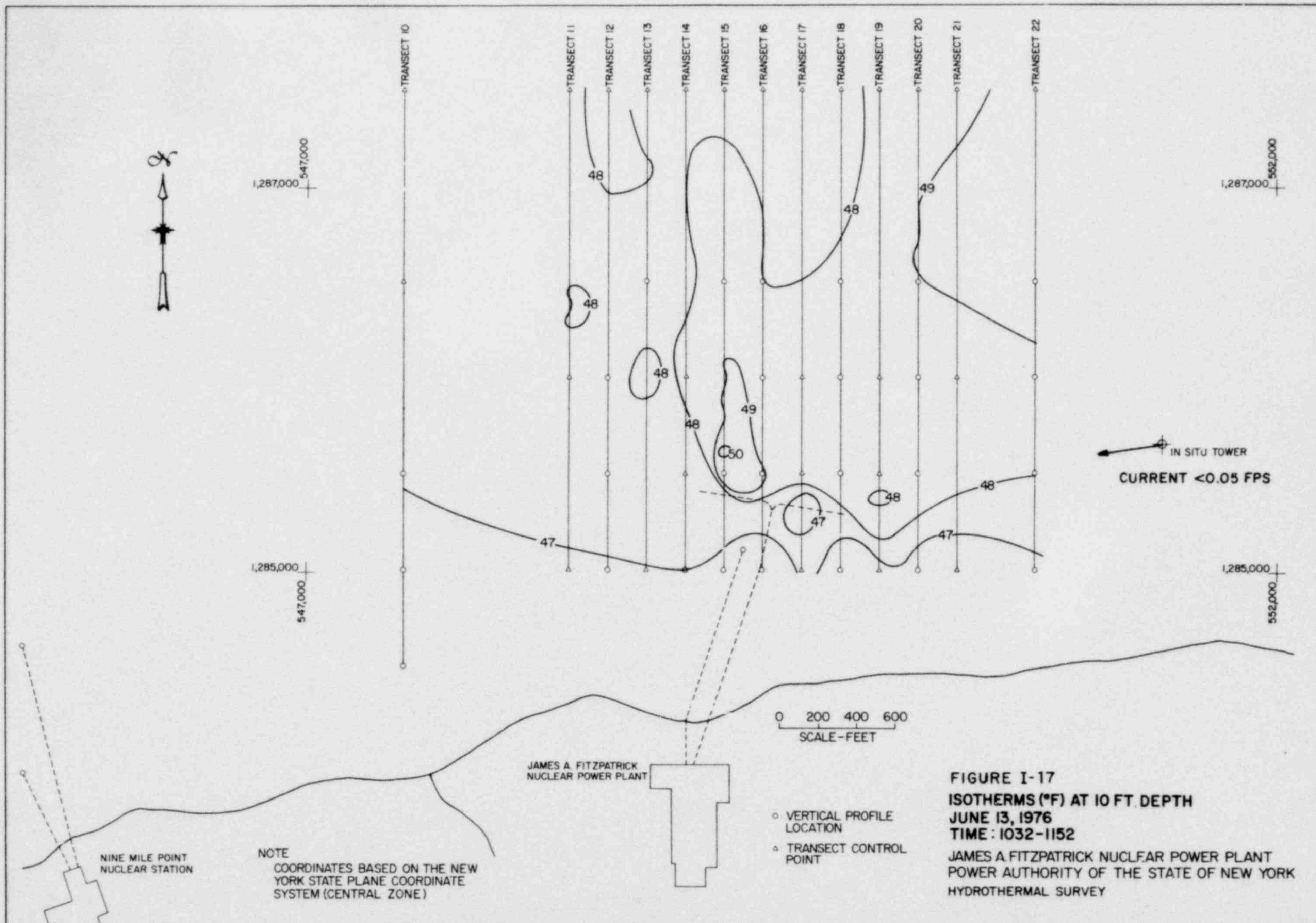


FIGURE I-17

ISOTHERMS (°F) AT 10 FT. DEPTH
JUNE 13, 1976
TIME: 1032-1152

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

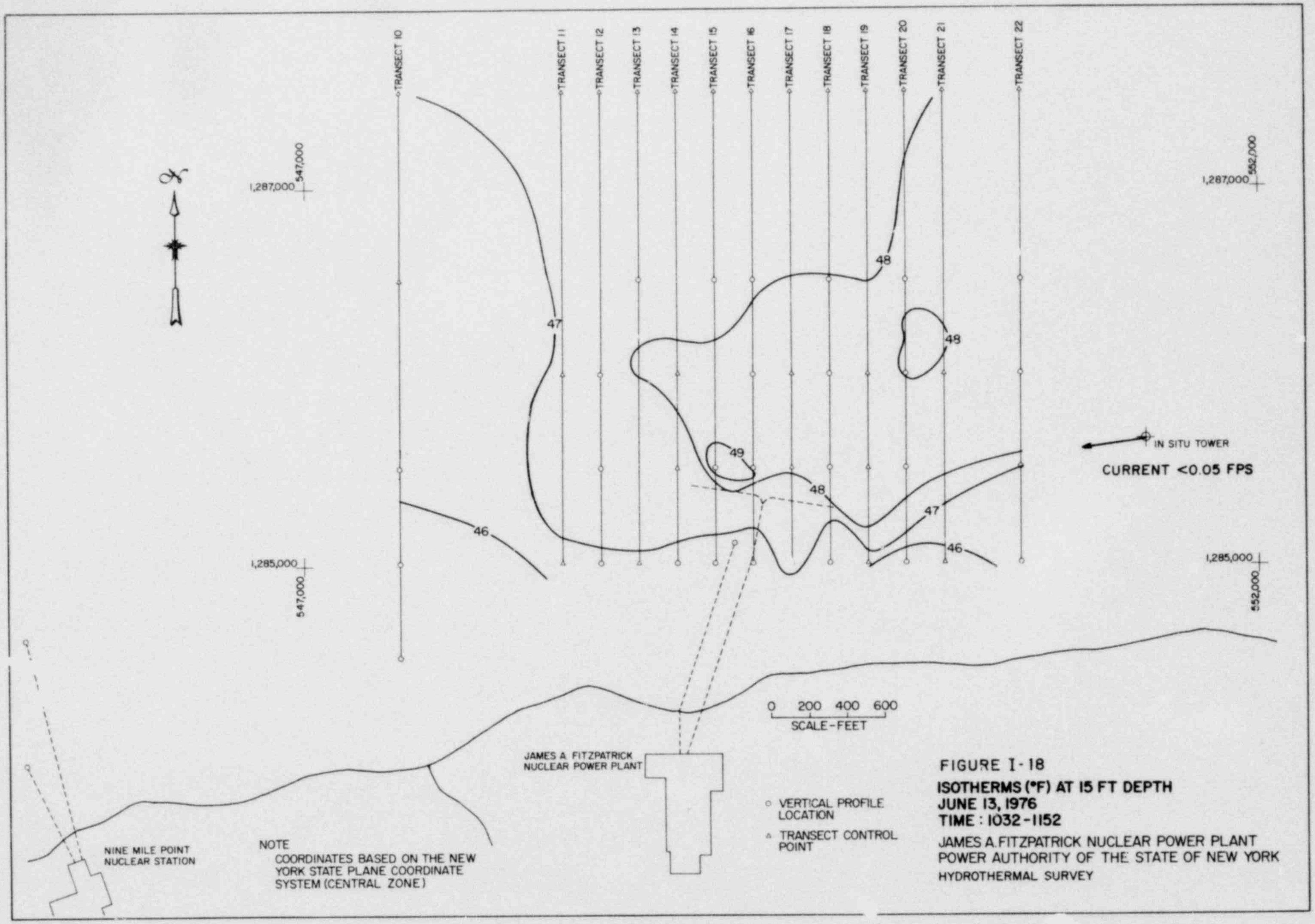
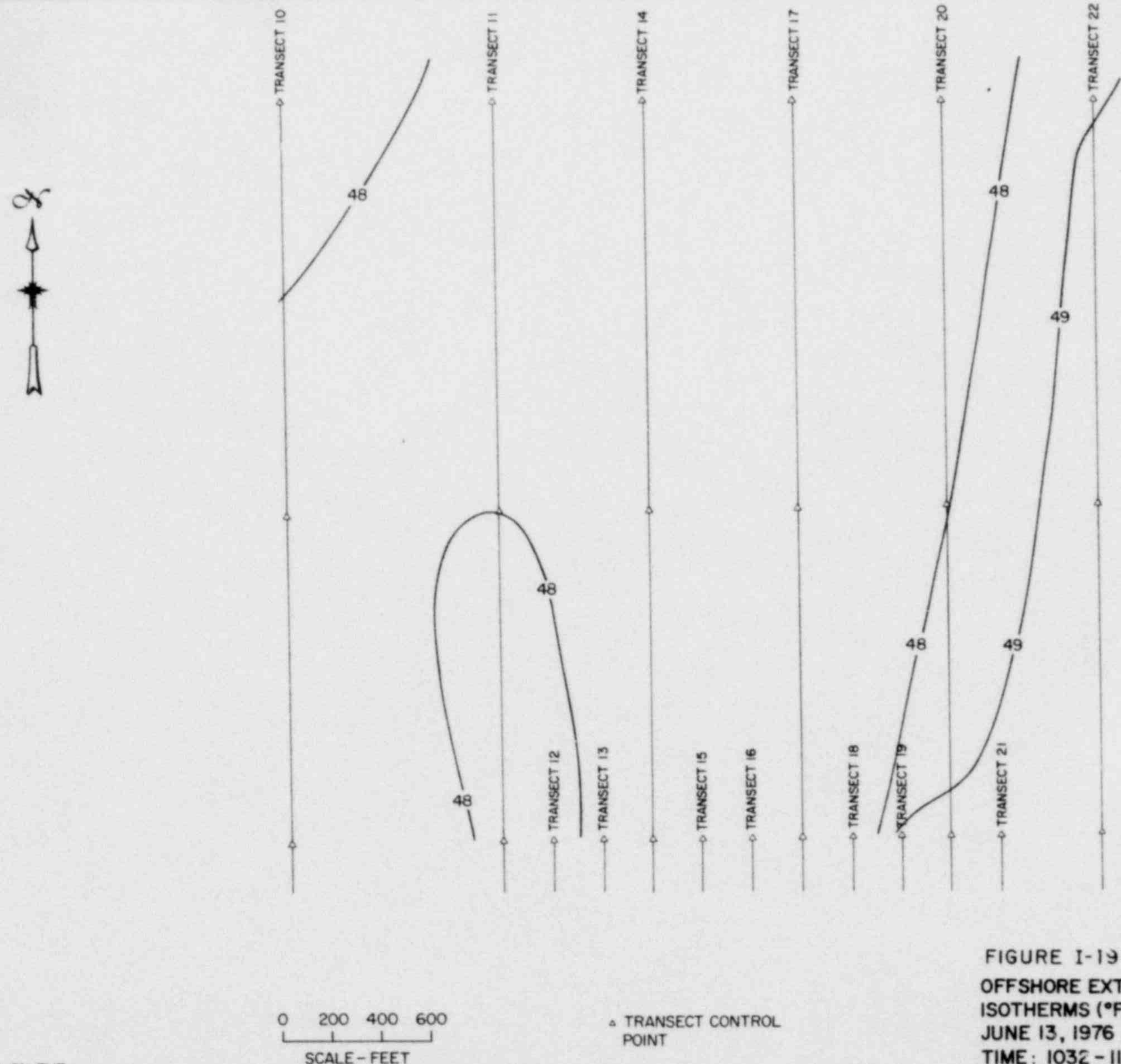


FIGURE I-18

ISOTHERMS (°F) AT 15 FT DEPTH
JUNE 13, 1976
TIME : 1032-1152

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE I-19
OFFSHORE EXTENSION OF ISOTHERMS (°F) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1032 - 1152
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

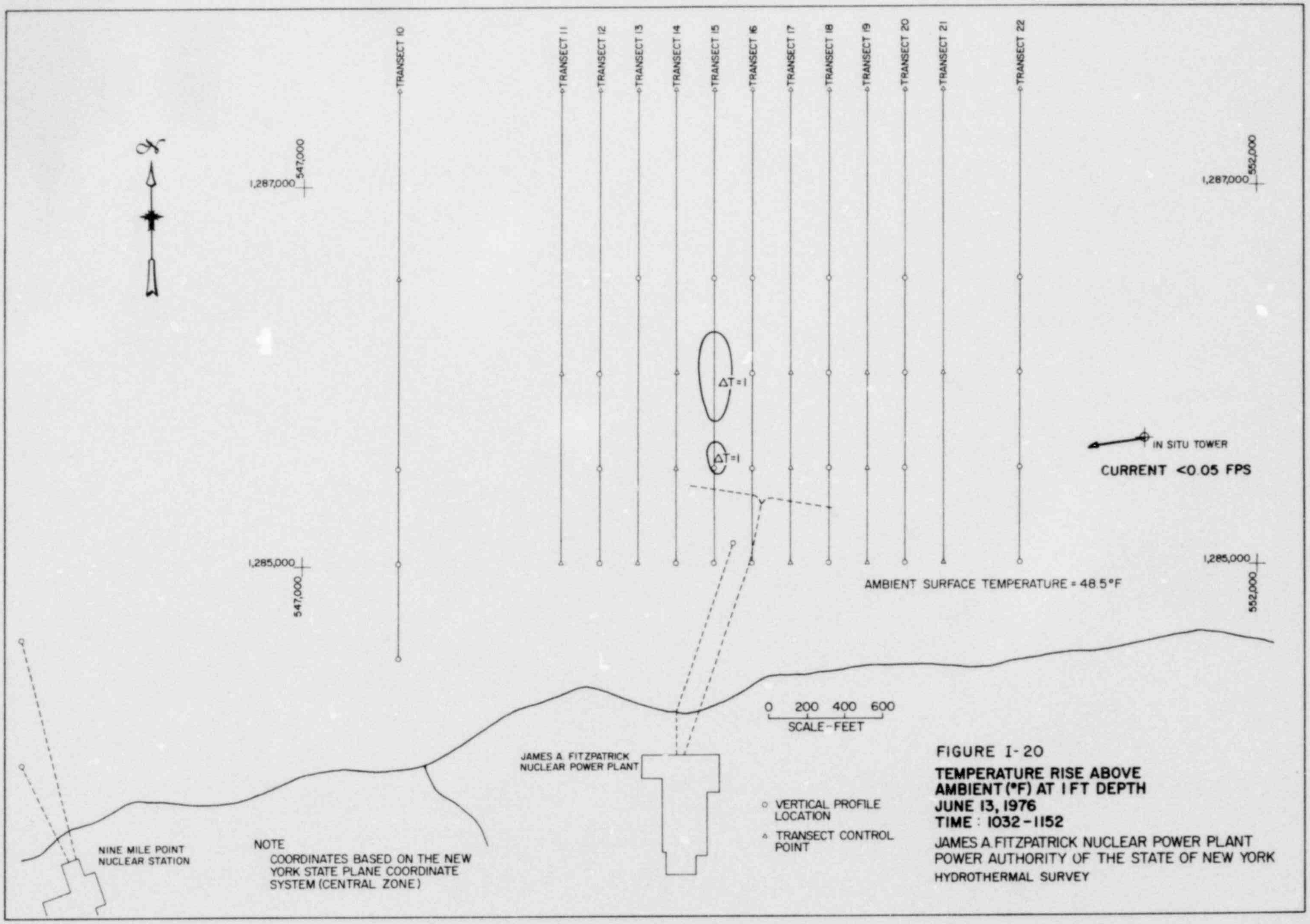


FIGURE I-20
TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
JUNE 13, 1976
TIME : 1032-1152
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

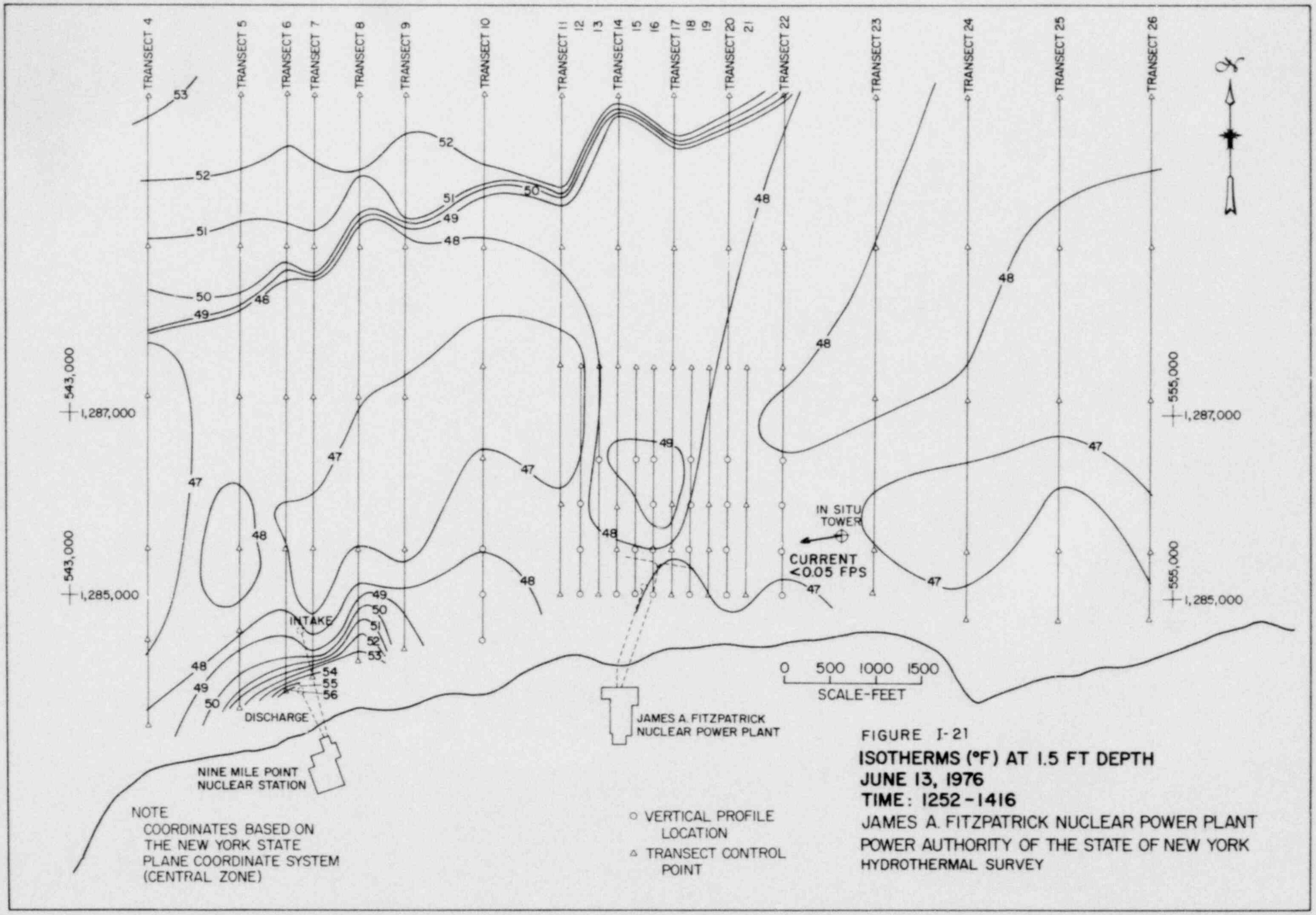


FIGURE I-21

ISOTHERMS (°F) AT 1.5 FT DEPTH
JUNE 13, 1976
TIME: 1252-1416

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

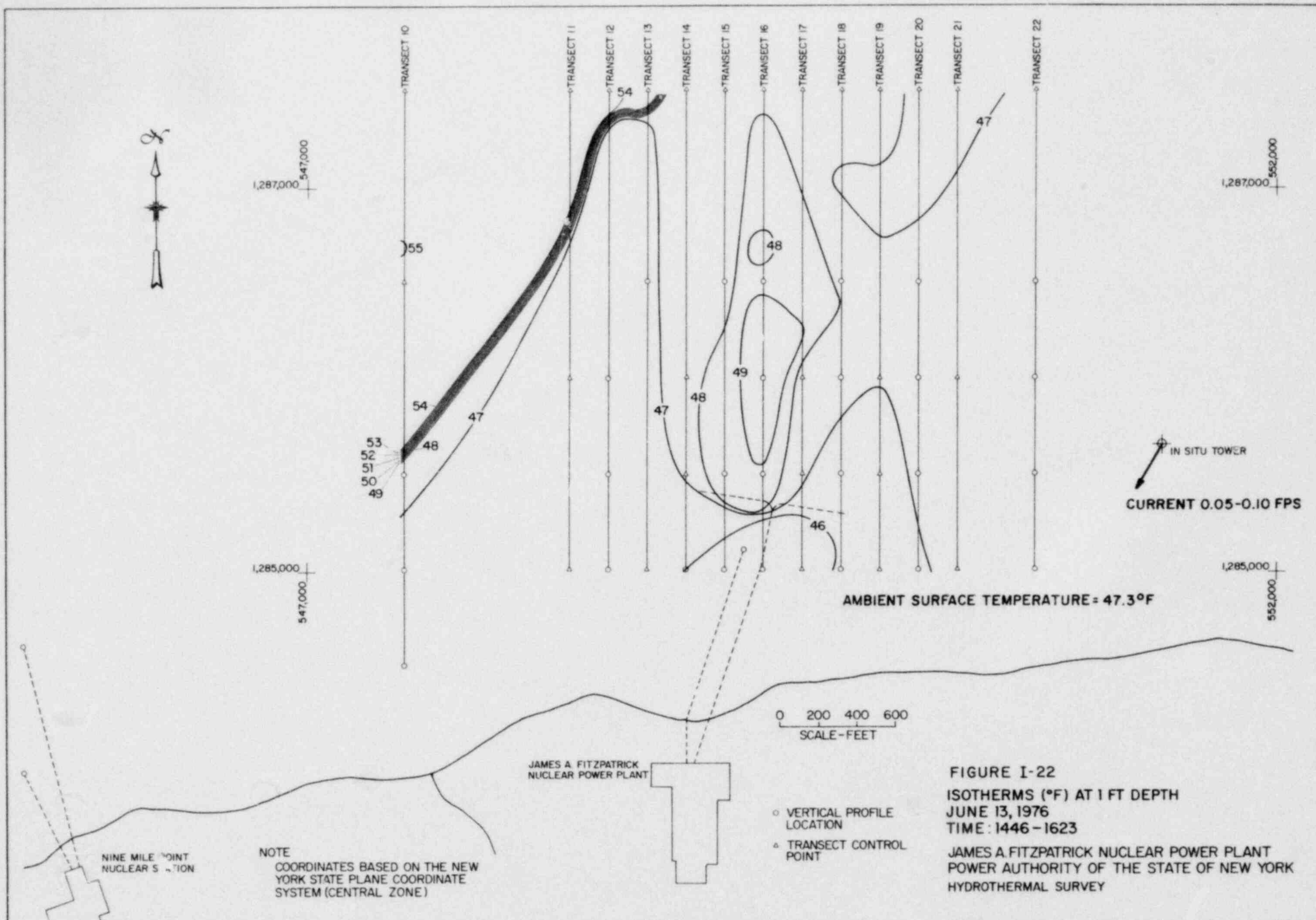


FIGURE I-22

ISOTHERMS (°F) AT 1 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

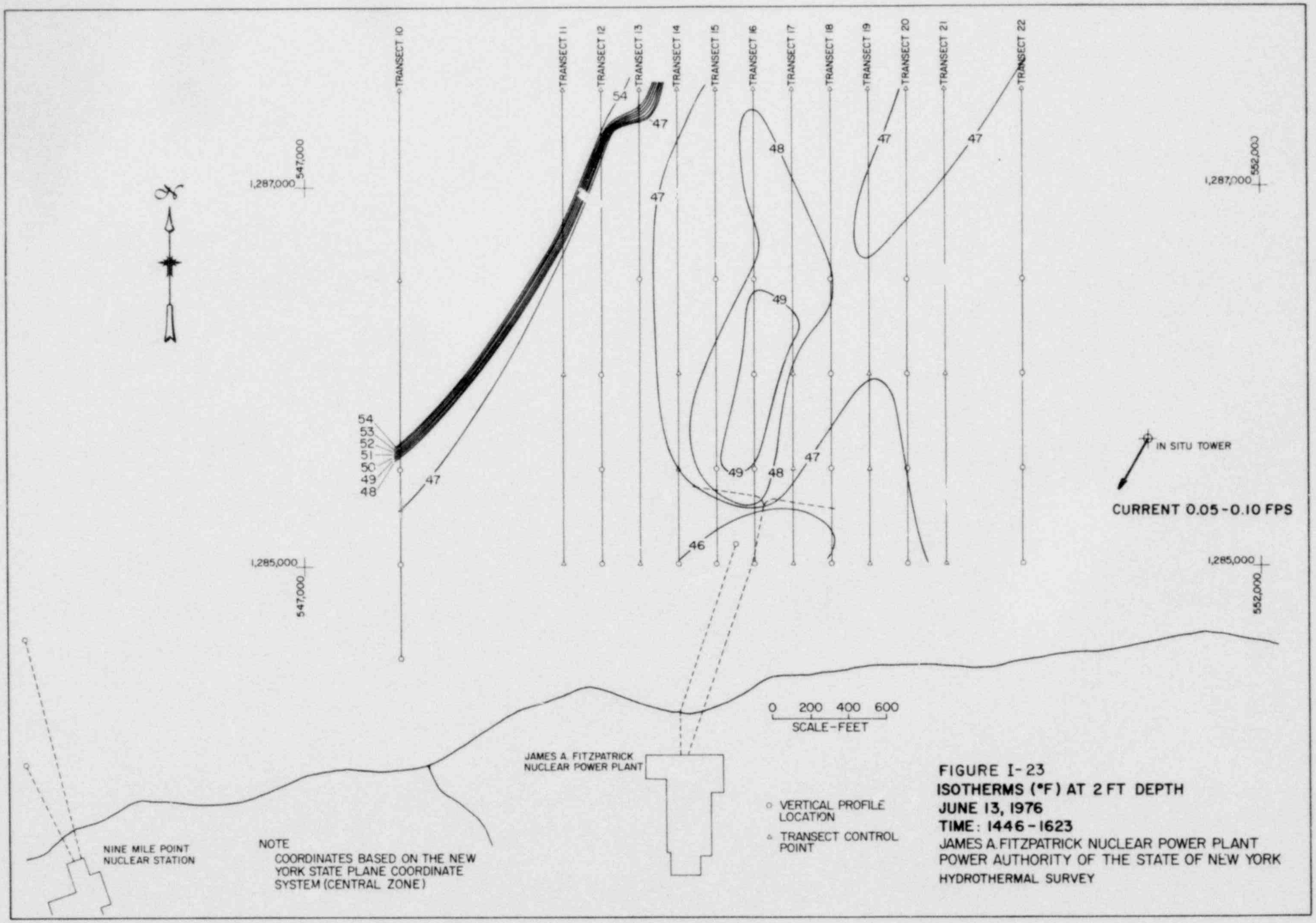


FIGURE I-23
ISOTHERMS (°F) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

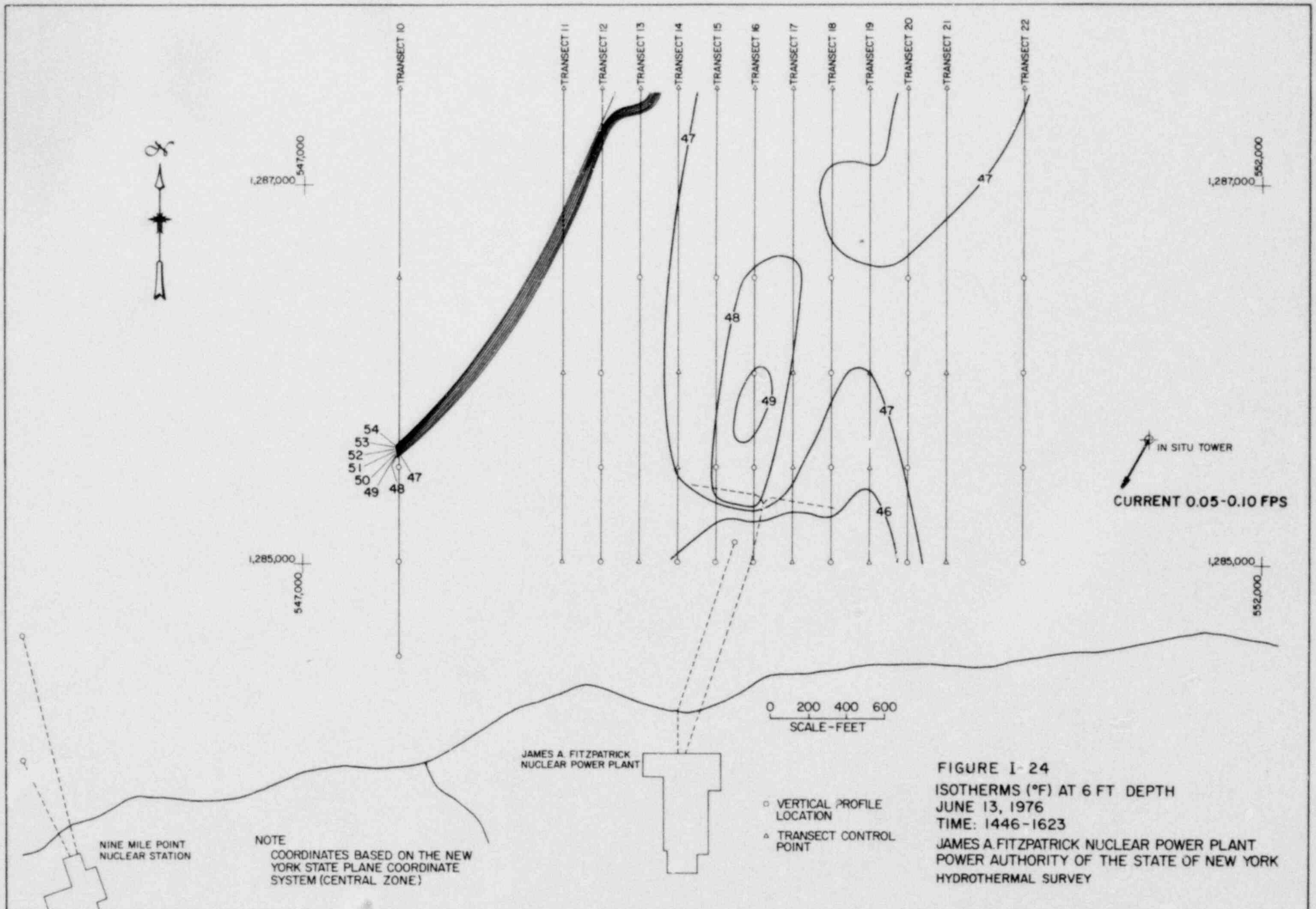


FIGURE I-24

ISOTHERMS (°F) AT 6 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

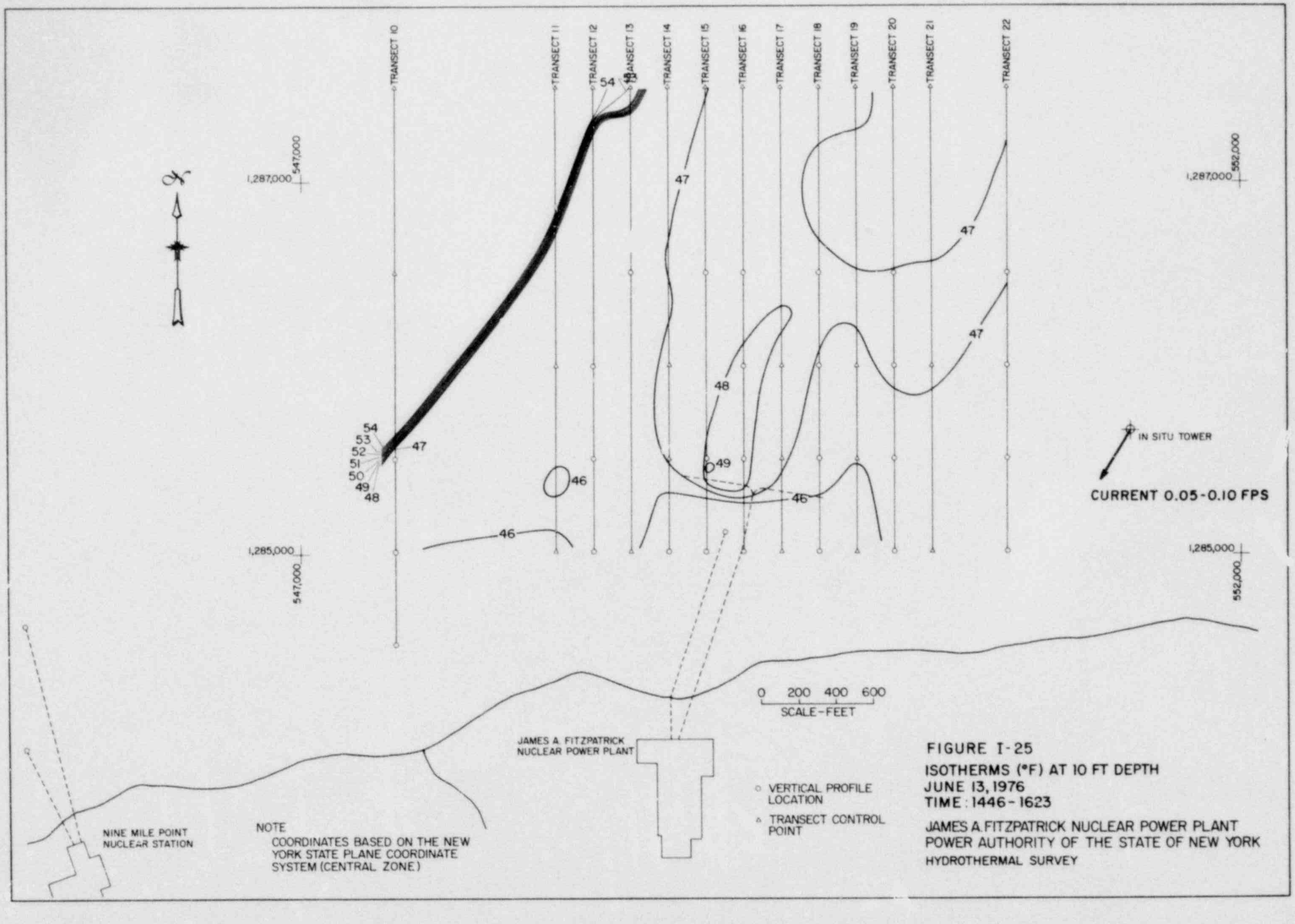


FIGURE I-25

ISOTHERMS (°F) AT 10 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

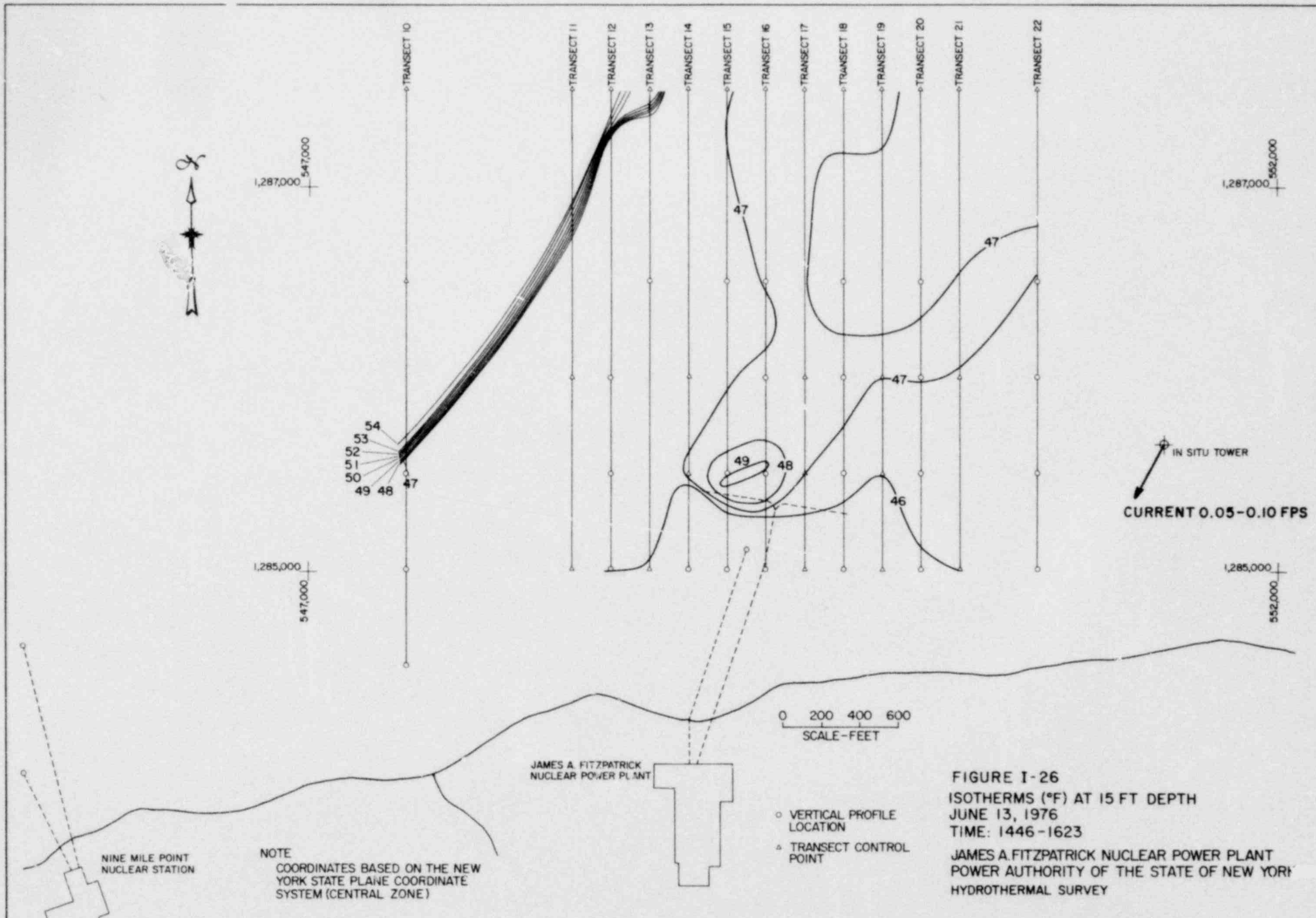
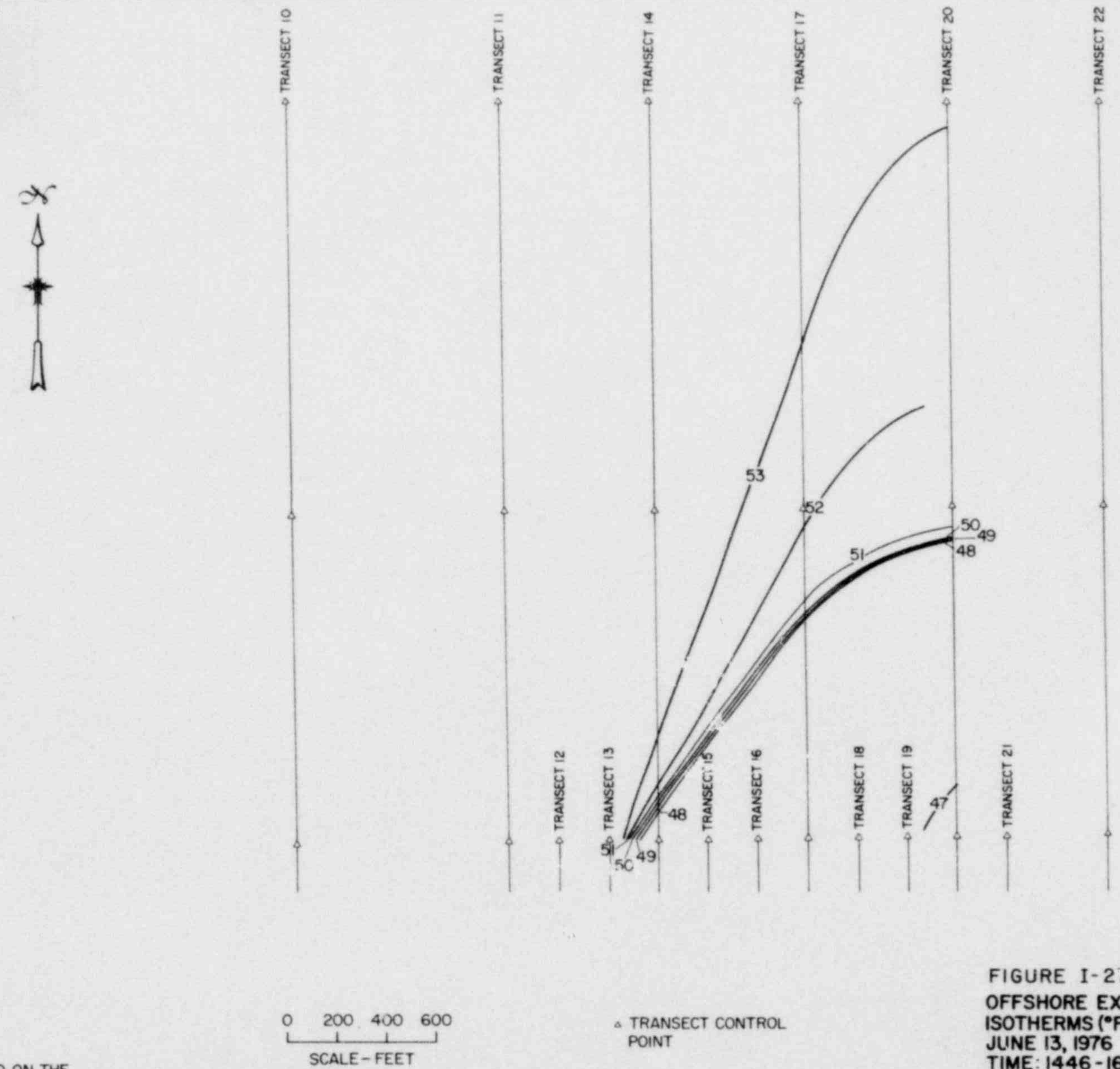


FIGURE I-26
ISOTHERMS (°F) AT 15 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE I-27
OFFSHORE EXTENSION OF ISOTHERMS (°F) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1446 - 1623
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

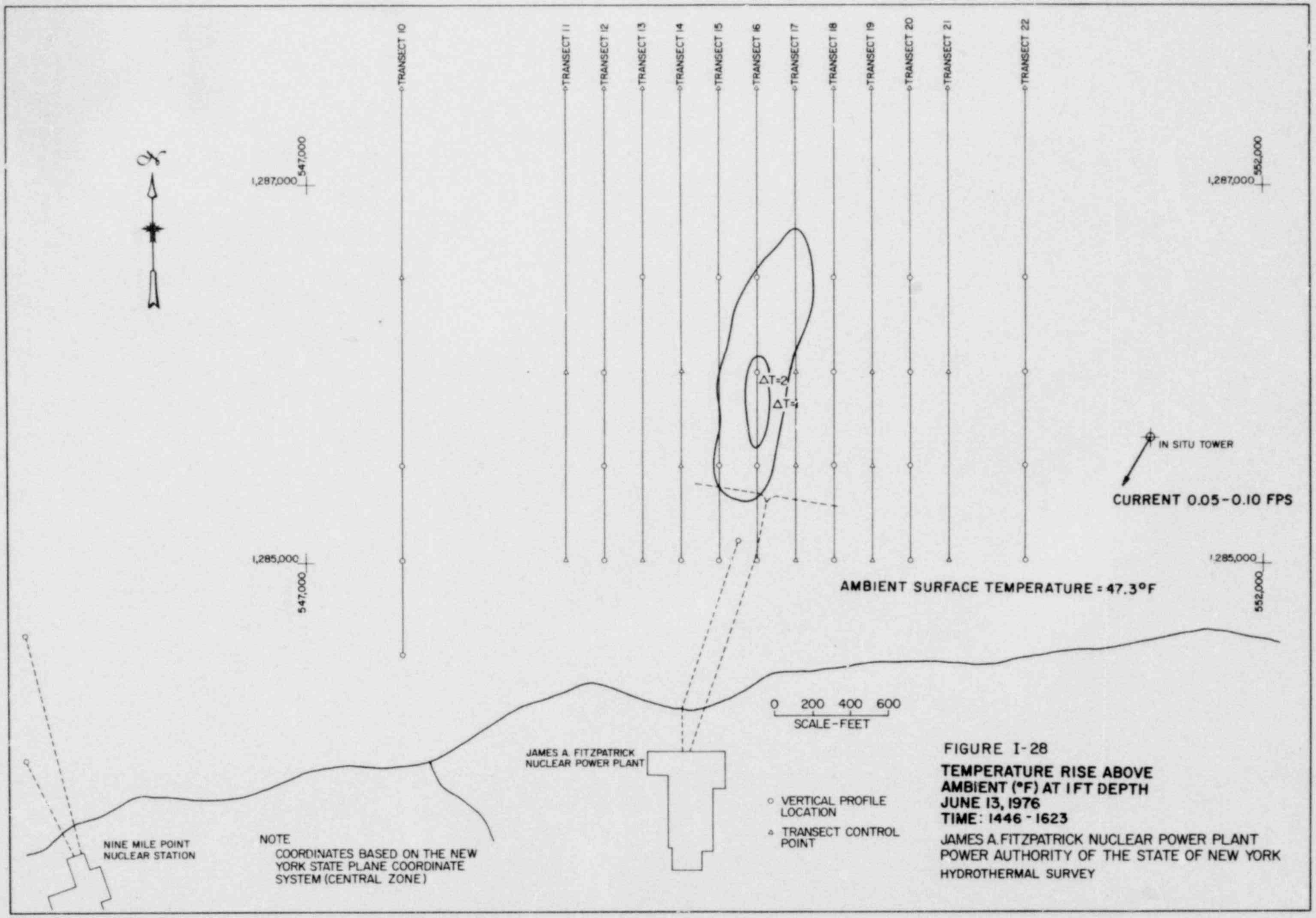
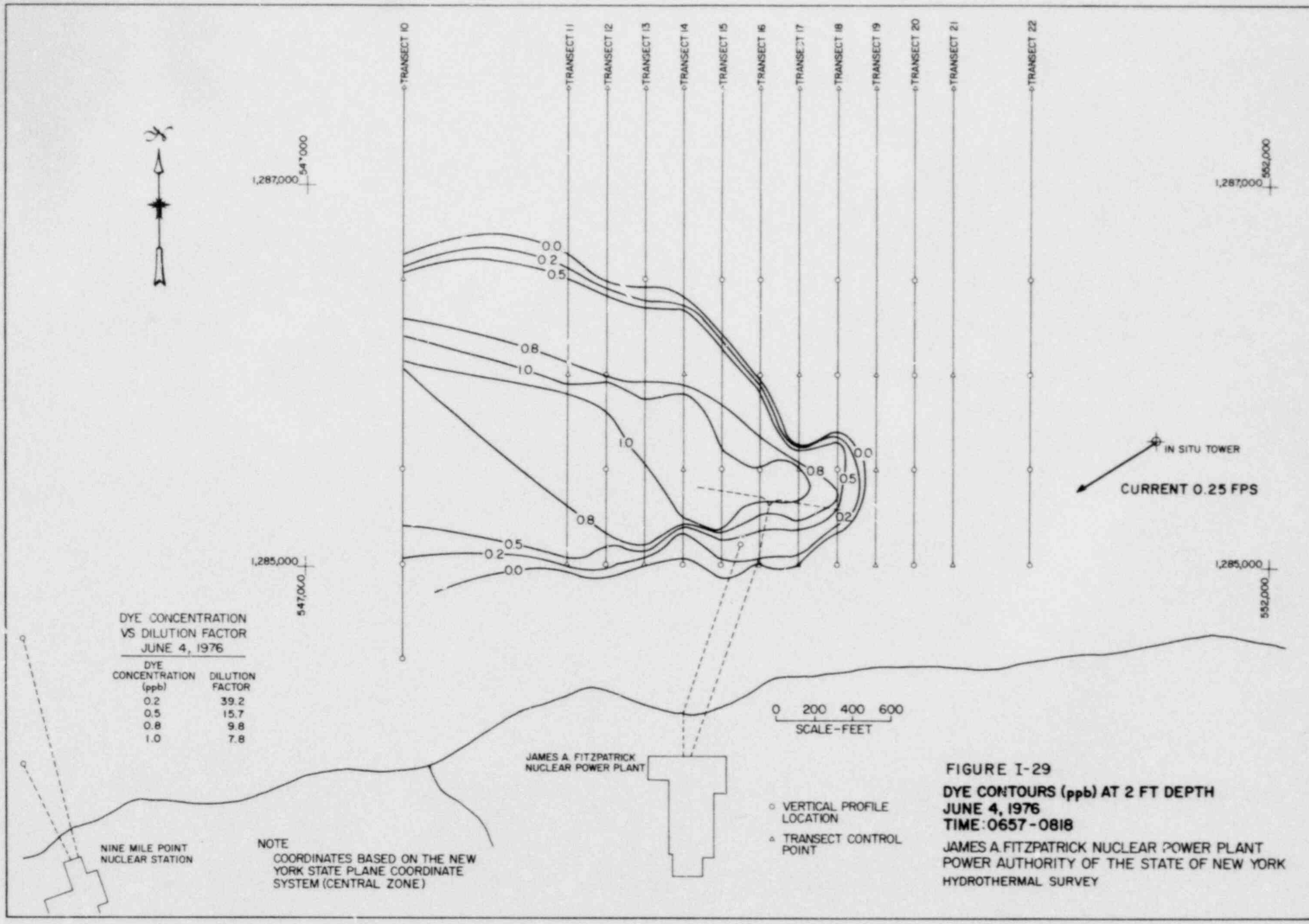


FIGURE I-28

TEMPERATURE RISE ABOVE
AMBIENT (°F) AT 1 FT DEPTH
JUNE 13, 1976
TIME: 1446 - 1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS DILUTION FACTOR
JUNE 4, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

FIGURE I-29
DYE CONTOURS (ppb) AT 2 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

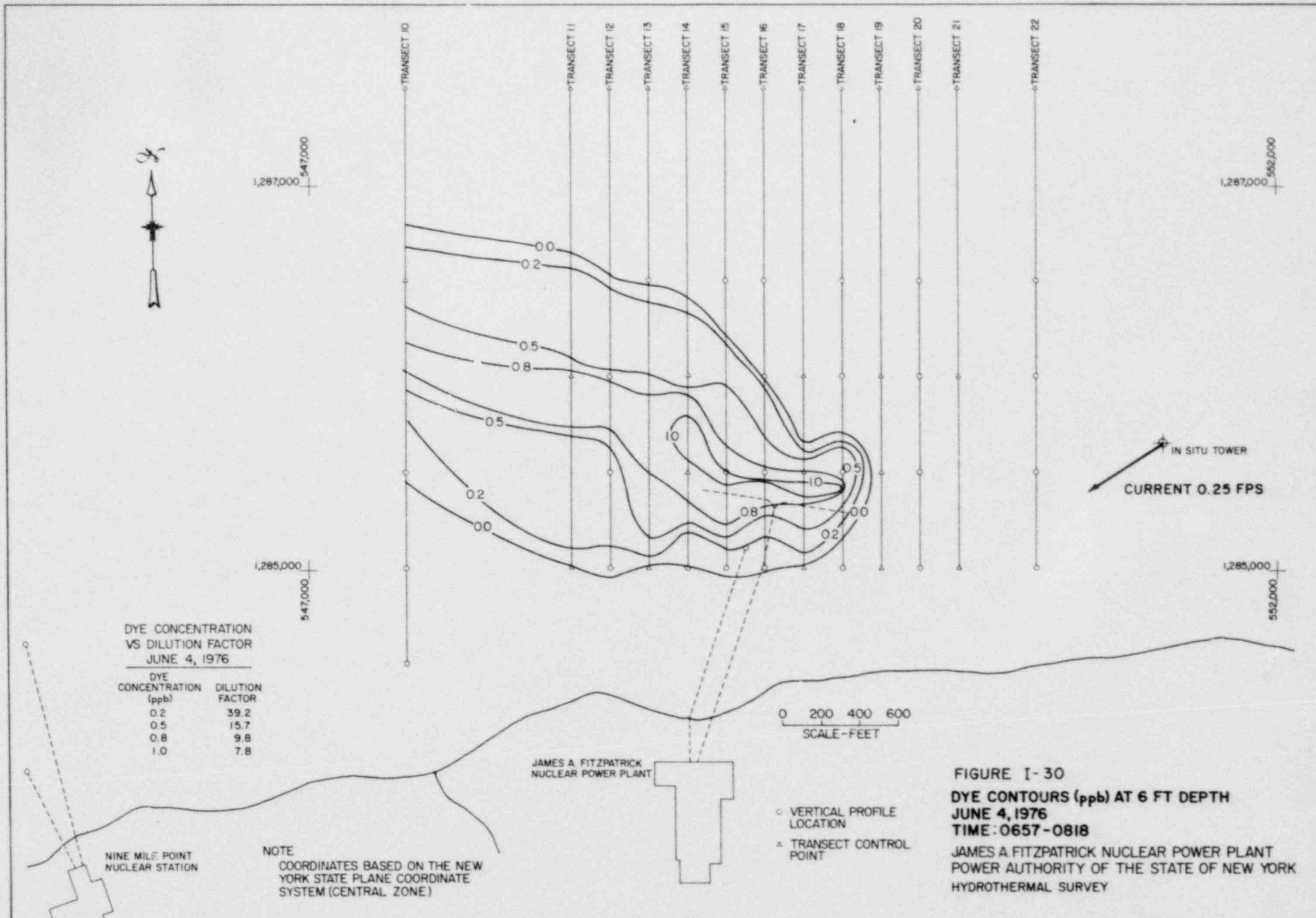
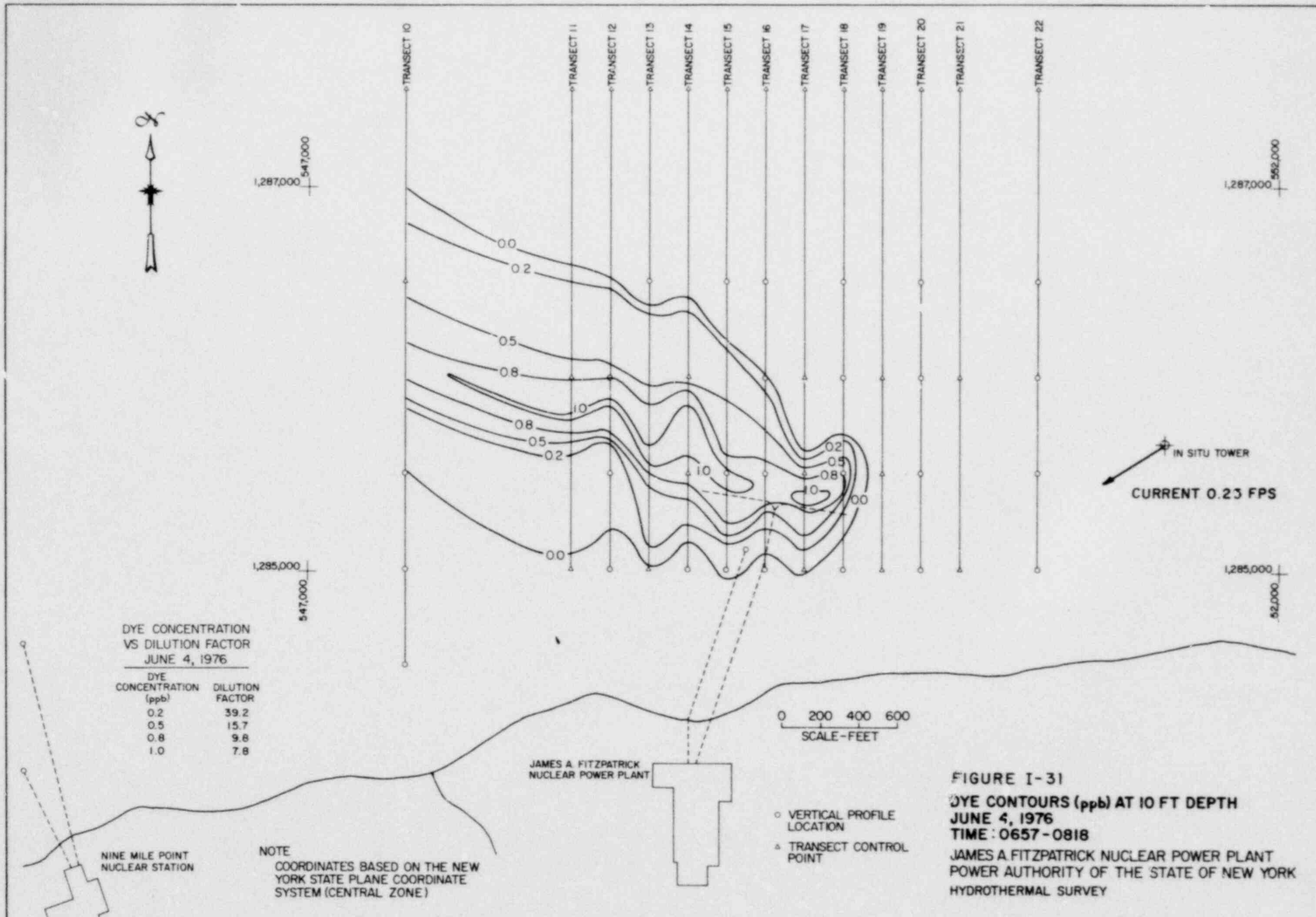


FIGURE I-30

DYE CONTOURS (ppb) AT 6 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

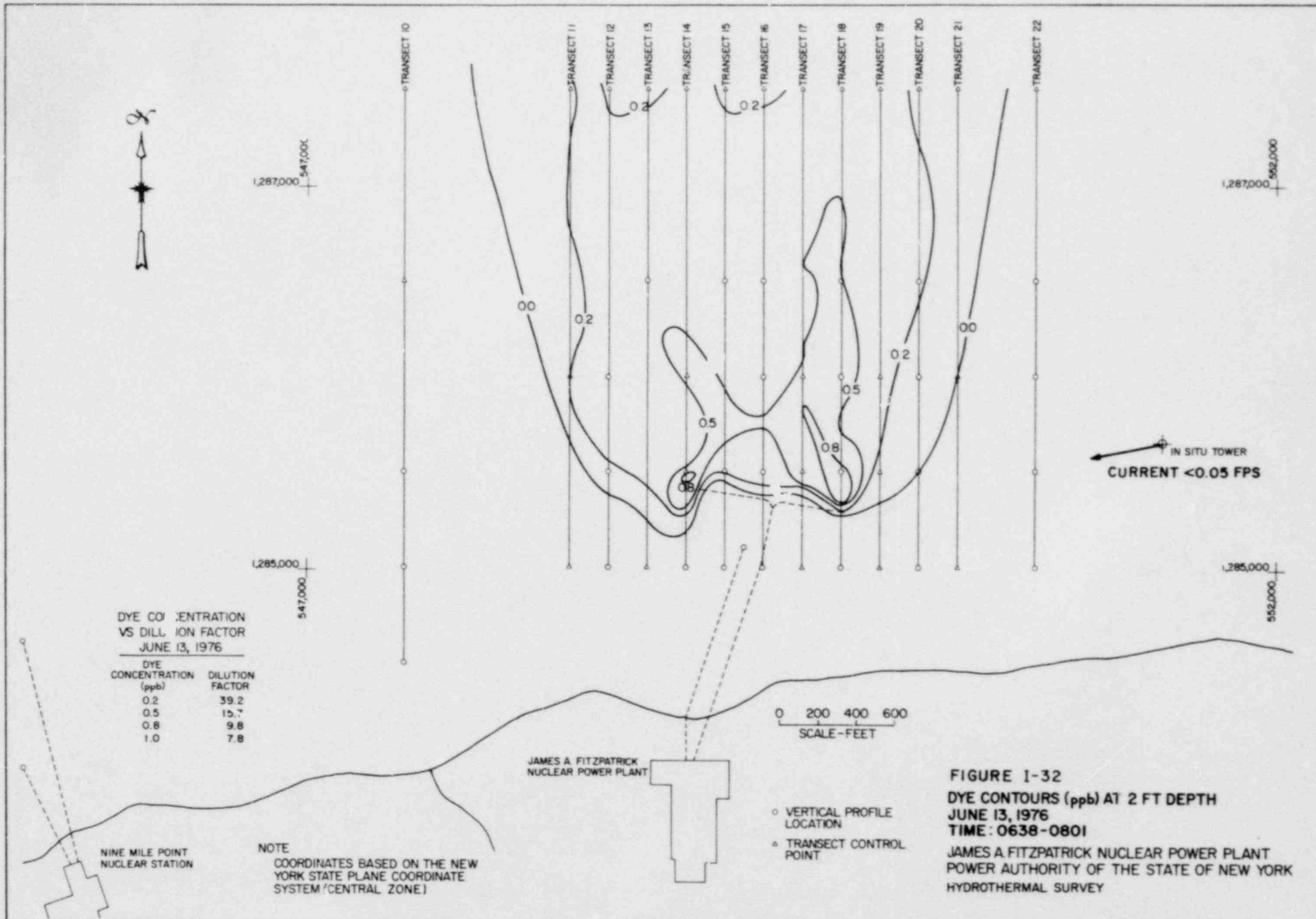


DYE CONCENTRATION VS DILUTION FACTOR
JUNE 4, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE I-31
DYE CONTOURS (ppb) AT 10 FT DEPTH
JUNE 4, 1976
TIME: 0657-0818
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

FIGURE I-32
DYE CONTOURS (ppb) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

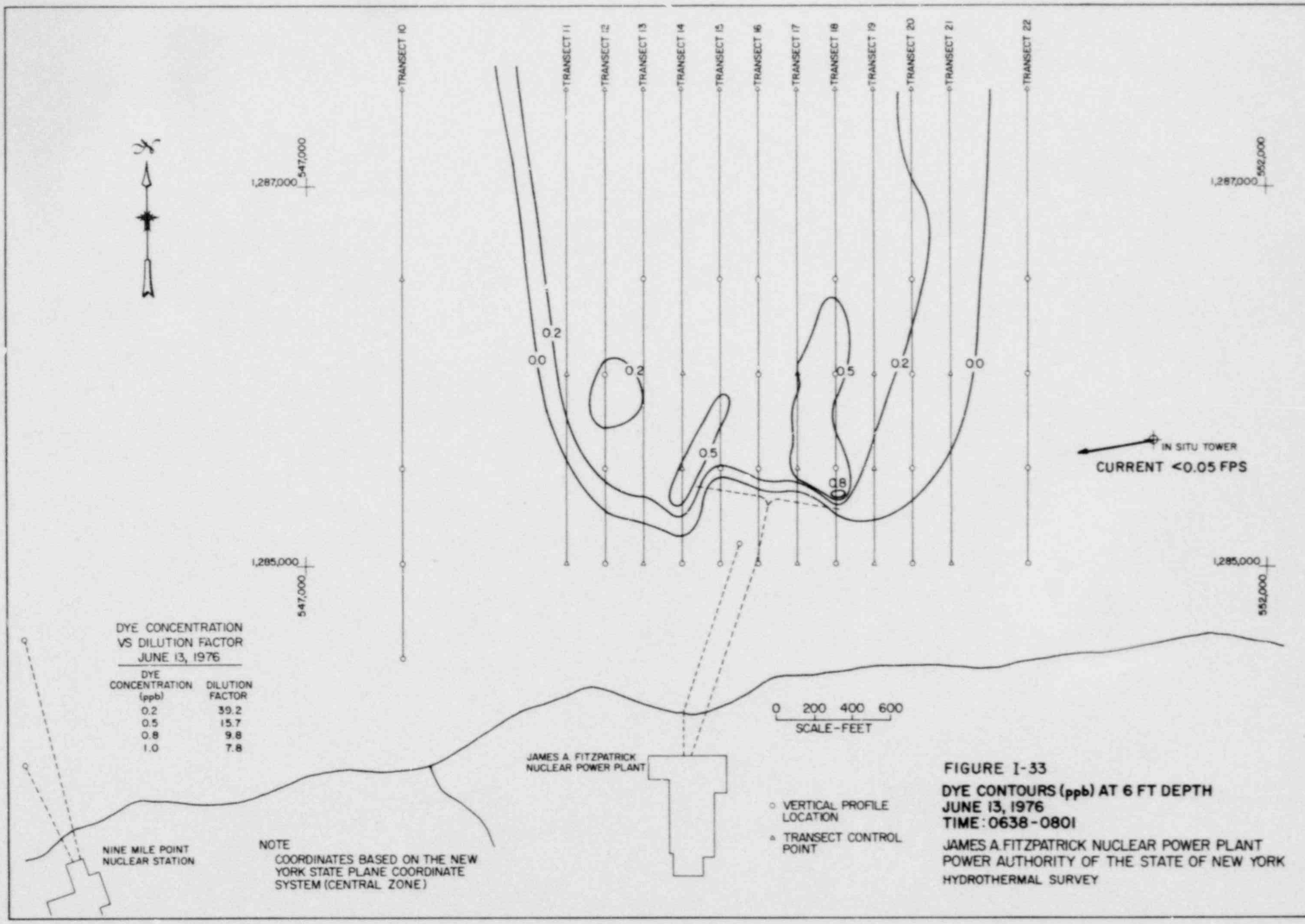


FIGURE I-33

DYE CONTOURS (ppb) AT 6 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

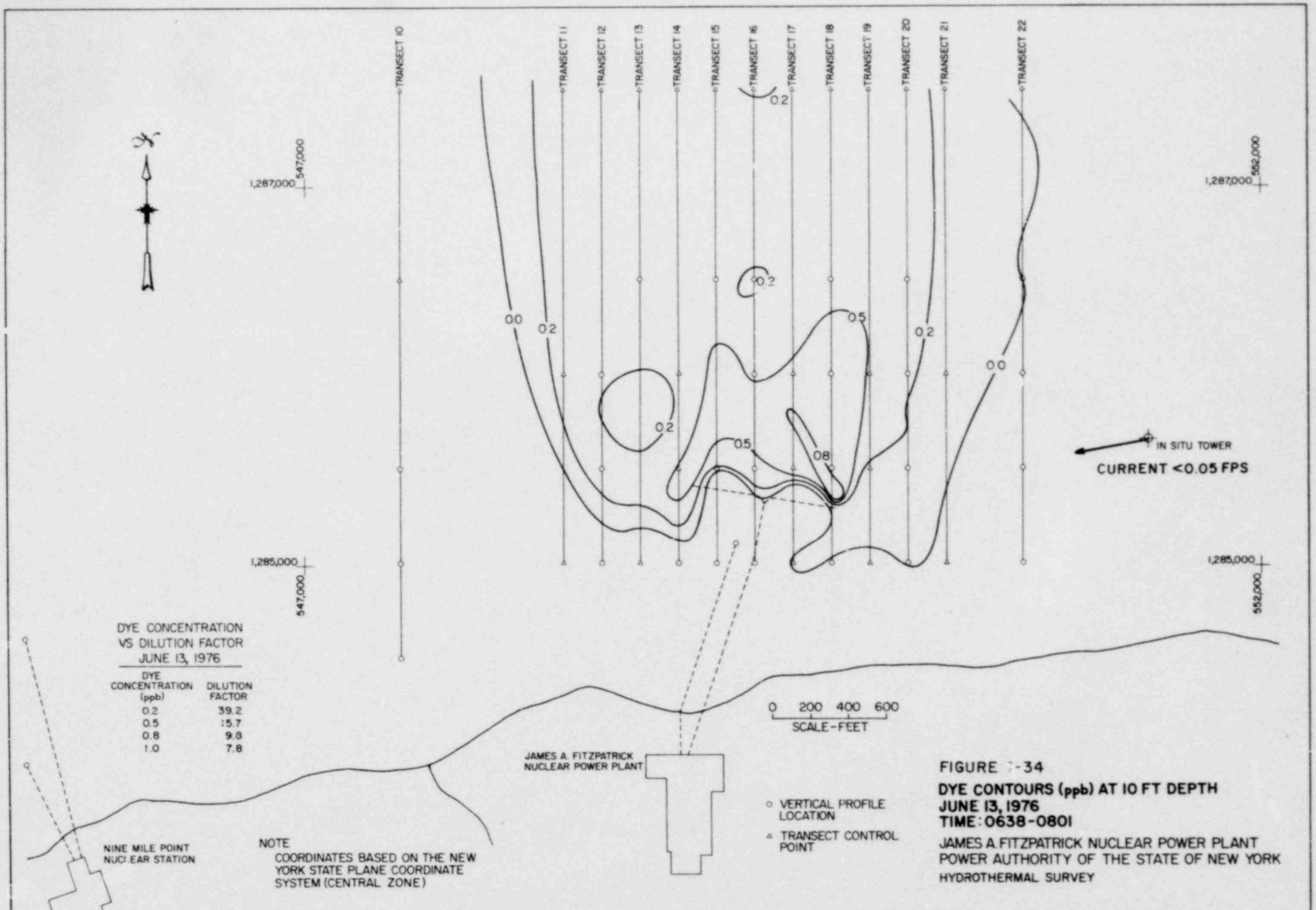
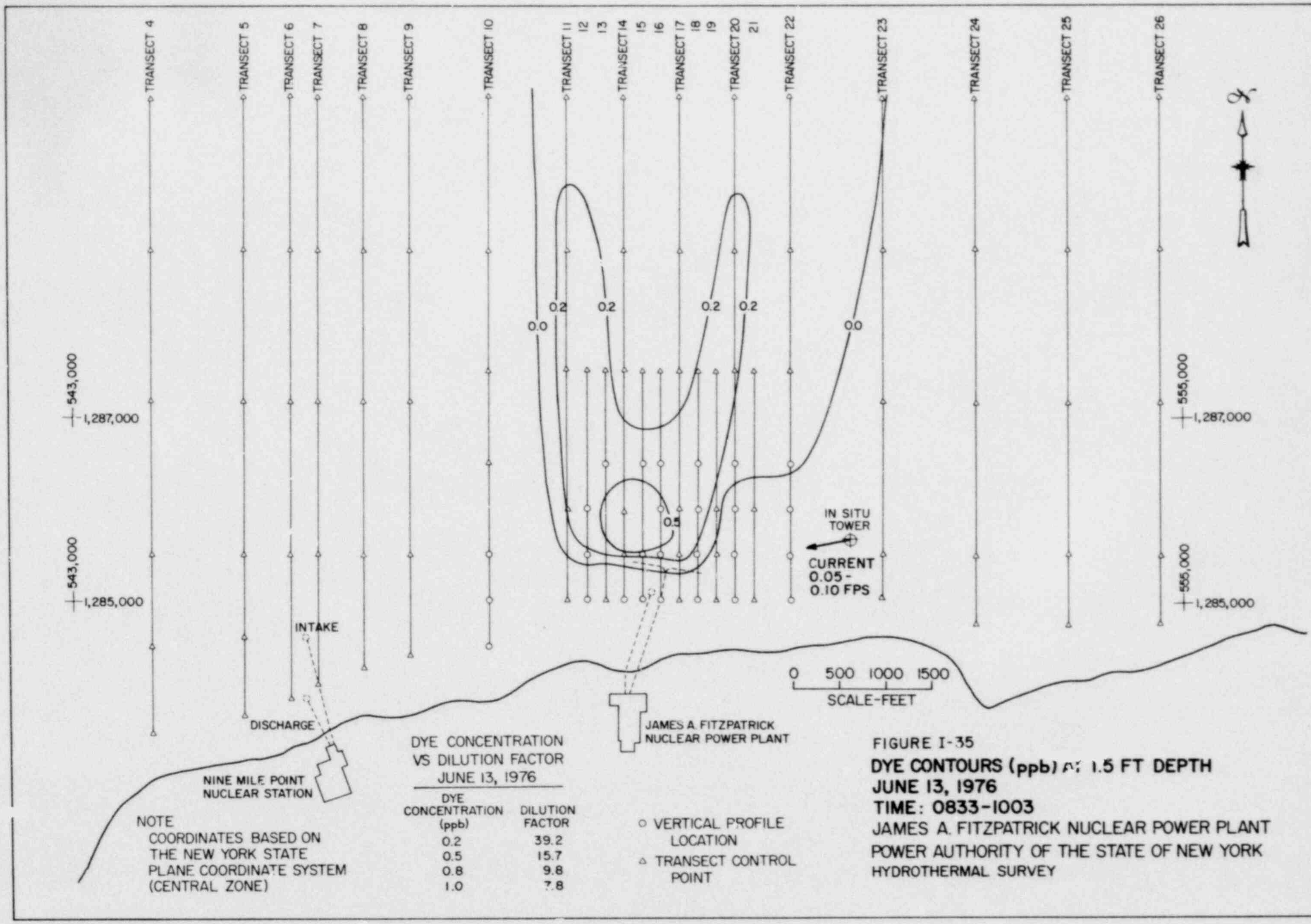


FIGURE 7-34
DYE CONTOURS (ppb) AT 10 FT DEPTH
JUNE 13, 1976
TIME: 0638-0801
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS DILUTION FACTOR
JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

FIGURE I-35

DYE CONTOURS (ppb) AT 1.5 FT DEPTH
JUNE 13, 1976
TIME: 0833-1003

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

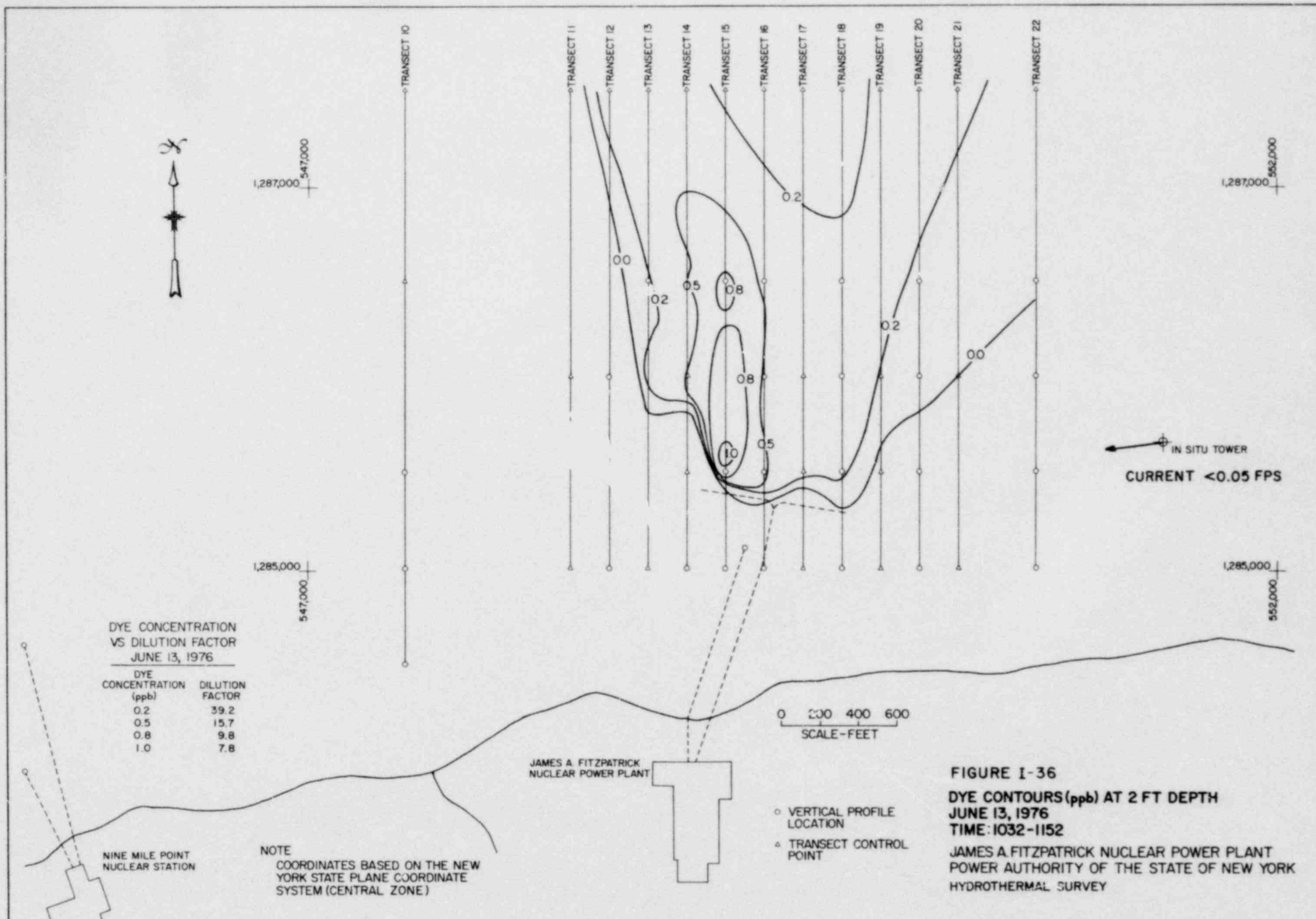
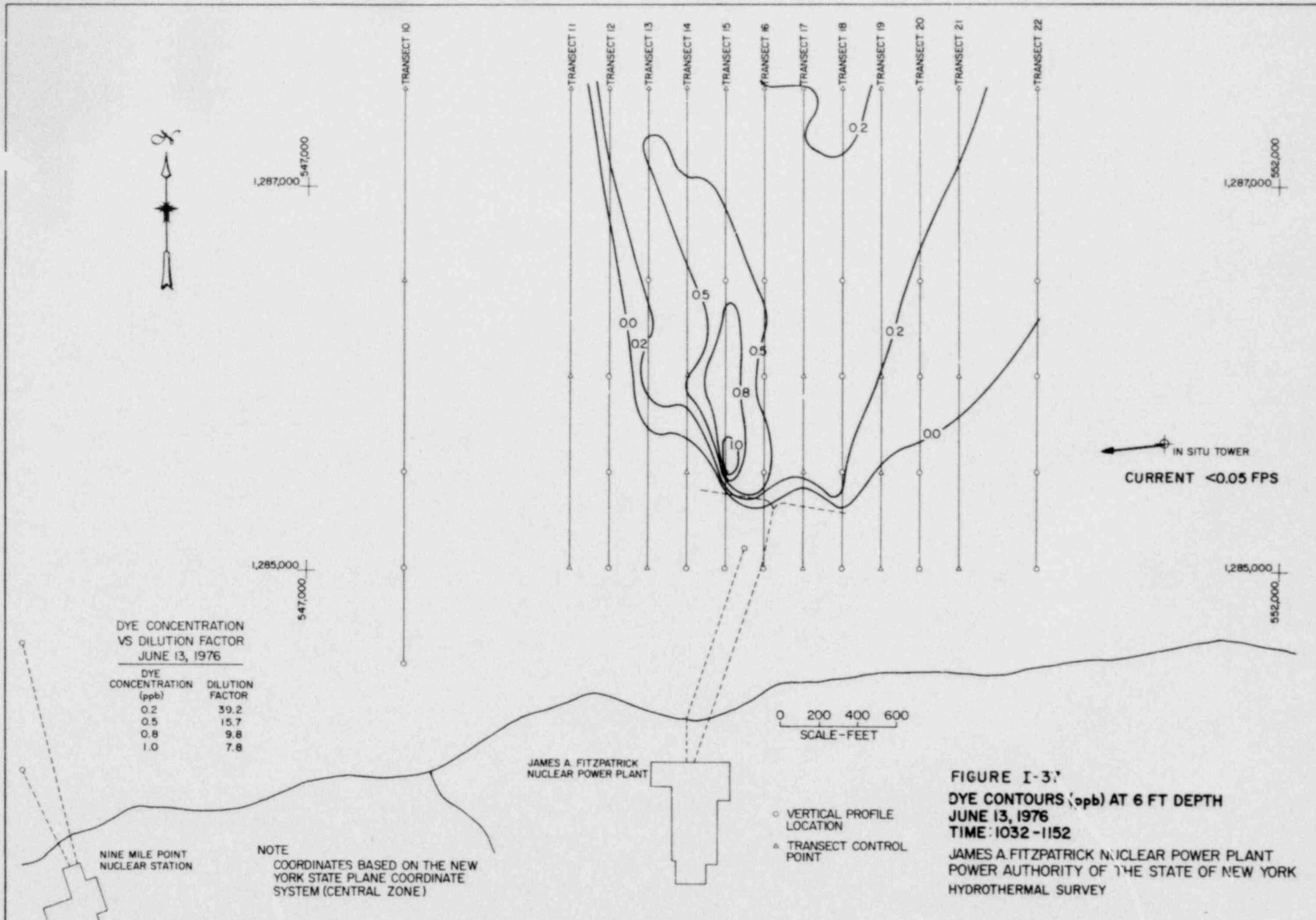


FIGURE I-36

DYE CONTOURS (ppb) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1032-1152

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

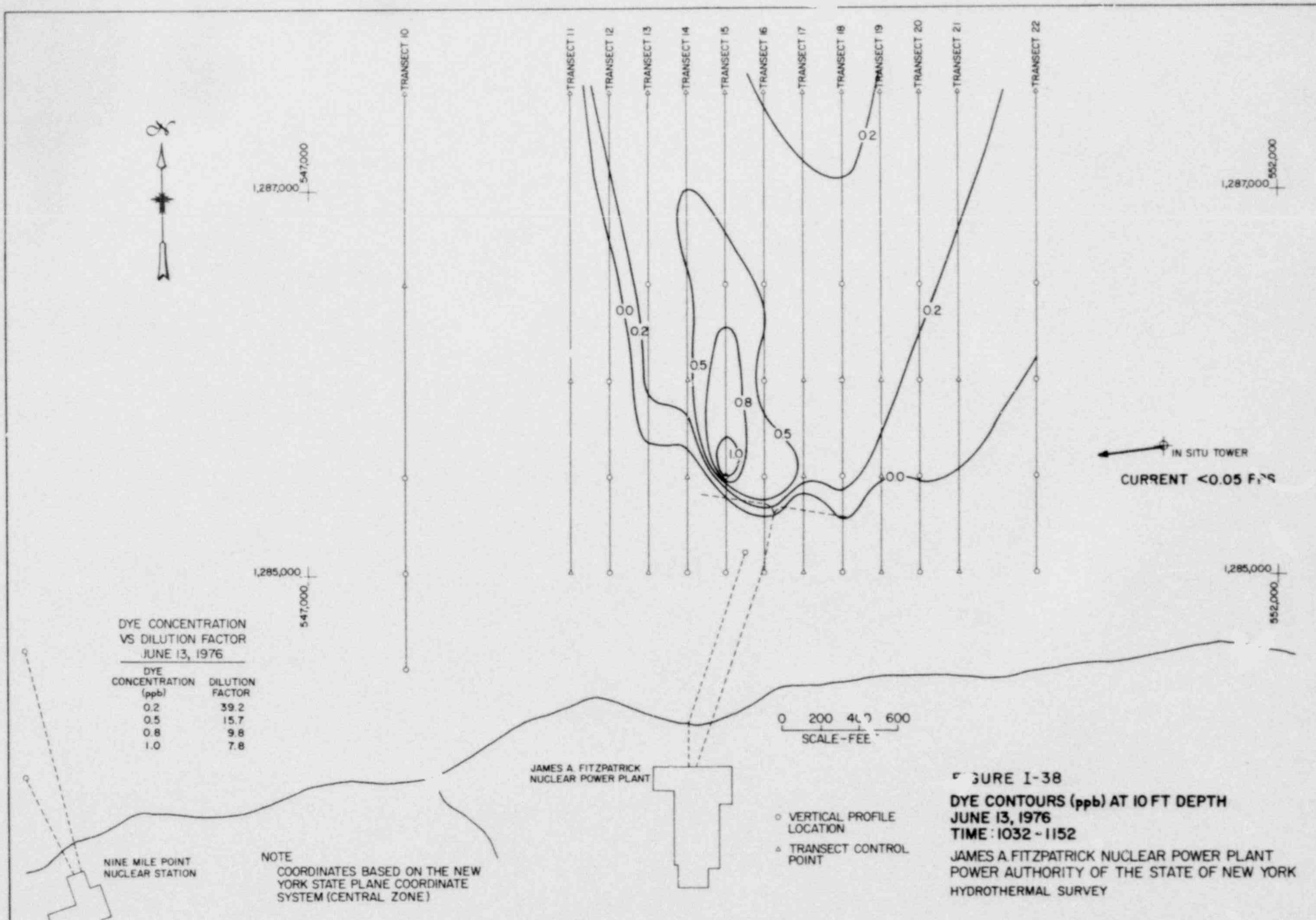


DYE CONCENTRATION VS DILUTION FACTOR
JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE I-37
DYE CONTOURS (ppb) AT 6 FT DEPTH
JUNE 13, 1976
TIME: 1032-1152
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



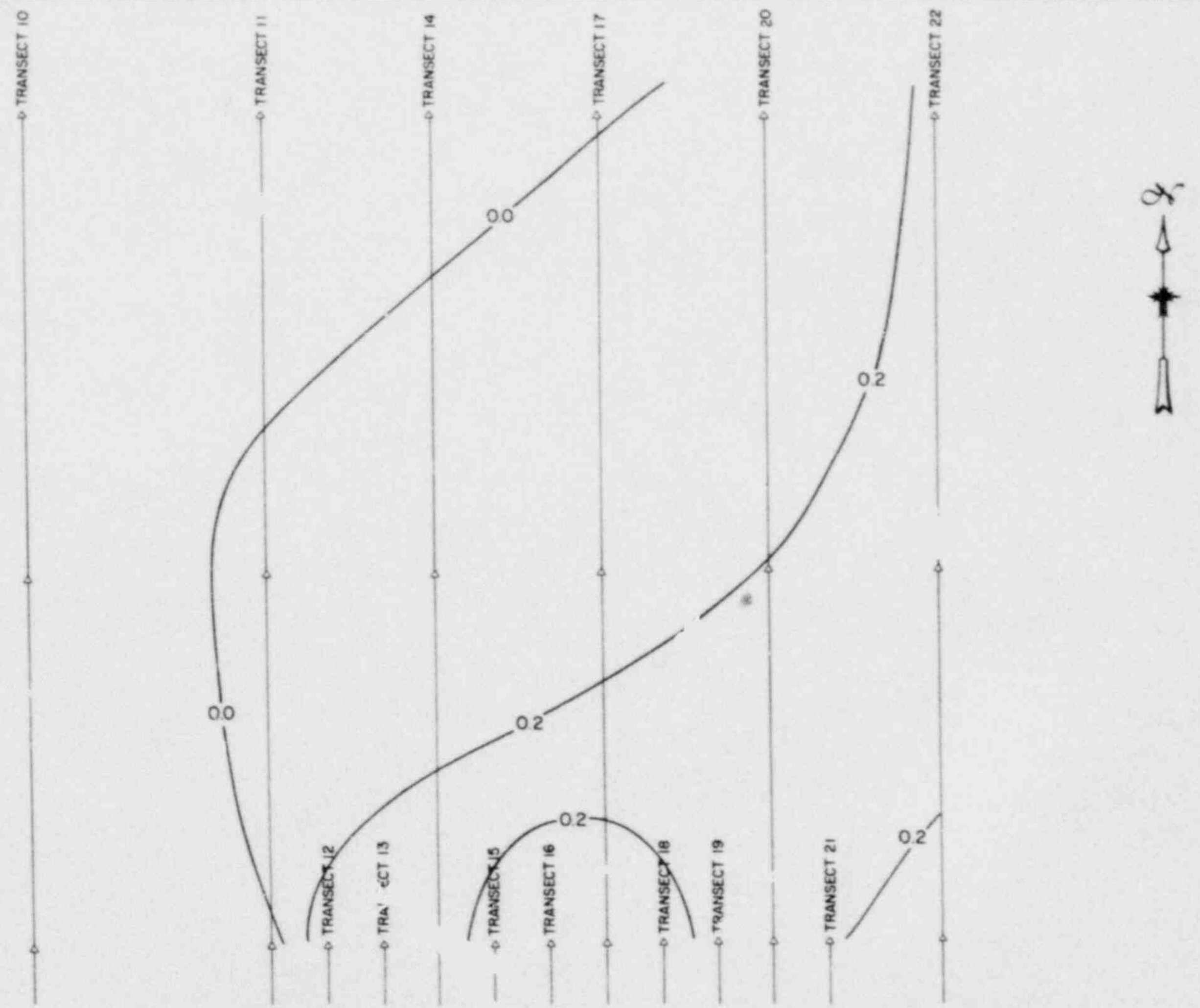
DYE CONCENTRATION VS DILUTION FACTOR
JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

FIGURE I-38
DYE CONTOURS (ppb) AT 10 FT DEPTH
JUNE 13, 1976
TIME: 1032 - 1152
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

DYE CONCENTRATION
VS DILUTION FACTOR
JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

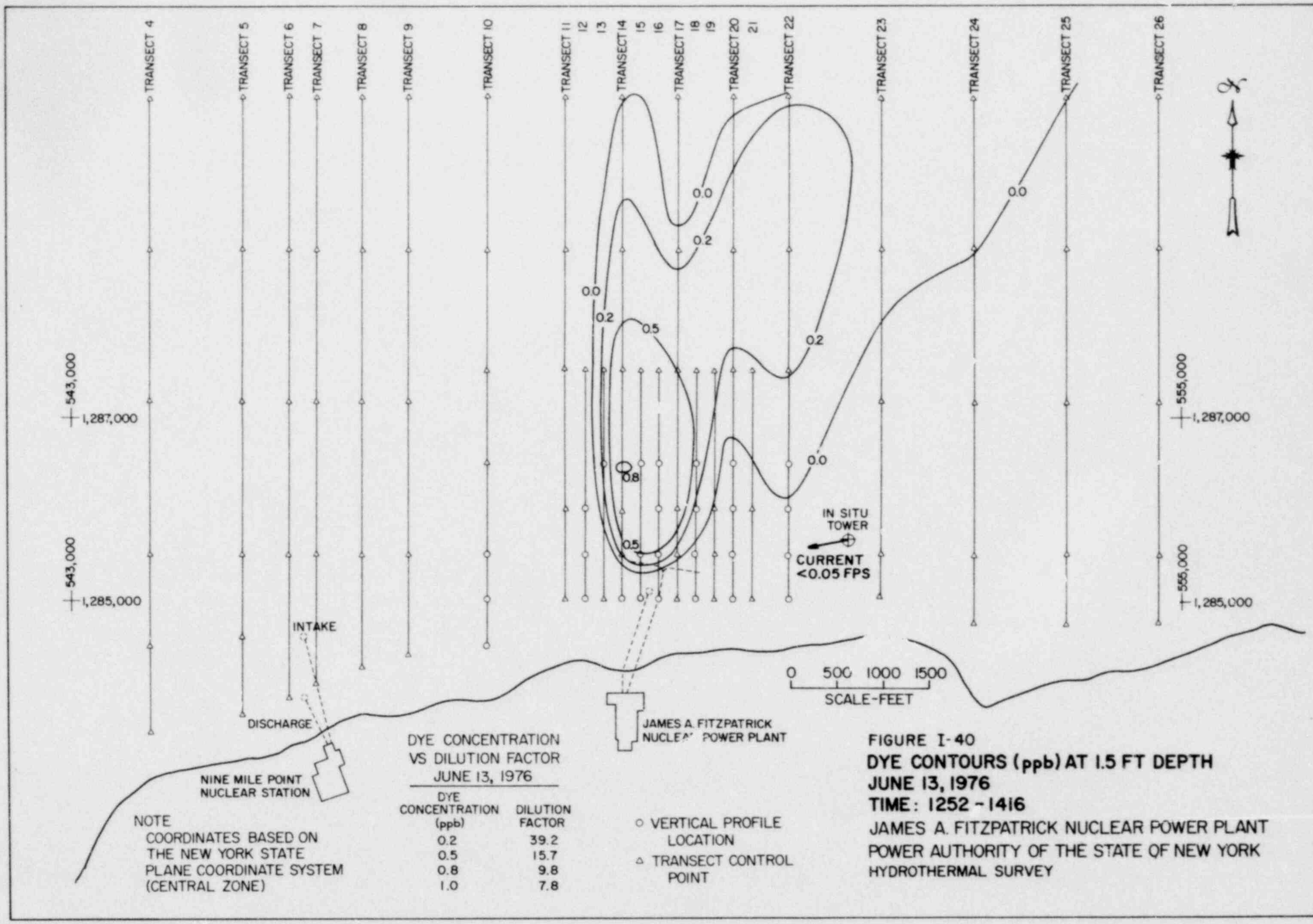


0 200 400 600
SCALE - FEET

△ TRANSECT CONTROL POINT

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

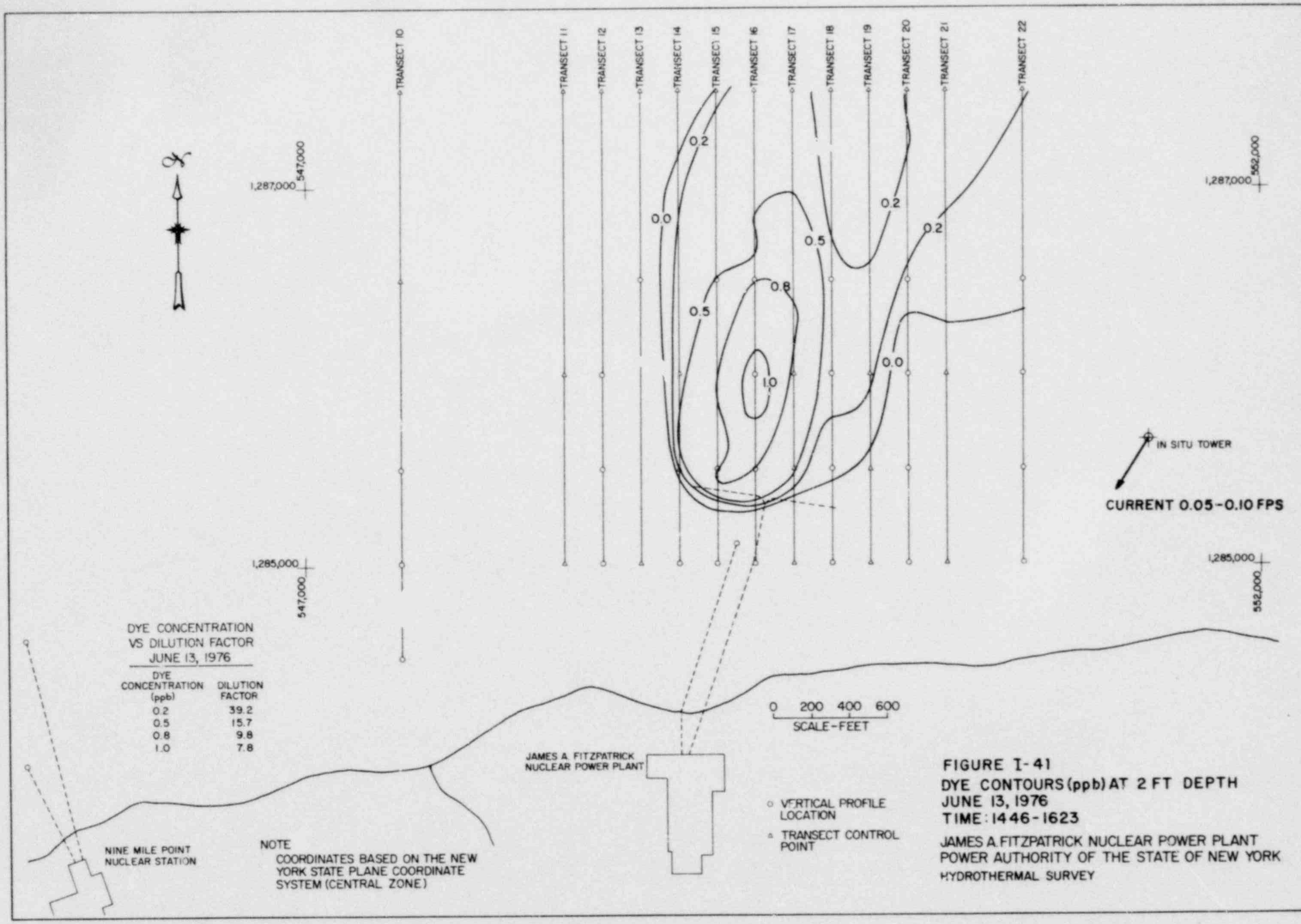
FIGURE I-39
OFFSHORE EXTENSION OF DYE CONTOURS (ppb) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1032 - 1152
JAMES A. FITZPATRICK NUCLEAR POWER ANT
POWER AUTHORITY OF THE STATE OF NEW ORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS DILUTION FACTOR JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

FIGURE I-40
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
JUNE 13, 1976
TIME: 1252 - 1416
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS DILUTION FACTOR
JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE I-41
DYE CONTOURS (ppb) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

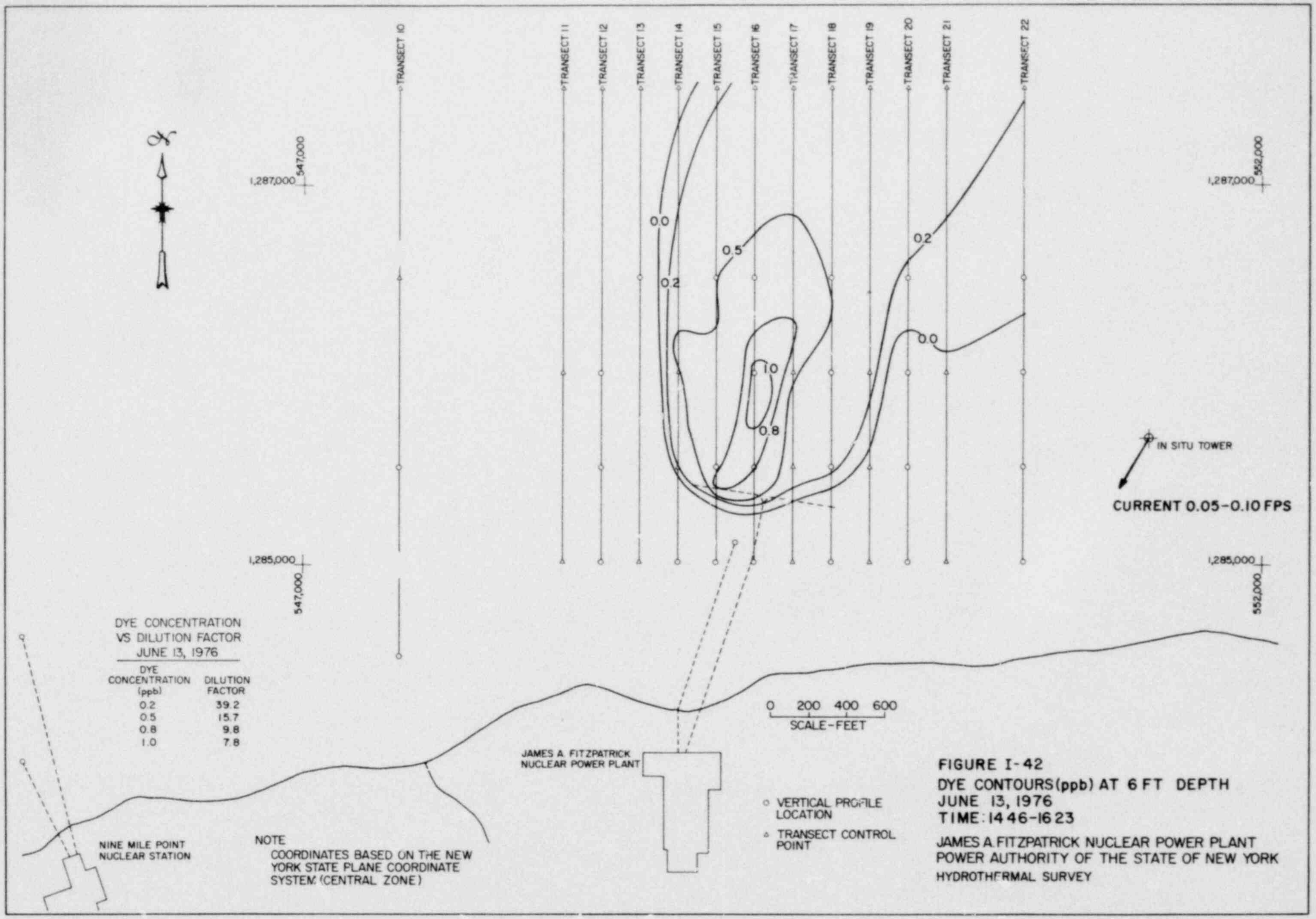
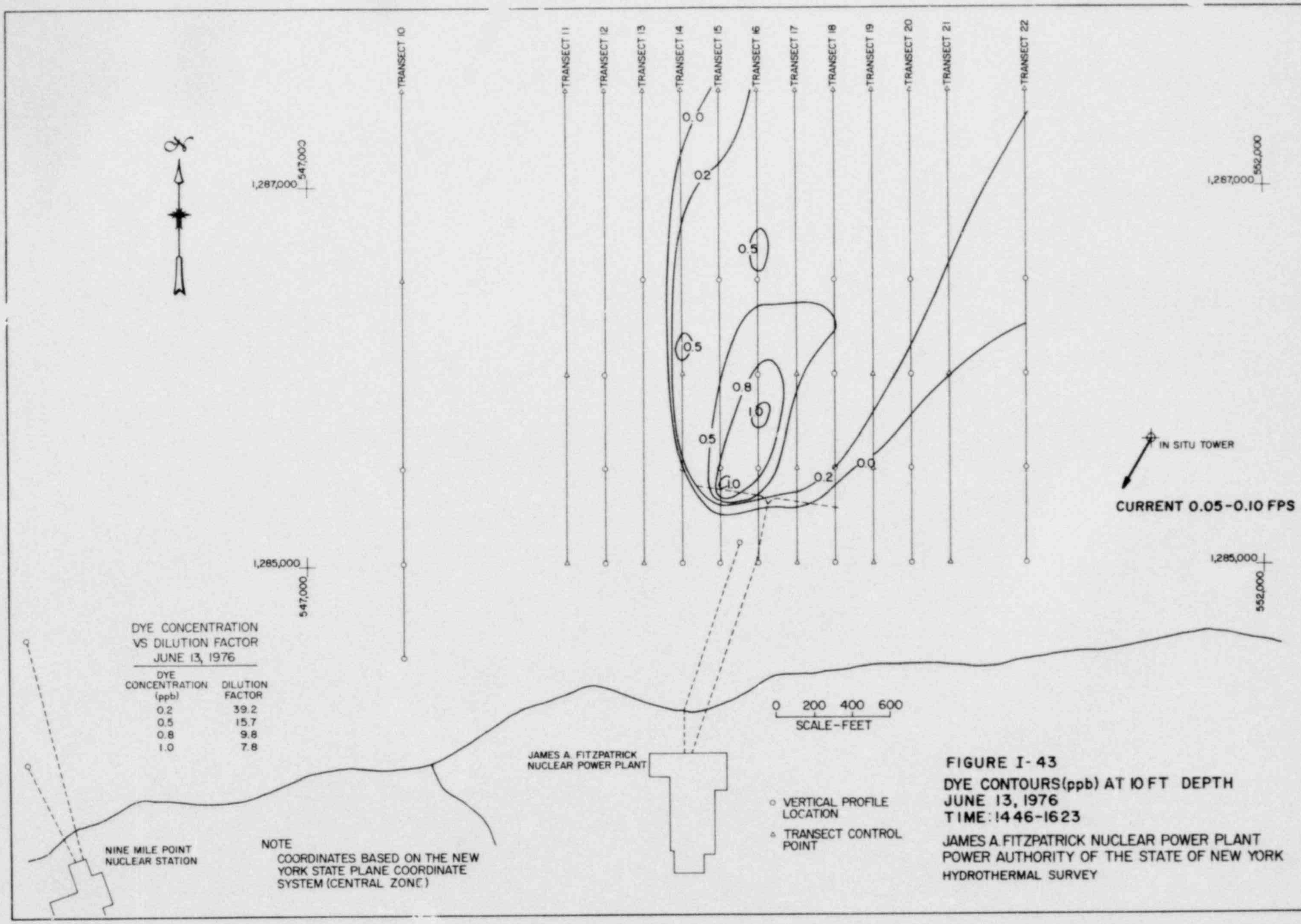


FIGURE I-42
DYE CONTOURS (ppb) AT 6 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

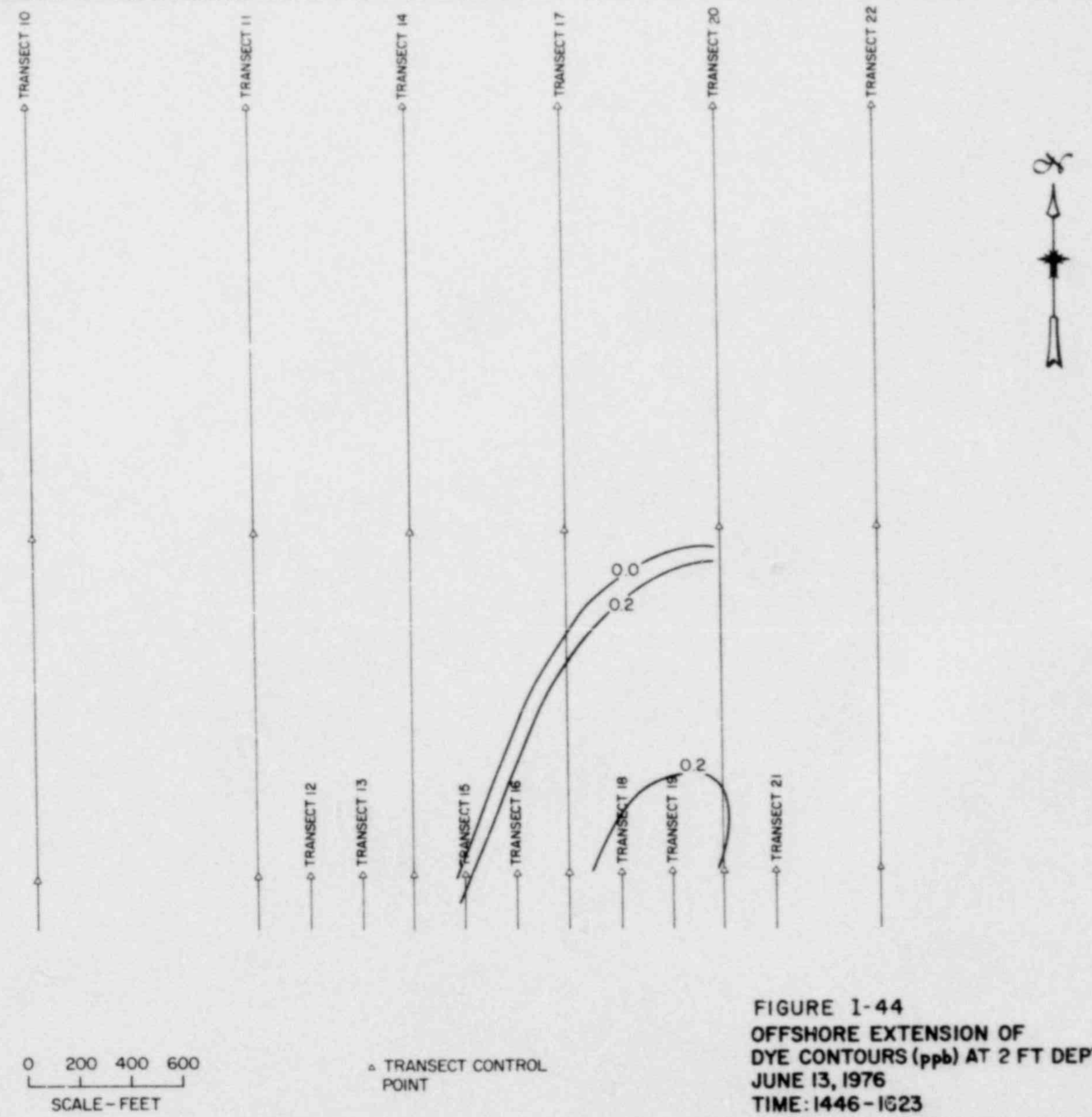


DYE CONCENTRATION VS DILUTION FACTOR
JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

FIGURE I-43
DYE CONTOURS(ppb) AT 10 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION
VS DILUTION FACTOR
JUNE 13, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.2
0.5	15.7
0.8	9.8
1.0	7.8

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE I-44
OFFSHORE EXTENSION OF DYE CONTOURS (ppb) AT 2 FT DEPTH
JUNE 13, 1976
TIME: 1446-1623
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

AUGUST 1976 POSTOPERATIONAL
HYDROTHERMAL SURVEY
FOR
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK

II-AUGUST 1976 SURVEY

TABLE OF CONTENTS

II-AUGUST 1976 SURVEY

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

II-AUGUST 1976 SURVEY

II.1 SUMMARY

The second postoperational hydrothermal survey of the JAFNPP was conducted on August 19 and 20, 1976. The NMP-1 station was in operation during the survey.

The primary objectives of this survey were:

1. To determine the three-dimensional thermal patterns in the discharge area produced by the joint operation of the NMP-1 and the JAFNPP, and

2. To determine the diffuser performance based on dye concentrations existing in the lake after releasing dye into the plant circulating water system.

These objectives were set forth so as to fulfill the requirements of the National Pollutant Discharge Elimination System permit (Permit No. NY0020109), administered by the U.S. Environmental Protection Agency; the JAFNPP Environmental Technical Specifications (Docket No. 50-333), administered by the U.S. Nuclear Regulatory Commission; and the New York State Department of Environmental Conservation's standards and requirements.

II.2 METHOD OF DATA ACQUISITION

Aquatec, Inc., of South Burlington, Vermont was contracted to perform the temperature and dye surveys of the JAFNPP discharge area. A report entitled "Second Operational Hydrothermal Survey, August 19 and 20, 1976, James A. FitzPatrick Nuclear Power Plant," which describes all aspects of the data acquisition and reduction, was provided by Aquatec.

Raytheon Company, Oceanographic & Environmental Services, of Portsmouth, Rhode Island was subcontracted by Aquatec to perform in situ data collection consisting of current speed and direction, lake temperature, and lake level during the temperature and dye surveys.

Niagara Mohawk Power Corporation, operator of NMP Unit 1, and the Power Authority of the State of New York, owner of the JAFNPP, maintain a meteorological tower at the site which records wind speed and direction at an elevation of 30 and 200 feet. Meteorological data for August 19 and 20 are listed in Section II.3.1.

Operating conditions are continuously monitored at the plant. Section II.3.3 lists the plant operating conditions at the time of the survey.

II.3 CONDITIONS DURING THE SURVEY

II.3.1 Meteorological Conditions

Daylight during the August 19 and 20, 1976 surveys occurred between approximately 0520 and 1907 hours EST and 0521 and 1906 hours, respectively.

The wind speed and direction for the survey hours on August 19, 1976 are given in Table II-1. During the intensive sampling period between 0806 and 1743 on August 19, 1976, the 30-foot wind at the NMP-1 site meteorological tower was variable in direction at an average speed of about 3 mph. The wind direction from 0800 to 1000 was observed to be approximately from the southeast, changing to a steady northwesterly direction at 1100.

The wind speed and direction for the survey hours on August 20, 1976 are given in Table II-2. During the intensive sampling period between 0818 and 1722 on August 20, 1976, the wind at 30 feet was from the southwest to west at an average speed of about 6 mph.

Due to the location of the meteorological tower relative to a forest to the south, wind speed and directions in Tables II-1 and II-2 are given for both an elevation of 200 and 30 feet. Presentation of data in this manner will distinguish any local anomalies.

II.3.2 Lake Conditions

An in situ tower, located 2,000 feet east of the centerline of the JAFNPP diffuser and 1,000 feet offshore, as shown in the figures, continuously recorded lake current speed and direction, lake temperature, and lake level during the survey period. The in situ tower was constructed and maintained by the Raytheon Company. In situ data are presented in the Aquatec report and discussed in Section II.4.2 of this report.

II.3.3 Plant Operating Conditions

The JAFNPP load and intake and discharge temperatures and average plant temperature rise are listed in Tables II-3 and II-4 for the surveys on August 19 and 20, 1976, respectively. Plant load is determined from hourly computer output at the JAFNPP. The plant load during the survey remained relatively constant at approximately 790 MWe gross.

The NMP-1 station load was steadily increasing from 340 MWe gross on August 19, 1976 to 468 MWe gross at 1700 on August 20, 1976.

The JAFNPP intake and discharge temperatures are based on readings taken in the intake and discharge shaft of the circulating water system during the survey as described in Section II-C of the Aquatec report.

II.4 SURVEY RESULTS

II.4.1 Temperature and Dye Studies

Temperature and dye concentration patterns, illustrating thermal effect and diffuser performance respectively of the joint operation of both the NMP-1 and the JAFNPP discharge, are presented for nearfield and farfield areas. Dye contour illustrations include tables to convert dye concentrations to dilution factors.

The nearfield study area consists of transects 10 through 22, as shown in Figures II-1 through II-65, except Figures II-7, II-8, II-14, II-15, II-27, II-28, II-34, II-35, II-45, II-49, II-57, and II-61. Temperature data were taken at depths of 1, 2, 6, 10, and 15 feet. Transects 11 through 22 are 2,500 feet long; transect 10 is 3,000 feet long. The tracking speed of the survey boat was from 8 to 10 fps with a data sampling interval of one data record per second. Offshore extensions of the nearfield study area are provided for selected runs on August 19 and 20, 1976.

The farfield study area consists of transects 4 through 26, as shown in Figures II-7, II-8, II-14, II-15, II-27, II-28, II-34, II-35, II-45, II-49, II-57, and II-61. Temperature and dye data were taken at a depth of 1.5 feet. The study area extends 5,000 feet either side of the diffuser along the shore and 5,000 feet offshore. The tracking speed of the survey boat was from 20 to 25 fps with a data sampling interval of one data record per second.

During each of the nearfield and farfield runs described in the following sections, vertical profiles of both temperature and dye were taken at 27 designated stations in addition to the horizontal transect work. Vertical profiles for the August survey are shown in Appendix II of the Aquatec report.

The dye concentration in the discharge shaft of the circulating water system was determined to be 7.9 parts per billion (ppb). This number was calculated by diluting the Rhodamine WT dye release rate of 1.49 pounds per hour with the total circulating water flow rate of 835 cfs. The circulating water flow rate is based on information in an Aquatec, Inc. report entitled "Pumphouse Dye Study" completed in October 1975, using a dye dilution technique to determine the flow rate within an accuracy of 2.59 percent.

Table II-5 defines the degree of thermal stratification in the intake region during the survey.

II.4.1.1 August 19, 1976 Temperature Patterns

Between 0806 and 1743 on August 19, 1976, three nearfield and two farfield runs were completed along the appropriate transects.

II.4.1.1.1 Sampling Period from 0806 to 0949 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures II-1, II-2, II-3, II-4, and II-5, respectively, during the nearfield sampling period on August 19, 1976 from 0806 to 0949.

Figure II-6 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 68.9°F was calculated by averaging temperatures in the diffuser vicinity along transect 19. The maximum temperature rise attributed to the JAFNPP at the 1-foot depth was observed to be 2.6°F. The maximum temperature rise above ambient at the 1-foot depth was observed to be along the southwest boundary of the study area, on the shoreward side of the JAFNPP diffuser. This region of maximum temperature does not result from the JAFNPP since Figure II-42 illustrates insignificant dye concentrations in this area, thus precluding any measurable temperature contribution from JAFNPP. Farfield sampling periods from 1003 to 1142 and from 1422 to 1542 on August 19, 1976 indicate that this heated water originates from the NMP-1 discharge.

II.4.1.1.2 Sampling Period from 1003 to 1142 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure II-7 during the farfield sampling period from 1003 to 1142. Figure II-8 represents the temperature rise above ambient at a 1.5-foot depth. The ambient temperature of 69°F was calculated by averaging temperatures in the diffuser vicinity along transect 20. The maximum temperature rise attributed to the JAFNPP at the 1.5-foot depth was observed to be 2.2°F.

II.4.1.1.3 Sampling Period from 1229 to 1358 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures II-9, II-10, II-11, II-12, and II-13, respectively, during the nearfield sampling period from 1229 to 1358. A figure representing temperature rise above ambient was not determined for the nearfield sampling period from 1229 to 1358 due to the influence of the NMP-1 plume on the study area.

II.4.1.1.4 Sampling Period from 1422 to 1542 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure II-14 during the farfield sampling period from 1422 to 1542. Figure II-15 represents the temperature rise above ambient at a 1.5-foot depth. The temperature rise attributed to the JAFNPP has the effect of pushing out the 1°F-, 2°F-, and 3°F-isotherms in the diffuser region, as shown in Figure II-15; however, the percentage of the NMP/JAFNPP contribution cannot be quantified. The ambient temperature of 71°F was calculated by averaging temperatures in the diffuser vicinity transect 23.

II.4.1.1.5 Sampling Period from 1603 to 1743 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures II-16, II-17, II-18, II-19, and II-20, respectively, during the nearfield sampling period from 1603 to 1743. Figure II-21 illustrates an offshore extension of the isotherms at a 2-foot depth.

As evidenced by Figure II-16, the JAFNPP discharge during this sampling period was observed to reduce the temperatures in the diffuser area compared to those temperatures that would have existed without JAFNPP operation. Due to entraining and mixing of the water, the JAFNPP diffuser has a cooling effect on the local surface water.

A figure representing temperature rise above ambient was not determined for the nearfield sampling period from 1603 to 1743 due to the influence of the NMP-1 plume on the entire study area.

II.4.1.2 August 20, 1976 Temperature Patterns

Between 0818 and 1722 on August 20, 1976, three nearfield and two farfield runs were completed along the appropriate transects.

Am ambient temperature was not determined for the nearfield study area on August 20, 1976 due to the influence of the NMP-1 plume on the study area. Figures representing temperature rise above ambient were, however, developed for the two farfield runs of August 20, 1976 by locating a transect which was outside the influence of the NMP-1 station.

The maximum surface temperature observed when the JAFNPP and NMP-1 plumes interacted was not significantly greater than that which would have existed without JAFNPP in operation. The area enclosed by the isotherms in the JAFNPP diffuser region due to the plume interaction was increased slightly, but it was not possible to quantify each plant's contribution other than to show a qualitative comparison of the temperature and dye figures as presented below.

II.4.1.2.1 Sampling Period from 0818 to 0949 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures II-22, II-23, II-24, II-25, and II-26, respectively, during the nearfield sampling period from 0818 to 0949.

II.4.1.2.2 Sampling Period from 1015 to 1142 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure II-27 during the farfield sampling period from 1015 to 1142.

Figure II-28 represents isotherms depicting the temperature rise above ambient at a 1.5-foot depth. The ambient water temperature of 71°F was calculated by averaging the temperatures along the offshore section of transect 4.

II.4.1.2.3 Sampling Period from 1231 to 1344 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures II-29, II-30, II-31, II-32, and II-33, respectively, during the nearfield sampling period from 1231 to 1344.

II.4.1.2.4 Sampling Period from 1409 to 1531 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure II-34 during the farfield sampling period from 1409 to 1531.

Figure II-35 represents isotherms depicting the temperature rise above ambient at a 1.5-foot depth. The ambient water temperature of 71°F was calculated by averaging the temperatures along the offshore section of transect 4.

II.4.1.2.5 Sampling Period from 1610 to 1722 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures II-36, II-37, II-38, II-39, and II-40, respectively, during the nearfield sampling period from 1610 to 1722. Figure II-41 illustrates an offshore extension of the isotherms at a 2-foot depth.

II.4.1.3 August 19, 1976 Dye Concentration Patterns

Between 0806 and 1743 on August 19, 1976, three nearfield and two farfield runs were completed along the appropriate transects.

II.4.1.3.1 Sampling Period from 0806 to 0949 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures II-42, II-43, and II-44, respectively, during the nearfield sampling period from 0806 to 0949 on August 19, 1976.

The maximum dye concentration at the 2-foot depth was observed to be 0.93 ppb. This value is based on an averaging of data along 33.3 feet of transect.

II.4.1.3.2 Sampling Period from 1003 to 1142 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure II-45 during the farfield sampling period from 1003 to 1142.

The maximum dye concentration at the 1.5-foot depth was observed to be 0.69 ppb.

II.4.1.3.3 Sampling Period from 1229 to 1358 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures II-46, II-47, and II-46, respectively, during the nearfield sampling period from 1229 to 1358.

The maximum dye concentration at the 2-foot depth was observed to by 1.06 ppb.

II.4.1.3.4 Sampling Period from 1422 to 1542 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure II-49 during the farfield sampling period from 1422 to 1542.

The maximum dye concentration at the 2-foot depth was observed to be 0.98 ppb.

II.4.1.3.5 Sampling Period from 1603 to 1743 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures II-50, II-51, and II-52, respectively, during the nearfield sampling period from 1603 to 1743. Figure II-53 illustrates an offshore extension of the dye contours at a 2-foot depth.

The maximum dye concentration at the 2-foot depth was observed to by 0.83 ppb.

II.4.1.4 August 20, 1976 Dye Concentration Patterns

Between 0818 and 1722 on August 20, 1976, three nearfield and two farfield runs were completed along the appropriate transects.

II.4.1.4.1 Sampling Period from 0818 to 0949 (nearfield)

Dye contours in ppb are shown in 2-, 6-, and 10-foot depths in Figures II-54, II-55, and II-56, respectively, during the nearfield sampling period from 0818 to 0949.

The maximum dye concentration at the 2-foot depth was observed to by 0.89 ppb.

II.4.1.4.2 Sampling Period from 1015 to 1142 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure II-57 during the farfield sampling period from 1015 to 1142.

The maximum dye concentration at the 1.5-foot depth was observed to be 0.84 ppb.

II.4.1.4.3 Sampling Period from 1231 to 1344 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures II-58, II-59, and II-60, respectively, during the nearfield sampling period from 1231 to 1344.

The maximum dye concentration at the 2-foot depth was observed to be 0.97 ppb.

II.4.1.4.4 Sampling Period from 1409 to 1531 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure II-61 during the farfield sampling from 1409 to 1531.

The maximum dye concentration at the 1.5-foot depth was observed to be 0.69 ppb.

II.4.1.4.5 Sampling Period from 1610 to 1722 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures II-62, II-63, and II-64, respectively, during the nearfield sampling period from 1610 to 1722. Figure II-65 illustrates an offshore extension of the dye contours at a 2-foot depth.

The maximum dye concentration at the 2-foot depth was observed to be 0.94 ppb.

II.4.2 In Situ Data

In situ data collection, consisting of current speed and direction, lake temperature, and lake level, was made by the Raytheon Company. The information is provided in the Aquatec report.

A summary of the average current speed and magnitude at the 10-, 20-, and 30-foot depth is presented on each figure by a vector and associated magnitude at the in situ tower. The lake levels for both the August 19 and 20, 1976 survey were observed to fluctuate between 247.4 and 247.6 feet USLS (United States Lake Survey 1935 Datum).

II-AUGUST 1976 SURVEY

TABLE II-1

WIND SPEED AND DIRECTION FOR AUGUST 19, 1976

Time	Data taken at 30-ft elev. Direction (Deg true)	Speed (mph)	Data taken at 200-ft elev. Direction (Deg true)	Speed (mph)
0400-0500	125	4	135	10
0500-0600	145	5	125	13
0600-0700	145	5	130	14
0700-0800	155	5	145	10
0800-0900*	155	4	145	7
0900-1000*	155	3	145	4
1000-1100*	315	3	305	6
1100-1200*	320	3	330	5
1200-1300*	320	3	320	6
1300-1400*	320	3	325	6
1400-1500*	330	3	340	6
1500-1600*	335	3	350	5
1600-1700*	005	1	035	1
1700-1800*	035	1	005	0
1800-1900	130	0	090	0
1900-2000	120	0	115	2
2000-2100	115	2	130	3
2100-2200	110	2	140	3
2200-2300	150	3	175	6
2300-2400	150	4	175	8

* Survey Period

TABLE II-2

WIND SPEED AND DIRECTION FOR AUGUST 20, 1976

	Data taken at 30-ft elev.		Data taken at 200-ft elev.	
Time	Direction (Deg true)	Speed (mph)	Direction (Deg true)	Speed (mph)
0000-0100	215	0	165	9
0100-0200	160	5	175	14
0200-0300	175	5	185	18
0300-0400	170	5	180	16
0400-0500	130	5	165	12
0500-0600	-	3	180	10
0600-0700	165	2	180	10
0700-0800	200	4	195	8
0800-0900*	260	7	235	7
0900-1000*	265	7	235	6
1000-1100*	265	8	255	10
1100-1200*	260	6	235	6
1200-1300*	265	7	245	8
1300-1400*	235	5	215	8
1400-1500*	255	6	245	9
1500-1600*	255	6	245	10
1600-1700*	280	2	255	4
1700-1800*	260	2	270	3

* Survey Period

TABLE II-3

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON AUGUST 19, 1976 FOR THE JAFNPP

Time	Average Plant Load (MWe)	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Plant Temperature Rise (°F)
		August 19, 1976		
0000-0100	794	71.0	100.5*	29.5
0100-0200	794	70.5	100.0	29.5
0200-0300	794	70.5	100.0	29.5
0300-0400	794	70.5	100.0	29.5
0400-0500	794	70.5	100.0	29.5
0500-0600	794	70.0	99.5	29.5
0600-0700	795	70.0	99.5	29.5
0700-0800	792	70.0	99.5	29.5
0800-0900**	788	70.0	99.0	29.0
0900-1000**	788	69.0	99.0	30.0
1000-1100**	78[illegible]	69.0	99.0	30.0
1100-1200**	787	69.0	99.0	30.0
1200-1300**	787	69.5	99.0	29.5
1300-1400**	793	70.5	100.0	29.5
1400-1500**	792	71.0	100.0	29.0
1500-1600**	792	71.5	100.5*	29.0
1600-1700**	791	72.5	101.0	28.5
1700-1800**	791	72.5	101.5*	29.0
1800-1900	791	73.0	102.0	29.0
1900-2000	791	73.0	102.0	29.0
2000-2100	788	72.5	102.0	29.5
2100-2200	791	72.0	101.5*	29.5
2200-2300	792	72.0	101.0	29.0
2300-2400	792	71.0	100.5*	29.5

* Temperature recorder in discharge shaft off scale (greater than 100°F). Value is based on outlet condenser water box temperature.

** Survey Period

TABLE II-4

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON AUGUST 20, 1976 FOR THE JAFNPP

Time	Average Plant Load (MWe)	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Plant Temperature Rise (°F)
		August 20, 1976		
0000-0100	793	71.0	100.0*	29.0
0100-0200	792	71.0	100.0*	29.0
0200-0300	794	70.5	100.0	29.5
0300-0400	792	70.5	100.0	29.5
0400-0500	794	70.5	100.0	29.5
0500-0600	794	70.5	100.0	29.5
0600-0700	793	71.0	100.0	29.0
0700-0800**	794	71.0	100.0	29.0
0800-0900**	703	71.0	100.0	29[illegible]
0900-1000**	793	70.5	100.0	2[illegible]
1000-1100**	793	71.0	99.0	28.0
1100-1200**	792	71.0	99.5	28.5
1200-1300**	792	72.0	99.5	27.5
1300-1400**	792	72.0	100.0	28.0
1400-1500**	791	72.0	100.0	28.0
1500-1600**	791	72.0	100.0	28.0
1600-1700**	791	72.0	101.0*	29.0
1700-1800**	791	72.0	101.0*	29.0

* Temperature recorder in discharge shaft off scale (greater than 100°F). Value is based on outlet condenser water box temperature.

** Survey Period

TABLE II-5

DEGREE OF THERMAL STRATIFICATION IN INTAKE REGION
FOR AUGUST 19 AND 20, 1976

Time	Average Water Temperature (°F) for Top 2 Ft of Water Column at Intake Region	Average Water Temperature (°F) for Bottom 2 Ft of Water Column at Intake Region	Thermal Stratification (°F) at Intake Region
		August 19, 1976	
0859	68.6	67.5	1.1
1107	72.1	67.4	4.7
1320	72.6	67.5	5.1
1523	72.8	67.4	5.4
		August 20, 1976	
0917	71.8	67.6	4.2
1114	72.2	69.9	2.3
1324	72.6	70.1	2.5
1502	74.3	70.5	3.8
1655	73.8	70.9	2.9

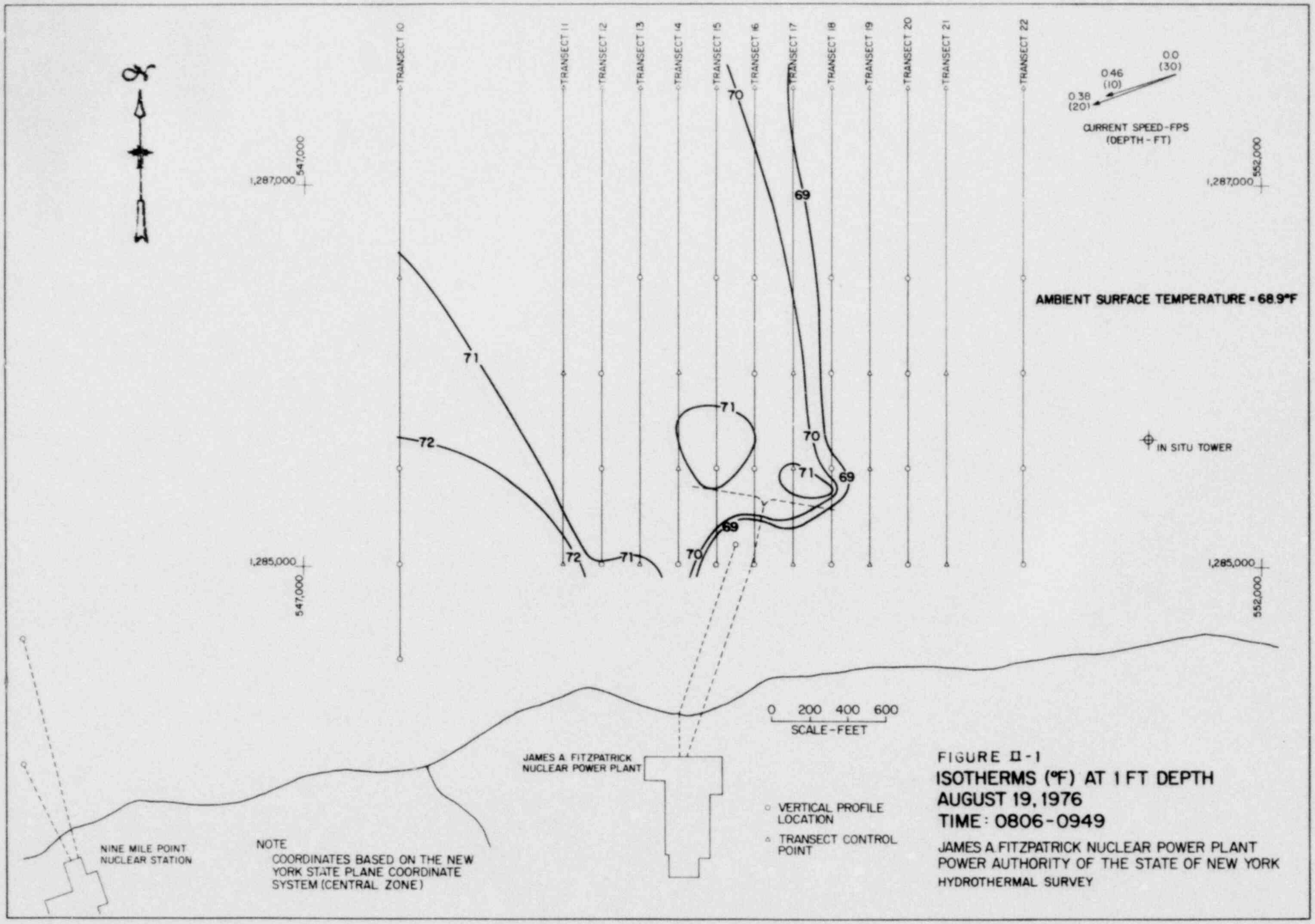


FIGURE II-1
ISOTHERMS (°F) AT 1 FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949
JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

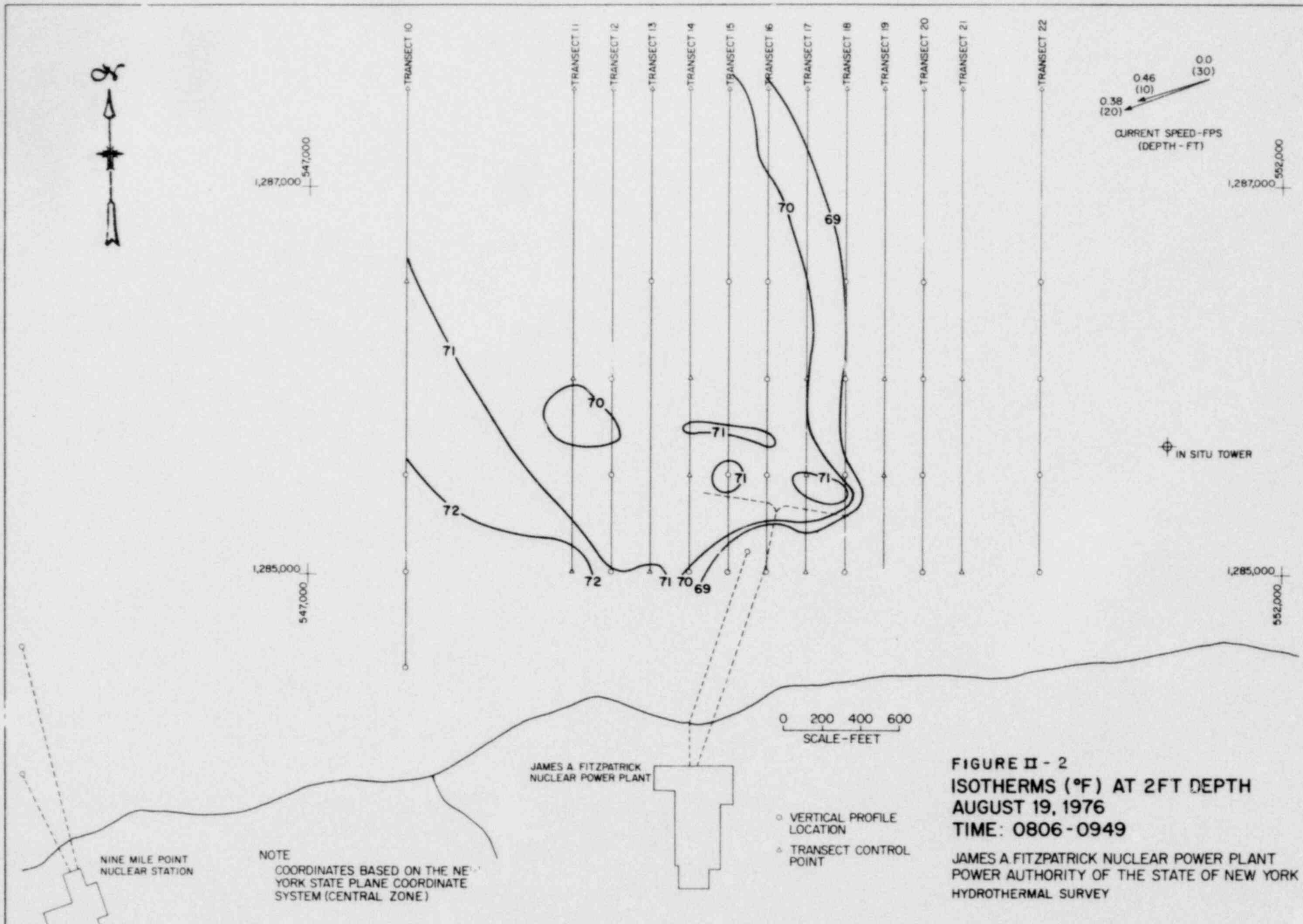


FIGURE II - 2
ISOTHERMS (°F) AT 2FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
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HYDROTHERMAL SURVEY

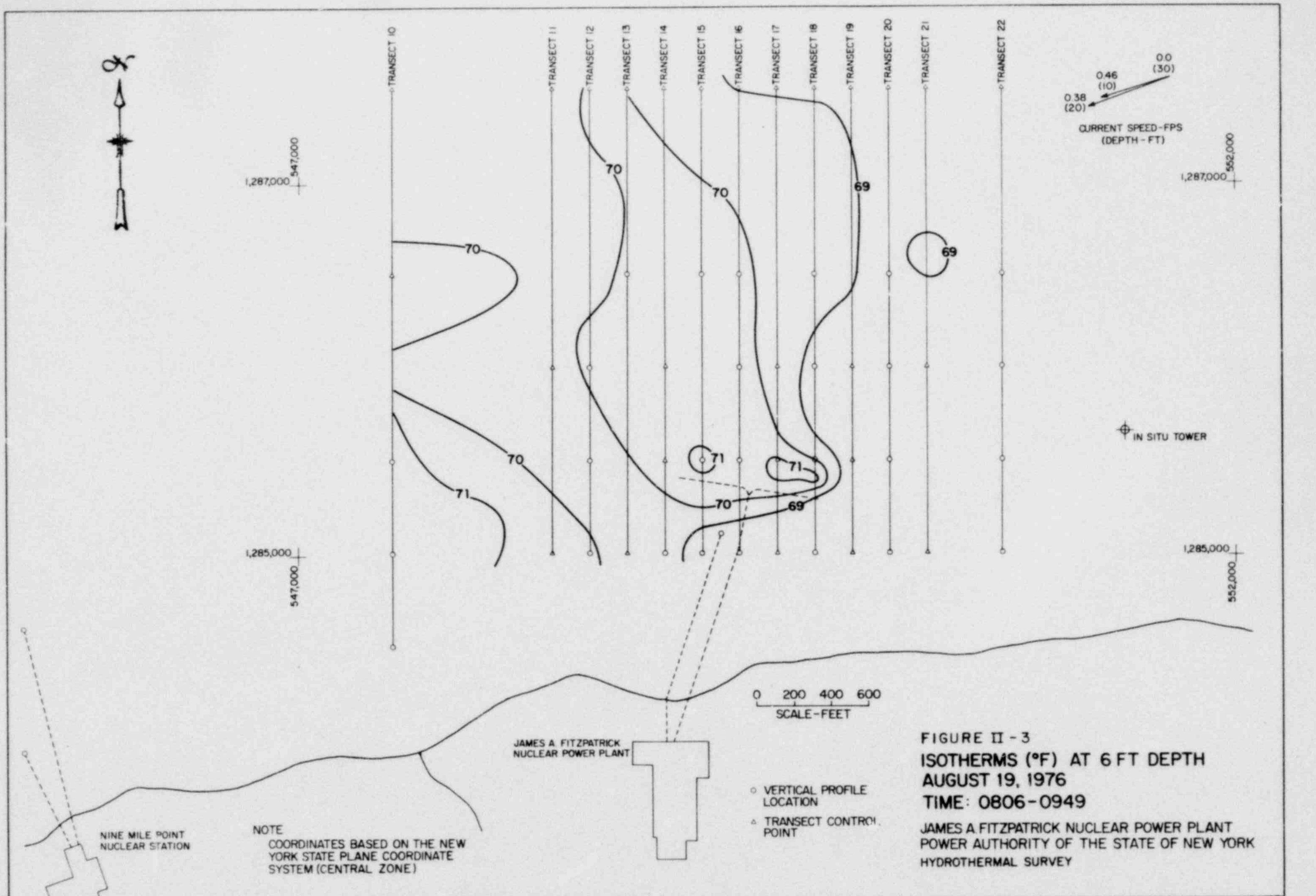

FIGURE II - 3
ISOTHERMS (°F) AT 6 FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
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HYDROTHERMAL SURVEY

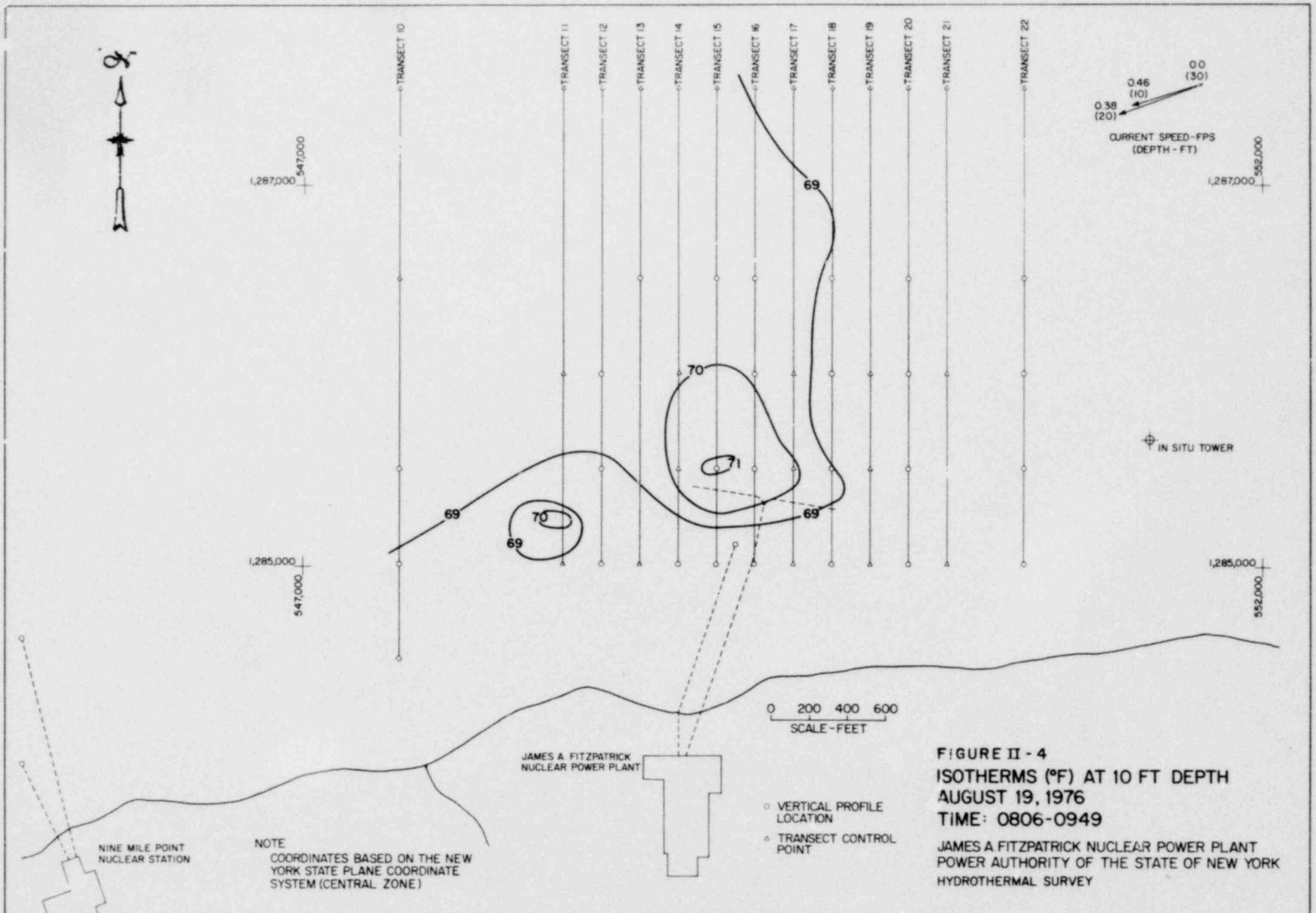


FIGURE II - 4
ISOTHERMS (°F) AT 10 FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

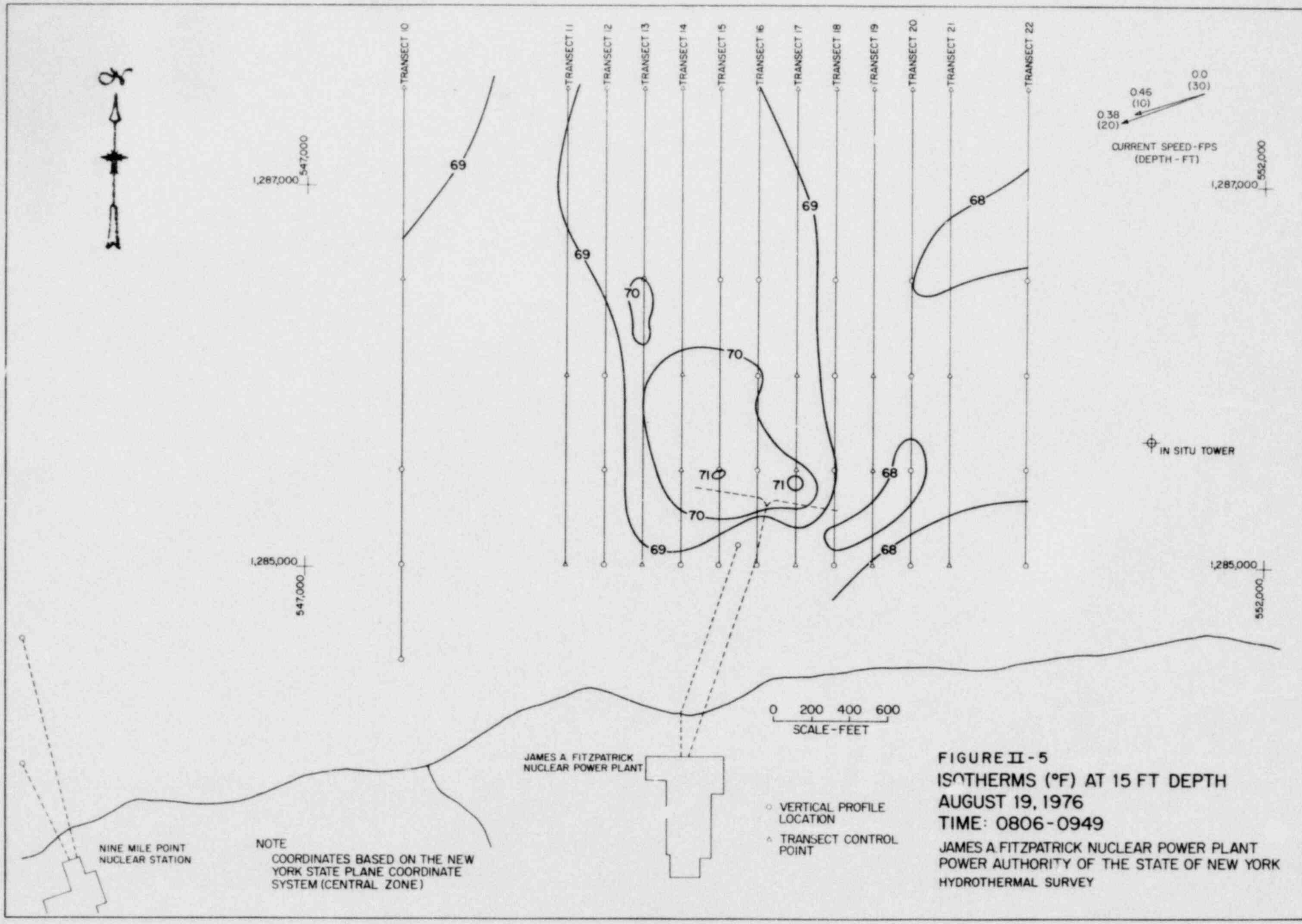


FIGURE II-5
ISOTHERMS (°F) AT 15 FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

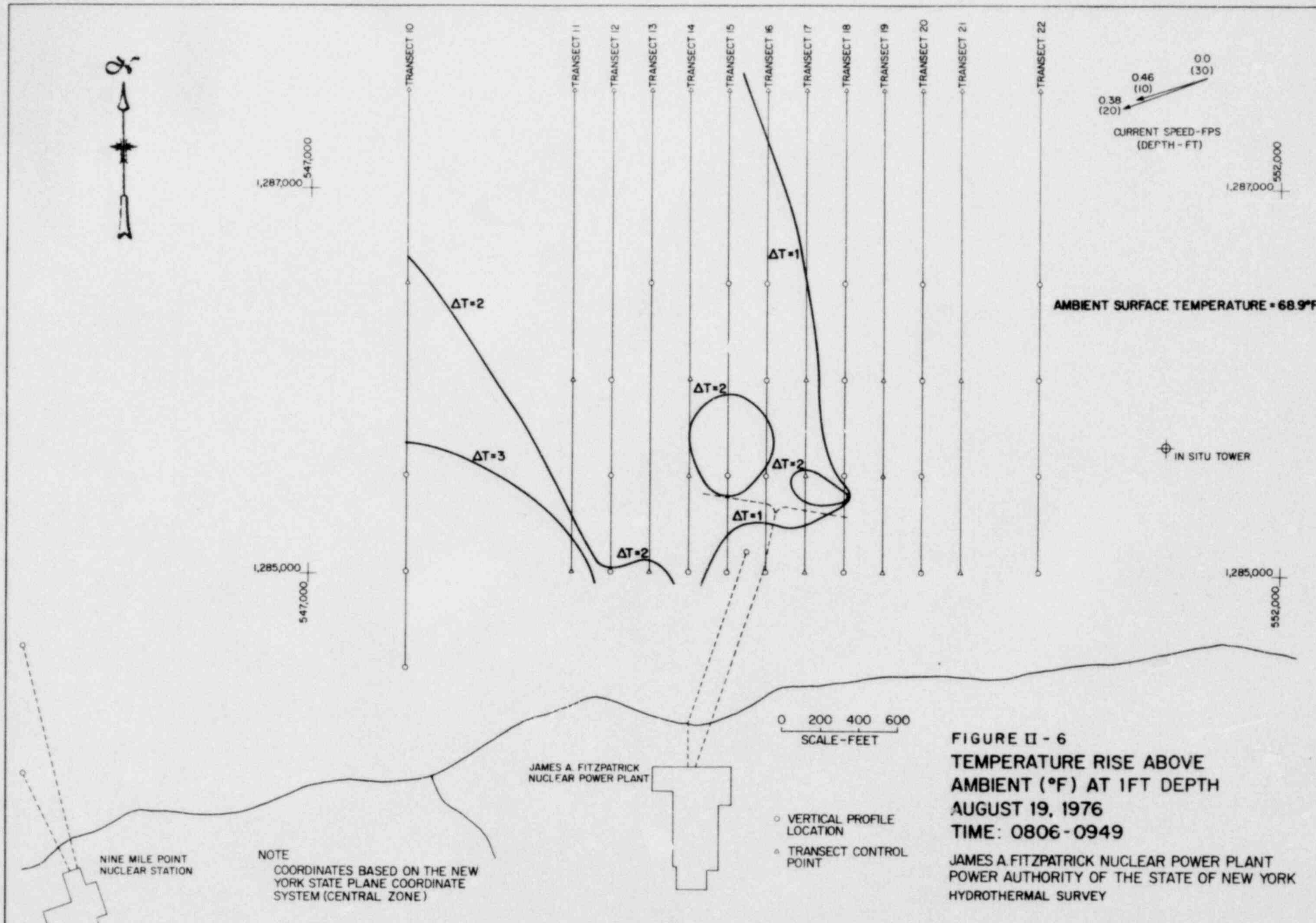


FIGURE II - 6
TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

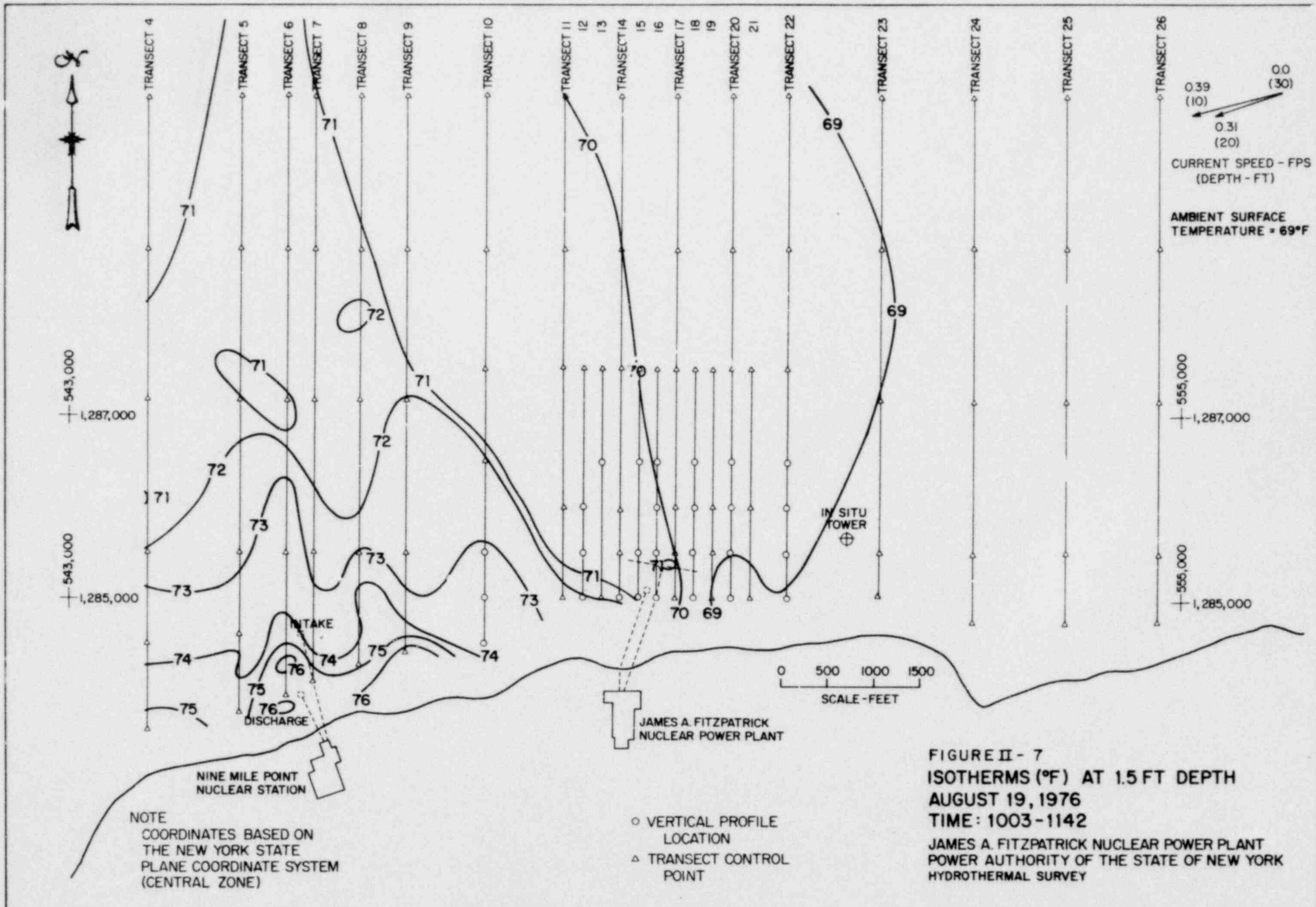


FIGURE II - 7
ISOTHERMS (°F) AT 1.5 FT DEPTH
AUGUST 19, 1976
TIME: 1003-1142
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

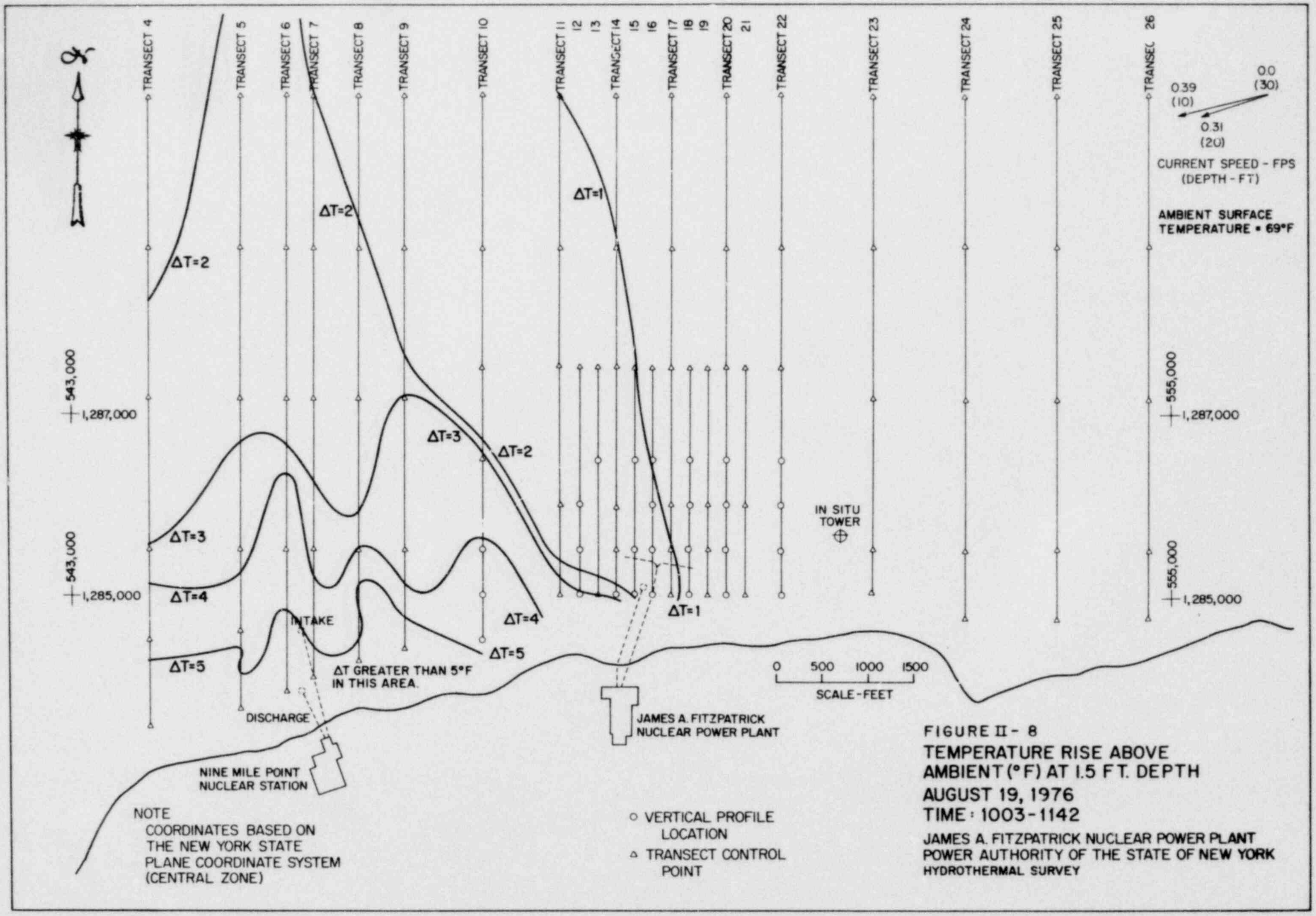


FIGURE II - 8
TEMPERATURE RISE ABOVE
AMBIENT (°F) AT 1.5 FT. DEPTH
AUGUST 19, 1976
TIME: 1003-1142
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

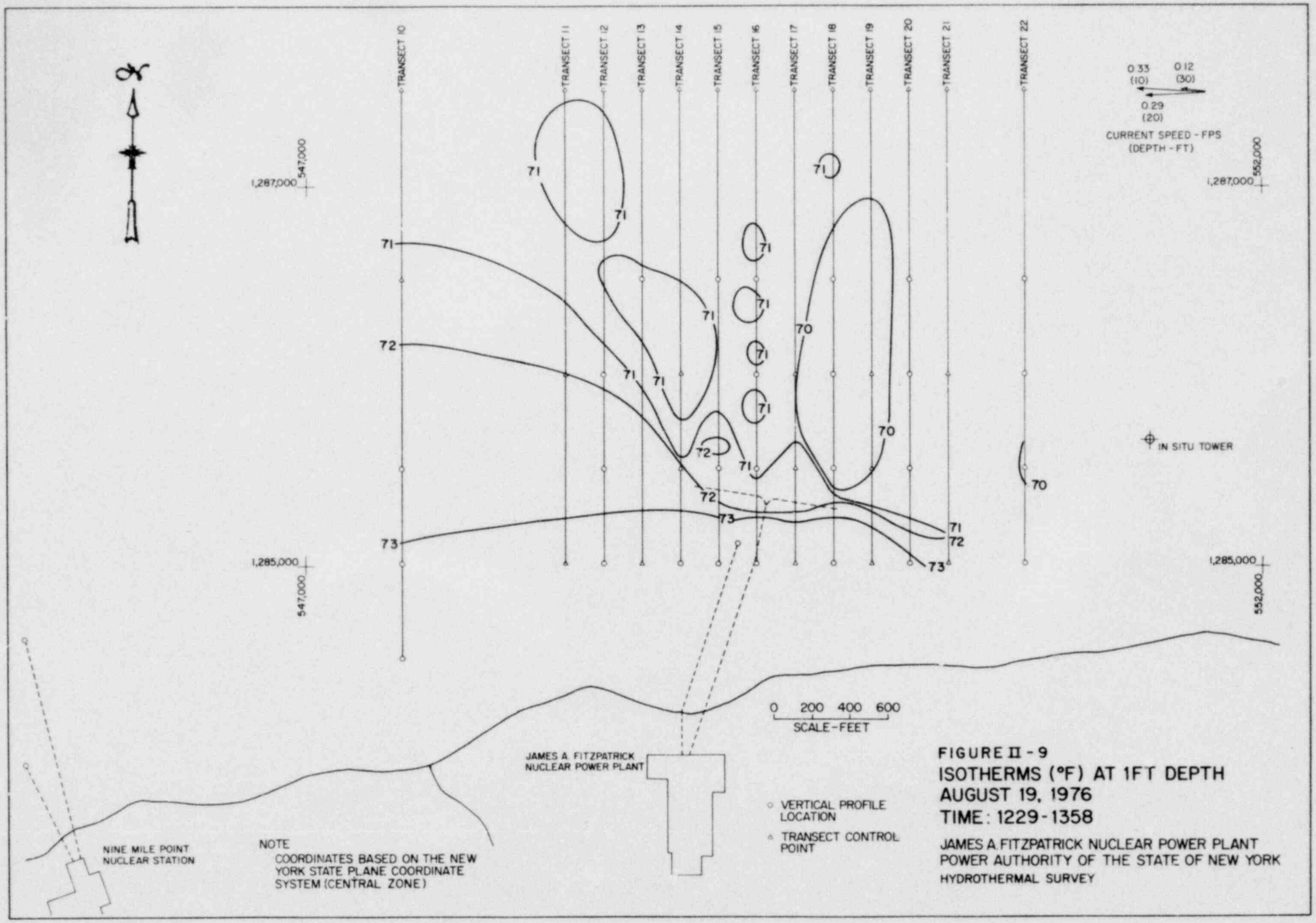


FIGURE II - 9
ISOTHERMS (°F) AT 1FT DEPTH
AUGUST 19, 1976
TIME: 1229-1358

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

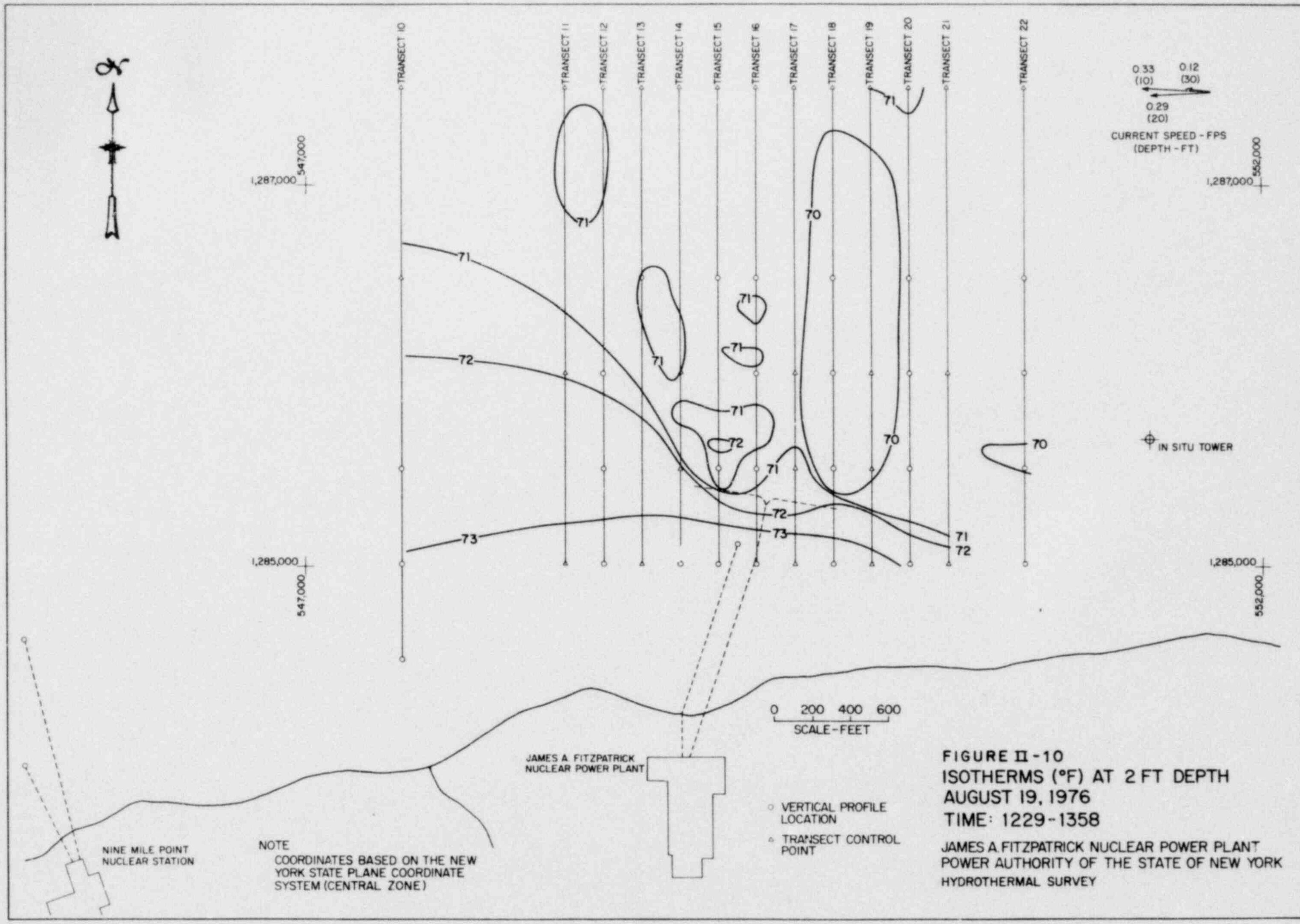
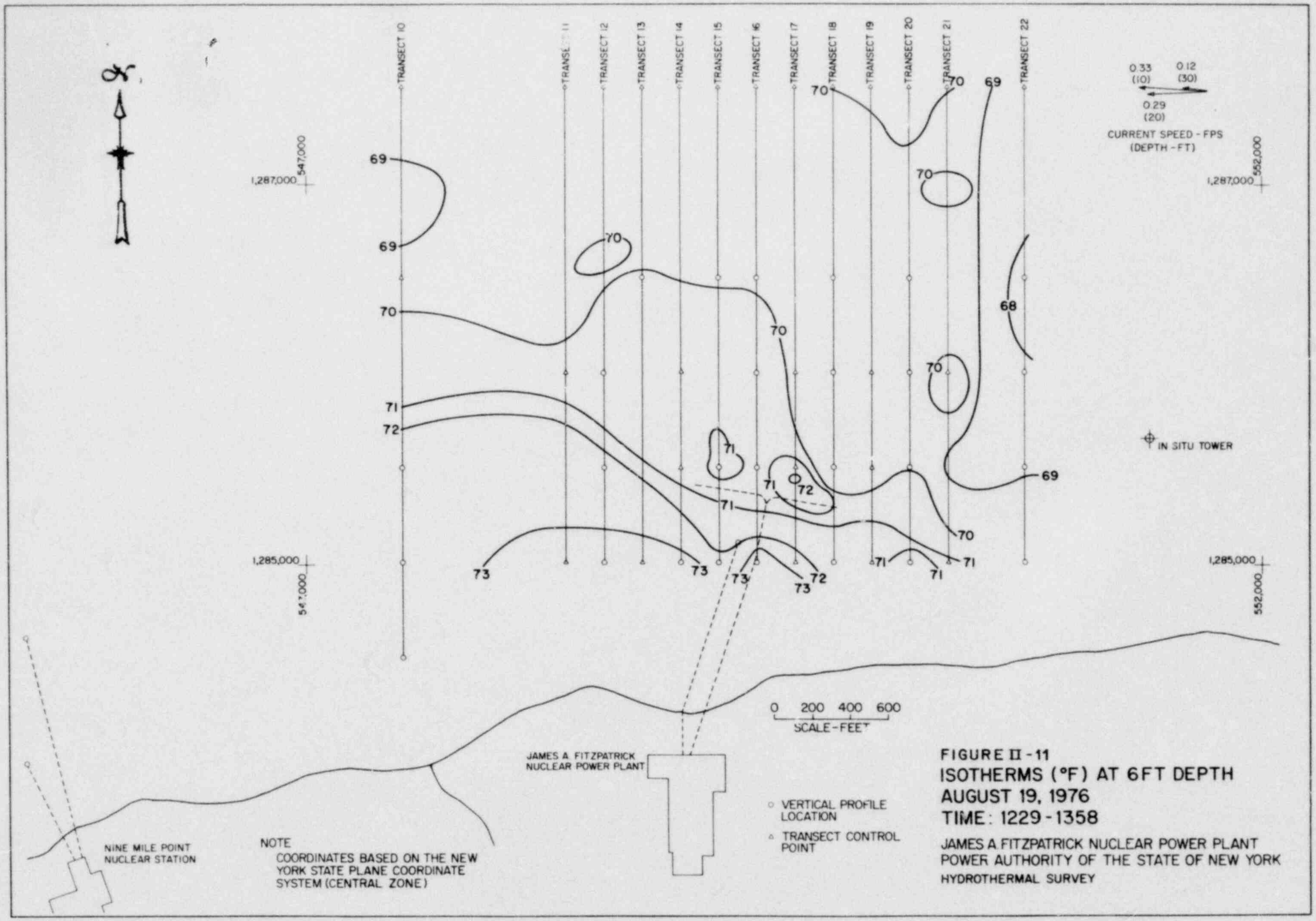


FIGURE II-10
ISOTHERMS (°F) AT 2 FT DEPTH
AUGUST 19, 1976
TIME: 1229-1358

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 11
ISOTHERMS (°F) AT 6 FT DEPTH
AUGUST 19, 1976
TIME: 1229 - 1358

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

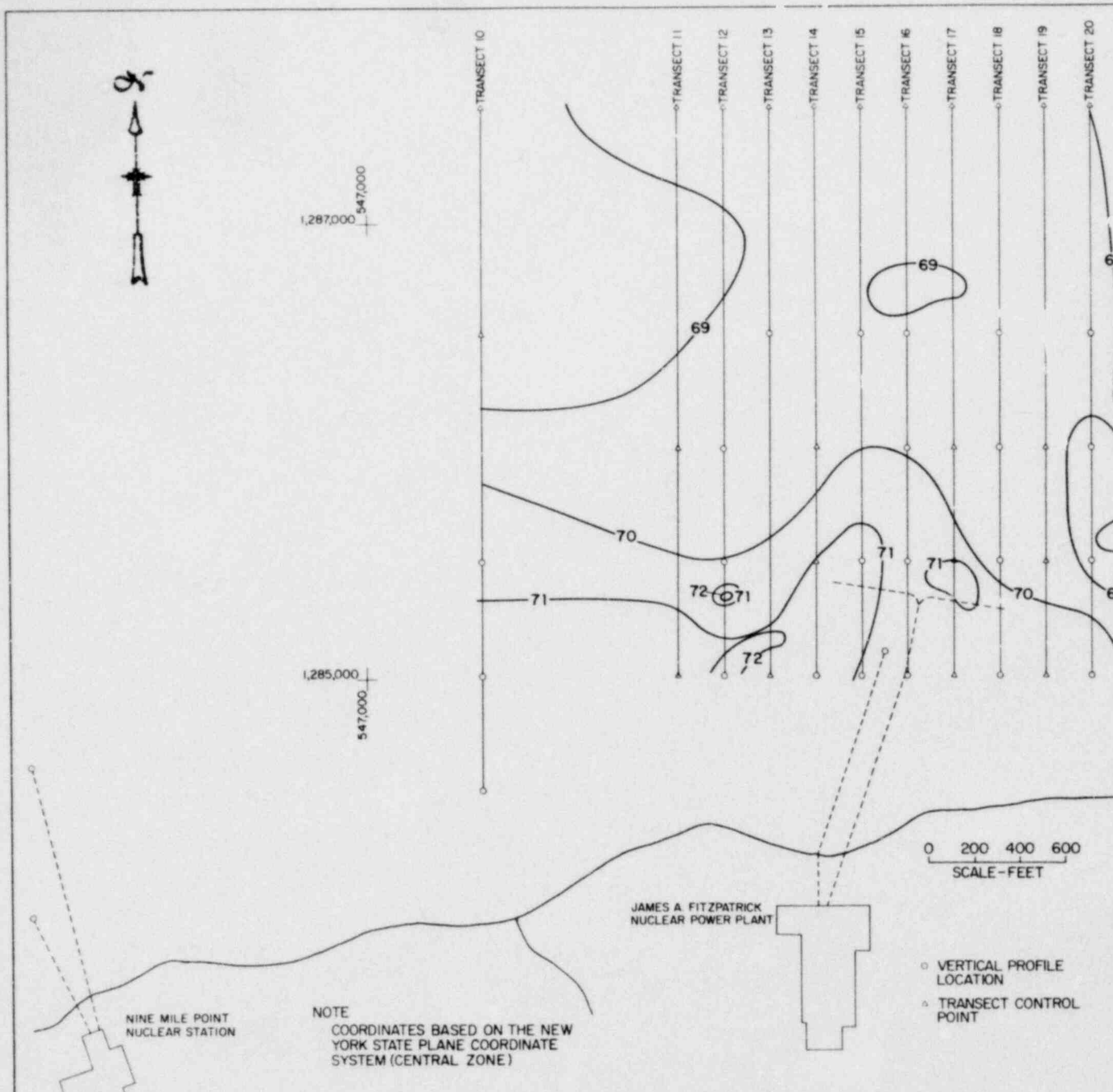


FIGURE II-12

ISOTHERMS (°F) AT 10 FT DEPTH
AUGUST 19, 1976
TIME: 1229-1358

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

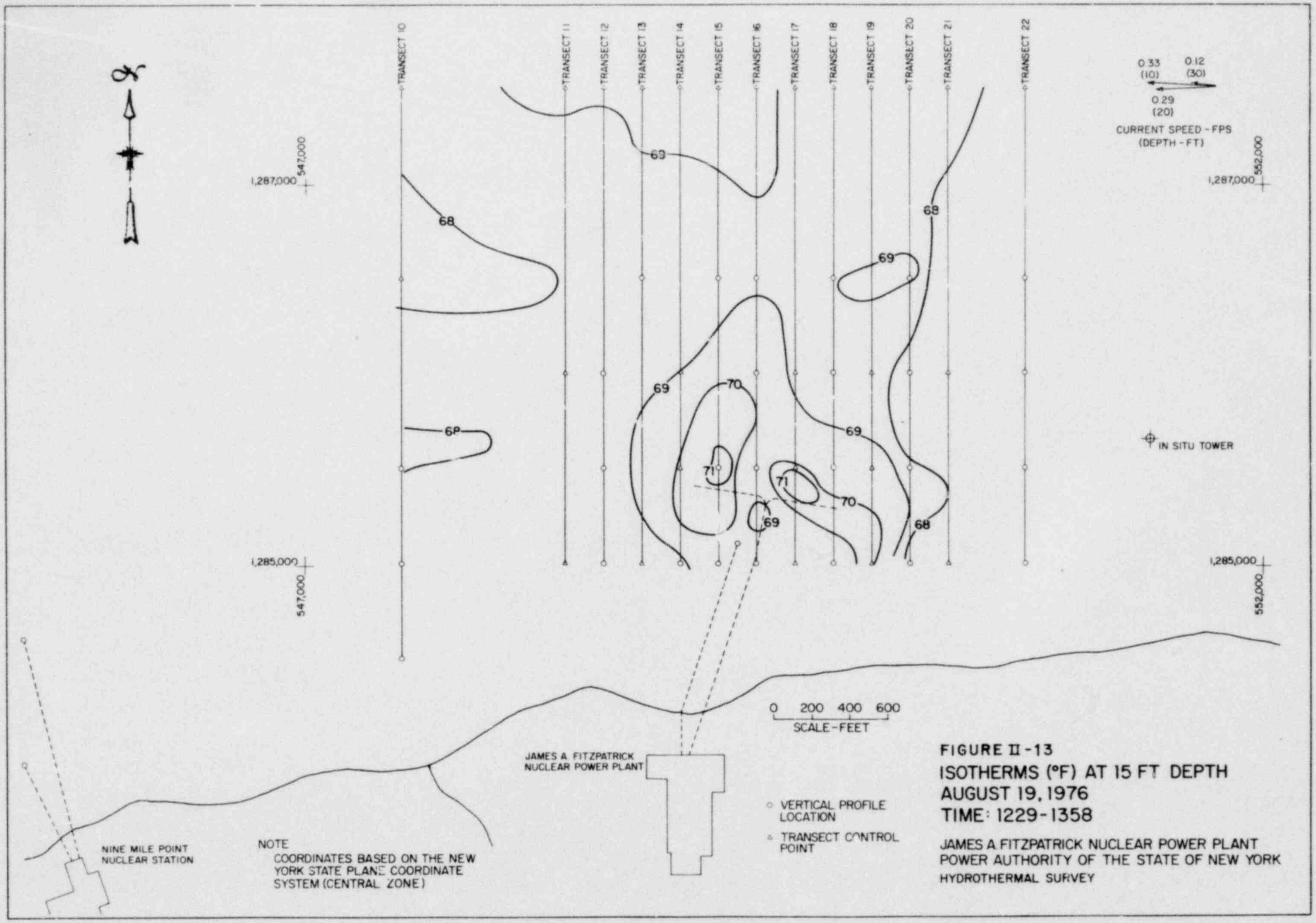


FIGURE II-13
ISOTHERMS (°F) AT 15 FT DEPTH
AUGUST 19, 1976
TIME: 1229-1358

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

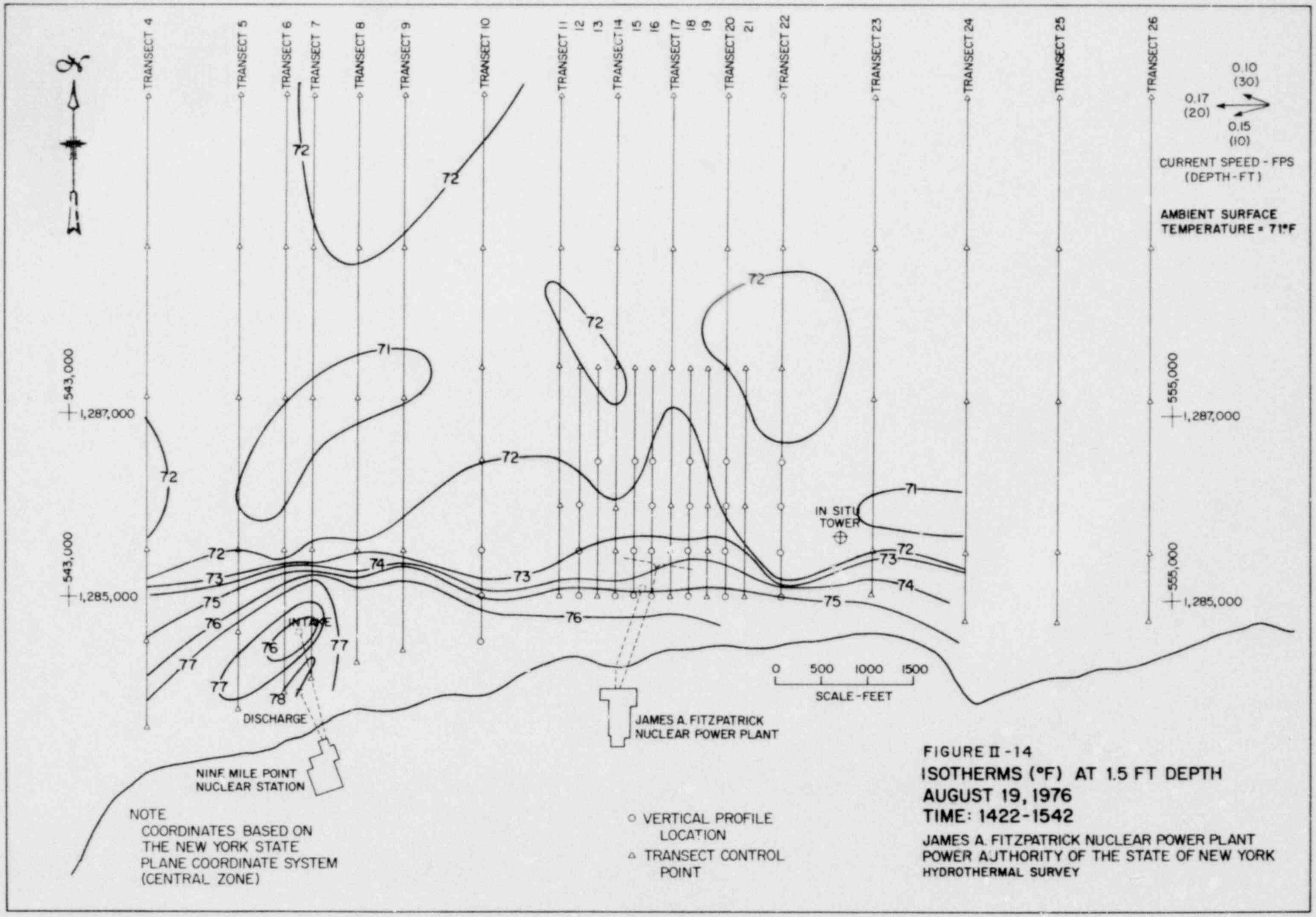


FIGURE II-14
ISOTHERMS (°F) AT 1.5 FT DEPTH
AUGUST 19, 1976
TIME: 1422-1542
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

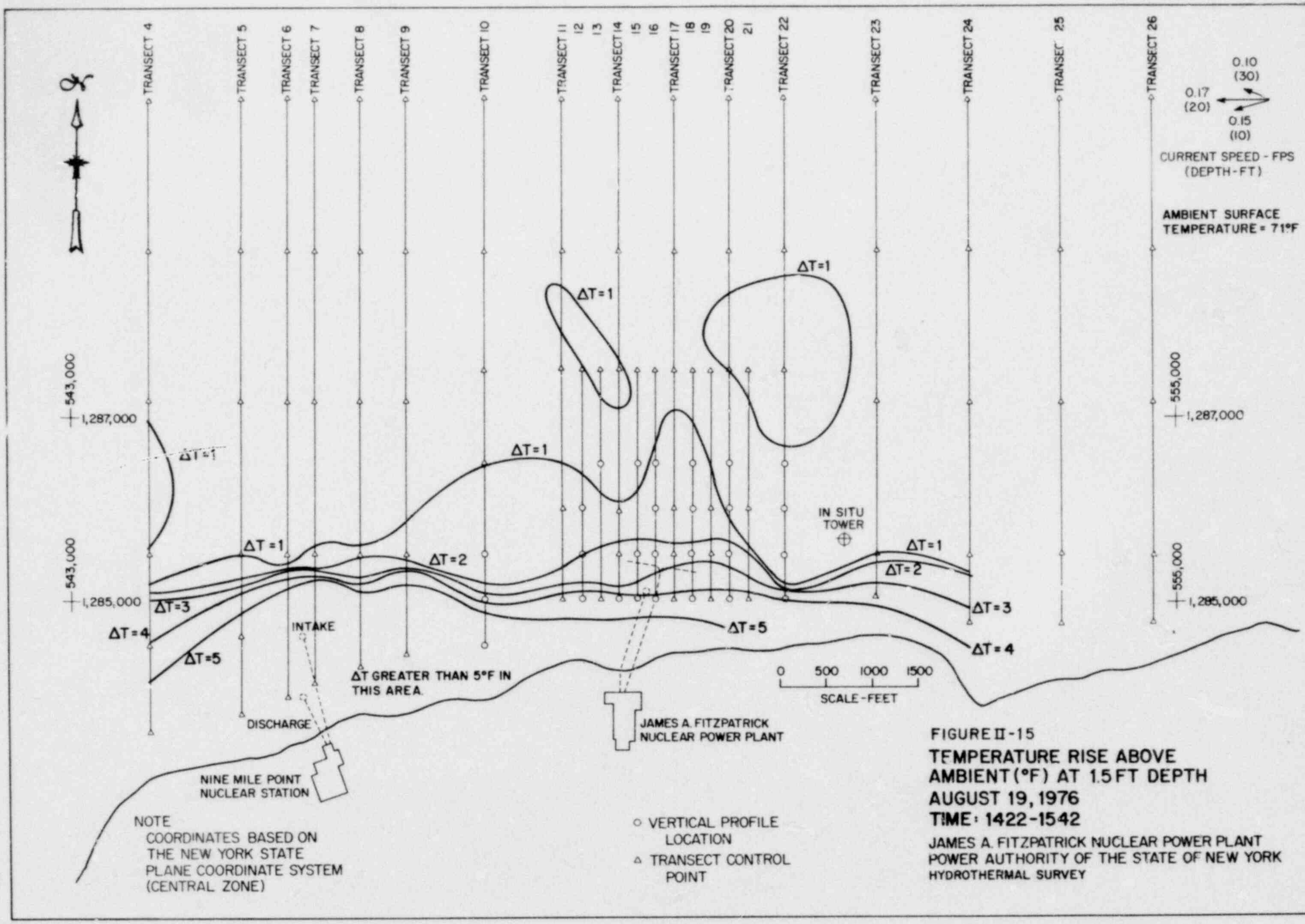


FIGURE II-15
TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1.5 FT DEPTH
AUGUST 19, 1976
TIME: 1422-1542

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

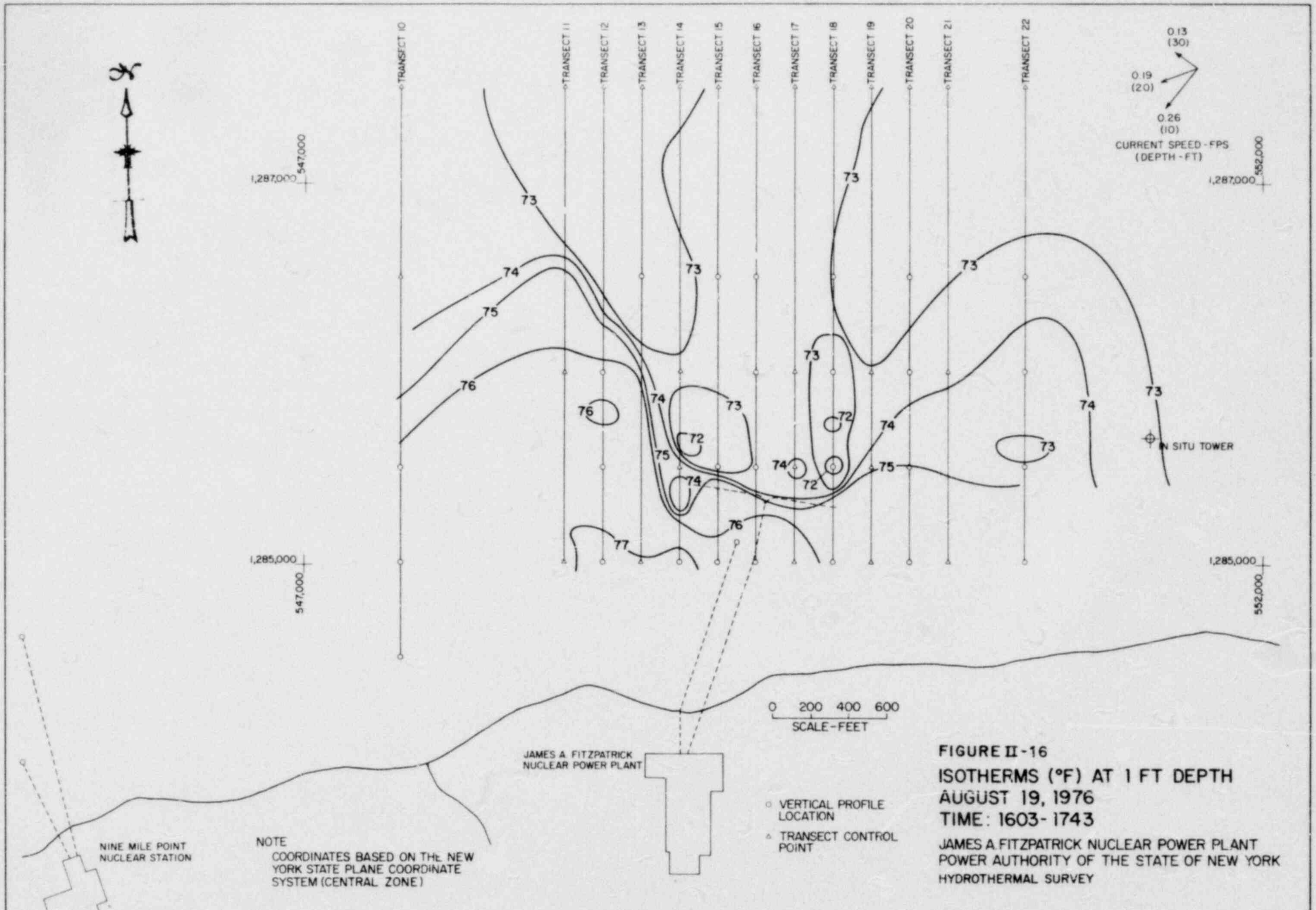


FIGURE II-16
ISOTHERMS (°F) AT 1 FT DEPTH
AUGUST 19, 1976
TIME: 1603-1743

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

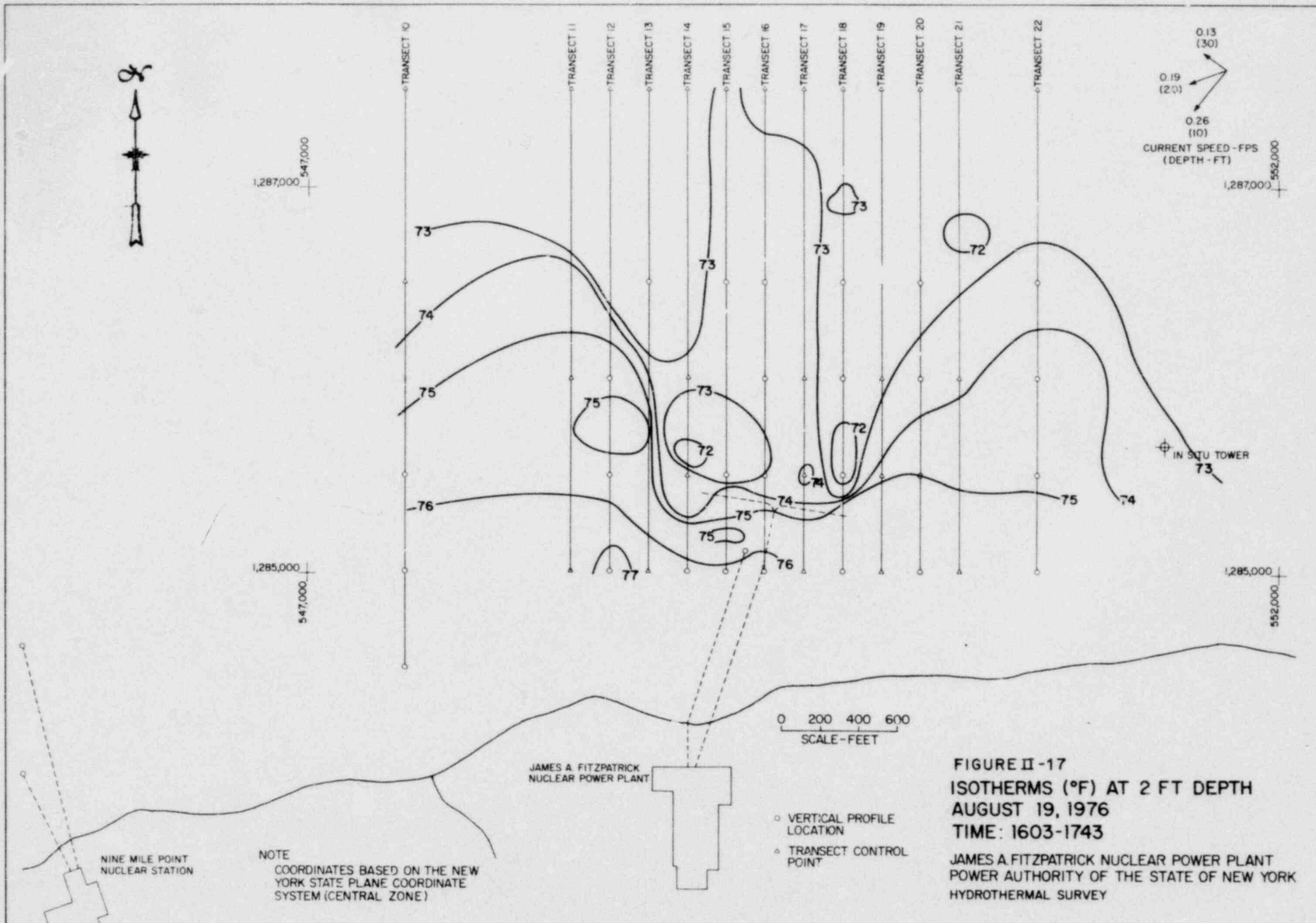


FIGURE II-17

ISOTHERMS (°F) AT 2 FT DEPTH
AUGUST 19, 1976
TIME: 1603-1743

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

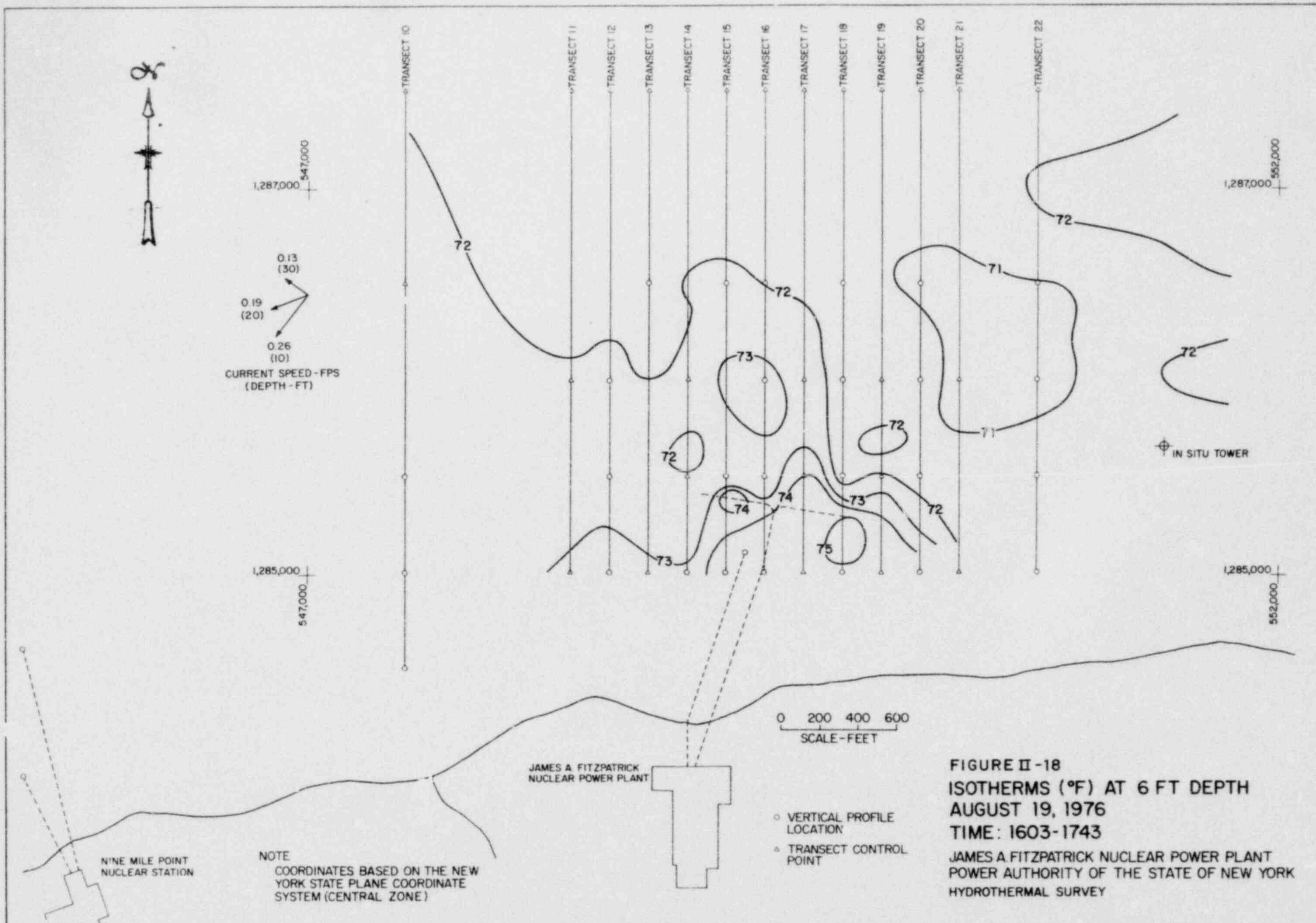


FIGURE II-18
ISOTHERMS (°F) AT 6 FT DEPTH
AUGUST 19, 1976
TIME: 1603-1743

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

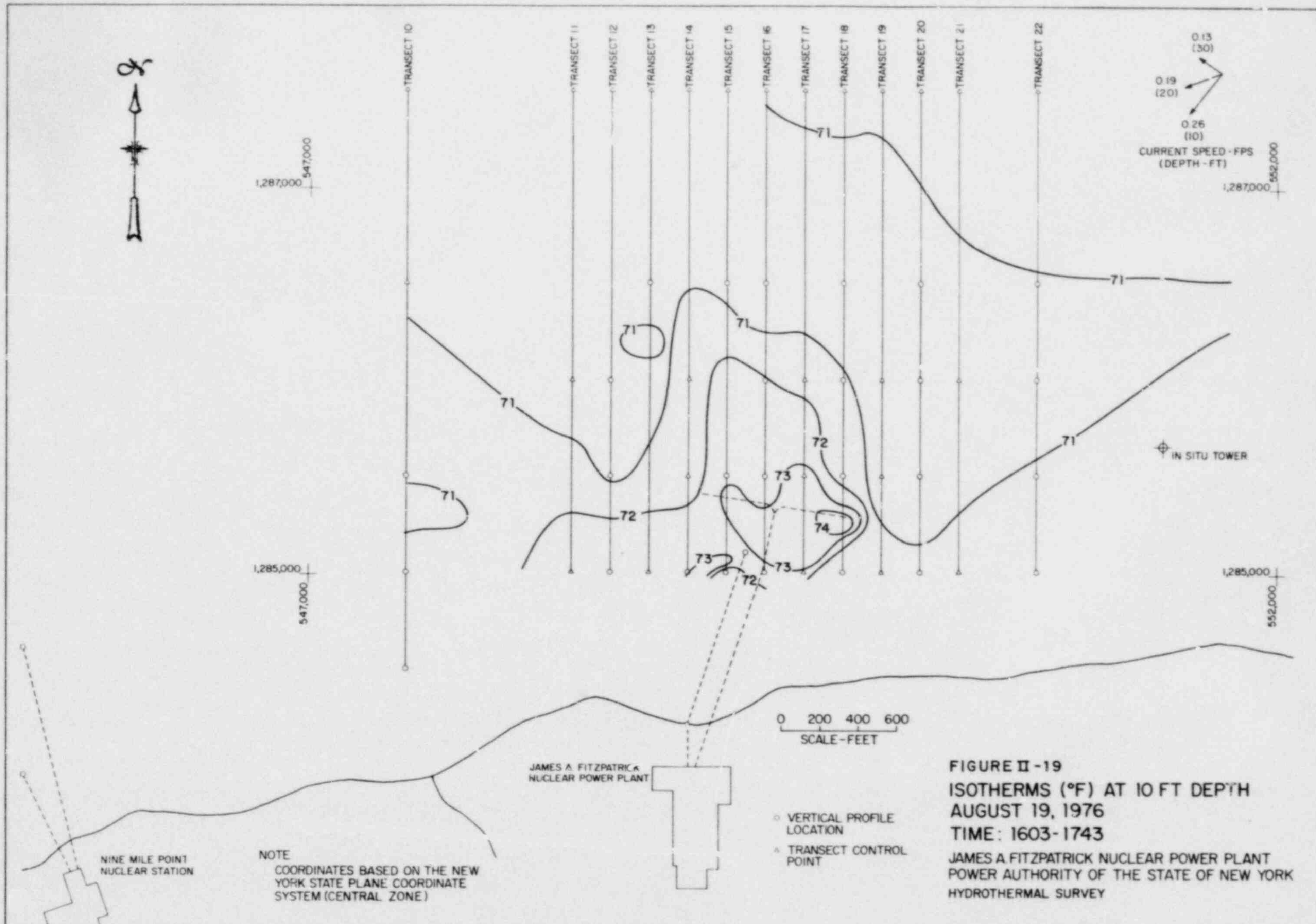


FIGURE II-19
ISOTHERMS (°F) AT 10 FT DEPTH
AUGUST 19, 1976
TIME: 1603-1743
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

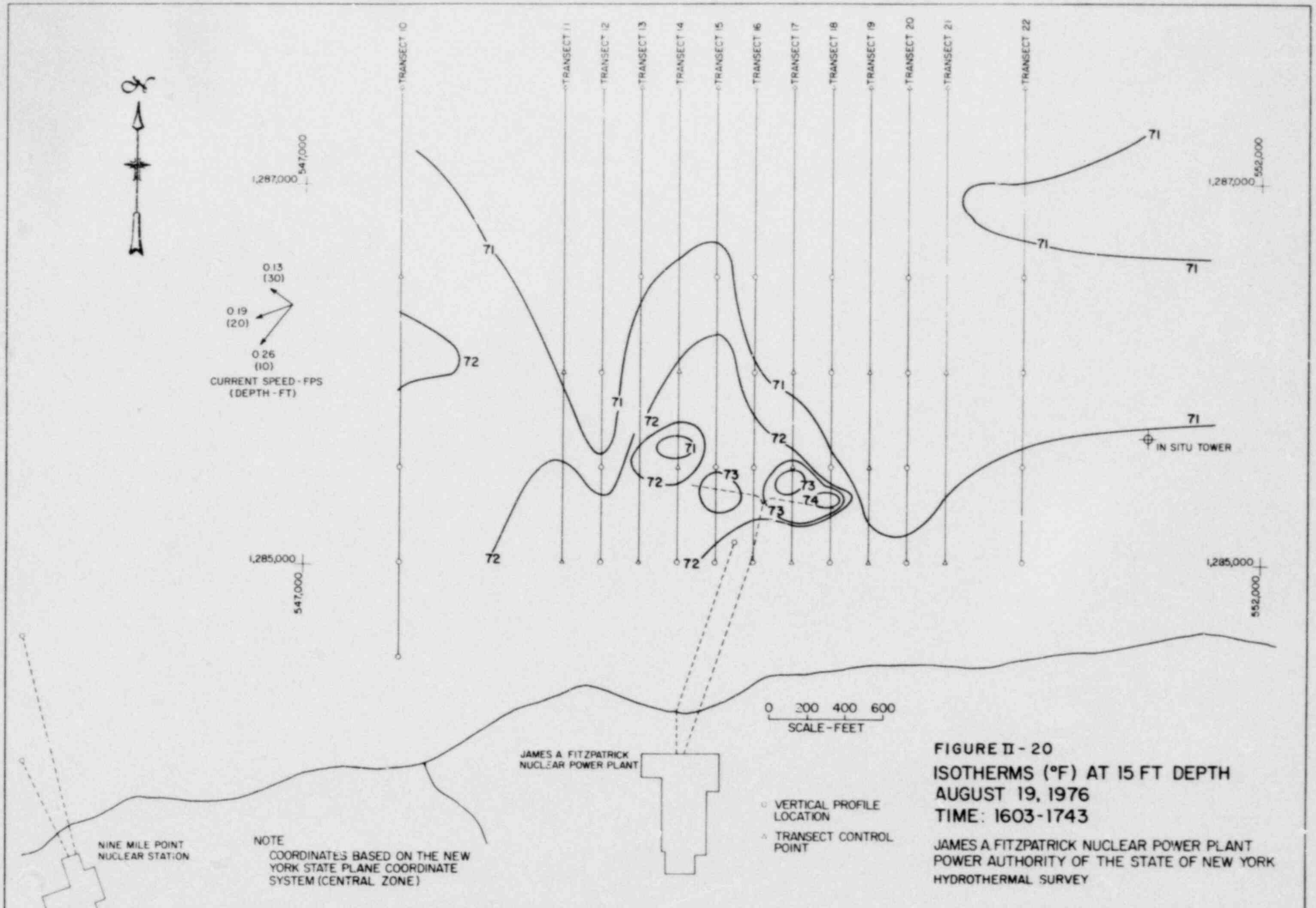
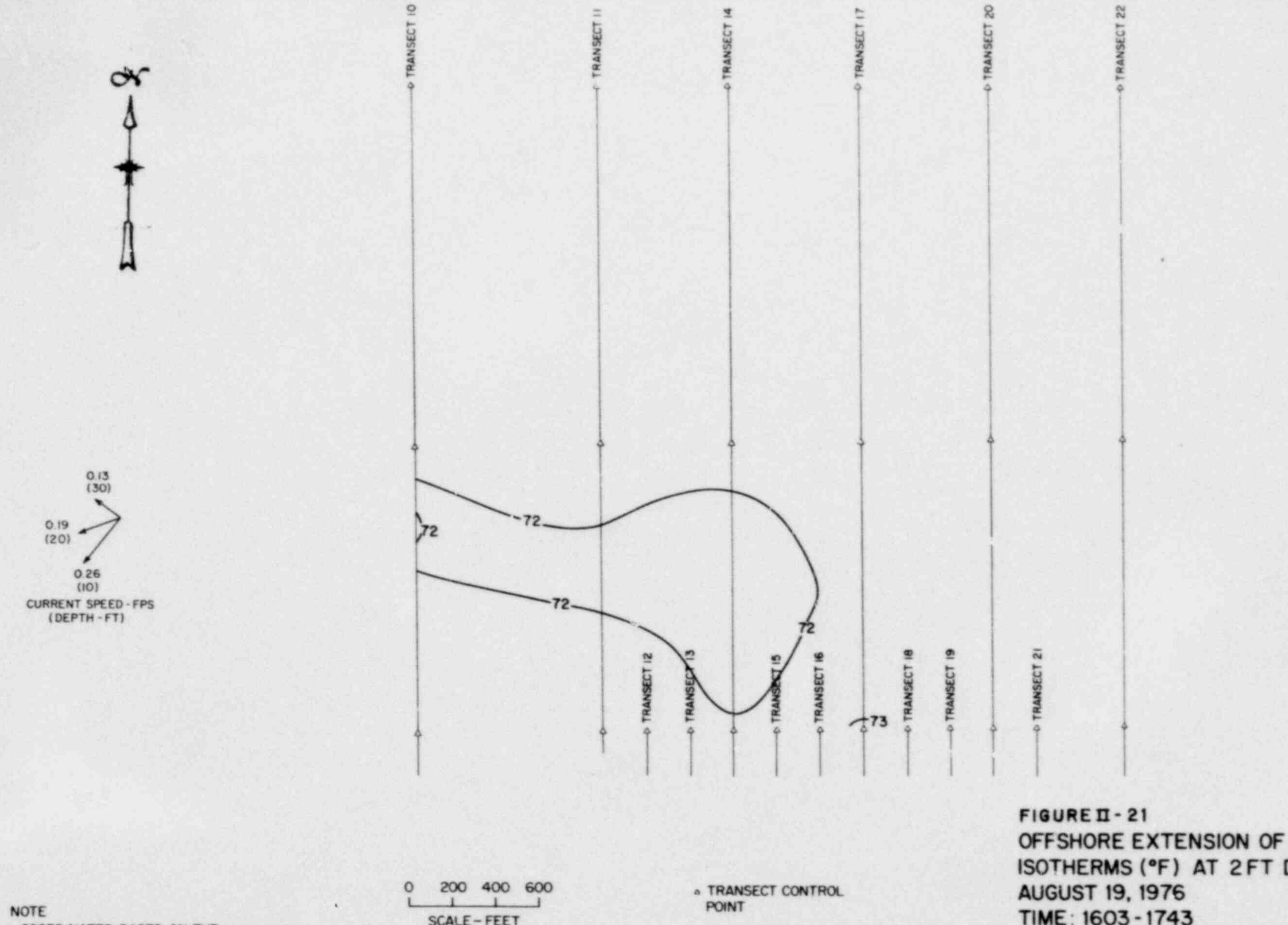


FIGURE II - 20
ISOTHERMS (°F) AT 15 FT DEPTH
AUGUST 19, 1976
TIME: 1603-1743

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 21
OFFSHORE EXTENSION OF ISOTHERMS (°F) AT 2 FT DEPTH
AUGUST 19, 1976
TIME: 1603 - 1743
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

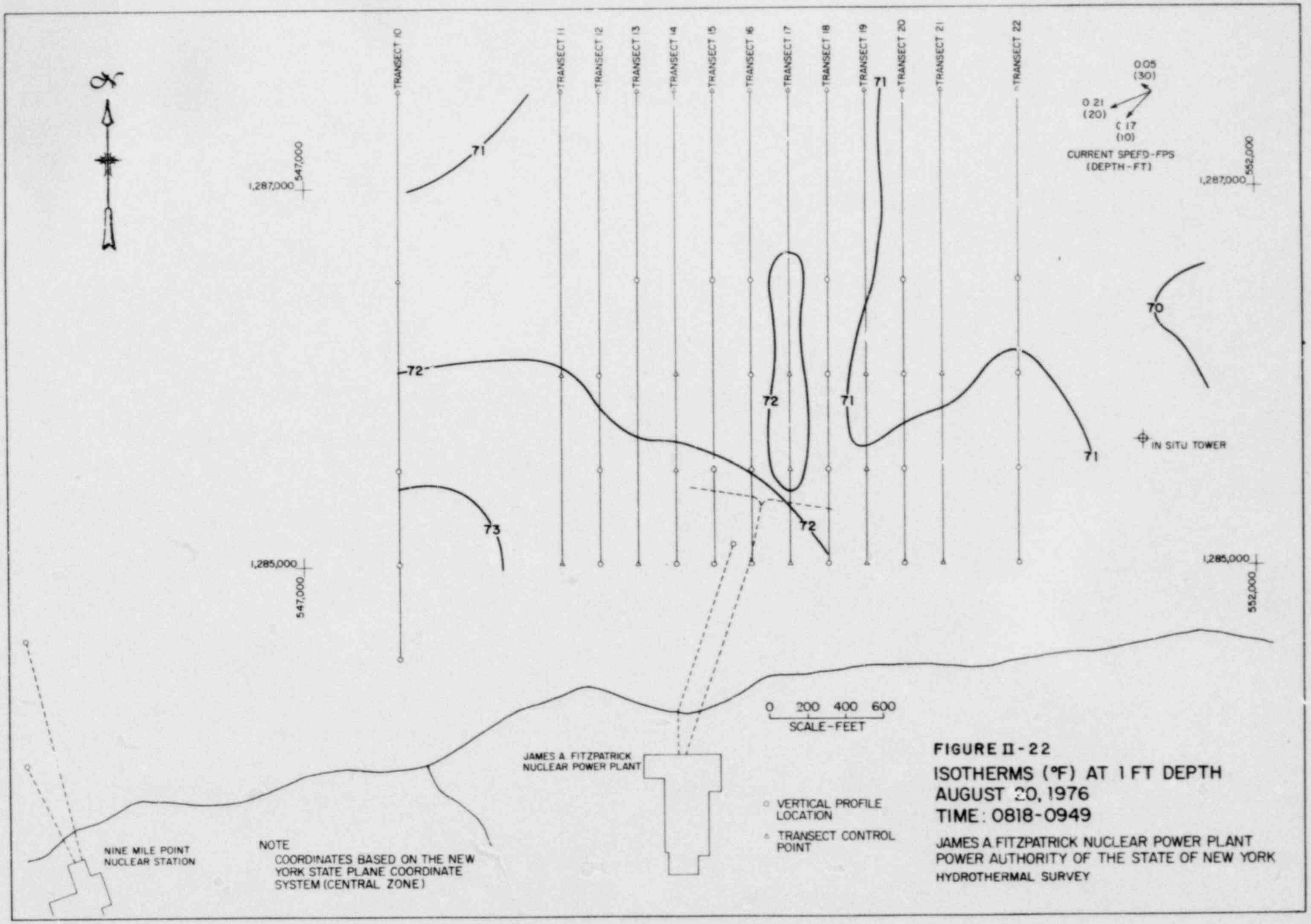


FIGURE II-22

ISOTHERMS (°F) AT 1 FT DEPTH
AUGUST 20, 1976
TIME: 0818-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

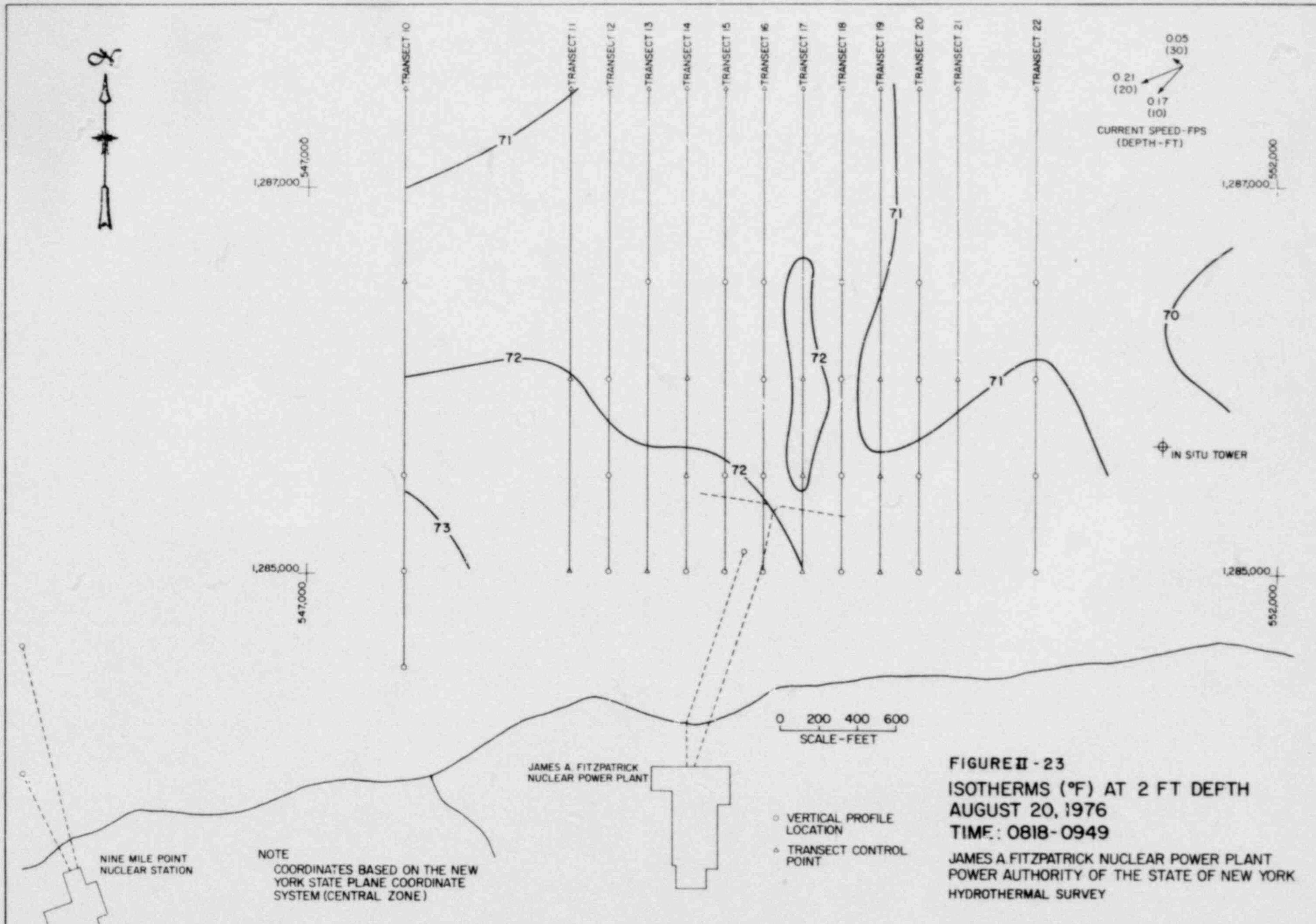


FIGURE II - 23

ISOTHERMS (°F) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 0818-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

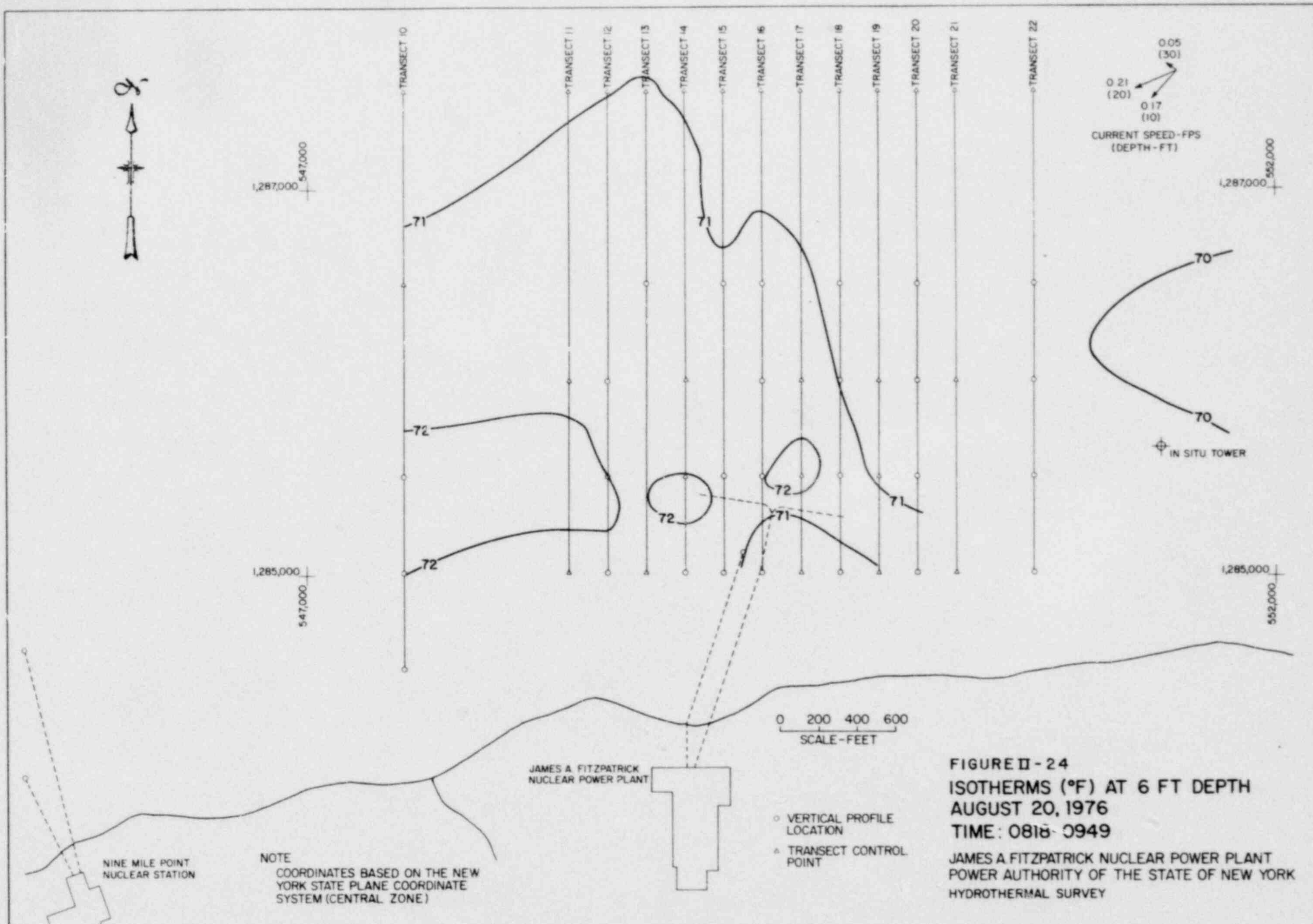


FIGURE II - 24
ISOTHERMS (°F) AT 6 FT DEPTH
AUGUST 20, 1976
TIME: 0818- 0949

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

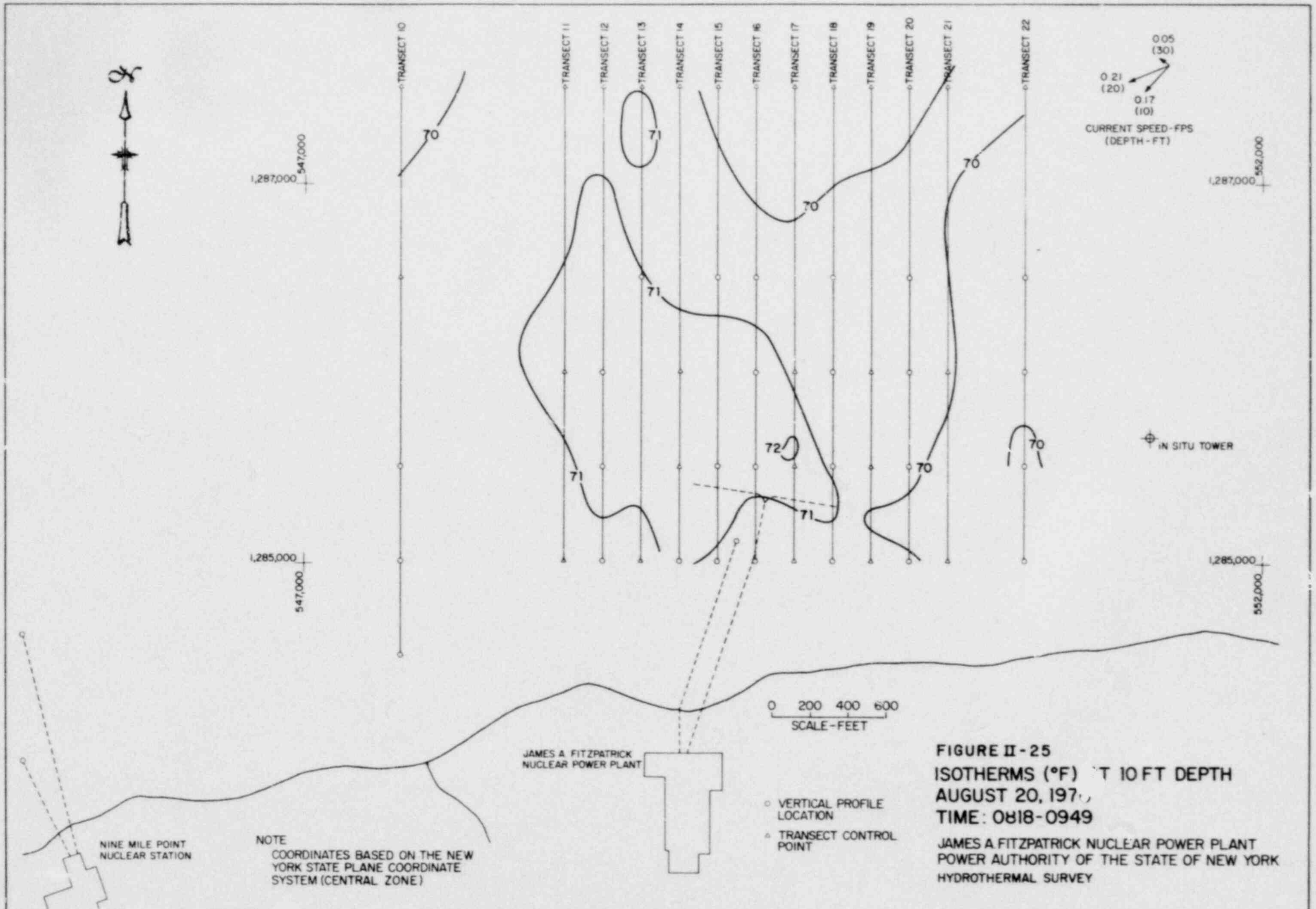


FIGURE II-25

ISOTHERMS (°F) AT 10 FT DEPTH
AUGUST 20, 197[illegible]
TIME: 0818-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

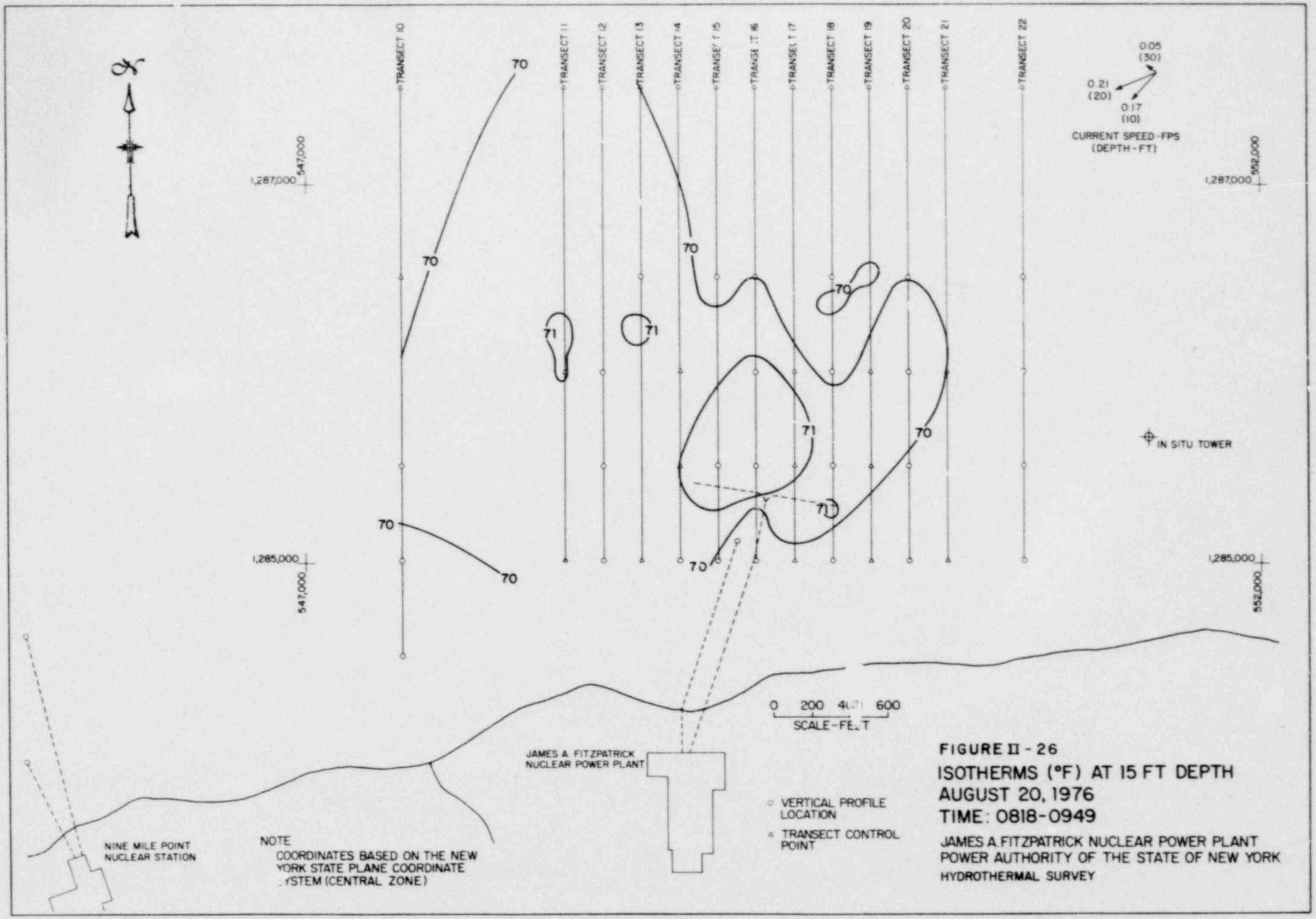


FIGURE II - 26

ISOTHERMS (°F) AT 15 FT DEPTH
AUGUST 20, 1976
TIME: 0818-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

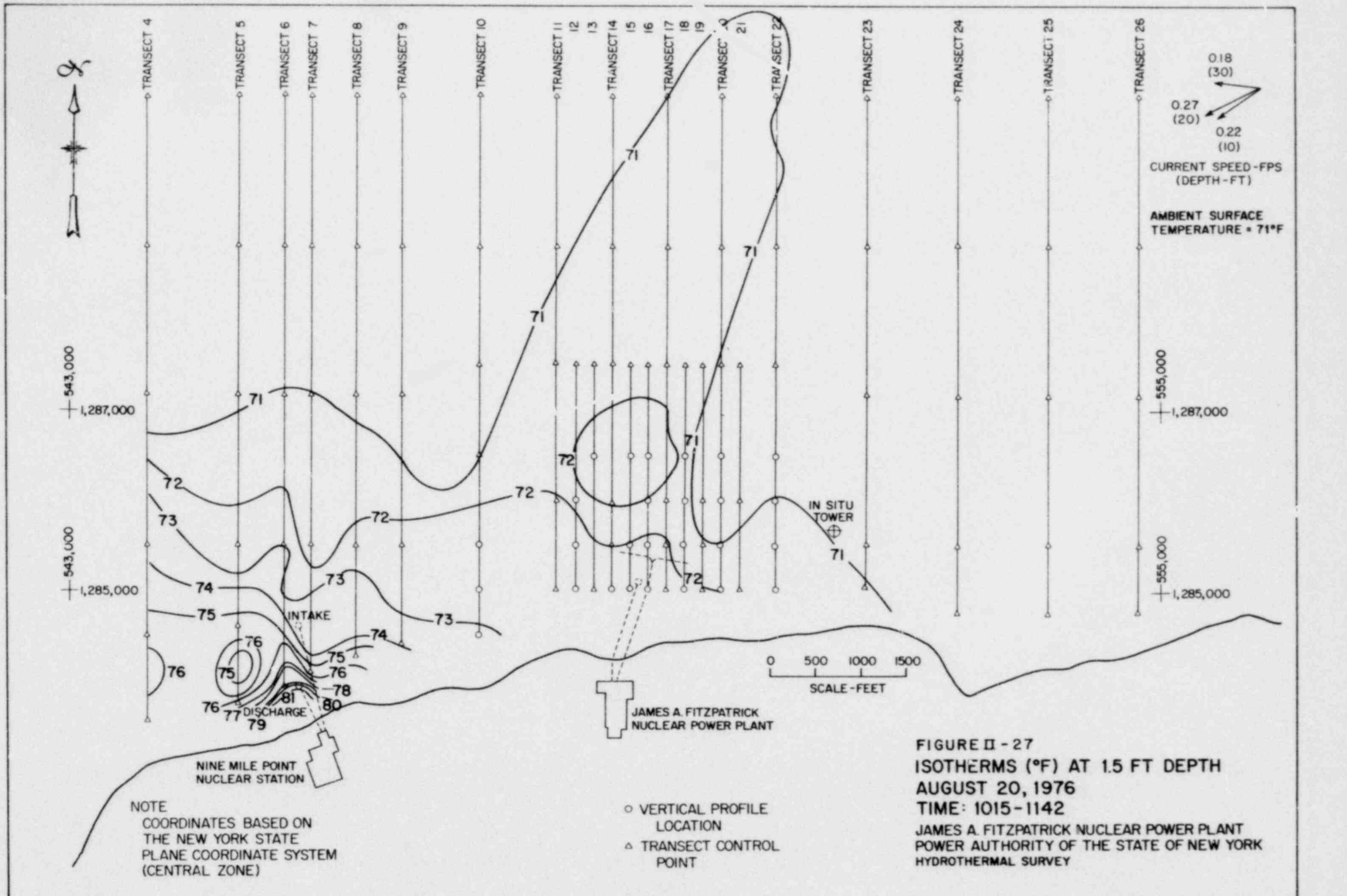


FIGURE II - 27
ISOTHERMS (°F) AT 1.5 FT DEPTH
AUGUST 20, 1976
TIME: 1015-1142
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

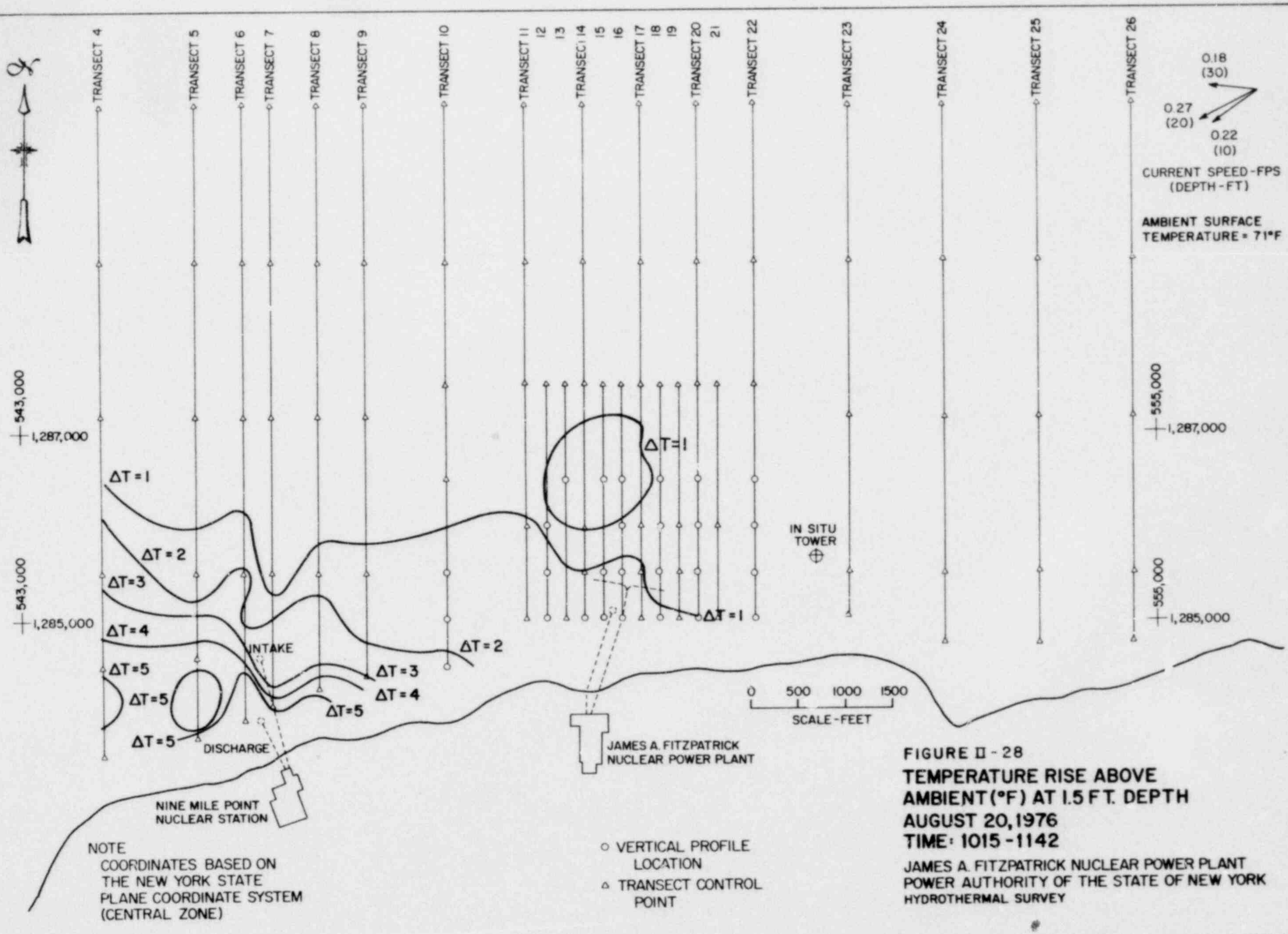


FIGURE II - 28
TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1.5 FT. DEPTH
AUGUST 20, 1976
TIME: 1015 - 1142

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

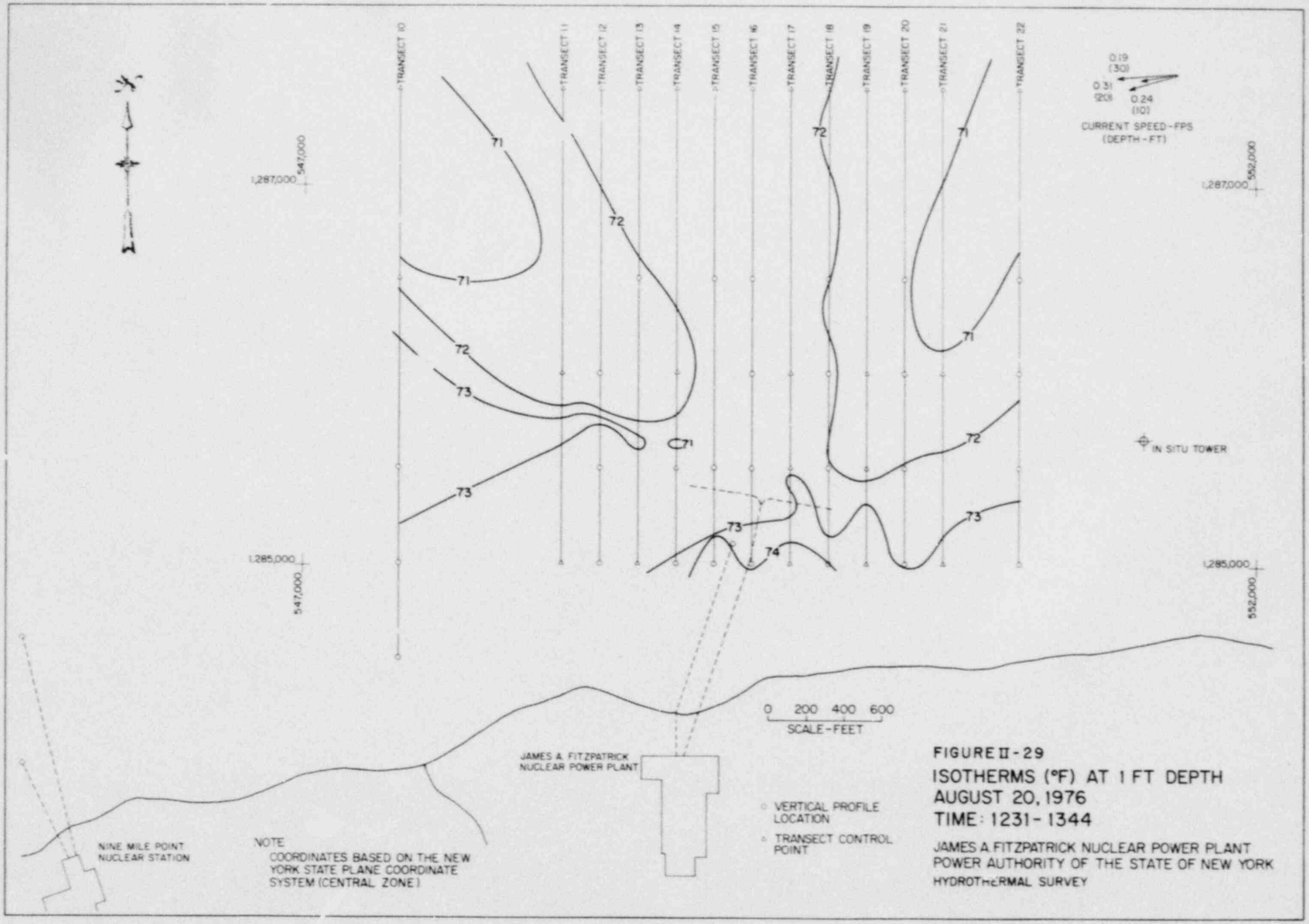
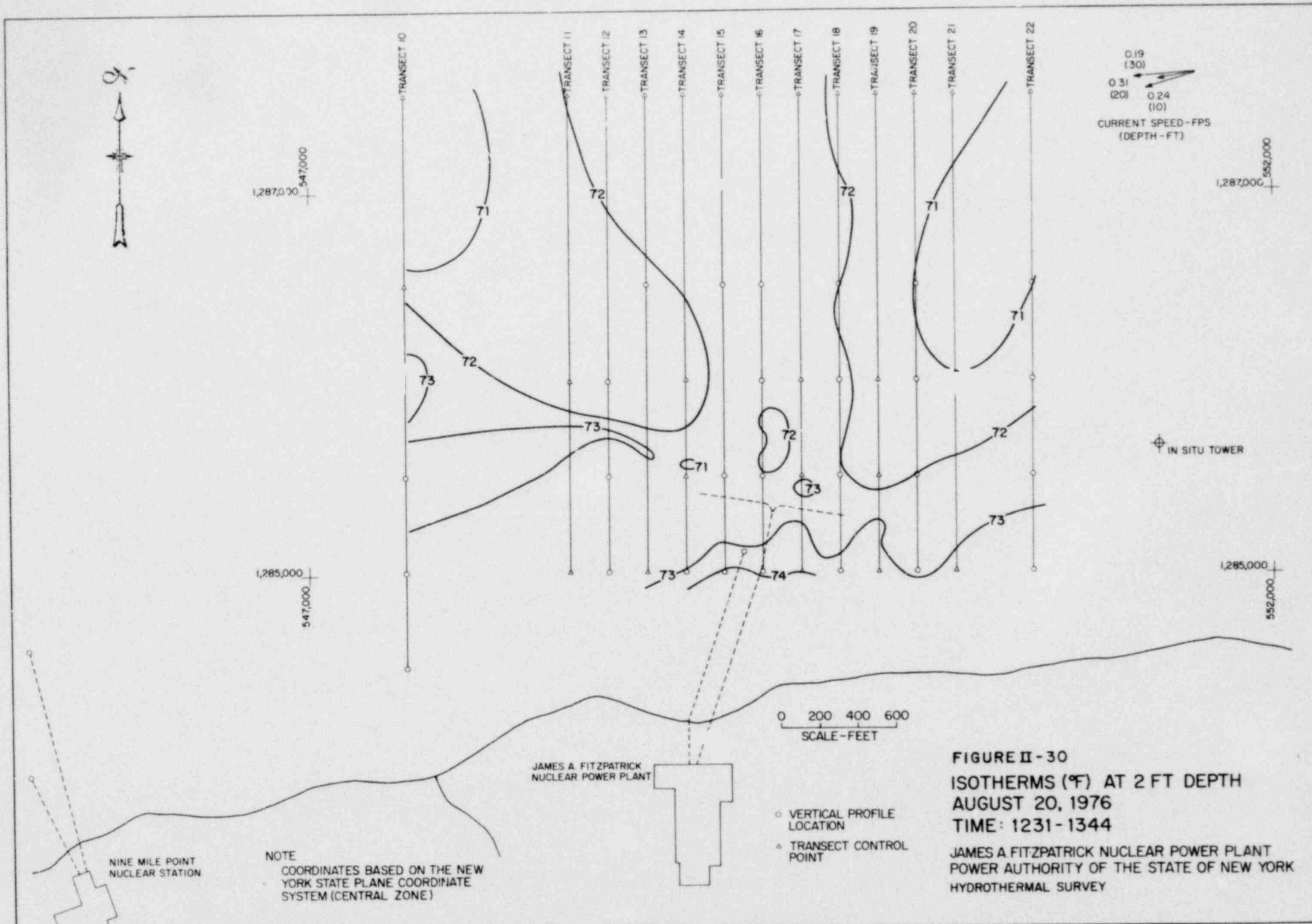


FIGURE II-29
ISOTHERMS (°F) AT 1 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II-30
ISOTHERMS (°F) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

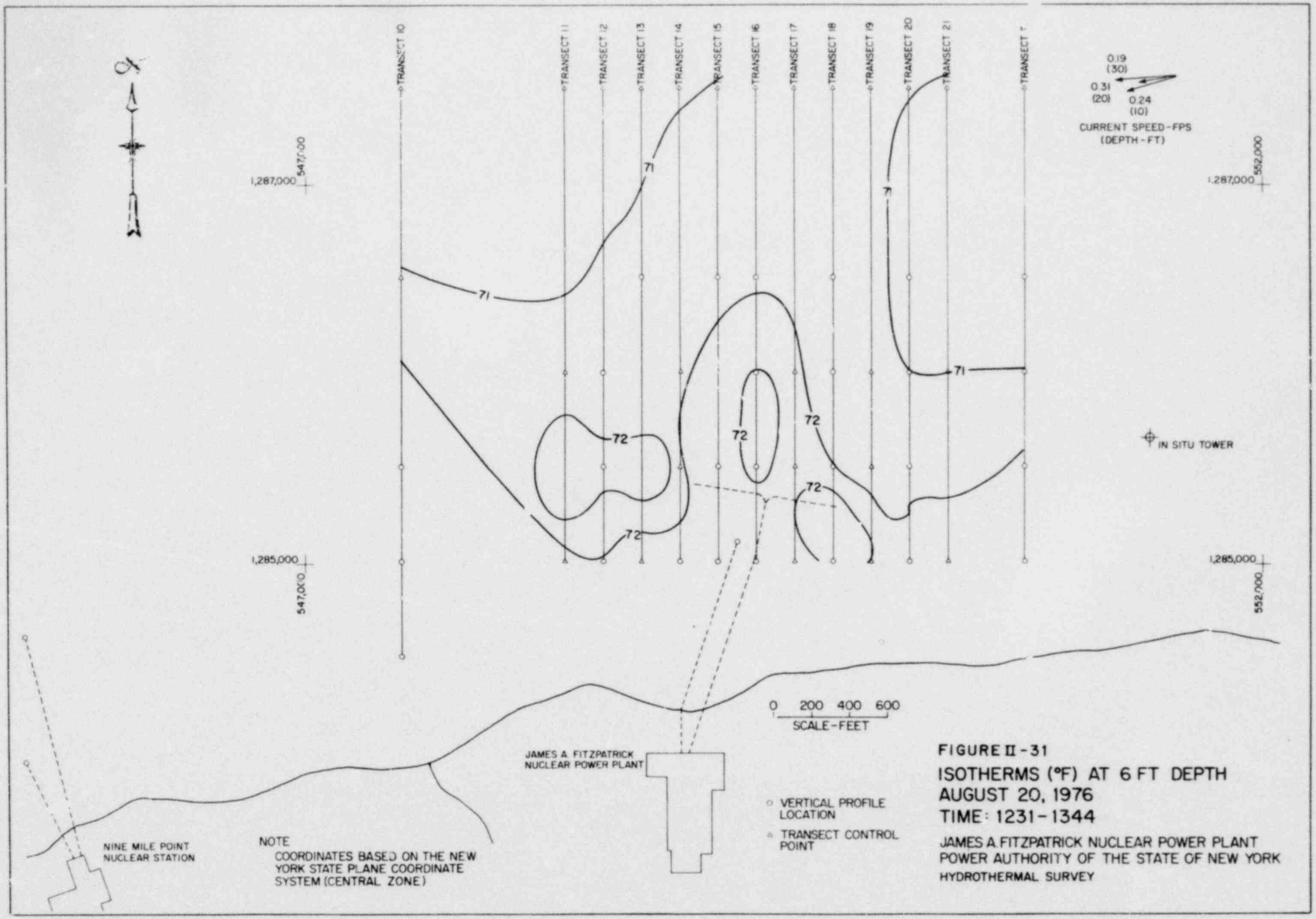


FIGURE II-31

ISOTHERMS (°F) AT 6 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

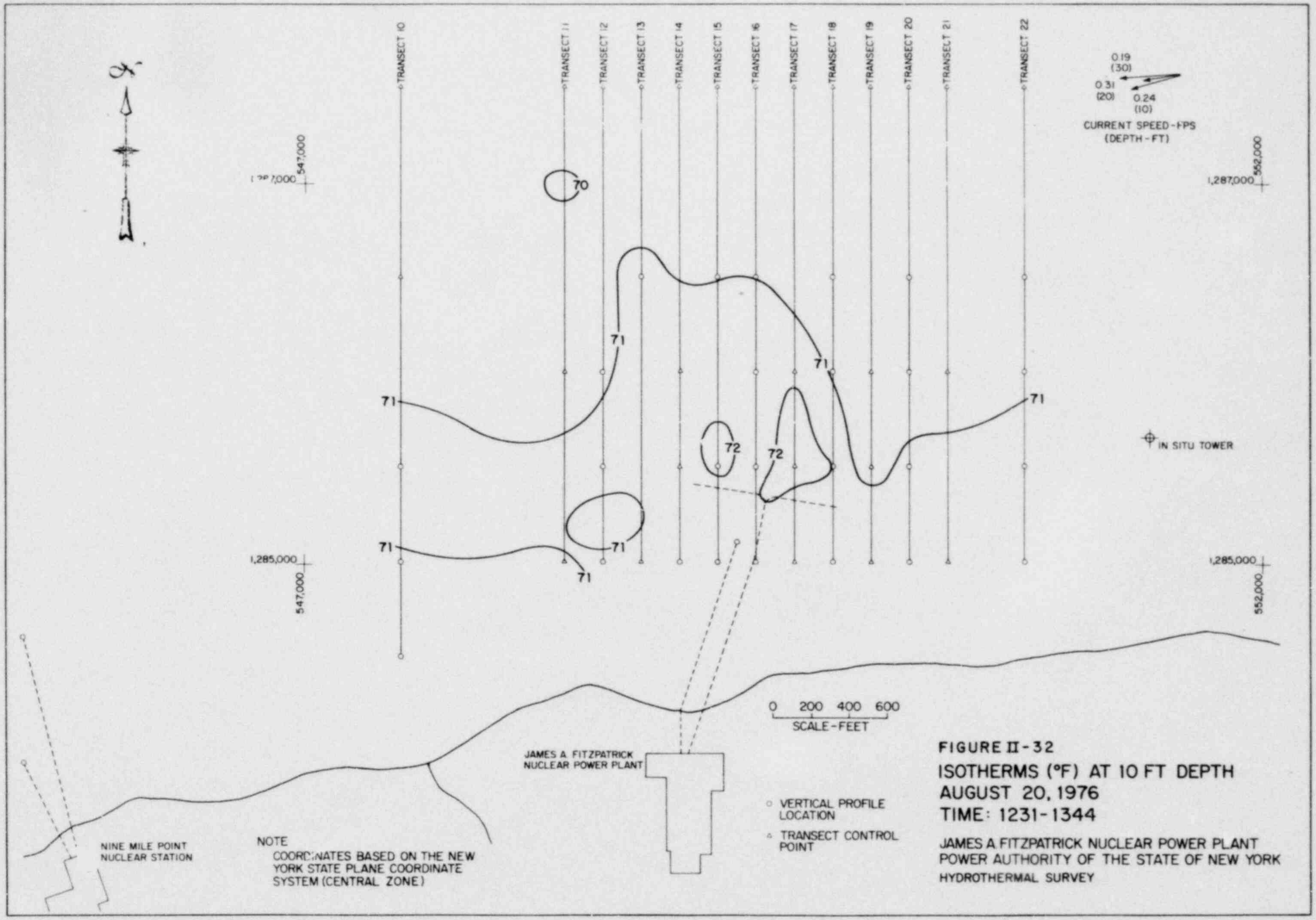


FIGURE II-32

ISOTHERMS (°F) AT 10 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

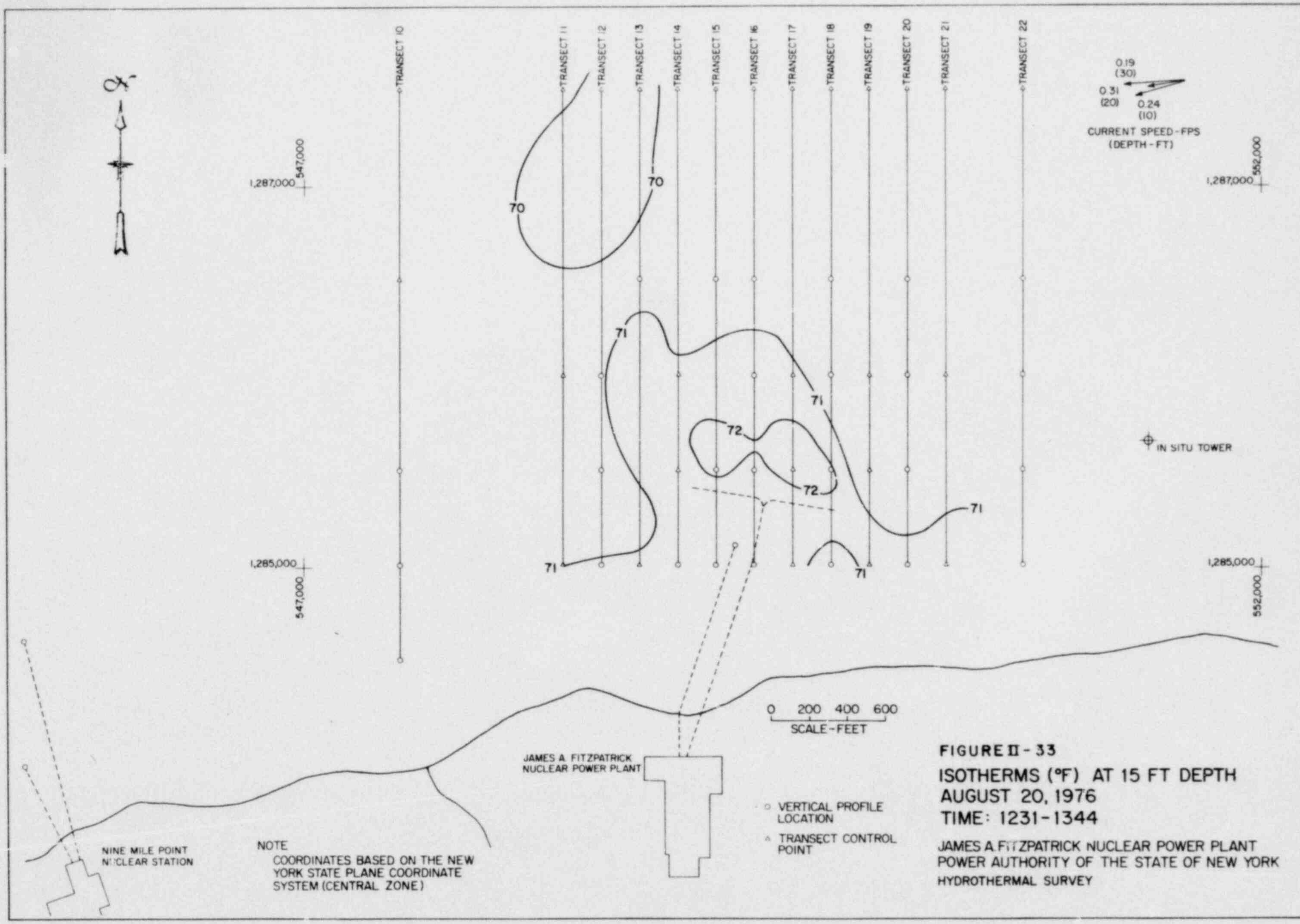


FIGURE II-33

ISOTHERMS (°F) AT 15 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

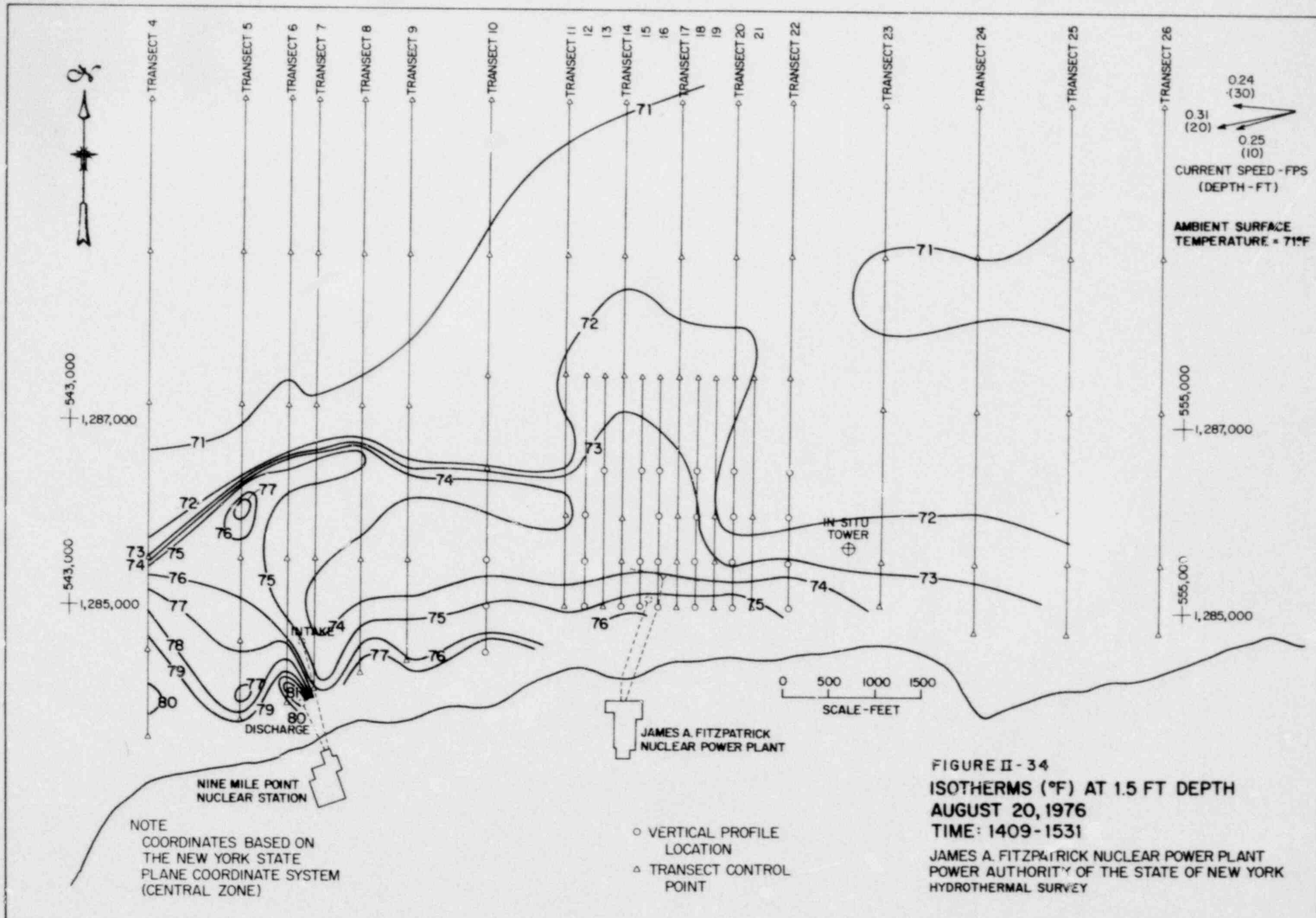


FIGURE II-34

ISOTHERMS (°F) AT 1.5 FT DEPTH
AUGUST 20, 1976
TIME: 1409-1531

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

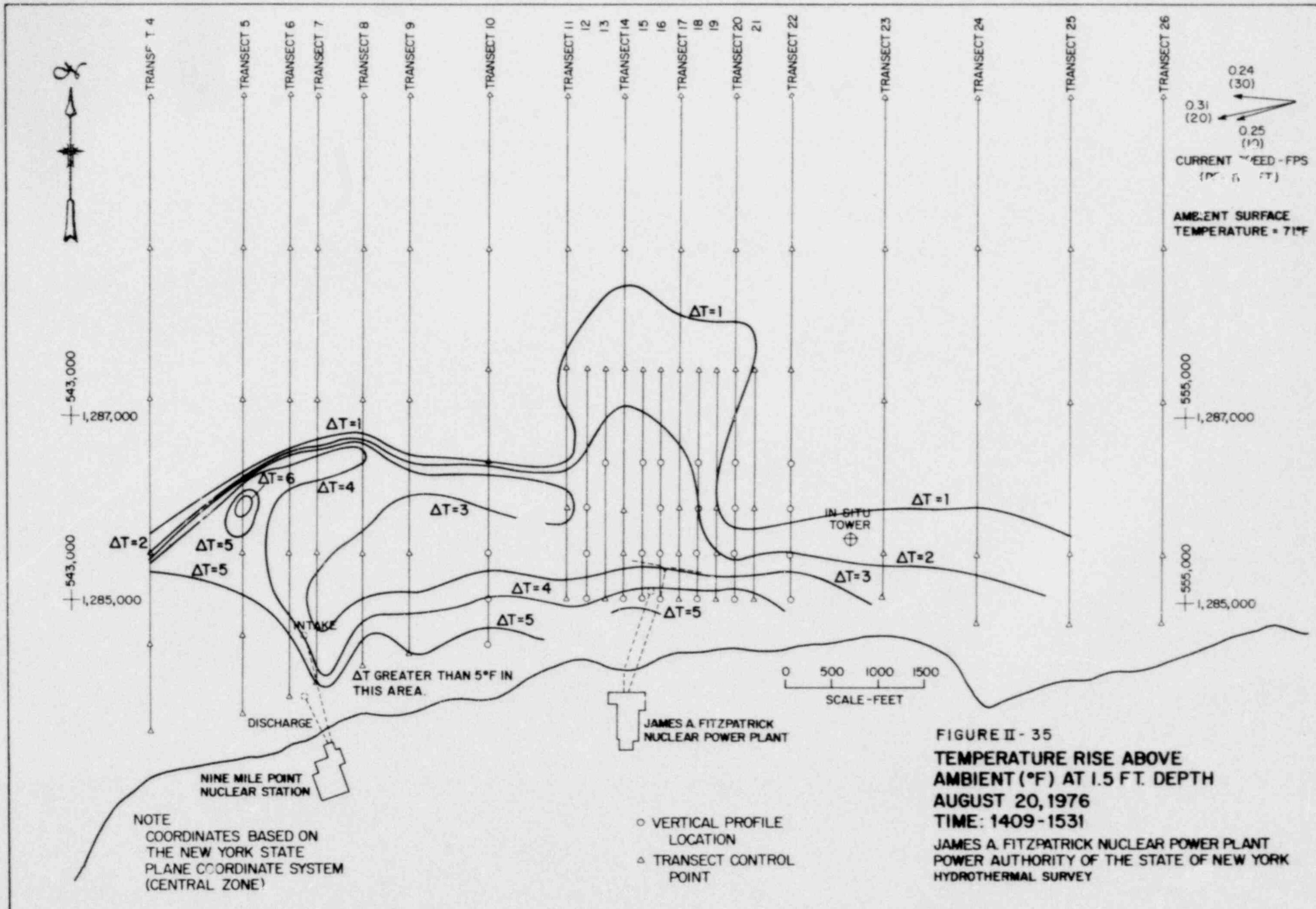


FIGURE II - 35

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1.5 FT. DEPTH
AUGUST 20, 1976
TIME: 1409-1531

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

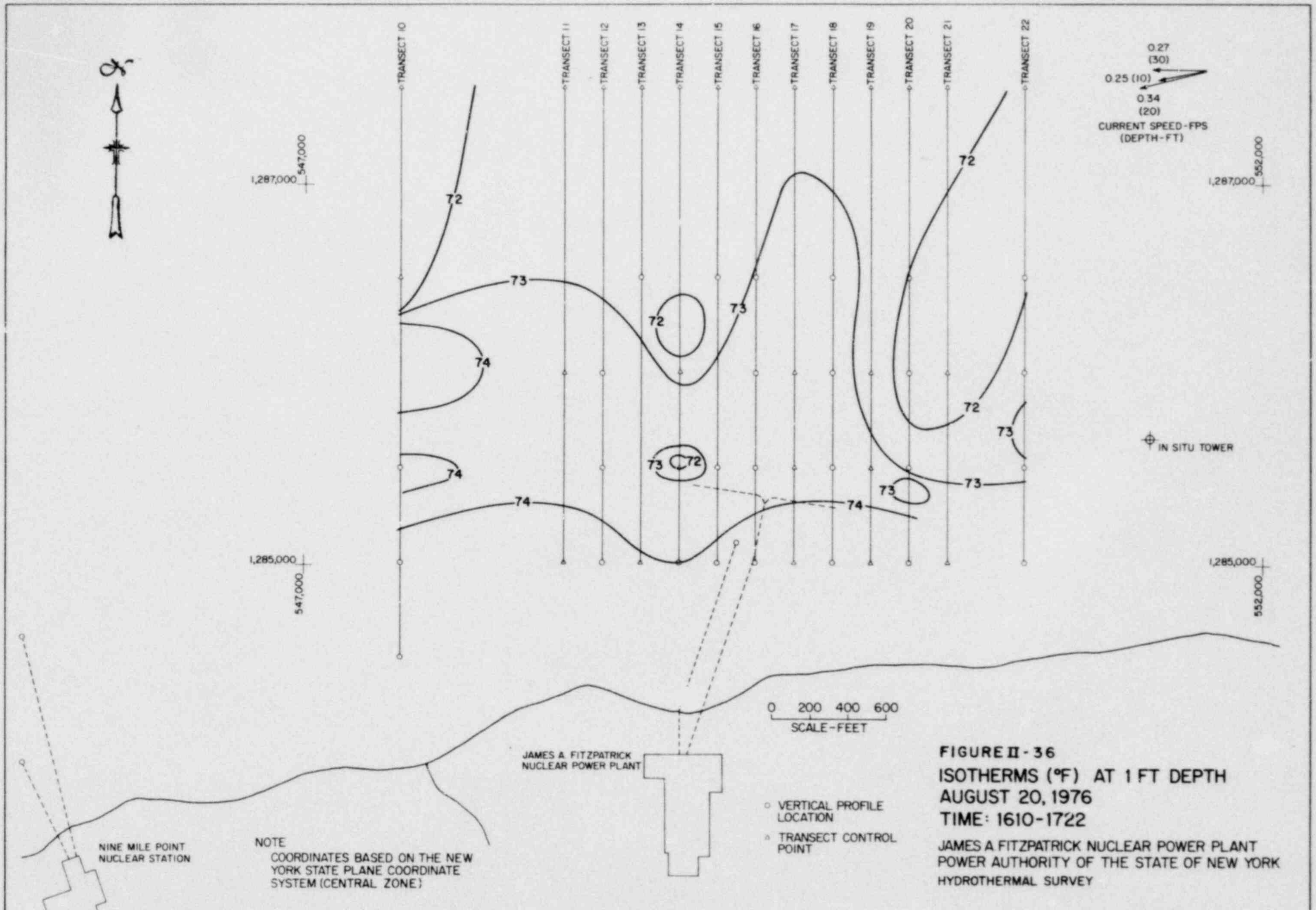


FIGURE II-36

ISOTHERMS (°F) AT 1 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

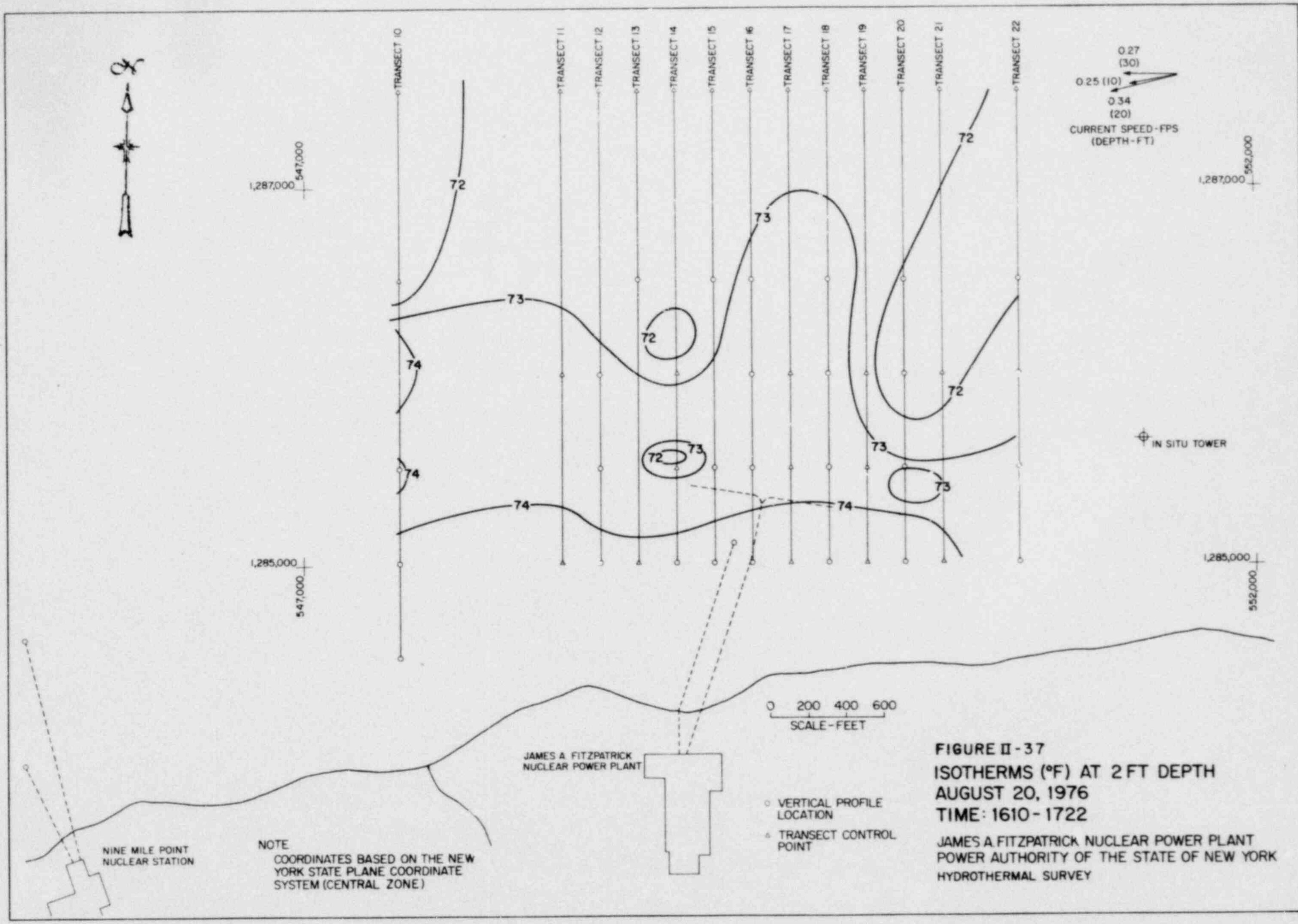


FIGURE II-37
ISOTHERMS (°F) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

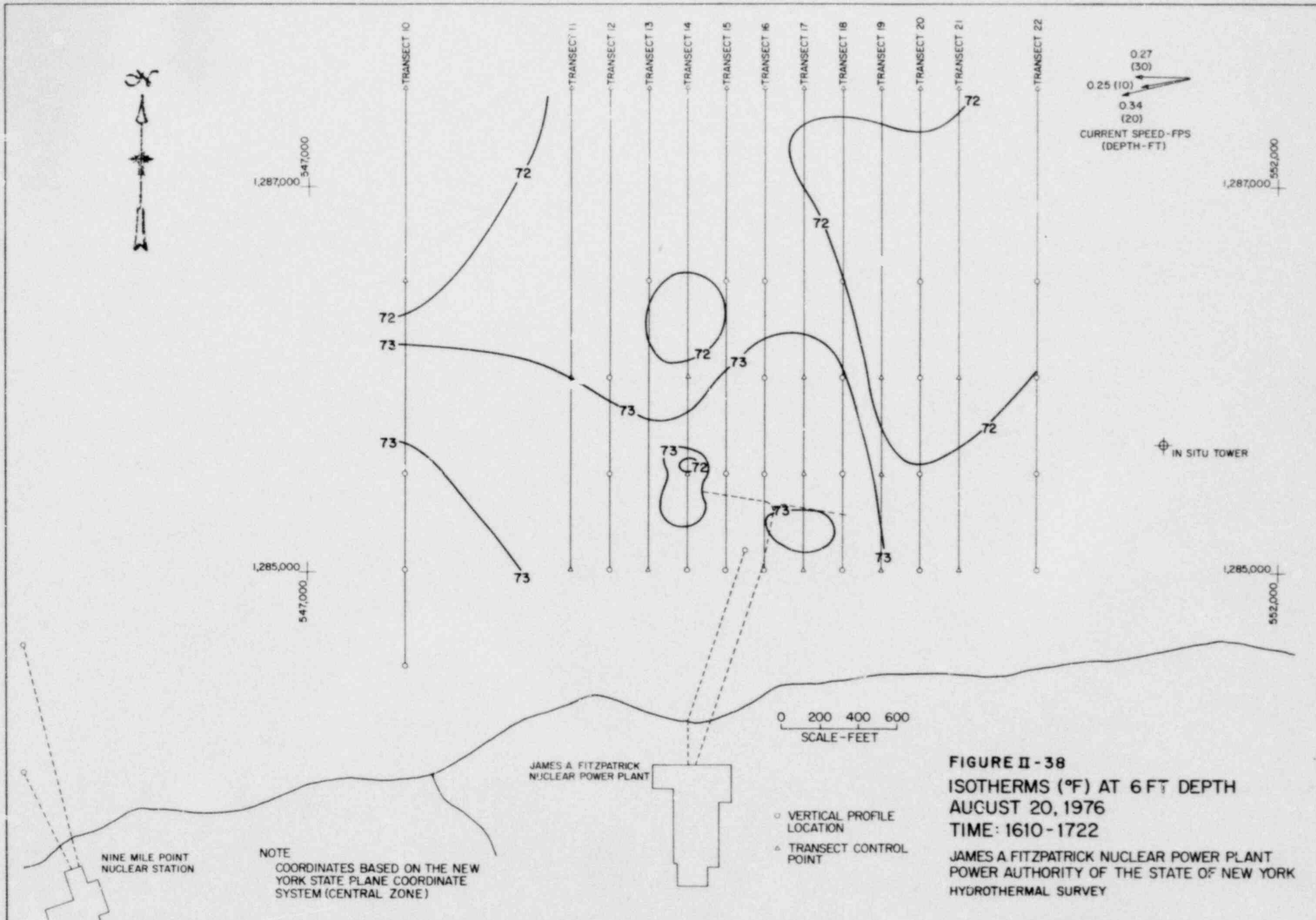


FIGURE II-38

ISOTHERMS (°F) AT 6 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

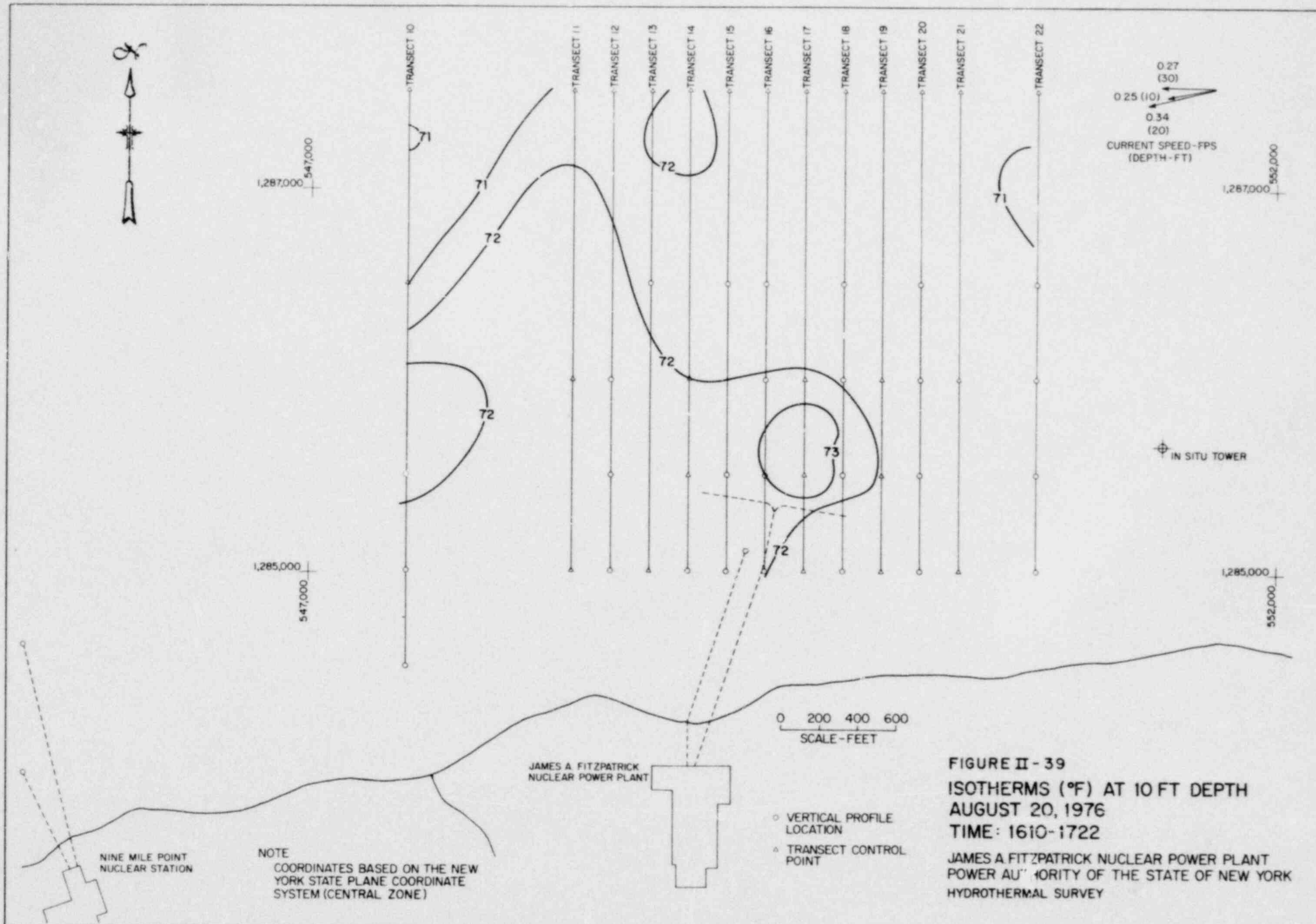


FIGURE II - 39

ISOTHERMS (°F) AT 10 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AU'' HORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

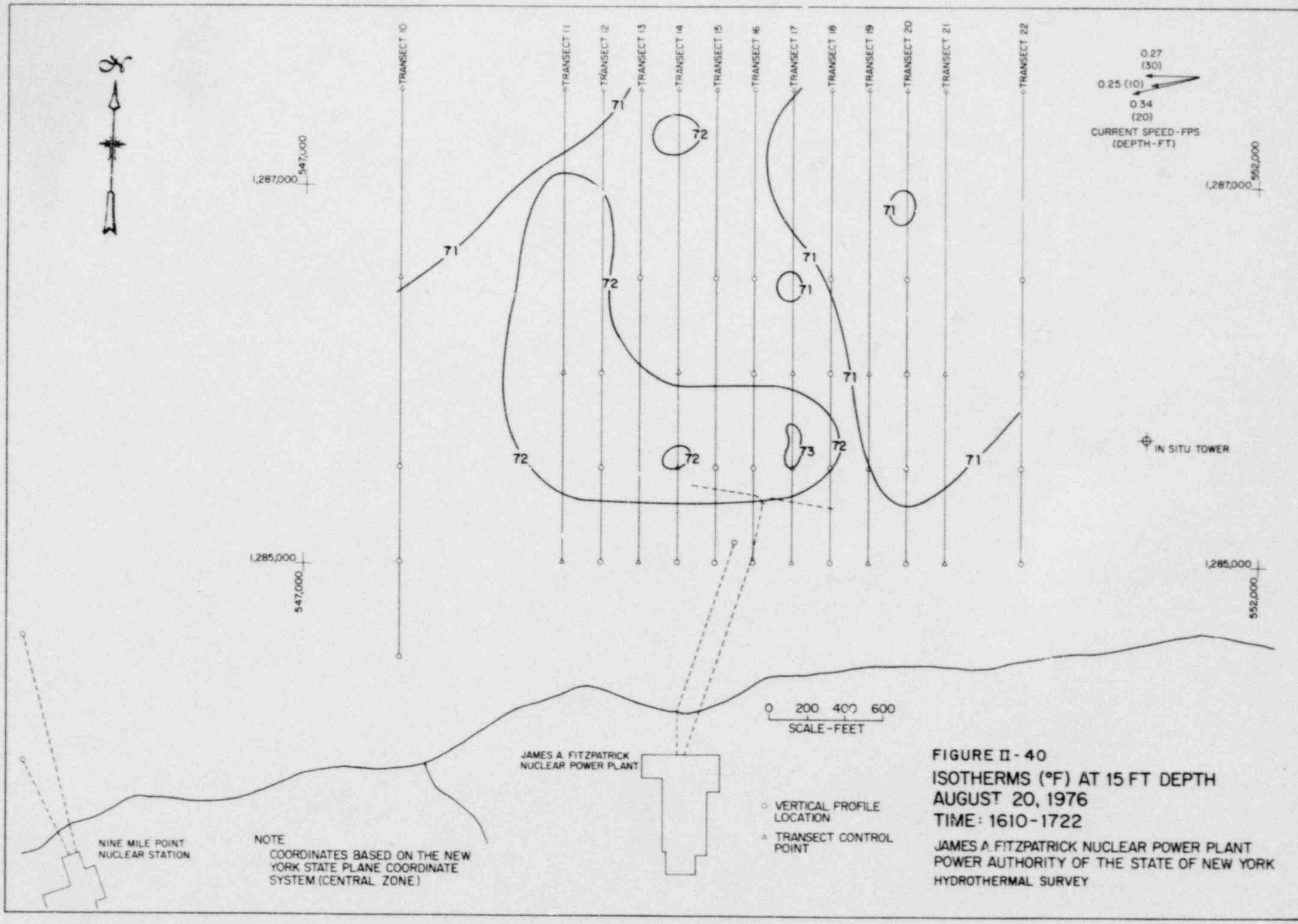
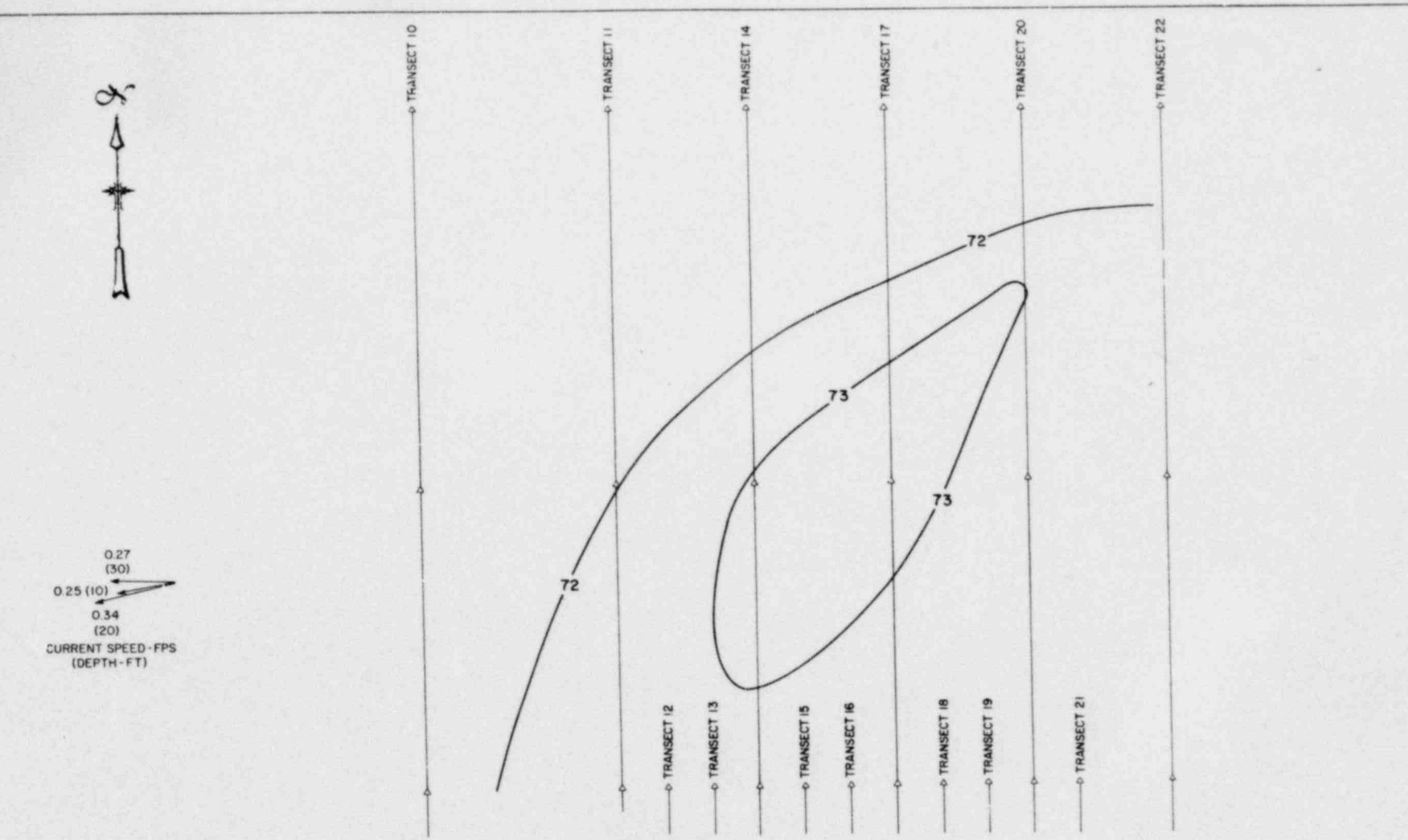


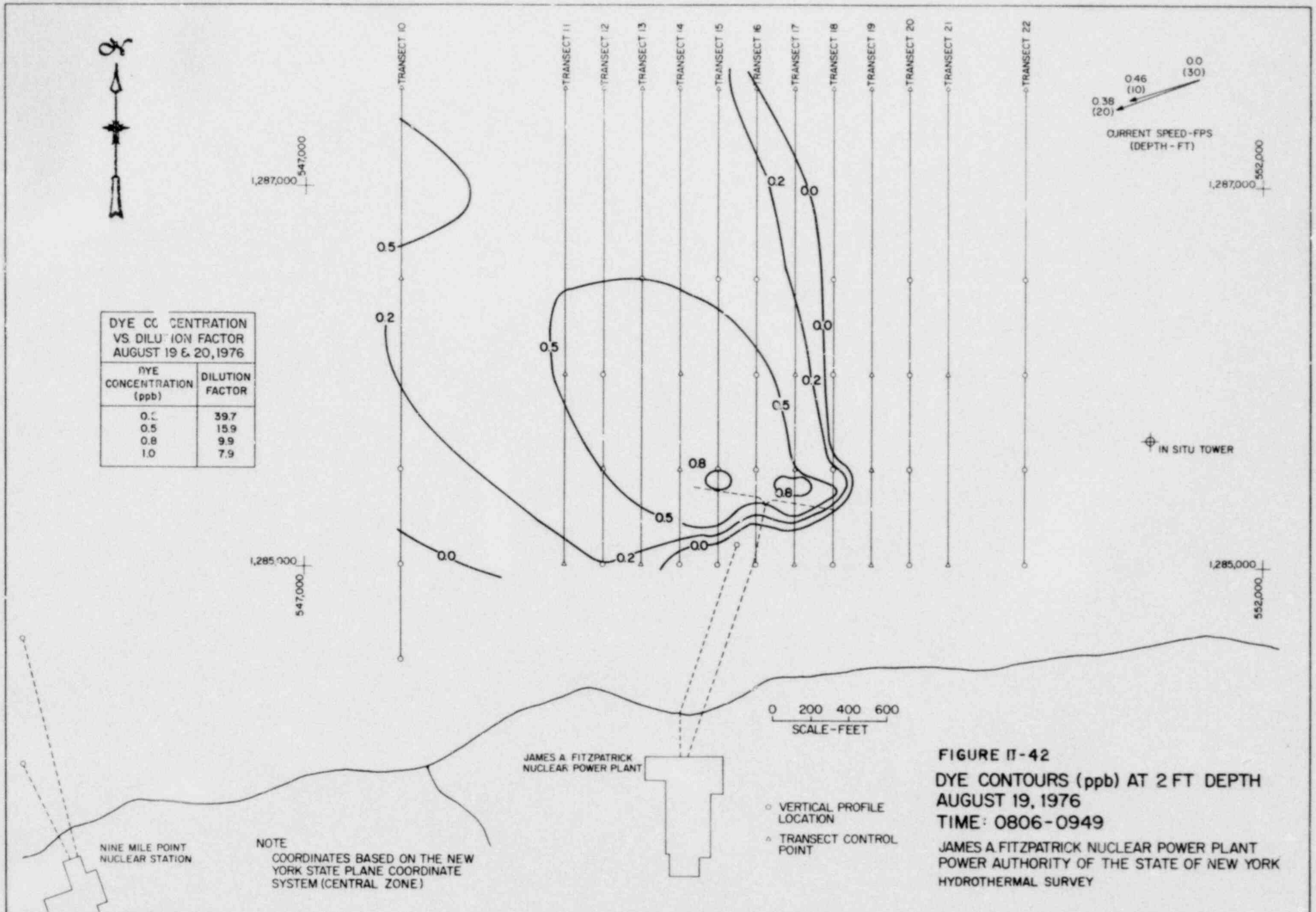
FIGURE II-40
ISOTHERMS (°F) AT 15 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II-41
OFFSHORE EXTENSION OF ISOTHERMS (°F) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



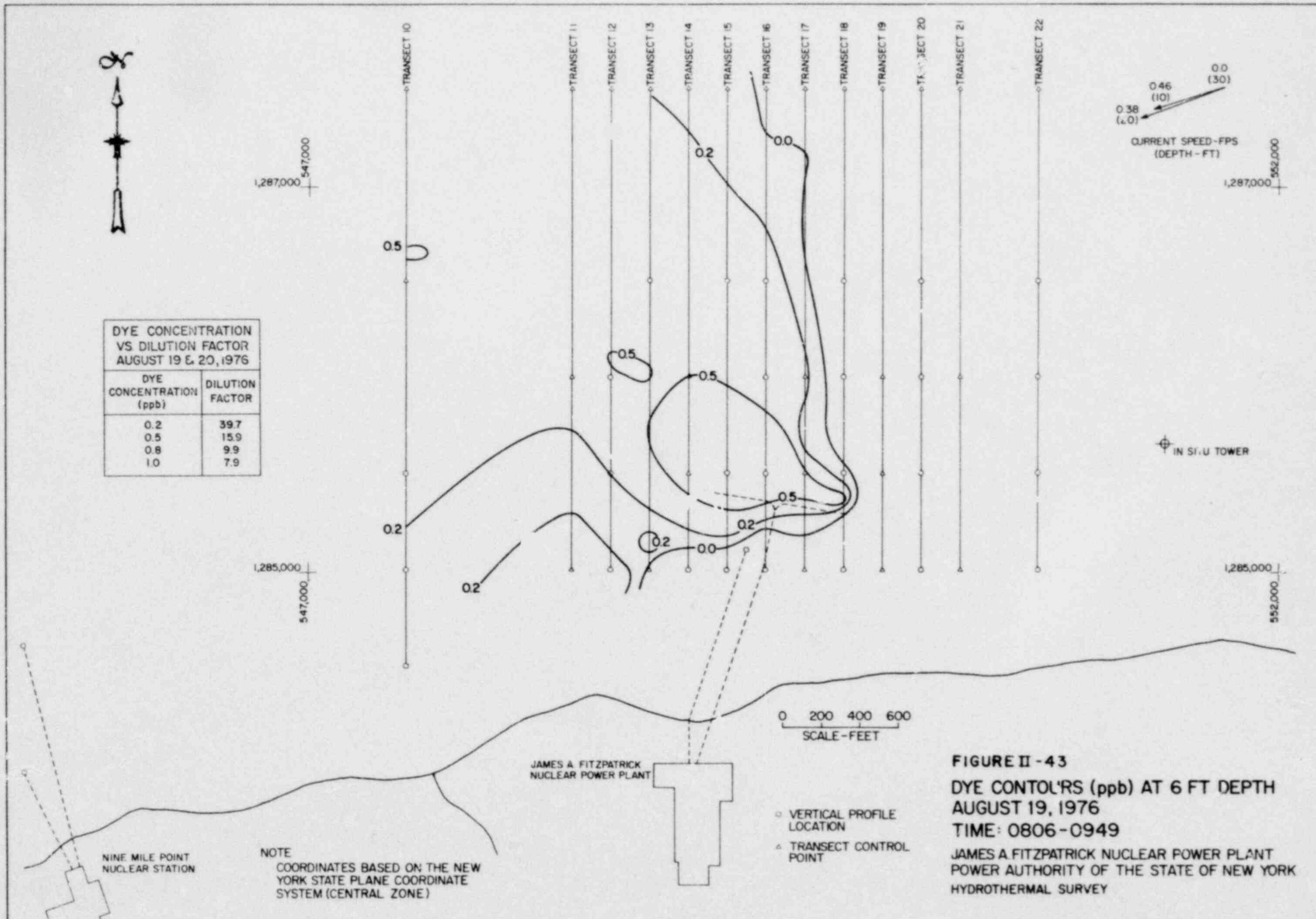
DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II-42
DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



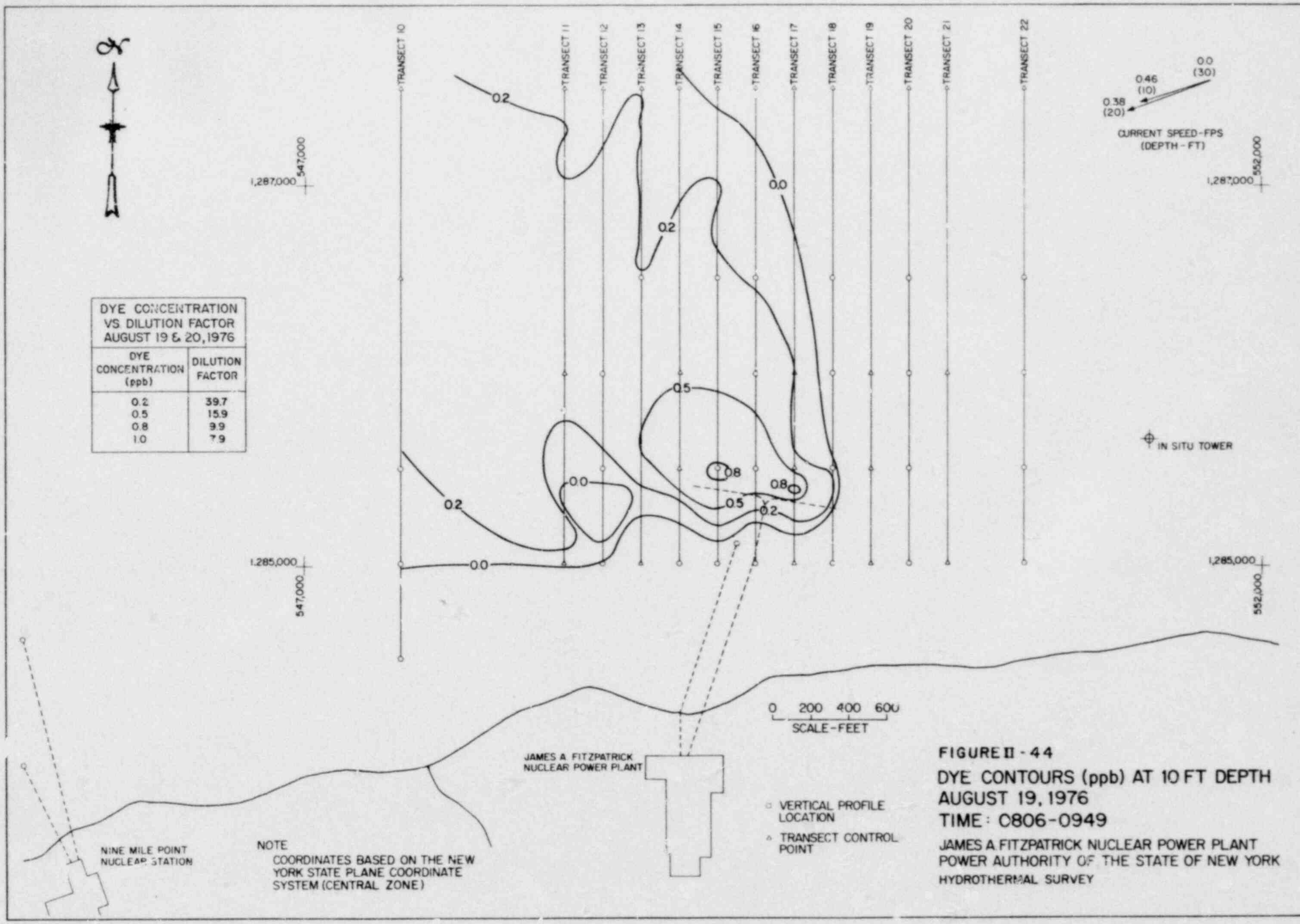
DYE CONCENTRATION VS DILUTION FACTOR AUGUST 19 & 20, 1976	
DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II-43

DYE CONTOURS (ppb) AT 6 FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



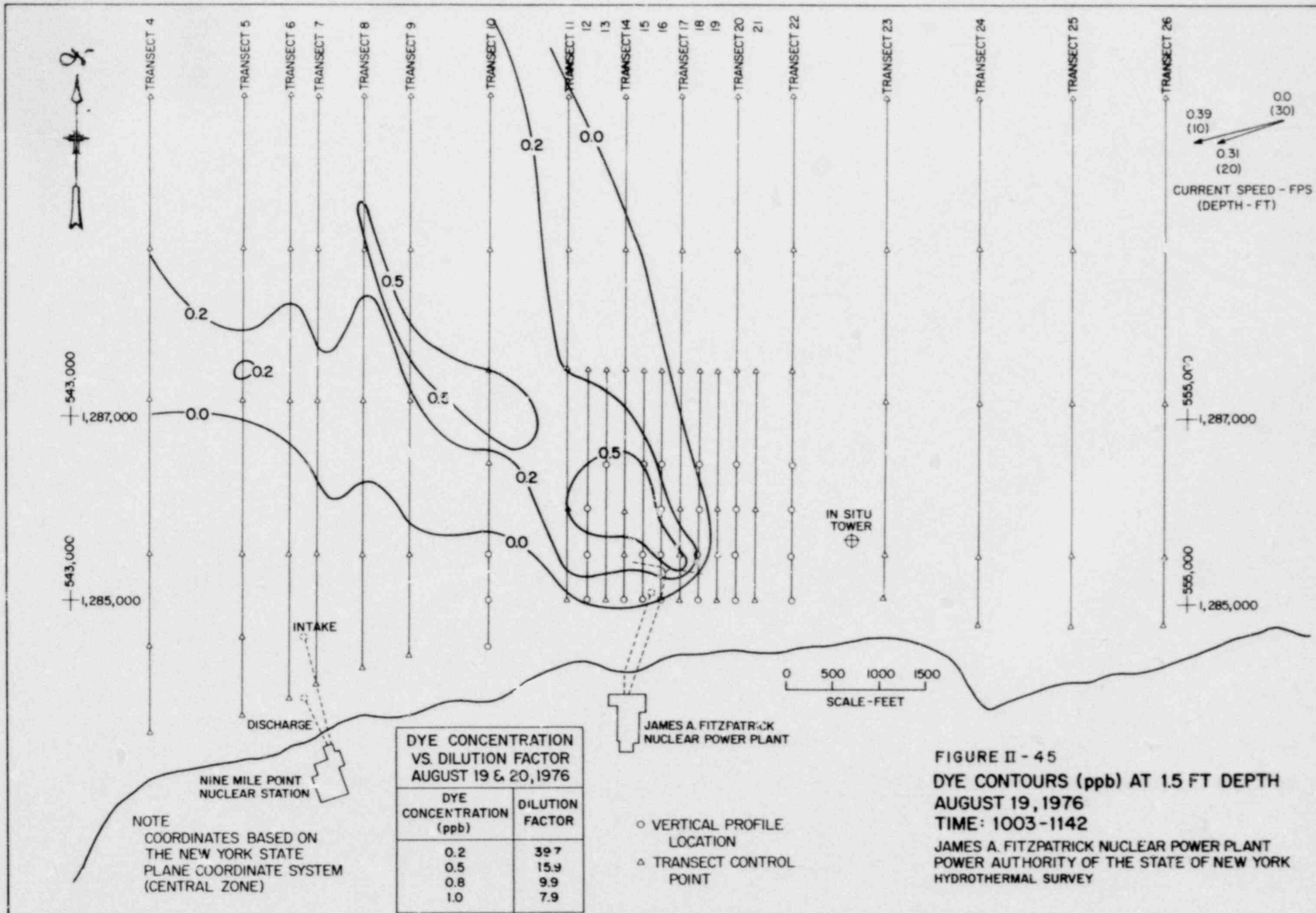
DYE CONCENTRATION VS DILUTION FACTOR AUGUST 19 & 20, 1976	
DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 44

DYE CONTOURS (ppb) AT 10 FT DEPTH
AUGUST 19, 1976
TIME: 0806-0949

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

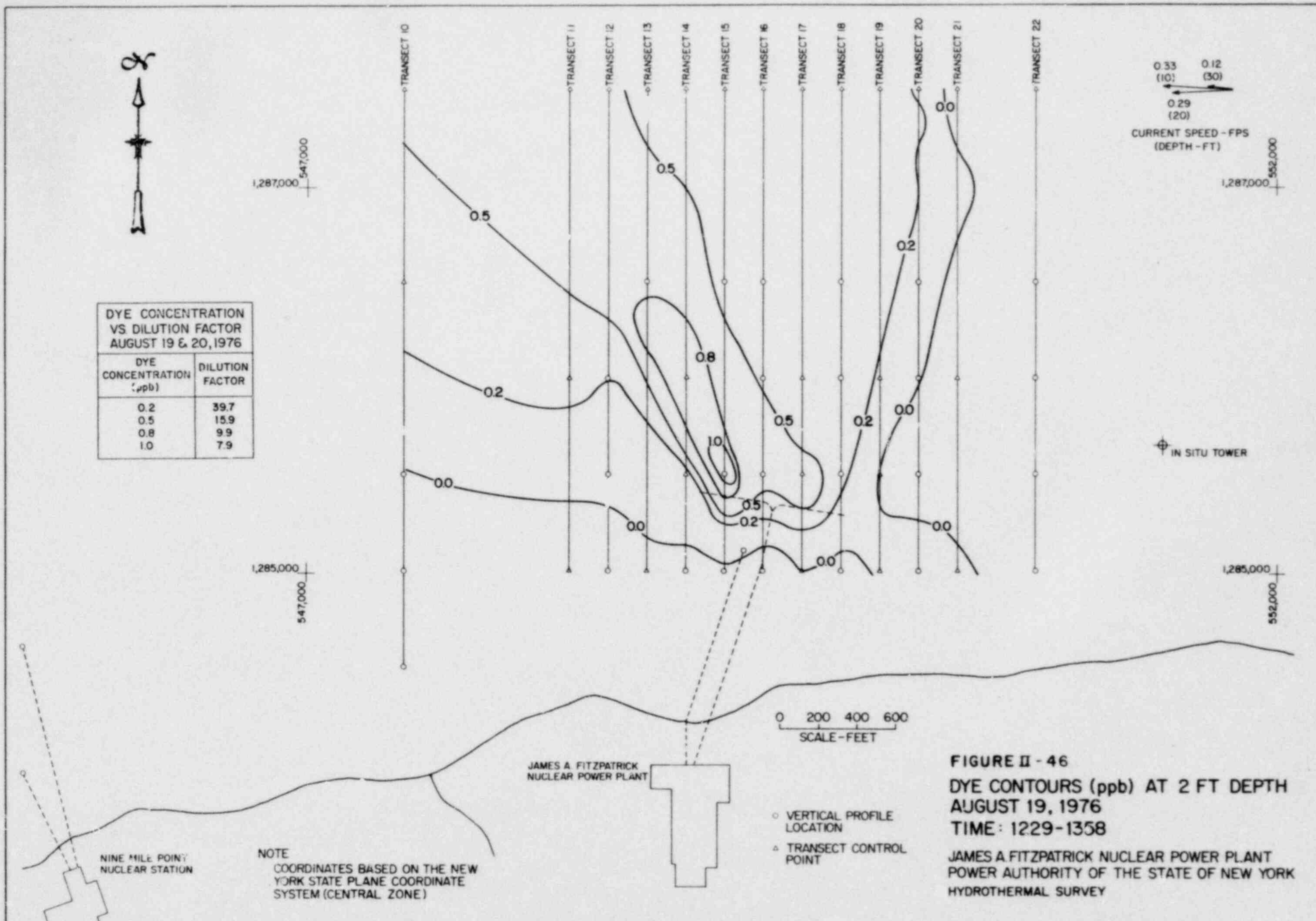


DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976	
DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

○ VERTICAL PROFILE LOCATION
△ TRANSECT CONTROL POINT

FIGURE II - 45
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
AUGUST 19, 1976
TIME: 1003-1142
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 46

DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 19, 1976
TIME: 1229-1358

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

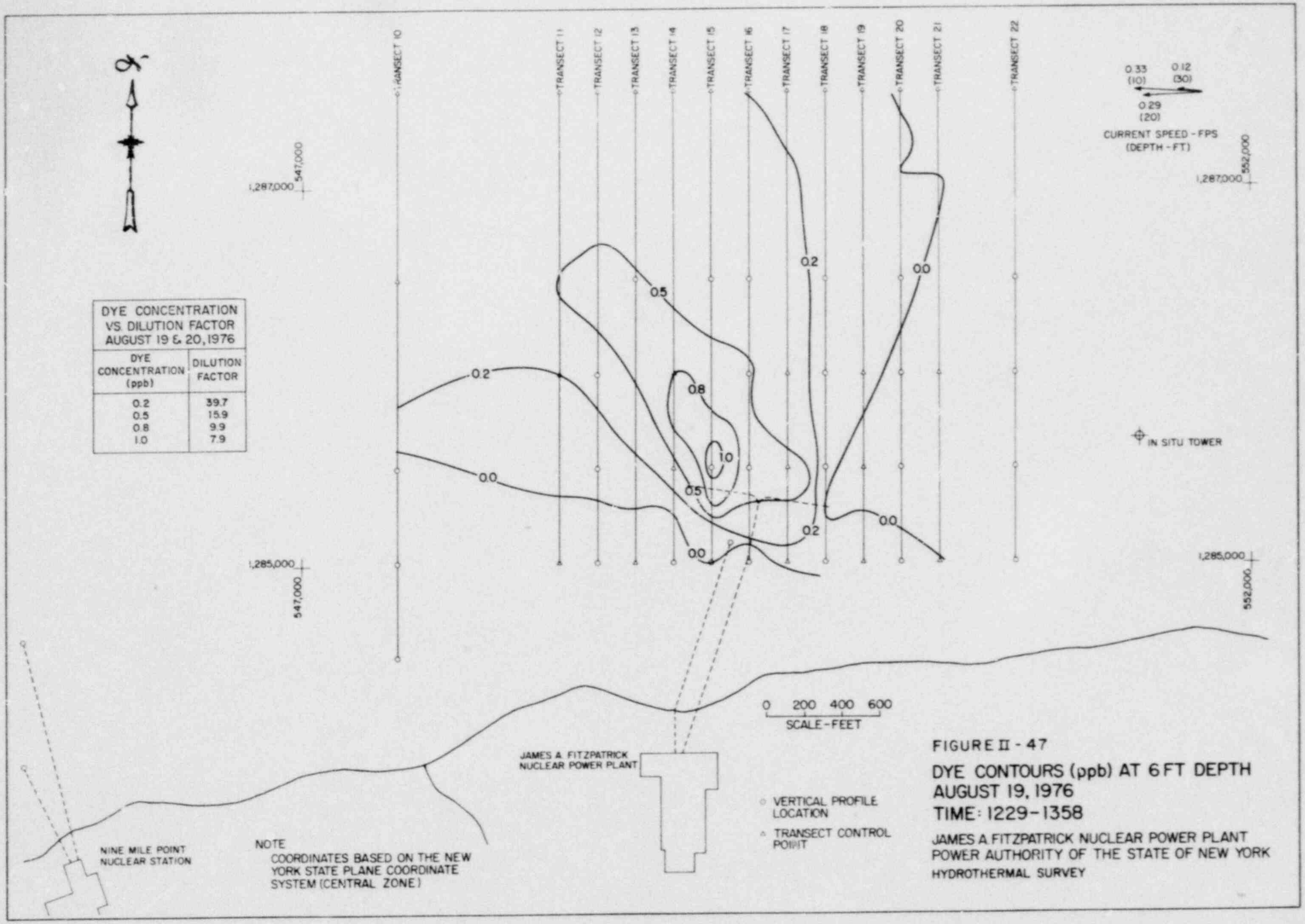
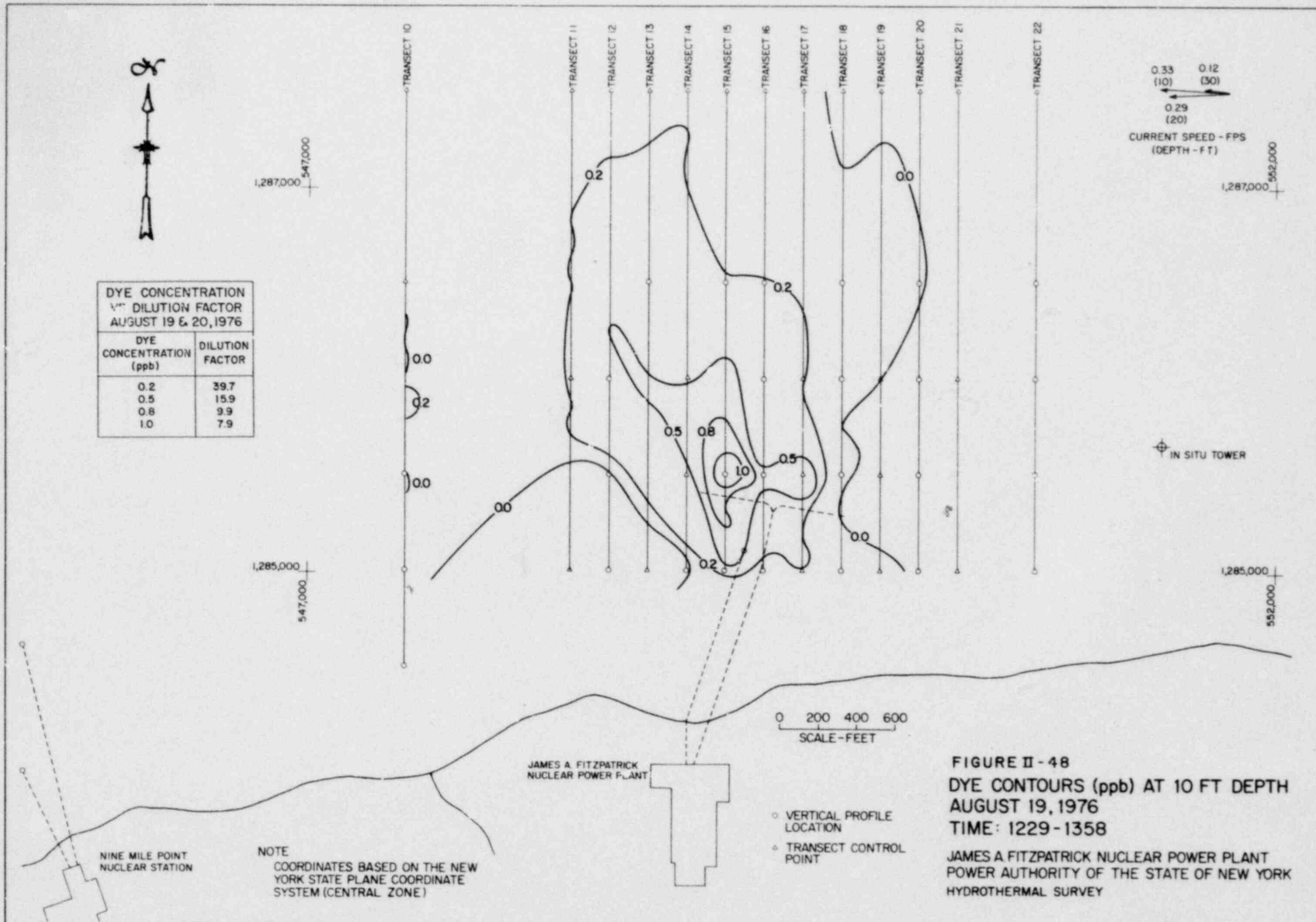


FIGURE II - 47

DYE CONTOURS (ppb) AT 6 FT DEPTH
AUGUST 19, 1976
TIME: 1229-1358

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



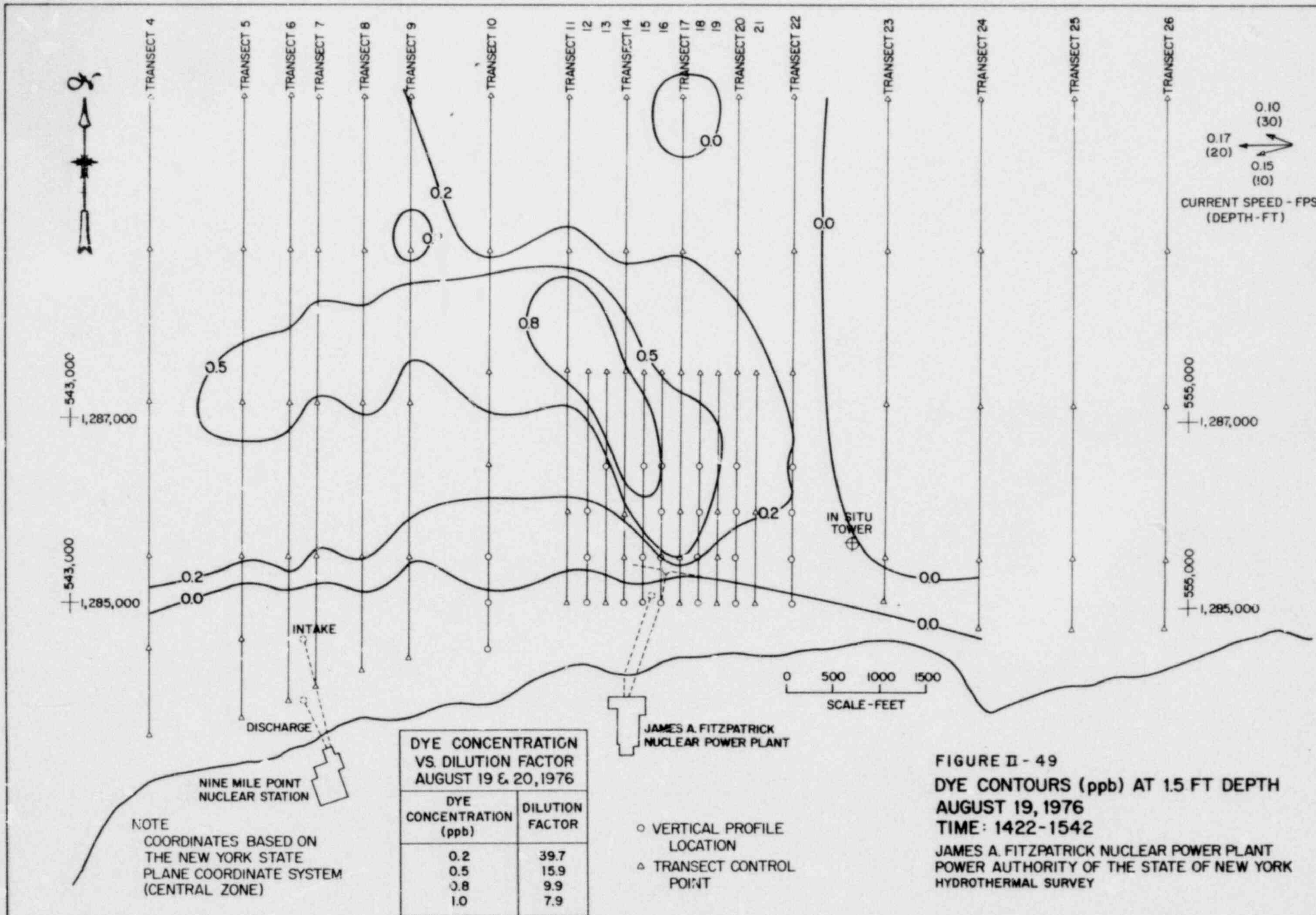
DYE CONCENTRATION VS DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 48
DYE CONTOURS (ppb) AT 10 FT DEPTH
AUGUST 19, 1976
TIME: 1229 - 1358

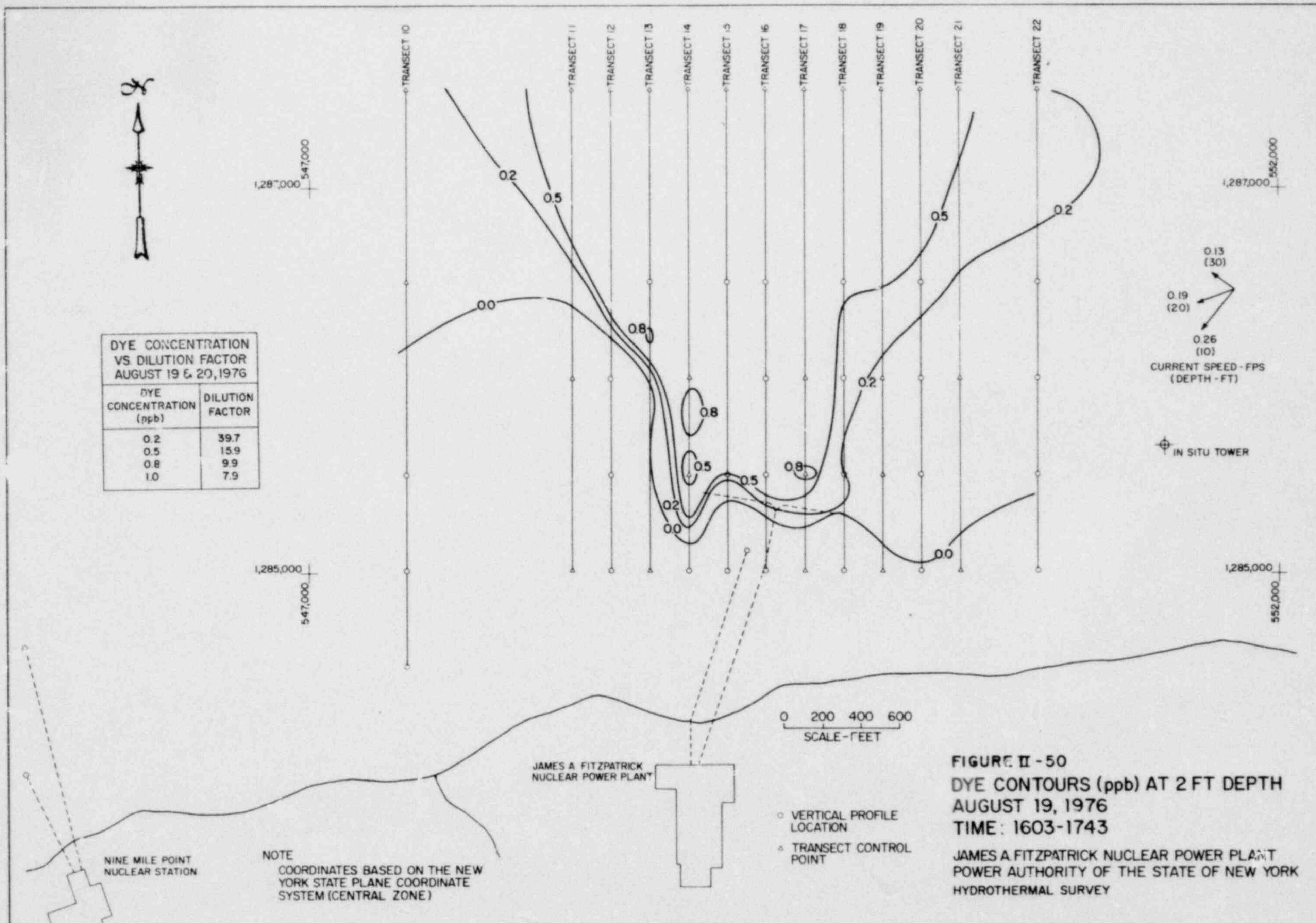
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 49
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
AUGUST 19, 1976
TIME: 1422-1542
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



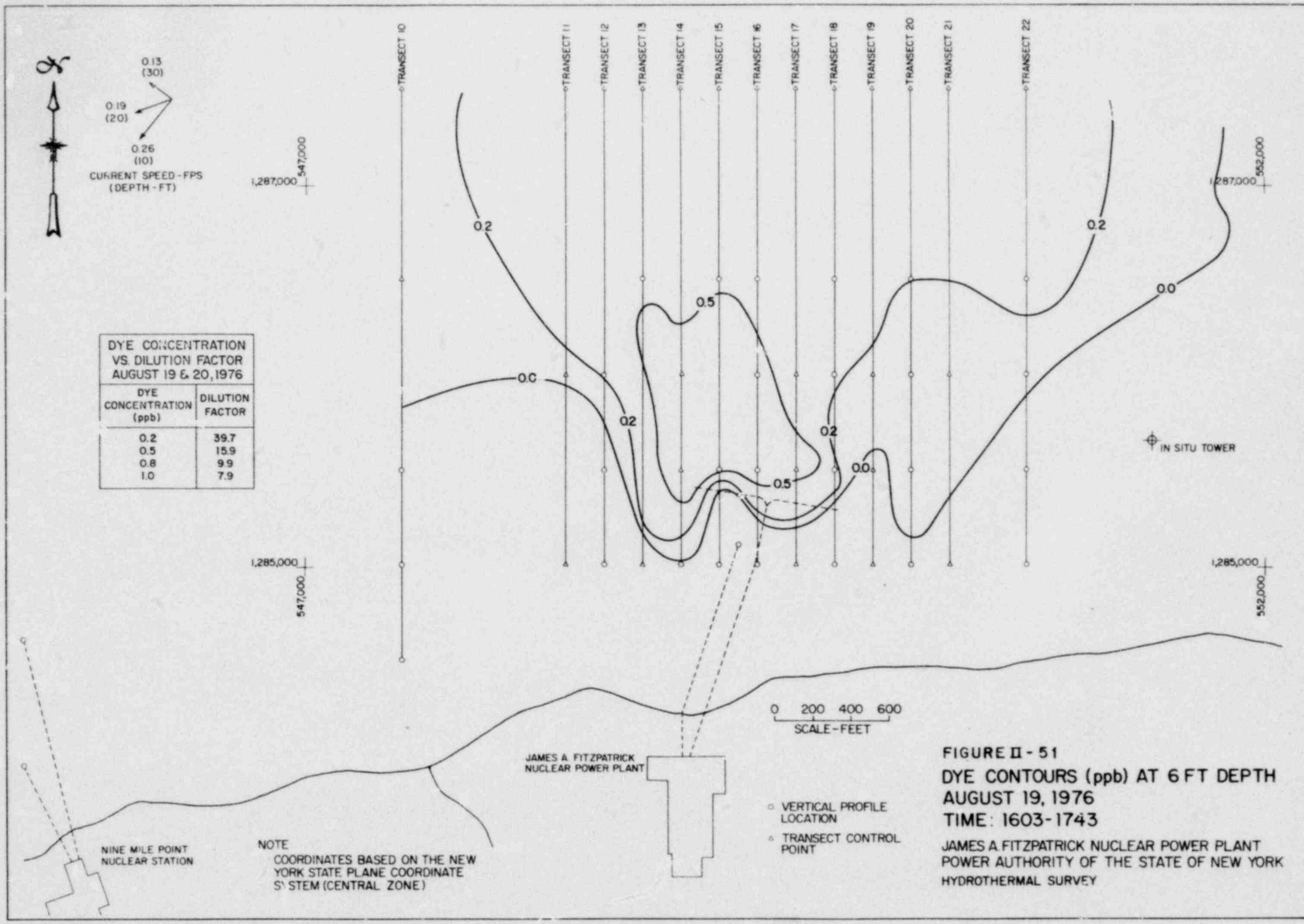
DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 50
DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 19, 1976
TIME: 1603-1743

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

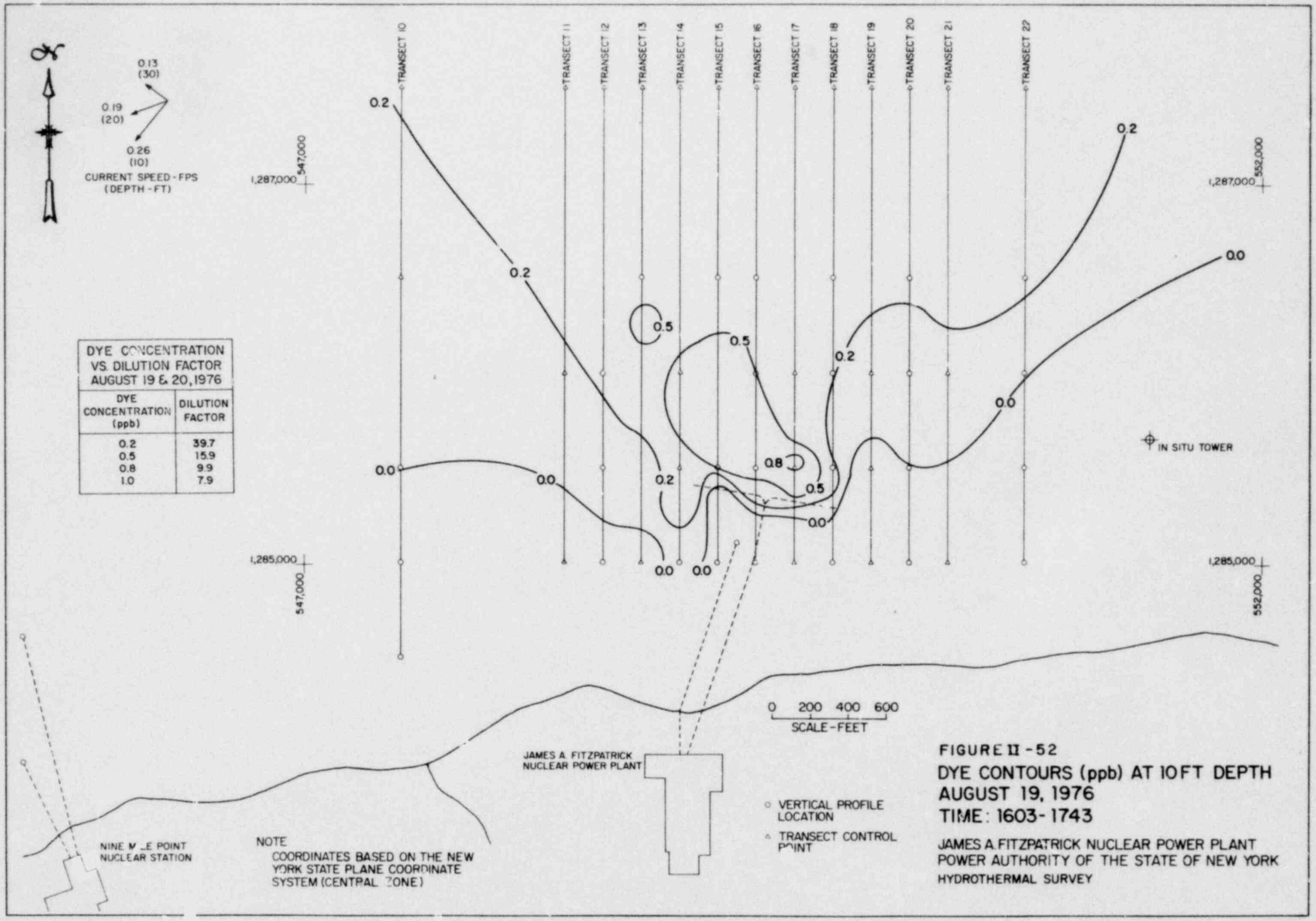


DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 51
DYE CONTOURS (ppb) AT 6 FT DEPTH
AUGUST 19, 1976
TIME: 1603-1743

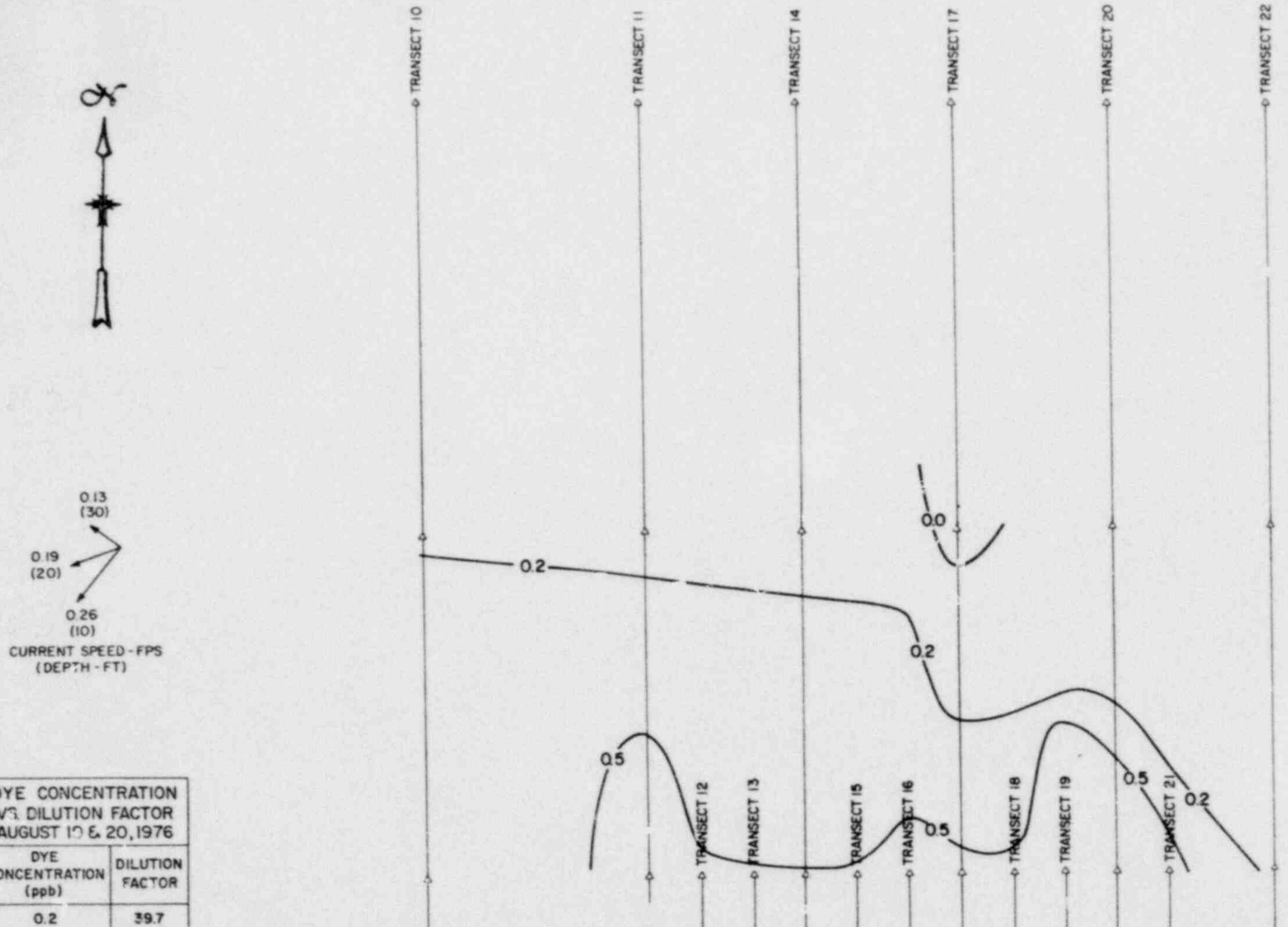
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976	
DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 52
DYE CONTOURS (ppb) AT 10 FT DEPTH
AUGUST 19, 1976
TIME: 1603 - 1743

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

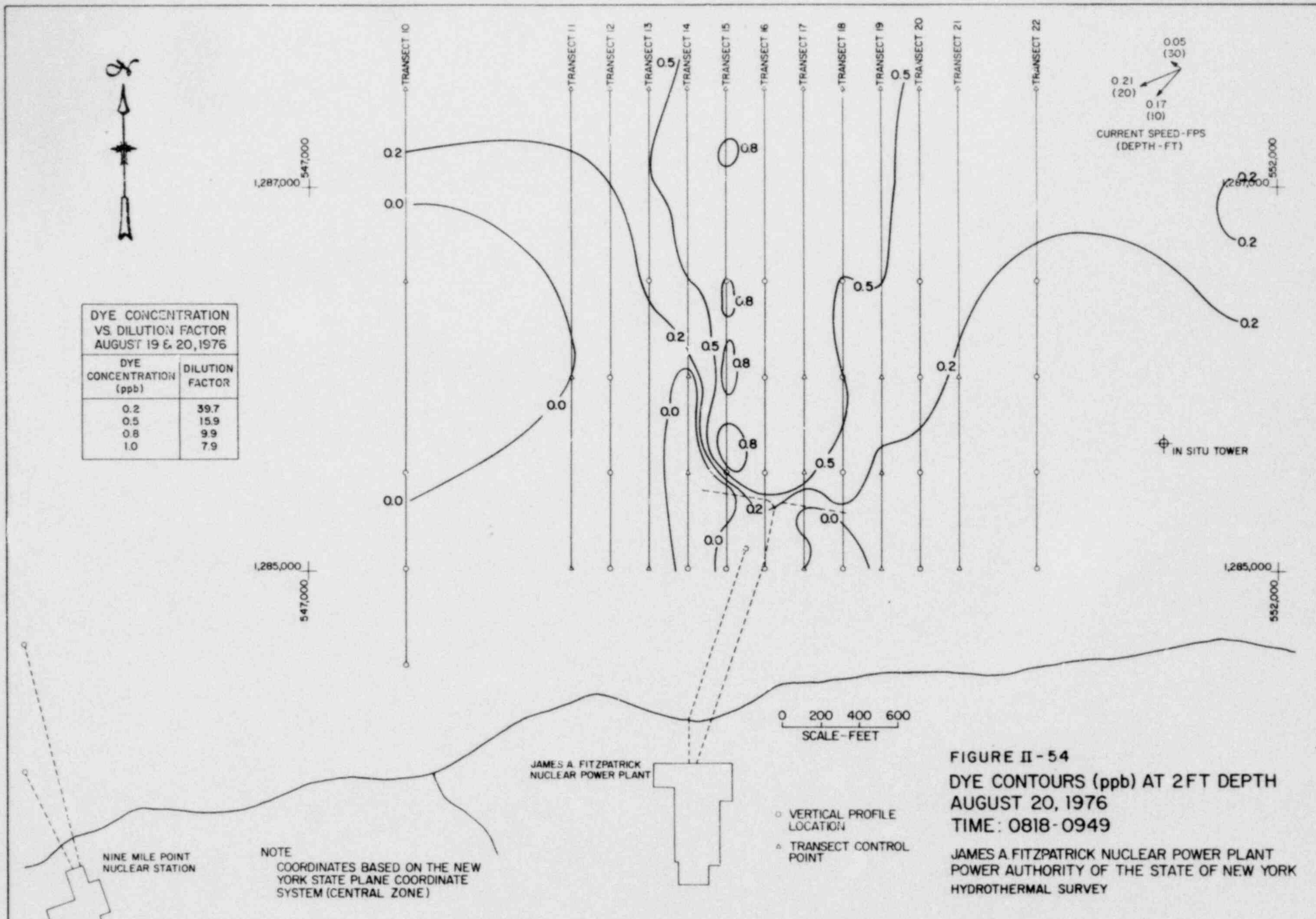
0 200 400 600
SCALE - FEET

△ TRANSECT CONTROL POINT

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 53
OFFSHORE EXTENSION OF DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 19, 1976
TIME: 1603 - 1743

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II-54
DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 0818-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

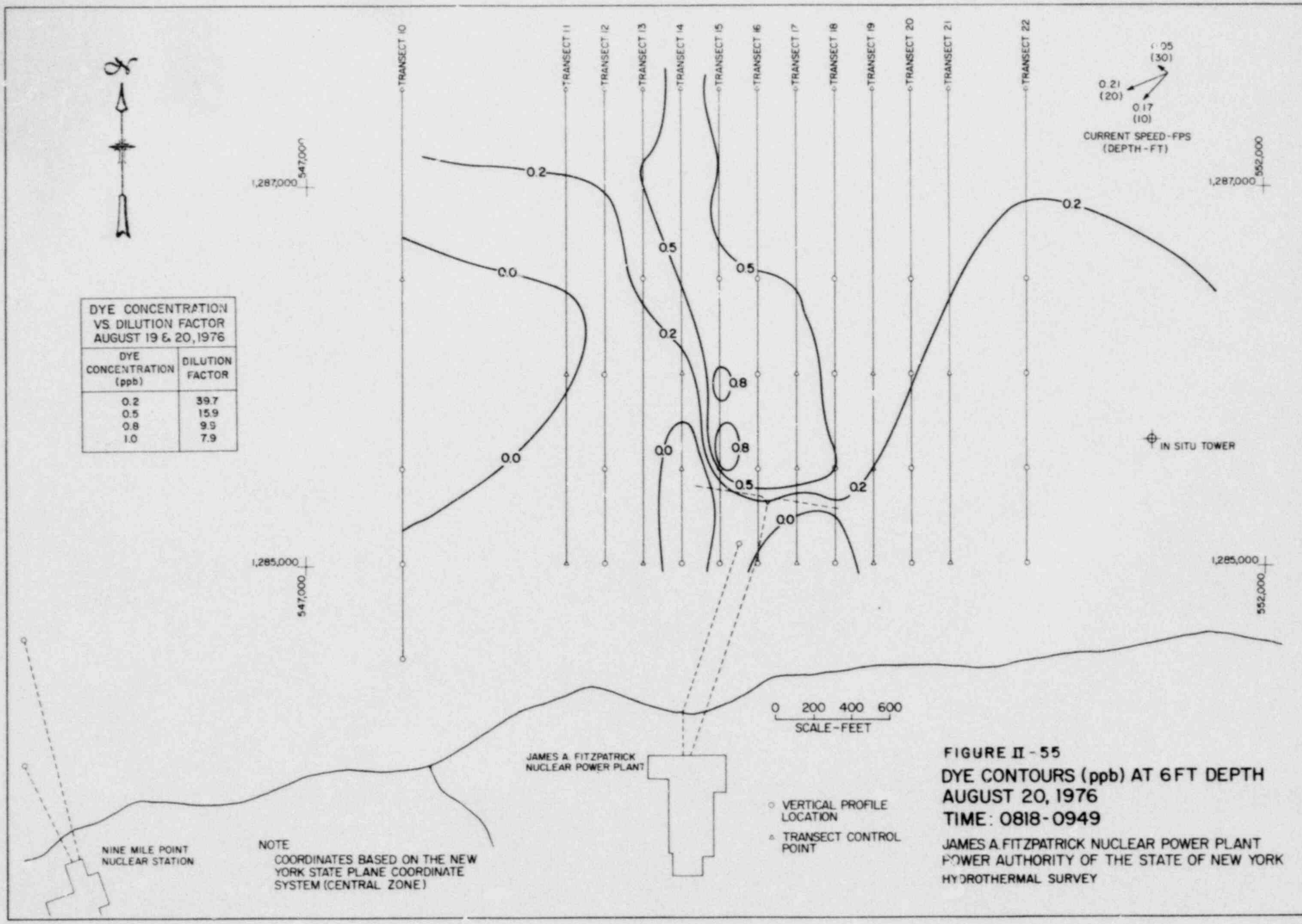
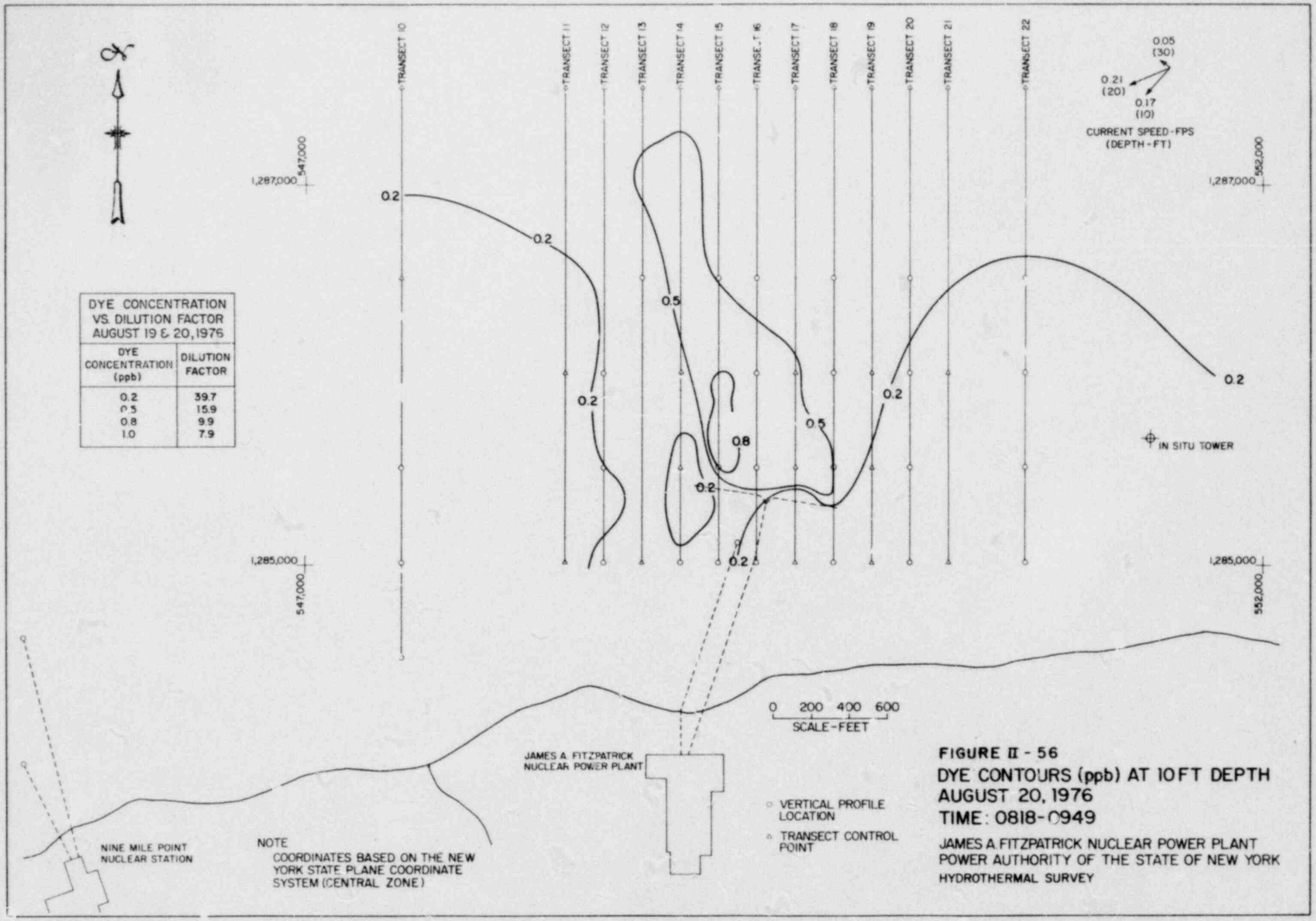


FIGURE II - 55

DYE CONTOURS (ppb) AT 6 FT DEPTH
AUGUST 20, 1976
TIME: 0818-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



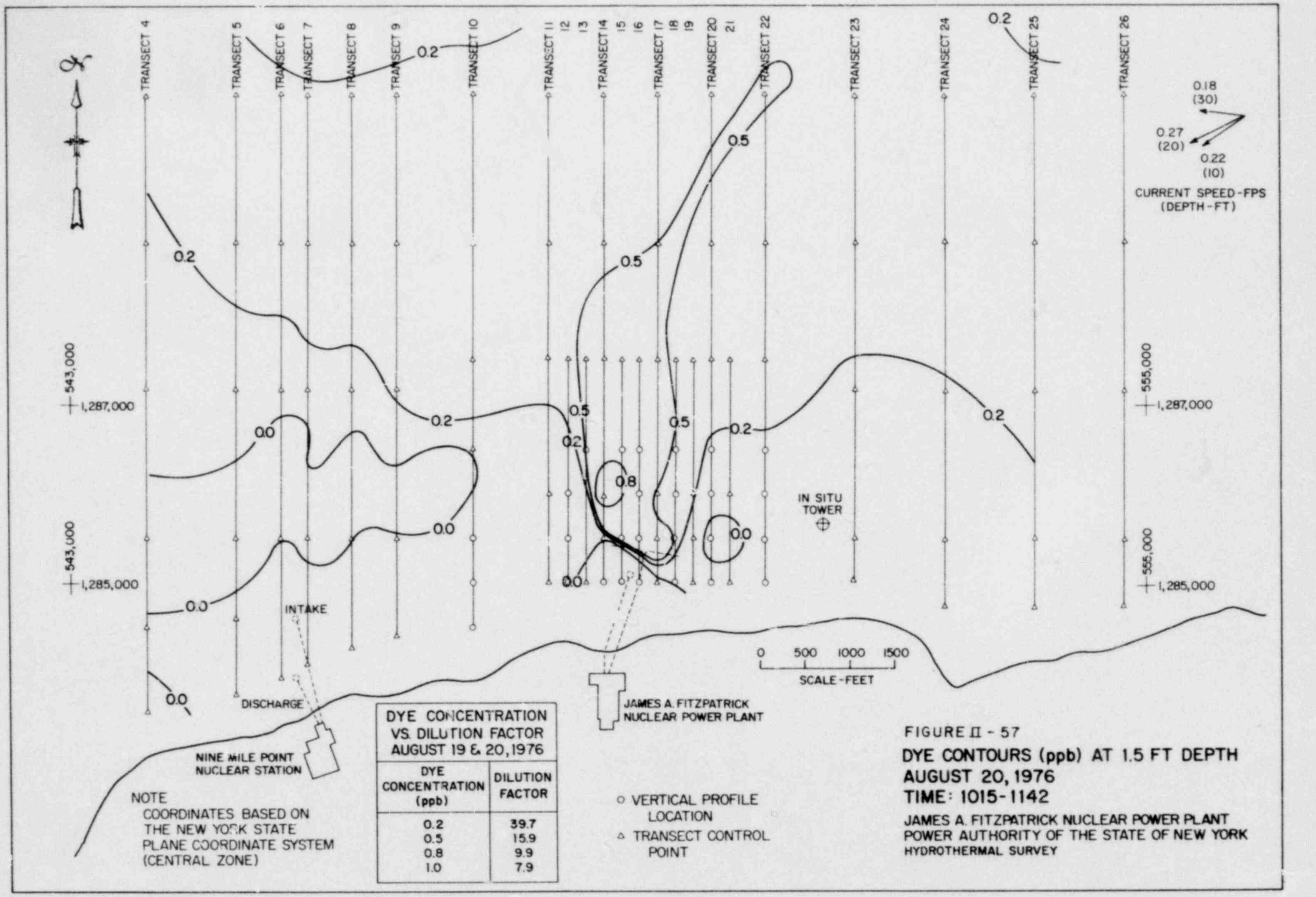
DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 56
DYE CONTOURS (ppb) AT 10 FT DEPTH
AUGUST 20, 1976
TIME: 0818-0949

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



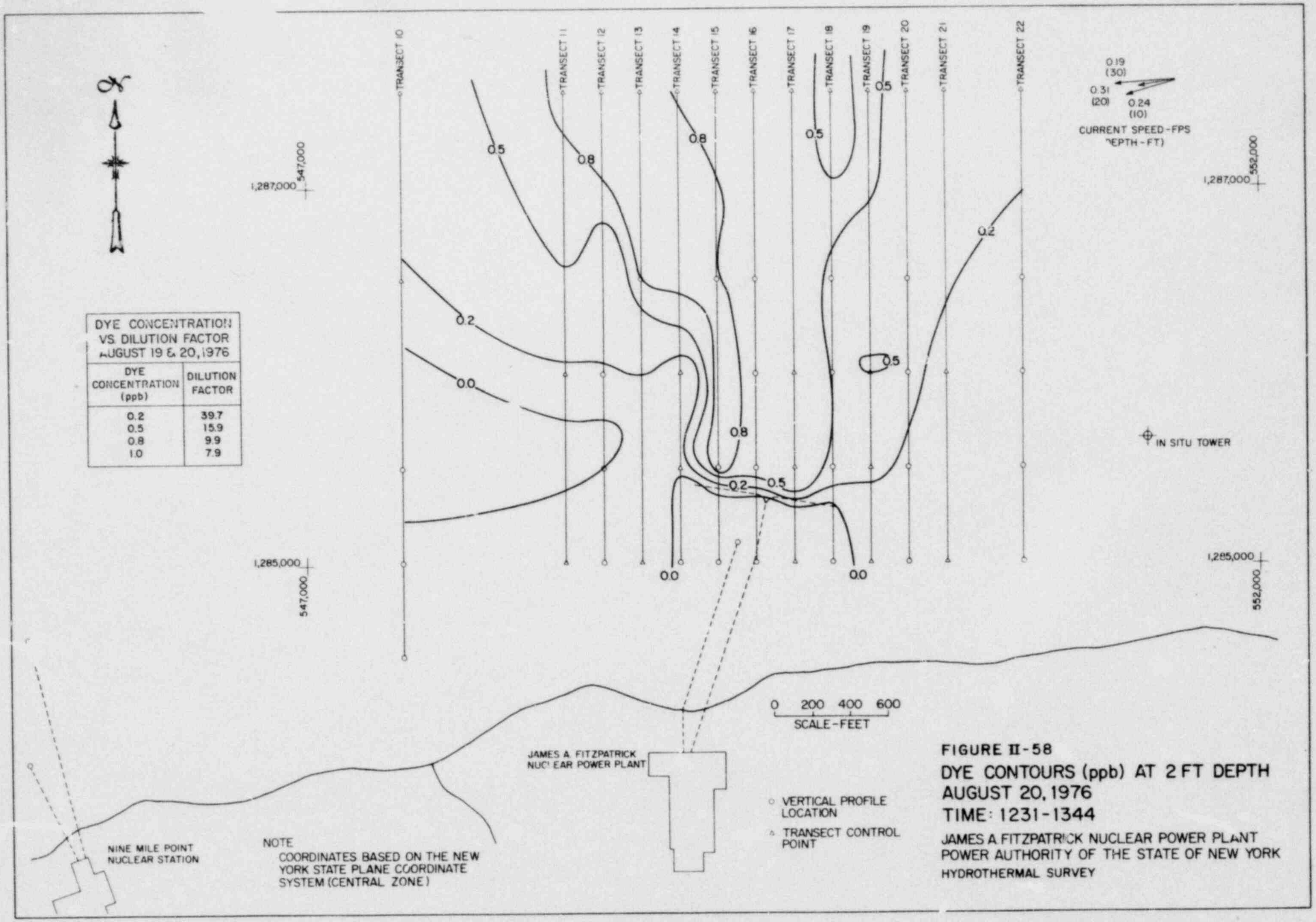
DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 57

DYE CONTOURS (ppb) AT 1.5 FT DEPTH
AUGUST 20, 1976
TIME: 1015-1142

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



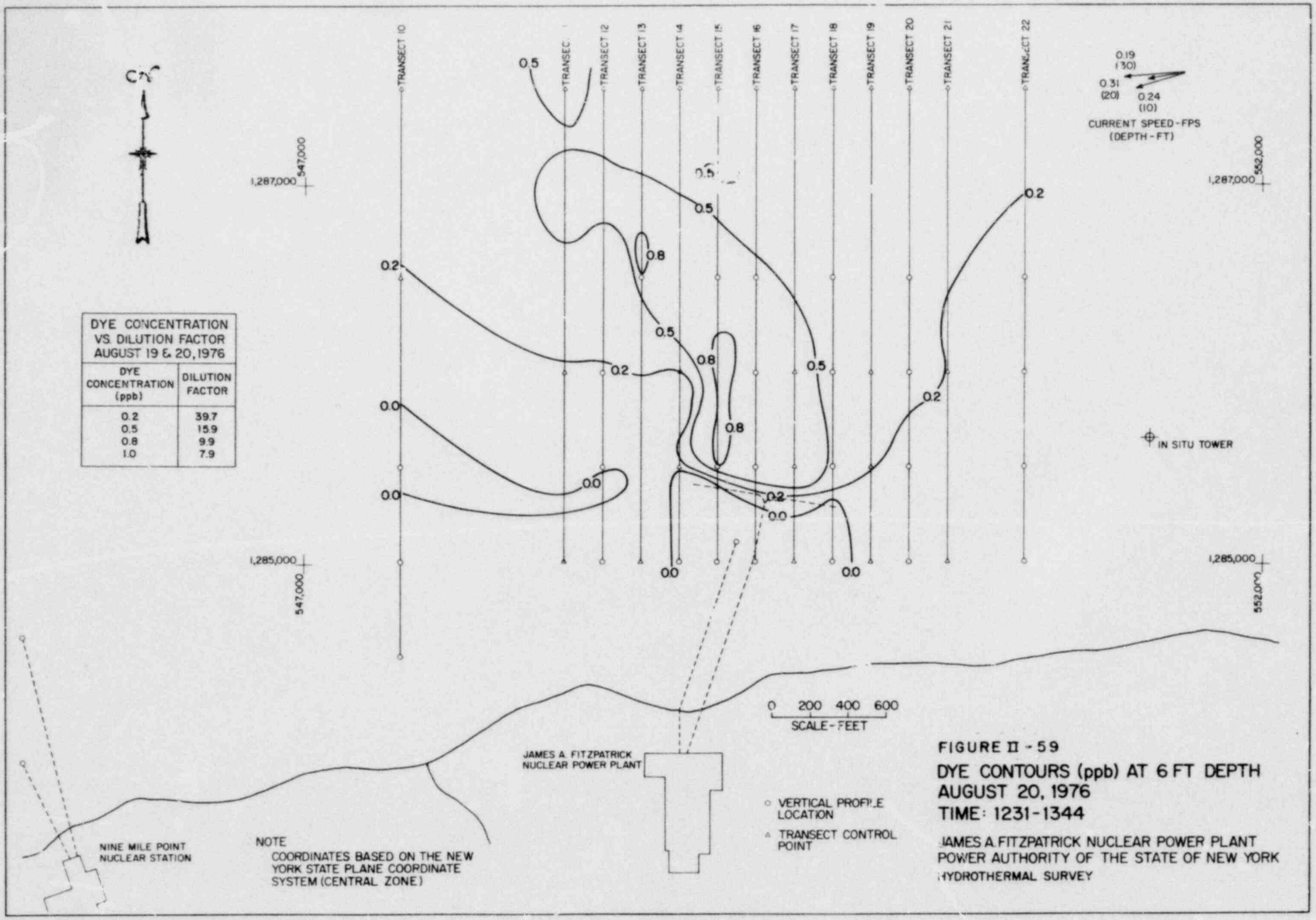
DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II-58

DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

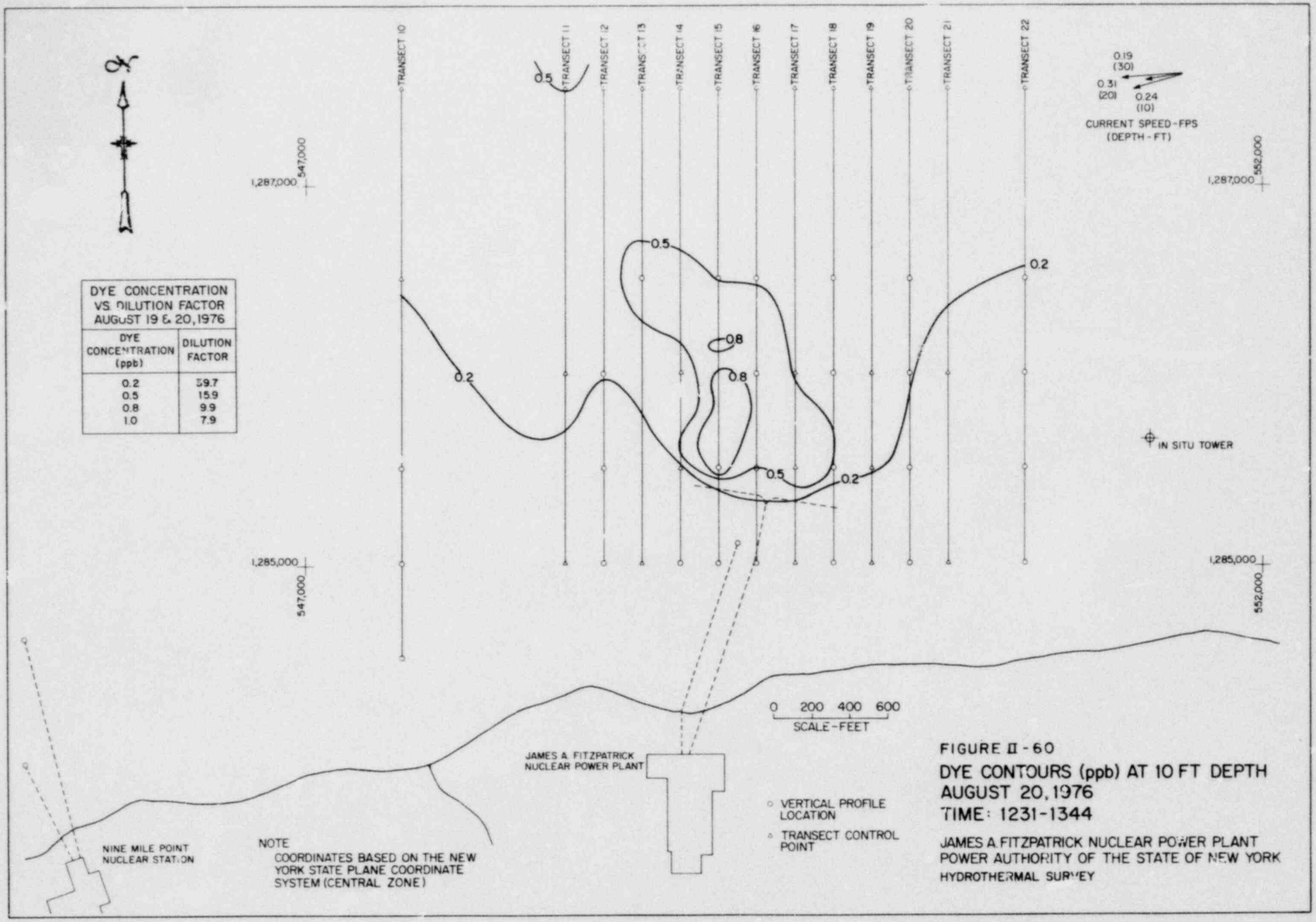


DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 59
DYE CONTOURS (ppb) AT 6 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



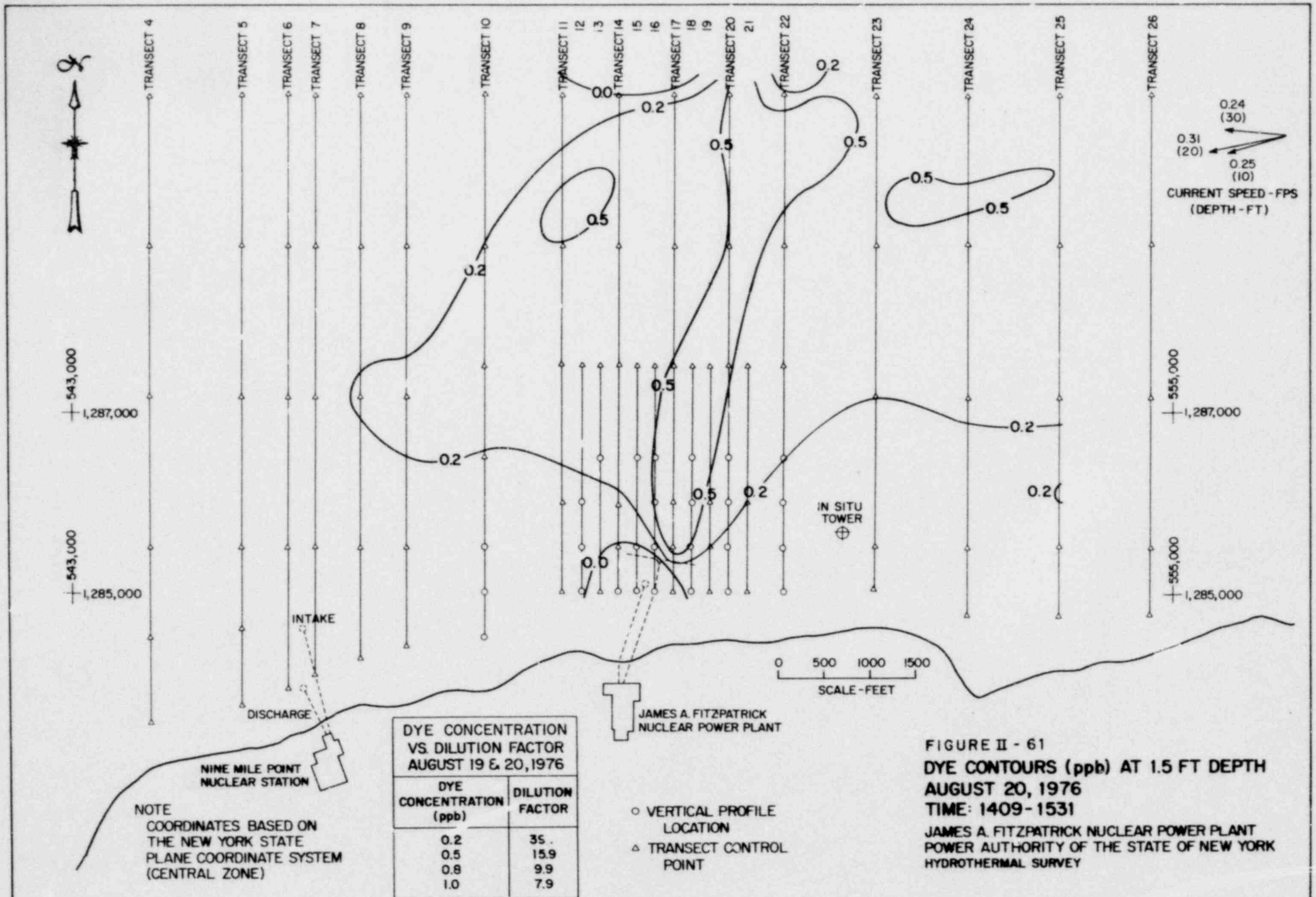
DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 60
DYE CONTOURS (ppb) AT 10 FT DEPTH
AUGUST 20, 1976
TIME: 1231-1344

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



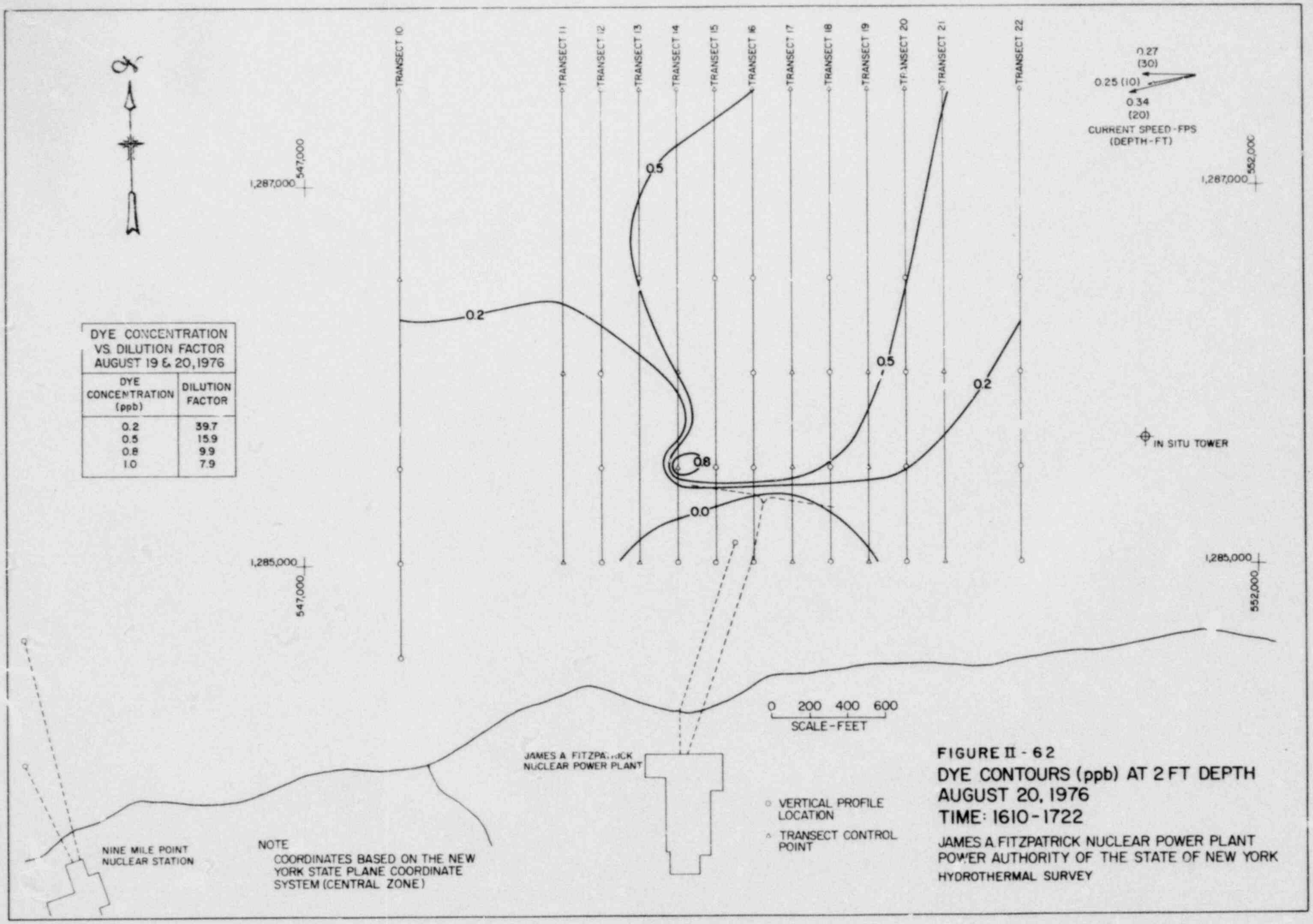
DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	35.
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 61

DYE CONTOURS (ppb) AT 1.5 FT DEPTH
AUGUST 20, 1976
TIME: 1409 - 1531

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

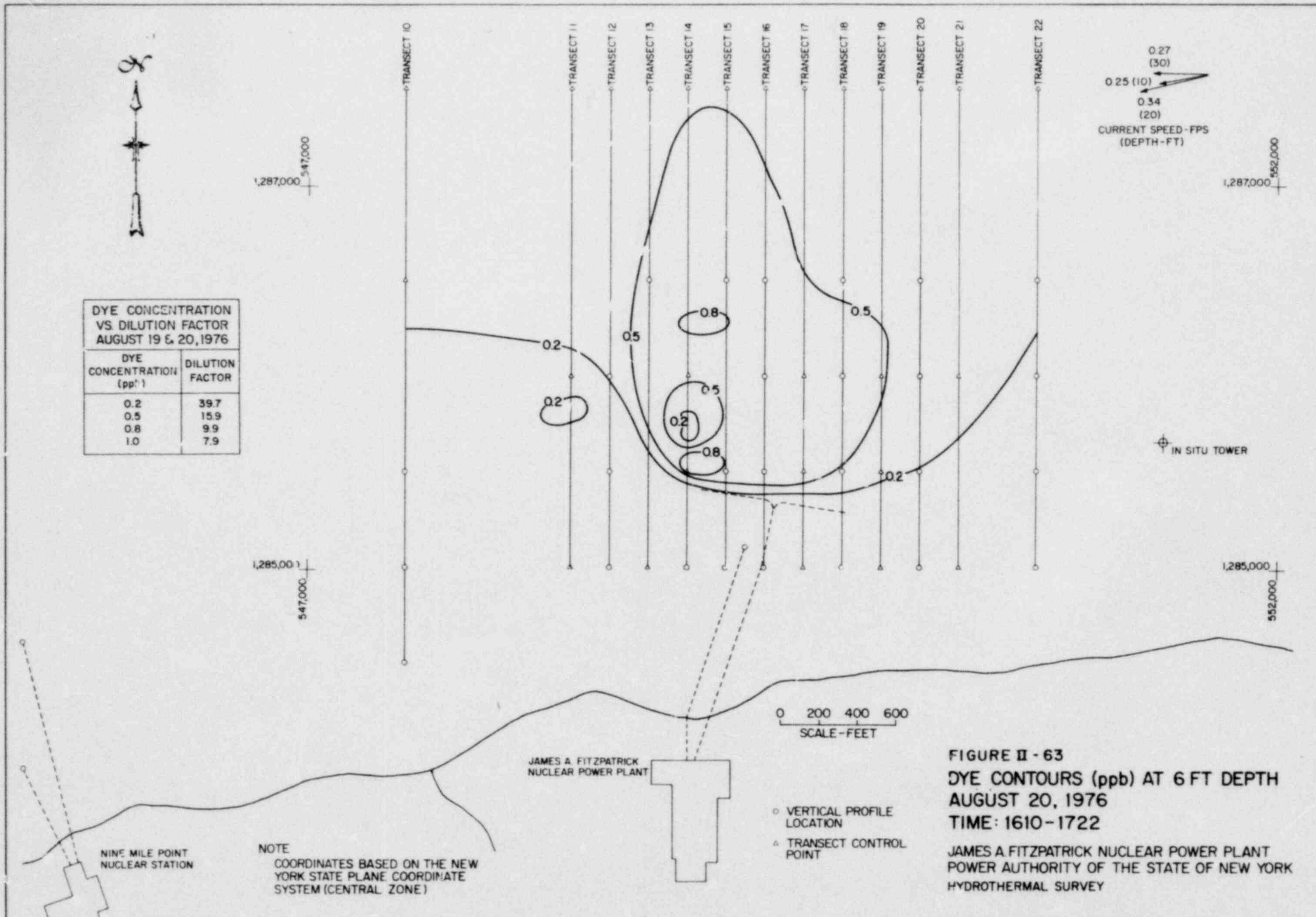


DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 62
DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 1610 - 1722

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

FIGURE II - 63
DYE CONTOURS (ppb) AT 6 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

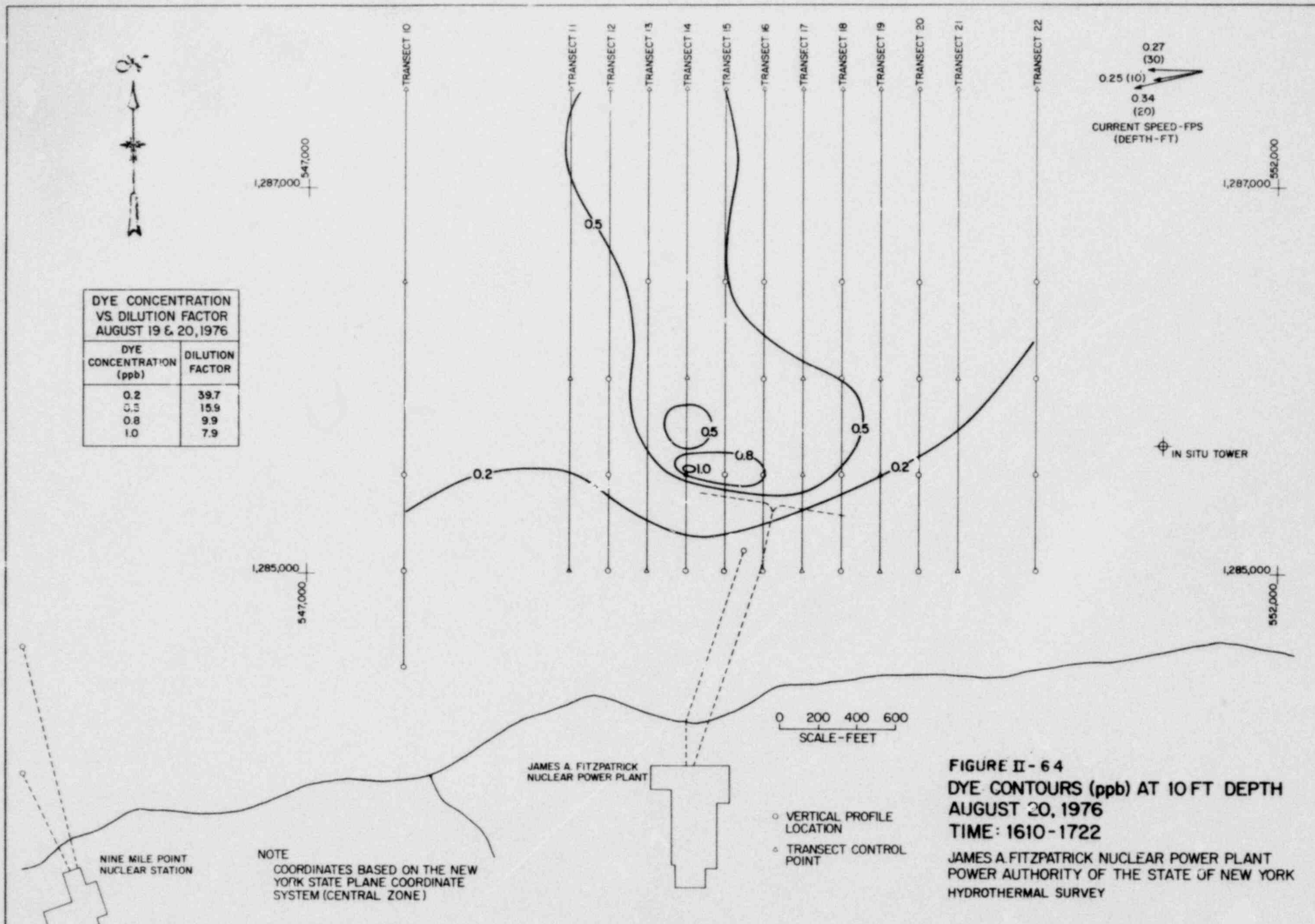
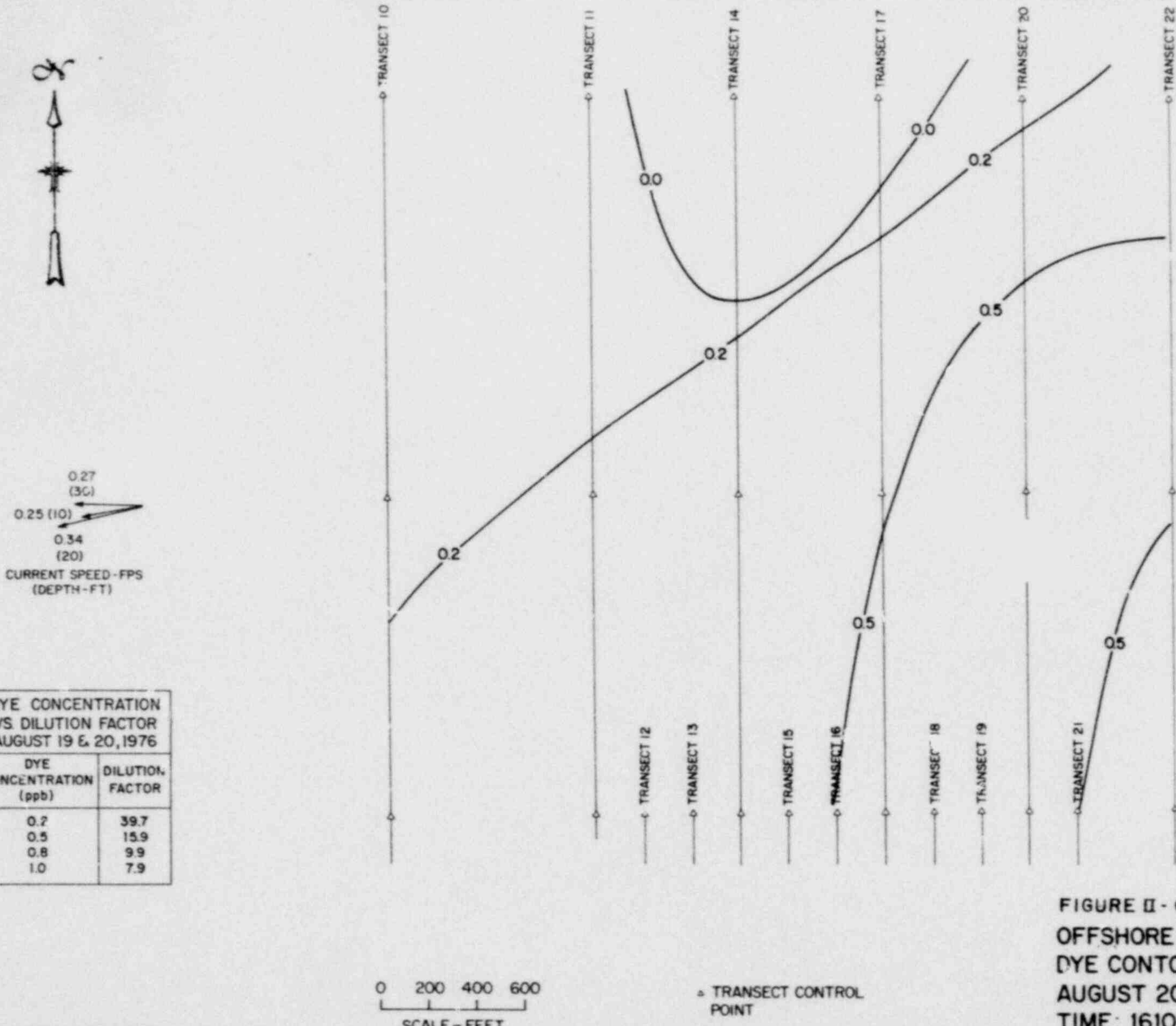


FIGURE II-64
DYE CONTOURS (ppb) AT 10 FT DEPTH
AUGUST 20, 1976
TIME: 1610-1722

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR AUGUST 19 & 20, 1976	
DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.7
0.5	15.9
0.8	9.9
1.0	7.9

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE II - 65
OFFSHORE EXTENSION OF
DYE CONTOURS (ppb) AT 2 FT DEPTH
AUGUST 20, 1976
TIME: 1610 - 1722

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

OCTOBER 1976 POSTOPERATIONAL
HYDROTHERMAL SURVEY
FOR
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK

III-OCTOBER 1976 SURVEY

TABLE OF CONTENTS

III-OCTOBER 1976 SURVEY

LIST OF TABLES

III-OCTOBER 1976 SURVEY

LIST OF FIGURES

LIST OF FIGURES (Cont)

III-OCTOBER 1976 SURVEY

III.1 SUMMARY

The third postoperational hydrothermal survey of the JAFNPP was conducted on October 7 and 8, 1976. The NMP-1 station was in operation during the survey.

The primary objectives of this survey were:

1. To determine the three-dimensional thermal patterns in the discharge area produced by the joint operation of NMP-1 and the JAFNPP, and

2. To determine the diffuser performance based on dye concentrations existing in the lake after releasing dye into the plant circulating water system.

These objectives were set forth so as to fulfill the requirements of the National Pollutant Discharge Elimination System permit (Permit No. NY0020109), administered by the U.S. Environmental Protection Agency; the JAFNPP Environmental Technical Specifications (Docket No. 50-333), administered by the U.S. Nuclear Regulatory Commission; and the New York State Department of Environmental Conservation's standards and requirements.

III.2 METHOD OF DATA ACQUISITION

Aquatec, Inc., of South Burlington, Vermont was contracted to perform the temperature and dye surveys of the JAFNPP discharge area. A report entitled "Third Operational Hydrothermal Survey, October 7 and 8, 1976, James A. FitzPatrick Nuclear Power Plant," which describes all aspects of the data acquisition and reduction, was provided by Aquatec.

Raytheon Company, Oceanographic & Environmental Services, of Portsmouth, Rhode Island was subcontracted by Aquatec to perform in situ data collection consisting of current speed and direction, lake temperature, and lake level during the temperature and dye surveys.

Niagara Mohawk Power Corporation, operator of the NMP-1, and the Power Authority of the State of New York, owner of the JAFNPP, maintain a meteorological tower at the site which records wind speed and direction at an elevation of 30 and 200 feet. Meteorological data for the dates of the survey are listed in Section III.3.1.

Operating conditions are continuously monitored at the plant. Section III.3.3 lists the plant operating conditions at the time of the survey.

III.3 CONDITIONS DURING THE SURVEY

III.3.1 Meteorological Conditions

Daylight during the October 7 and 8, 1976 surveys occurred between approximately 0614 and 1742 hours EST and 0616 and 1740 hours, respectively.

The wind speed and direction for the survey hours on October 7, 1976 are given in Table III-1. During the intensive sampling period between 0828 and 1803 on August 19, 1976, the 30-foot wind at the NMP-1 site meteorological tower was from the west to northwest at an average speed varying from 15 to 5 mph.

The wind speed and direction for the survey hours on October 8, 1976 are given in Table III-2. During the intensive sampling period between 1505 and 1759 on October 8, 1976, the wind at 30 feet was from the north to northeast at an average speed of about 5 mph.

Due to the location of the meteorological tower relative to a forest to the south, wind speed and directions in Tables III-1 and III-2 are given for both an elevation of 200 and 30 feet. Presentation of data in this manner will distinguish any local anomalies at 30 feet from the representative wind over Lake Ontario.

Small craft warnings were in effect on October 7 and 8, 1976 and 2- to 4-foot waves were observed in the survey area.

III.3.2 Lake Conditions

An in situ tower, located 2,000 feet east of the centerline of the JAFNPP diffuser and 1,000 feet offshore, as shown in the figures, continuously recorded lake current speed and direction, lake temperature, and lake level during the survey period. The in situ tower was constructed and maintained by the Raytheon Company. In situ data are presented in the Aquatec report and discussed in Section III-4.2 of this report.

III.3.3 Plant Operating Conditions

The JAFNPP load and intake and discharge temperatures and average plant temperature rise are listed in Tables III-3 and III-4 for the surveys on October 7 and 8, 1976, respectively. Plant load is determined from hourly computer output at the JAFNPP. The plant load for the survey hours between October 7 and 8, 1976 remained relatively constant at approximately 725 MWe gross.

The NMP Unit 1 station load remained relatively constant at approximately 550 MWe gross for the survey hours on October 7 and 8, 1976.

The JAFNPP intake and discharge temperatures are based on readings taken in the intake and discharge shaft of the circulating water system during the survey as described in Section II-C of the Aquatec report.

III.4 SURVEY RESULTS

III.4.1 Temperature and Dye Studies

Temperature and dye concentration patterns, illustrating thermal effect and diffuser performance respectively of the joint operation of both the NMP Unit 1 and the JAFNPP discharge, are presented for nearfield and farfield areas. Dye contour illustrations include tables to convert dye concentrations to dilution factors.

The nearfield study area consists of transects 10 through 22, as shown in Figures III-1 through III-32, except Figures III-7, III-14, III-15, III-25, III-29, and III-30. Temperature data were taken at depths of 1, 2, 6, 10, and 15 feet and dye concentrations at depths of 2, 6, and 10 feet. Transects 11 through 22 are 2,500 feet long; transect 10 is 3,000 feet long. The tracking speed of the survey boat was from 8 to 10 feet per second (fps) with a data sampling interval of one data record per second.

The farfield study area consists of transects 4 through 26, as shown in Figures III-7, III-14, III-15, III-25, III-29, and III-30. Temperature and dye data were taken at a depth of 1.5 feet. The study area extends 5,000 feet either side of the diffuser along the shore and 5,000 feet offshore. The tracking speed of the survey boat was from 20 to 25 fps with a data sampling interval of one data record per second.

During the afternoon runs on October 8, 1976, there was no thermal stratification because strong onshore winds and waves caused substantial mixing. Refer to Table III-5 for the degree of thermal stratification on October 7 and 8, 1976. Dye concentration patterns between 1505 and 1759 on October 8, 1976 were found to correlate well with temperature patterns for the corresponding time periods.

The dye concentration in the discharge shaft of the circulating water system was determined to be 8.2 and 7.9 parts per billion (ppb) for October 7 and 8, respectively. This number was calculated by diluting the Rhodamine WT dye release rate of 1.55 and 1.48 lb per hour with the total circulating water flow rate of 835 cfs. The circulating water flow rate is based on information in an Aquatec, Inc. report entitled "Pumphouse Dye

Study" completed in October 1975, using a dye dilution technique to determine the flow rate within an accuracy of 2.59 percent.

During each of the nearfield and farfield runs described in the following sections, vertical profiles of both temperature and dye were taken at 27 designated stations in addition to the horizontal transect work. Vertical profiles for the October survey are shown in Appendix II of the Aquatec report.

Table III-6 summarizes lake conditions and figure numbers applicable to the October survey.

III.4.1.1 October 7, 1976 Temperature Patterns

Between 0828 and 1803 on October 7, 1976, two nearfield and two farfield runs were completed along the appropriate transects.

III.4.1.1.1 Sampling Period from 0828 to 1004 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures III-1, III-2, III-3, III-4, and III-5, respectively, during the nearfield sampling period from 0828 to 1004.

Figure III-6 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 61.1°F was calculated by averaging temperatures in the diffuser vicinity along transect 19. The maximum temperature rise attributed to the JAFNPP at the 1-foot depth was observed to be 4.2°F. The maximum temperature rise above ambient at the 1-foot depth was observed in an area where heated water from the NMP-1 discharge was also present.

III.4.1.1.2 Sampling Period from 1029 to 1204 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure III-7 during the farfield sampling period from 1029 to 1204.

III.4.1.1.3 Sampling Period from 1502 to 1615 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures III-8, III-9, III-10, III-11, and III-12, respectively, during the nearfield sampling period from 1502 to 1615. Figure III-13 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 60.9°F was calculated by averaging temperatures in the diffuser vicinity along transect 10. The maximum temperature rise above ambient at the 1-foot depth was observed to be 4.3°F.

III.4.1.1.4 Sampling Period from 1627 to 1803 (farfield)

Isotherms in increment of 1°F are shown at the 1.5-foot depth in Figure III-14 during the farfield sampling period from 1627 to 1803.

III.4.1.2 August 20, 1976 Temperature Patterns

Between 1505 and 1759 on October 8, 1976, one nearfield run and one farfield run were completed along the appropriate transects. Data collection was limited to two runs in the afternoon due to high winds and rough lake conditions.

III.4.1.2.1 Sampling Period from 1505 to 1631 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure III-15 during the farfield sampling period from 1505 to 1631.

III.4.1.2.2 Sampling Period from 1642 to 1759 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures III-16, III-17, III-18, III-19, and III-20, respectively, during the nearfield sampling period from 1642 to 1759. Figure III-21 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 60.0°F was calculated by averaging temperatures in the diffuser vicinity along transect 19. The maximum temperature rise above ambient at the 1-foot depth was observed to be 3.5°F.

III.4.1.3 October 7, 1976 Dye Concentration Patterns

Between 0828 and 1803 on October 7, 1976, two nearfield and two farfield runs were completed along the appropriate transects.

III.4.1.3.1 Sampling Period from 0828 to 1004 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures III-22, III-23, and III-24, respectively, during the nearfield sampling period from 0828 to 1004.

The maximum dye concentration at the 2-foot depth was observed to be 1.56 ppb. This value is based on an averaging of data along 33.3 feet of transect.

III.4.1.3.2 Sampling Period from 1029 to 1204 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure III-25 during the farfield sampling period from 1029 to 1204.

The maximum dye concentration at the 1.5-foot depth was observed to be 1.49 ppb.

III.4.1.3.3 Sampling Period from 1502 to 1615 (nearfield)

At 1356 on October 7, 1976, the dye pump injecting Rhodamine WT dye into the circulating water system failed; however, it was restarted at 1415. Due to a lower-than-normal pumping rate, the pump was removed at 1539 and replaced with a new pump which was operational by 1616. The unsteady dye release rate during the last two runs of October 7, 1976 has negated the ability of the dye to quantify the dilution capability of the diffuser; however, the resulting figures have been included to describe the general plume boundaries for these times.

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures III-26, III-27, and III-28, respectively, during the nearfield sampling period from 1502 to 1615.

III.4.1.3.4 Sampling Period from 1627 to 1803 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure III-29 during the farfield sampling period from 1627 to 1803.

III.4.1.4 October 8, 1976 Dye Concentration Patterns

Between 1505 and 1759 on October 8, 1976, one nearfield and one farfield run were completed along the appropriate transects.

III.4.1.4.1 Sampling Period from 1505 to 1631 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure III-30 during the farfield sampling period from 1505 to 1631.

The maximum dye concentration at the 1.5-foot depth was observed to be 1.34 ppb.

III.4.1.4.2 Sampling Period from 1642 to 1759 (nearfield)

During the sampling period from 1642 to 1759, a failure occurred in the boat-mounted pump which brought the water sample at the 10-foot depth to the fluorometer. Consequently dye data collected at the 10-foot depth were not complete over the entire study area and were not, therefore, included in this report.

Dye contours in ppb are shown for 2- and 6-foot depths in Figures III-31 and III-32, respectively, during the nearfield sampling period from 1642 to 1759.

The maximum dye concentration at the 2-foot depth was observed to be 1.33 ppb.

III.4.2 In Situ Data

In situ data collection, consisting of current speed and direction, lake temperature, and lake level, was made by the Raytheon Company. The information is provided in the Aquatec report.

The lake current during the morning of October 7, 1976 was basically eastward at 0.4 fps reducing to near zero in the afternoon. A westward current at approximately 0.5 fps was observed during the afternoon runs on October 8, 1976.

A summary of the average current speed and magnitude at the 10-, 20-, and 30-foot depth is presented on each figure by a direction arrow and associated magnitude at the in situ tower. The lake levels for both the October 7 and 8, 1976 surveys were observed to fluctuate between 246.0 and 246.2 feet USLS (United States Lake Survey 1935 Datum).

III-OCTOBER 1976 SURVEY

TABLE III-1

WIND SPEED AND DIRECTION FOR OCTOBER 7, 1976*

	Data taken at 30-ft elev.		Data taken at 200-ft elev.	
Time	Direction (Deg true)	Speed (mph)	Direction (Deg true)	Speed (mph)
0400-0500	250	14	245	18
0500-0600	255	19	255	24
0600-0700**	255	19	255	23
0700-0800**	260	17	260	19
0800-0900**	245	14	250	19
0900-1000**	310	11	305	16
1000-1100**	310	7	315	13
1100-1200**	305	7	305	10
1200-1300**	305	7	305	9
1300-1400**	315	6	310	9
1400-1500**	305	6	305	8
1500-1600**	310	6	315	9
1600-1700**	315	4	330	10
1700-1800**	315	3	335	8
1800-1900**	010	3	360	8
1900-2000	035	5	025	12
2000-2100	045	6	045	14
2100-2200	055	5	050	13
2200-2300	040	4	040	11
2300-2400	030	4	030	9

* Preliminary data - directions generally accurate to ±5 deg and speed to ±1 mph.

** Survey Period

TABLE III-2

WIND SPEED AND DIRECTION FOR OCTOBER 8, 1976*

	Data taken at 30-ft elev.		Data taken at 200-ft elev.	
Time	Direction (Deg. true)	Speed (mph)	Direction (Deg. true)	Speed (mph)
0000-0100	045	3	040	10
0100-0200	045	4	045	11
0200-0300	040	5	035	14
0300-0400	040	6	035	17
0400-0500	045	6	040	17
0500-0600	045	6	040	17
0600-0700	040	6	040	16
0700-0800	040	7	035	18
0800-0900	-	6	-	-
0900-1000	035	5	025	15
1000-1100	035	5	030	12
1100-1200	035	5	030	11
1200-1300	015	5	025	12
1300-1400	010	4	005	15
1400-1500	010	5	010	14
1500-1600**	015	5	005	15
1600-1700**	020	5	025	12
1700-1800**	030	5	035	13

* Preliminary data - directions generally accurate to ±5 deg and speed to ±1 mph.

** Survey Period

TABLE III-3

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON OCTOBER 7, 1976 FOR THE JAFNPP

Time	Plant Load (MWe) at end of hour	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Plant Temperature Rise (°F)
		October 7, 1976		
0000-0100	727	62.0	88.5	26.5
0100-0200	727	61.5	88.0	26.5
0200-0300	728	62.0	88.0	26.0
0300-0400	727	62.0	88.0	26.0
0400-0500	728	62.0	88.5	26.5
0500-0600	727	62.5	88.5	26.0
0600-0700*	727	61.5	88.0	26.5
0700-0800*	728	62.5	88.5	26.0
0800-0900*	726	63.0	89.0	26.0
0900-1000*	726	62.5	89.0	26.5
1000-1100*	727	62.5	89.0	26.5
1100-1200*	727	62.0	88.0	26.0
1200-1300*	728	62.5	88.5	26.0
1300-1400*	727	62.5	88.5	26.0
1400-1500*	727	62.5	88.5	26.0
1500-1600*	726	63.0	89.0	26.0
1600-1700*	726	63.0	89.0	26.0
1700-1800*	726	62.5	89.0	26.5
1800-1900*	726	62.5	88.0	25.5
1900-2000	726	62.5	88.0	25.5
2000-2100	726	63.0	89.0	26.0
2100-2200	726	63.0	89.0	26.0
2200-2300	726	62.5	88.5	26.0
2300-2400	727	62.5	88.5	26.0

* Survey Period

TABLE III-4

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON OCTOBER 8, 1976 FOR THE JAFNPP

Time	Plant Load (MWe) at end of hour	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Plant Temperature Rise (°F)
		October 8, 1976		
0000-0100	726	62.5	88.0	25.5
0100-0200	726	62.0	88.0	26.0
0200-0300	727	62.0	88.0	26.0
0300-0400	727	62.0	88.0	26.0
0400-0500	728	62.0	88.0	26.0
0500-0600	726	62.0	88.0	26.0
0600-0700	728	62.0	87.5	25.5
0700-0800	727	62.0	87.5	25.5
0800-0900	726	62.0	87.5	25.5
0900-1000	726	62.0	87.5	25.5
1000-1100	726	62.0	87.5	25.5
1100-1200	725	62.0	87.5	25.5
1200-1300	726	62.0	87.5	25.5
1300-1400	725	62.0	87.5	25.5
1400-1500	725	61.5	87.5	26.0
1500-1600*	725	61.5	87.5	26.0
1600-1700*	726	61.5	87.5	26.0
1700-1800*	725	61.5	87.5	26.0

* Survey Period

TABLE III-5

DEGREE OF THERMAL STRATIFICATION IN INTAKE REGION
FOR OCTOBER 7 AND 8, 1976

Time	Average Water Temperature (°F) for Top 2 Ft of Water Column at Intake Region	Average Water Temperature (°F) for Bottom 2 Ft of Water Column at Intake Region	Thermal Stratification (°F) at Intake Region
		October 7, 1976	
0932	63.5	61.4	2.1
1553	65.1	61.1	4.0
1710	63.5	61.1	2.4
		October 8, 1976	
1418	60.3	60.4	-0.1
1609	60.4	60.4	0.0

TABLE III-6

SUMMARY OF FIGURE NUMBERS AND DATA FOR OCTOBER 1976 SURVEY

Time	10-ft Current Direction	10-ft Current Speed (fps)	Ambient Surface Temperature (°F)	Depth (ft)	Isotherm Figure No.	Temperature Rise Figure No.	Dye Figure No.
			October 7, 1976				
0828-1004	Eastward	0.43	61.1	1.0	III-1	III-6	-
				2.0	III-2	-	III-22
				6.0	III-3	-	III-23
				10.0	III-4	-	III-24
				15.0	III-5	-	-
1029-1204	Eastward	0.35	61.0	1.5	III-7	-	III-25
1502-1615	Eastward	0.07	60.9	1.0	III-8	III-13	III-26
				2.0	III-9	-	III-27
				6.0	III-10	-	III-28
				10.0	III-11	-	
				15.0	III-12	-	
1627-1803	Eastward	0.02	61.0	1.5	III-14	-	III-29
			October 8, 1976				
1505-1631	Westward	0.48	61.0	1.5	III-15	-	III-30
1642-1759	Westward	0.52	60.0	1.0	III-16	III-21	III-31
				2.0	III-17	-	III-32
				6.0	III-18	-	-
				10.0	III-19	-	-
				15.0	III-20	-	-

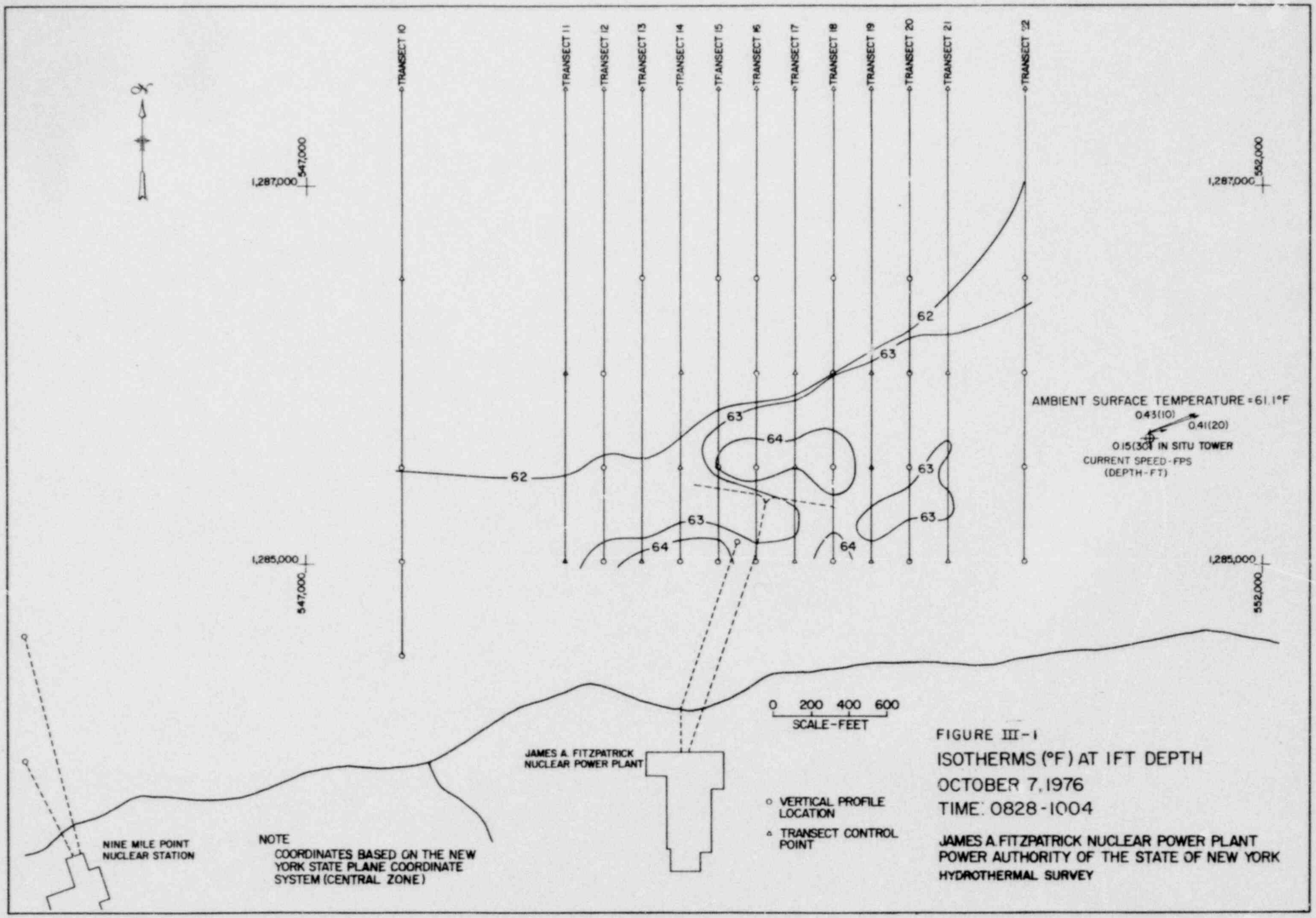


FIGURE III-1

ISOTHERMS (°F) AT 1FT DEPTH

OCTOBER 7, 1976

TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

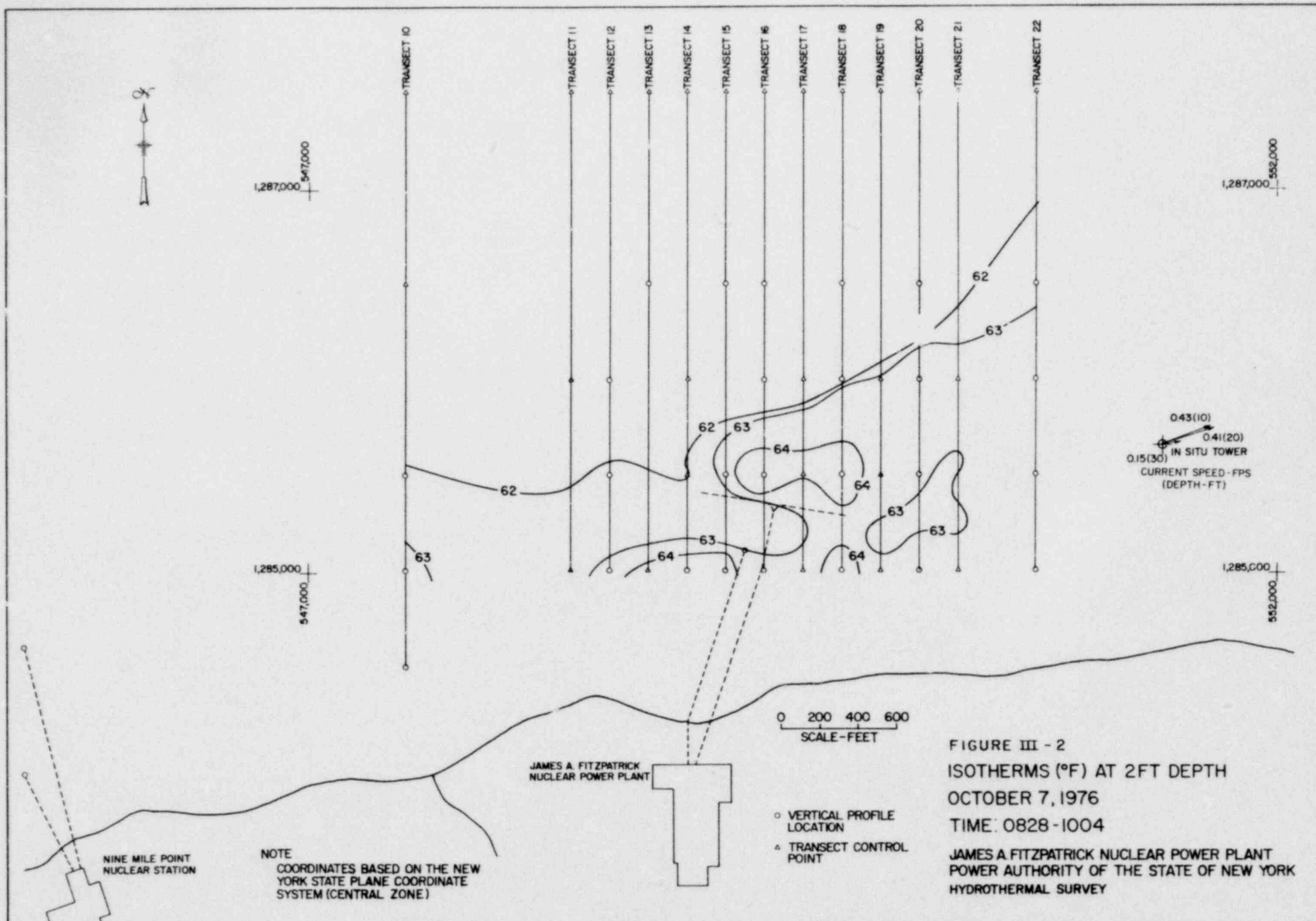


FIGURE III - 2

ISOTHERMS (°F) AT 2FT DEPTH

OCTOBER 7, 1976

TIME: 0828 - 1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

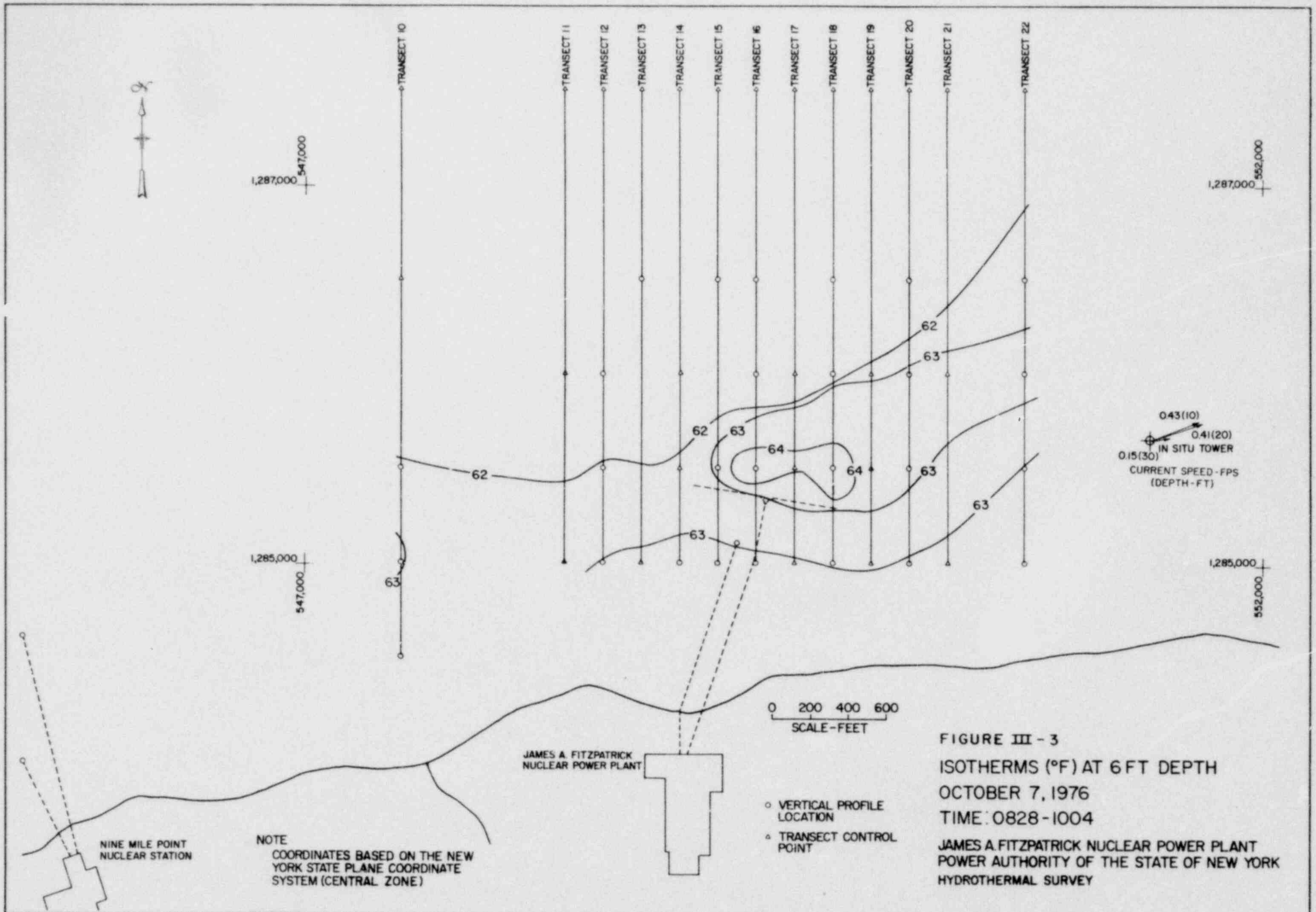


FIGURE III - 3

ISOTHERMS (°F) AT 6 FT DEPTH

OCTOBER 7, 1976

TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

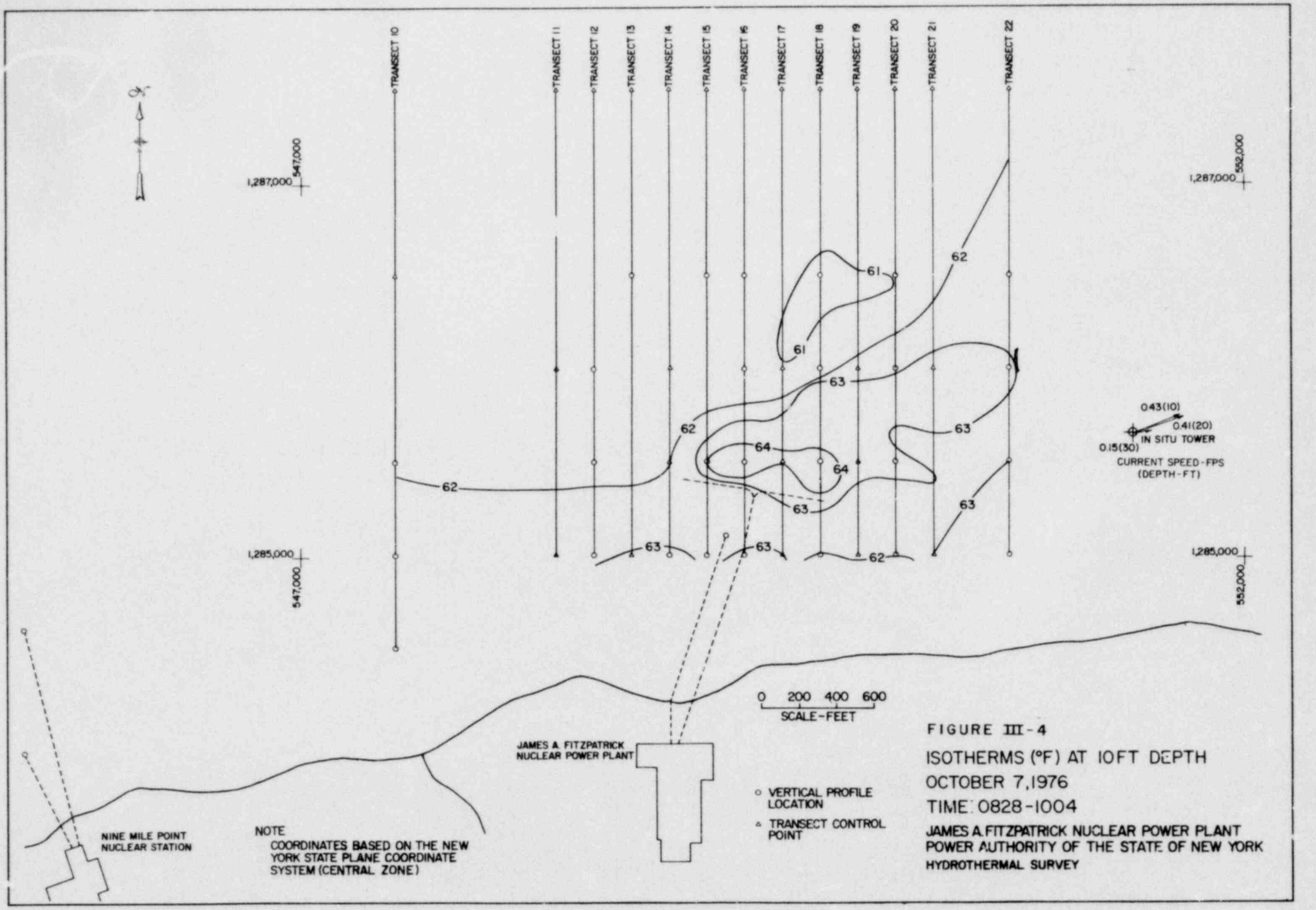


FIGURE III-4

ISOTHERMS (°F) AT 10FT DEPTH
OCTOBER 7, 1976
TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

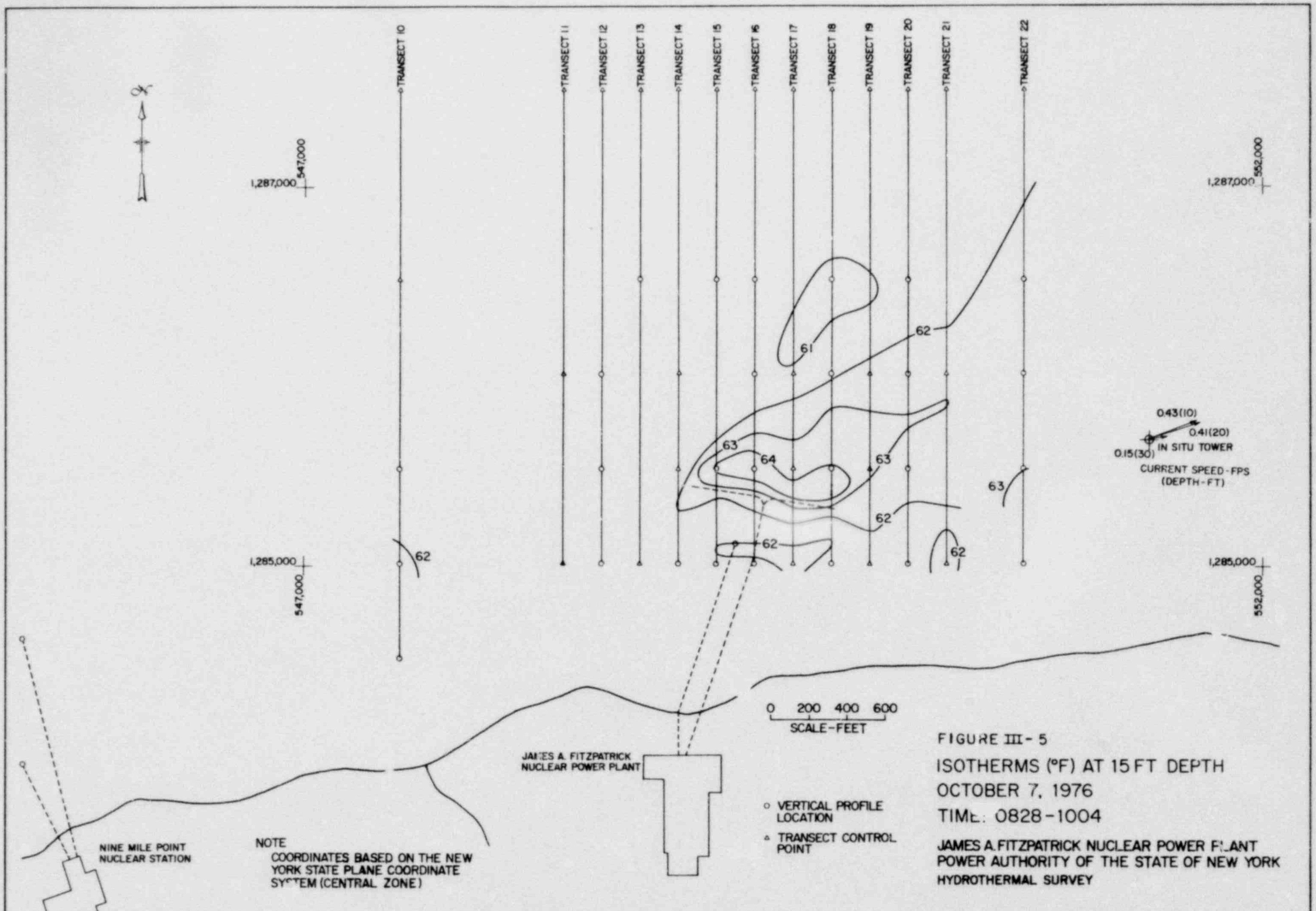


FIGURE III-5

ISOTHERMS (°F) AT 15 FT DEPTH

OCTOBER 7, 1976

TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

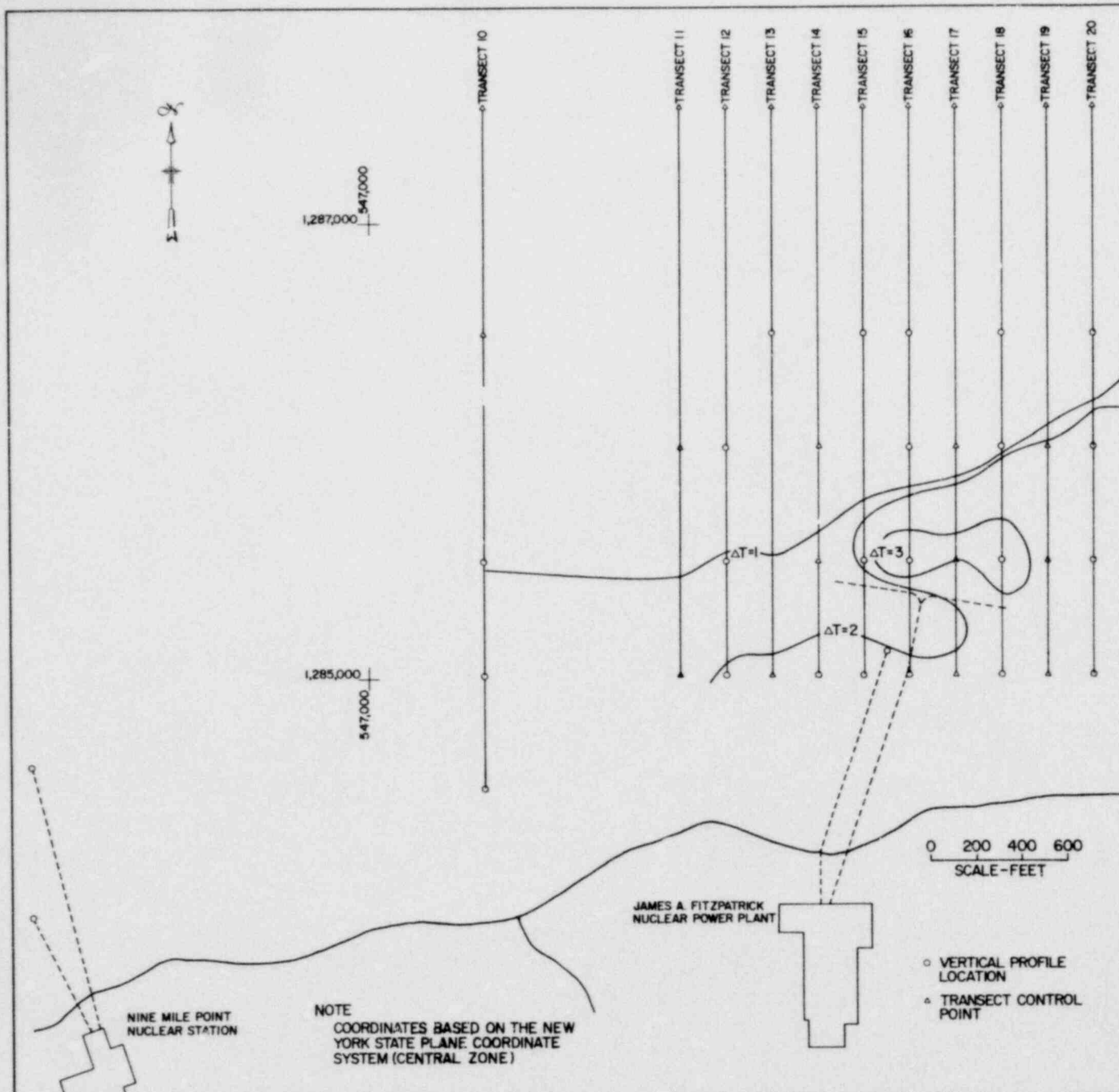


FIGURE III - 6

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1FT DEPTH

OCTOBER 7, 1976

TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

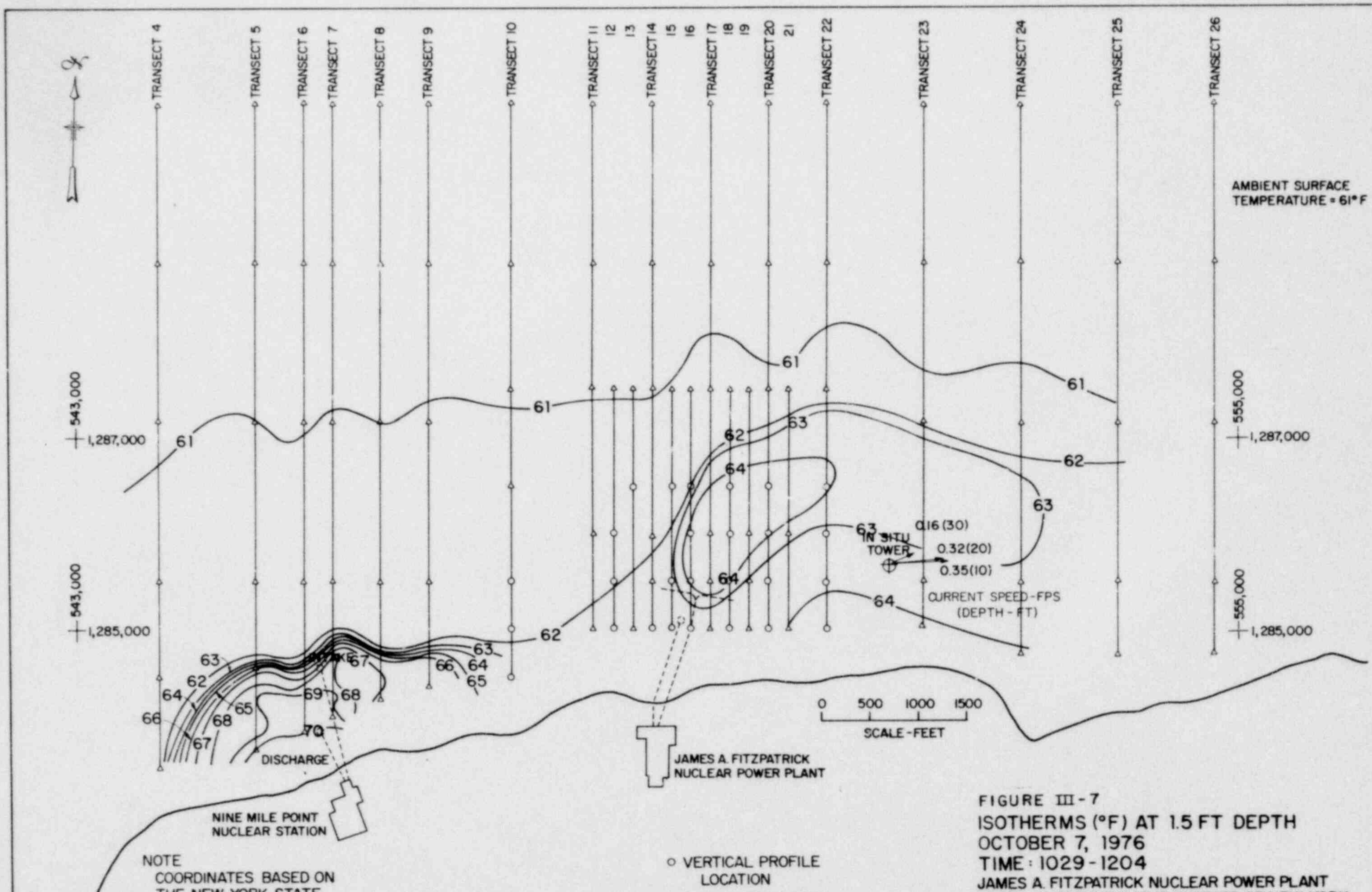


FIGURE III-7
ISOTHERMS (°F) AT 1.5 FT DEPTH
OCTOBER 7, 1976
TIME: 1029-1204
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

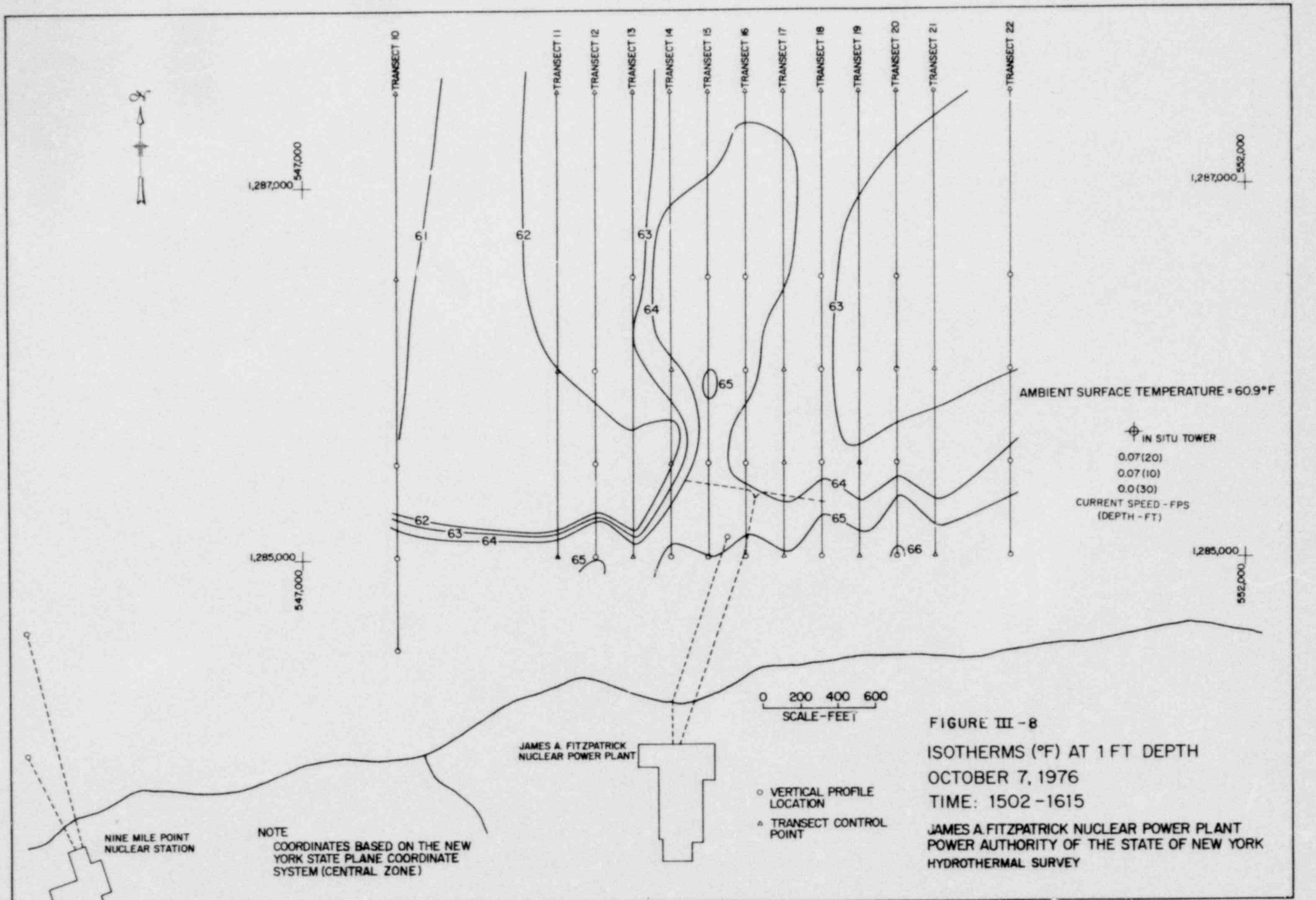


FIGURE III - 8

ISOTHERMS (°F) AT 1 FT DEPTH

OCTOBER 7, 1976

TIME: 1502 - 1615

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

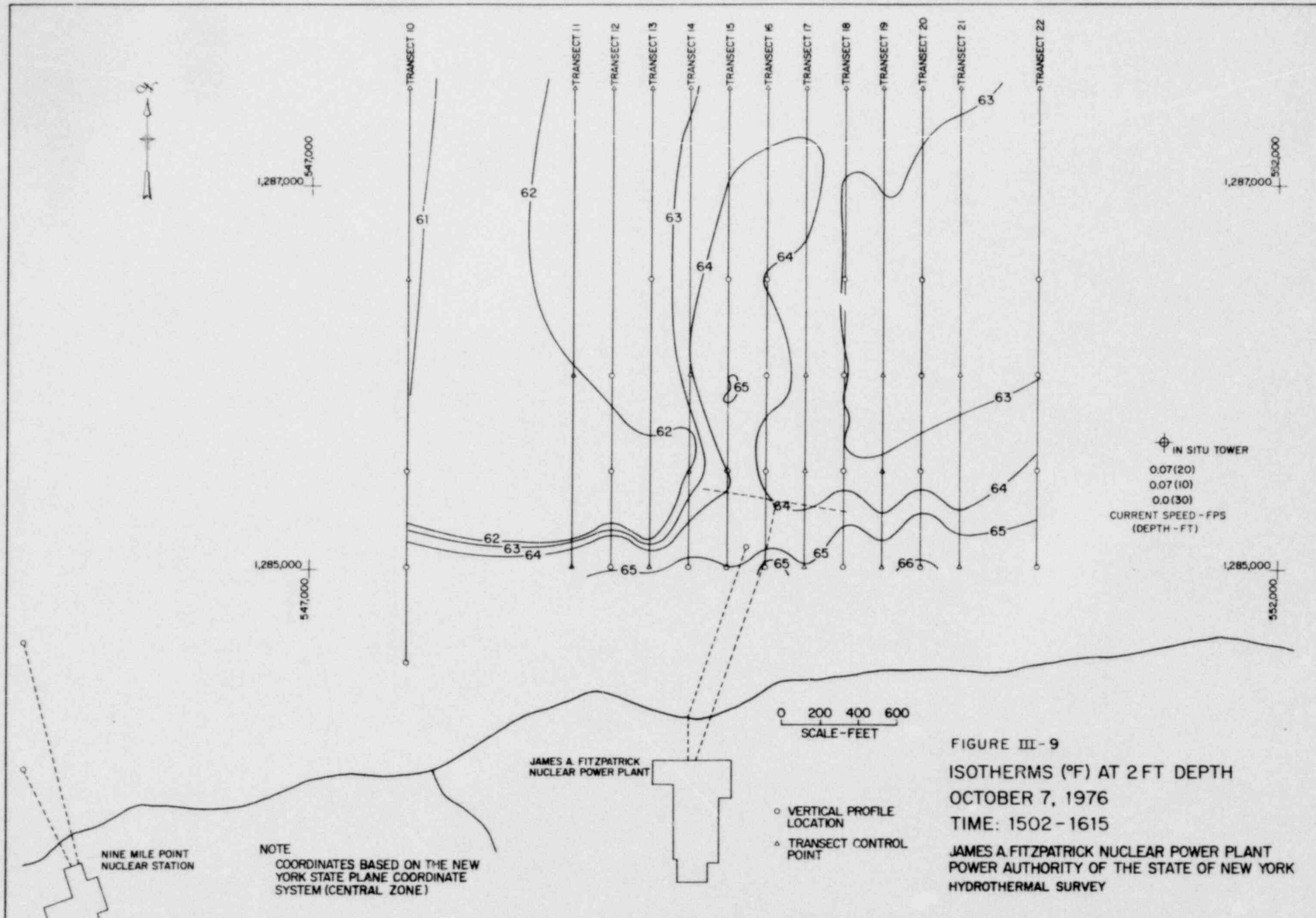


FIGURE III-9

ISOTHERMS (°F) AT 2 FT DEPTH

OCTOBER 7, 1976

TIME: 1502-1615

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

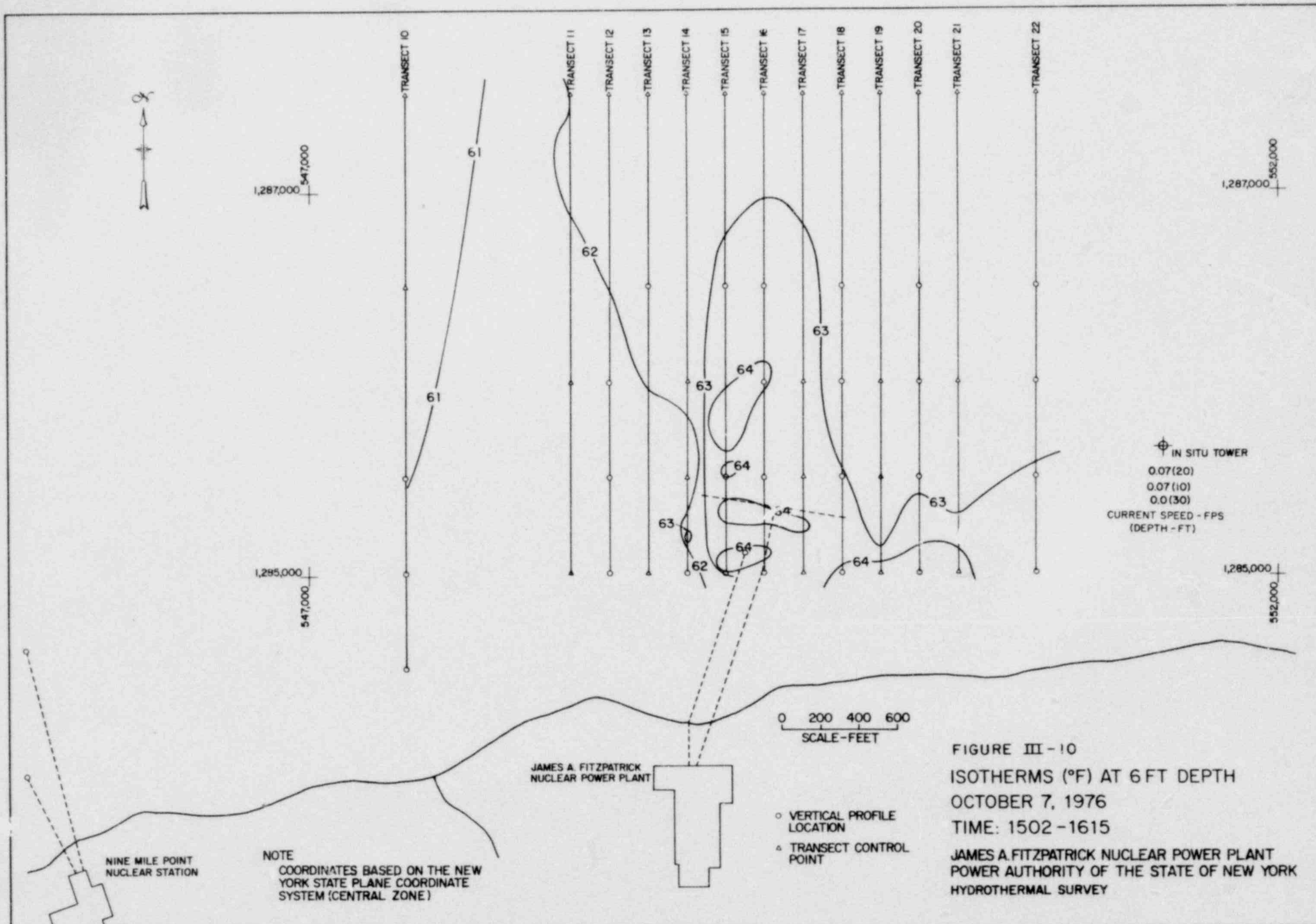


FIGURE III-10

ISOTHERMS (°F) AT 6 FT DEPTH

OCTOBER 7, 1976

TIME: 1502-1615

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

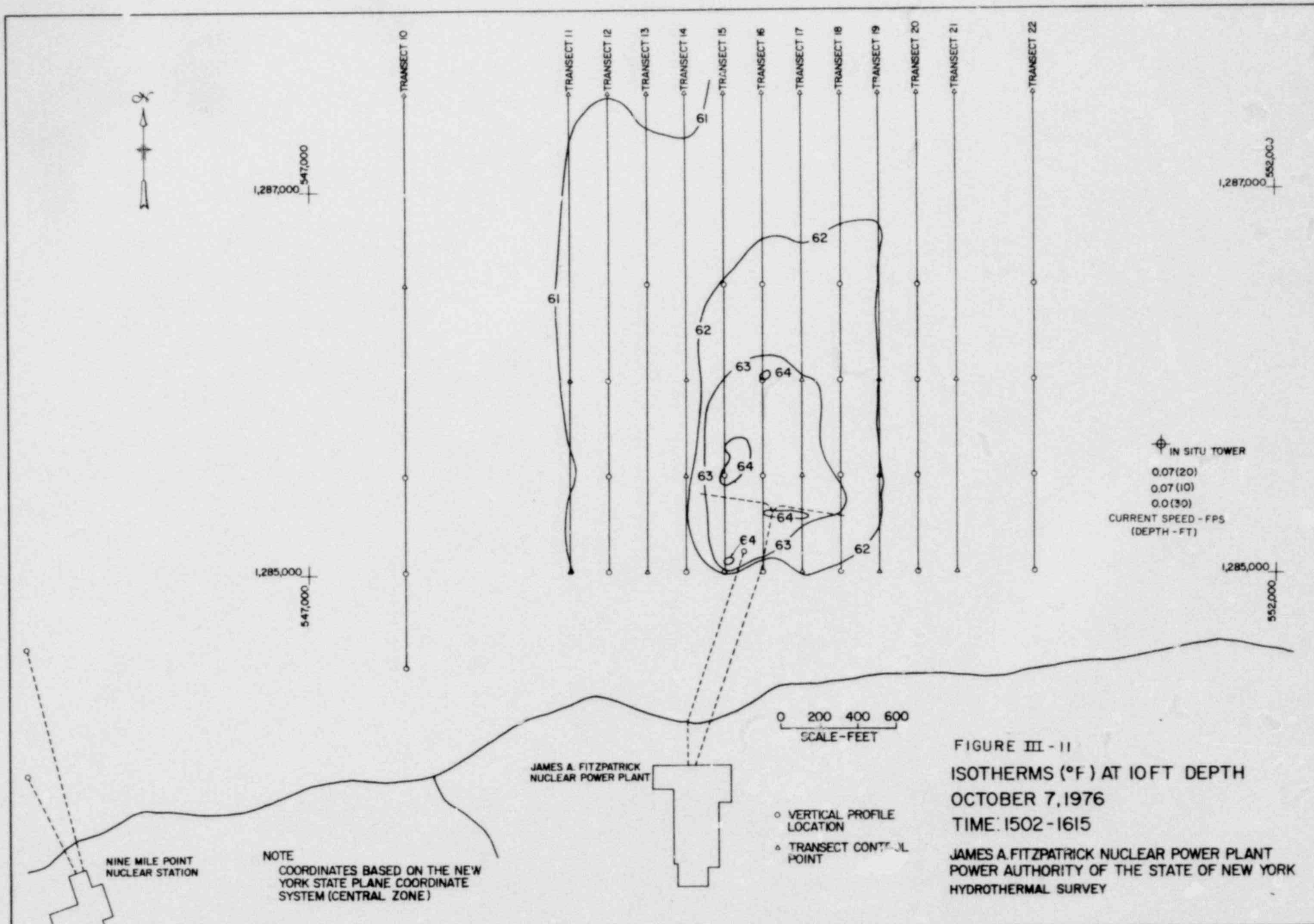


FIGURE III - 11

ISOTHERMS (°F) AT 10FT DEPTH

OCTOBER 7, 1976

TIME: 1502 - 1615

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

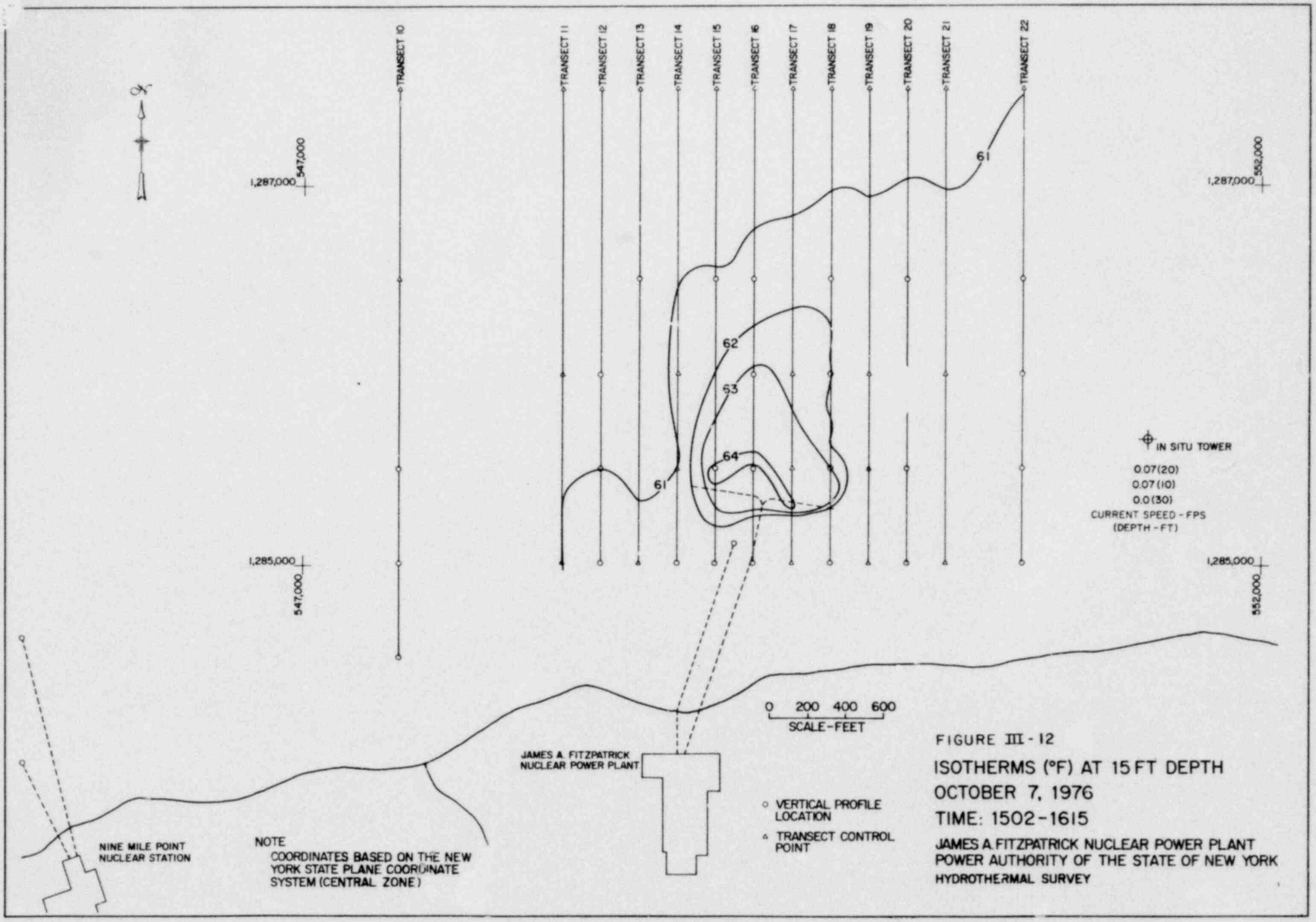
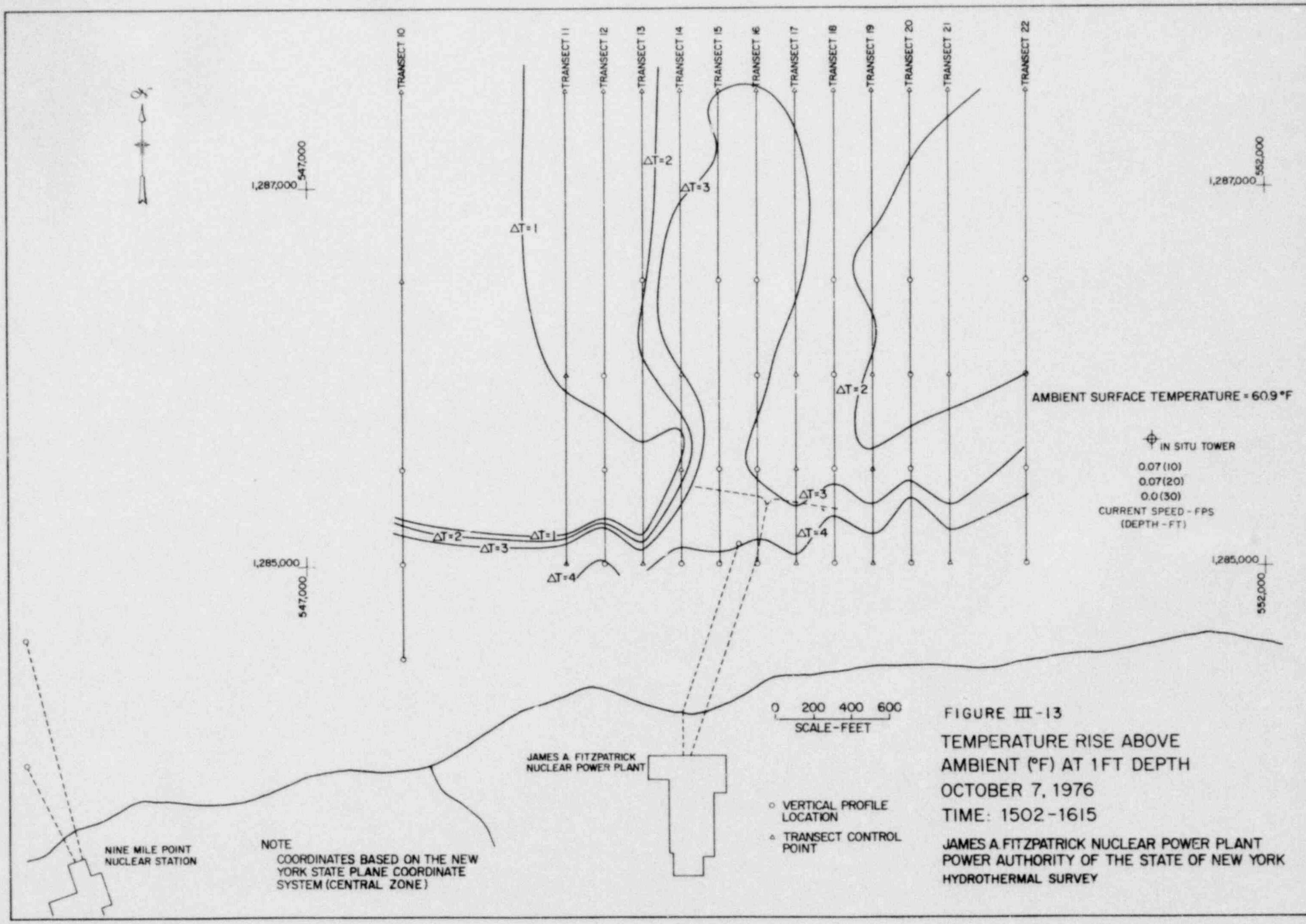


FIGURE III-12

ISOTHERMS (°F) AT 15 FT DEPTH
OCTOBER 7, 1976
TIME: 1502-1615

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE III-13

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
OCTOBER 7, 1976
TIME: 1502-1615

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

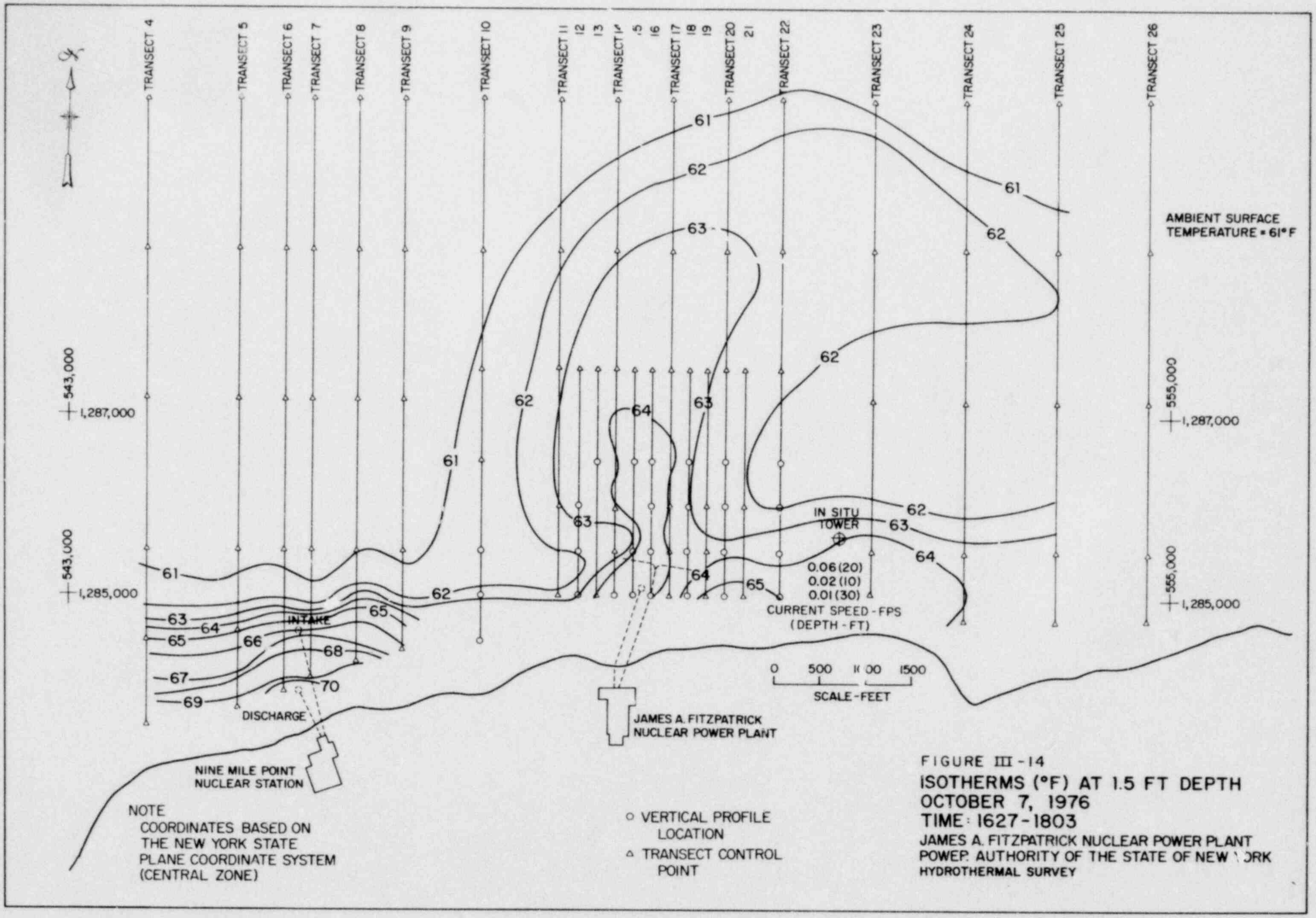


FIGURE III - 14
ISOTHERMS (°F) AT 1.5 FT DEPTH
OCTOBER 7, 1976
TIME: 1627 - 1803
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

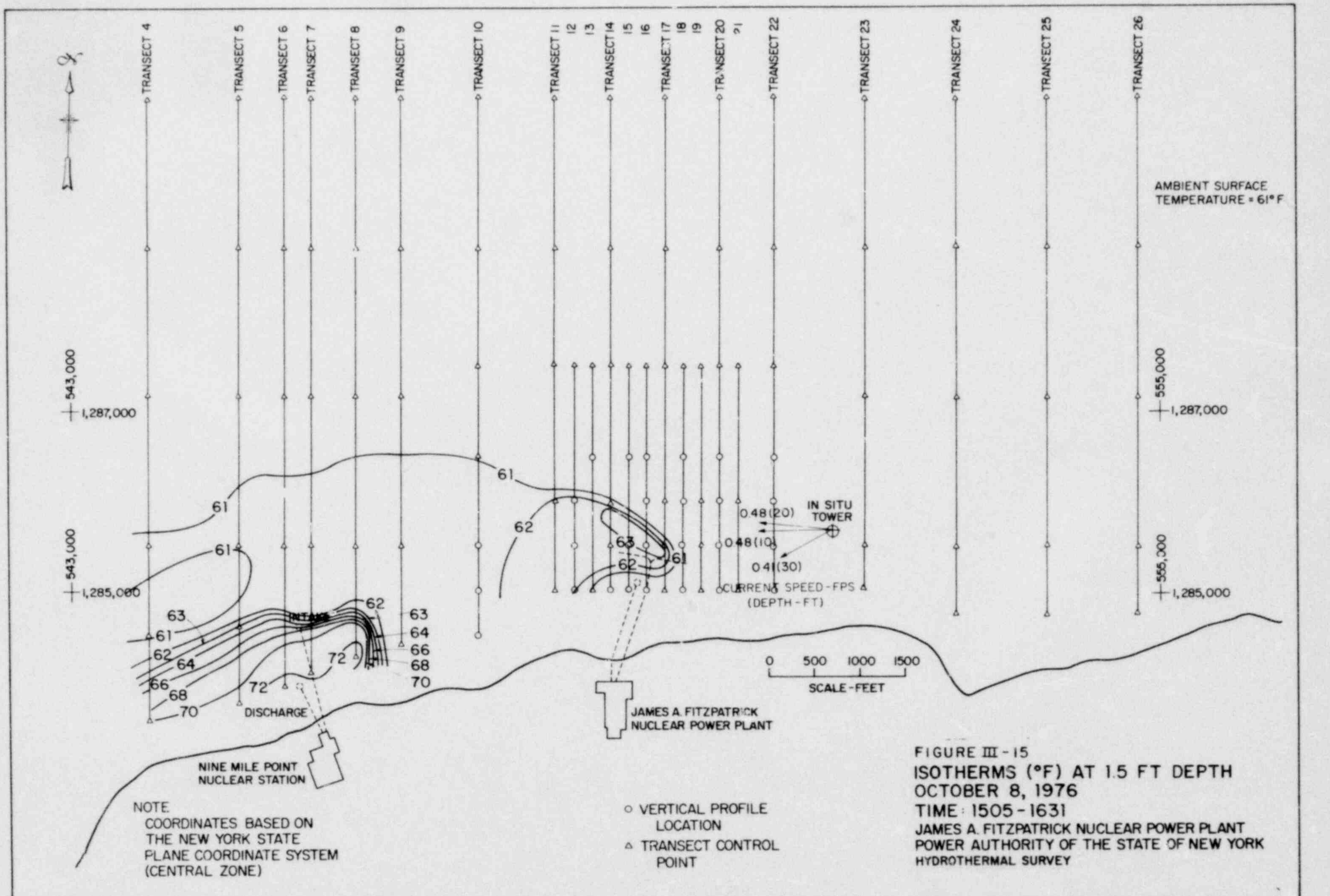


FIGURE III - 15
ISOTHERMS (°F) AT 1.5 FT DEPTH
OCTOBER 8, 1976
TIME: 1505 - 1631
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

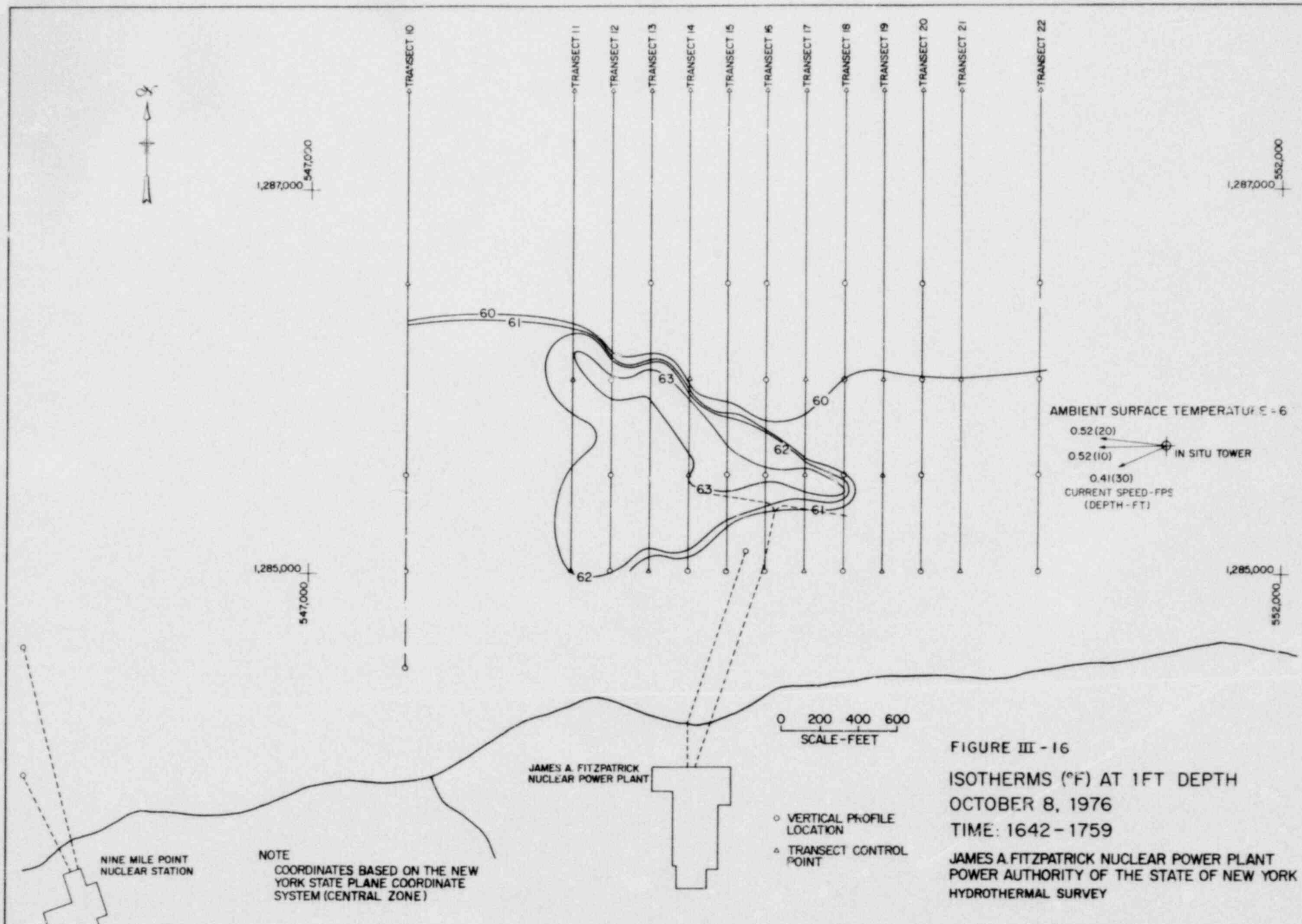


FIGURE III - 16

ISOTHERMS (°F) AT 1FT DEPTH
OCTOBER 8, 1976
TIME: 1642 - 1759

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

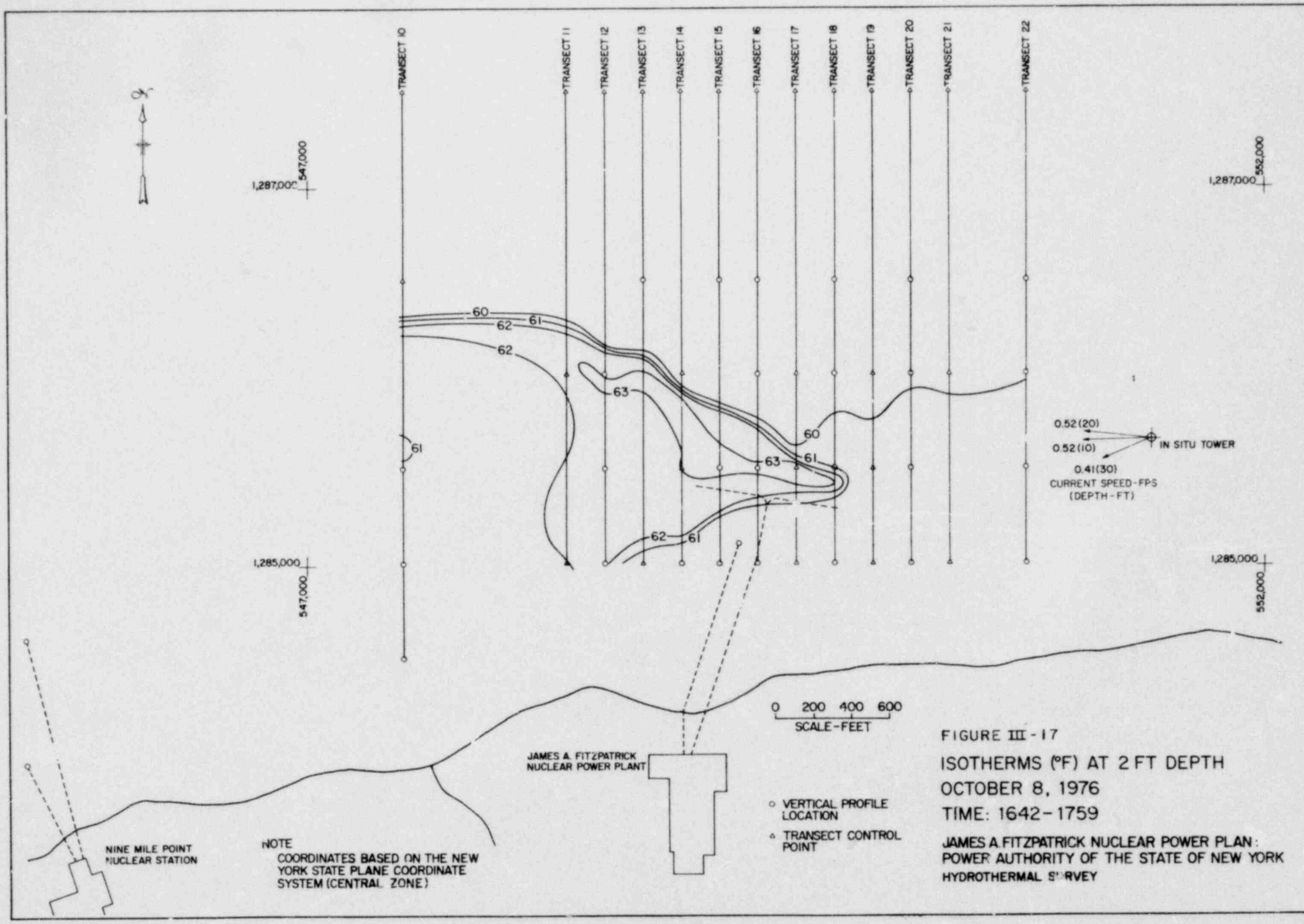


FIGURE III - 17

ISOTHERMS (°F) AT 2 FT DEPTH
OCTOBER 8, 1976
TIME: 1642-1759

JAMES A. FITZPATRICK NUCLEAR POWER PLAN:
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

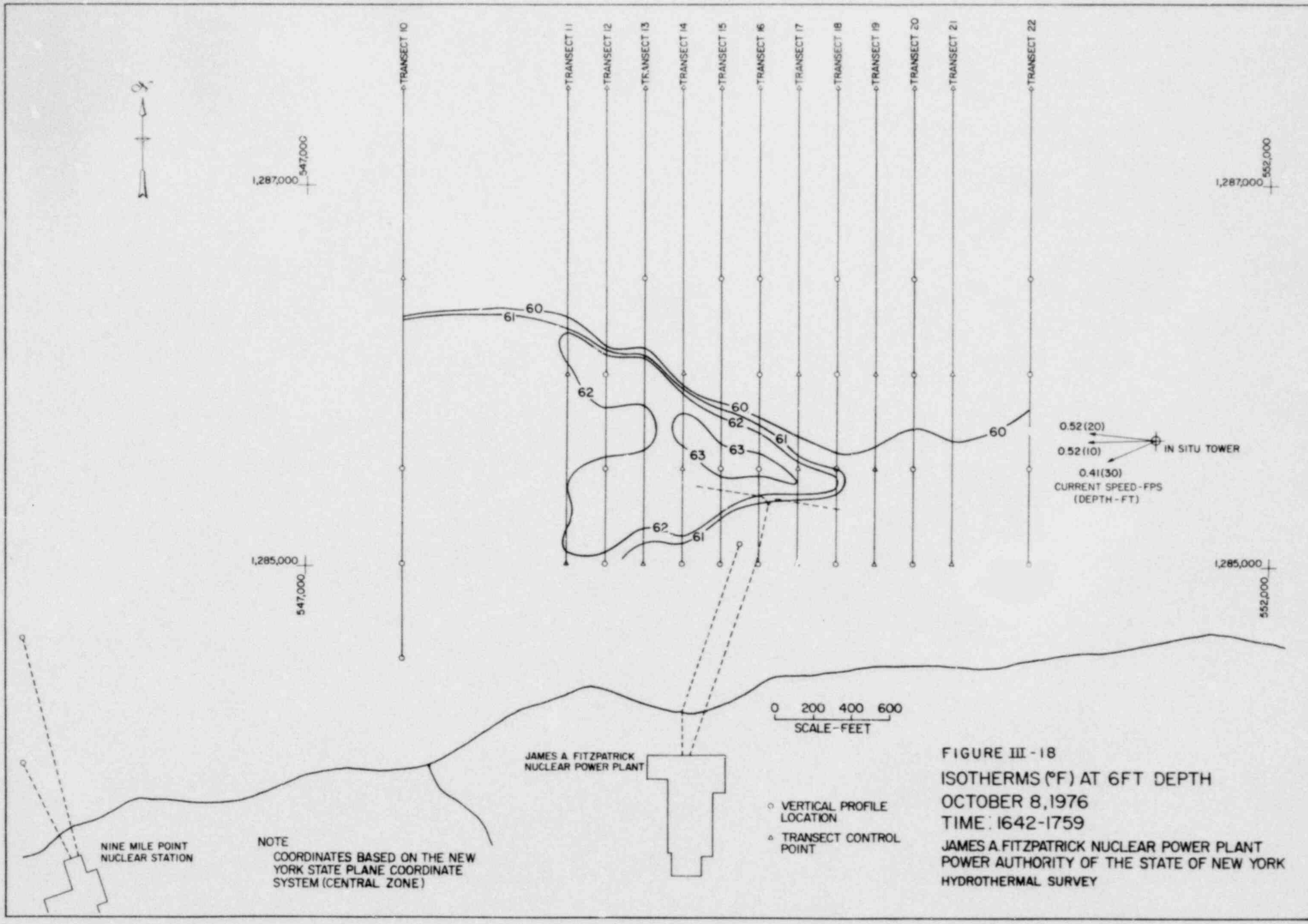


FIGURE III-18

ISOTHERMS (°F) AT 6FT DEPTH
OCTOBER 8, 1976
TIME: 1642-1759

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

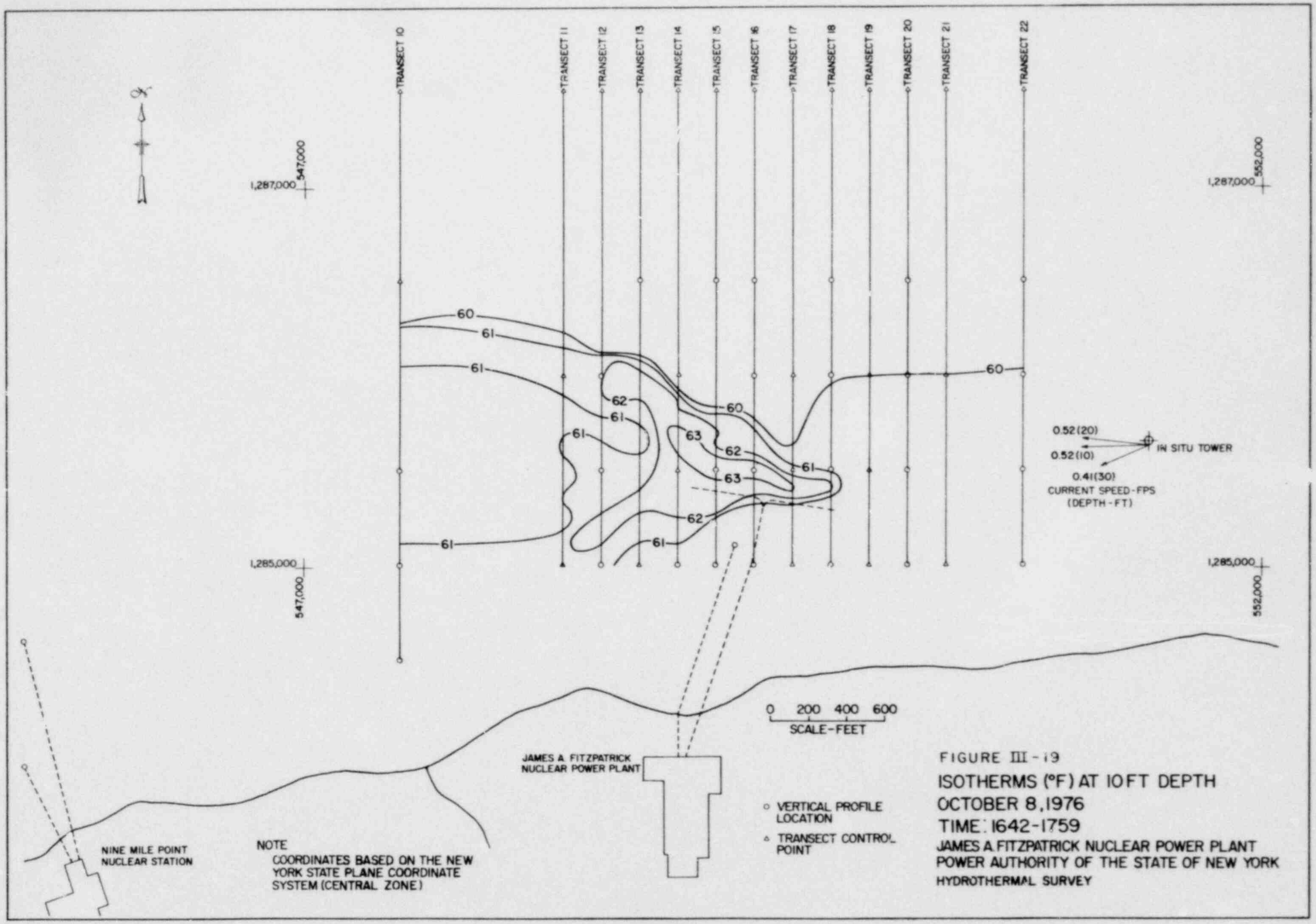
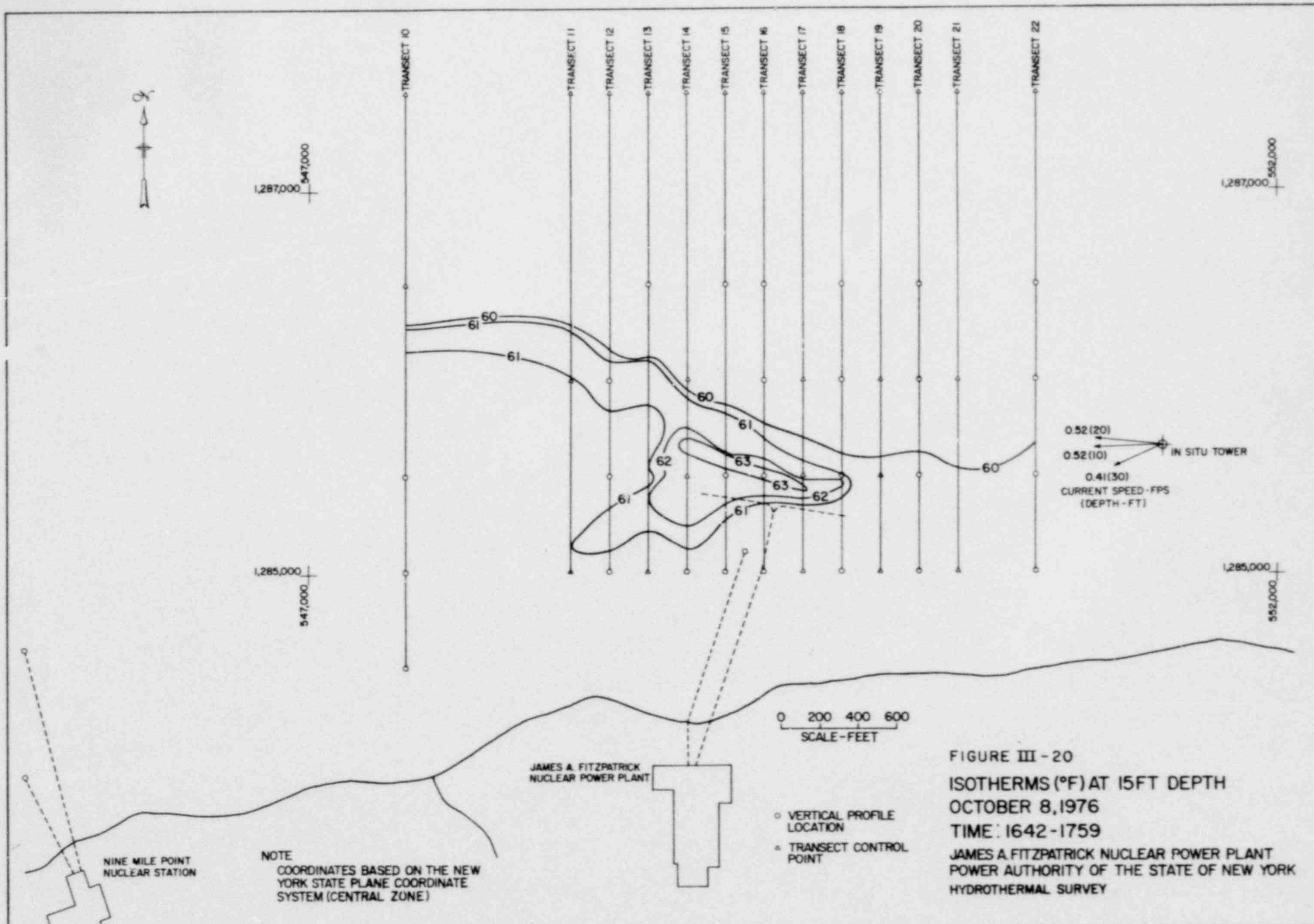


FIGURE III-19

ISOTHERMS (°F) AT 10 FT DEPTH
OCTOBER 8, 1976
TIME: 1642-1759

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE III-20

ISOTHERMS (°F) AT 15FT DEPTH
OCTOBER 8, 1976
TIME: 1642-1759

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

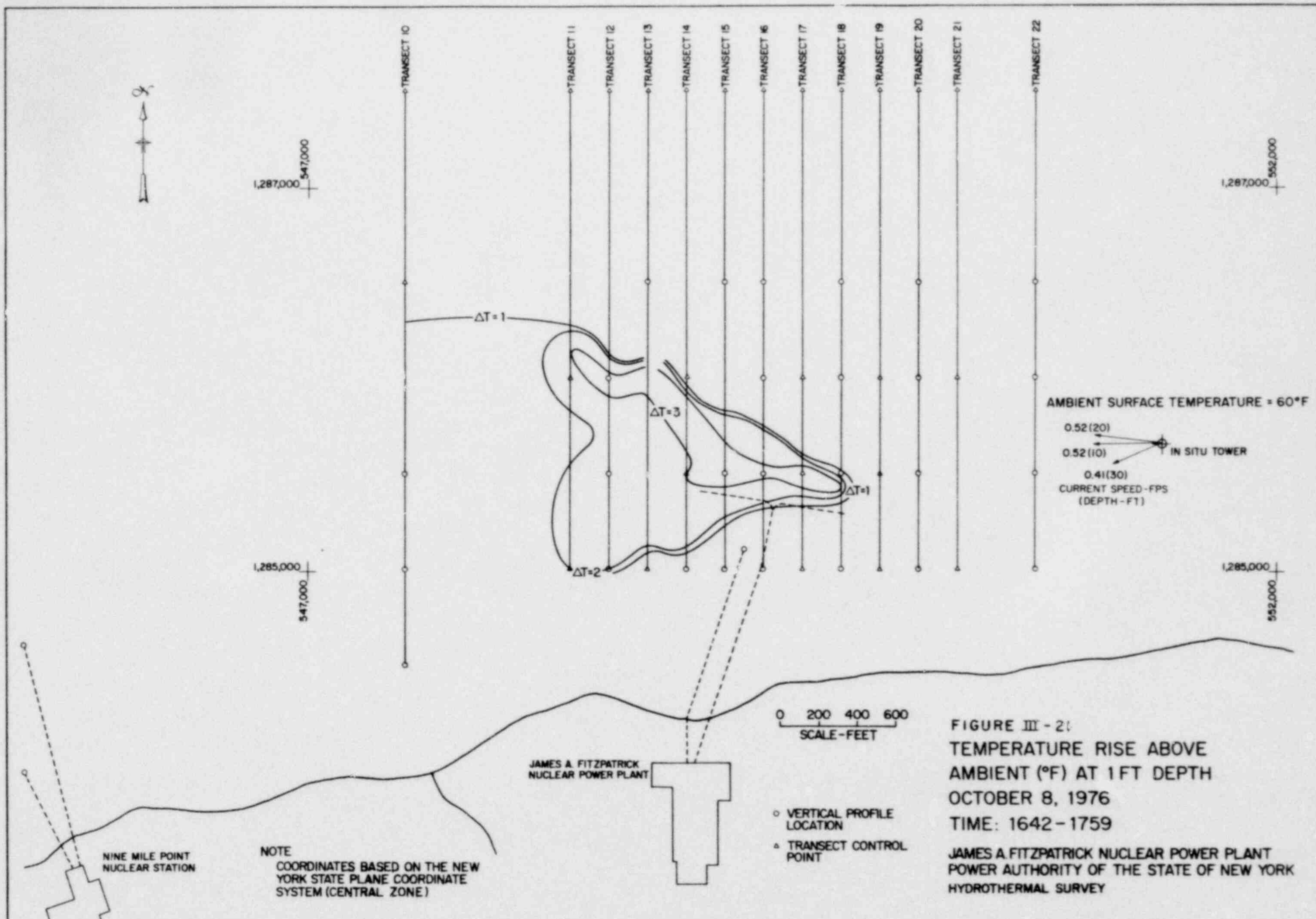
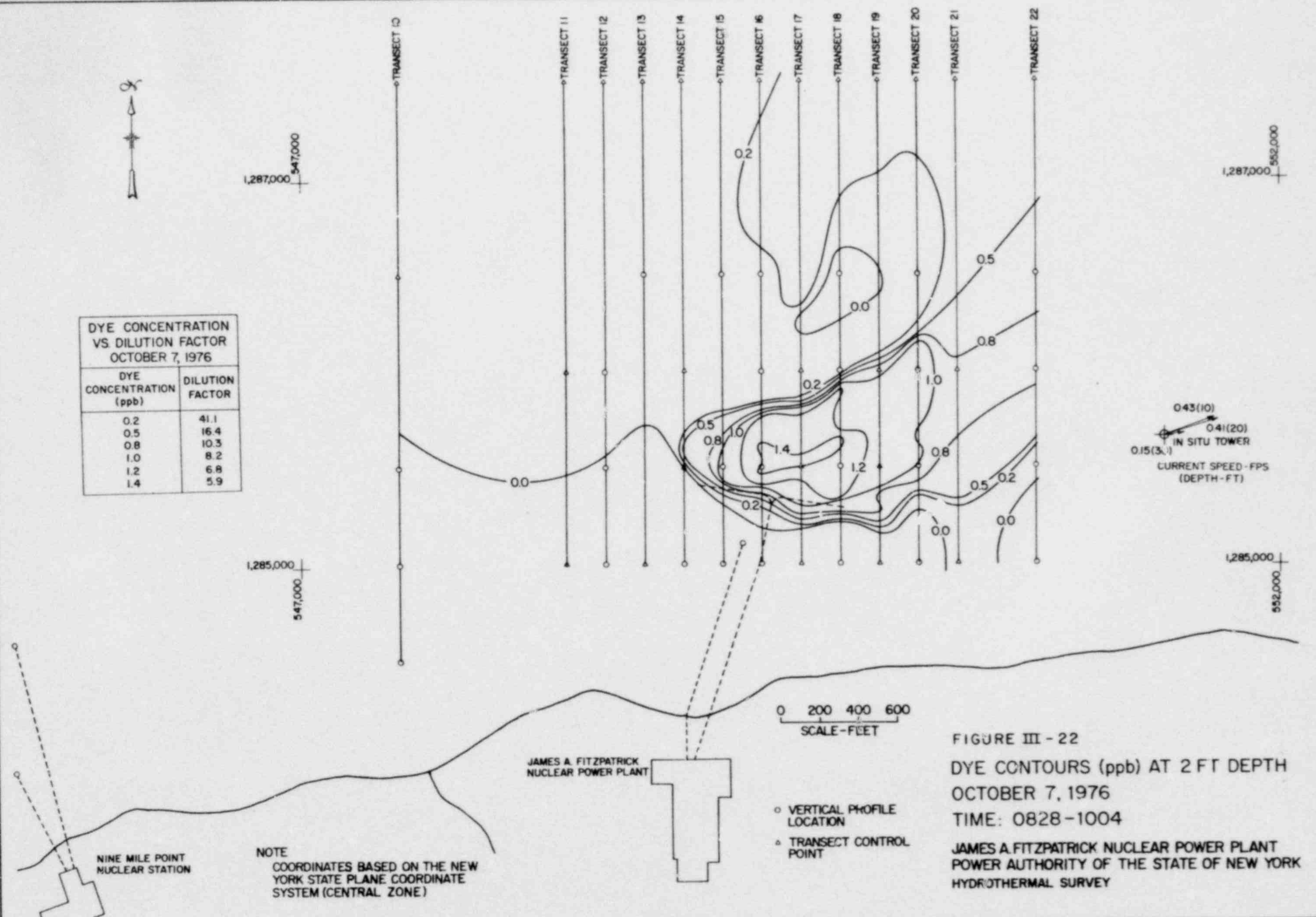


FIGURE III - 21

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
OCTOBER 8, 1976
TIME: 1642 - 1759

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR OCTOBER 7, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	41.1
0.5	16.4
0.8	10.3
1.0	8.2
1.2	6.8
1.4	5.9

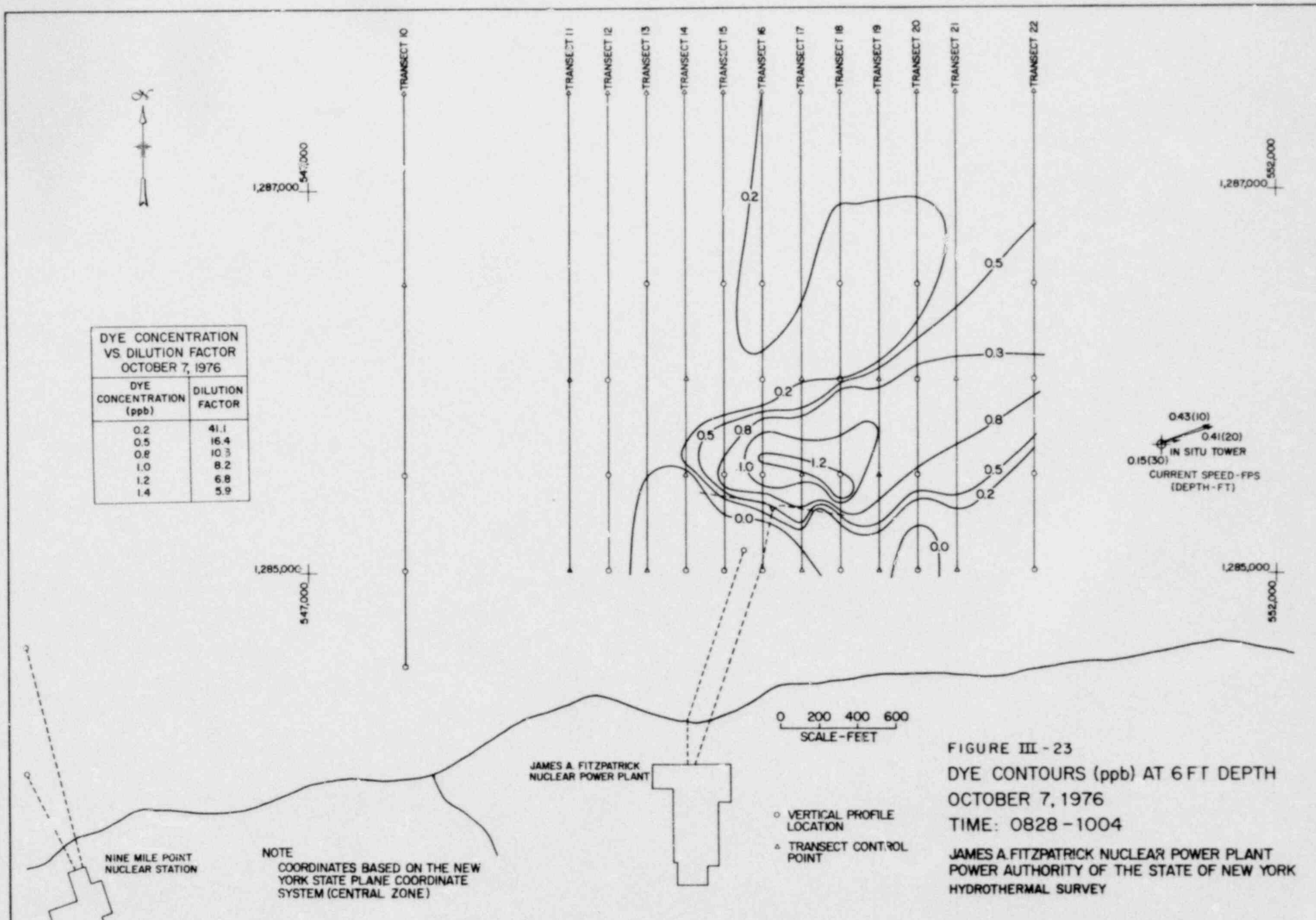
FIGURE III - 22

DYE CONTOURS (ppb) AT 2 FT DEPTH

OCTOBER 7, 1976

TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR OCTOBER 7, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	41.1
0.5	16.4
0.8	10.3
1.0	8.2
1.2	6.8
1.4	5.9

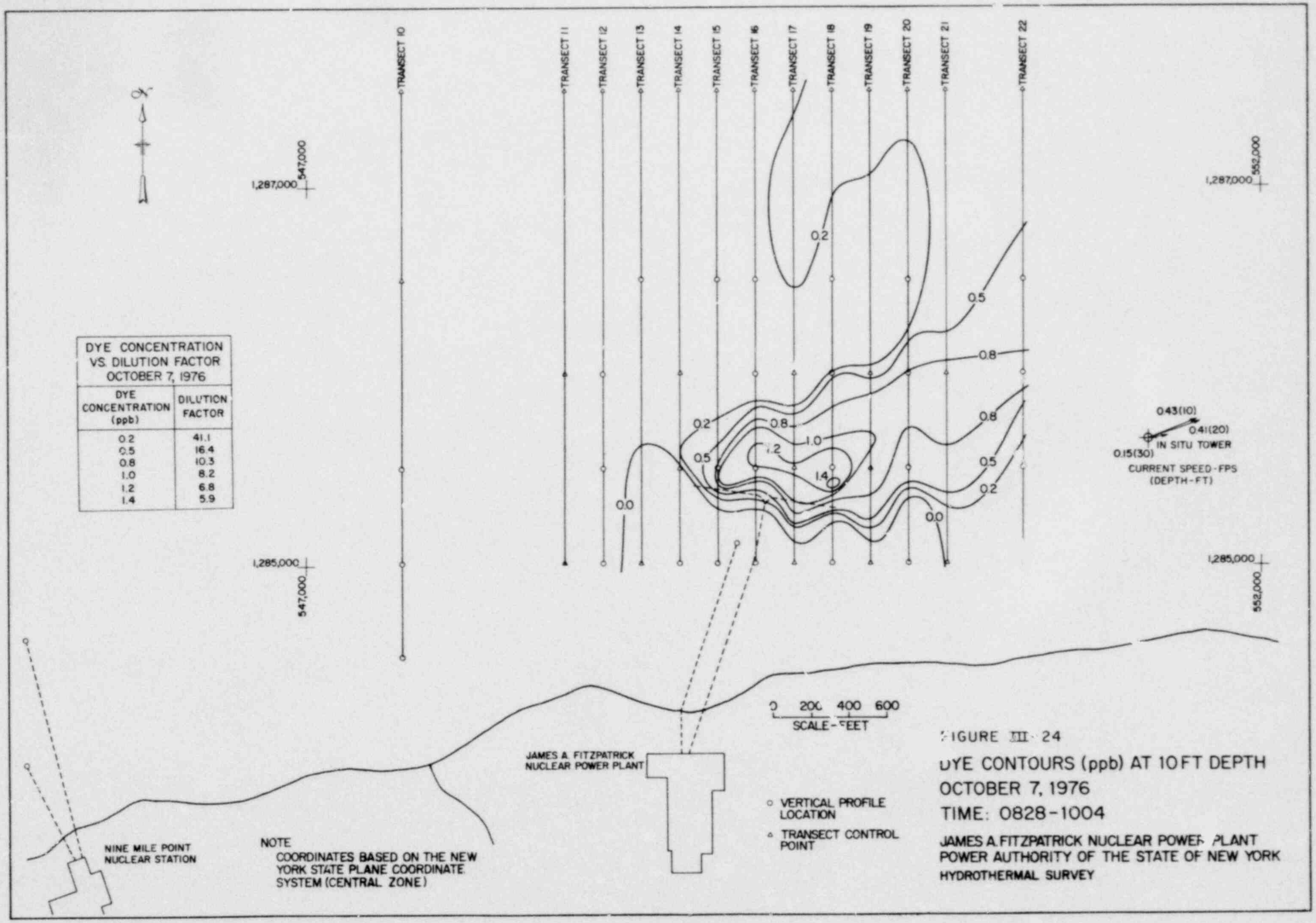
FIGURE III-23

DYE CONTOURS (ppb) AT 6 FT DEPTH

OCTOBER 7, 1976

TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



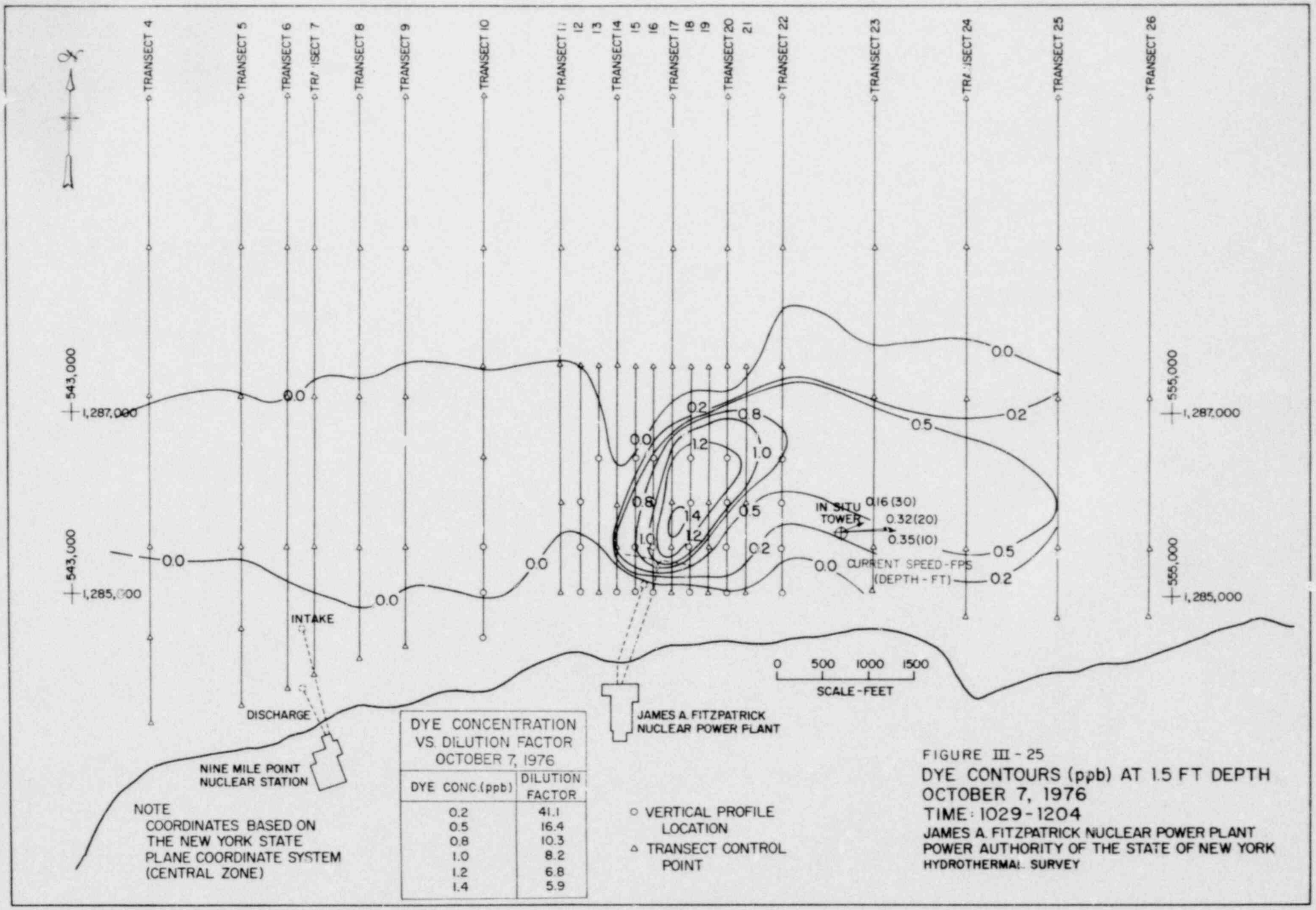
NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

DYE CONCENTRATION VS. DILUTION FACTOR
OCTOBER 7, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	41.1
0.5	16.4
0.8	10.3
1.0	8.2
1.2	6.8
1.4	5.9

FIGURE III-24
DYE CONTOURS (ppb) AT 10 FT DEPTH
OCTOBER 7, 1976
TIME: 0828-1004

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR OCTOBER 7, 1976

DYE CONC.(ppb)	DILUTION FACTOR
0.2	41.1
0.5	16.4
0.8	10.3
1.0	8.2
1.2	6.8
1.4	5.9

FIGURE III - 25
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
OCTOBER 7, 1976
TIME: 1029-1204
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

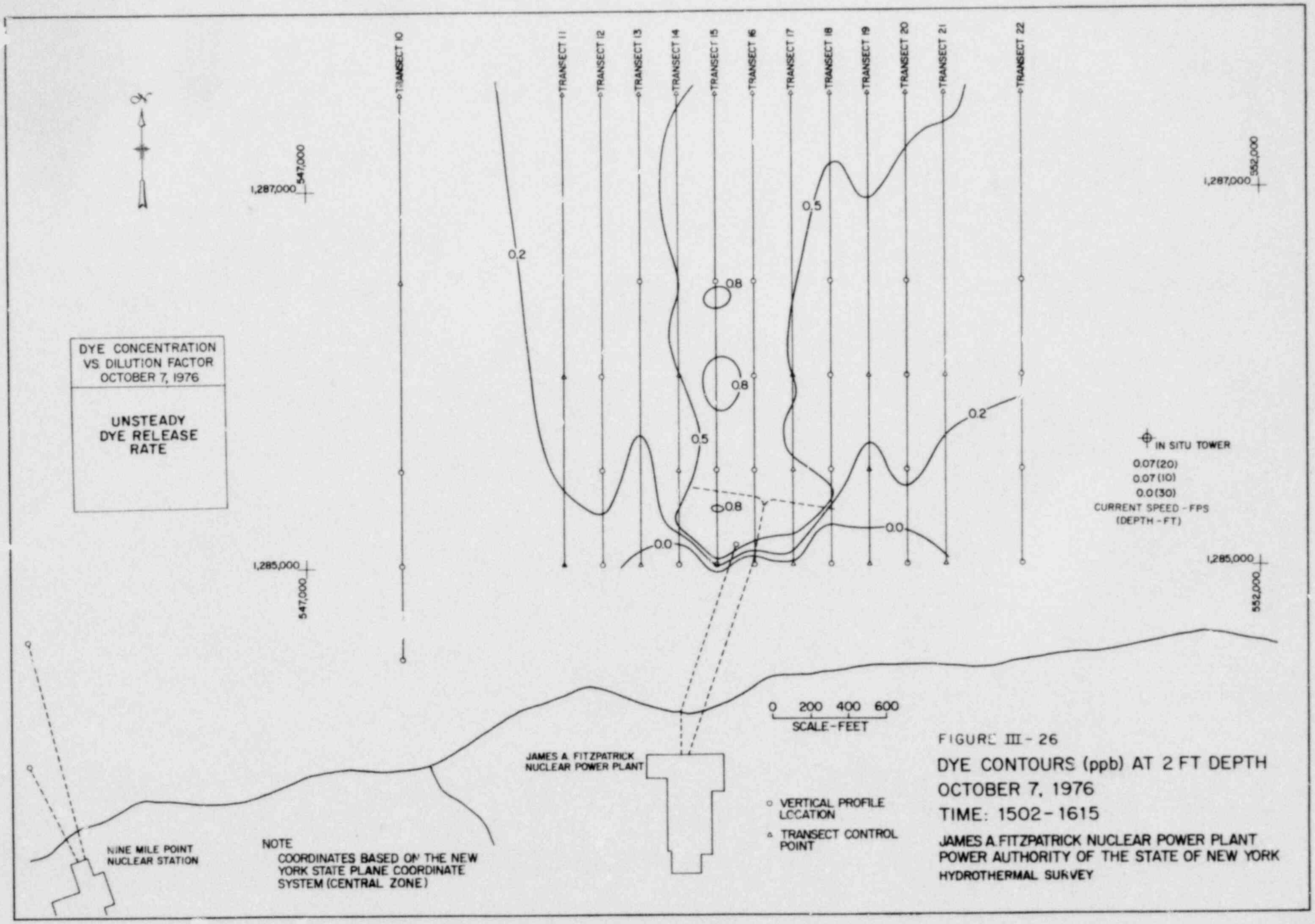


FIGURE III - 26
DYE CONTOURS (ppb) AT 2 FT DEPTH
OCTOBER 7, 1976
TIME: 1502 - 1615
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

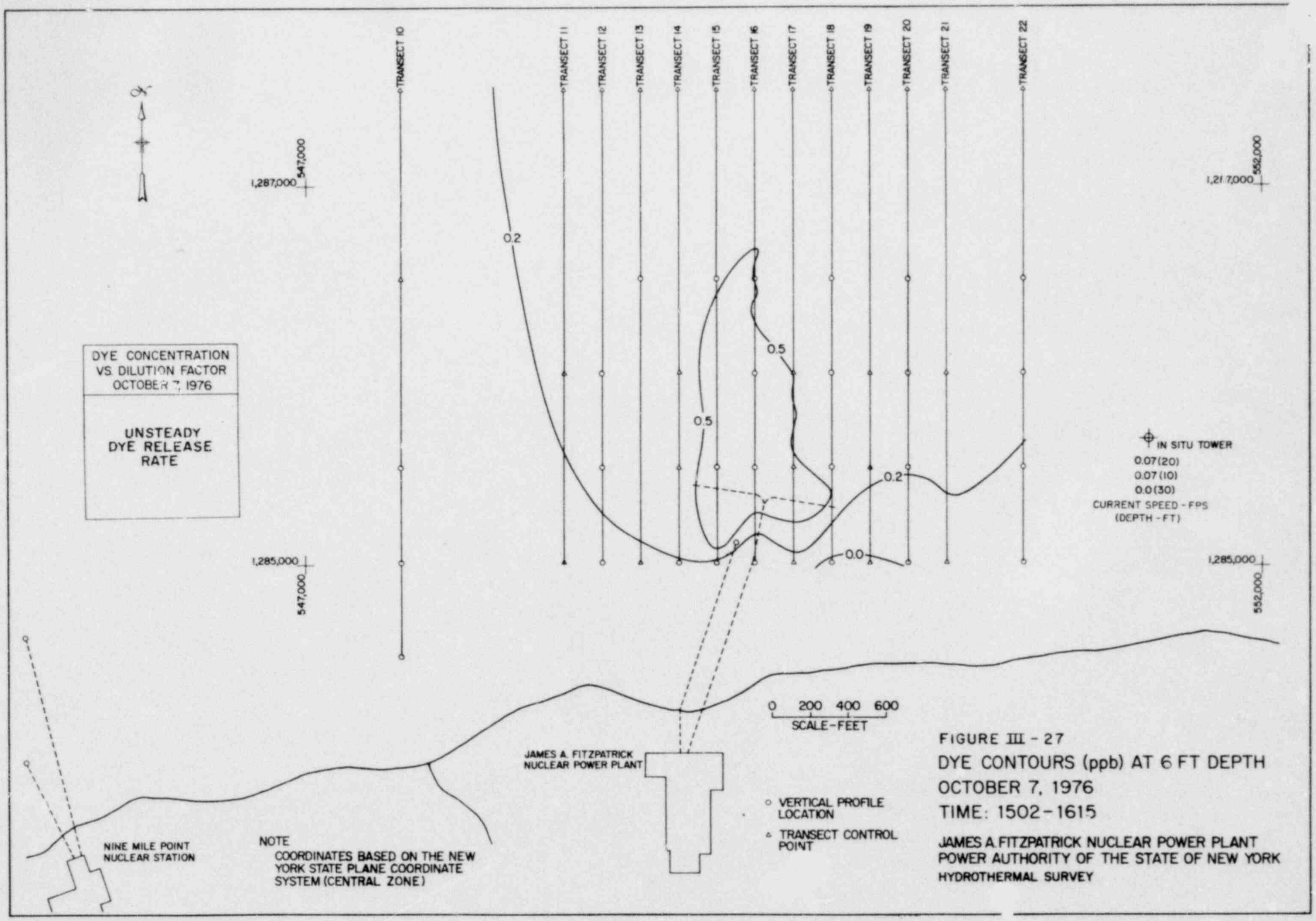


FIGURE III - 27
DYE CONTOURS (ppb) AT 6 FT DEPTH
OCTOBER 7, 1976
TIME: 1502-1615

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

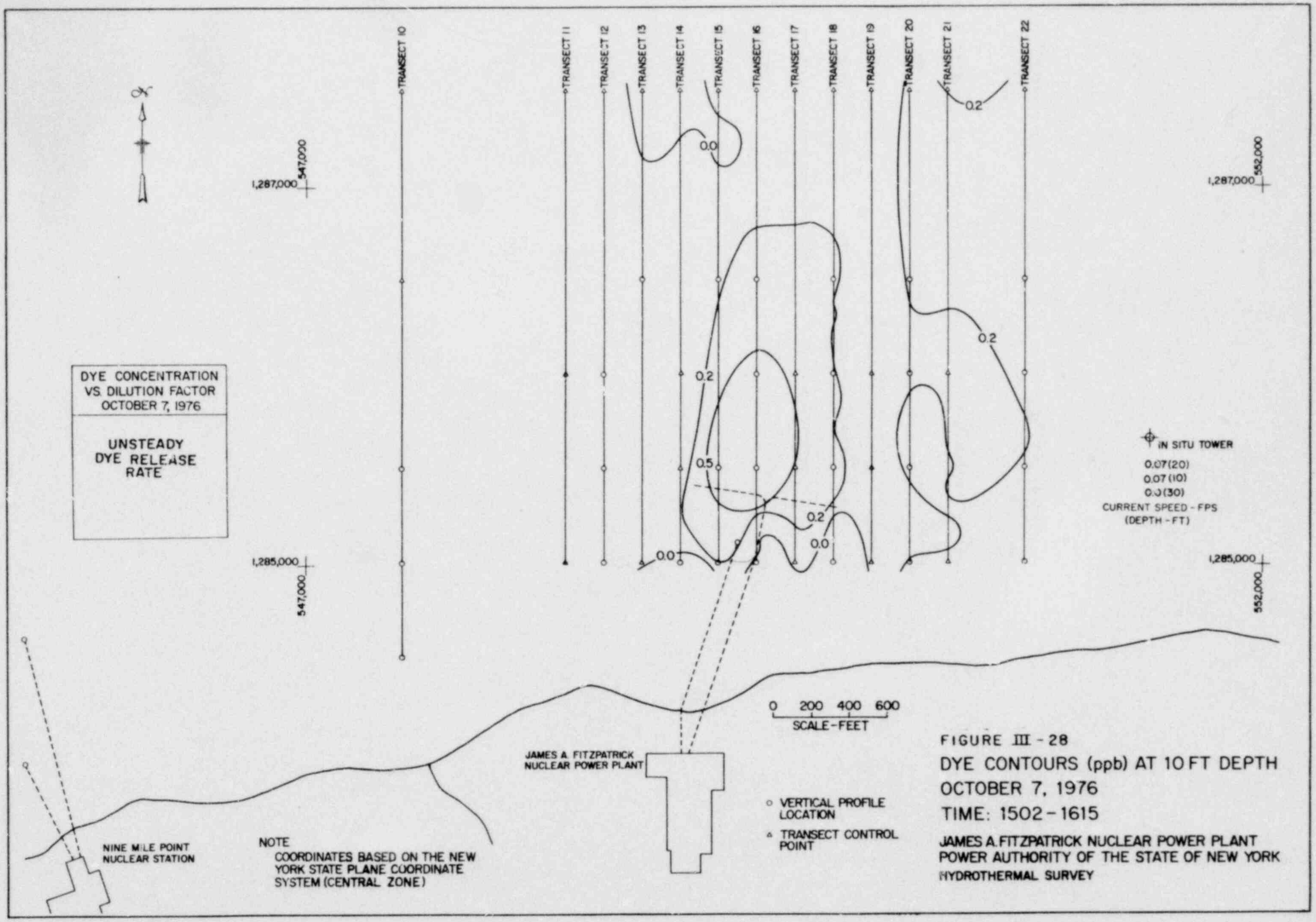


FIGURE III - 28
DYE CONTOURS (ppb) AT 10 FT DEPTH
OCTOBER 7, 1976
TIME: 1502 - 1615
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

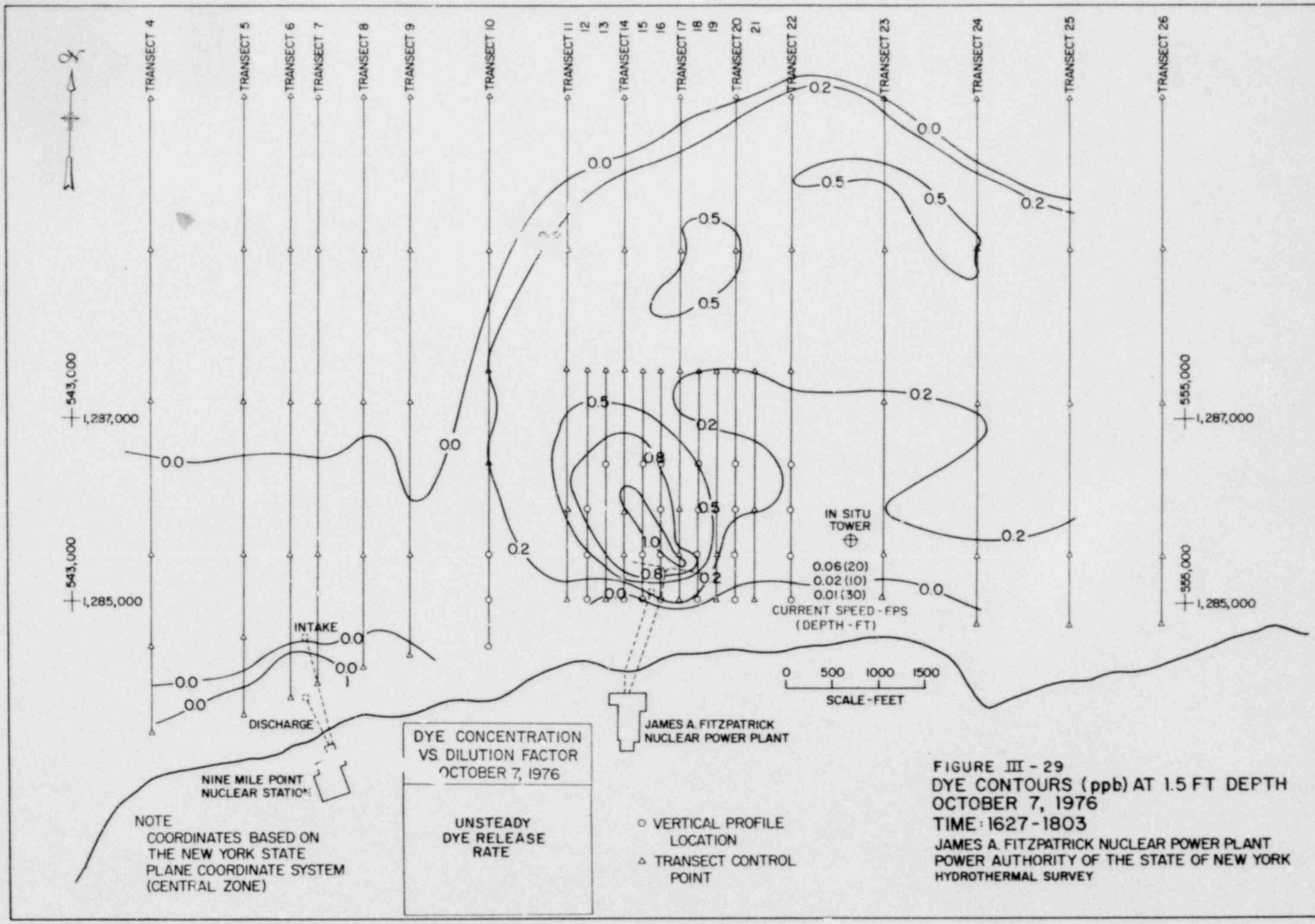
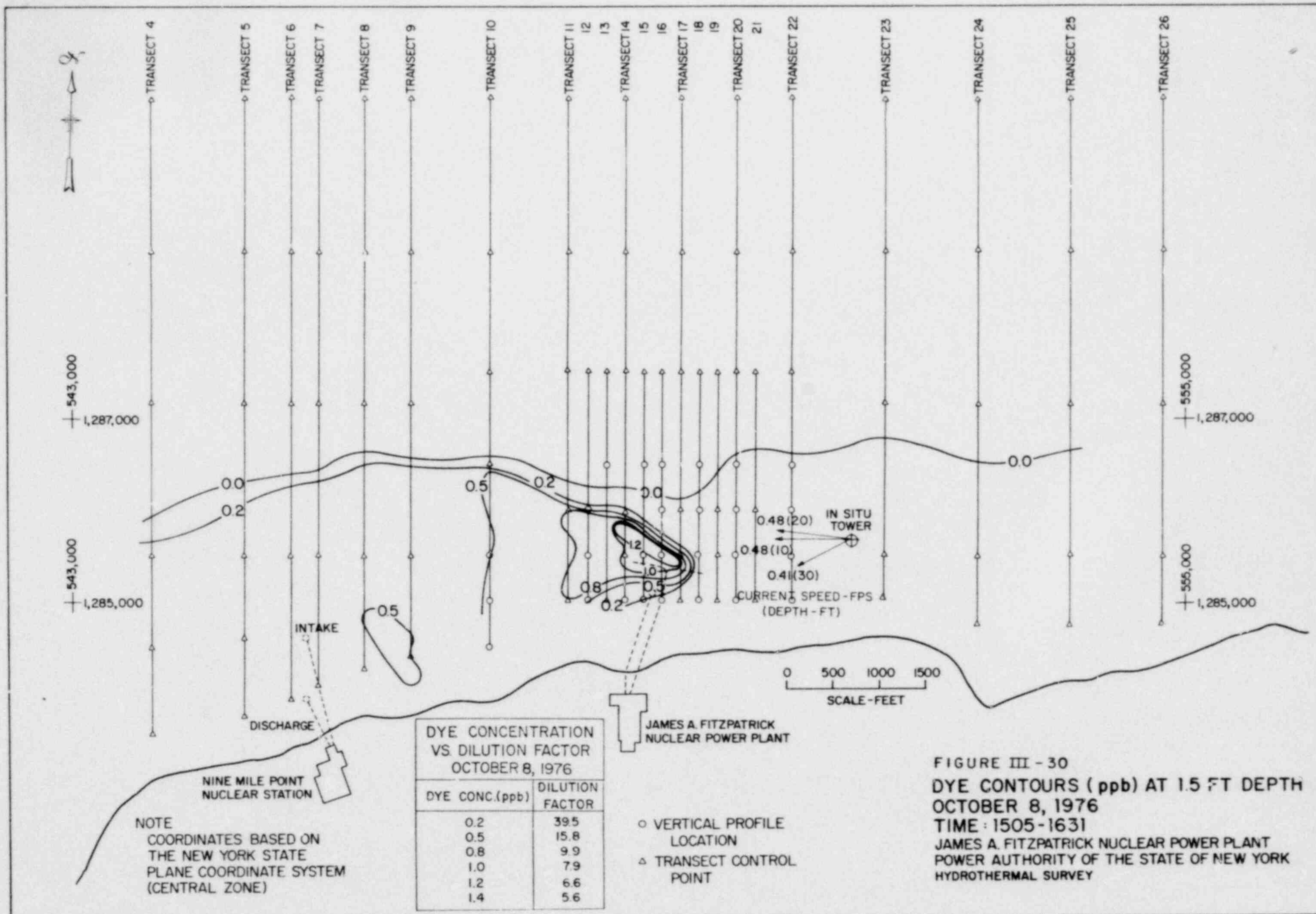


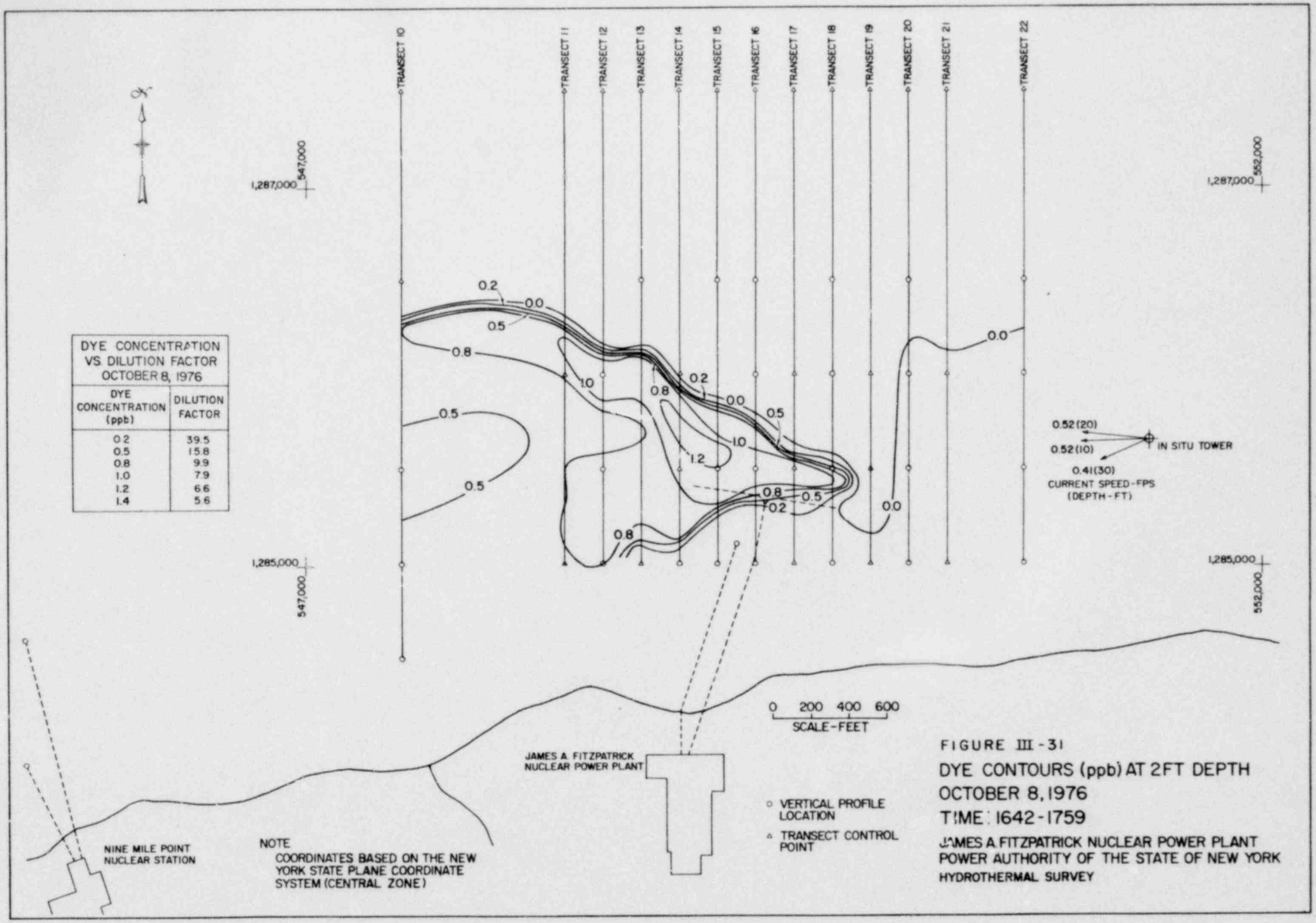
FIGURE III - 29
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
OCTOBER 7, 1976
TIME: 1627-1803
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR OCTOBER 8, 1976

DYE CONC.(ppb)	DILUTION FACTOR
0.2	39.5
0.5	15.8
0.8	9.9
1.0	7.9
1.2	6.6
1.4	5.6

FIGURE III - 30
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
OCTOBER 8, 1976
TIME: 1505-1631
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



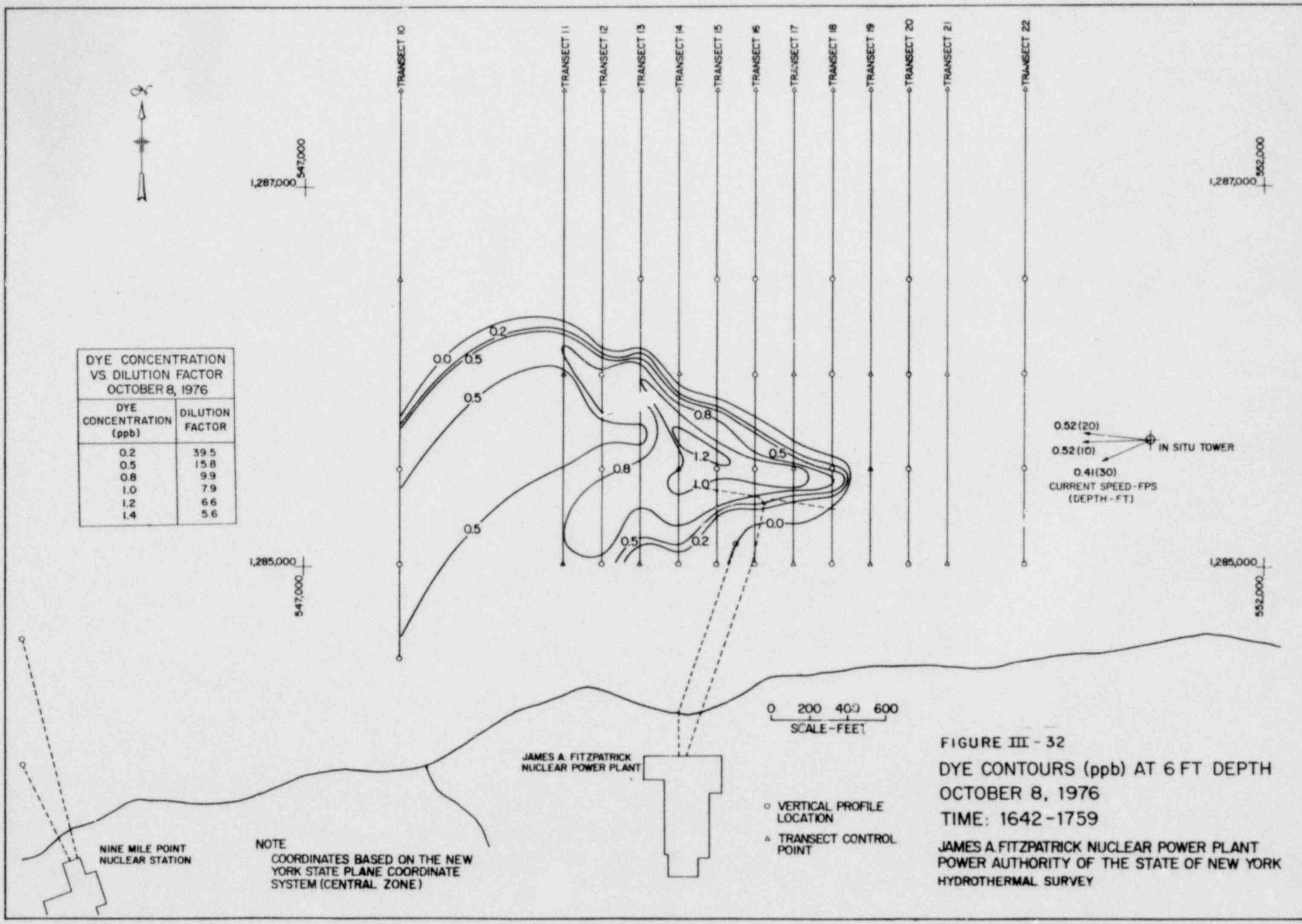
DYE CONCENTRATION VS. DILUTION FACTOR OCTOBER 8, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.5
0.5	15.8
0.8	9.9
1.0	7.9
1.2	6.6
1.4	5.6

FIGURE III-31

DYE CONTOURS (ppb) AT 2 FT DEPTH
OCTOBER 8, 1976
TIME: 1642-1759

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR OCTOBER 8, 1976

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.5
0.5	15.8
0.8	9.9
1.0	7.9
1.2	6.6
1.4	5.6

FIGURE III - 32

DYE CONTOURS (ppb) AT 6 FT DEPTH
OCTOBER 8, 1976
TIME: 1642-1759

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

APRIL 1977 POSTOPERATIONAL
HYDROTHERMAL SURVEY
FOR
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK

IV-APRIL 1977 SURVEY

TABLE OF CONTENTS

IV-APRIL 1977 SURVEY

LIST OF TABLES

IV-APRIL 1977 SURVEY

LIST OF FIGURES

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

IV-APRIL 1977 SURVEY

IV.1 SUMMARY

The fourth postoperational hydrothermal survey of the JAFNPP was conducted on April 13 and 14, 1977. The NMP-1 station was not in operation during the survey.

The primary objectives of this survey were:

1. To determine the three-dimensional thermal patterns in the discharge area produced by operation of the plant, and

2. To determine the diffuser performance based on dye concentrations existing in the lake after releasing dye into the plant circulating water system.

These objectives were set forth so as to fulfill the requirements of the National Pollutant Discharge Elimination System Permit (Permit No. NY0020109), administered by the U.S. Environmental Protection Agency; the JAFNPP Environmental Technical Specifications (Docket No. 50-333), administered by the U.S. Nuclear Regulatory Commission; and the New York State Department of Environmental Conservation's standards and requirements.

IV.2 METHOD OF DATA ACQUISITION

Aquatec, Incorporated, of South Burlington, Vermont was contracted to perform the temperature, dye, and in situ current speed and direction surveys of the JAFNPP discharge area. A report submitted by Aquatec, entitled "James A. FitzPatrick Nuclear Power Plant, Fourth Operational Hydrothermal Survey, April 13 and 14, 1977," supplements this document and describes all aspects of data acquisition and reduction.

Niagara Mohawk Power Corporation, operator of NMP-1, and the Power Authority of the State of New York, owner of JAFNPP, maintain a meteorological tower at the site which records wind speed and direction at elevations of 30 and 200 feet. Meteorological data for the dates of the survey are listed in Section IV.3.1.

Operating conditions are continuously monitored at the plant. Section IV.3.3 lists the plant operating conditions at the time of the survey.

IV.3 CONDITIONS DURING THE SURVEY

IV.3.1 Meteorological Conditions

Daylight during the April 13 and 14, 1977 surveys occurred between approximately 0533 and 1851 hours EST and 0531 and 1852 hours EST, respectively.

The wind speed and direction for the survey hours on April 13, 1977 are given in Table IV-1. During the intensive sampling period between 0942 and 1616 on April 13, 1977, the 200-foot-level wind at the NMP-1 site meteorological tower was from the southwest to west at an average speed of about 28 mph.

The wind speed and direction for the survey hours on April 14, 1977 are given in Table IV-2. During the intensive sampling period between 0800 and 1428 on April 14, 1977, the 200-foot-level wind at the NMP-1 site meteorological tower was from the west to northwest at an average speed of about 12 mph.

Due to the location of the meteorological tower relative to a forest to the south, wind speed and direction at the 30-foot elevation were not suitable for the purposes of this study.

IV.3.2 Lake Conditions

Three in situ current meter stations, located along the boundary of the nearfield study area, as shown in the figures, continuously recorded lake current speed and direction at depths of 15 feet during the survey period.

ESE currents prevailed below the surface at an average speed of about 0.27 feet per second (fps) throughout most of the survey.

The in situ data are further discussed in Section IV.4.2 of this report and in Section 3 of the Aquatec report.

The lake level during the April 13 and 14, 1977 survey was 245.1 feet USLS (United States Lake Survey 1955 Datum) based on daily mean water levels at Oswego as reported by the Lake Survey Center (NOAA), Detroit, Michigan.

IV.3.3 Plant Operating Conditions

The JAFNPP load, intake and discharge temperatures, and average plant temperature rise are listed in Tables IV-3 and IV-4 for the surveys on April 13 and 14, 1977, respectively. The plant load is determined from hourly computer output at the plant. The plant load for the survey hours on April 13 and 14, 1977, remained relatively constant at approximately 727 MWe gross.

The NMP-1 station was not operating during the April 1977 survey period.

The plant intake and discharge temperatures are based on readings taken in the intake and discharge shaft of the circulating water system during the survey, as described in Section 2.3 of the Aquatec report.

IV.4 SURVEY RESULTS

IV.4.1 Temperature and Dye Studies

Temperature and dye concentration patterns, illustrating thermal effect and diffuser performance, respectively, for the JAFNPP discharge, are presented for nearfield and farfield areas. Dye contour illustrations include tables to convert dye concentrations to dilution factors.

The nearfield study area consists of transects 10 through 22, as shown in Figures IV-1 through IV-39, except Figures IV-7, IV-19, IV-29, and IV-36. Temperature data were taken at depths of 1, 2, 6, 10, and 15 feet and dye concentration data at depths of 2, 6, and 10 feet. Transects 11 through 22 are 2,500 feet long; transect 10 is 3,000 feet long. The tracking speed of the survey boat was from 8 to 10 fps with a data sampling interval of one data record per second.

The farfield study area consists of transects 4 through 26, as shown in Figures IV-7, IV-19, IV-29, and IV-36. Temperature and dye data were taken at a depth of 1.5 feet. The study area extends 5,000 feet either side of the diffuser along the shore and 5,000 feet offshore. The tracking speed of the survey boat was from 20 to 25 fps with a data sampling interval of one data record per second.

Temperature and dye readings represent the average of 2 to 3 data points measured along approximately 25 feet of transect in the nearfield and an average of 2 to 3 data points measured along approximately 65 feet of transect in the farfield.

During each of the nearfield and farfield runs described in the following sections, vertical profiles of both temperature and dye were taken at the 27 designated stations in addition to the horizontal transect work. Vertical profiles for the April 13 and 14, 1977 survey are shown in Appendix II of the Aquatec report.

The dye concentration in the discharge shaft of the circulating water system was calculated to be 8.4 parts per billion (ppb) during the April 1977 survey period. This number was calculated by diluting the Rhodamine WT dye, released at a rate of 1.58 lb per hr, with the total circulating water flow rate of 835 cfs. The circulating water flow rate is based on information in an Aquatec, Inc. report entitled "Pumphouse Dye Study" completed in October 1975, using a dye dilution technique to determine the flow rate within an accuracy of 2.59 percent.

Table IV-5 defines the degree of thermal stratification in the intake region during the April survey. Table IV-6 summarizes lake conditions and figure numbers applicable to the April survey.

IV.4.1.1 April 13, 1977 Temperature Patterns

Between 0942 and 1616 on April 13, 1977, two nearfield runs and one farfield run were completed along the appropriate transects.

IV.4.1.1.1 Sampling Period from 0942 to 1104 (nearfield)

Isotherms in increments of 10°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures IV-1, IV-2, IV-3, IV-4, and IV-5, respectively, during the first nearfield sampling period from 0942 to 1104.

Figure IV-6 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 35.2°F was calculated by averaging temperatures approximately 300 feet offshore from the start of transect 13. The maximum temperature rise above ambient at the 1-foot depth attributed to the JAFNPP was observed to be 4.6°F.

IV.4.1.1.2 Sampling Period from 1250 to 1354 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure IV-7 during the farfield sampling period from 1250 to 1354.

IV.4.1.1.3 Sampling Period from 1445 to 1616 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures IV-8, IV-9, IV-10, IV-11, and IV-12, respectively, during the second nearfield sampling period from 1445 to 1616. Figure IV-13 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 36.3°F was calculated by averaging temperatures approximately 800 feet offshore from the start of transect 13. The maximum temperature rise above ambient at the 1-foot depth was observed to be 5.9°F.

IV.4.1.2 April 14, 1977 Temperature Patterns

Between 0800 and 1428 on April 14, 1977, two nearfield runs and one farfield run were completed along the appropriate transects.

IV.4.1.2.1 Sampling Period from 0800 to 0923 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, and 10-foot depths in Figures IV-14, IV-15, IV-16, and IV-17, respectively, during the first nearfield sampling period from 0800 to 0923. Temperature data at the 15-foot depth were not available due to a thermistor malfunction. Figure IV-18 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 35.4°F was calculated by averaging temperatures approximately 800 feet offshore from the start of transect 13. The maximum temperature rise above ambient at the 1-foot depth was observed to be 6.0°F.

IV.4.1.2.2 Sampling Period from 1017 to 1141 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure IV-19 during the farfield sampling period from 1017 to 1141.

IV.4.1.2.3 Sampling Period from 1309 to 1428 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures IV-20, IV-21, IV-22, IV-23, and IV-24, respectively, during the second nearfield sampling period from 1309 to 1428. Figure IV-25 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 36.3°F was calculated by averaging temperatures approximately 800 feet offshore from the start of transect 13. The maximum temperature rise above ambient at the 1-foot depth was observed to be 6.6°F.

IV.4.1.3 April 13, 1977 Dye Concentration Patterns

Between 0942 and 1616 on April 13, 1977, two nearfield runs and one farfield run were completed along the appropriate transects.

IV.4.1.3.1 Sampling Period from 0942 to 1104 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures IV-26, IV-27, and IV-28, respectively, during the first nearfield sampling period was from 0942 to 1104.

The maximum dye concentration at the 2-foot depth was observed to be 1.62 ppb.

IV.4.1.3.2 Sampling Period from 1250 to 1354 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure IV-29 during the farfield sampling period from 1250 to 1354.

The maximum dye concentration at the 1.5-foot depth was observed to be 1.92 ppb.

IV.4.1.3.3 Sampling Period from 1445 to 1616 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures IV-30, IV-31, and IV-32, respectively, during the second nearfield sampling period from 1445 to 1616. The maximum dye concentration at the 2-foot depth observed to be 1.86 ppb.

IV.4.1.4 April 14, 1977 Dye Concentration Patterns

Between 0800 and 1428 on April 8, 1977, two nearfield runs and one farfield run were completed along the appropriate transects.

IV.4.1.4.1 Sampling Period from 0800 to 0923 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures IV-33, IV-34, and IV-35, respectively, during the first nearfield sampling period from 0800 to 0923. The maximum dye concentration at the 2-foot depth was observed to be 1.78 ppb.

IV.4.1.4.2 Sampling Period from 1017 to 1141 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure IV-36 during the farfield sampling period from 1017 to 1141. Data were not reported along the nearfield segment of transects 17, 19, and 20 due to an instrument operation error.

The maximum dye concentration at the 1.5-foot depth could not be determined because of missing data.

IV.4.1.4.3 Sampling Period from 1309 to 1428 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures IV-37, IV-38, and IV-39, respectively, during the second nearfield sampling period from 1309 to 1428.

The maximum dye concentration at the 2-foot depth was observed to be 2.03 ppb.

IV.4.2 In Situ Data

In situ data collection consisted of current speed and direction collected at three current meter stations, as shown in each of the figures and in Appendix III of the Aquatec report.

Lake current speed and direction during the April 13 and April 14, 1977 surveys are shown in Table IV-5.

The average current speed and direction during each survey period at 15-foot depths are presented in each figure by a vector diagram.

Due to instrument malfunction, current speeds at the station east of the diffuser were not recorded.

The in situ portion of the hydrothermal survey is described in Section 3 of the Aquatec report.

IV-APRIL 1977 SURVEY

TABLE IV-1

WIND SPEED AND DIRECTION* FOR APRIL 13, 1977

Time	Data taken at 200-ft elev. Direction (Deg. true)	Speed (mph)
0000-0100	155	14
0100-0200	160	12
0200-0300	160	13
0300-0400	175	15
0400-0500	180	16
0500-0600	175	16
0600-0700	175	17
0700-0800	190	12
0800-0900	245	20
0900-1000**	245	22
1000-1100**	260	27
1100-1200**	260	25
1200-1300**	255	25
1300-1400**	265	28
1400-1500**	255	25
1500-1600**	265	36
1600-1700**	260	37
1700-1800	255	35
1800-1900	310	36
1900-2000	260	11
2000-2100	265	18
2100-2200	020	12
2200-2300	030	14
2300-2400	320	09

*Does not reflect semiannual calibration results which may differ by ± 5 deg.

**Survey Period

TABLE IV-2

WIND SPEED AND DIRECTION* FOR APRIL 14, 1977

Time	Data taken at 200-ft elev. Direction (Deg true)	Speed (mph)
0000-0100	290	16
0100-0200	300	25
0200-0300	300	25
0300-0400	290	21
0400-0500	265	13
0500-0600	270	12
0600-0700	260	11
0700-0800**	270	10
0800-0900**	310	18
0900-1000**	335	12
1000-1100**	350	16
1100-1200**	340	16
1200-1300**	330	10
1300-1400**	300	06
1400-1500**	260	10
1500-1600	260	13
1600-1700	255	15
1700-1800	250	14
1800-1900	260	13
1900-2000	265	13
2000-2100	280	06
2100-2200	300	08
2200-2300	325	14
2300-2400	360	00

*Does not reflect semiannual calibration results which may differ by ± 5 deg.

**Survey Period

TABLE IV-3

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON APRIL 13, 1977 FOR THE JAFNPP

Time	Plant Load (MWe) at end of hour	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Circulating Water Temperature Rise (°F)
		April 13, 1977		
0000-0100	691	37.0	68.5	31.5
0100-0200	694	38.5	70.0	31.5
0200-0300	698	40.0	71.5	31.5
0300-0400	703	38.0	70.0	32.0
0400-0500	709	37.5	70.0	32.5
0500-0600	712	36.5	69.0	32.5
0600-0700	717	37.0	69.5	32.5
0700-0800	719	37.0	69.5	32.5
0800-0900	721	36.5	69.5	33.0
0900-1000*	724	36.5	70.0	33.5
1000-1100*	727	37.0	70.0	33.0
1100-1200*	728	37.0	70.5	33.5
1200-1300*	727	38.0	71.5	33.5
1300-1400*	727	38.5	72.0	33.5
1400-1500*	727	38.0	71.5	33.5
1500-1600*	727	38.0	72.0	34.0
1600-1700*	727	38.5	72.0	33.5
1700-1800	726	38.0	72.0	34.0
1800-1900	725	37.5	71.0	33.5
1900-2000	723	38.0	71.5	33.5
2000-2100	723	38.5	71.5	33.0
2100-2200	726	39.0	72.5	33.5
2200-2300	725	39.0	72.5	33.5
2300-2400	726	38.5	72.0	33.5

*Survey Period

TABLE IV-4

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON APRIL 14, 1977 FOR THE JAFNPP

Time	Plant Load (MWe) at end of hour	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Circulating Water Temperature Rise (°F)
		April 14, 1977		
0000-0100	725	38.5	72.0	33.5
0100-0200	726	38.5	72.0	33.5
0200-0300	723	38.5	72.0	33.5
0300-0400	725	38.0	71.5	33.5
0400-0500	723	37.5	71.0	33.5
0500-0600	724	37.0	70.5	33.5
0600-0700	724	37.0	70.5	33.5
0700-0800*	724	37.0	70.5	33.5
0800-0900*	729	-	71.0	-
0900-1000*	729	38.0	71.5	33.5
1000-1100*	728	38.5	72.0	33.5
1100-1200*	729	38.5	72.0	33.5
1200-1300*	728	38.5	72.0	33.5
1300-1400*	728	38.5	72.0	33.5
1400-1500*	728	38.5	72.0	33.5

*Survey Period

TABLE IV-5

DEGREE OF THERMAL STRATIFICATION
IN INTAKE REGION FOR APRIL 13 AND 14, 1977

Time	Average Water Temperature (°F) for Top 2 Ft of Water Column at Intake Region	Average Water Temperature (°F) for Bottom 2 Ft of Water Column at Intake Region	Thermal Stratification (°F) at Intake Region
		April 13, 1977	
1100	35.8	35.9	-0.1
1303	37.5	37.5	0.0
1604	37.2	37.4	-0.2
		April 14, 1977	
0850	36.0	37.6	-1.6
1129	36.7	38.1	-1.4
1346	37.0	37.9	-0.9

TABLE IV-6

SUMMARY OF FIGURE NUMBERS AND DATA FOR APRIL 1977 SURVEY

Time	15-ft Current Direction			15-ft Current Speed (fps)			Ambient Surface Temperature (°F)	Depth (ft)	Isotherm Figure No.	Temperature Rise Figure No.	Dye Figure No.
	Station No.			Station No.							
	1	2	3	1	2	3					
							April 13, 1977				
0942-1104	WNW to	ESE	W	NA	0.12	0.12	35.2	1.0	IV-1	IV-6	-
								2.0	IV-2	-	IV-26
								6.0	IV-3	-	IV-27
								10.0	IV-4	-	IV-28
								15.0	IV-5	-	-
1250-1354	ESE	ESE	WSW to SSE	NA	0.37	0.12	36.0	1.5	IV-7	-	IV-29
1445-1616	ESE	ESE	ESE	NA	0.42	0.08	36.3	1.0	IV-8	IV-13	-
								2.0	IV-9	-	IV-30
								6.0	IV-10	-	IV-31
								10.0	IV-11	-	IV-32
								15.0	IV-12	-	-
							April 14, 1977				
0800-0923	ESE	ESE	SE	NA	0.30	0.30	35.4	1.0	IV-14	IV-18	-
								2.0	IV-15	-	IV-33
								6.0	IV-16	-	IV-34
								10.0	IV-17	-	IV-35
1017-1141	ESE	ESE	ESE	NA	0.34	0.22	36.3	1.5	IV-19	-	-
1309-1428	ESE	ESE	ESE	NA	0.34	0.25	36.3	1.0	IV-20	IV-25	-
								2.0	IV-21	-	IV-37
								6.0	IV-22	-	IV-38
								10.0	IV-23		IV-39
								15.0	IV-24	-	-

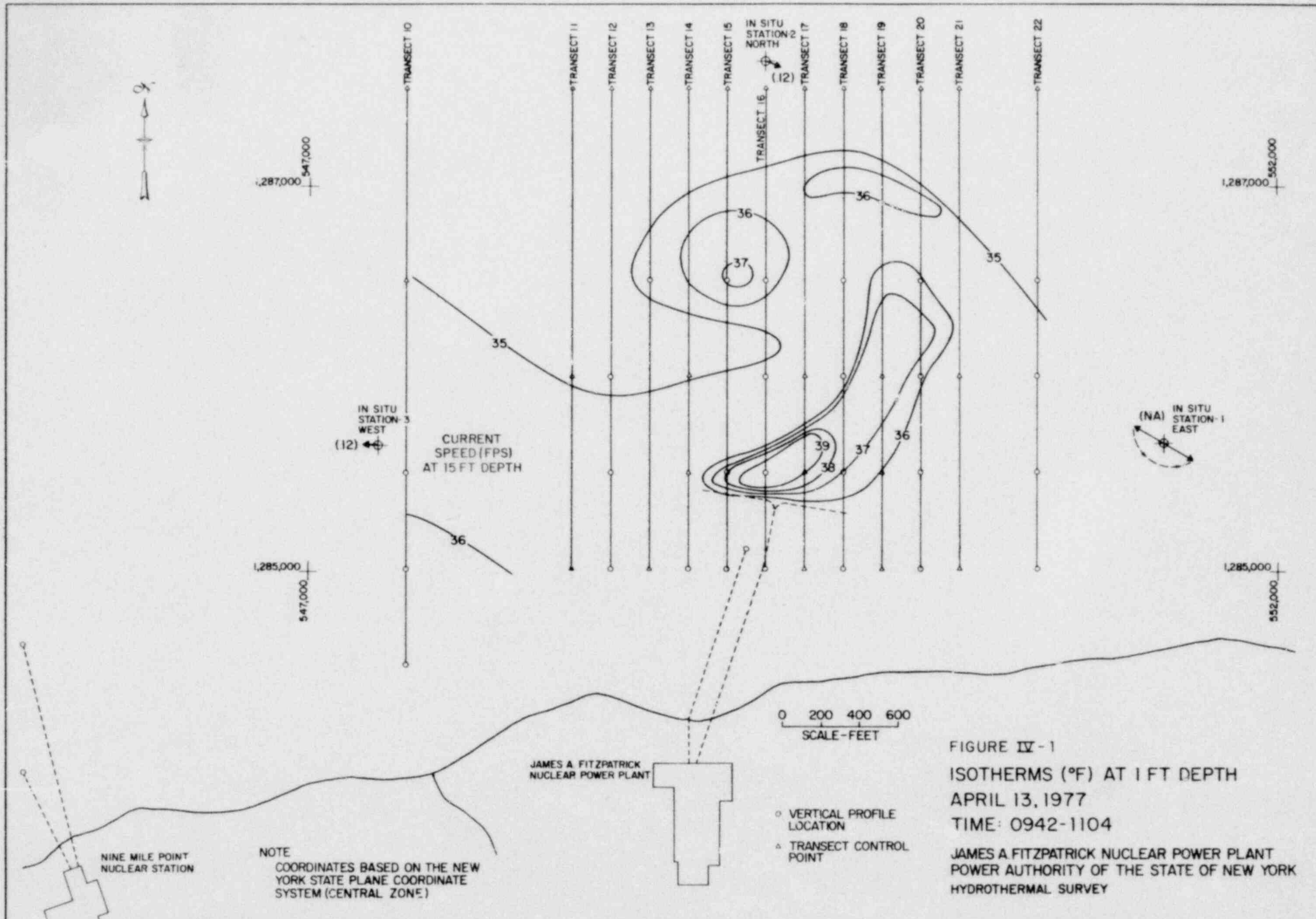


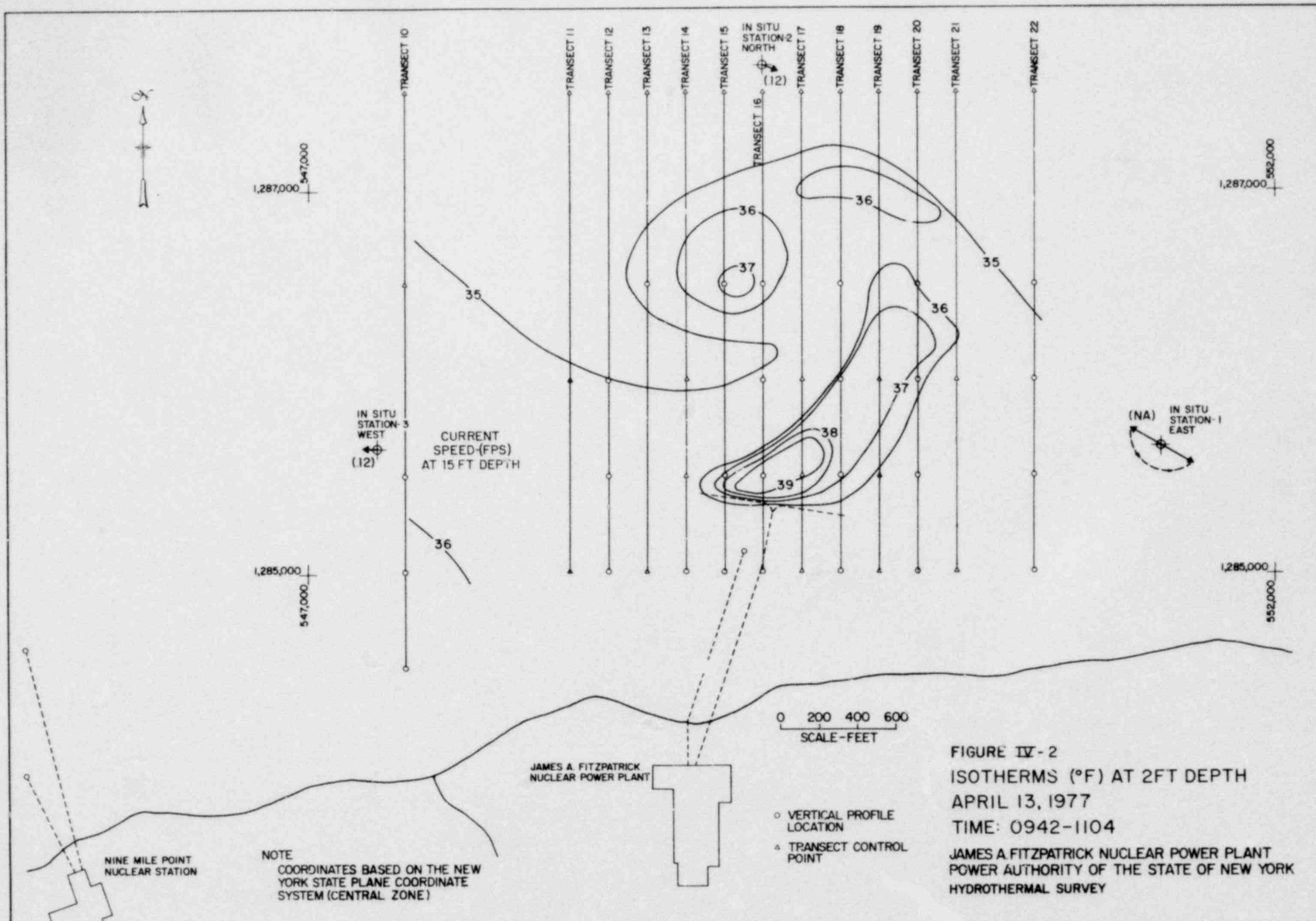
FIGURE IV-1

ISOTHERMS (°F) AT 1 FT DEPTH

APRIL 13, 1977

TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE IV-2
ISOTHERMS (°F) AT 2FT DEPTH
APRIL 13, 1977
TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

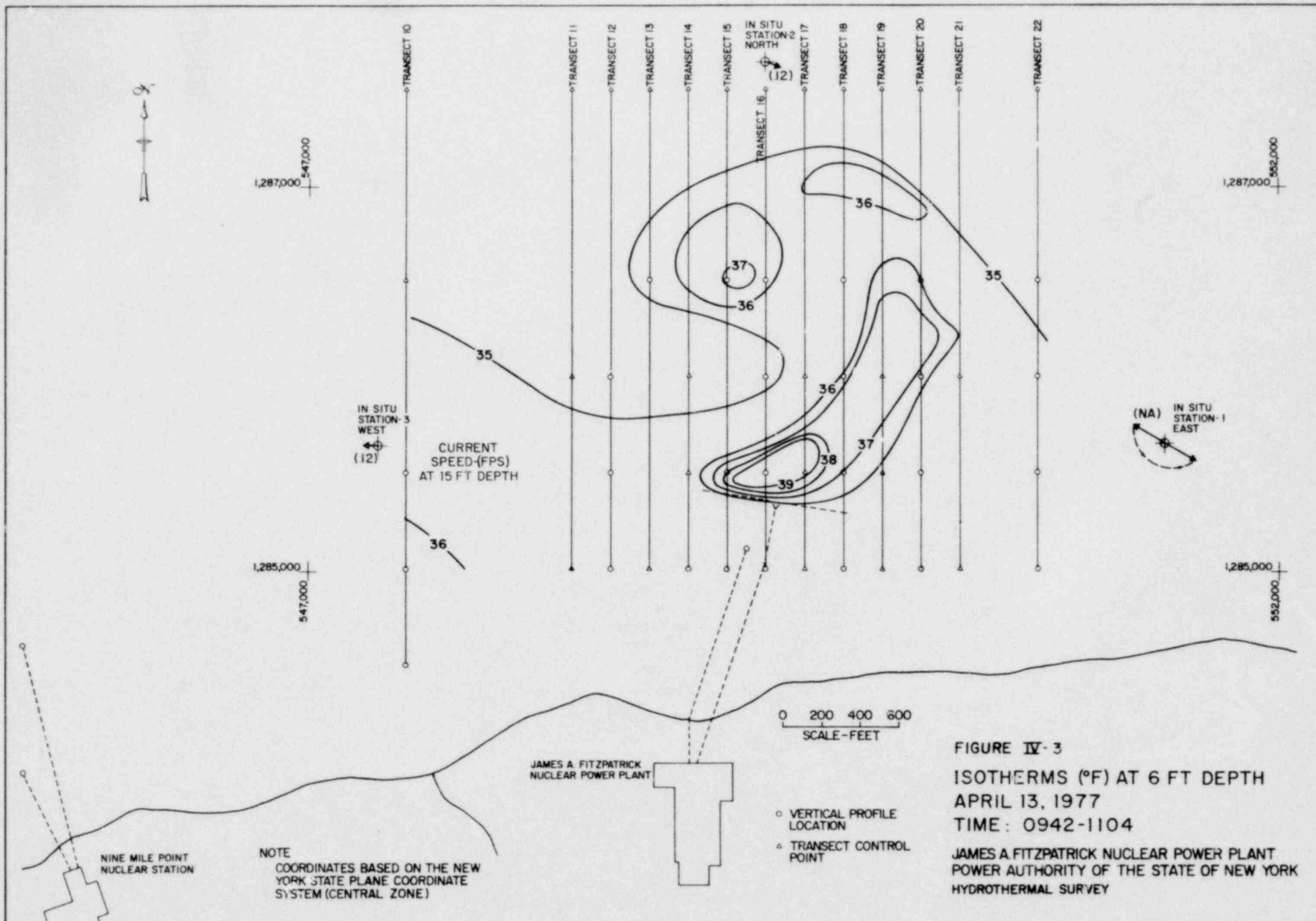


FIGURE IV-3
ISOTHERMS (°F) AT 6 FT DEPTH
APRIL 13, 1977
TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

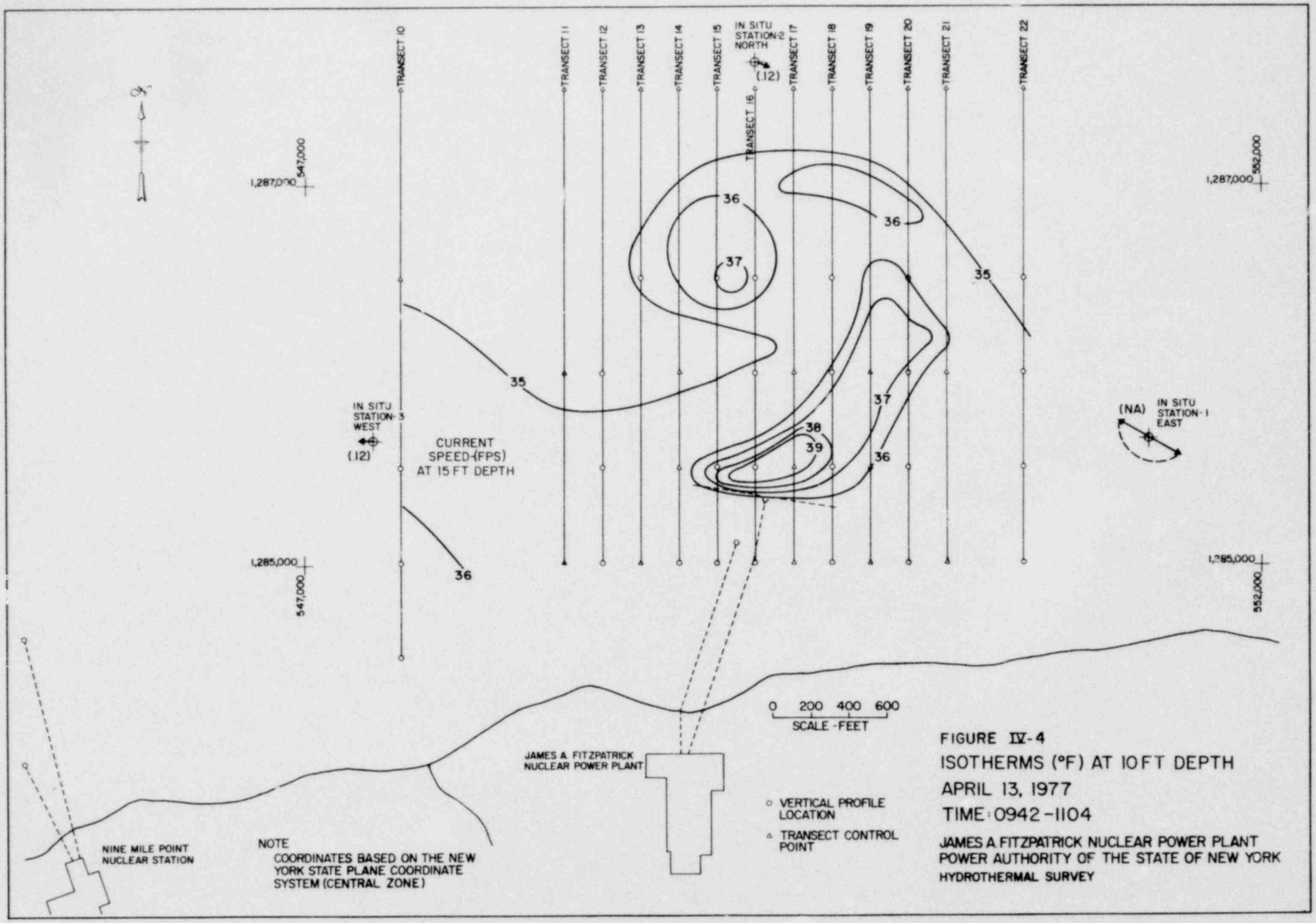


FIGURE IV-4
ISOTHERMS (°F) AT 10 FT DEPTH
APRIL 13, 1977
TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

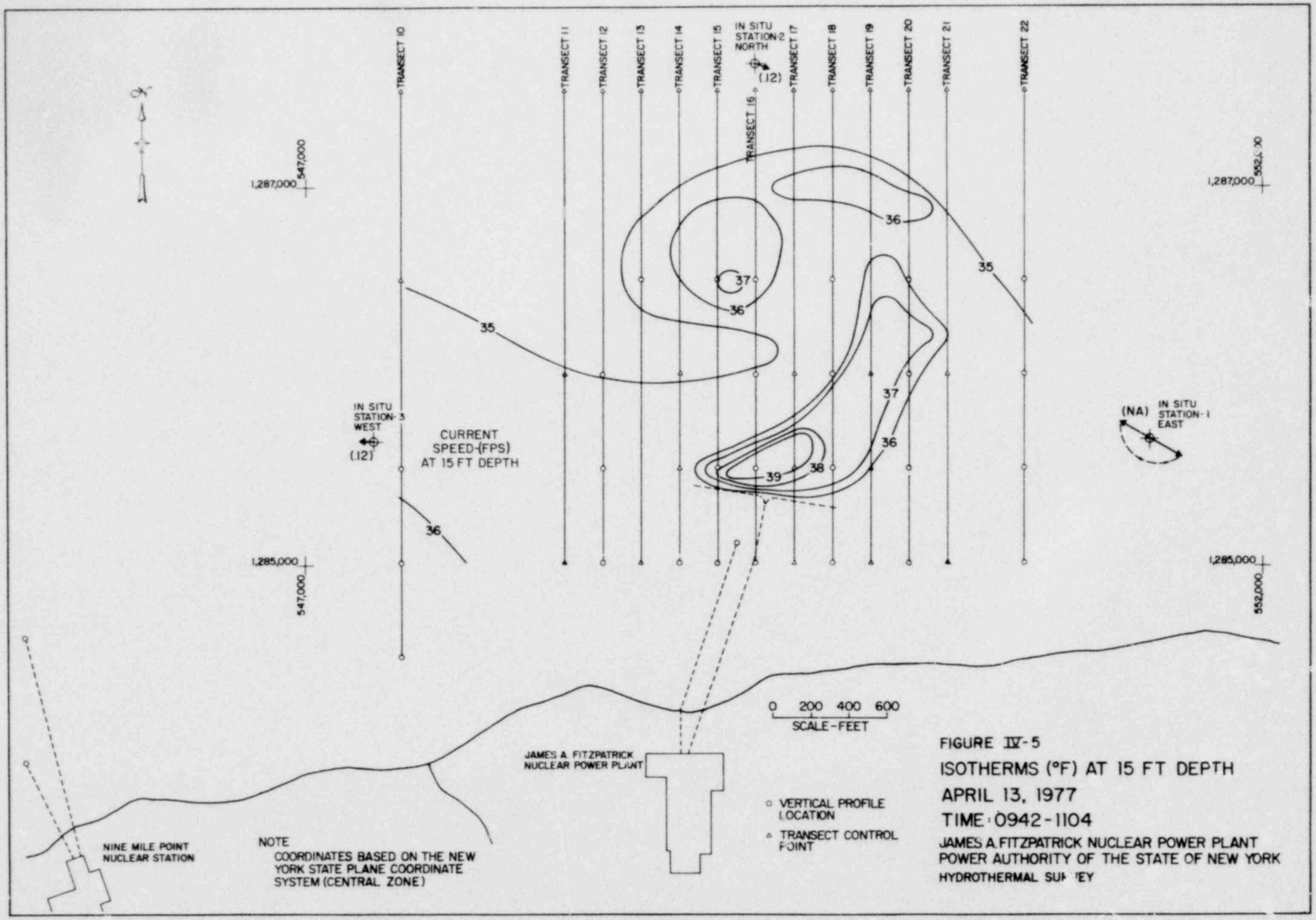


FIGURE IV-5

ISOTHERMS (°F) AT 15 FT DEPTH

APRIL 13, 1977

TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

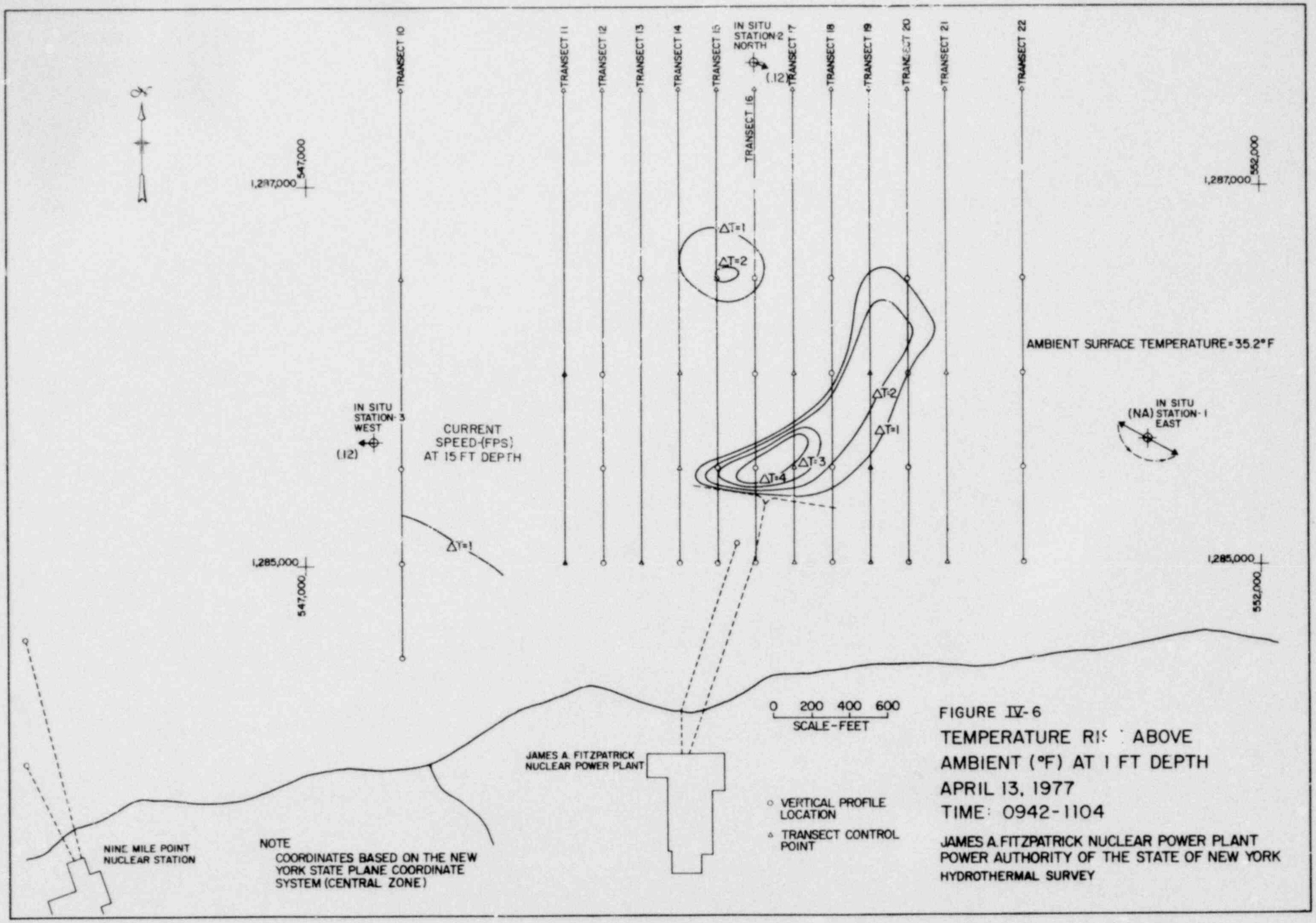


FIGURE IV-6
TEMPERATURE RIS[illegible] ABOVE AMBIENT (°F) AT 1 FT DEPTH
APRIL 13, 1977
TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

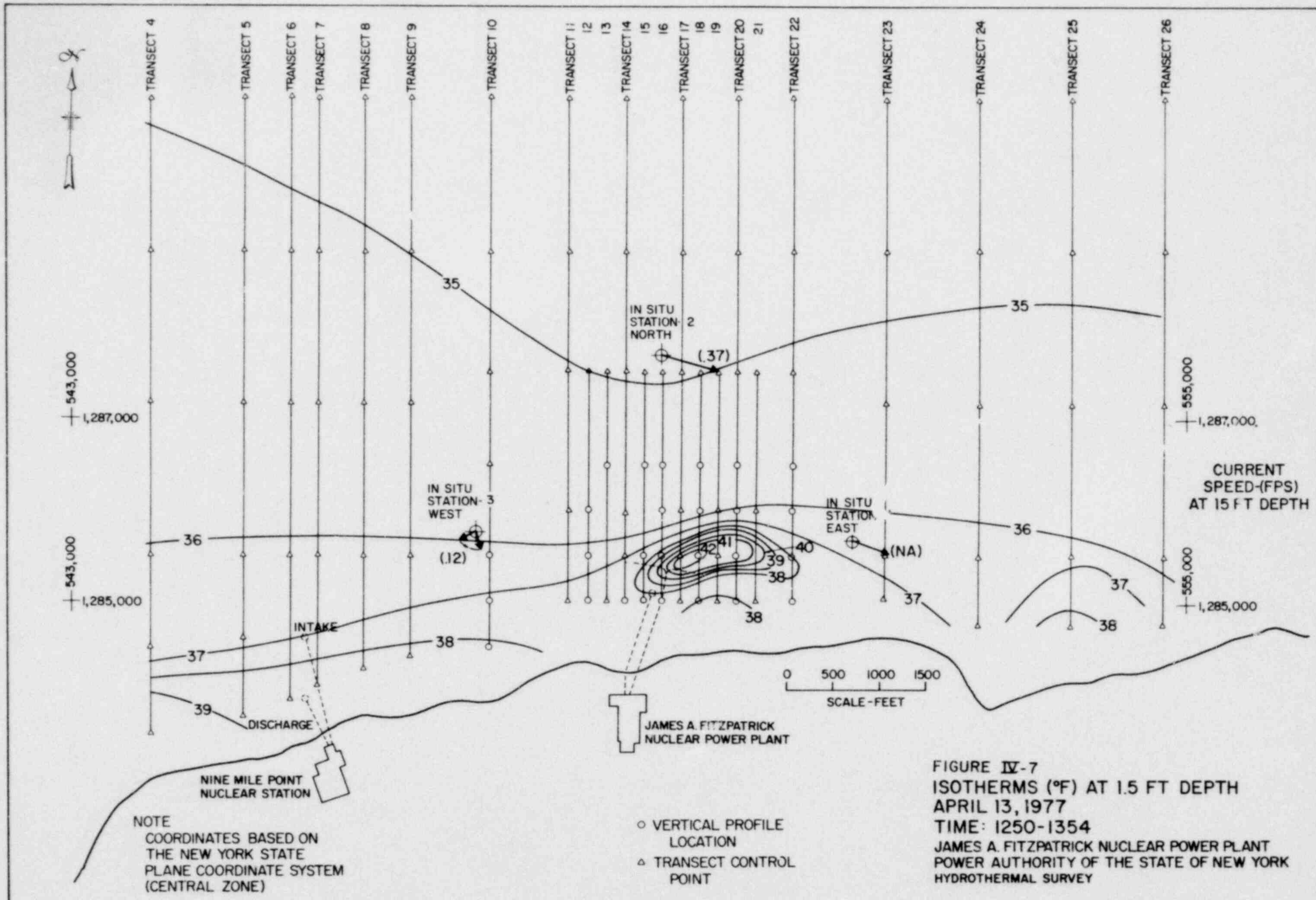


FIGURE IV-7
ISOTHERMS (°F) AT 1.5 FT DEPTH
APRIL 13, 1977
TIME: 1250-1354
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

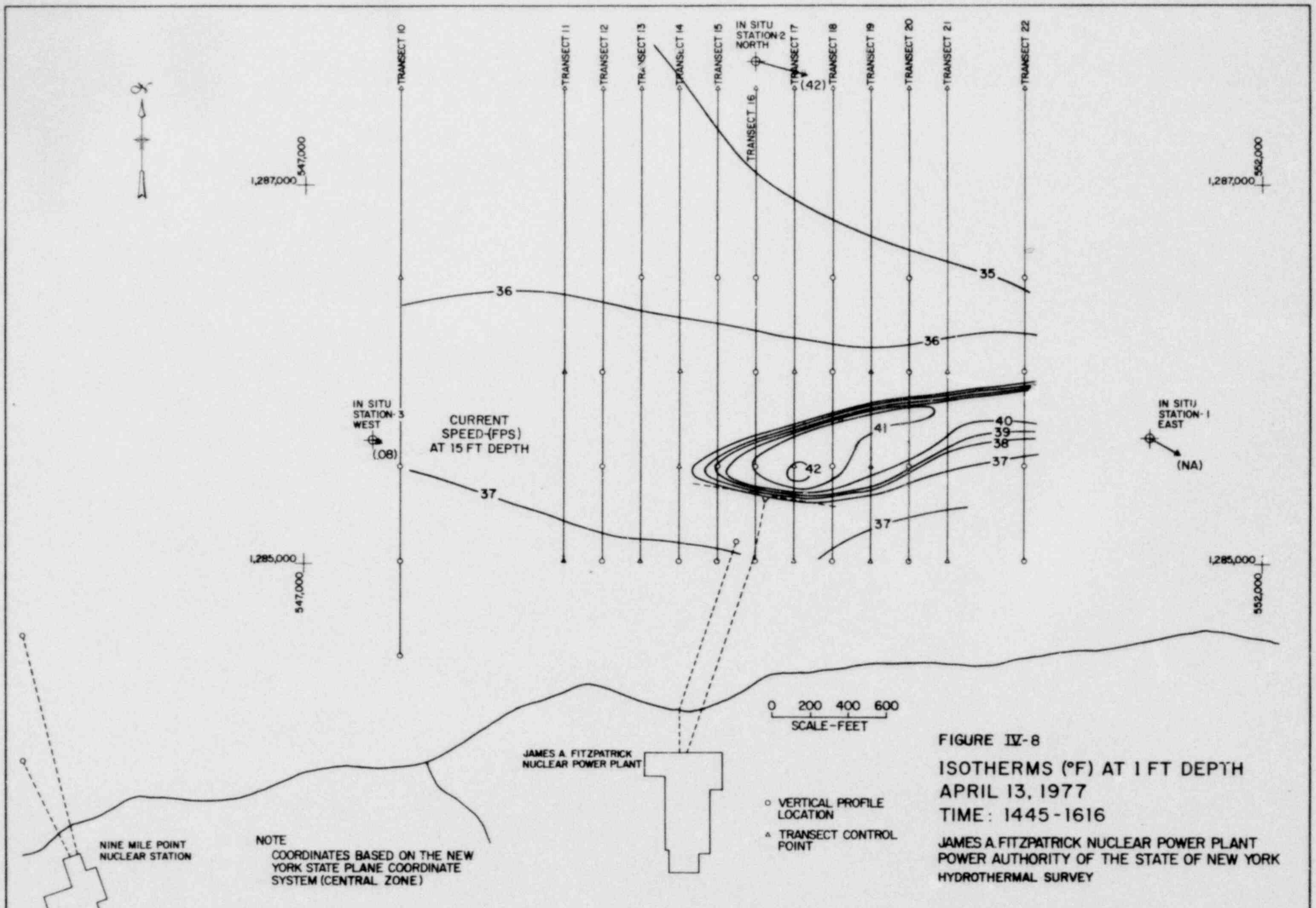


FIGURE IV-8

ISOTHERMS (°F) AT 1 FT DEPTH
APRIL 13, 1977
TIME: 1445-1616

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

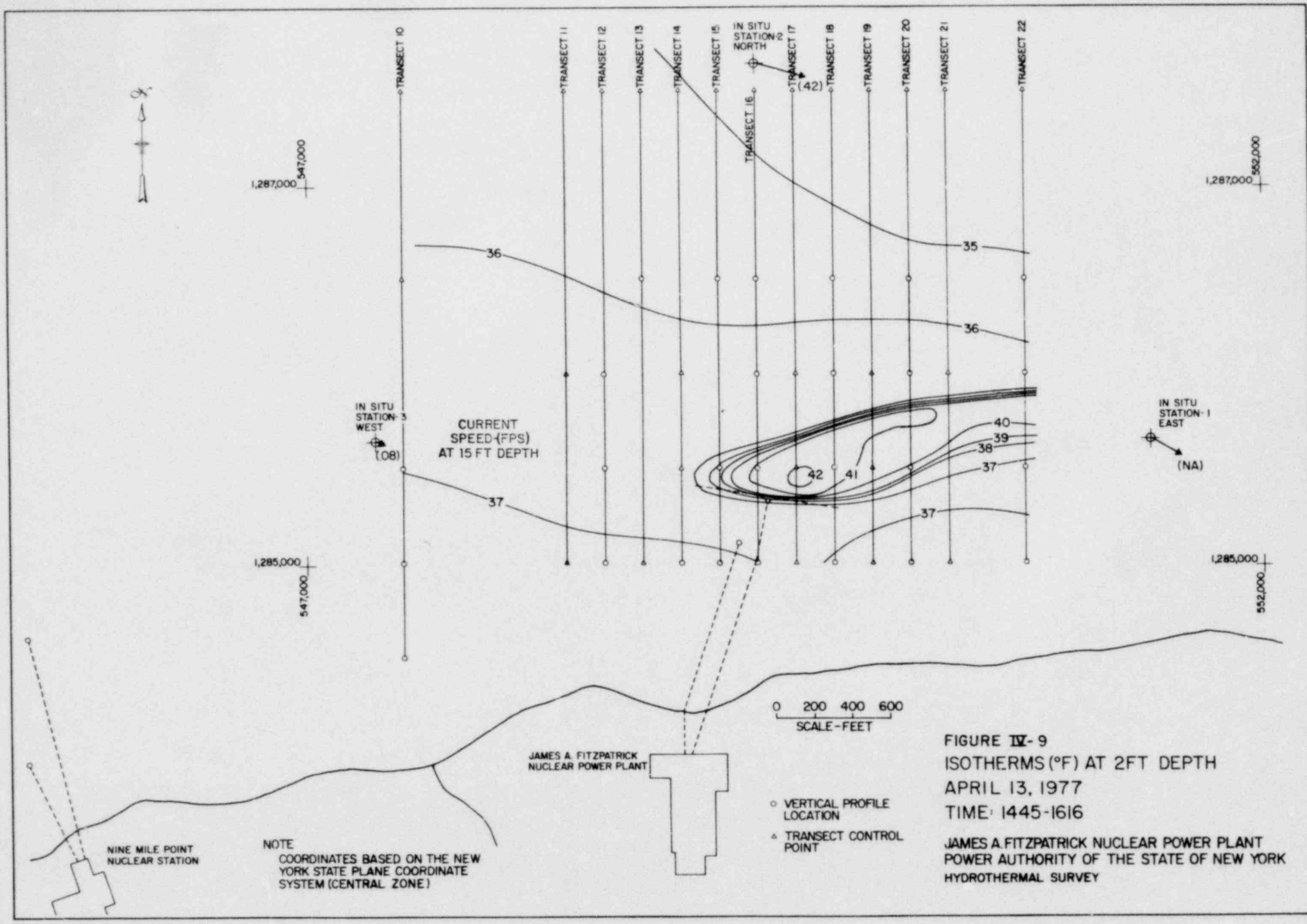


FIGURE IV-9
ISOTHERMS (°F) AT 2FT DEPTH
APRIL 13, 1977
TIME: 1445-1616

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

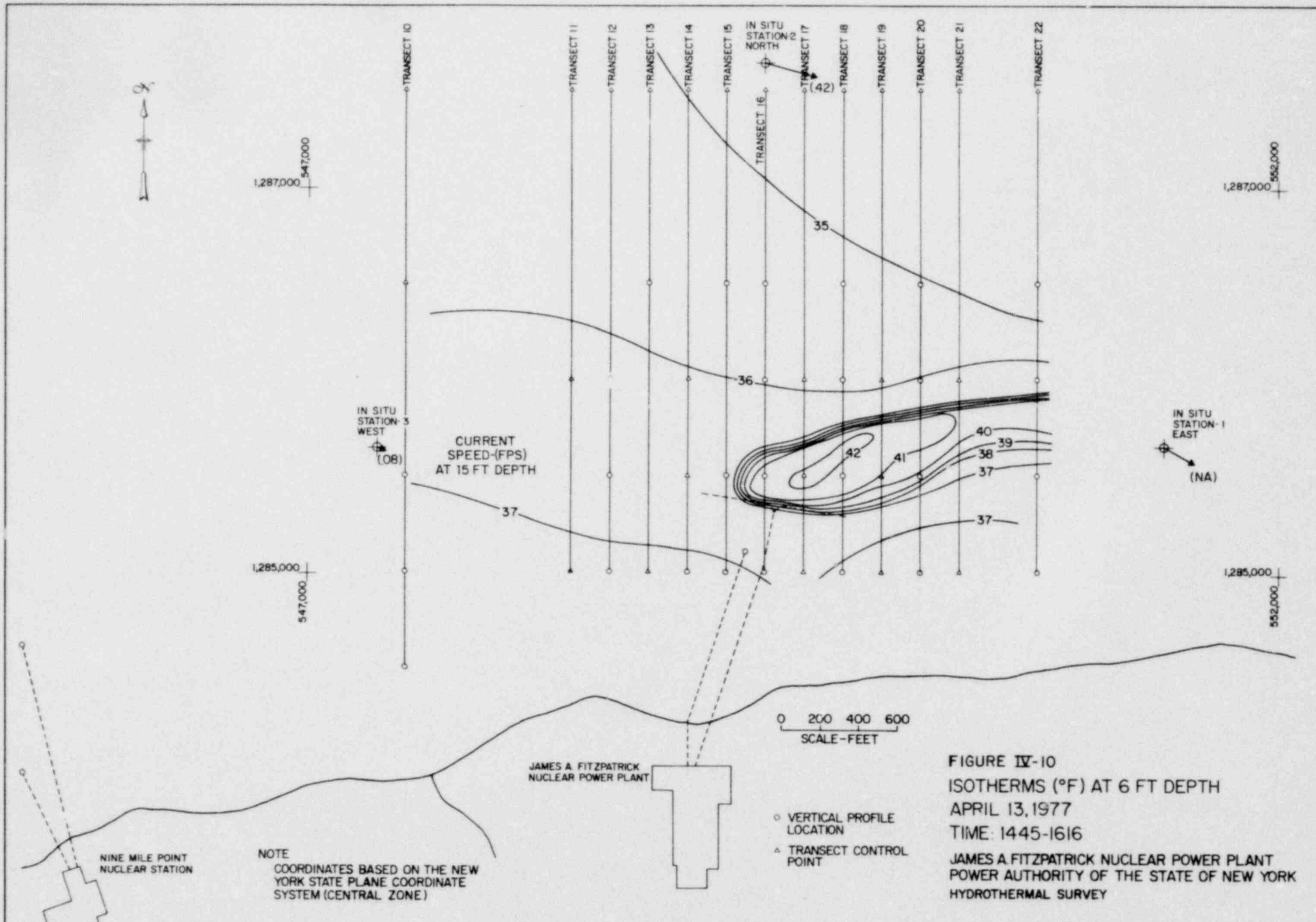
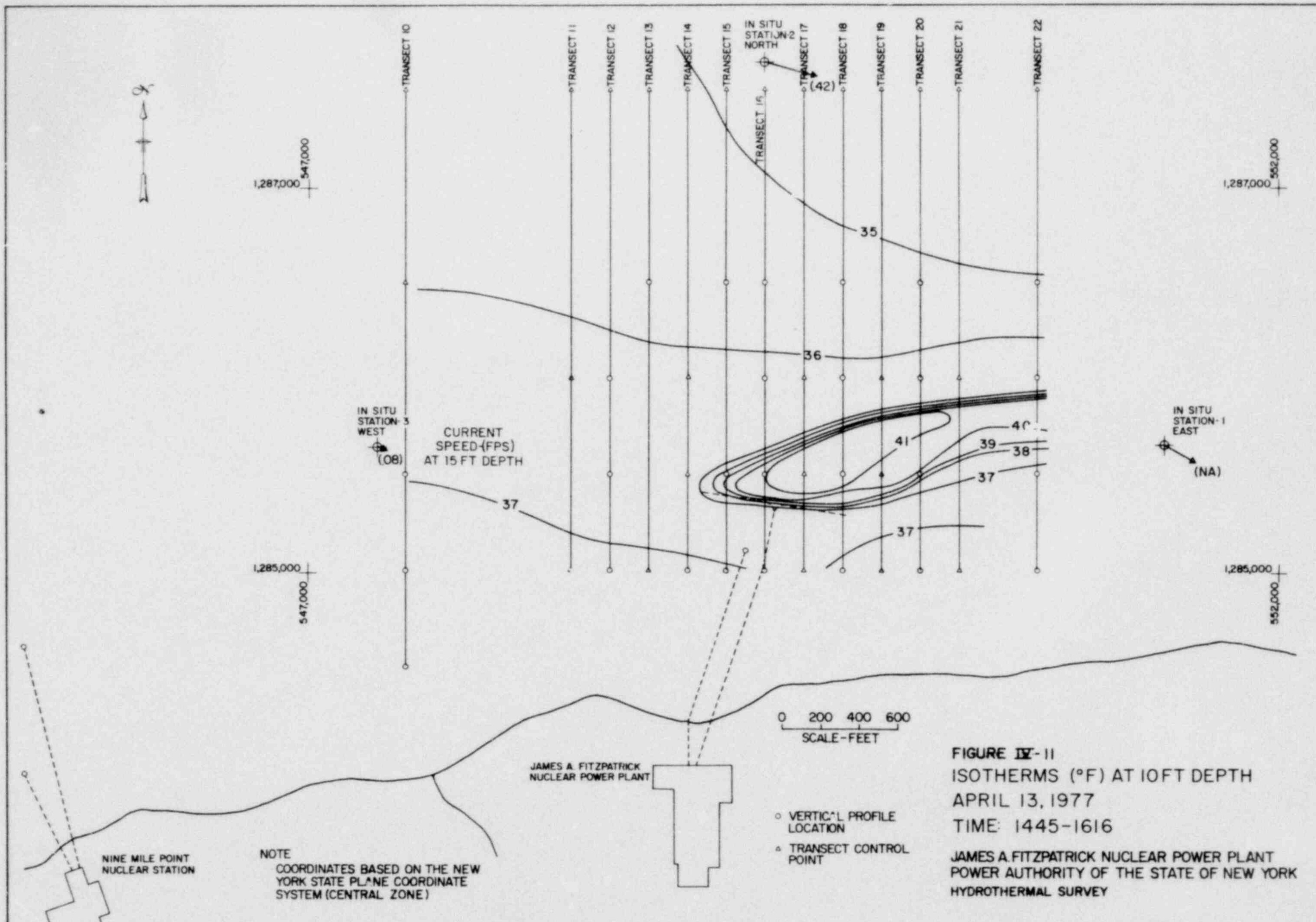


FIGURE IV-10
ISOTHERMS (°F) AT 6 FT DEPTH
APRIL 13, 1977
TIME: 1445-1616
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE IV-11
ISOTHERMS (°F) AT 10 FT DEPTH
APRIL 13, 1977
TIME: 1445-1616

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

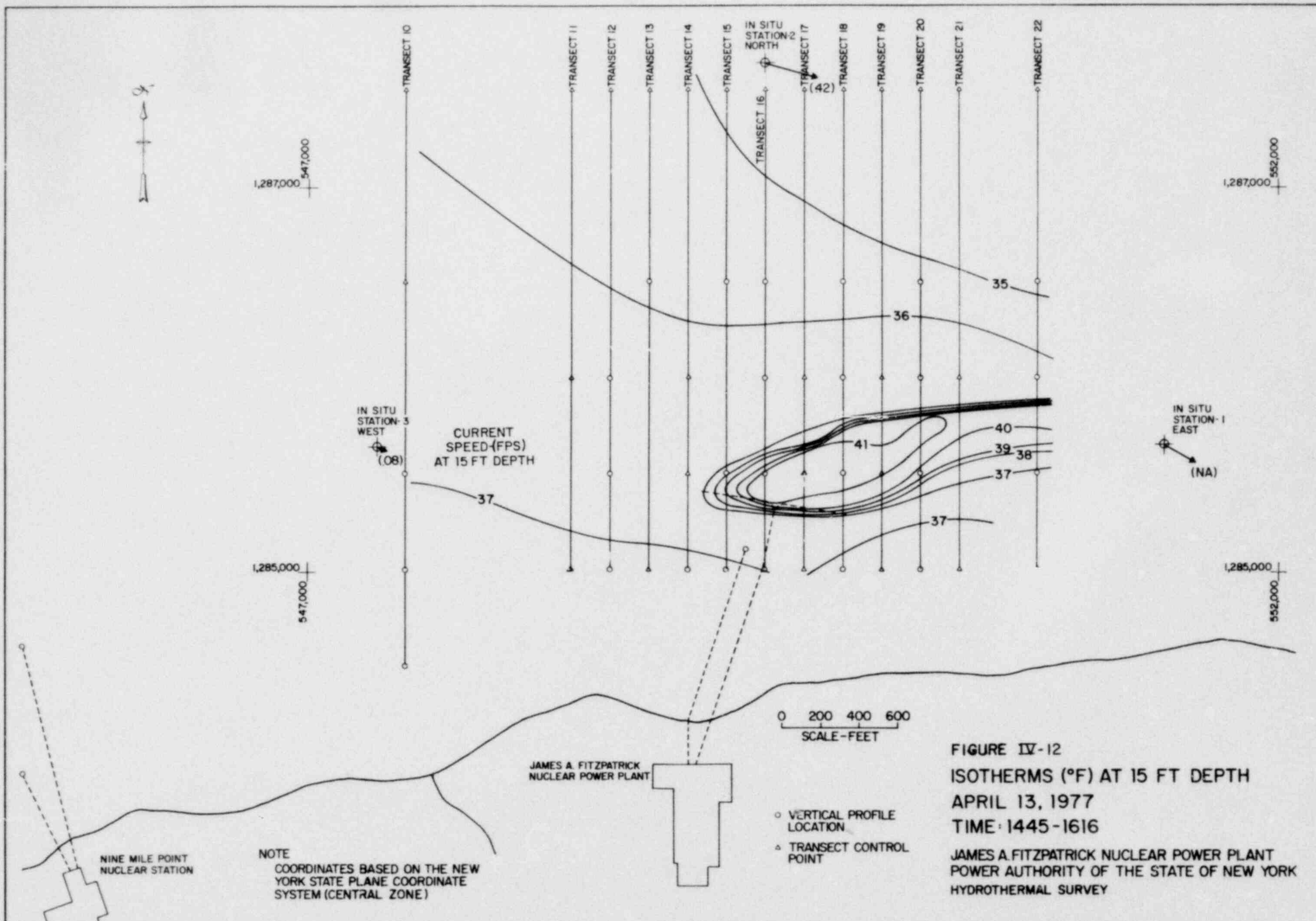


FIGURE IV-12

ISOTHERMS (°F) AT 15 FT DEPTH

APRIL 13, 1977

TIME: 1445-1616

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

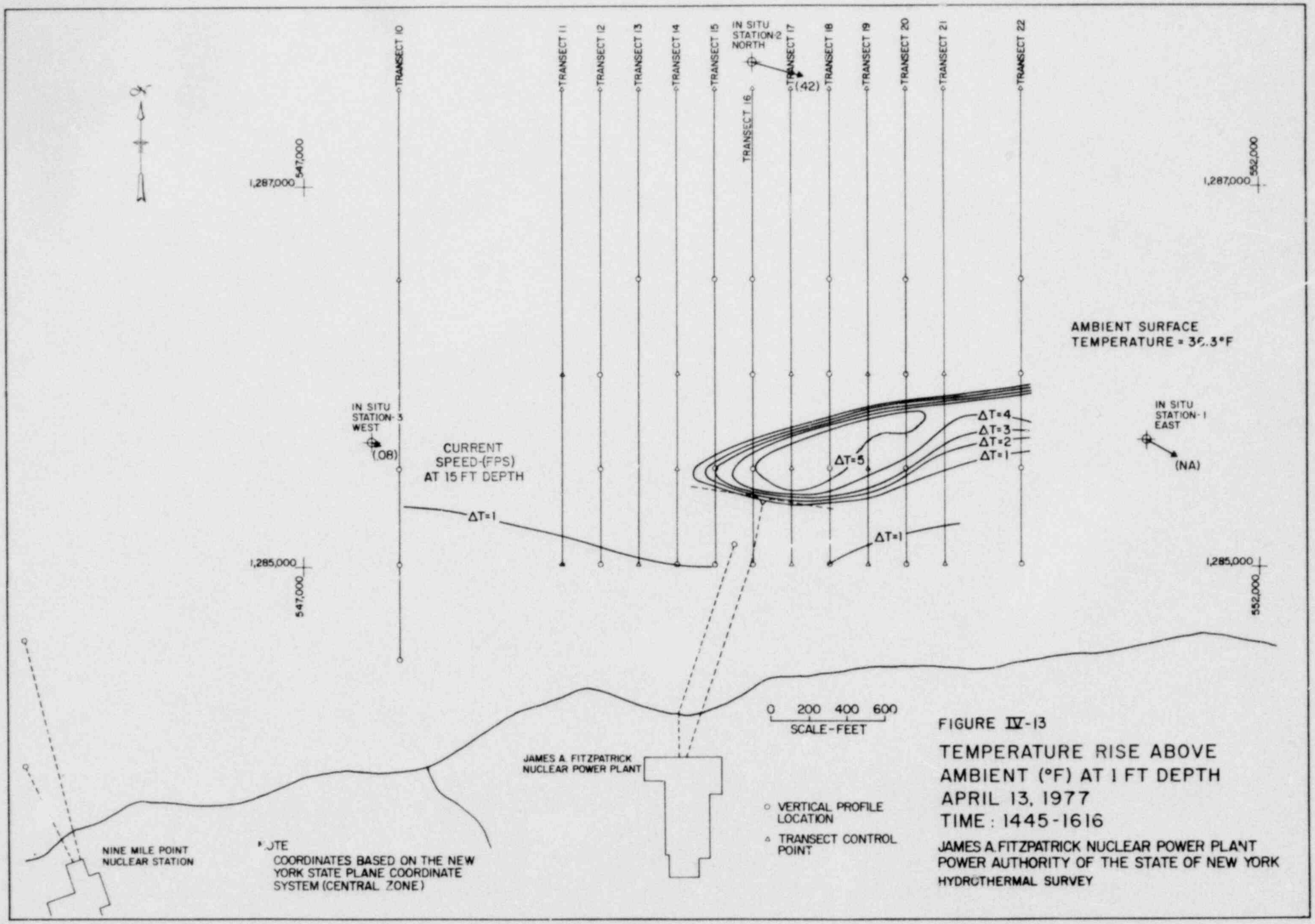


FIGURE IV-13

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
APRIL 13, 1977
TIME: 1445-1616

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

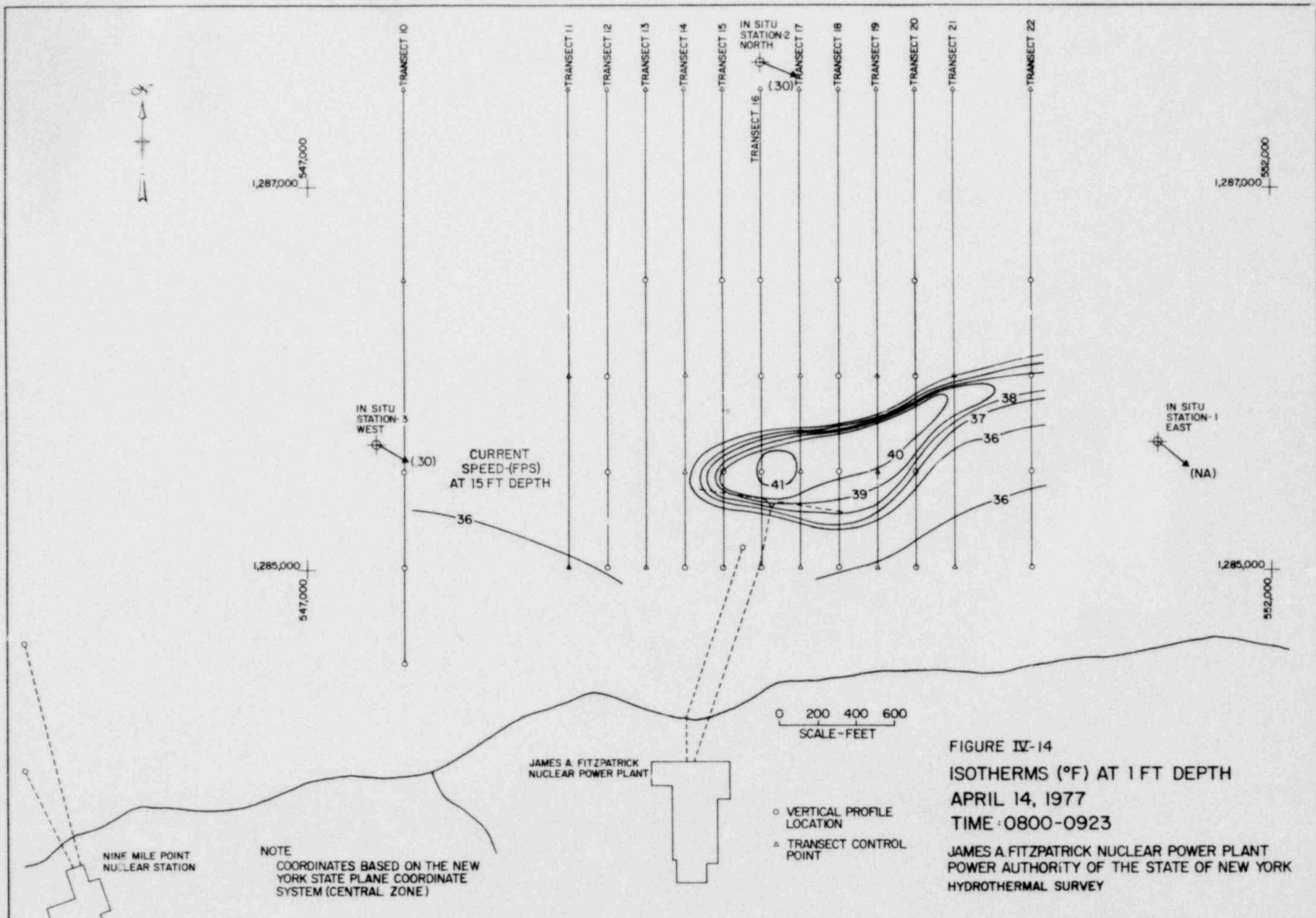


FIGURE IV-14

ISOTHERMS (°F) AT 1 FT DEPTH

APRIL 14, 1977

TIME: 0800-0923

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

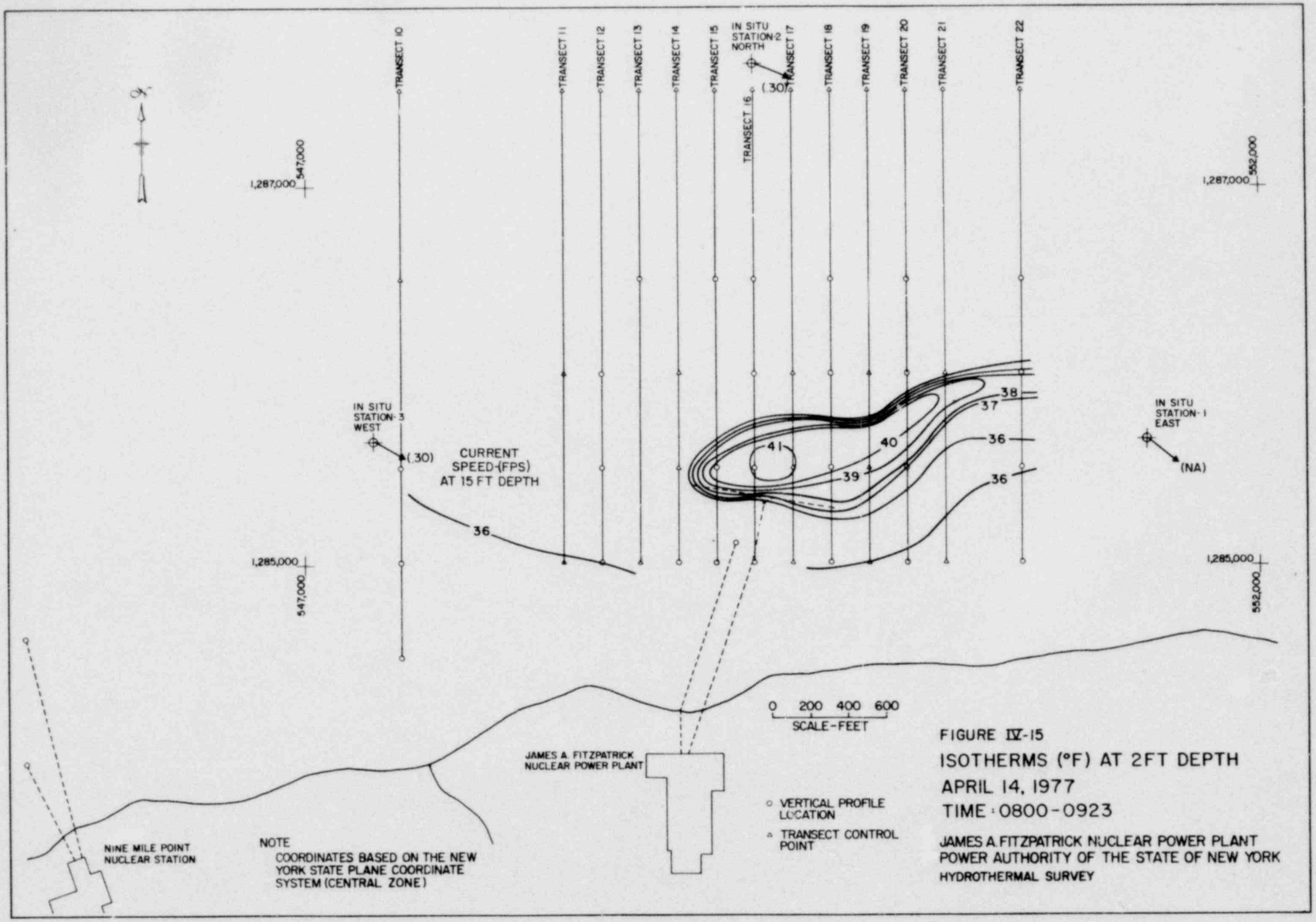


FIGURE IV-15

ISOTHERMS (°F) AT 2FT DEPTH

APRIL 14, 1977

TIME: 0800-0923

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

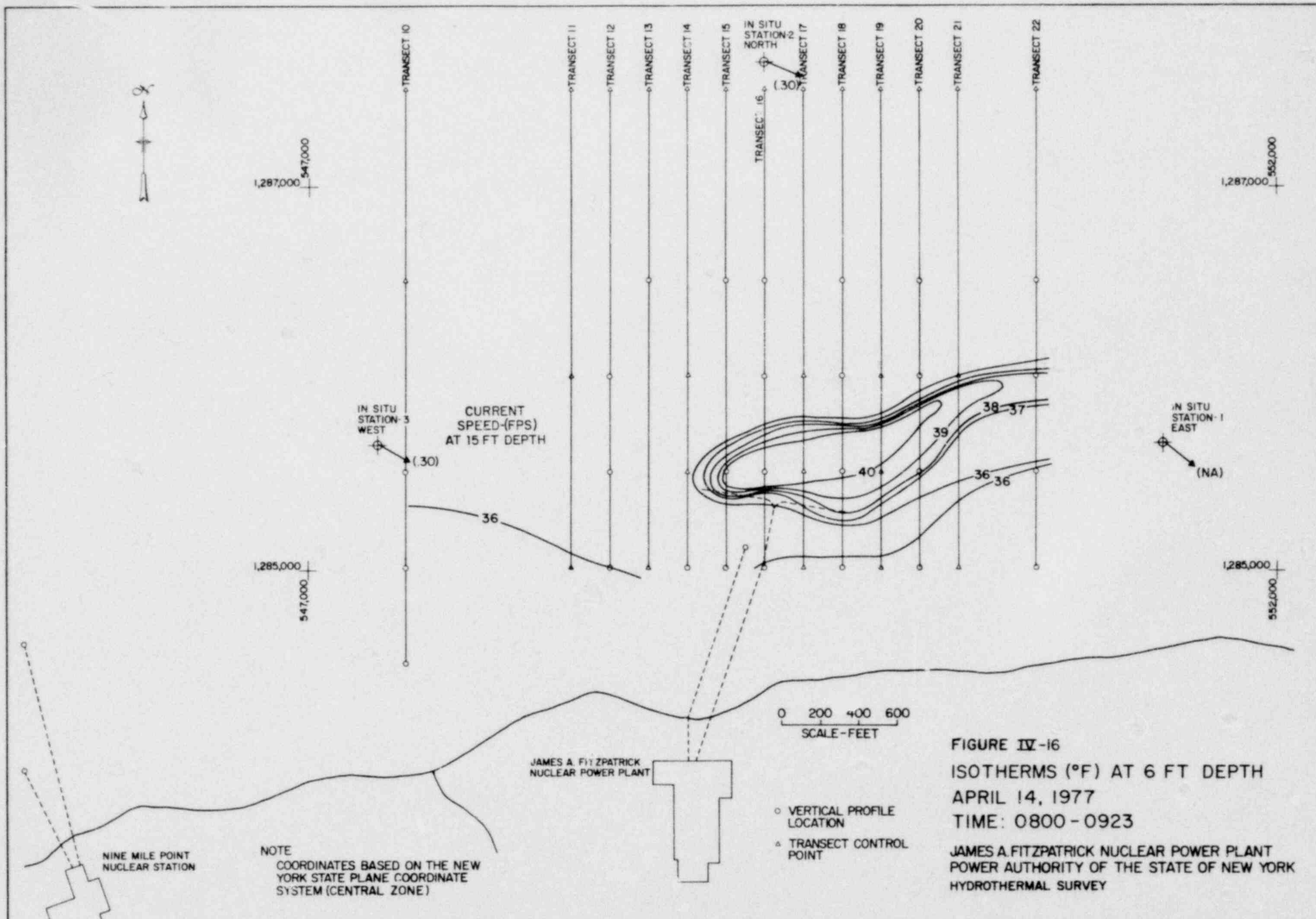


FIGURE IV-16

ISOTHERMS (°F) AT 6 FT DEPTH

APRIL 14, 1977

TIME: 0800-0923

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

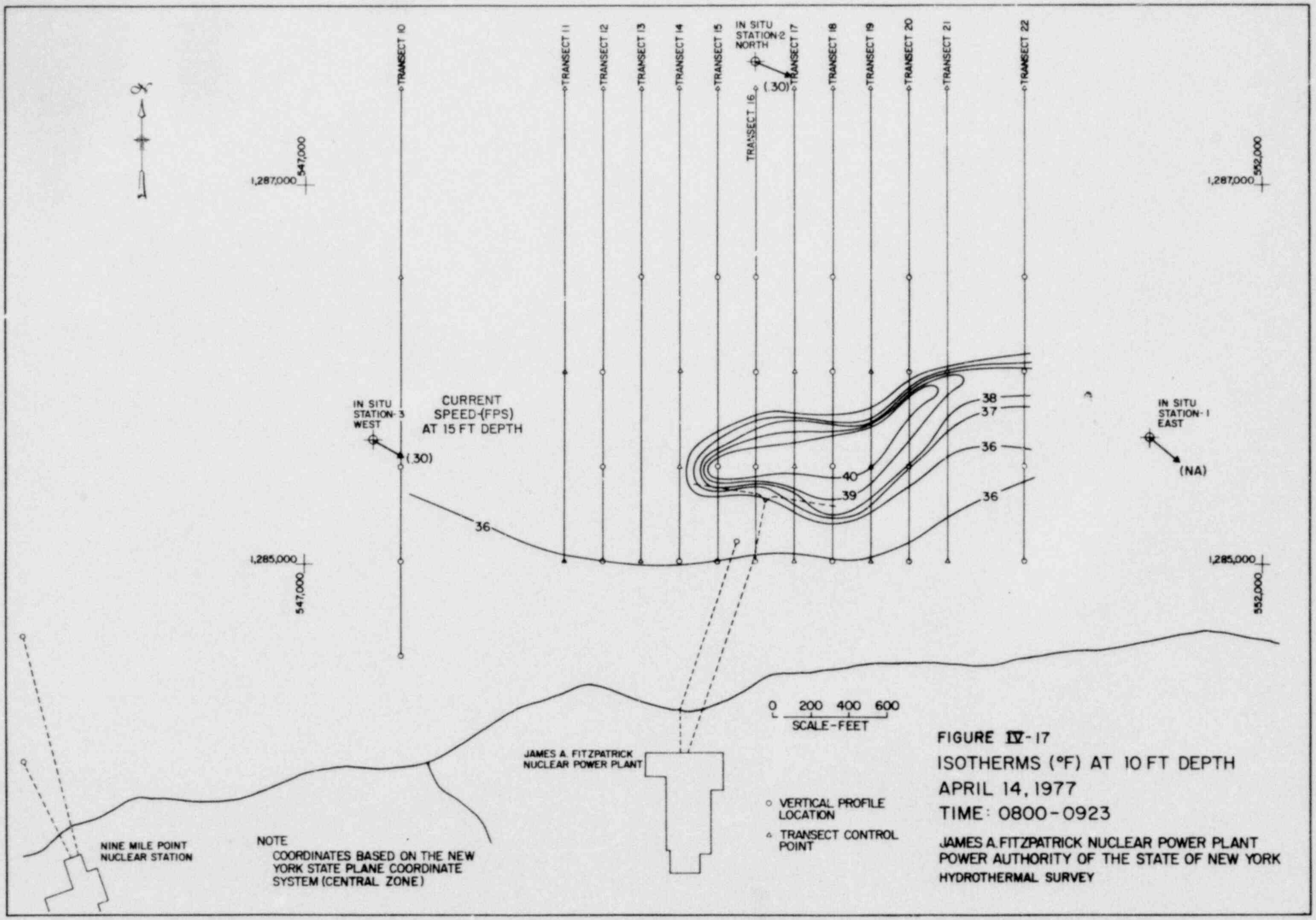


FIGURE IV-17

ISOTHERMS (°F) AT 10 FT DEPTH

APRIL 14, 1977

TIME: 0800-0923

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

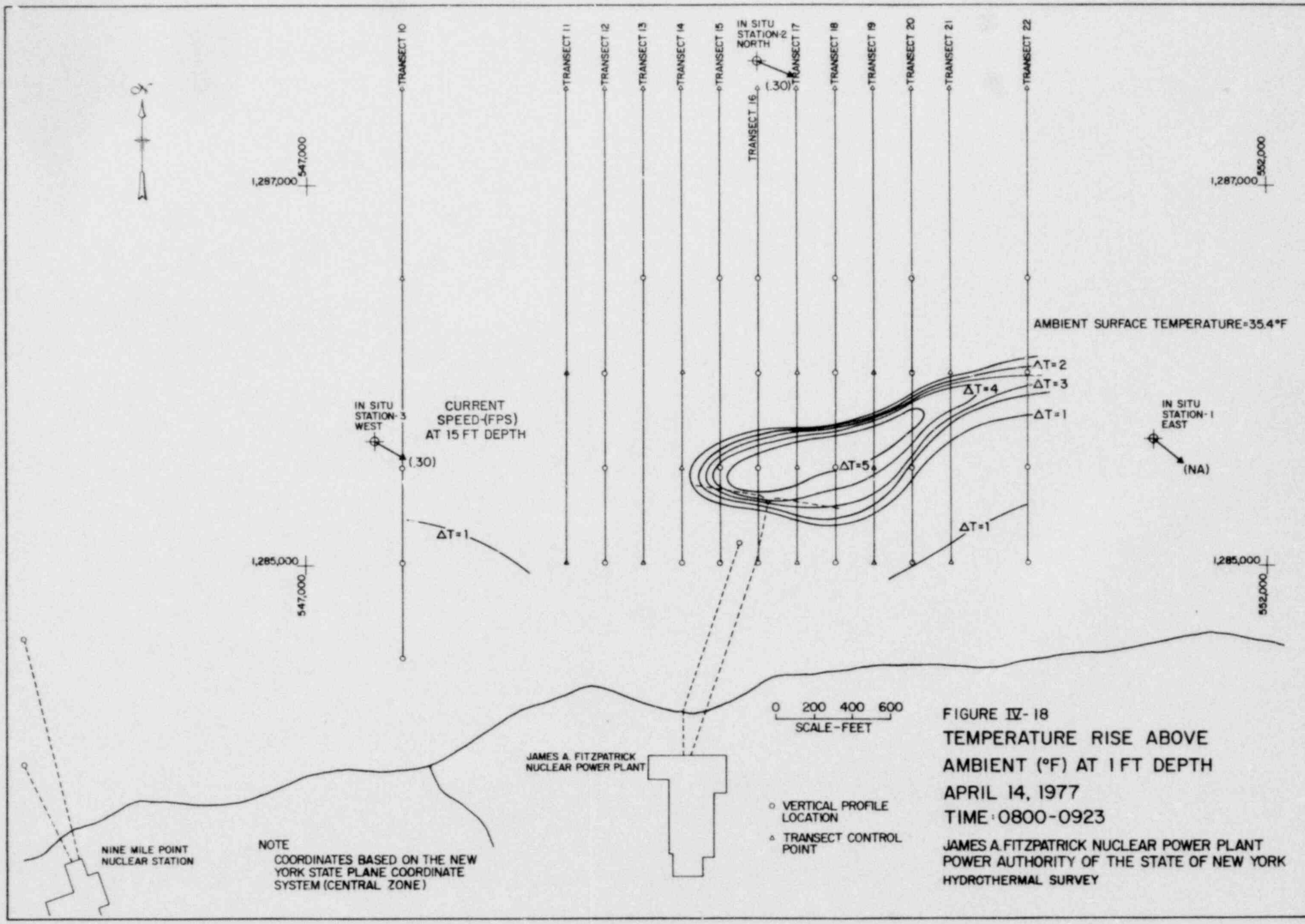


FIGURE IV-18
TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
APRIL 14, 1977
TIME: 0800-0923

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

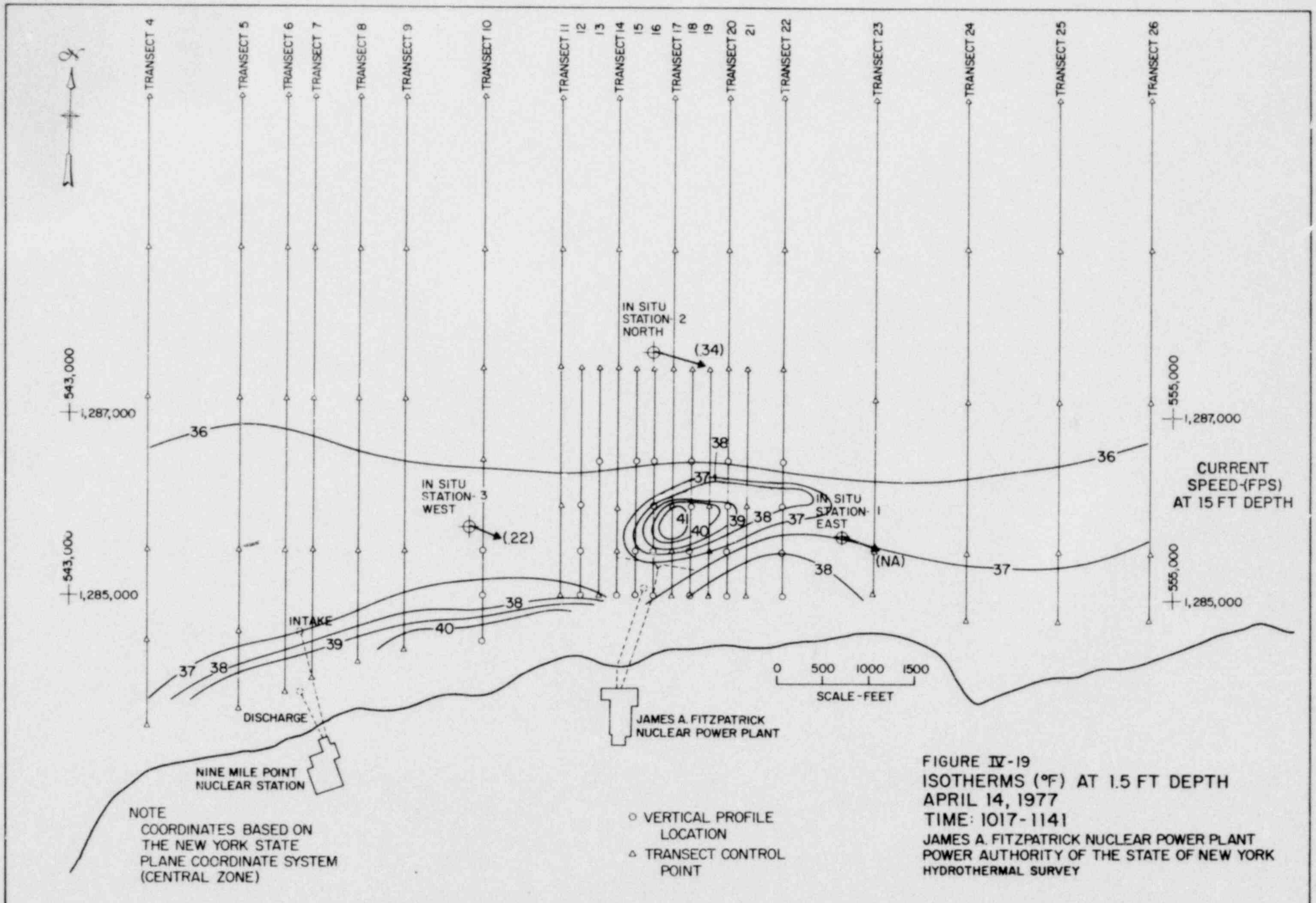


FIGURE IV-19
ISOTHERMS (°F) AT 1.5 FT DEPTH
APRIL 14, 1977
TIME: 1017-1141
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

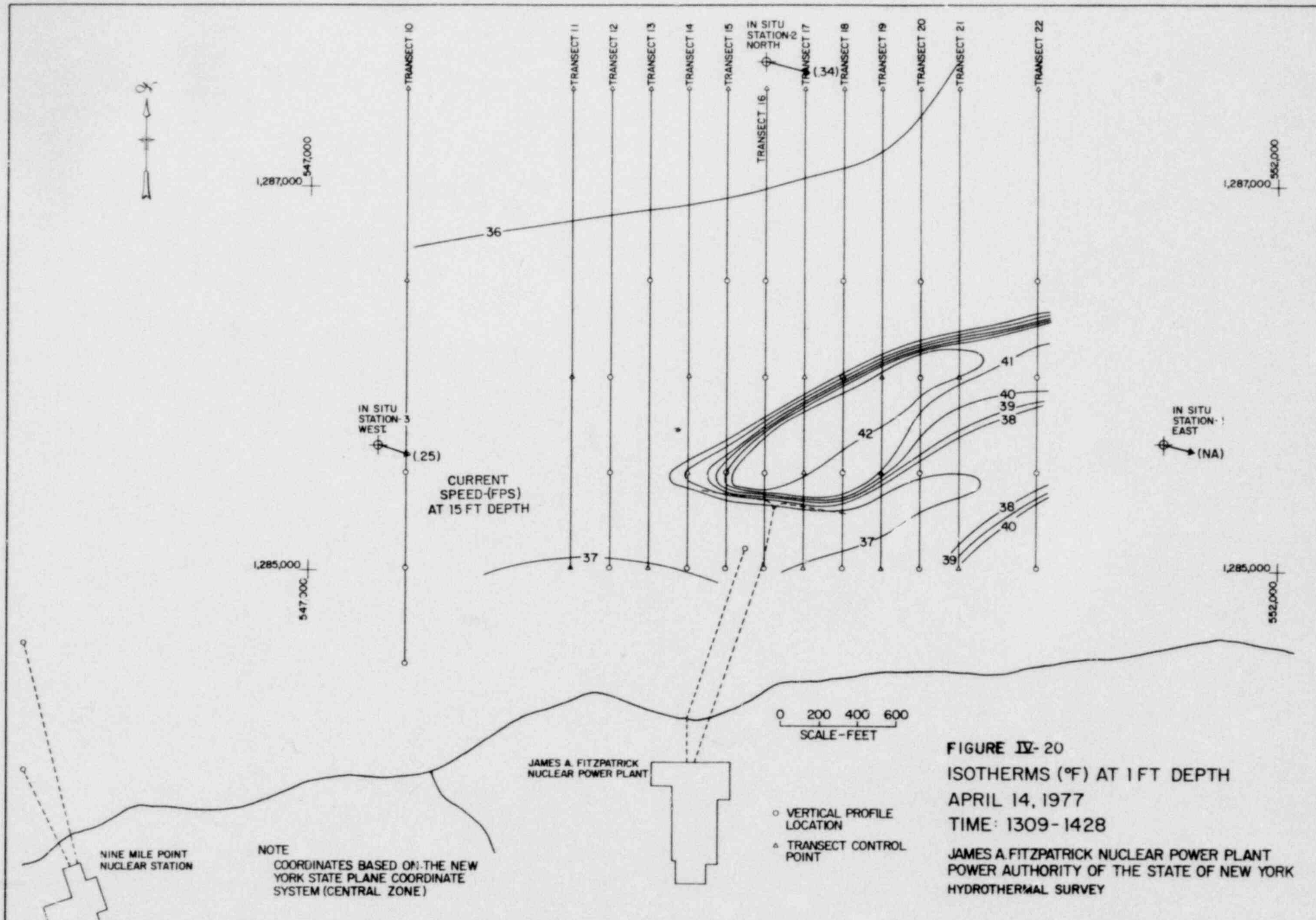


FIGURE IV-20

ISOTHERMS (°F) AT 1 FT DEPTH

APRIL 14, 1977

TIME: 1309-1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

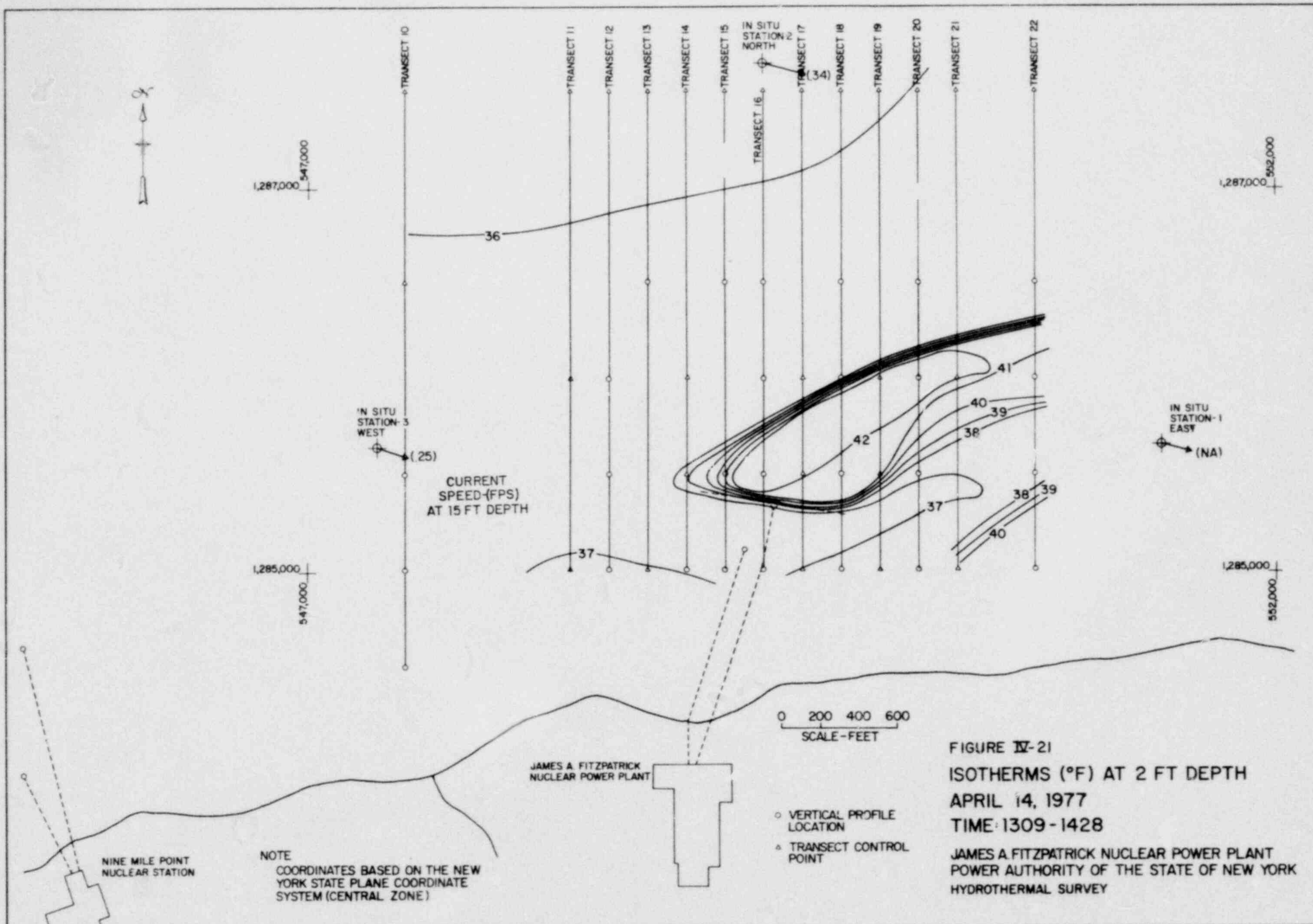


FIGURE IV-21
ISOTHERMS (°F) AT 2 FT DEPTH
APRIL 14, 1977
TIME: 1309-1428
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

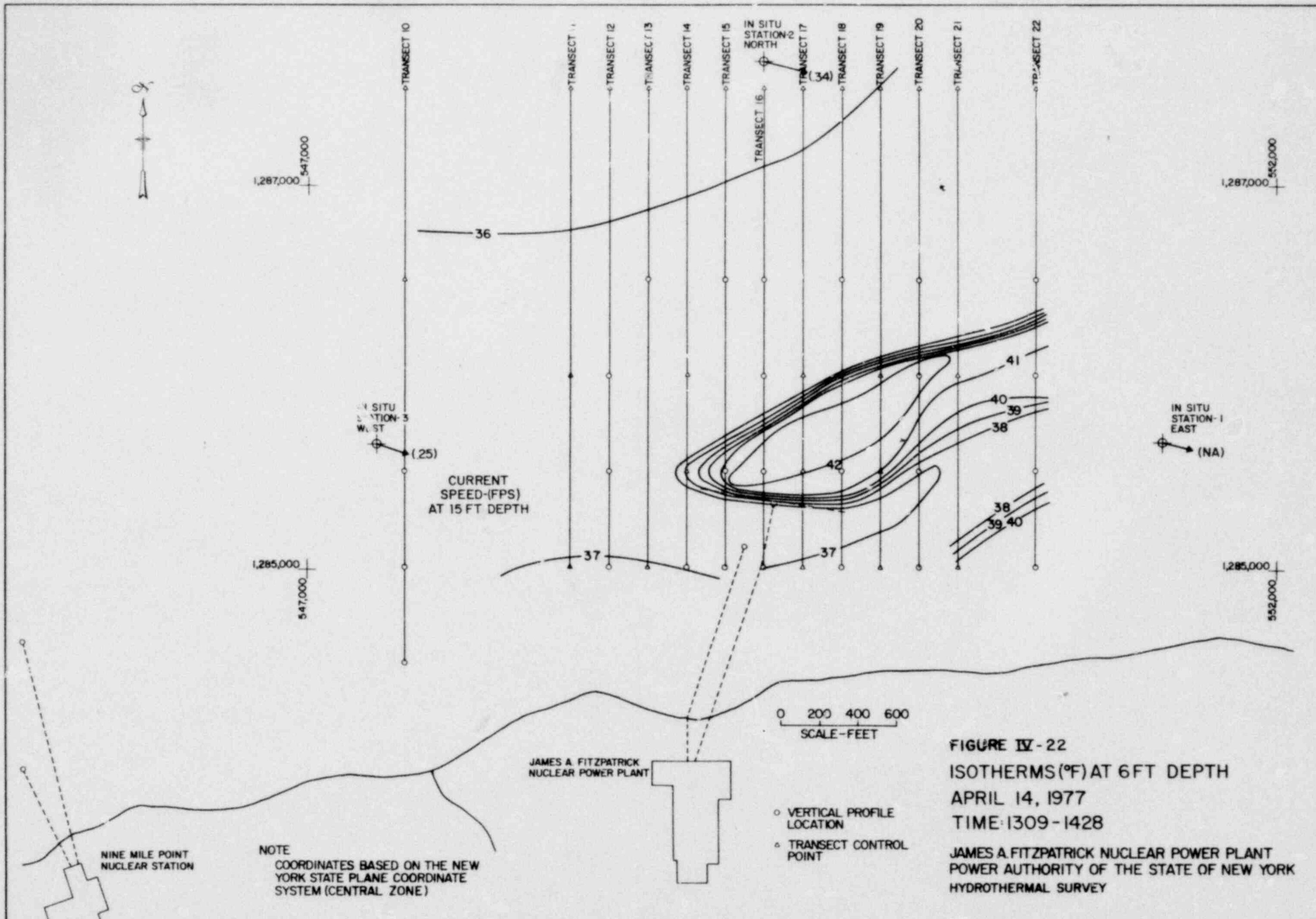


FIGURE IV - 22

ISOTHERMS (°F) AT 6 FT DEPTH

APRIL 14, 1977

TIME 1309 - 1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

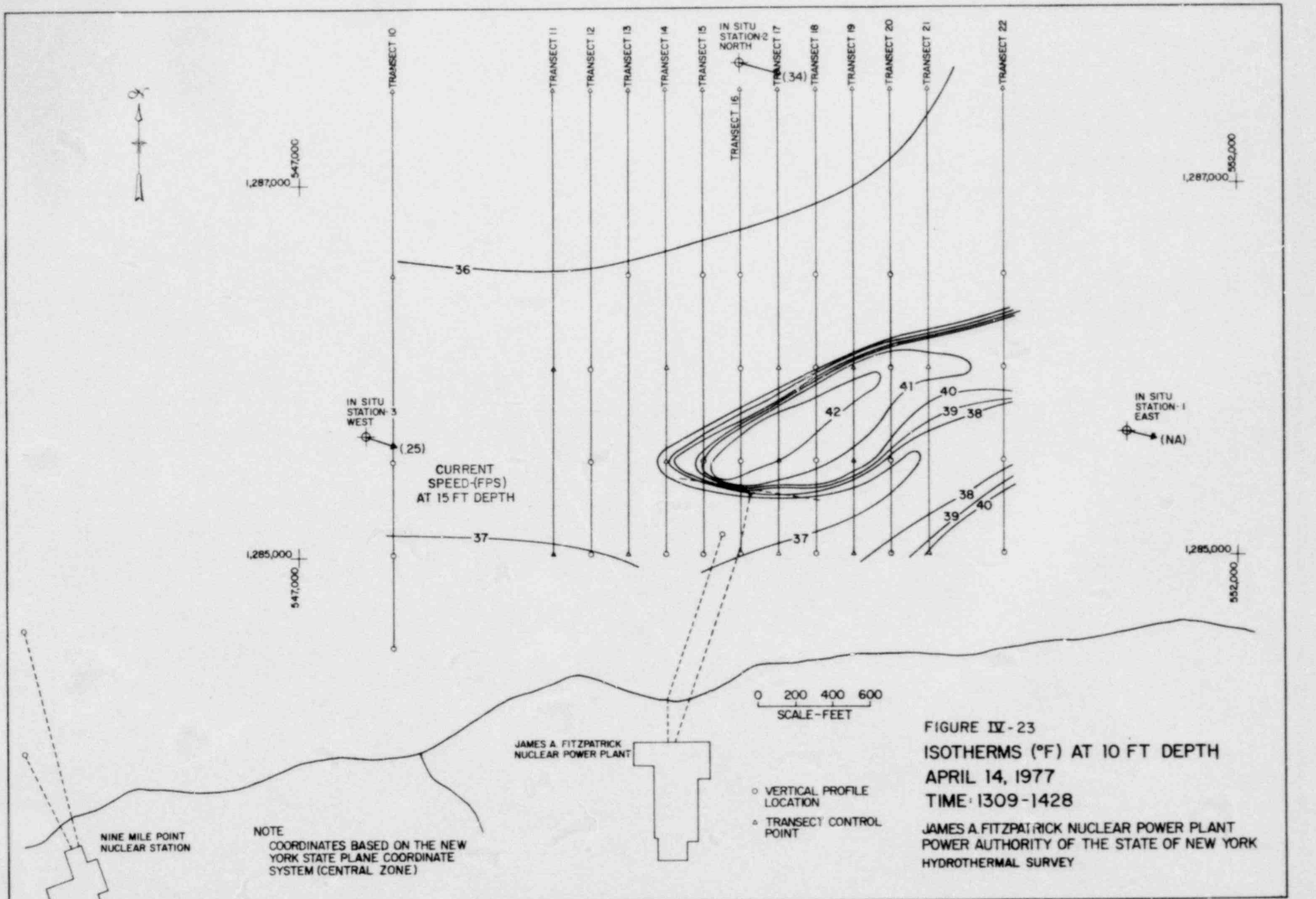


FIGURE IV-23

ISOTHERMS (°F) AT 10 FT DEPTH

APRIL 14, 1977

TIME: 1309-1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

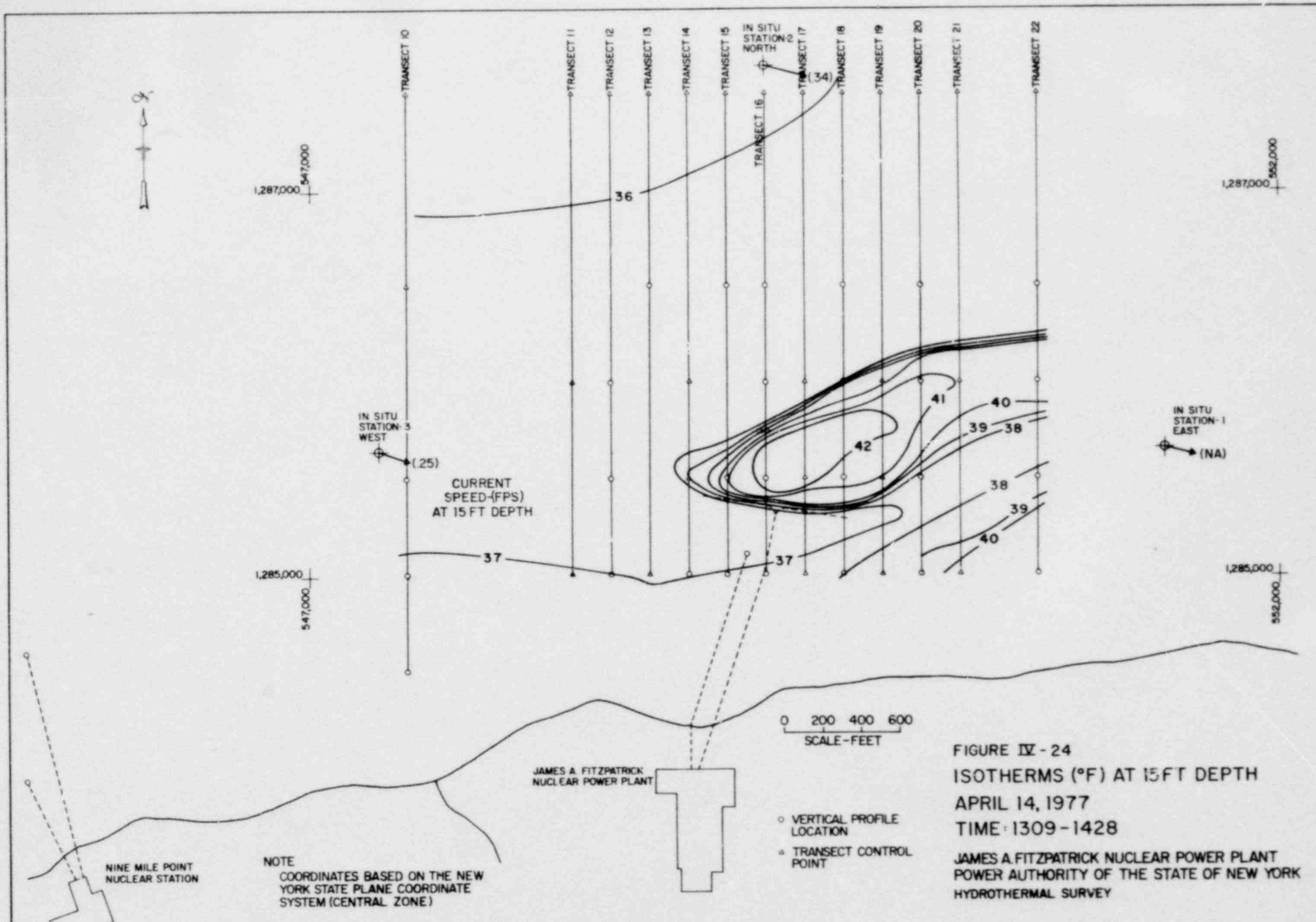


FIGURE IV - 24

ISOTHERMS (°F) AT 15 FT DEPTH

APRIL 14, 1977

TIME: 1309-1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

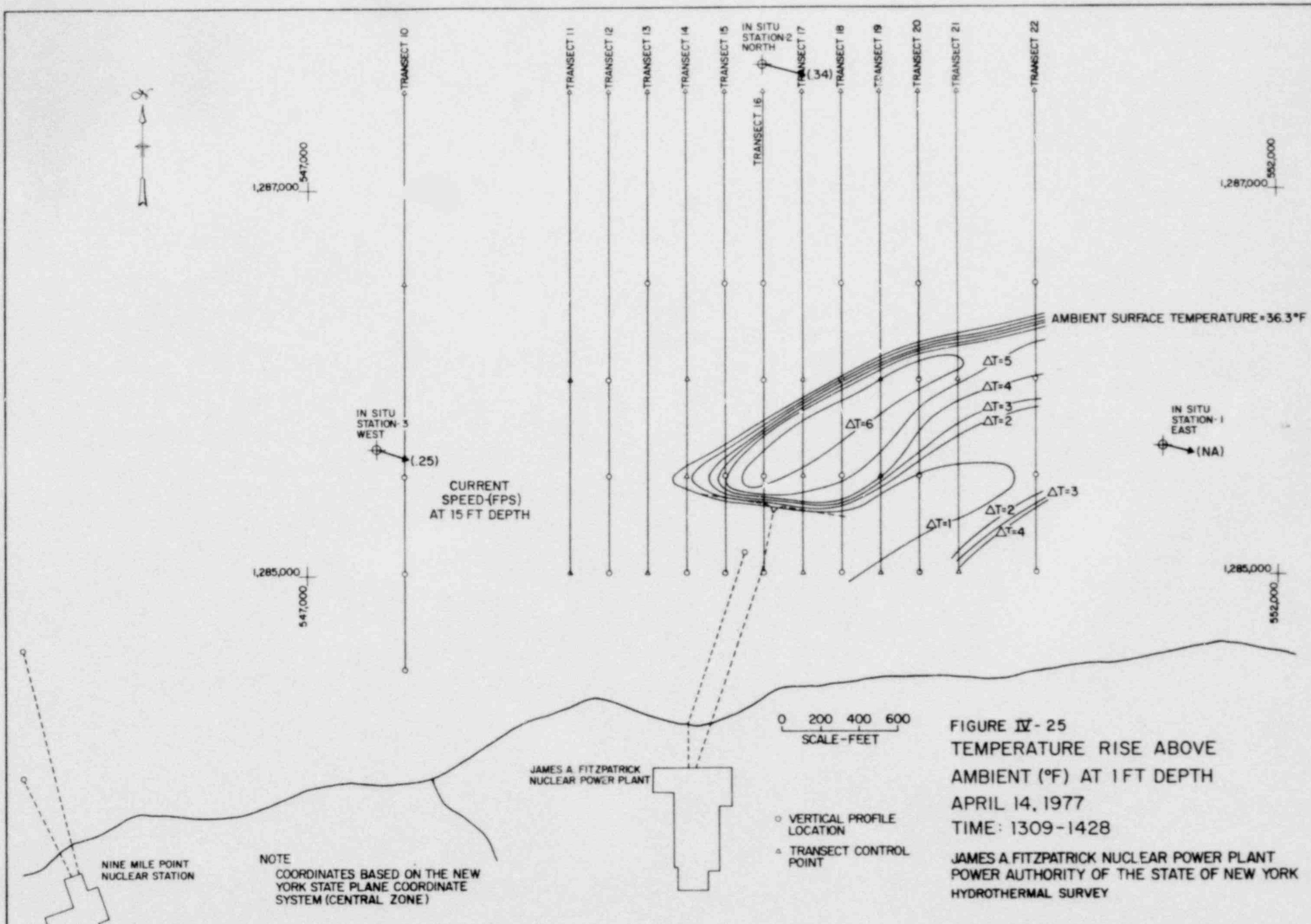
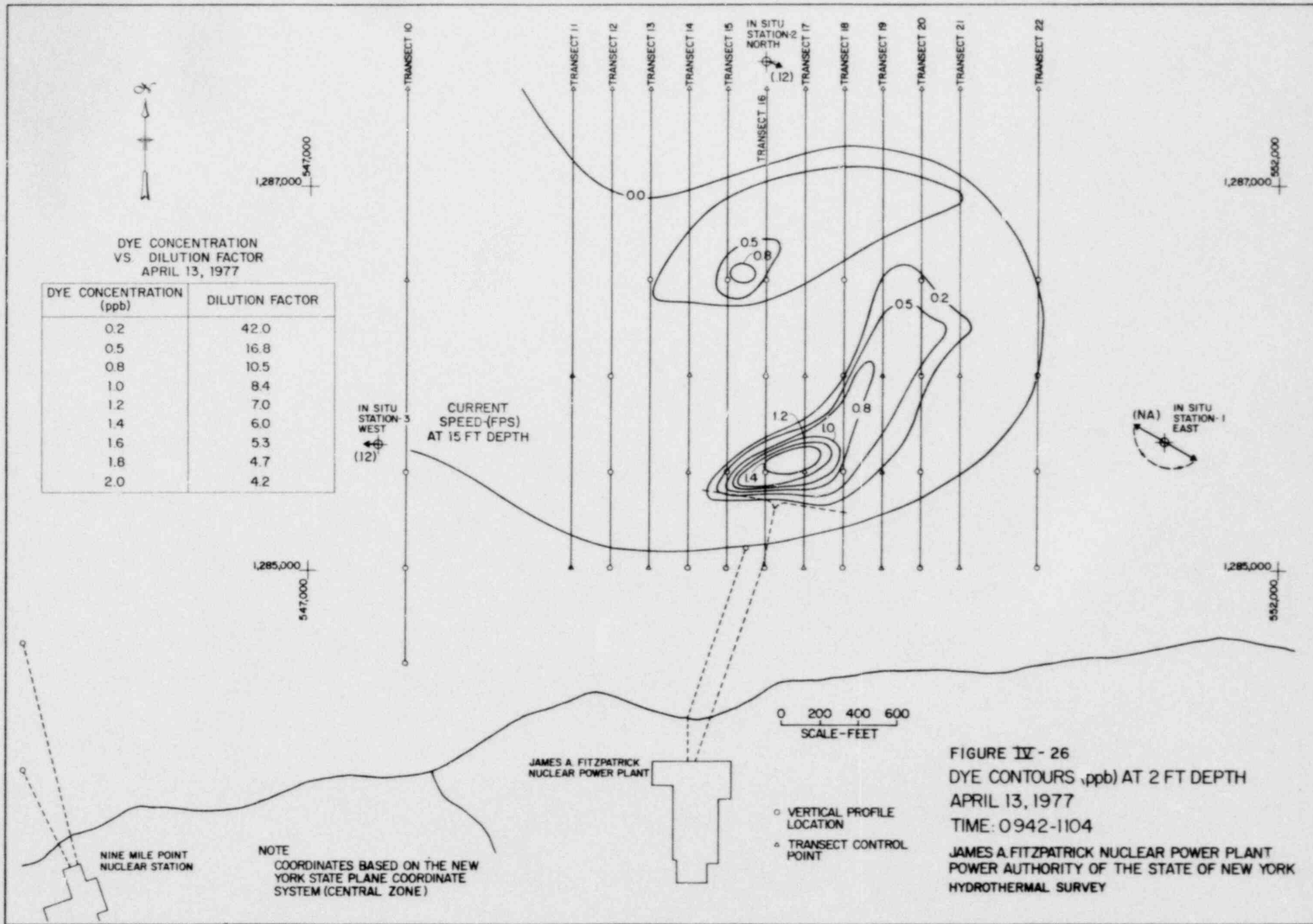


FIGURE IV-25
TEMPERATURE RISE ABOVE
AMBIENT (°F) AT 1 FT DEPTH
APRIL 14, 1977
TIME: 1309-1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

DYE CONCENTRATION
VS. DILUTION FACTOR
APRIL 13, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

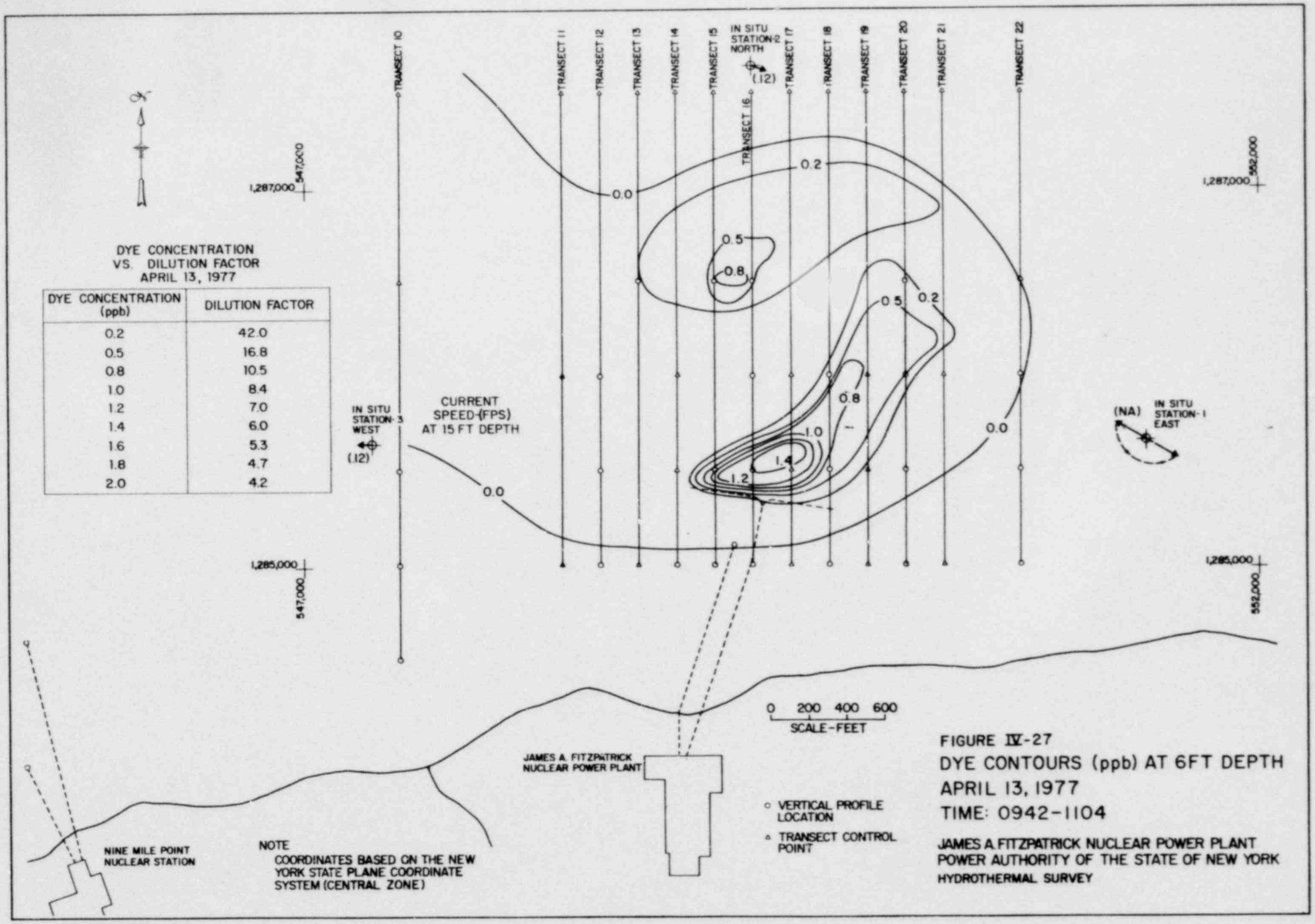


NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

○ VERTICAL PROFILE LOCATION
△ TRANSECT CONTROL POINT

FIGURE IV - 26
DYE CONTOURS (ppb) AT 2 FT DEPTH
APRIL 13, 1977
TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

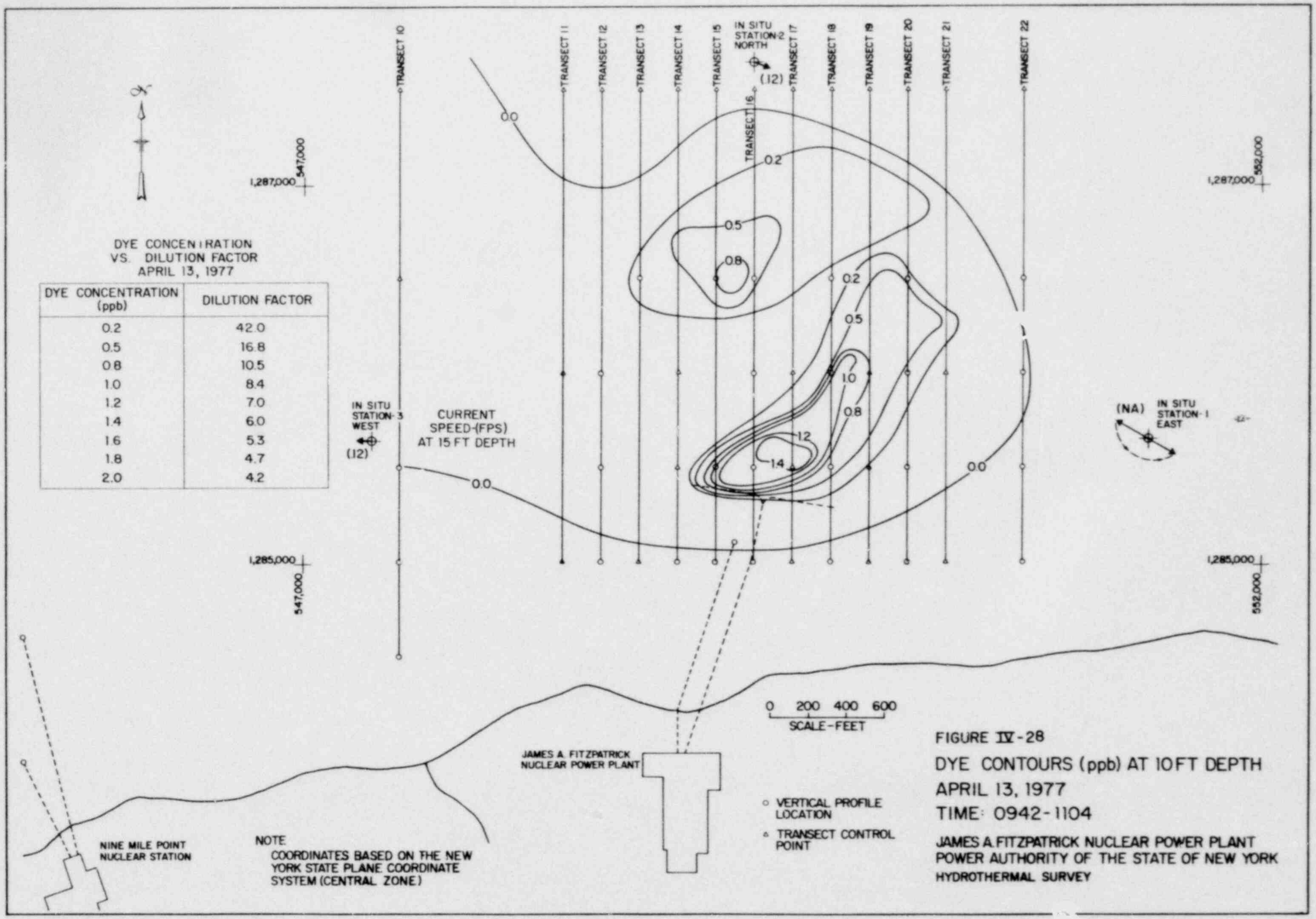


DYE CONCENTRATION VS. DILUTION FACTOR APRIL 13, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-27
DYE CONTOURS (ppb) AT 6FT DEPTH
APRIL 13, 1977
TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR
APRIL 13, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

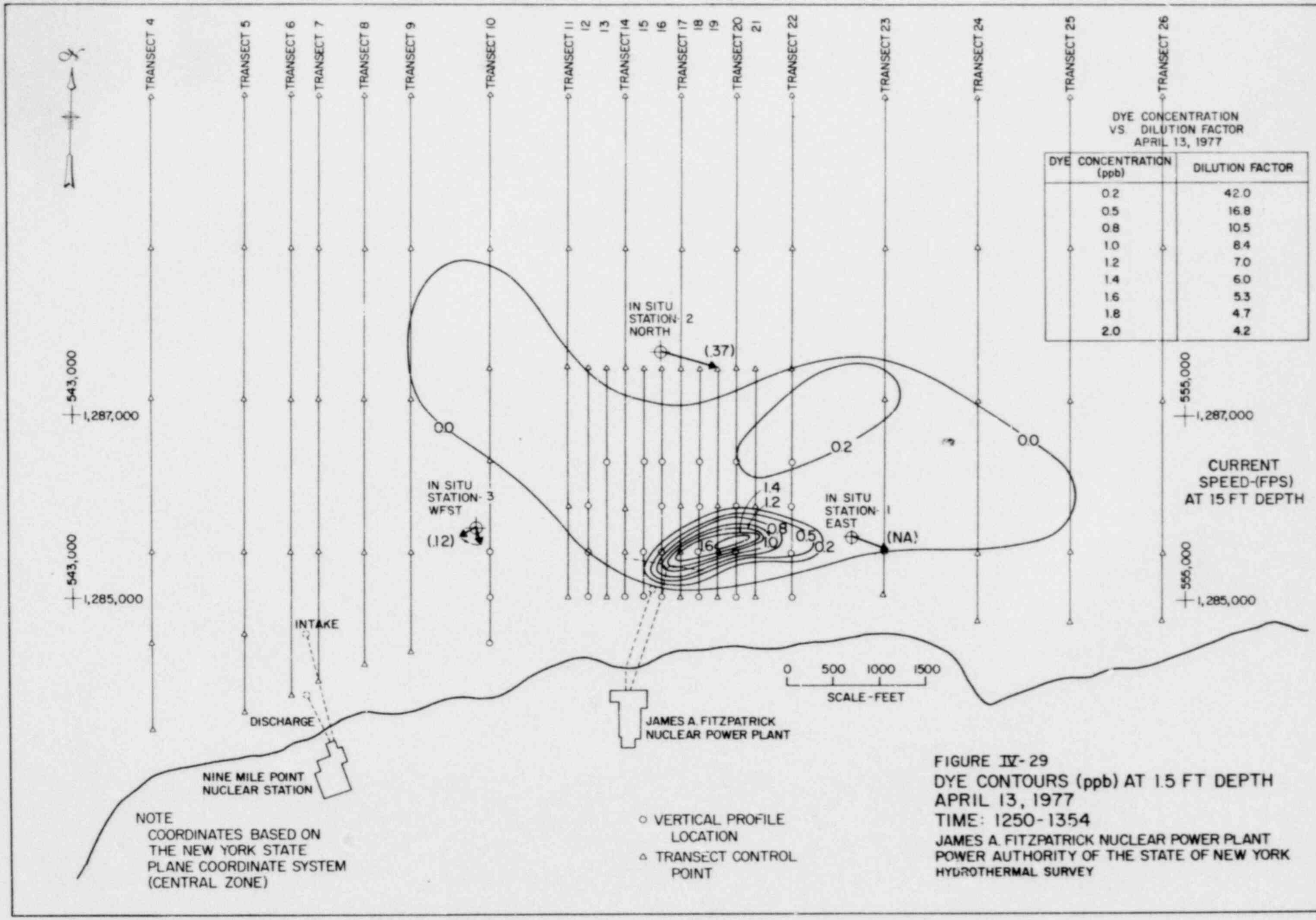
FIGURE IV-28

DYE CONTOURS (ppb) AT 10 FT DEPTH

APRIL 13, 1977

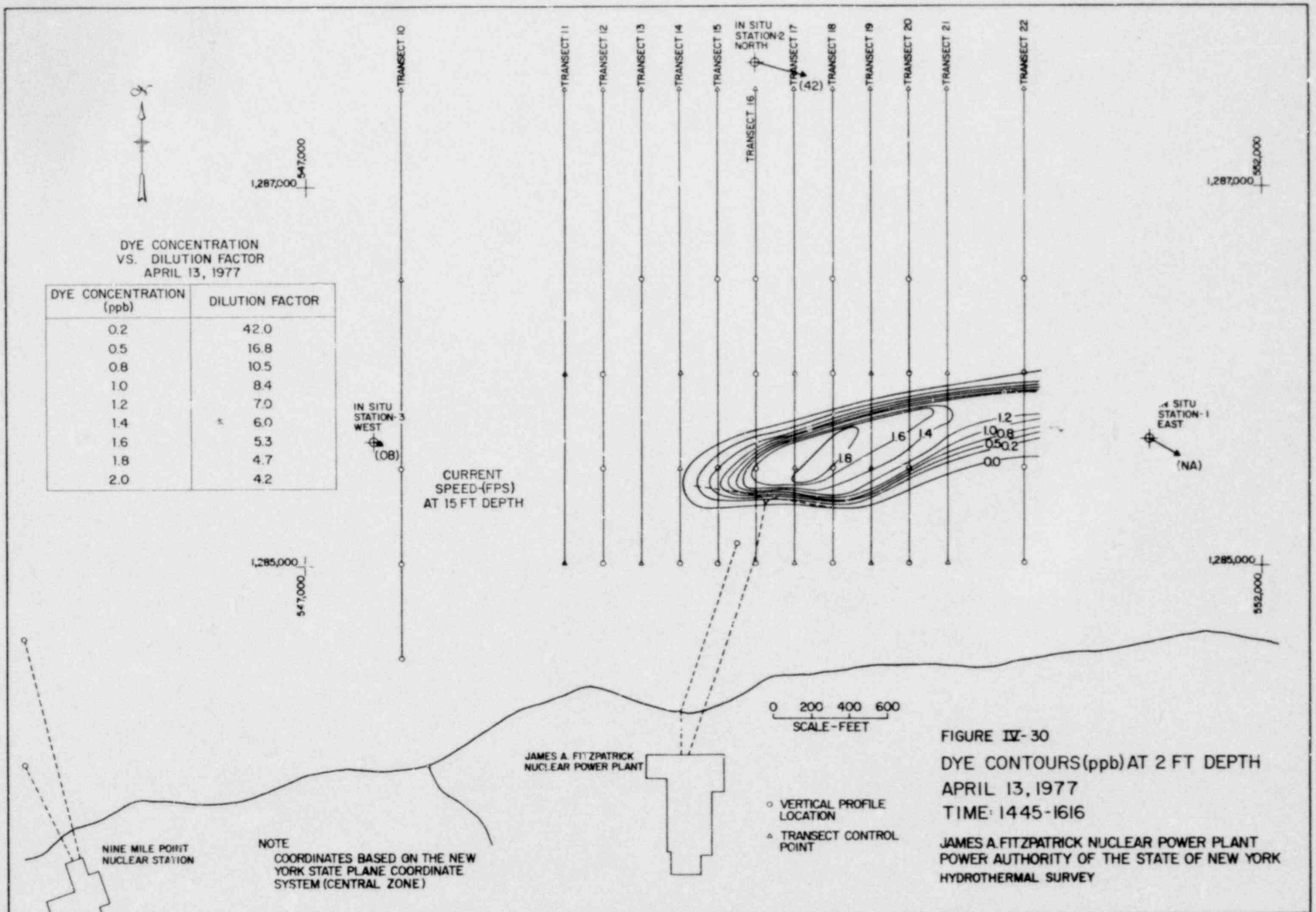
TIME: 0942-1104

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV- 29
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
APRIL 13, 1977
TIME: 1250-1354
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

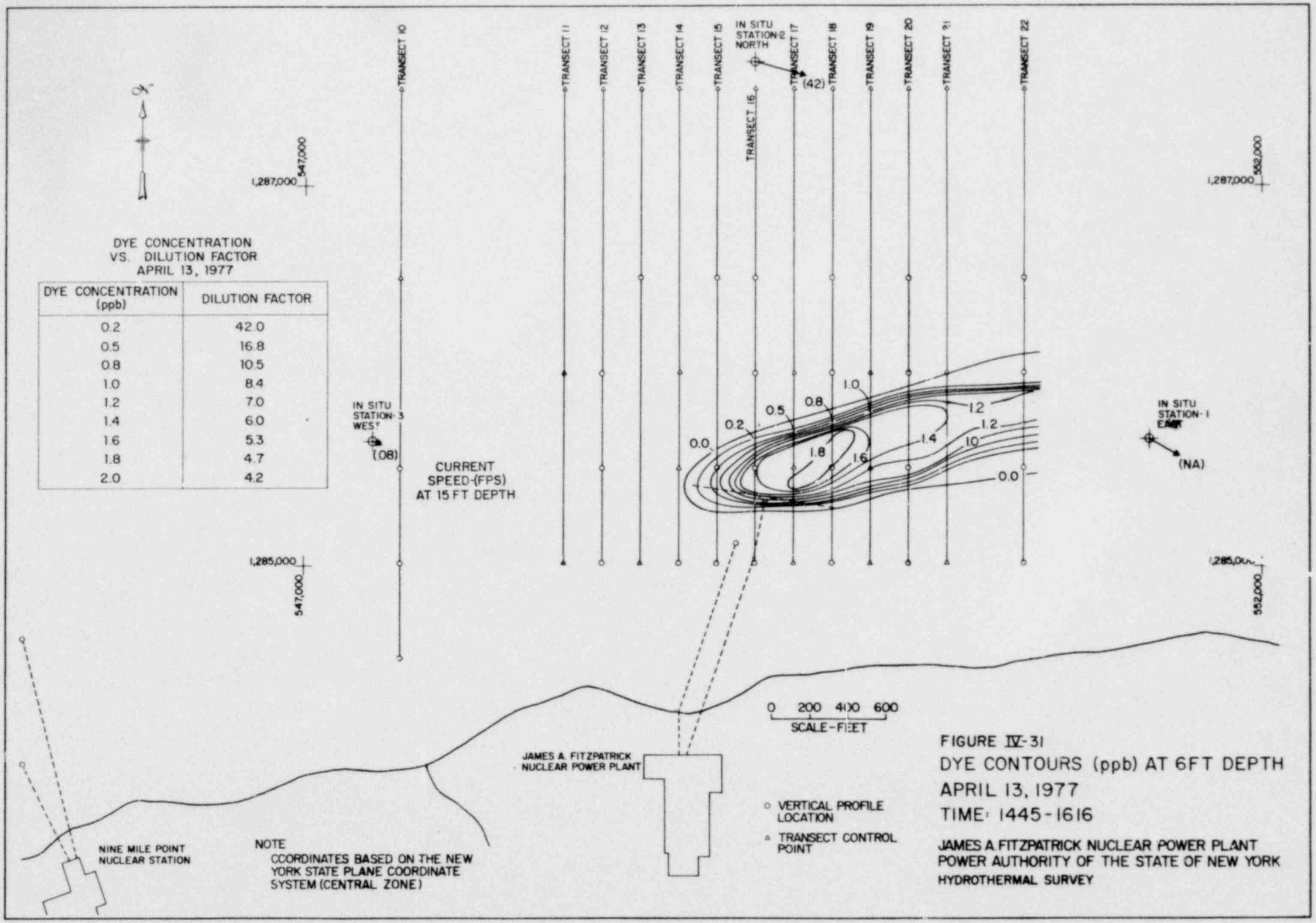


DYE CONCENTRATION VS. DILUTION FACTOR APRIL 13, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-30
DYE CONTOURS (ppb) AT 2 FT DEPTH
APRIL 13, 1977
TIME: 1445-1616

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

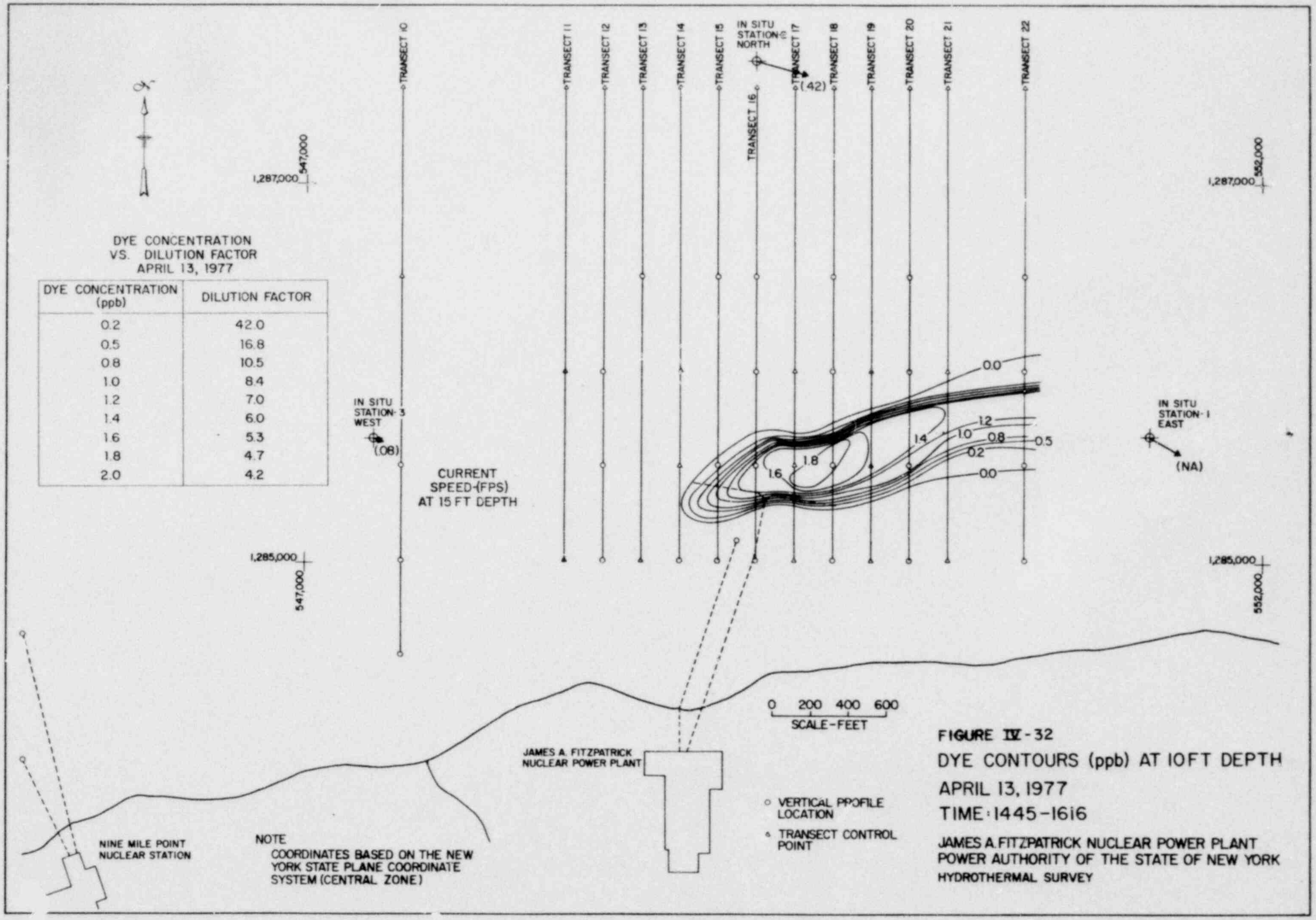


DYE CONCENTRATION VS. DILUTION FACTOR
APRIL 13, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-31
DYE CONTOURS (ppb) AT 6FT DEPTH
APRIL 13, 1977
TIME: 1445-1616

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

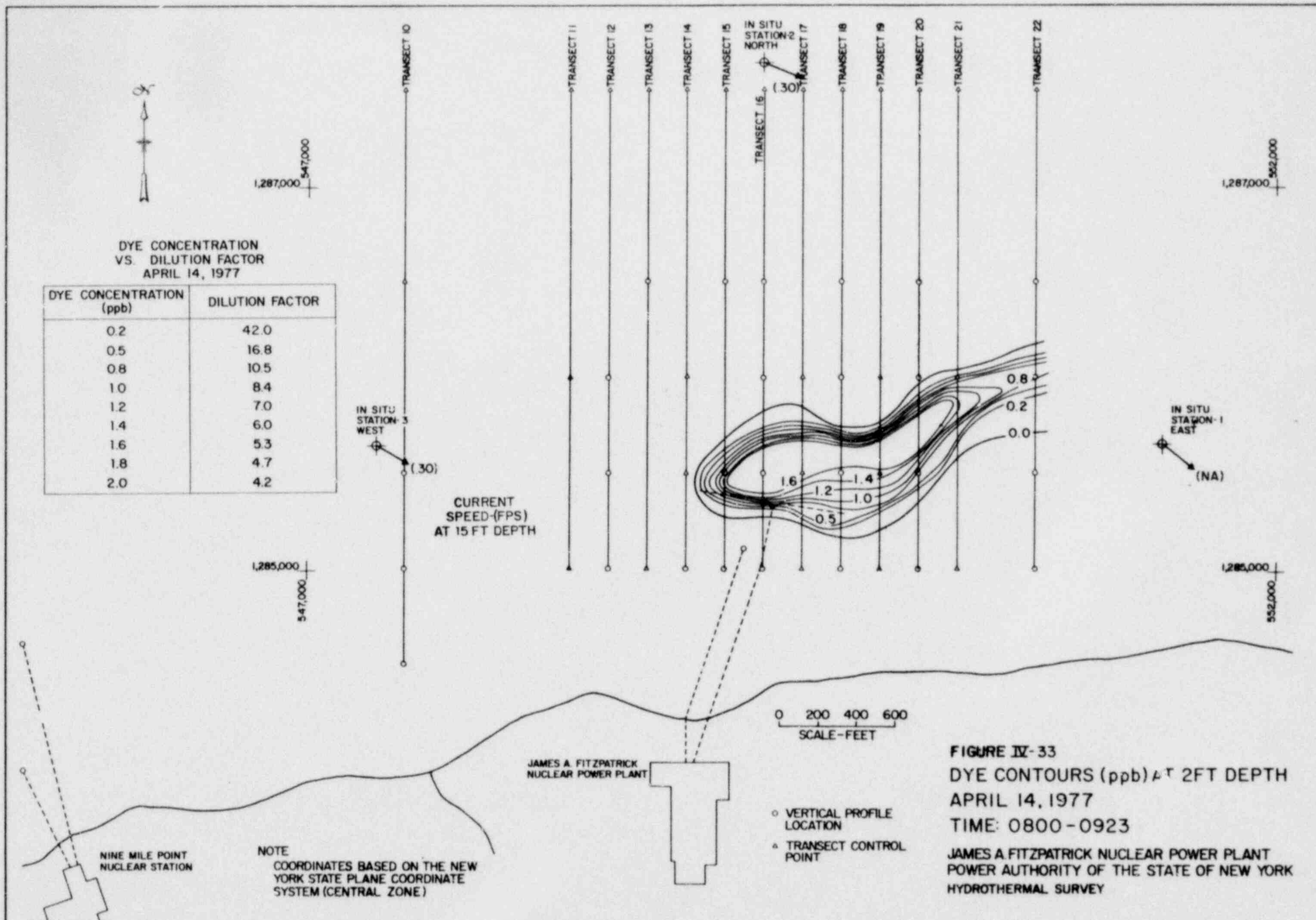


DYE CONCENTRATION VS. DILUTION FACTOR APRIL 13, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-32
DYE CONTOURS (ppb) AT 10 FT DEPTH
APRIL 13, 1977
TIME: 1445-1616

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



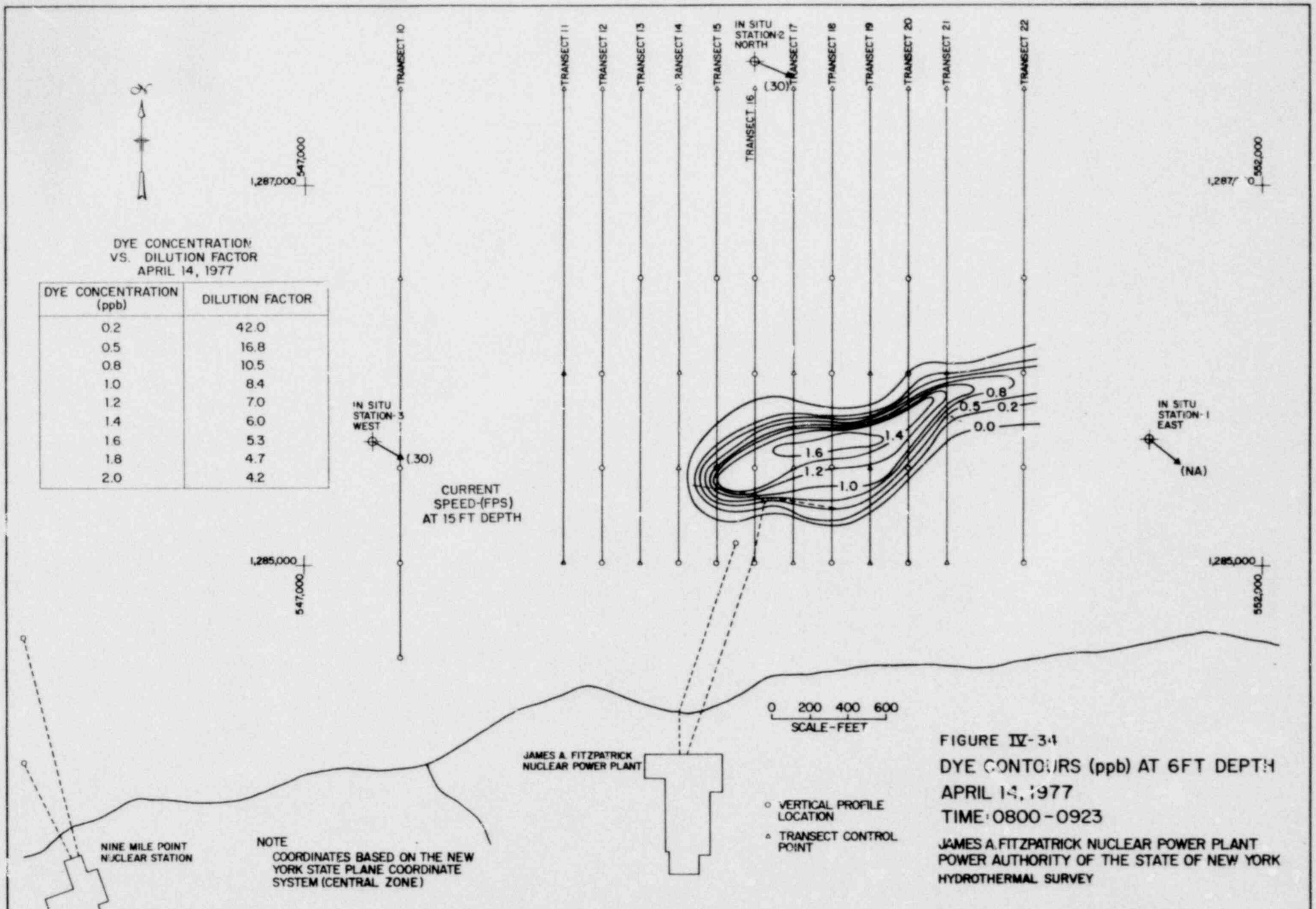
DYE CONCENTRATION VS. DILUTION FACTOR APRIL 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-33
DYE CONTOURS (ppb) AT 2FT DEPTH
APRIL 14, 1977
TIME: 0800-0923
JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

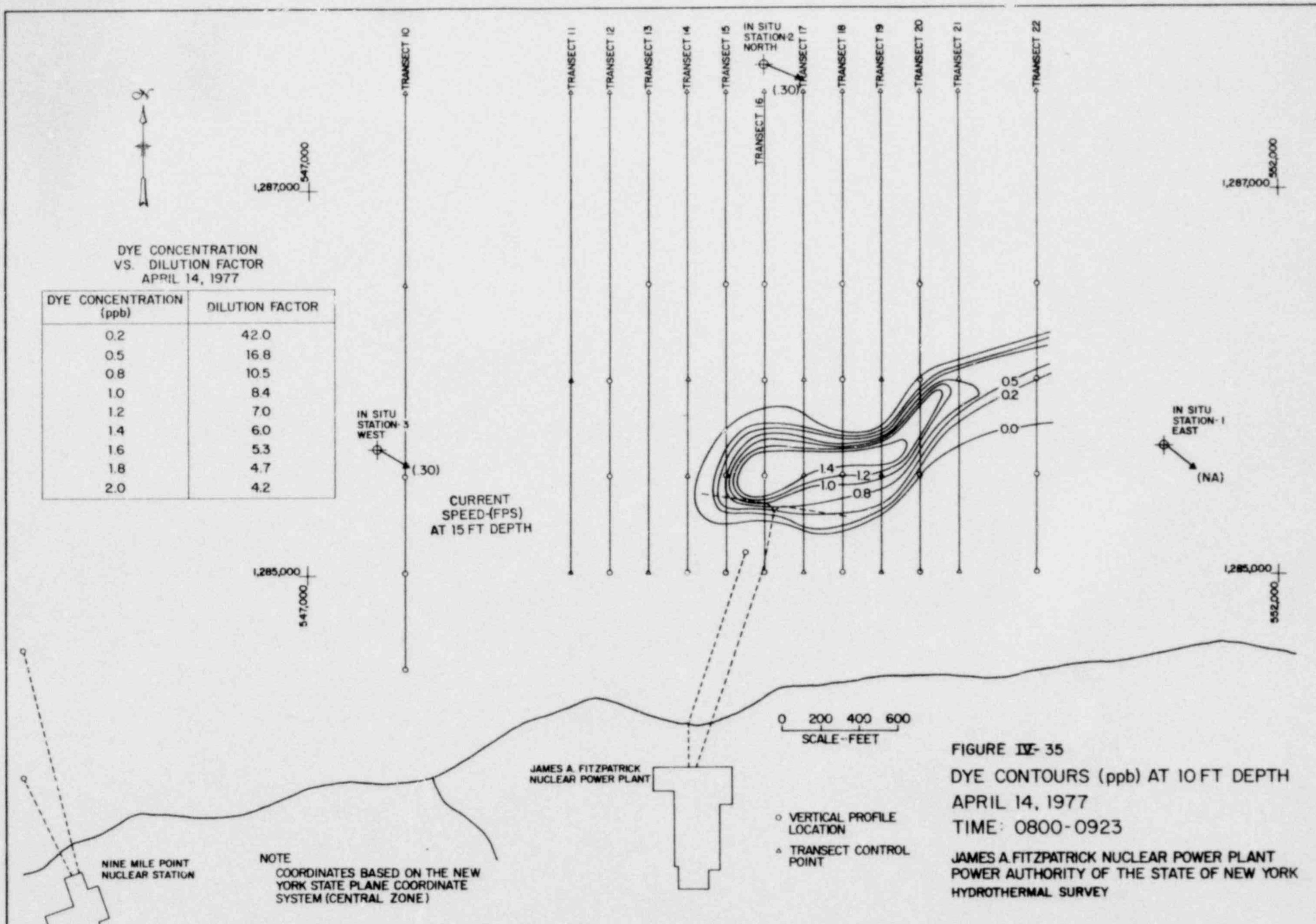
DYE CONCENTRATION VS. DILUTION FACTOR
APRIL 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE IV-34
DYE CONTOURS (ppb) AT 6FT DEPTH
APRIL 14, 1977
TIME: 0800 - 0923
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

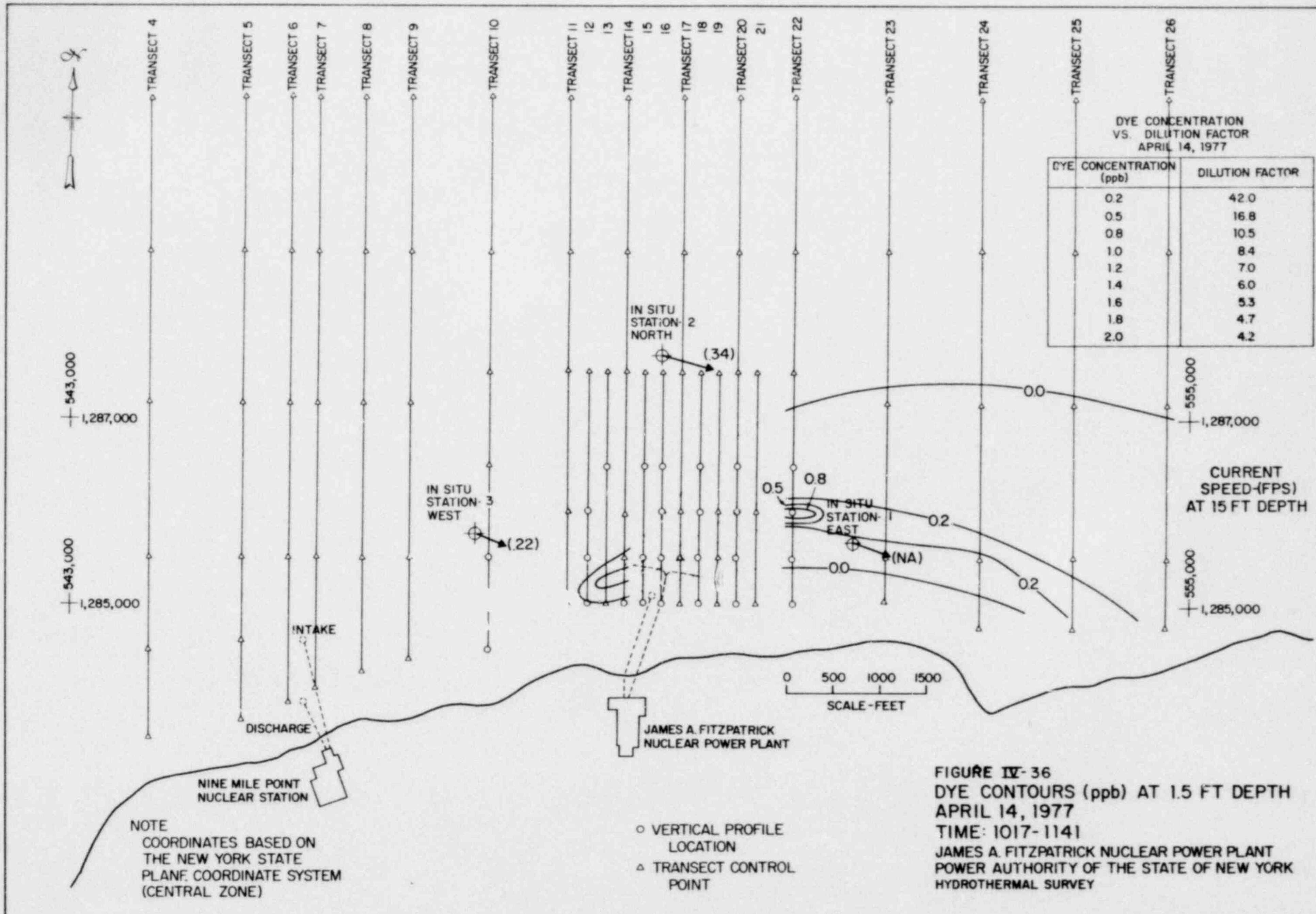


DYE CONCENTRATION VS. DILUTION FACTOR
APRIL 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-35
DYE CONTOURS (ppb) AT 10 FT DEPTH
APRIL 14, 1977
TIME: 0800-0923

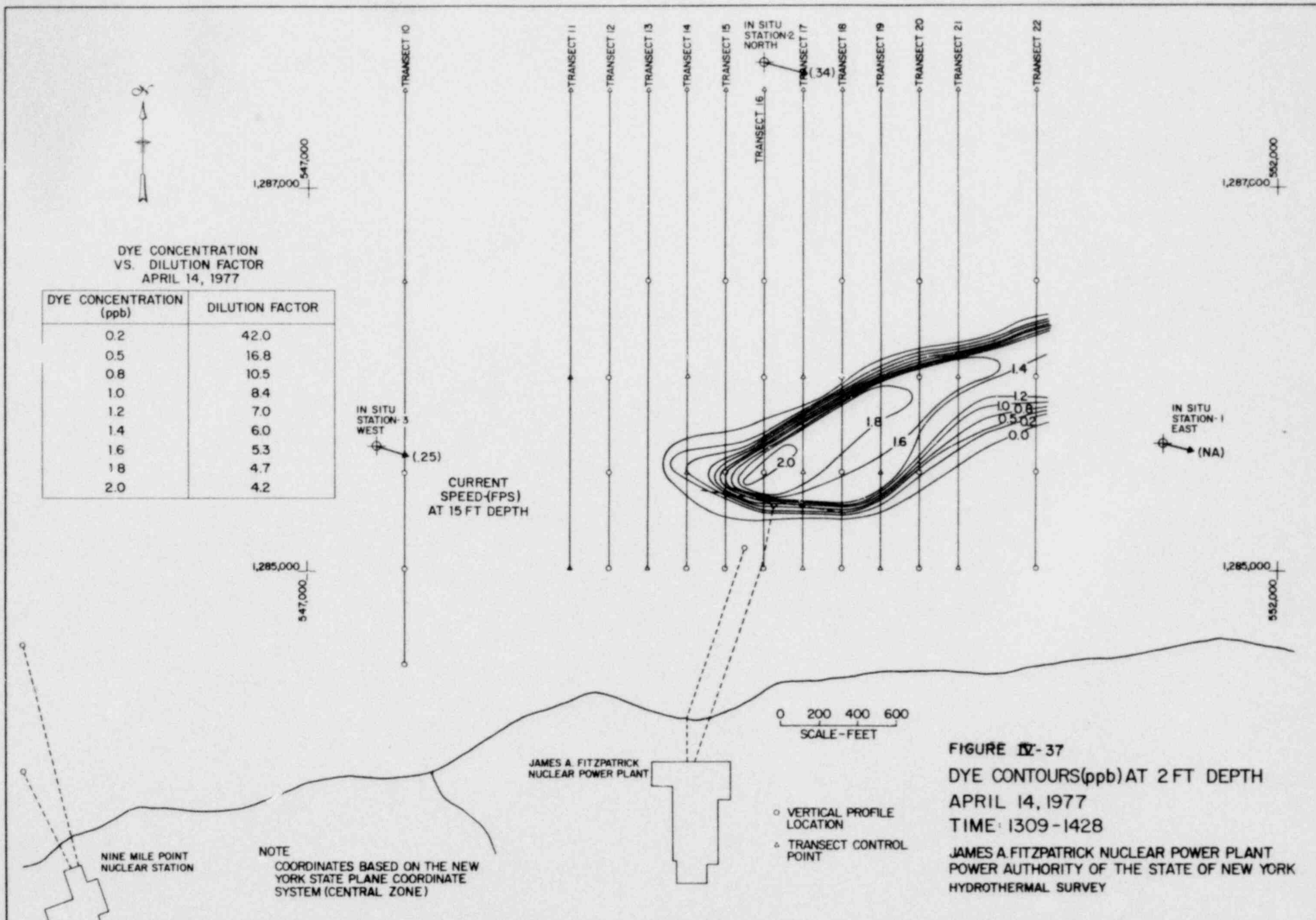
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR APRIL 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-36
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
APRIL 14, 1977
TIME: 1017-1141
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



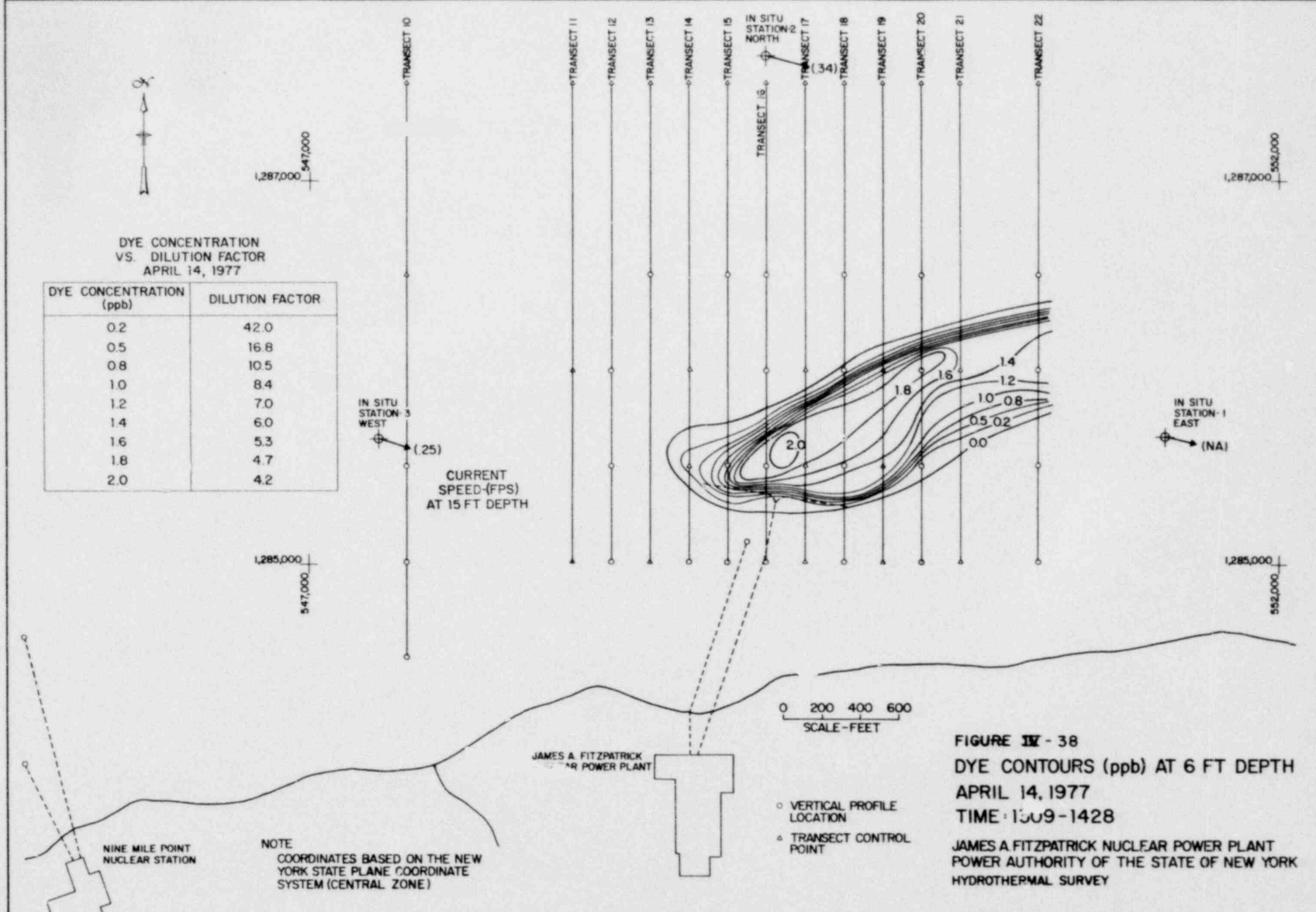
DYE CONCENTRATION
VS. DILUTION FACTOR
APRIL 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-37

DYE CONTOURS(ppb) AT 2 FT DEPTH
APRIL 14, 1977
TIME: 1309-1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION
VS. DILUTION FACTOR
APRIL 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

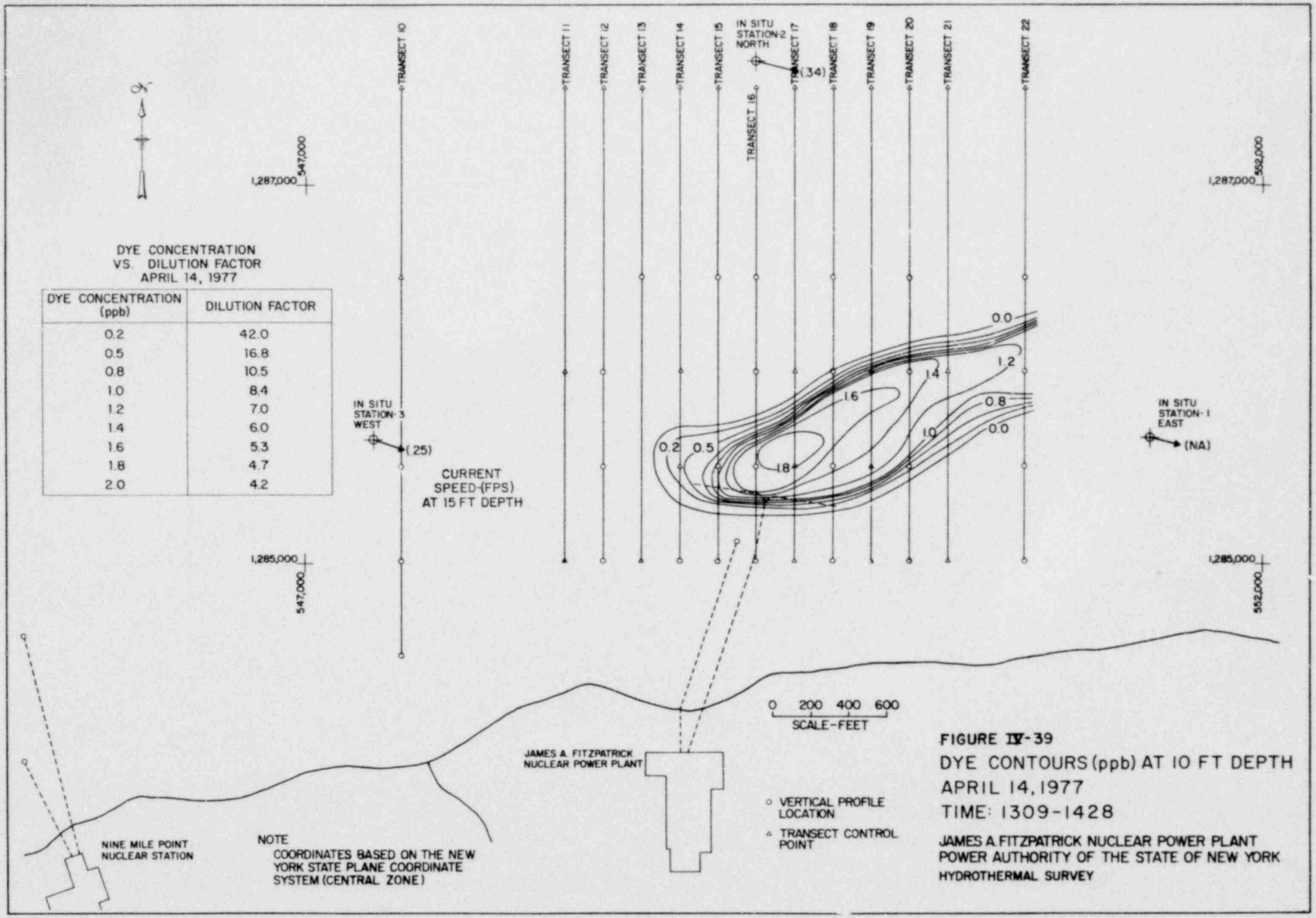
FIGURE IV - 38

DYE CONTOURS (ppb) AT 6 FT DEPTH

APRIL 14, 1977

TIME: 1309-1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR APRIL 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	42.0
0.5	16.8
0.8	10.5
1.0	8.4
1.2	7.0
1.4	6.0
1.6	5.3
1.8	4.7
2.0	4.2

FIGURE IV-39
DYE CONTOURS (ppb) AT 10 FT DEPTH
APRIL 14, 1977
TIME: 1309-1428

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

JUNE 1977 POSTOPERATIONAL
HYDROTHERMAL SURVEY
FOR
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK

V-JUNE 1977 SURVEY

TABLE OF CONTENTS

LIST OF TABLES

V-JUNE 1977 SURVEY

LIST OF FIGURES

V-JUNE 1977 SURVEY

V.1 SUMMARY

The fifth postoperational hydrothermal survey of the JAFNPP was conducted on June 14, 1977. The NMP-1 station was not in operation during the survey.

The primary objectives of this survey were:

1. To determine the three-dimensional thermal patterns in the discharge area produced by operation of the plant, and

2. To determine the diffuser performance based on dye concentrations existing in the lake after releasing dye into the plant circulating water system.

These objectives were set forth so as to fulfill the requirements of the National Pollutant Discharge Elimination System Permit (Permit No. NY0020109), administered by the U.S. Environmental Protection Agency; the JAFNPP Environmental Technical Specifications (Docket No. 50-333), administered by the U.S. Nuclear Regulatory Commission; and the New York State Department of Environmental Conservation's standards and requirements.

V.2 METHOD OF DATA ACQUISITION

Aquatec, Incorporated, of South Burlington, Vermont was contracted to perform the temperature, dye, and in situ current speed and direction surveys of the JAFNPP discharge area. A report submitted by Aquatec, entitled "James A. FitzPatrick Nuclear Power Plant, Fifth Operational Hydrothermal Survey, June 14, 1977," supplements this document and describes all aspects of data acquisition and reduction.

Niagara Mohawk Power Corporation, operator of NMP Unit 1, and the Power Authority of the State of New York, owner of the JAFNPP, maintain a meteorological tower at the site which records wind speed and direction at elevations of 30 and 200 feet. Meteorological data for the survey date are listed in Section V.3.1.

Operating conditions are continuously monitored at the plant. Section V.3.3 lists the plant operating conditions at the time of the survey.

V.3 CONDITIONS DURING THE SURVEY

4.3.1 Meteorological Conditions

Daylight during the June 14, 1977 survey occurred between approximately 0530 and 2051 hours EST.

The wind speed and direction on June 14, 1977 are given in Table V-1. During the intensive sampling period between 0950 and 1355 on June 14, 1977, the 200-foot-level wind at the NMP-1 site meteorological tower was from the east at an average speed of about 9 mph.

Due to the location of the meteorological tower relative to a forest to the south, wind speed and direction at the 30-foot elevation were not suitable for the purposes of this study.

V.3.2 Lake Conditions

Three in situ current meter stations, located along the boundary of the nearfield study area, as shown in the figures, continuously recorded lake current speed and direction at depths of 15 feet during the survey period.

Average current speeds throughout most of the survey were less than 0.20 fps. Currents were in a westerly direction at station 1 and an easterly direction at stations 2 and 3.

The in situ data are further discussed in Section V.4.2 of this report and in Section 3 of the Aquatec report.

The lake level during the June 14, 1977 survey was 244.93 feet USLS (United States Lake Survey 1955 Datum) based on provisional daily mean water levels at Oswego as reported by the Lake Survey Center (NOAA), Detroit, Michigan.

V.3.3 Plant Operating Conditions

The JAFNPP load, intake and discharge temperatures, and average plant temperature rise are listed in Table V-2 for the June 1977 survey. The plant load is determined from hourly computer output at the plant. The plant load for the survey hours on June 14, 1977 remained relatively constant at approximately 703 MWe gross.

The NMP Unit 1 station was not operating during the June 1977 survey period.

The plant intake and discharge temperatures are based on readings taken in the intake and discharge shaft of the circulating water system during the survey, as described in Section 2.3 of the Aquatec report.

V.4 SURVEY RESULTS

V.4.1 Temperature and Dye Studies

Temperature and dye concentration patterns, illustrating thermal effect and diffuser performance, respectively, for the JAFNPP discharge, are presented for nearfield and farfield areas. Dye contour illustrations include tables to convert dye concentrations to dilution factors.

The nearfield study area consists of transects 10 through 22, as shown in Figures V-1 through V-6 and V-8 through V-10. Temperature data were taken at depths of 1, 2, 6, 10, and 15 feet and dye concentration data at depths of 2, 6, and 10 feet. Transects 11 through 22 are 2,500 feet long; transect 10 is 3,000 feet long.

The farfield study area consists of transects 4 through 26, as shown in Figures V-7 and V-11. Temperature and dye data were taken at a depth of 1.5 feet. The study area extends 5,000 feet either side of the diffuser along the shore and 5,000 feet offshore.

Temperature and dye readings measured in the field represent actual recorded temperature and dye concentrations plotted at the location of measurement.

The dye concentration in the discharge shaft of the circulating water system was calculated to be 8.6 parts per billion (ppb) during the June 1977 survey period. This number was calculated by diluting the Rhodamine WT dye, released at a rate of 1.63 lb per hr, with the total circulating water flow rate of 835 cfs. The circulating water flow rate is based on information in an Aquatec, Inc. report entitled "Pumphouse Dye Study" completed in October 1975, using a dye dilution technique to determine the flow rate within an accuracy of 2.59 percent.

Table V-3 summarizes lake conditions and figure numbers applicable to the June survey.

V.4.1.1 June 14, 1977, Temperature Patterns

Between 0950 and 1355 on June 14, 1977, one nearfield and one farfield run were completed along the appropriate transects.

V.4.1.1.1 Sampling Period from 0950 to 1130 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures V-1, V-2, V-3, V-4, and V-5, respectively, during the nearfield sampling period from 0950 to 1130.

Figure V-6 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 53.5°F was calculated by averaging temperatures approximately 800 feet offshore at the start of transect 19. Temperatures in the discharge area at the 1-foot depth were observed to be equal to or less than ambient.

V.4.1.1.2 Sampling Period from 1150 to 1355 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure V-7 during the farfield sampling period from 1150 to 1355.

V.4.1.2 June 14, 1977, Dye Concentration Patterns

Between 0950 and 1355 on June 14, 1977, one nearfield and one farfield run were completed along the appropriate transects.

V.4.1.2.1 Sampling Period from 0950 to 1130 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures V-8, V-9, and V-10, respectively, during the nearfield sampling period from 0950 to 1130.

The maximum dye concentration at the 2-foot depth was observed to be 1.81-ppb.

V.4.1.2.2 Sampling Period from 1150 to 1355 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure V-11 during the farfield sampling period from 1150 to 1355.

The maximum dye concentration at the 1.5-foot depth was observed to be 1.42 ppb.

V.4.2 In Situ Data

In situ data collection consisted of current speed and direction collected at three current meter stations, as shown in each of the figures and in Appendix III of the Aquatec report. Lake current speed and direction during the June 14, 1977, survey are shown in Table V-3. The average current speed and direction during each survey period at 15-foot depths are presented in each figure by a vector diagram. Due to instrument malfunction, current speeds at the station west of the diffuser were not recorded.

TABLE V-1

WIND SPEED AND DIRECTION FOR JUNE 14, 1977

	Data taken at 200-ft elev.	
Time	Direction (Deg true)	Speed (mph)
0000-0100	175	14
0100-0200	175	8
0200-0300	170	4
0300-0400	115	8
0400-0500	155	12
0500-0600	155	10
0600-0700	125	9
0700-0800	120	10
0800-0900	110	6
0900-1000*	105	9
1000-1100*	100	9
1100-1200*	085	8
1200-1300*	075	8
1300-1400*	085	9
1400-1500	075	11
1500-1600	105	7
1600-1700	200	6
1700-1800	210	1
1800-1900	160	6
1900-2000	185	9
2000-2100	190	11
2100-2200	180	11
2200-2300	180	9
2300-2400	180	8

*Survey Period

TABLE V-2

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON JUNE 14, 1977 FOR THE JAFNPP

Time	Plant Load (MWe) at end of hour	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Circulating Water Temperature Rise (°F)
0000-0100	703	52.5	78.5	26.0
0100-0200	703	52.0	78.0	26.0
0200-0300	704	52.0	77.5	25.5
0300-0400	704	52.5	78.0	25.5
0400-0500	703	52.0	77.5	25.5
0500-0600	703	52.0	77.5	25.5
0600-0700	703	51.5	77.0	25.5
0700-0800	703	51.5	77.5	26.0
0800-0900	703	51.5	77.5	26.0
0900-1000*	702	51.5	77.5	26.0
1000-1100*	703	52.0	77.5	25.5
1100-1200*	703	52.0	77.5	25.5
1200-1300*	703	52.0	77.5	25.5
1300-1400*	702	52.0	77.0	25.0

*Survey Period

TABLE V-3

SUMMARY OF FIGURE NUMBERS AND DATA FOR JUNE 1977 SURVEY

Time	15-ft Current Direction			15-ft Current Speed (fps)			Ambient Surface Temperature (°F)	Depth (ft)	Isotherm Figure No.	Temperature Rise Figure No.	Dye Figure No.
	Station No.			Station No.							
	1	2	3	1	2	3					
0950-1130	WSW	E	E	0.08	0.15	NA	53.5	1.0	V-2	V-6	
								2.0	V-2	-	V-8
								6.0	V-3	-	V-9
								10.0	V-4	-	V-10
								15.0	V-5	-	-
1150-1355	WNW	E	E	0.04	0.15	NA	54.0	1.5	V-7	-	V-11

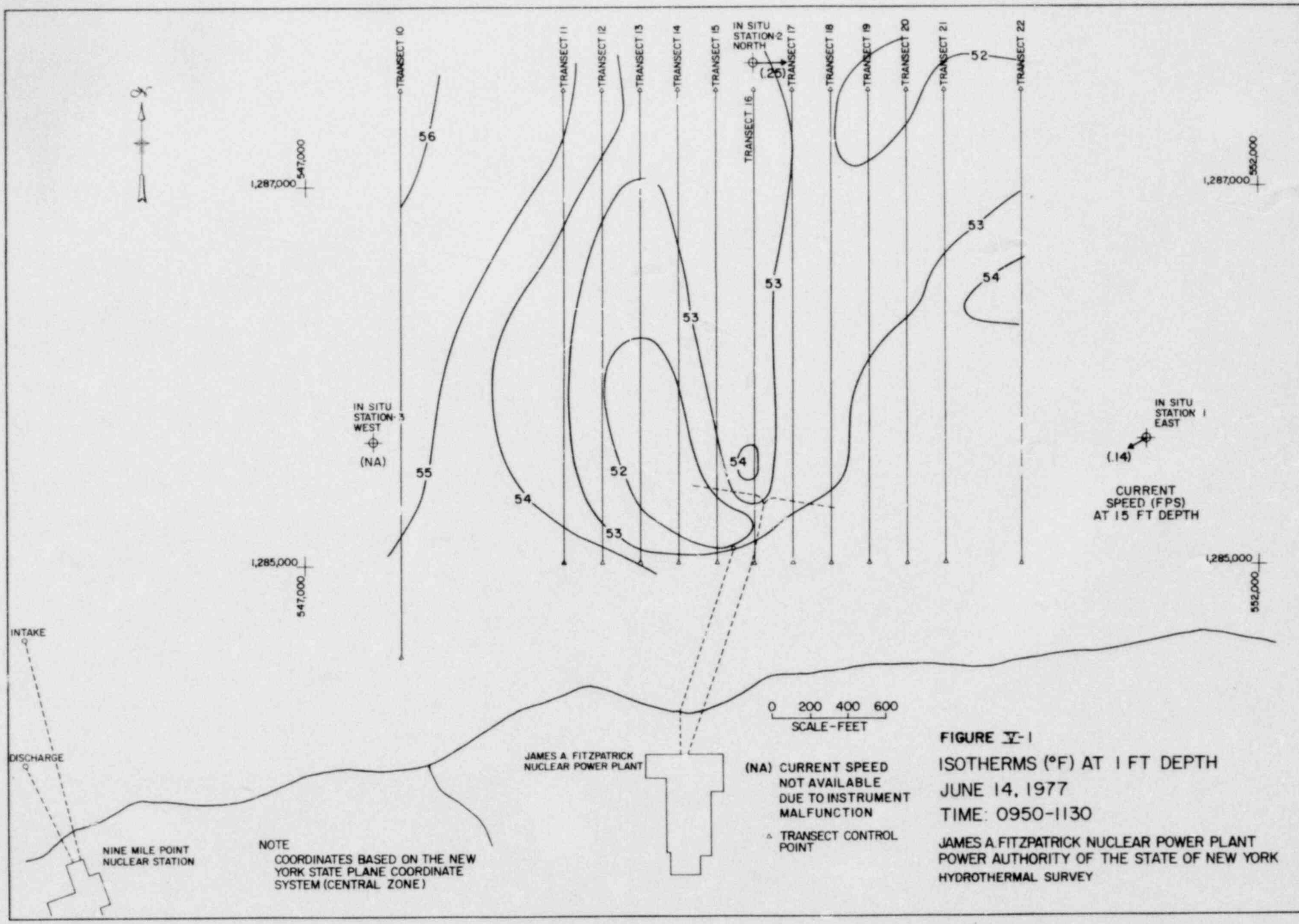


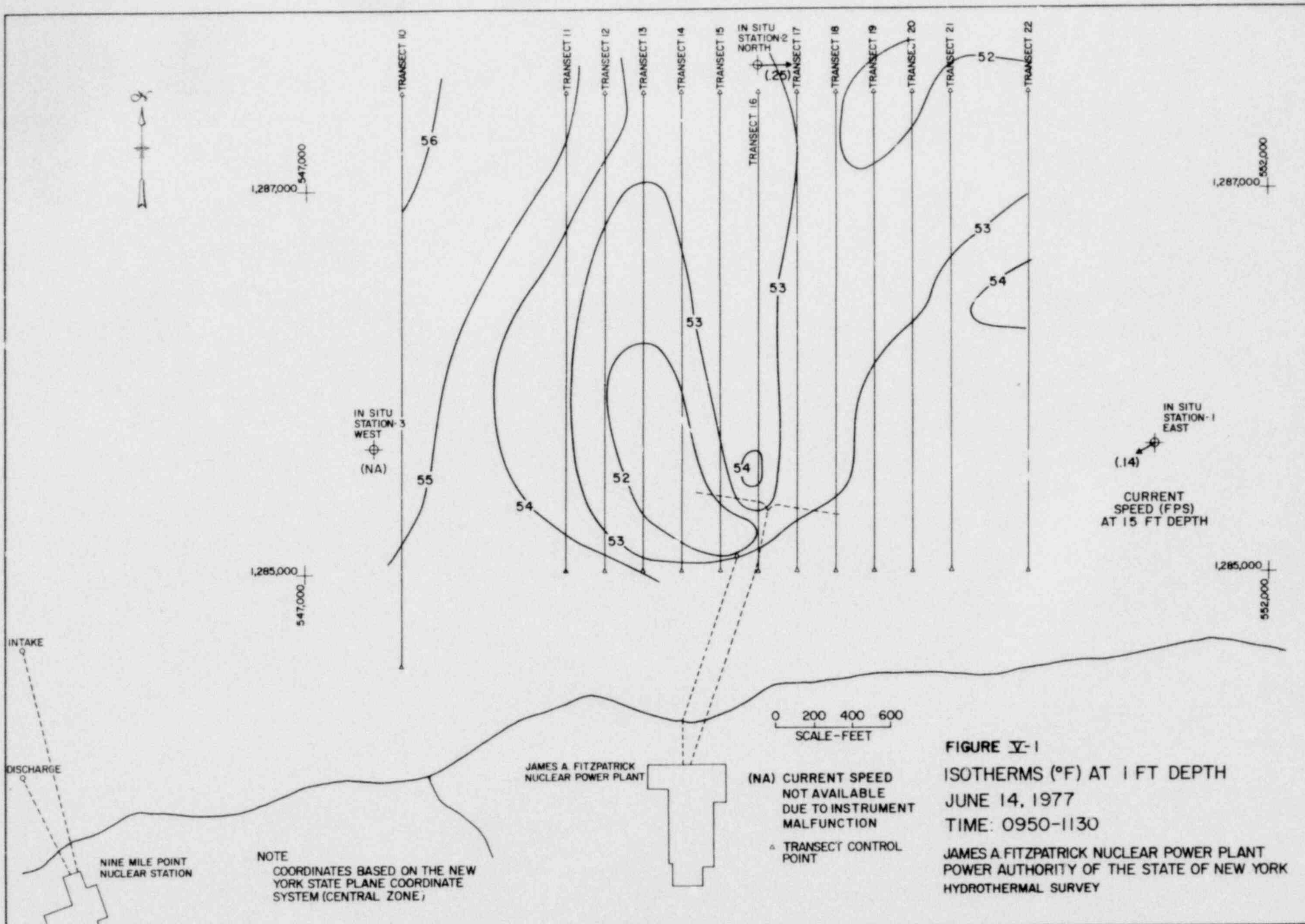
FIGURE V-1

ISOTHERMS (°F) AT 1 FT DEPTH

JUNE 14, 1977

TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

(NA) CURRENT SPEED NOT AVAILABLE DUE TO INSTRUMENT MALFUNCTION

△ TRANSECT CONTROL POINT

FIGURE V-1
ISOTHERMS (°F) AT 1 FT DEPTH
JUNE 14, 1977
TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

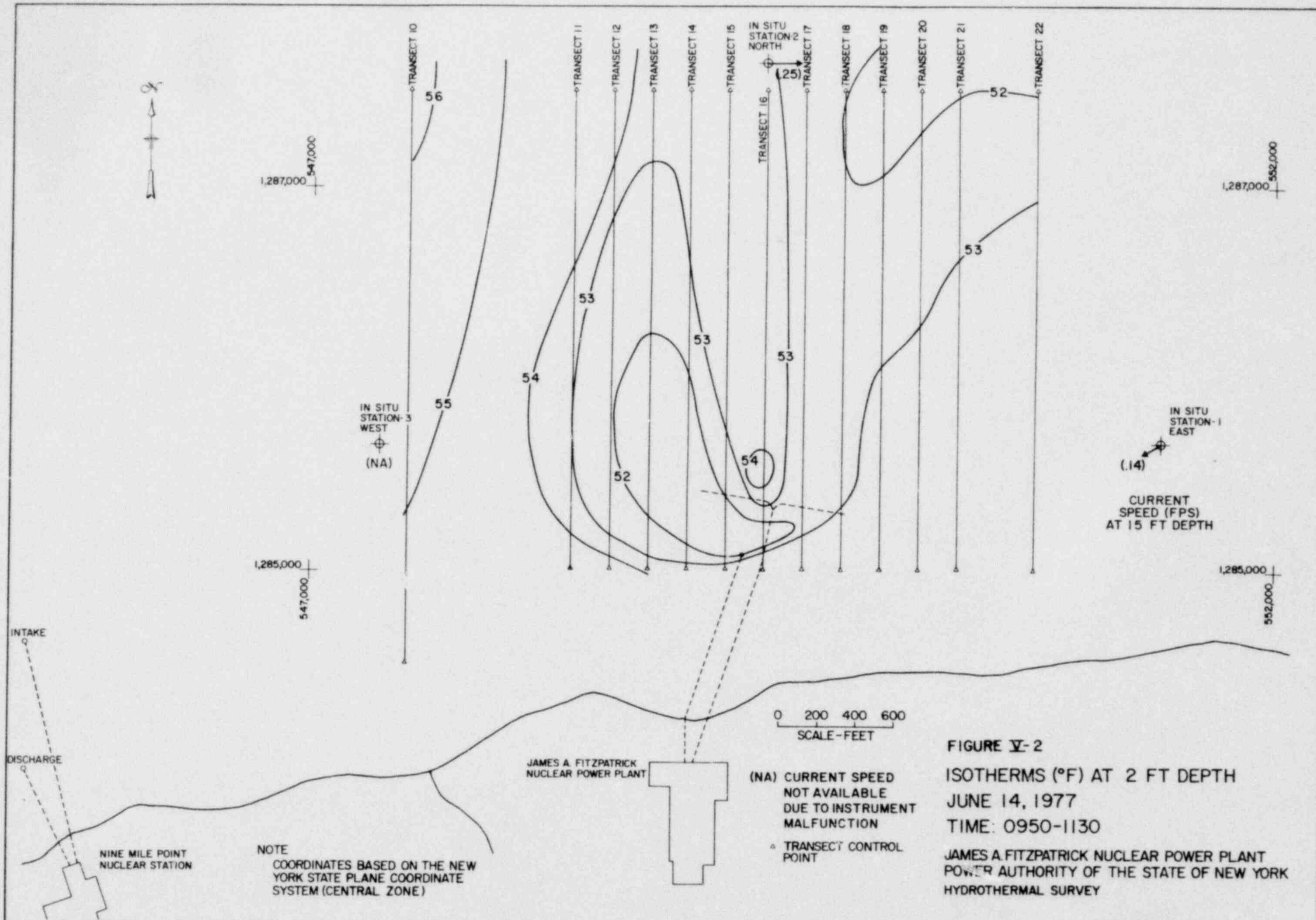


FIGURE V-2

ISOTHERMS (°F) AT 2 FT DEPTH

JUNE 14, 1977

TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

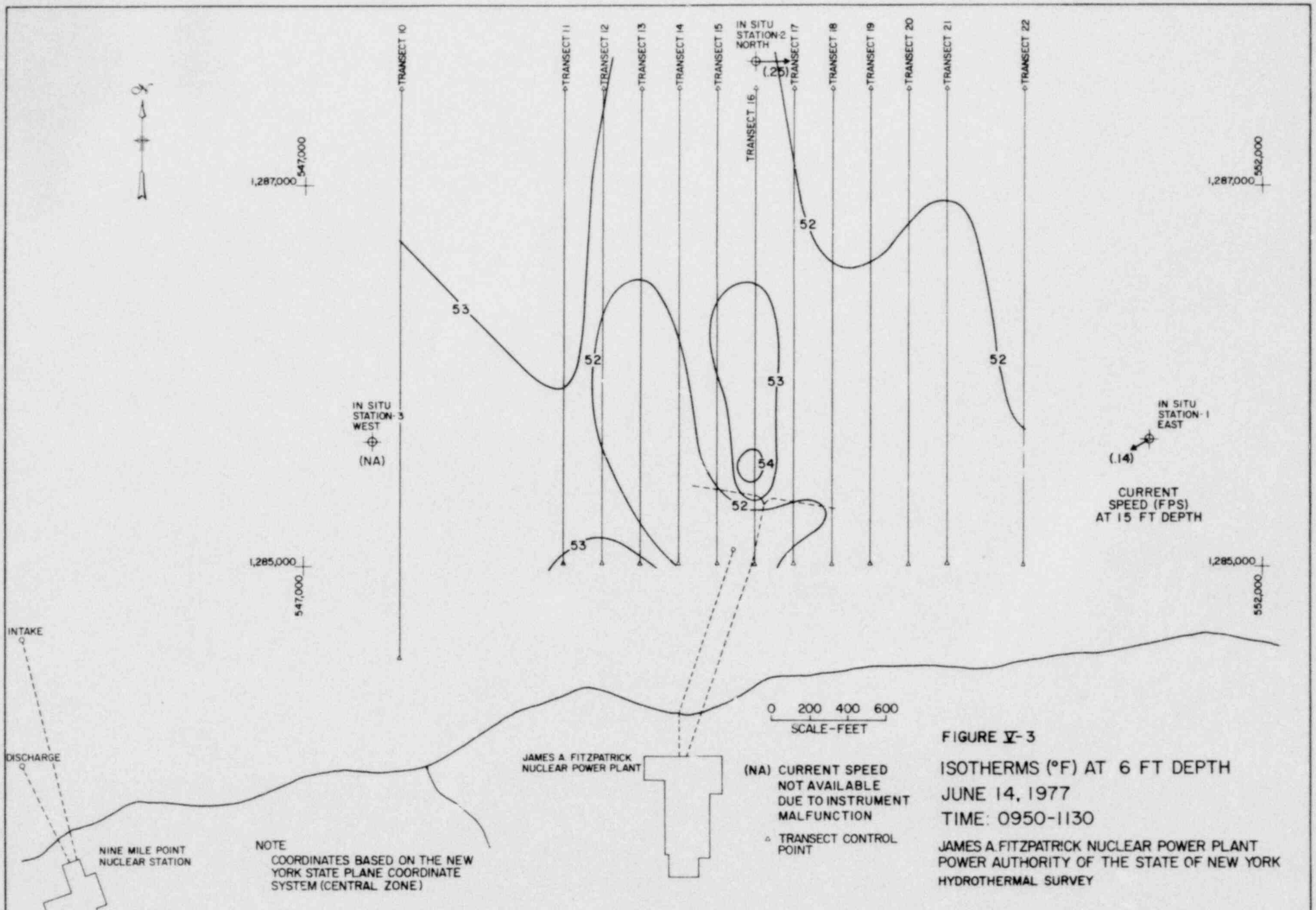


FIGURE V-3

ISOTHERMS (°F) AT 6 FT DEPTH

JUNE 14, 1977

TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

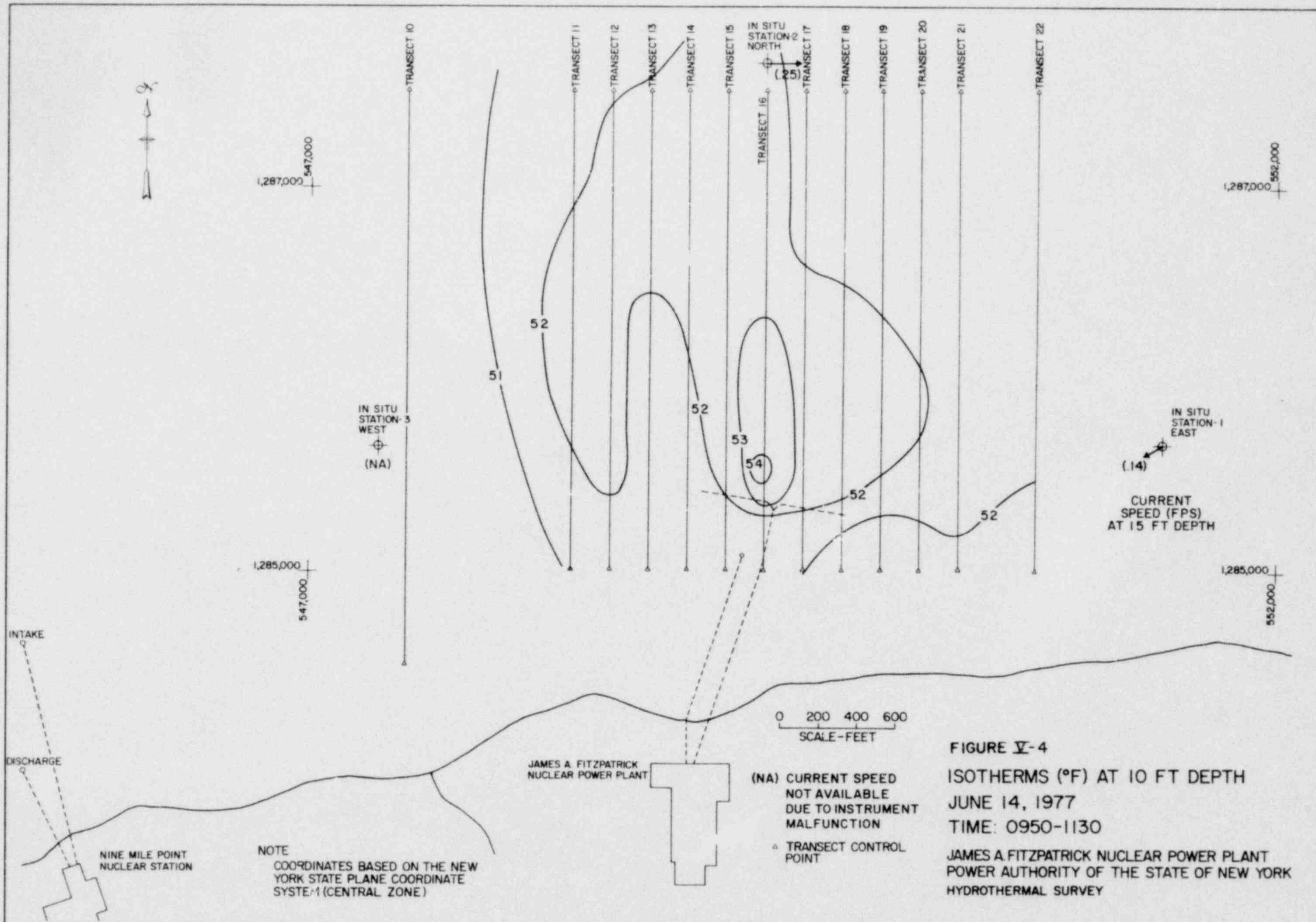


FIGURE V-4

ISOTHERMS (°F) AT 10 FT DEPTH

JUNE 14, 1977

TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

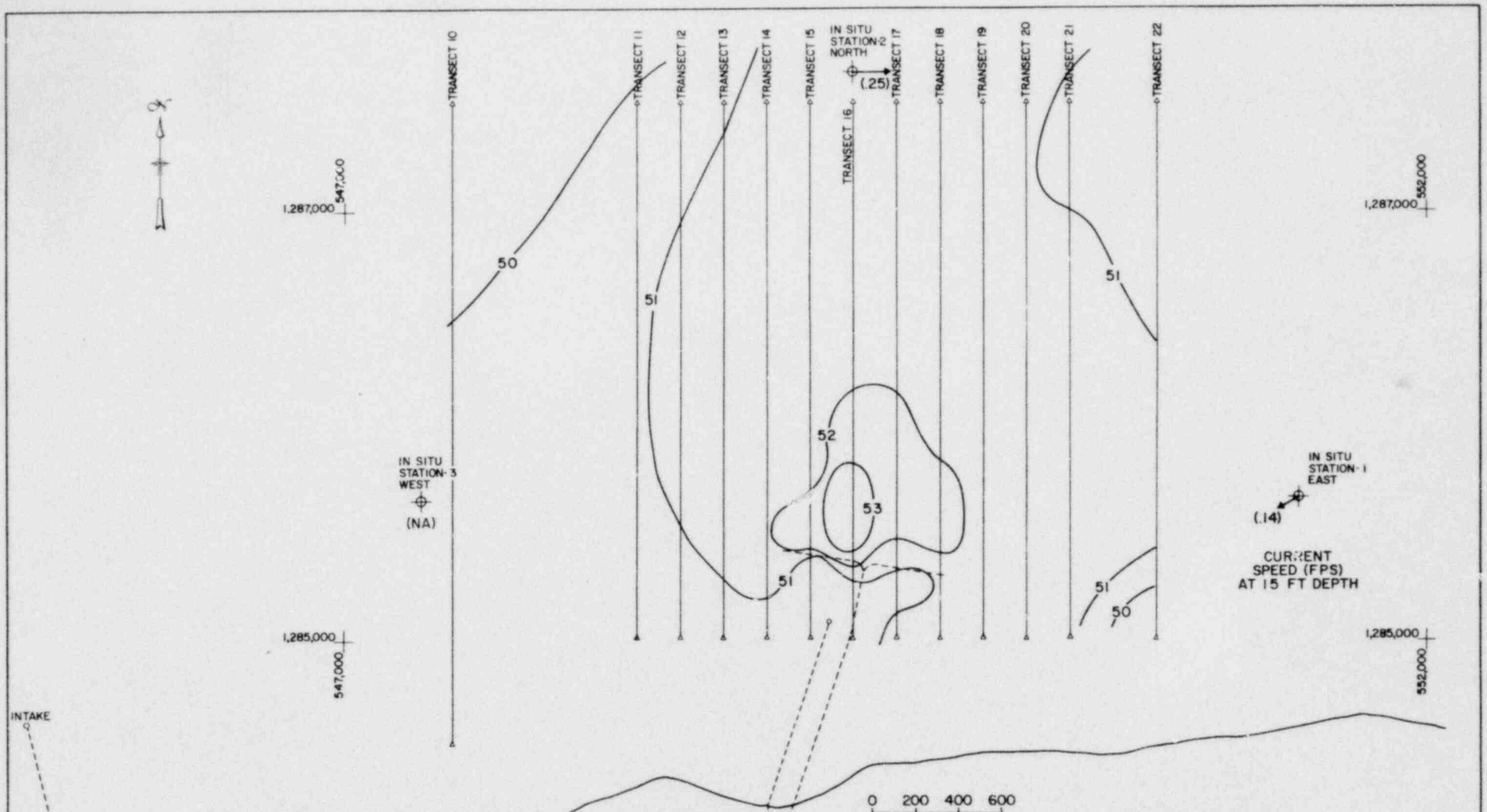


FIGURE V-5

ISOTHERMS (°F) AT 15 FT DEPTH
JUNE 14, 1977
TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

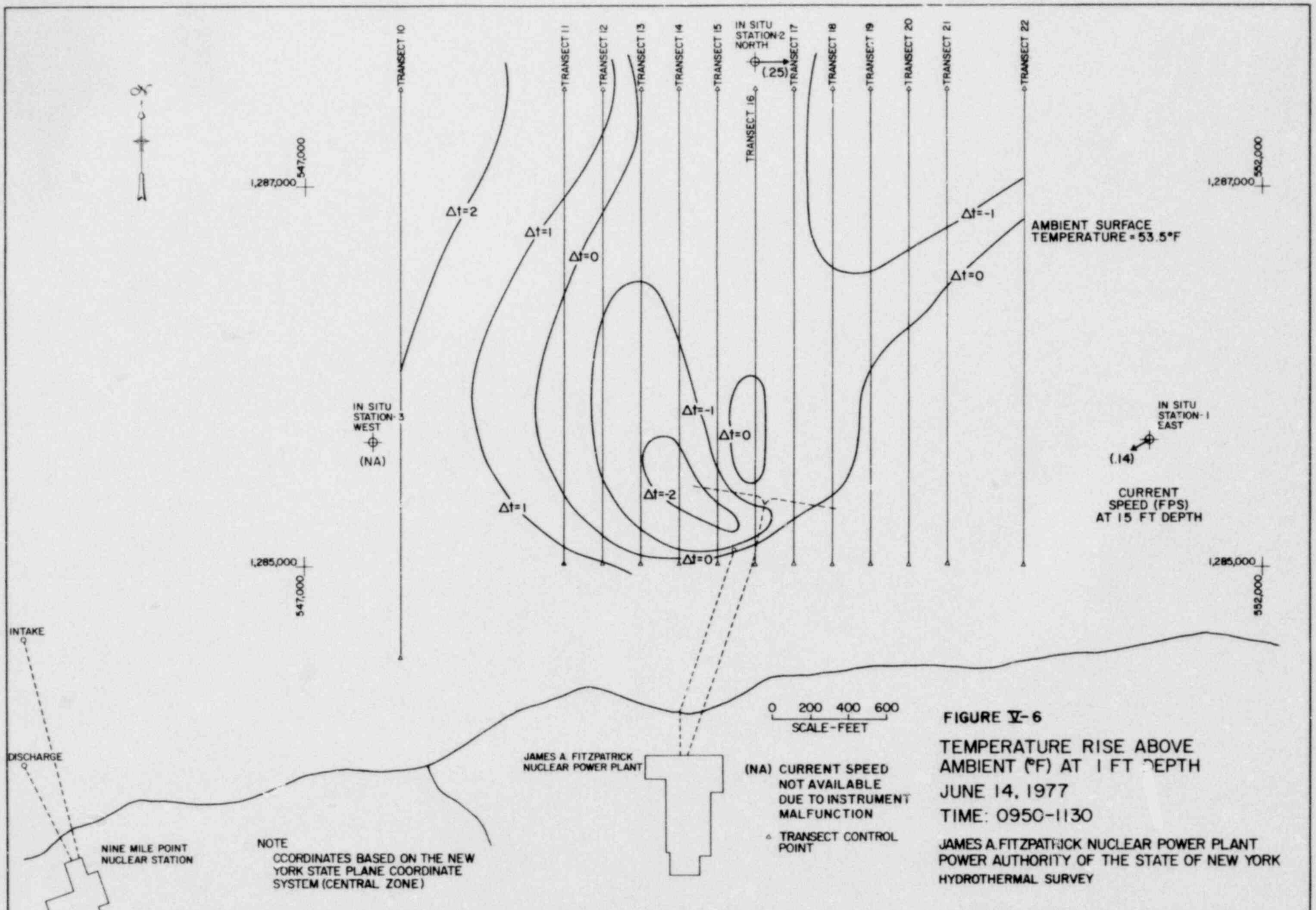


FIGURE V-6

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH

JUNE 14, 1977

TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

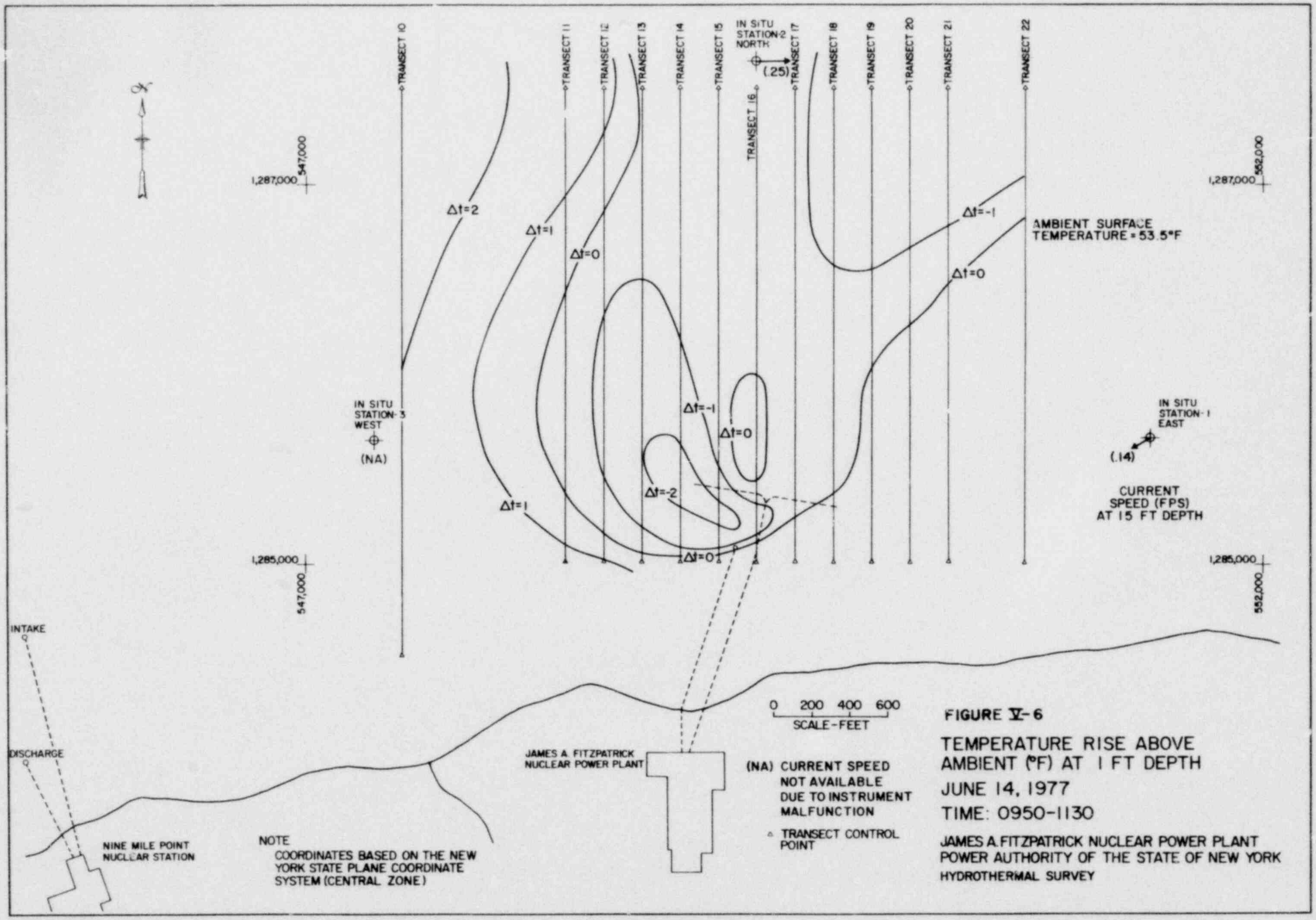


FIGURE V-6

TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH

JUNE 14, 1977

TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

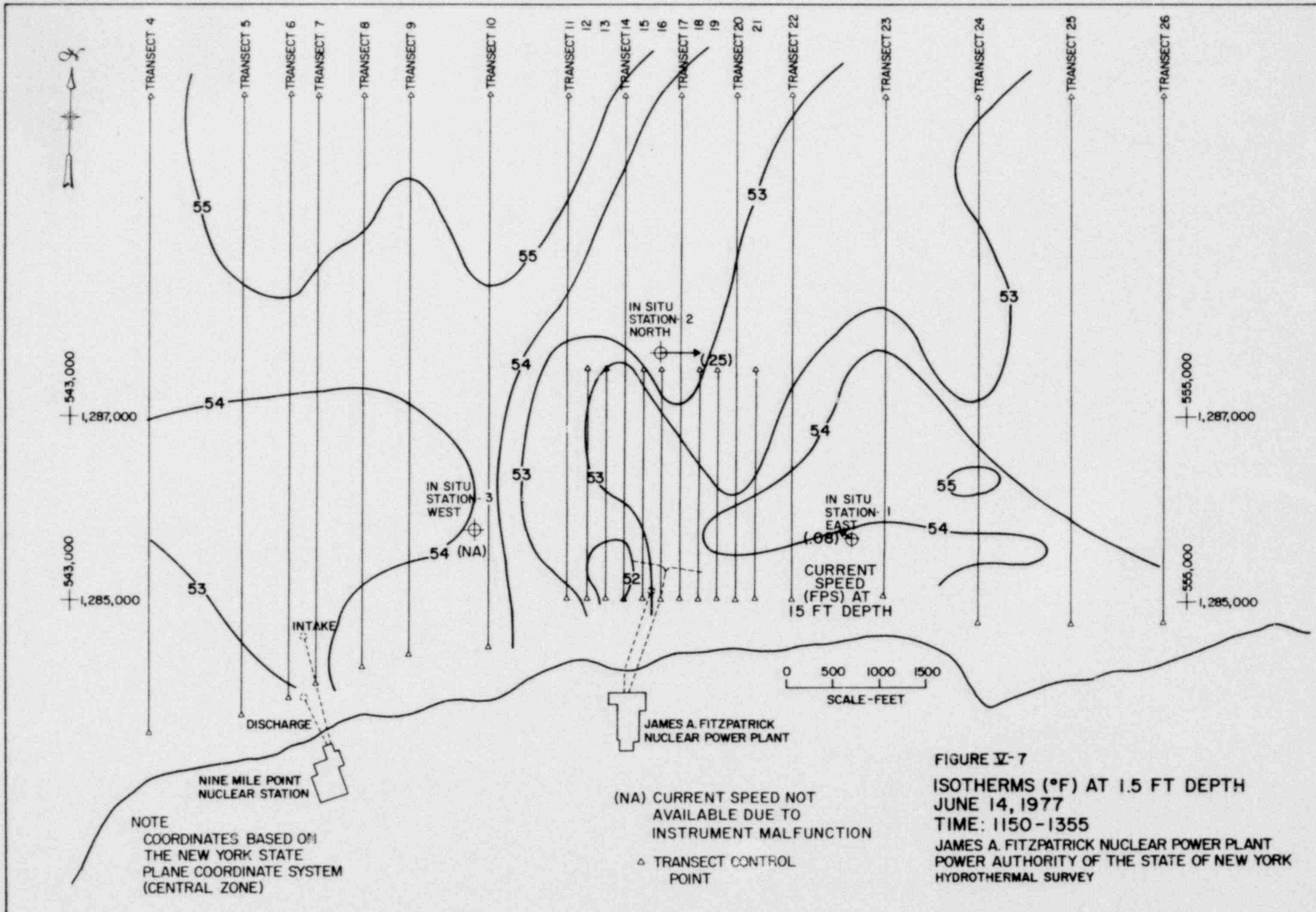
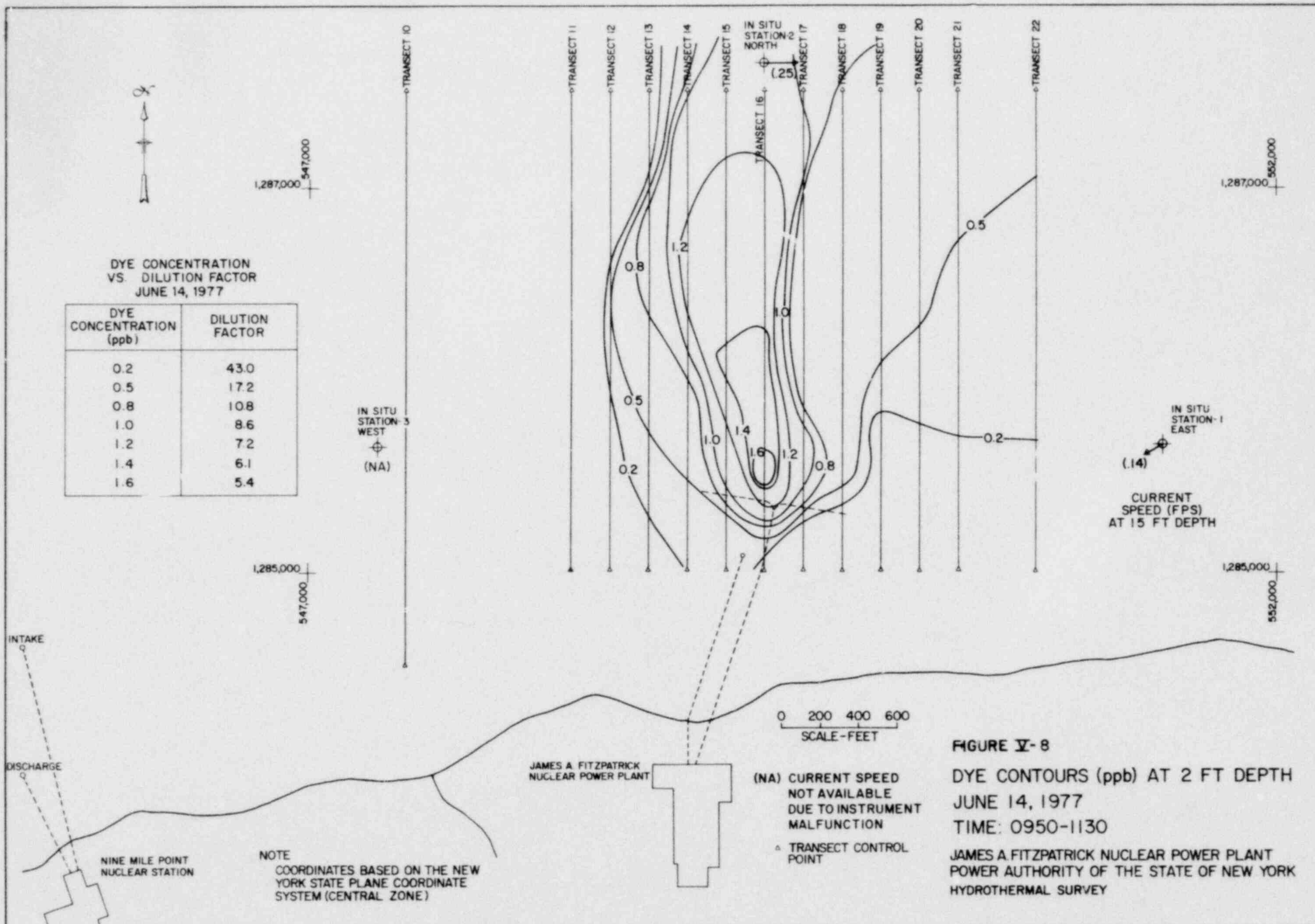


FIGURE V-7

ISOTHERMS (°F) AT 1.5 FT DEPTH
JUNE 14, 1977
TIME: 1150-1355
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



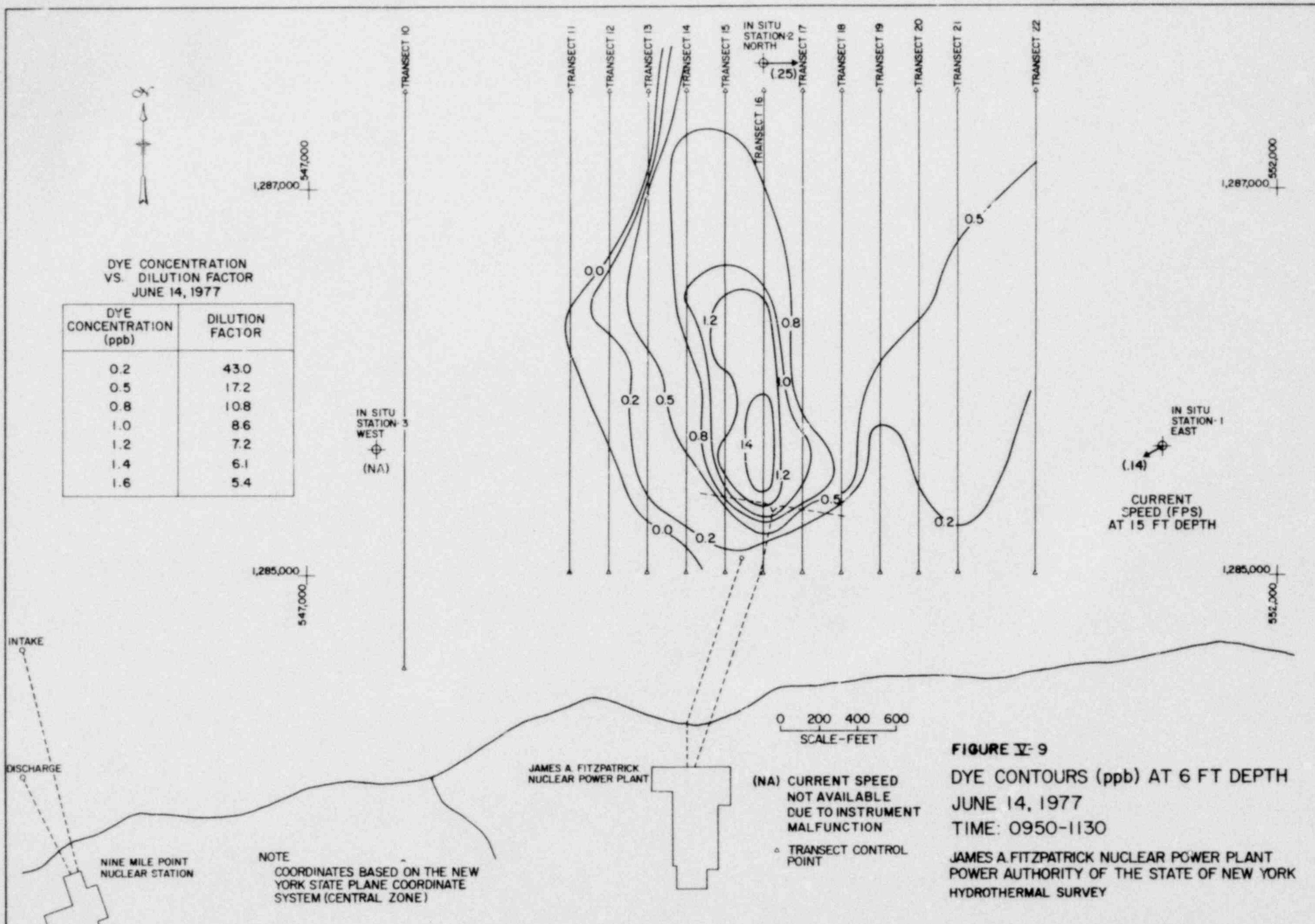
DYE CONCENTRATION VS. DILUTION FACTOR
JUNE 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	43.0
0.5	17.2
0.8	10.8
1.0	8.6
1.2	7.2
1.4	6.1
1.6	5.4

FIGURE V-8

DYE CONTOURS (ppb) AT 2 FT DEPTH
JUNE 14, 1977
TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



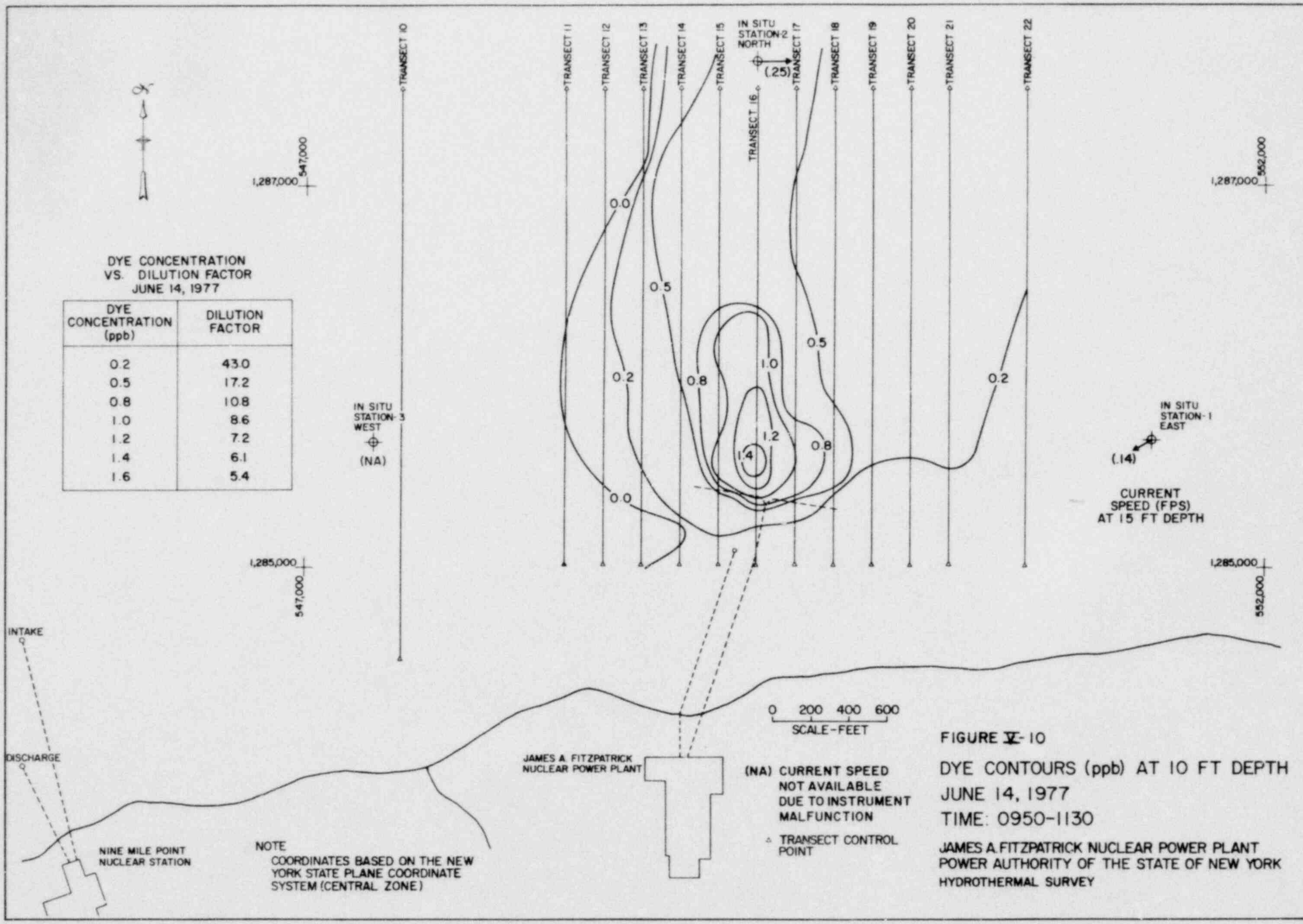
DYE CONCENTRATION VS. DILUTION FACTOR JUNE 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	43.0
0.5	17.2
0.8	10.8
1.0	8.6
1.2	7.2
1.4	6.1
1.6	5.4

FIGURE V-9

DYE CONTOURS (ppb) AT 6 FT DEPTH
JUNE 14, 1977
TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



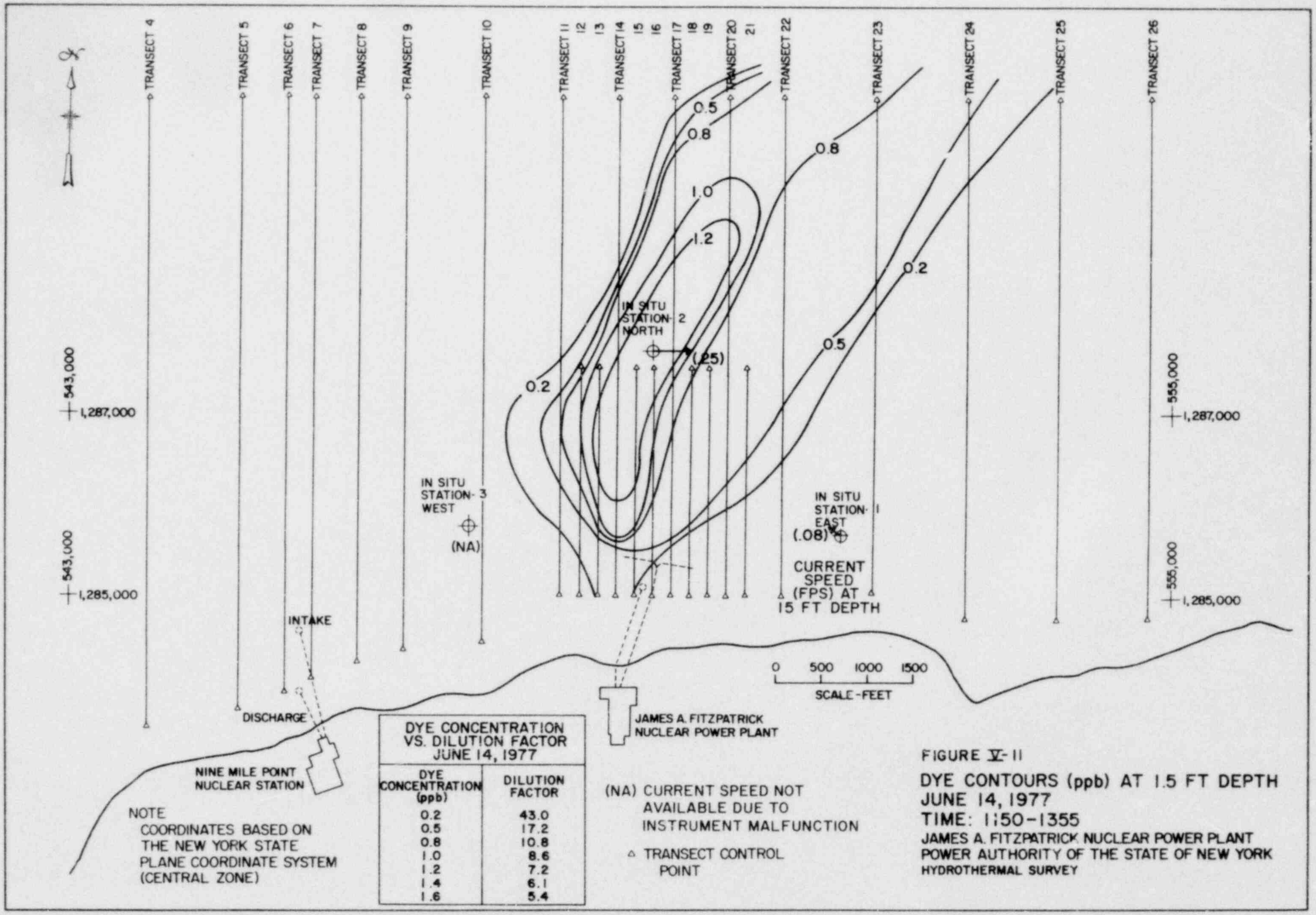
DYE CONCENTRATION VS. DILUTION FACTOR
JUNE 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	43.0
0.5	17.2
0.8	10.8
1.0	8.6
1.2	7.2
1.4	6.1
1.6	5.4

FIGURE V-10

DYE CONTOURS (ppb) AT 10 FT DEPTH
JUNE 14, 1977
TIME: 0950-1130

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR JUNE 14, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	43.0
0.5	17.2
0.8	10.8
1.0	8.6
1.2	7.2
1.4	6.1
1.6	5.4

FIGURE V-11

DYE CONTOURS (ppb) AT 1.5 FT DEPTH
JUNE 14, 1977
TIME: 1150-1355
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

NOVEMBER 1977 POSTOPERATIONAL HYDROTHERMAL SURVEY FOR JAMES A. FITZPATRICK NUCLEAR POWER PLANT POWER AUTHORITY OF THE STATE OF NEW YORK

VI-NOVEMBER 1977 SURVEY

TABLE OF CONTENTS

VI-NOVEMBER 1977

LIST OF TABLES

LIST OF FIGURES

VI-NOVEMBER 1977 SURVEY

VI.1 SUMMARY

The sixth postoperational hydrothermal survey of the JAFNPP was conducted on November 2, 1977. The NMP-1 station was in operation during the November 1977 survey.

The primary objectives of this survey were:

1. To determine the three-dimensional thermal patterns in the discharge area produced by the joint operation of NMP Unit 1 and the JAFNPP, and

2. To determine the diffuser performance based on dye concentrations existing in the lake after releasing dye into the plant circulating water system.

These objectives were set forth so as to fulfill the requirements of the National Pollutant Discharge Elimination System Permit (Permit No. NY0020109), administered by the U.S. Environmental Protection Agency; the JAFNPP Environmental Technical Specifications (Docket No. 50-333), administered by the U.S. Nuclear Regulatory Commission; and the New York State Department of Environmental Conservation's standards and requirements.

VI.2 METHOD OF DATA ACQUISITION

Aquatec, Incorporated, of South Burlington, Vermont was contracted to perform the temperature, dye, and in situ current speed and direction surveys of the JAFNPP discharge area. A report submitted by Aquatec, entitled "James A. FitzPatrick Nuclear Power Plant, Sixth Operational Hydrothermal Survey, November 2, 1977," supplements this document and describes all aspects of data acquisition and reduction.

Niagara Mohawk Power Corporation, operator of NMP Unit 1, and the Power Authority of the State of New York, owner of JAFNPP, maintain a meteorological tower at the site which records wind speed and direction at elevations of 30 and 200 feet. Meteorological data for the survey date are discussed in Section VI.3.1.

Lake conditions in the study area during the survey are discussed in Section VI.3.2.

Operating conditions are continuously monitored at the plant. Section VI.3.3 discusses the plant operating conditions at the time of the survey.

VI.3 CONDITIONS DURING THE SURVEY

VI.3.1 Meteorological Conditions

Daylight during the November 2, 1977 survey occurred between approximately 0646 and 1702 hours EST.

The wind speed and direction on November 2, 1977 are given in Table VI-1. During the intensive sampling period between 0853 and 1309 on November 2, 1977, the 200-foot level wind at the NMP-1 site meteorological tower was from the south southeast at an average speed of about 14 mph.

Due to the location of the meteorological tower relative to a forest to the south, wind speed and direction at the 30-foot elevation were not suitable for the purposes of this study.

VI.3.2 Lake Conditions

Two in situ current meter stations were located along the east and west boundary of the nearfield study area as shown in the figures. Station 1 continuously recorded lake current speed and direction and station 3 continuously recorded lake current direction at depths of 15 feet during the survey period.

Average current speeds at station 1 were less than 0.30 fps throughout most of the survey. Currents were in a westerly direction station 1 and station 3.

The in situ data are further discussed in Section VI.4.2 of this report and in Section 3 of the Aquatec report.

The lake level during the November 2, 1977 survey was 244.62 feet USLS (United States Lake Survey 1955 Datum) based on provisional daily mean water levels at Oswego as reported by the Lake Survey Center (NOAA), Detroit, Michigan.

VI.3.3 Plant Operating Conditions

The JAFNPP load, intake and discharge temperatures, and average plant temperature rise for the November 1977 survey are listed in Table VI-2. The plant load is determined from hourly computer output at the plant. The plant load for the survey hours on November 2, 1977 remained relatively constant at approximately 822 MWe gross.

The NMP Unit 1 station load was 601 MWe during the November 1977 survey period.

The plant intake and discharge temperatures are based on readings taken in the intake and discharge shaft of the circulating water system during the survey. The methods used for collecting this data are similar to the previous five surveys and are described in Section 2.3 of the Aquatec report.

VI.4 SURVEY RESULTS

VI.4.1 Temperature and Dye Studies

Temperature and dye concentration patterns, illustrating thermal effect and diffuser performance, respectively, for joint operation of both the NMP Unit 1 and the JAFNPP discharge, are presented for nearfield and farfield areas. Dye contour illustrations include tables to convert dye concentrations to dilution factors.

The nearfield study area consists of transects 10 through 22 as shown in Figures VI-1 through VI-6 and VI-8 through VI-10. Temperature data were taken at depths of 1, 2, 6, 10, and 15 feet and dye concentration data at depths of 2, 6, and 10 feet. Transects 11 through 22 are 2,500 feet long; transect 10 is 3,000 feet long.

The farfield study area consists of transects 4 through 26 as shown in Figures VI-7 and VI-11. Temperature and dye data were taken at a depth of 1.5 feet. The study area extends 5,000 feet either side of the diffuser and 5,000 feet offshore.

Temperature and dye readings measured in the field represent actual recorded temperature and dye concentrations plotted at the location of measurement.

The average dye concentration in the discharge shaft of the circulating water system was calculated to be 7.9 parts per billion (ppb) during the November 1977 survey period. This number was calculated by diluting the Rhodamine WT dye, released at a rate of 1.49 lb per hr, with the total circulating water flow rate of 835 cfs. The circulating water flow rate is based on information in an Aquatec, Inc. report entitled "Pumphouse Dye Study" completed in October 1975, using a dye dilution technique to determine the flow rate within an accuracy of 2.59 percent.

Table VI-3 summarizes lake conditions and figure numbers applicable to the November survey.

VI.4.1.1 November 2, 1977 Temperature Patterns

Between 0853 and 1309 on November 2, 1977, one nearfield and one farfield run were completed along the appropriate transects.

VI.4.1.1.1 Sampling Period from 0853 to 1030 (nearfield)

Isotherms in increments of 1°F are shown for 1-, 2-, 6-, 10-, and 15-foot depths in Figures VI-1, VI-2, VI-3, VI-4, and VI-5, respectively. The nearfield sampling period on November 2, 1977 was from 0853 to 1030.

Figure VI-6 represents the temperature rise above ambient at a 1-foot depth. The ambient temperature of 51.8°F was calculated by averaging temperatures in the study area where dye was not apparent.

VI.4.1.1.2 Sampling Period from 1057 to 1309 (farfield)

Isotherms in increments of 1°F are shown at the 1.5-foot depth in Figure VI-7 during the farfield sampling period from 1057 to 1309.

VI.4.1.2 November 2, 1977 Dye Concentration Patterns

Between 0853 and 1309 on November 2, 1977, one nearfield and one farfield run were completed along the appropriate transects.

VI.4.1.2.1 Sampling Period from 0853 to 1030 (nearfield)

Dye contours in ppb are shown for 2-, 6-, and 10-foot depths in Figures VI-8, VI-9, and VI-10, respectively. The nearfield sampling period on November 2, 1977 was from 0853 to 1030.

The maximum dye concentration and corresponding dilution factor at the 2-foot depth was observed to be 1.35 ppb and 5.9 respectively.

VI.4.1.2.2 Sampling Period from 1057 to 1309 (farfield)

Dye contours in ppb are shown at the 1.5-foot depth in Figure VI-11 during the farfield sampling period from 1057 to 1309.

The maximum dye concentration and corresponding dilution factor at the 1.5-foot depth was observed to be 0.87 ppb and 9.1 respectively.

VI.4.2 In Situ Data

In situ data collection consisted of current speed and direction collected at current meter station 1 and current direction at current meter station 3, as shown in each of the figures and in Appendix III of the Aquatec report. Lake current speed and direction during the November 2, 1977 survey are shown in Table VI-3. The average current speed and direction during each survey period at 15-foot depths is presented in each figure by a vector diagram at current meter station 1. To avoid delays, a current meter was not installed at station 2 because the mooring could not be located. Due to instrument malfunction, current speeds at current meter station 3 were not recorded.

TABLE VI-1

WIND SPEED AND DIRECTION FOR NOVEMBER 2, 1977

	Data taken at 200-ft elev.	
Time	Direction (Deg true)	Speed (mph)
0000-0100	150	19
0100-0200	155	17
0200-0300	140	8
0300-0400	125	12
0400-0500	125	10
0500-0600	135	14
0600-0700	130	15
0700-0800	120	13
0800-0900*	130	16
0900-1000*	145	14
1000-1100*	150	14
1100-1200*	155	13
1200-1300*	165	14
1300-1400*	160	12
1400-1500	175	12
1500-1600	185	13
1600-1700	195	11
1700-1800	175	9
1800-1900	135	13
1900-2000	140	12
2000-2100	150	16
2100-2200	150	21
2200-2300	145	16
2300-2400	145	13

*Survey Period

TABLE VI-2

PLANT LOAD, INTAKE TEMPERATURE, DISCHARGE TEMPERATURE, AND PLANT TEMPERATURE RISE ON NOVEMBER 2, 1977 FOR THE JAFNPP

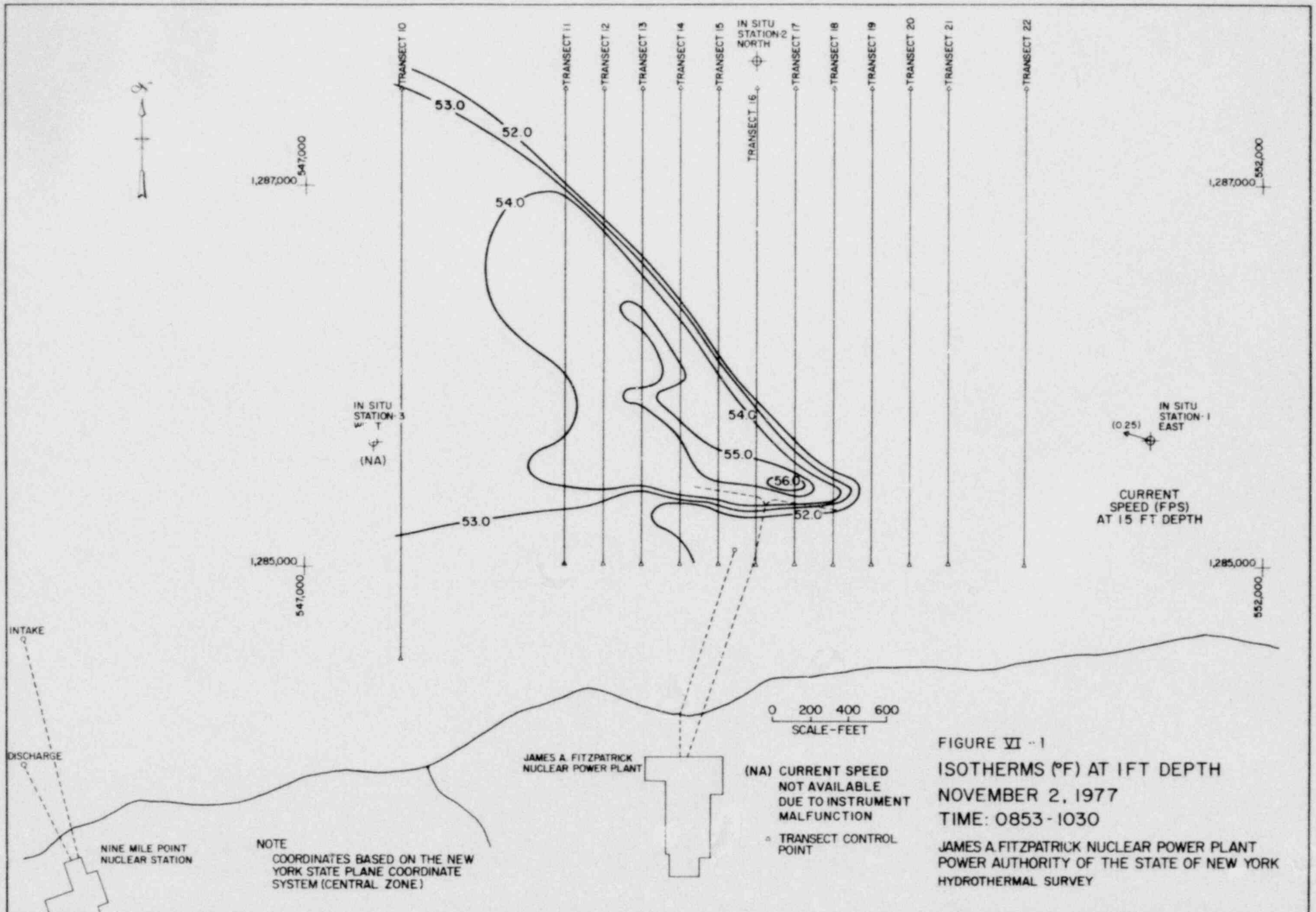
Time	Plant Load (MWe) at end of hour	Average Intake Temp. (°F)	Average Discharge Temp. (°F)	Average Circulating Water Temperature Rise (°F)
0000-0100	822	52.0	82.3	30.3
0100-0200	822	52.0	82.2	30.2
0200-0300	822	52.0	82.3	30.3
0300-0400	822	52.0	82.3	30.3
0400-0500	822	52.0	82.2	30.2
0500-0600	822	52.0	82.0	30.0
0600-0700	822	52.0	82.0	30.0
0700-0800	822	52.0	82.0	30.0
0800-0900*	822	51.9	82.0	30.1
0900-1000*	822	51.9	82.0	30.1
1000-1100*	822	51.9	82.2	30.3
1100-1200*	822	52.1	82.3	30.2
1200-1300*	822	52.1	82.4	30.3

*Survey Period

TABLE VI-3

SUMMARY OF FIGURE NUMBERS AND DATA FOR NOVEMBER 1977 SURVEY

Time	15-ft Current Direction			15-ft Current Speed (fps)			Ambient Surface Temperature (°F)	Depth (ft)	Isotherm Figure No.	Temperature Rise Figure No.	Dye Figure No.
	Station No.			Station No.							
	1	2	3	1	2	3					
0853-1030	WNW	NA	WSW	0.25	NA	NA	51.8	1.0	VI-1	VI-6	
								2.0	VI-2	-	VI-8
								6.0	VI-3	-	VI-9
								10.0	VI-4	-	VI-10
								15.0	VI-5	-	-
1057-1309	WNW	NA	WSW	0.29	NA	NA	51.9	1.5	VI-7	-	VI-11



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

(NA) CURRENT SPEED NOT AVAILABLE DUE TO INSTRUMENT MALFUNCTION

▵ TRANSECT CONTROL POINT

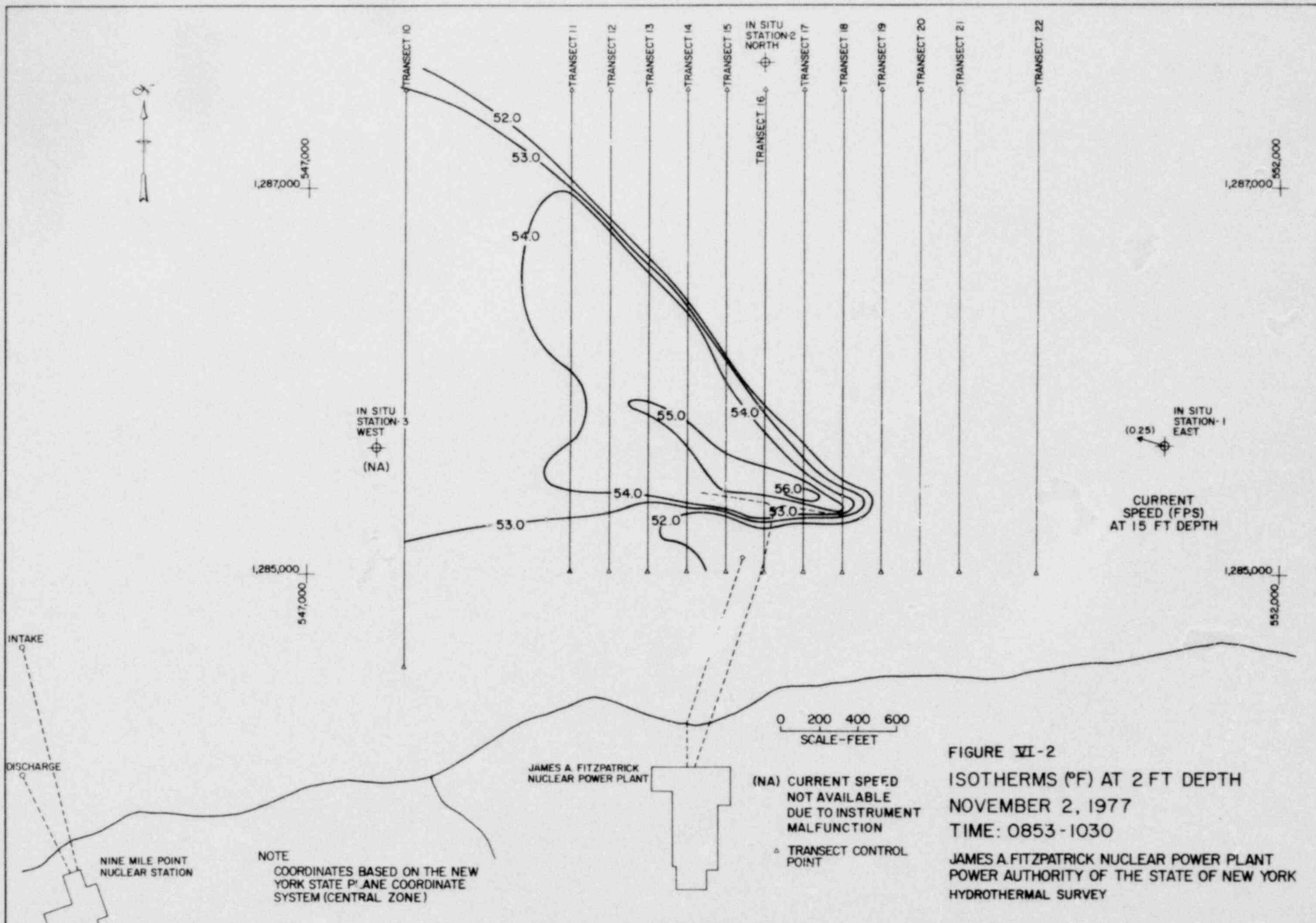
FIGURE VI - 1

ISOTHERMS (°F) AT 1 FT DEPTH

NOVEMBER 2, 1977

TIME: 0853 - 1030

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

(NA) CURRENT SPEED NOT AVAILABLE DUE TO INSTRUMENT MALFUNCTION

△ TRANSECT CONTROL POINT

FIGURE VI-2

ISOTHERMS (°F) AT 2 FT DEPTH

NOVEMBER 2, 1977

TIME: 0853-1030

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

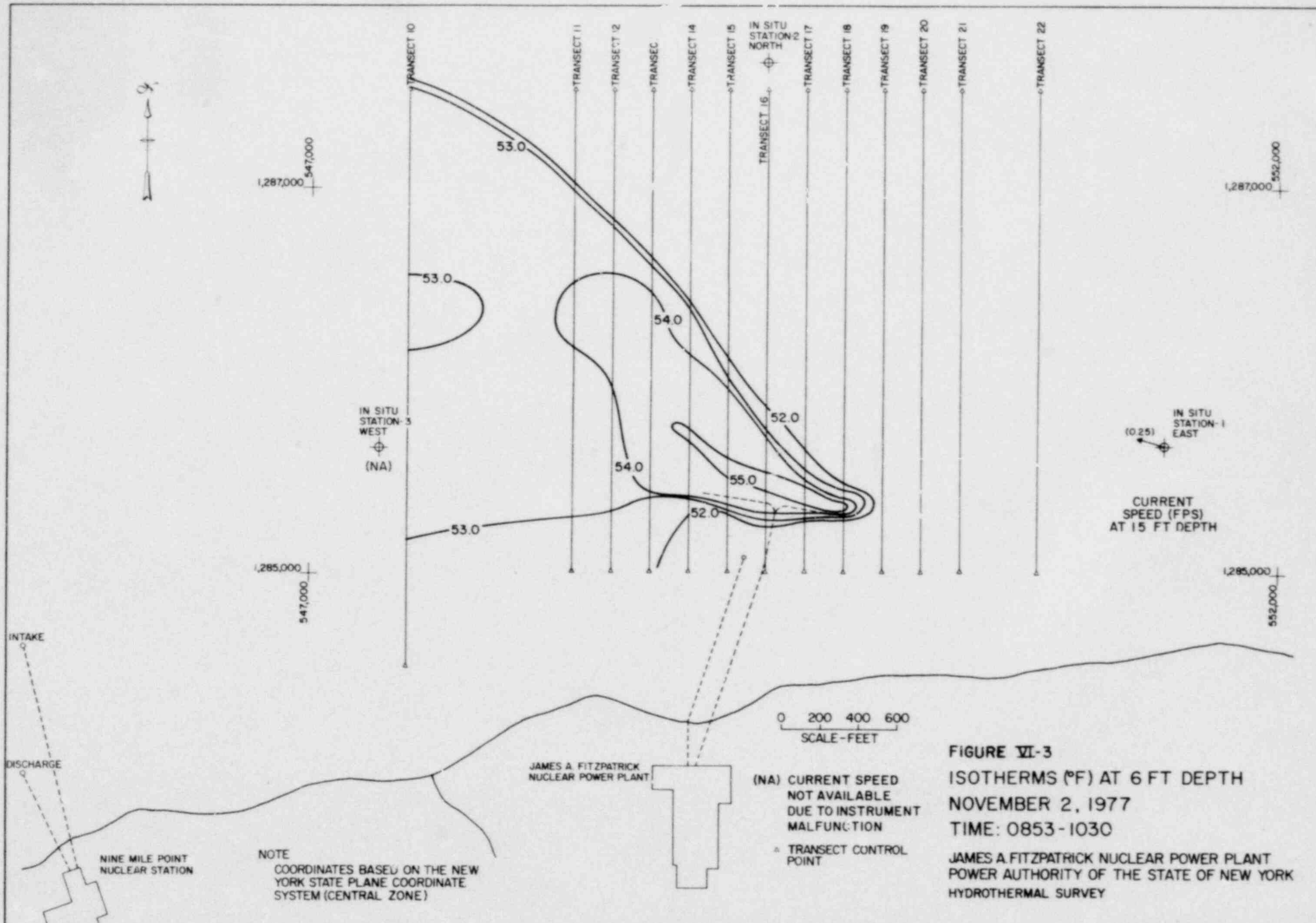


FIGURE VI-3

ISOTHERMS (°F) AT 6 FT DEPTH

NOVEMBER 2, 1977

TIME: 0853-1030

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

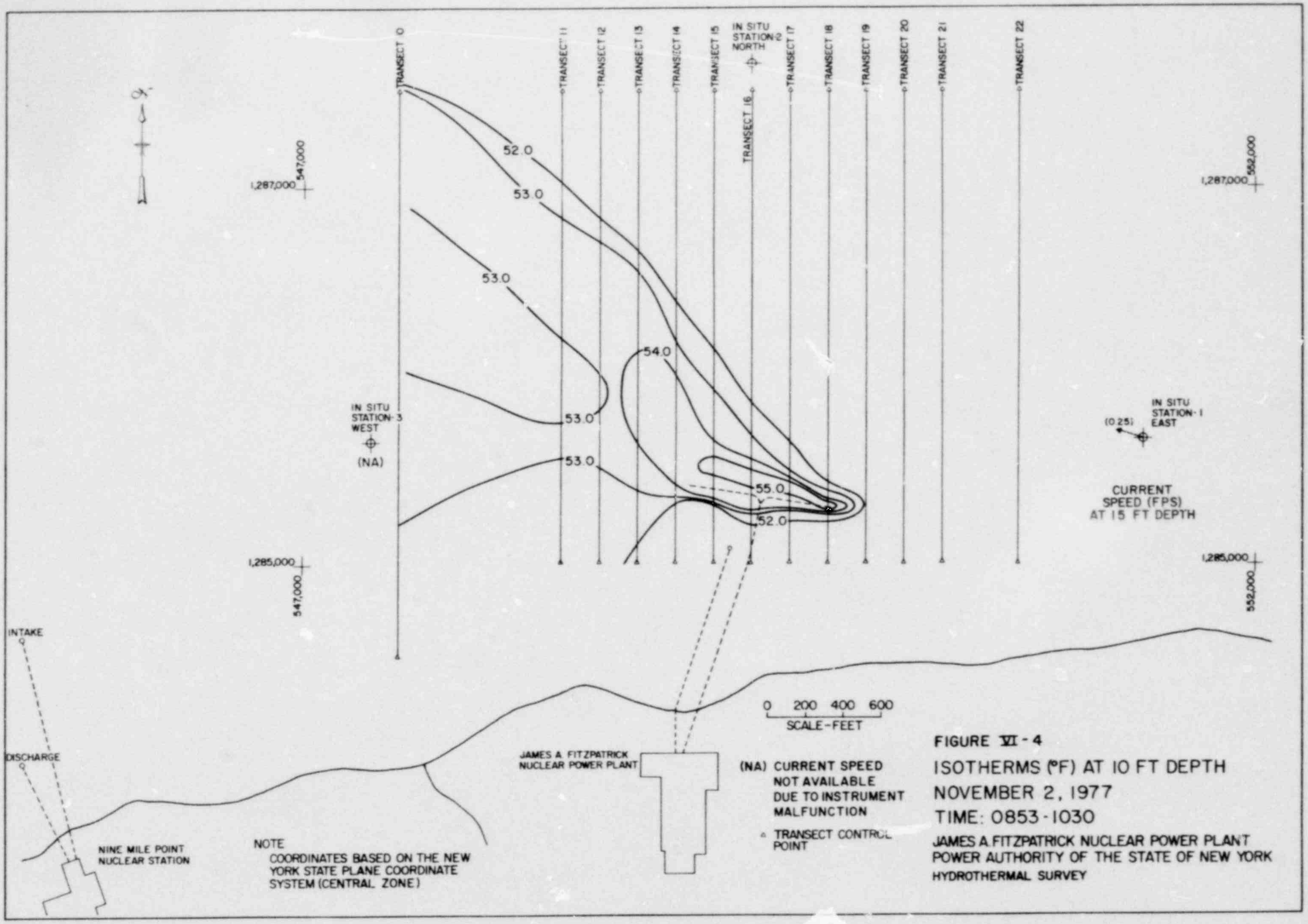


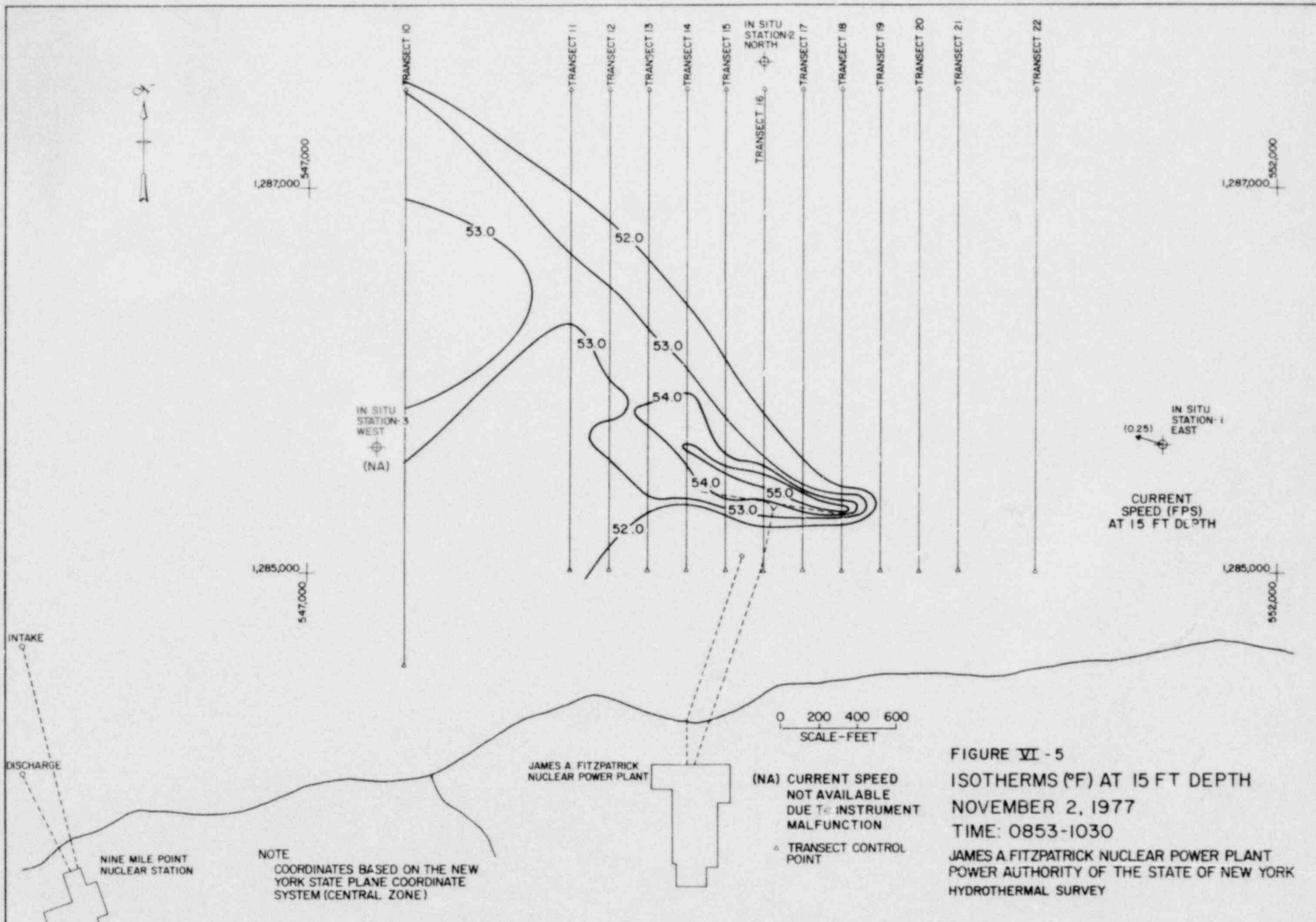
FIGURE VI - 4

ISOTHERMS (°F) AT 10 FT DEPTH

NOVEMBER 2, 1977

TIME: 0853 - 1030

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

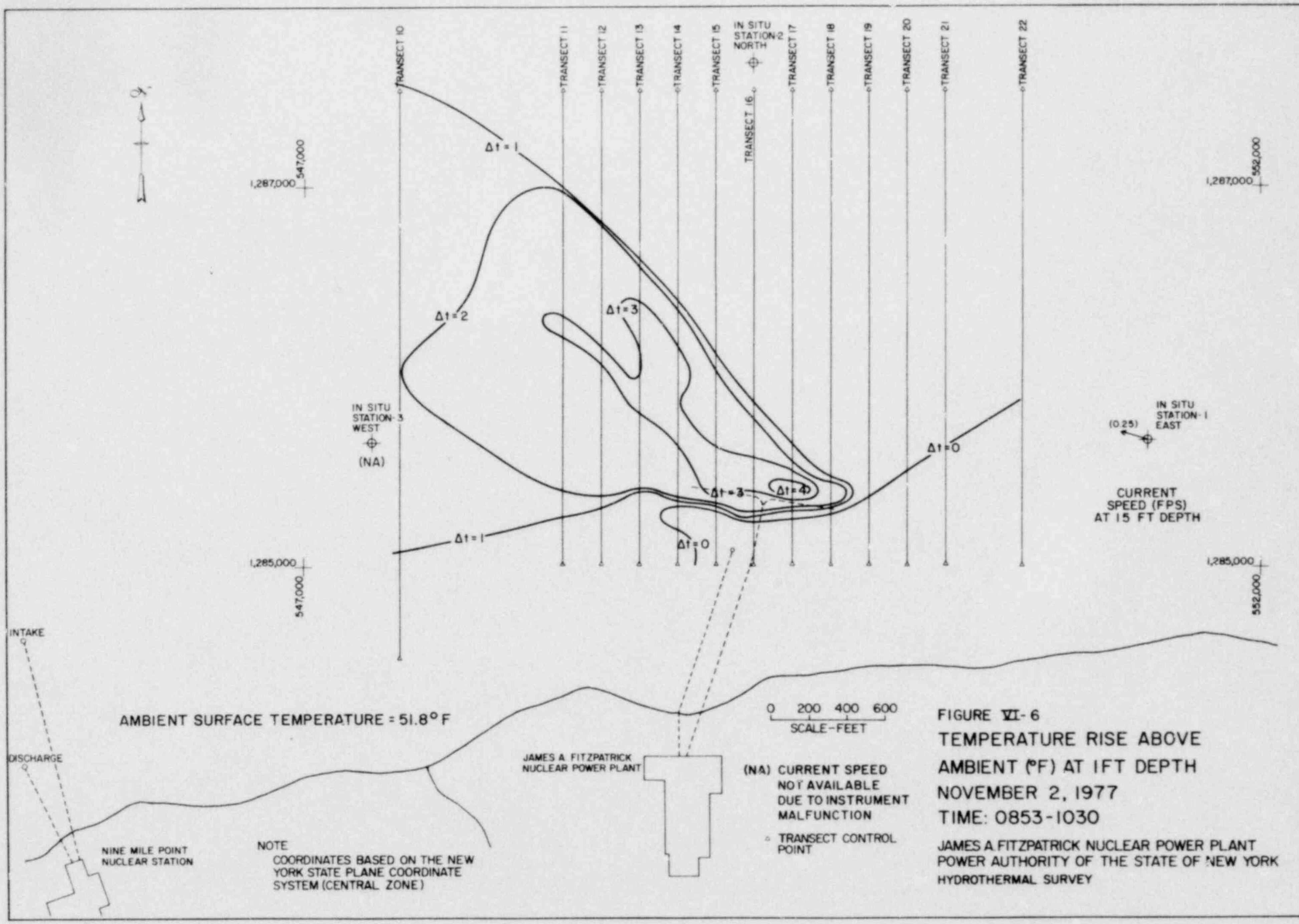


NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

(NA) CURRENT SPEED NOT AVAILABLE DUE TO INSTRUMENT MALFUNCTION

△ TRANSECT CONTROL POINT

FIGURE VI - 5
ISOTHERMS (°F) AT 15 FT DEPTH
NOVEMBER 2, 1977
TIME: 0853-1030
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



AMBIENT SURFACE TEMPERATURE = 51.8° F

(NA) CURRENT SPEED NOT AVAILABLE DUE TO INSTRUMENT MALFUNCTION

△ TRANSECT CONTROL POINT

NOTE
COORDINATES BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (CENTRAL ZONE)

FIGURE VI-6
TEMPERATURE RISE ABOVE AMBIENT (°F) AT 1 FT DEPTH
NOVEMBER 2, 1977
TIME: 0853-1030

JAMES A FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

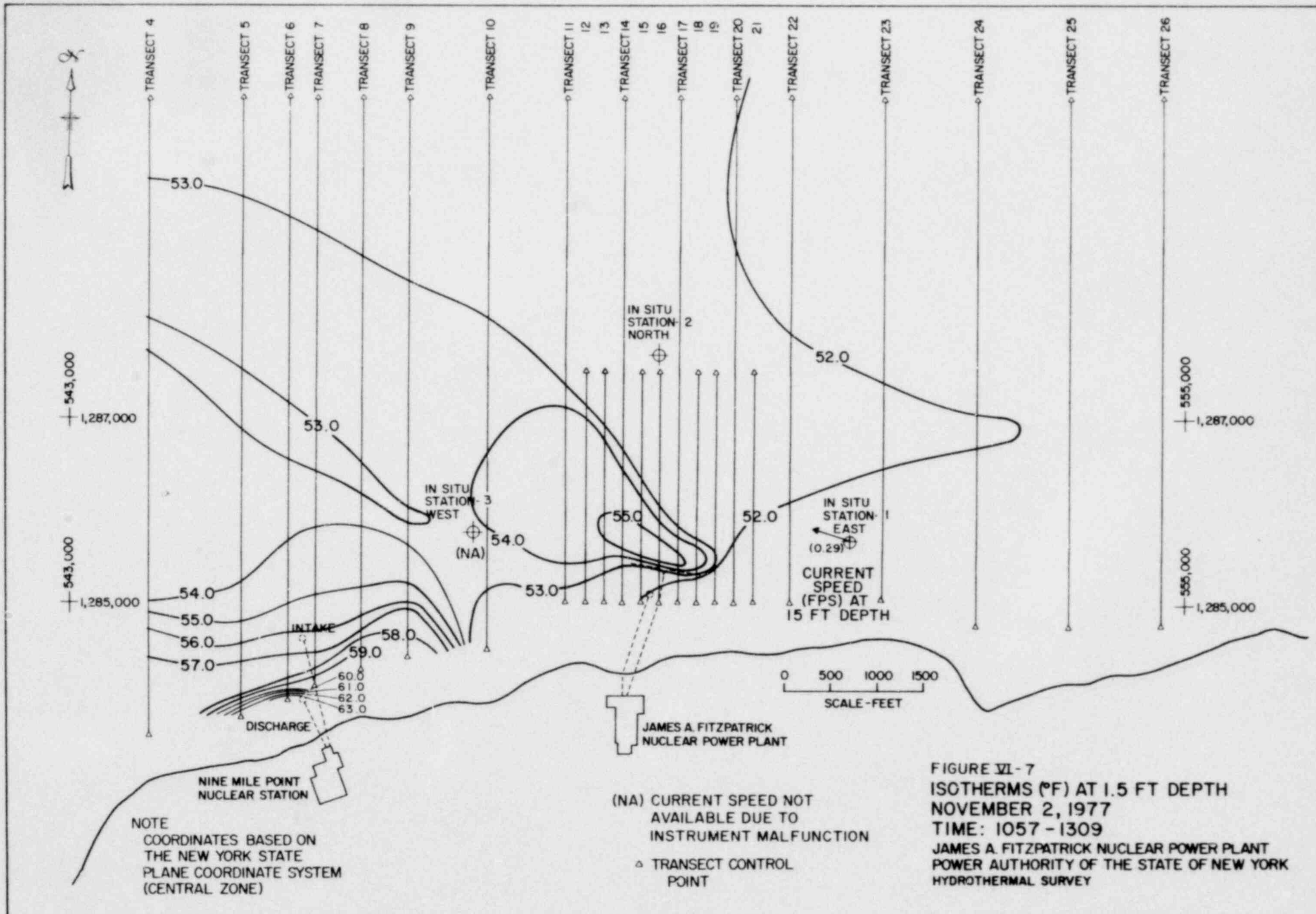
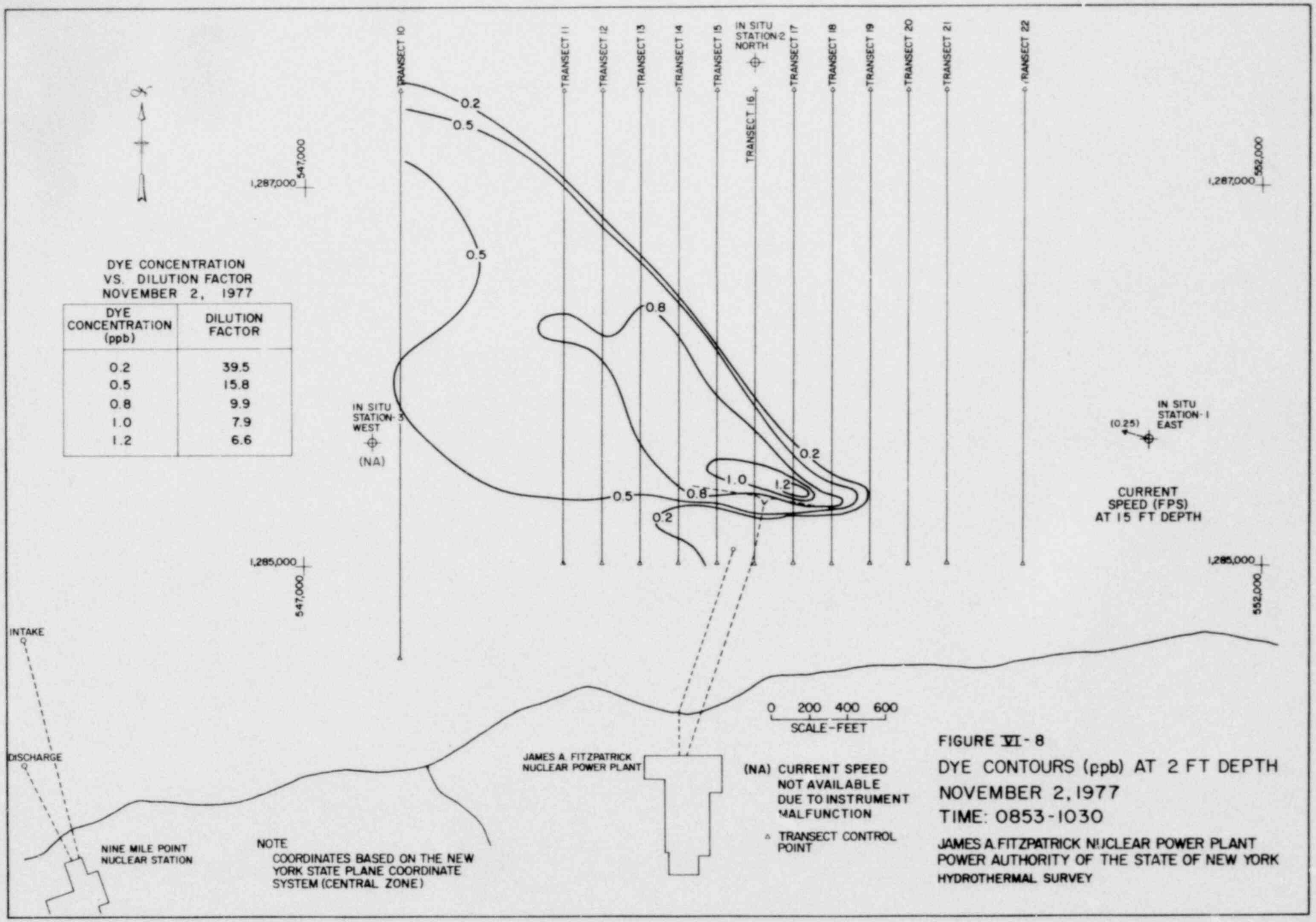


FIGURE VI-7
ISOTHERMS (°F) AT 1.5 FT DEPTH
NOVEMBER 2, 1977
TIME: 1057-1309
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR NOVEMBER 2, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.5
0.5	15.8
0.8	9.9
1.0	7.9
1.2	6.6

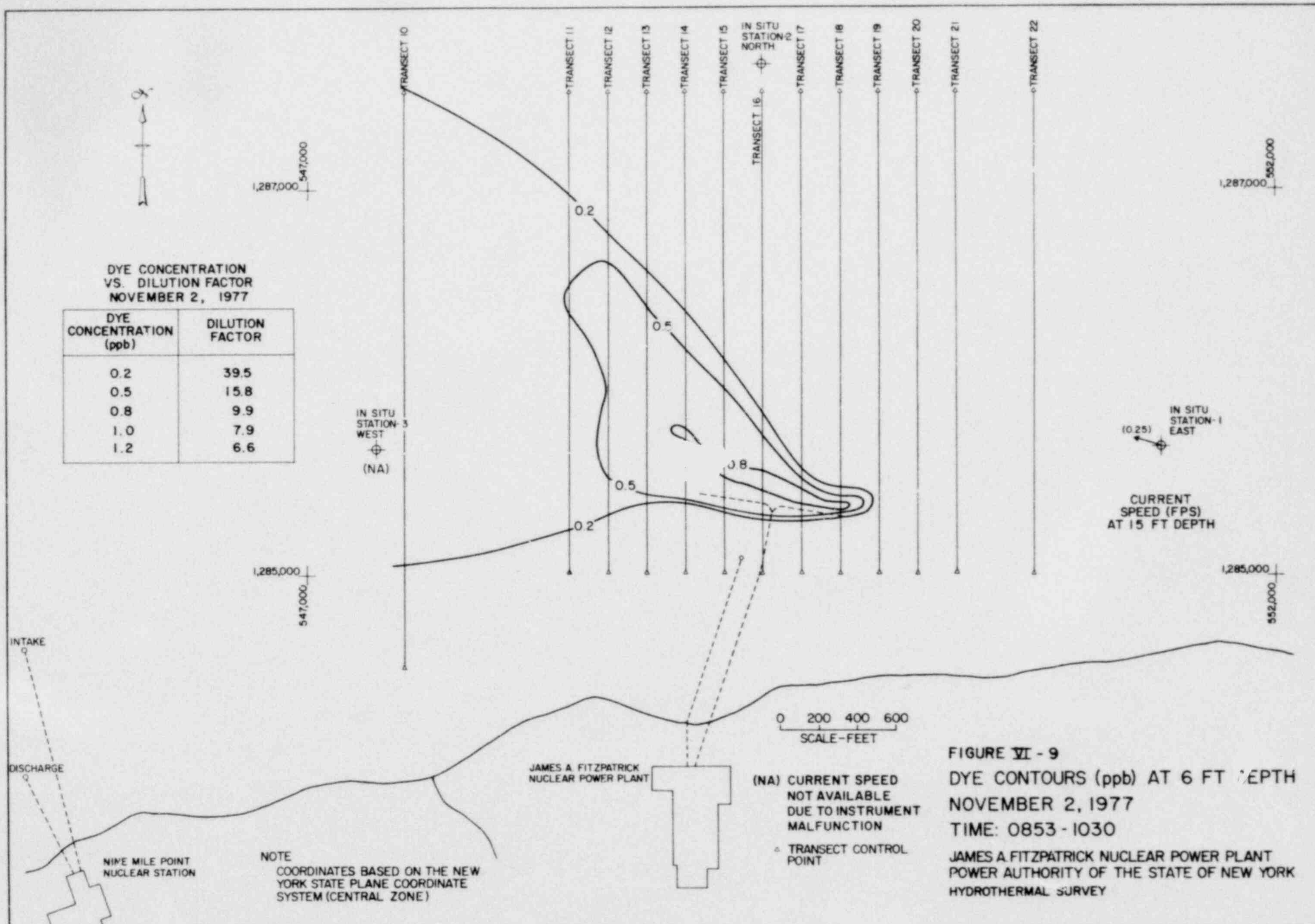
FIGURE VI - 8

DYE CONTOURS (ppb) AT 2 FT DEPTH

NOVEMBER 2, 1977

TIME: 0853-1030

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

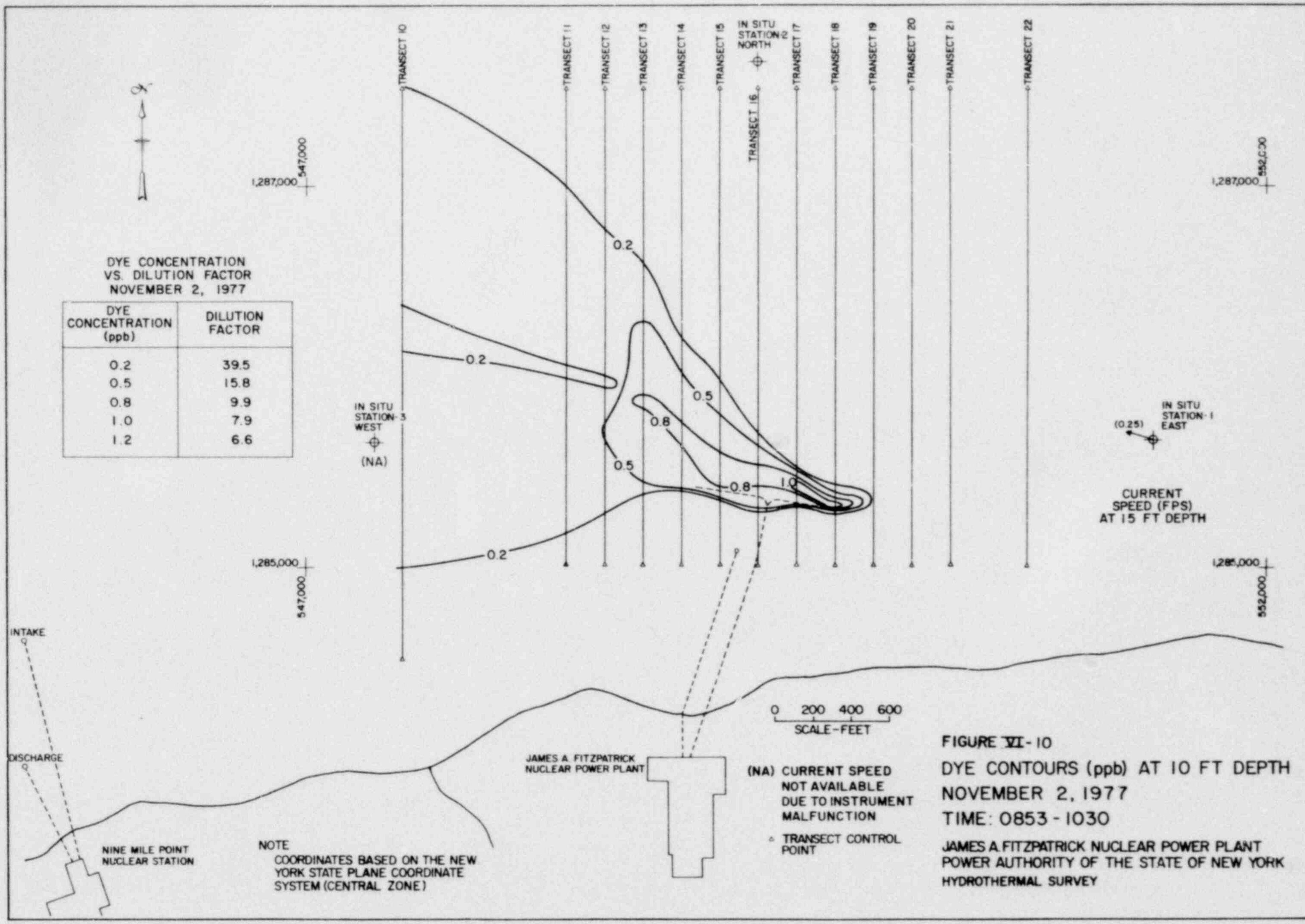


DYE CONCENTRATION VS. DILUTION FACTOR NOVEMBER 2, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.5
0.5	15.8
0.8	9.9
1.0	7.9
1.2	6.6

FIGURE VI - 9
DYE CONTOURS (ppb) AT 6 FT DEPTH
NOVEMBER 2, 1977
TIME: 0853 - 1030

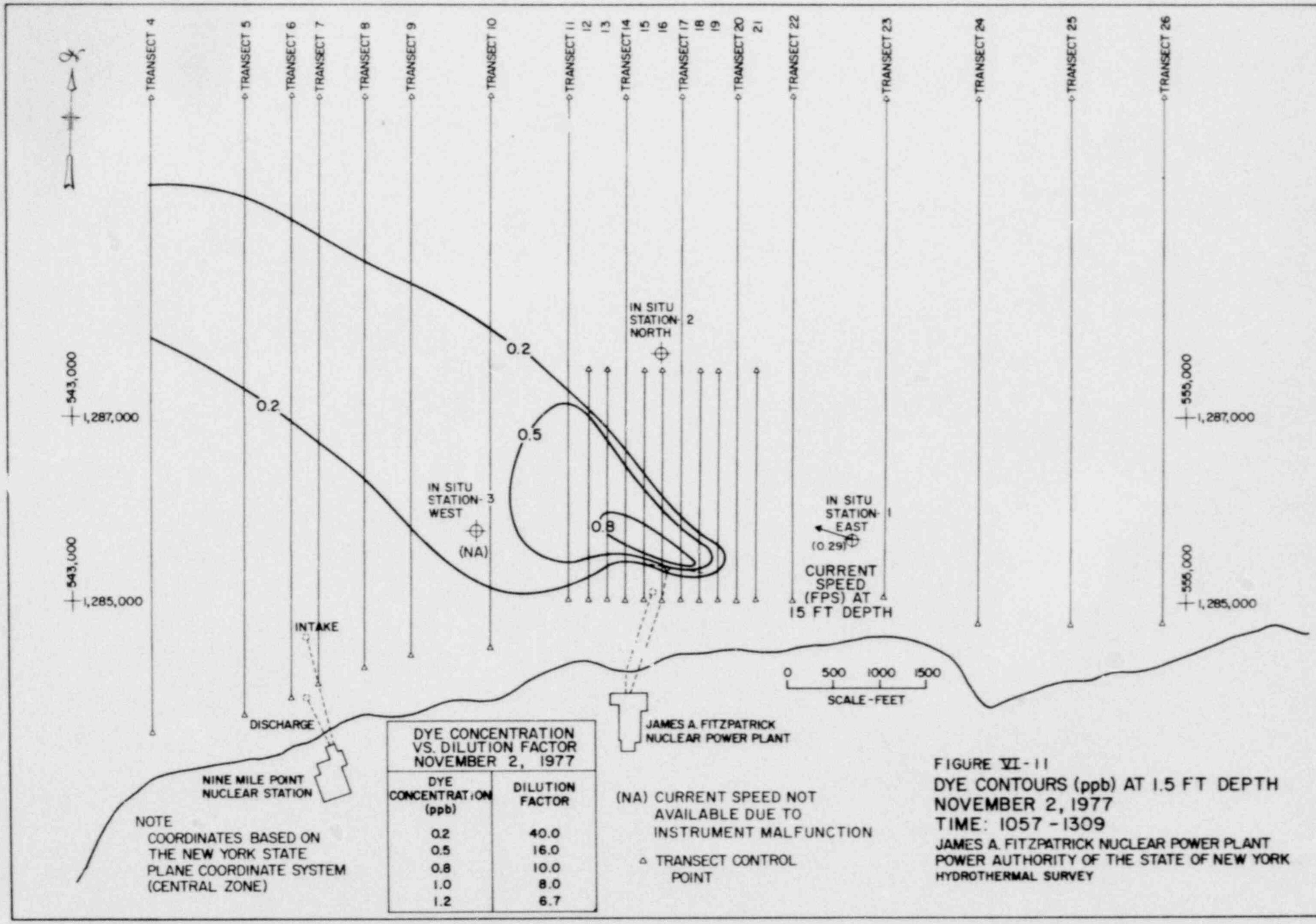
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR NOVEMBER 2, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	39.5
0.5	15.8
0.8	9.9
1.0	7.9
1.2	6.6

FIGURE VI-10
DYE CONTOURS (ppb) AT 10 FT DEPTH
NOVEMBER 2, 1977
TIME: 0853 - 1030
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY



DYE CONCENTRATION VS. DILUTION FACTOR NOVEMBER 2, 1977

DYE CONCENTRATION (ppb)	DILUTION FACTOR
0.2	40.0
0.5	16.0
0.8	10.0
1.0	8.0
1.2	6.7

FIGURE VI-11
DYE CONTOURS (ppb) AT 1.5 FT DEPTH
NOVEMBER 2, 1977
TIME: 1057-1309
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK
HYDROTHERMAL SURVEY

JUNE 1976 POSTOPERATIONAL
HYDROTHERMAL SURVEY
FOR
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
POWER AUTHORITY OF THE STATE OF NEW YORK