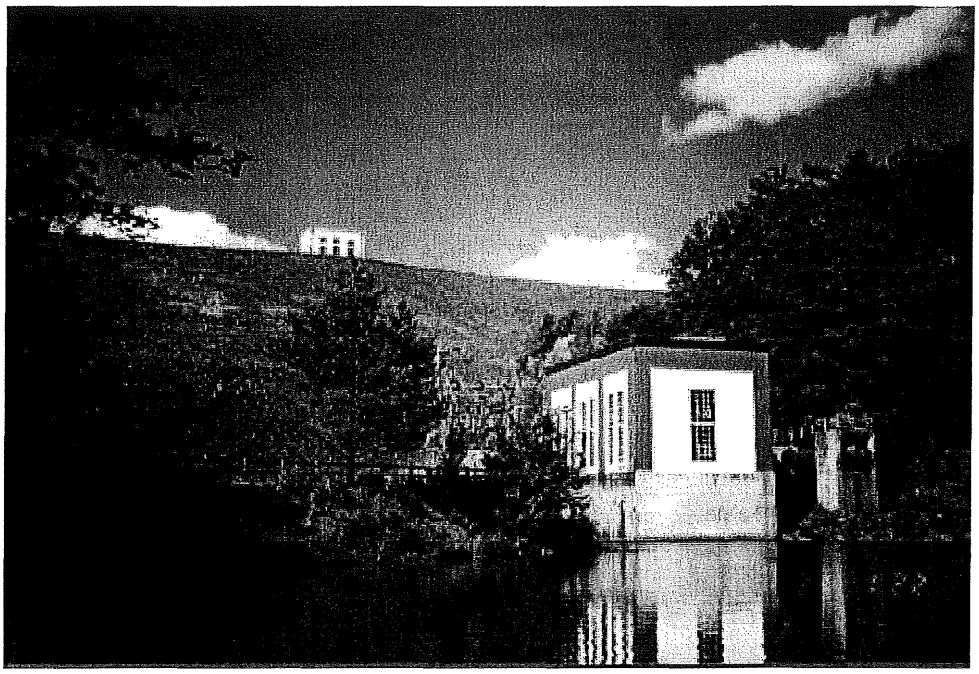
WATERBURY HYDROELECTRIC PROJECT
FERC NO. 2090

WATERBURY RESERVOIR
TURBIDITY STUDY
DRAFT REPORT



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1.0 INTRODUCTION

The Green Mountain Power Corporation (GMP) owns the Waterbury Hydroelectric Project (Project) located on the Little River approximately 2.5 miles upstream from the Winooski River in the Town of Waterbury, Vermont. The Project has an installed capacity of 5,520 KW and uses water from Waterbury Reservoir to supply electric service to over 82,000 customers in the State of Vermont. The current license for the Project expires on September 1, 2001.

1.1 AGENCY CONSULTATION

On August 27, 1999, GMP submitted an application to the Federal Energy Regulatory Commission (FERC) for a new license, which described all aspects of the Project, including natural resources. Information regarding water quality was included in the application. However, an Additional Information Request (AIR) was submitted to FERC by the State of Vermont regarding the need for additional information about turbidity conditions in the reservoir and tailrace. Specific focus was given to turbidity dynamics throughout the reservoir during drawdown and during refill. The geographic scope included the Little River upstream of the reservoir (downstream from Miller Brook), Cotton Brook, and the tailrace.

1.2 OBJECTIVES OF THE STUDY

This study was conducted to evaluate the effects of reservoir drawdown associated with hydroelectric power generation on the turbidity and thermal characteristics of Waterbury Reservoir and tailrace. Specific objectives were:

1. Document reservoir turbidity levels,
2. Document thermal characteristics, and
3. Identify potential factors that influence turbidity dynamics.

2.0 DESCRIPTION OF STUDY AREA

2.1 DESCRIPTION OF RESERVOIR

Waterbury Reservoir, which drains portions of Lamoille County and Washington County, Vermont, is approximately 3.0 miles long in the north-south direction and is approximately 2.3 miles wide at it widest point. At the normal maximum pool elevation of 592.0 feet (1929 National Geodetic Vertical Datum), the reservoir has a surface area of 890 acres and an estimated gross storage of 37,000 acre-feet. At the fixed spillway crest elevation of 617.5 feet, the reservoir covers 1,330 acres and has a gross storage of 64,700 acre-feet. The current FERC license does not contain a maximum drawdown limit for the reservoir. The average annual drawdown[1] of the reservoir is 34 feet (to elevation 558.0 feet). The estimated usable storage within this operating range of the Project (elevation 592.0 to 558.0 feet) is approximately 22,800 acre-feet. At a maximum turbine discharge of 580 cfs and in the absence of reservoir inflow, approximately 17 hours is required to draw down the reservoir 1.0 foot from a reservoir elevation of 592.0 feet .

2.2 DESCRIPTION OF SAMPLING LOCATIONS

Samples were collected from eight locations throughout Waterbury Reservoir from January through April 2000 (Figure 2.2-1). Individual descriptions of the sampling locations are given below.

Upstream

This site is located in the riverine reach of the Little River approximately 0.3 miles downstream from Miller Brook in Lamoille County, Vermont. The Global Positioning System (GPS) coordinates were 44°26'360" N, 72°44'442" W. Samples were collected approximately 15 feet from the shoreline during ice cover and from the shoreline during ice-free periods. The river was completely free from ice cover beginning on March 2, 2000.

Cotton Brook

This site is a riverine site located in Washington County, Vermont approximately 2.0 miles downstream from Miller Brook. The GPS coordinates were 44°25'124" N, 72°45'316" W. Cotton Brook is one of two major tributaries to Waterbury Reservoir that drains eastward through the Mount Mansfield State Forest. Cotton Brook is a third-order tributary to Waterbury Reservoir that drains a basin of high topographic relief, and consequently has large amounts of bed load at the mouth. The sample collection location was approximately 150 feet upstream from the confluence with Waterbury Reservoir/Little River. Samples were collected from the middle of the channel. The mouth of Cotton Brook was completely free from ice cover beginning on March 2, 2000.

[1] The average annual drawdown was determined from the average of the lowest reservoir levels for the periods1953 80 and 1987-95: 1981-1986 was excluded because the reservoir was drained for dam repairs.

Inflow

This site is a riverine/lacustrine site of the Little River located in Washington County, Vermont typically ranging from 1.2-2.5 miles downstream from Miller Brook. The actual sampling location varied relative to reservoir elevation (Table 2.2-1). Samples were collected from the middle of the channel during ice cover and from the shoreline during ice-free periods. The inflow and upper reaches of Waterbury Reservoir were completely free from ice cover beginning on March 2, 2000. With the exception of April 28, samples were not collected after March 30 since the sampling location was similar to the Upstream sampling location under full pond conditions.

Table 2.2-1. Sampling locations at the inflow to Waterbury Reservoir, Vermont, relative to water surface elevations, winter/spring 2000.

Date	GPS Coordinates	Water Surface Elevation (feet)
February 3, 2000	44°24'899" N, 72°45'334" W	569.7
February 15, 2000	44°24'830" N, 72°45'396" W	562.6
February 18, 2000	44°24'820" N, 72°45'406" W	561.3
February 21, 2000	44°24'793" N, 72°45'431" W	560.4
February 24, 2000	44°24'715" N, 72°45'444" W	558.8
March 8, 2000	44°25'003" N, 72°45'288" W	569.7
March 16, 2000	44°25'076" N, 72°45'276" W	573.7
March 23, 2000	44°25'084" N, 72°45'203" W	573.2
March 30, 2000	44°25'613" N, 72°44'680" W	585.0
April 6, 2000	*	593.0
April 13, 2000	*	591.9
April 20, 2000	*	592.0
April 28, 2000	Coordinates not determined	592.0

*sample not collected

Reservoir – East Arm (Alder/Bryant Brook)

This site is a lacustrine site located in Washington County, Vermont approximately 1,400 feet upstream from the East Arm-North Arm confluence of Waterbury Reservoir. The GPS coordinates were 44°23'308" N, 72°45'058" W. Samples were collected approximately 200 feet from the south shoreline over the river channel. The East Arm was completely free from ice cover beginning on April 20.

Reservoir – North Arm (Little River)

This site is a lacustrine site located in Washington County, Vermont approximately 1,800 feet upstream from the North Arm-East Arm confluence of Waterbury Reservoir. The GPS coordinates were 44°23'562" N, 72°45'342" W. Samples were collected approximately 150 feet from the east shoreline over the river channel, and 150 feet upstream from the mouth of Stevenson Brook. The North Arm was completely free from ice cover beginning on April 20.

Reservoir – Intake (Little River)

This site is a lacustrine site located in Washington County, Vermont approximately 0.8 miles downstream from the North Arm-East Arm confluence and 300 feet upstream from the Waterbury Reservoir intake structure and dam. The GPS coordinates were 44°22'987" N, 72°46'140" W. This site was completely free from ice cover beginning on April 20.

Stevenson Brook

This site is a riverine site located in Washington County, Vermont. Stevenson Brook is the second of two major tributaries to Waterbury Reservoir that drains eastward through the Mount Mansfield State Forest. Stevenson Brook is a third-order tributary to Waterbury Reservoir at the sample collection location, which varied with reservoir elevation (Table 2.2-2). Samples were collected from the shoreline. The mouth of Stevenson Brook was completely free from ice cover beginning on March 2, 2000.

Table 2.2-2. Sampling locations in Stevenson Brook relative to water surface elevations, winter/spring 2000.

Date	GPS Coordinates	Water Surface Elevation (feet)
February 21, 2000	44°23'434" N, 72°45'710" W	560.4
February 24, 2000	44°23'434" N, 72°45'710" W	558.8
March 2, 2000	44°23'396" N, 72°45'804" W	569.1
March 8, 2000	44°23'396" N, 72°45'804" W	569.7
March 16, 2000	44°23'396" N, 72°45'804" W	573.7
March 23, 2000	44°23'396" N, 72°45'804" W	573.2
March 30, 2000	44°23'489" N, 72°45'795" W	585.0
April 6, 2000	44°23'495" N, 72°45'830" W	593.0
April 13, 2000	*	591.9
April 20, 2000	*	592.0
April 28, 2000	44°23'495" N, 72°45'830" W	592.0

** sample not collected

Tailrace

This site is a riverine site located approximately 30 feet downstream from the powerhouse in Washington County, Vermont. Samples were collected from the west shoreline during generation flows (580 cubic feet per second). The tailrace was not ice covered during the study.

3.0 METHODS

All sampling sites were accessed using cross-country skis from January 28 through February 24, although a snowmobile was used on February 1. All sites were accessed on foot beginning on March 2 due to the loss of snowpack; a 12-foot boat with outboard motor was used to access all sites above the dam on April 28. A six-inch diameter ice auger enabled collection of samples through the ice at the Inflow and Reservoir sites; the auger was not needed at the Inflow after February 24. Samples were not collected at any of the Reservoir sites on April 6, 13, and 20 due to the instability of the ice layer, particularly around the reservoir perimeter. Also, samples were not collected from the Inflow site on April 6, 13, and 20 since the location of the Inflow site was nearly equal to the location of the Upstream site.

3.1 WATER TEMPERATURE

Water temperature data were collected from the riverine (Upstream, Cotton Brook, Inflow, Stevenson Brook, and Tailrace) sites using a Cole-Parmer 08403-00 electronic benchtop thermistor thermometer coupled with a two-foot long cable/probe. Temperature data from the reservoir sites (North Arm, East Arm, Intake) were collected using the thermistor thermometer coupled with a 150-foot long cable/probe to determine water column temperatures at five-foot intervals.

3.2 TURBIDITY AND TOTAL SUSPENDED SOLIDS

Water samples from riverine sites were collected directly into one-liter plastic bottles for turbidity and total suspended solids (TSS) analysis and transported to Severn-Trent Laboratories (Colchester, VT) within 24-hours of collection. This included the Inflow site after ice-out. Prior to ice-out, water samples from the Inflow site were collected beneath the ice layer into a one-liter plastic bottle and transferred to a one-liter sample storage bottle. Water samples from reservoir-based sites (East Arm, North Arm, and Reservoir (Intake)) were collected through the ice at five-foot intervals using a stainless steel sampling device ("sewage sampler"). The device collected approximately 1.5 liters of water, which were transferred to a one-liter sample storage bottle (turbidity and TSS) or a 250-milliliter sample storage bottle (turbidity only); excess water was discarded. Table 3.2-1 shows the water quality parameters and depths sampled at each reservoir-based site.

Table 3.2-1. General sampling scheme used for the winter/spring 2000 turbidity study of Waterbury Reservoir, Vermont. Reservoir depths varied according to water surface elevation.

Depth (feet)	Reservoir – East Arm	Reservoir – North Arm	Reservoir – Intake
5	Temperature, Turbidity, TSS	Temperature, Turbidity, TSS	Temperature, Turbidity, TSS
10	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
15	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
20	Temperature, Turbidity, TSS	Temperature, Turbidity, TSS	Temperature, Turbidity
25	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
30	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
35	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
40	Temperature, Turbidity, TSS	Temperature, Turbidity, TSS	Temperature, Turbidity, TSS
45	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
50	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
55	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
60	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
65	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity
70	Temperature, Turbidity	Temperature, Turbidity	Temperature, Turbidity, TSS
75	-	Temperature, Turbidity	Temperature, Turbidity
80	-	-	Temperature, Turbidity
85	-	-	Temperature, Turbidity
90	-	-	Temperature, Turbidity
95	-	-	Temperature, Turbidity

3.3 GLOBAL POSITIONING SYSTEM

All water quality sampling locations, except for the tailrace, were geographically referenced using a Magnavox MX200 GPS receiver coupled with a Leica MX41R radio beacon receiver with differential corrections from the St. Jean, Quebec radio beacon station.

3.4 SAMPLING SCHEDULE

January						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29				

March						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

April						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Sample Collection Day

4.0 RESULTS

4.1 WATER TEMPERATURE

Riverine Characteristics

The Little River (Upstream and Inflow sites) and Cotton Brook experienced similar water temperature patterns during the study period, with the lowest temperatures at the Upstream site from January 28 through February 24 (Figure 4.1-1). Temperatures ranged from 0.3 to 1.0°C during this period. The water temperatures in the Tailrace ranged from 1.9 to 3.8°C, and experienced a general decline through February 24. Water temperatures at all sampling locations increased between February 24 and March 2; the magnitude of the increase varied from 1.1°C at Cotton Brook, 2.8°C at the Tailrace, and 5.0°C at Stevenson Brook. Water temperatures subsequently decreased on March 8 at all sites. Water temperatures among all sites were least variable on March 16, where the highest temperature was at the Inflow (2.4°C) and lowest temperature was at the Tailrace (1.7°C). Stevenson Brook typically exhibited the warmest temperatures among all sites.

Lacustrine (Reservoir) Characteristics

Waterbury Reservoir experienced inverse thermal stratification in the East Arm and North Arm, and at the Intake during the study period (Figures 4.1-2 – 4.1-4). Inverse stratification was most pronounced at the Intake from January 28 through February 24, where deep water approached maximum density (4.0°C) on February 1. Water temperatures near the bottom of the reservoir at the Intake ranged from 2.0 to 3.8°C, whereas temperatures near the bottom of the reservoir in the North Arm and East Arm ranged from 2.1 to 2.3°C and 1.2 to 1.8°C, respectively. The temperature differential (maximum temperature-minimum temperature) during inverse stratification was greatest at the Intake from January 28 through February 24, but greatest in the North Arm from March 2 through March 23 (Figure 4.1-5). The temperature differential in the East Arm was always lower than the Intake and North Arm during the study period. Water temperatures were spatially consistent throughout the reservoir on April 28, with temperatures ranging from 5.2 to 5.5°C at the surface and 4.3 to 4.5°C at the bottom in the East Arm, North Arm, and at the Intake (Figures 4.1-2 – 4.1-4).

4.2 TURBIDITY

Riverine Characteristics

The Little River between Miller Brook and the Waterbury Dam tailrace from January 28 through April 28 experienced variable (typically less than 5 ntu) turbidity levels at the Upstream and Inflow sites (Figure 4.2-1). Turbidity exceeded 10 ntu at the Inflow site on February 24, and was 8.8 ntu on February 7. However, it is unclear whether the actual turbidity on February 24 was 35 ntu, as shown in Figure 4.2-1. The sample collected on February 24 may have included interference from bottom sediments that may have suspended after the ice auger contacted the bottom prior to collection of the sample. Turbidity levels at the Upstream site were slightly higher during the refill period (mean = 1.7 ntu) than during the drawdown period (mean = 0.9 ntu). In contrast, turbidity at the Inflow site was lower during the refill period (mean = 2.1 ntu) than during the drawdown period (mean = 3.9 ntu). Table 4.2-1 compares the

ranges and arithmetic means of turbidity among the sites during the sampling period.

Turbidity levels in the Tailrace varied temporally during the study, where higher levels occurred between March 2 and April 28 (refill) when compared to the period between January 28 and February 24 (drawdown). Turbidity exceeded 10 ntu in the Tailrace on April 6, but averaged 6.0 ntu between March 2 and April 28. Turbidity was less than 5.0 ntu in the Tailrace from January 28 through February 24.

Eighty-six percent (86%) of the samples collected at the Inflow exceeded Upstream turbidity, 89% of the samples collected at the Tailrace exceeded Upstream turbidity, and 57% of the samples collected at the Inflow exceeded Tailrace turbidity (Table 4.2-2). However, turbidity samples at the Inflow site only exceeded Tailrace turbidity during the drawdown period, whereas turbidity samples at the Tailrace always exceeded Inflow turbidity during the refill period.

Turbidity levels in Cotton Brook were generally consistent throughout the study, although the range was 2.1 to 9.5 ntu. Cotton Brook contributed higher levels of turbidity to Waterbury Reservoir than Stevenson Brook, except on March 23 (Figure 4.2-2). Turbidity levels in Stevenson Brook were consistently low (less than 3.0 ntu) during the study, although turbidity reached 8.3 ntu on February 24.

Table 4.2-1. Turbidity characteristics of the Little River (Waterbury Reservoir) and primary tributaries to Waterbury Reservoir, Vermont, winter/spring 2000. Individual values represent means; ranges are denoted in parentheses. Data are expressed as ntu.

Period	**Site**				
	Upstream	**Inflow**	**Tailrace**	**Cotton Brook**	**Stevenson Brook**
Drawdown	0.9 (0.5 - 2.0)	3.9 (1.5 – 8.8)	1.3 (1.0 – 1.6)	5.9 (4.3 – 9.3)	--
Refill	1.7 (1.0 – 3.0)	2.1 (1.3 – 3.3)	6.0 (3.6 – 12.0)	5.7 (2.1 – 9.5)	1.0 (0.2 – 2.2)
Entire Study	1.4 (0.5 – 3.0)	5.3 (1.3 – 35.0)	3.7 (1.0 – 12.0)	5.9 (2.1 – 9.5)	1.0 (0.2 – 2.2)

Table 4.2-2. Comparison of turbidity data among Little River sites relative to Waterbury Reservoir, Vermont, winter/spring 2000. Data are expressed as ntu. Shaded area indicates refill period.

Date	Site					
	Upstream	Inflow	Tailrace	Difference (Upstream-Inflow)	Difference (Upstream-Tailrace)	Difference (Inflow-Tailrace)
1/28	0.9	--	1.4	--	-0.5	--
2/1	0.7	1.5	1.2	-0.8	-0.5	0.3
2/3	0.5	3.4	1.0	-2.9	-0.5	2.4
2/7	0.7	8.8	1.0	-8.1	-0.3	7.8
2/10	1.2	2.4	1.6	-1.2	-0.4	0.8
2/15	0.6	4.6	1.5	-4.0	-0.9	3.1
2/18	0.8	2.5	1.4	-1.7	-0.6	1.1
2/21	2.0	4.0	1.5	-2.0	0.5	2.5
2/24	2.5	35.0	2.0	-32.5	2.0	33.0
3/2	2.0	2.9	8.0	-0.9	-6.0	-5.1
3/8	1.5	1.6	5.7	-0.1	-4.2	-4.1
3/16	3.0	3.3	6.0	-0.3	-3.0	-2.7
3/23	1.3	1.3	3.9	0.0	-2.6	-2.6
3/30	1.5	2.0	5.5	-0.5	-4.0	-3.5
4/6	2.5	--	12.0	--	-9.5	--
4/13	1.0	--	5.5	--	-4.5	--
4/20	1.0	--	3.6	--	-2.6	--
4/28	1.6	1.5	4.2	0.1	-2.6	-2.7

reservoir full +

Lacustrine (Reservoir) Characteristics

Waterbury Reservoir experienced spatial and temporal variation in turbidity during the study, although spatial variations were minimal and depicted in the East Arm. Average water column turbidity levels were typically higher in the East Arm, particularly on March 2 (8.9 ntu) and March 8 (9.6 ntu), when compared to the North Arm and at the Intake (Figure 4.2-3). Average water column turbidities were consistently higher (> 6.0 ntu) at all reservoir sites from March 2 through March 16, but averaged less than 3.0 ntu throughout the reservoir during February. Average water column turbidity levels throughout the reservoir were similar (6.2 to 6.5 ntu) on March 16 and again on April 28 (3.9 to 4.2 ntu).

Water column turbidity levels were highest from March 2 through March 16, specifically in the North Arm and East Arm, where 10 ntu was exceeded at several depths (Figures 4.2-4 and 4.2-5). Turbidity through the water column was also least uniform during this time, with ranges of 4.9 to 15.0 ntu and 4.0 to 15.0 ntu in the East Arm and North Arm, respectively, on March 2. Elevated turbidity was observed at shallow depth (North Arm) and shallow and bottom depth (East Arm). The range of water column turbidity was dissimilar between the North Arm (4.5 to 9.0 ntu) and East Arm (7.5 to 13 ntu) on March 8, but was similar on March 16 (East Arm 4.0 to 8.0 ntu and North Arm 3.1 to 7.5 ntu). Elevated turbidity levels receded in the North Arm and East Arm on March 23, with ranges of 1.6 to 3.0 ntu and 1.2 to 4.5 ntu, respectively. Turbidity was lowest during February in the East Arm and North Arm, and typically ranged from 0.5 to 4.0 ntu.

The Intake also experienced elevated turbidity levels during March, but did not exceed 10 ntu (Figure 4.2-6). Water column turbidity was typically uniform during February, increased in March, and receded by March 23. Highest turbidity levels occurred on March 8, and ranged from 4.4 to 10.0 ntu. Similar to the North Arm and East Arm, turbidity at the Intake was lowest during February, although a small increase occurred on February 10 (1.4 to 4.5 ntu).

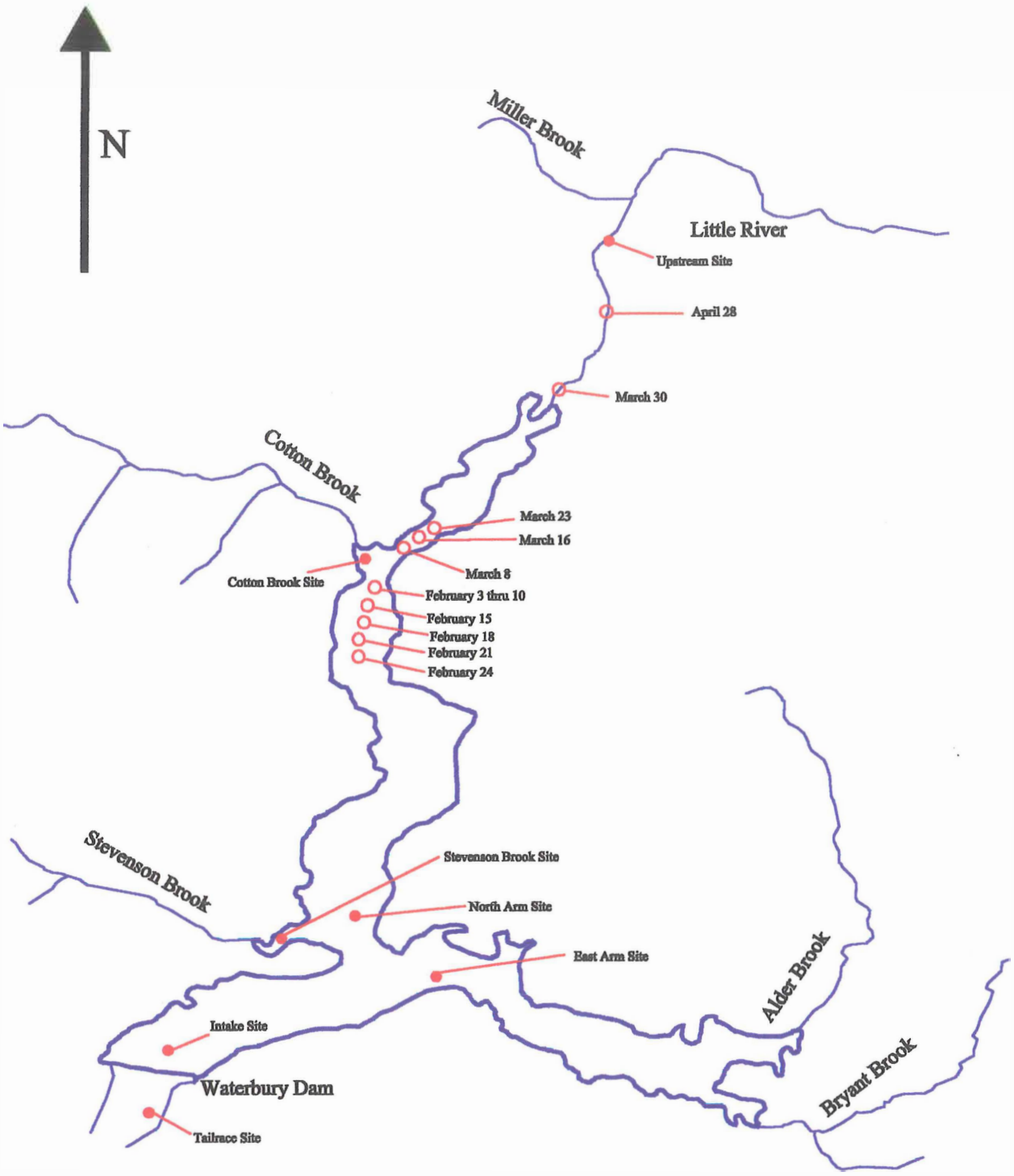
Turbidity was typically highest within the first 20-25 feet of the water column at all sites on March 8, and in the North Arm and East Arm on March 16. However, turbidity increased from 6.9 to 15.0 ntu between 35 and 45 feet in the East Arm on March 2.

5.0 DISCUSSION

The maximum density of water occurs at a water temperature of 4°C, which typically occurs at the bottom of lakes and reservoirs during the winter months. High-density water from cool/cold inflows can create density currents, which catalyze the movement of water and the transport of suspended sediments through a lake or reservoir. Although inverse stratification did occur during the study, and the highest turbidity measurements were near the bottom when inverse stratification was greatest (i.e., February), the measurements were only 1-2 ntu in the water column and about twice this level near bottom. Likewise, the discharge from the tailrace in February was only about 1-1.5 ntu. This suggests that turbidity dynamics in Waterbury Reservoir during drawdown is a function of physical parameters other than water temperatures and density driven resuspension at depth.

Elevated turbidity levels in the reservoir and at the inflow may be a result of headcutting processes between the Upstream and Inflow sites. During the drawdown period, the data collected during this study show that turbidity levels are higher at the Inflow site than at the Upstream site sometimes significantly higher (e.g., 2/24 although that inflow datum may be in error). However, the reservoir does not show elevated turbidity until the refill period – reservoir turbidity during drawdown is constantly in the 1-3 ntu range with no trend towards an increase as the water level drops. Furthermore, the tailrace turbidity is even lower than the reservoir during the drawdown period. Although inflow turbidity was highest during the lowest pool elevation, a statistically significant correlation ($r^2 = .24$; $p > 0.1$) does not exist between inflow turbidity levels and decreasing water surface elevations Thus, it is appears that exposing the channel by drawing down the reservoir does not result in the resuspension of sediments.

Reservoir turbidity increased during the refill period, although there was no trend over time. The turbidity was uniformly low at all stations during the last February sample, with the exception of the possibly erroneous inflow measurement. (Note: The low North Arm measurement on 2/24 leads to a conclusion that the inflow measurement was due to sampling errors.) Turbidity then jumped in March at all Reservoir stations and remained high for several weeks despite the fact that none of the tributaries show any spike. Since the inflow station also remains low, the only conclusion is that processes within the reservoir during refill account for the increased turbidity. The temporal patterns of turbidity in the Tailrace during refill mirror the spatial and temporal patterns of turbidity at the Intake. That is, turbidity jumps suddenly with the beginning of the refill. Increased flows to Waterbury Reservoir can cause the resuspension of sediments within the reservoir, and subsequently increase turbidity levels. Resuspension within the reservoir could be significant if the volume and density – due to either temperature or suspended material – of inflows was high such that this flow scoured sediments from the bottom. Flow data might help to discriminate these effects, however, no flow data are available at this time. In summary, higher turbidity occurs during the refill period for reasons that are not well understood, but are attributable to resuspension within the reservoir.



● Sampling Location (Constant)
○ Sample Location (Variable) [see Table 3.2-1 & 3.2-2]

Figure 2.2-1. Map of Waterbury Reservoir, Vermont, showing sampling locations for the Winter/Spring 2000 turbidity study.

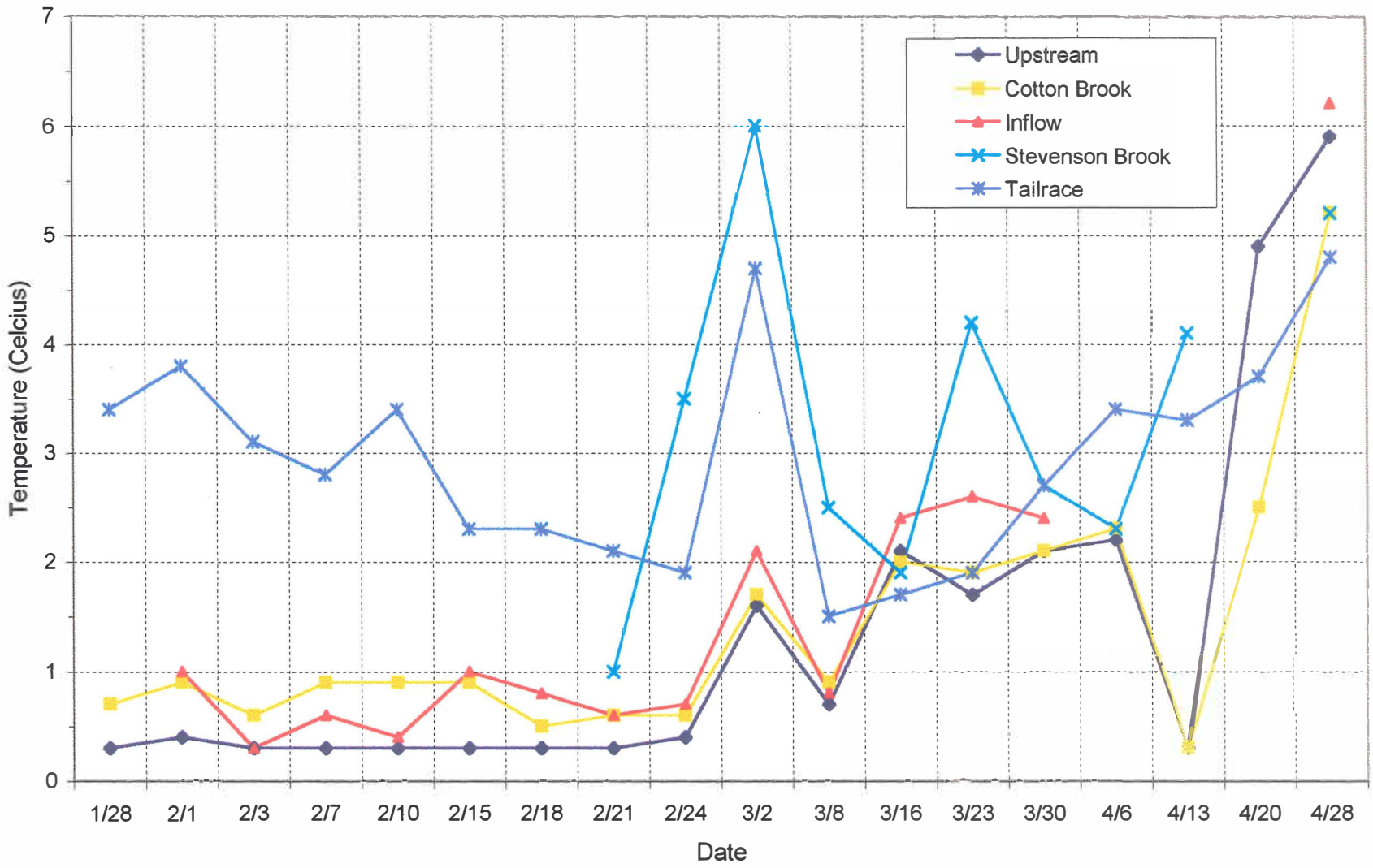


Figure 4.1-1. Water temperature dynamics of the Little River and tributaries, Waterbury, Vermont, winter/spring 2000.

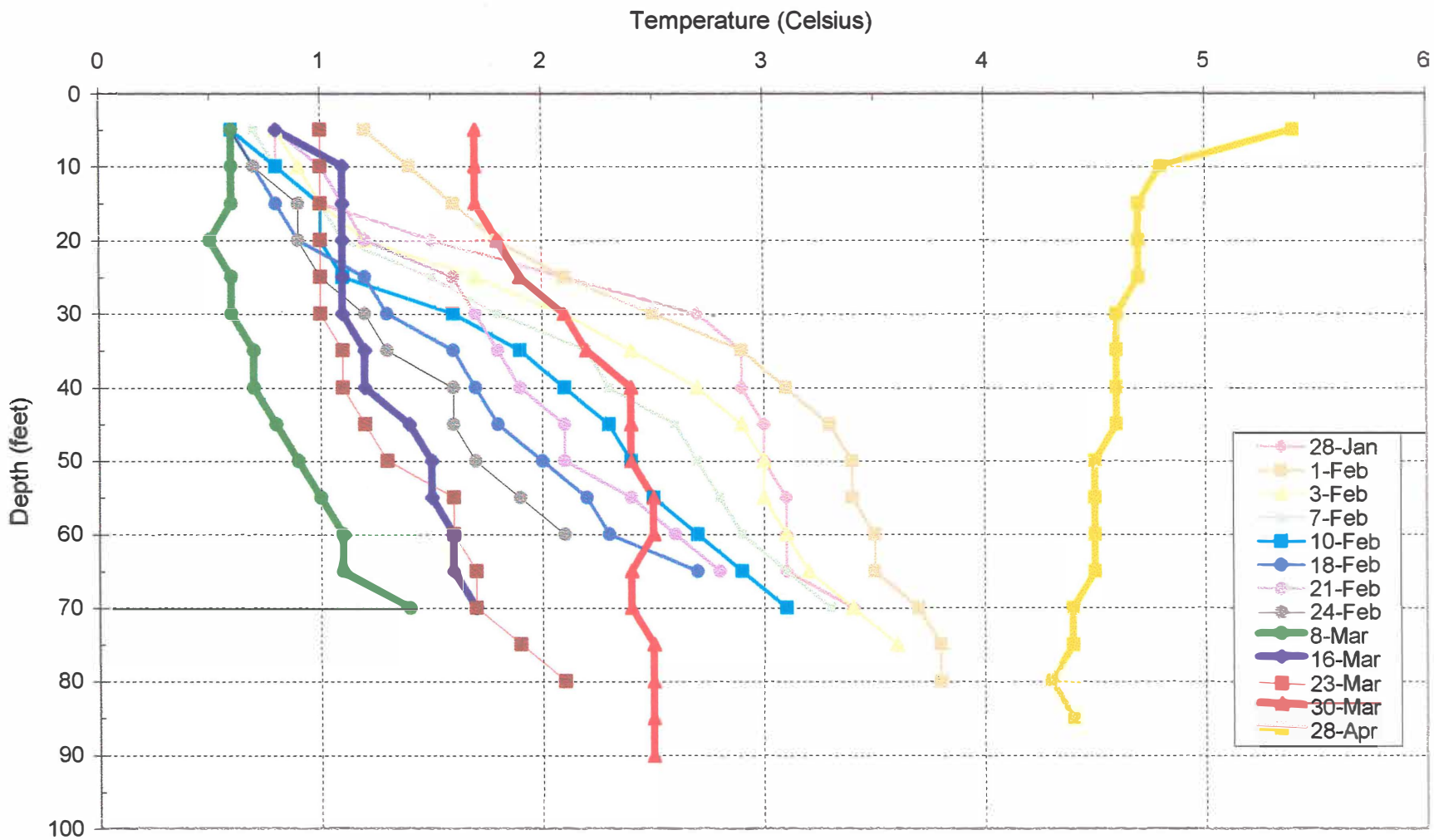


Figure 4.1-2. Water temperature profiles of Waterbury Reservoir at the intake to the Waterbury Hydroelectric Project, Waterbury, Vermont, winter/spring 2000.

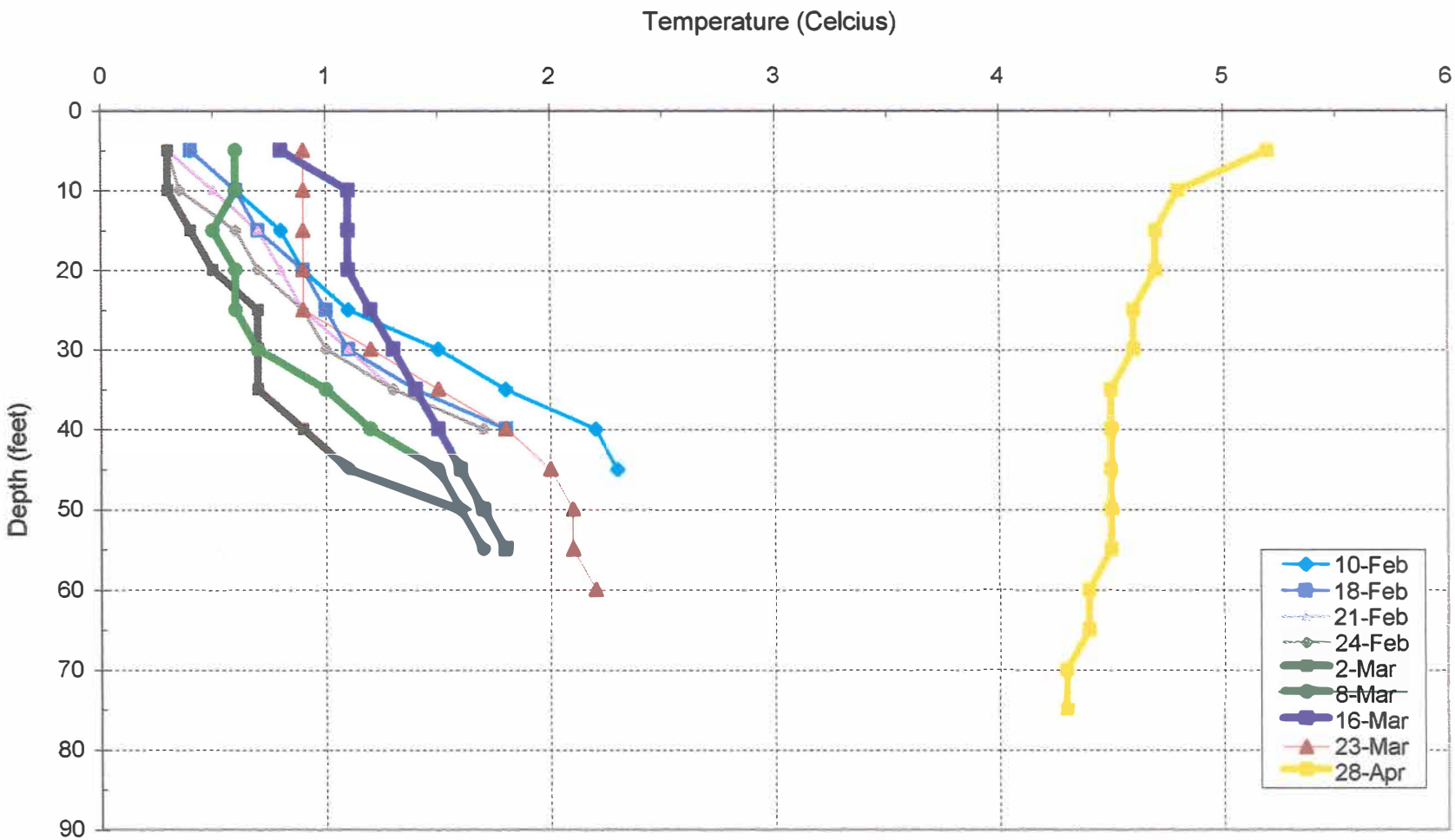


Figure 4.1-3. Water temperature profiles of Waterbury Reservoir at the North Arm, Waterbury, Vermont, winter/spring 2000.

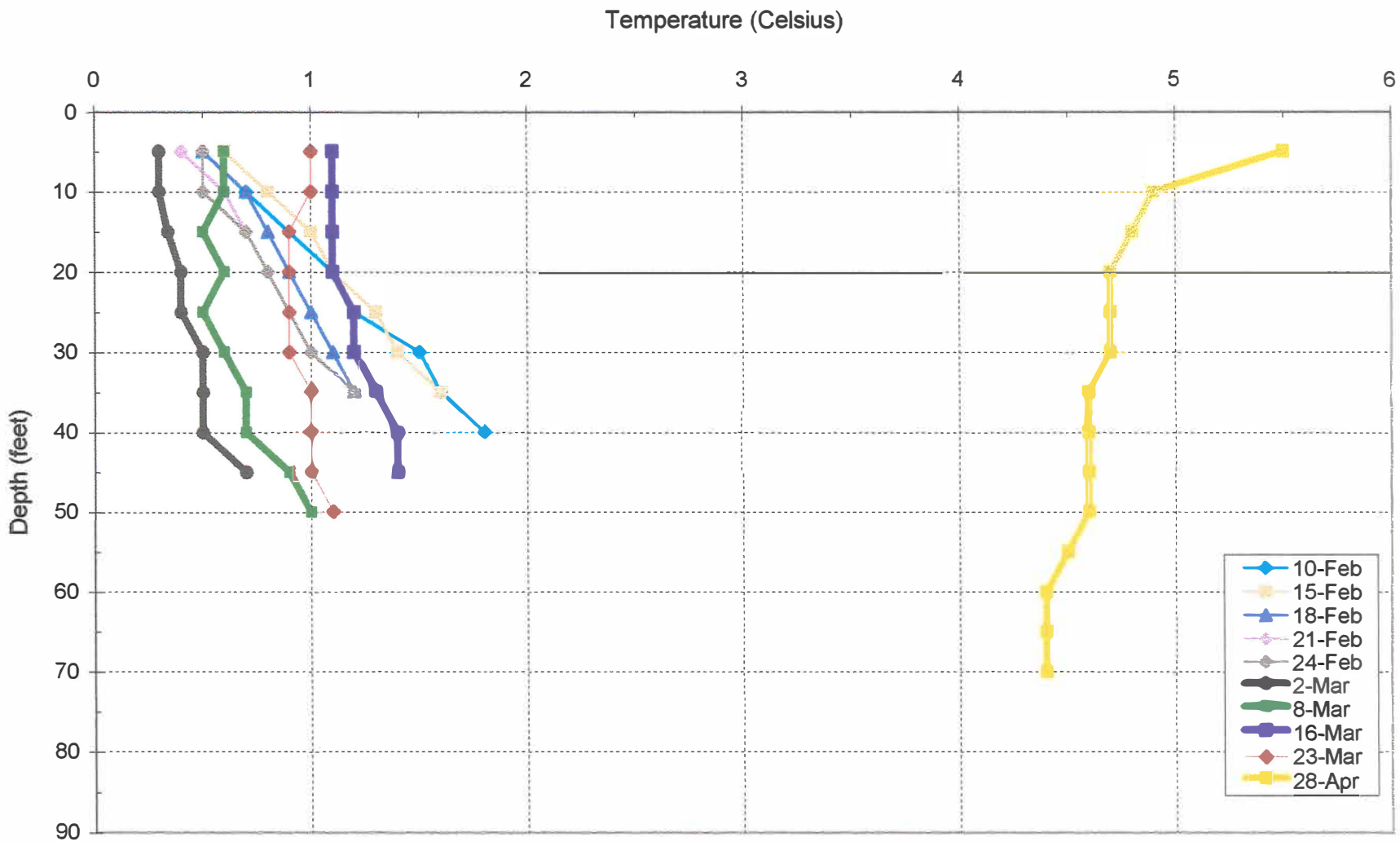


Figure 4.1-4. Water temperature profiles of Waterbury Reservoir at the East Arm, Waterbury, Vermont, winter/spring 2000.

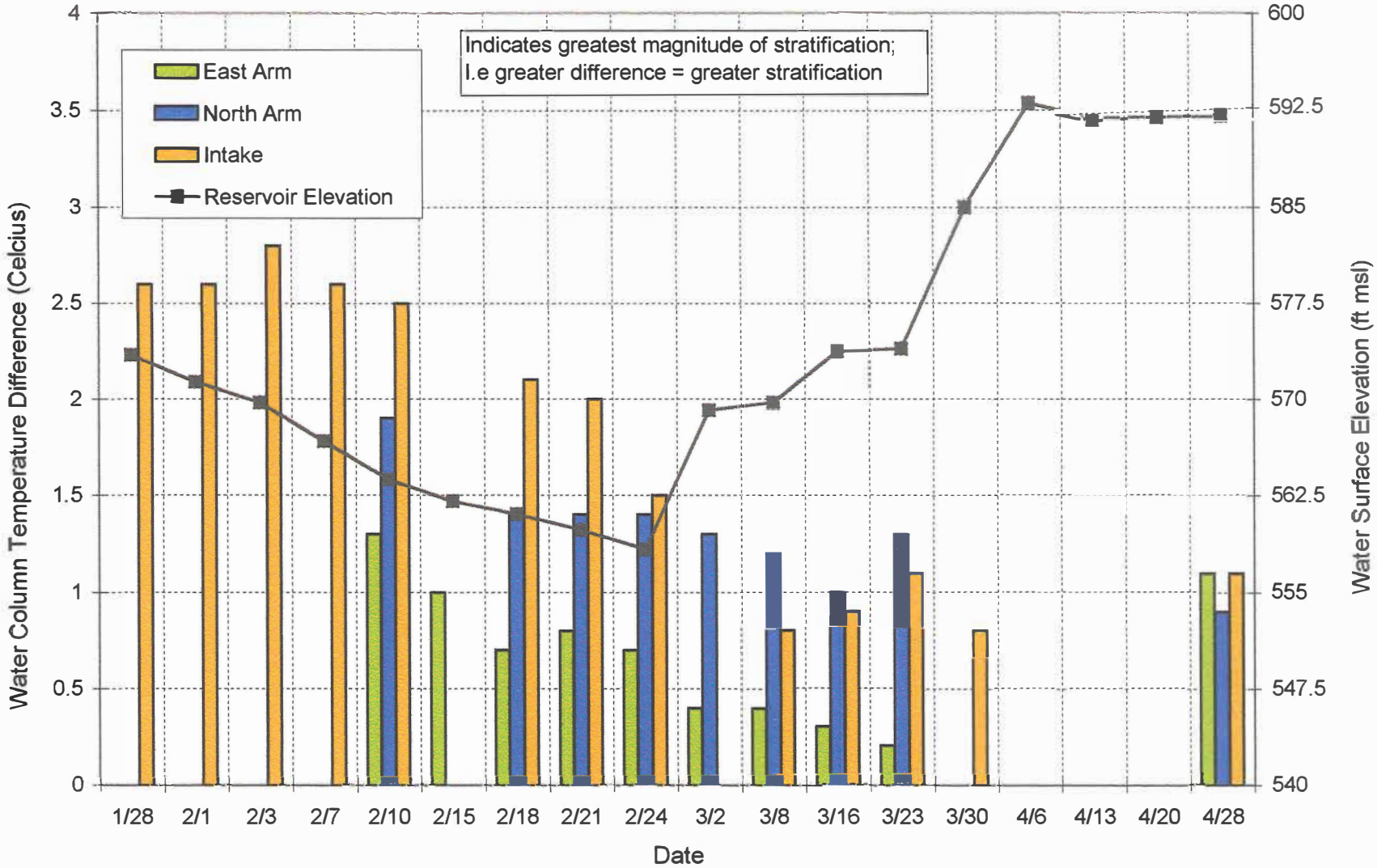


Figure 4.1-5. Spatial and temporal stratification patterns of Waterbury Reservoir, Waterbury, Vermont, winter/spring 2000. Bars represent the absolute maximum differences of water temperatures in the water column on each sampling day.

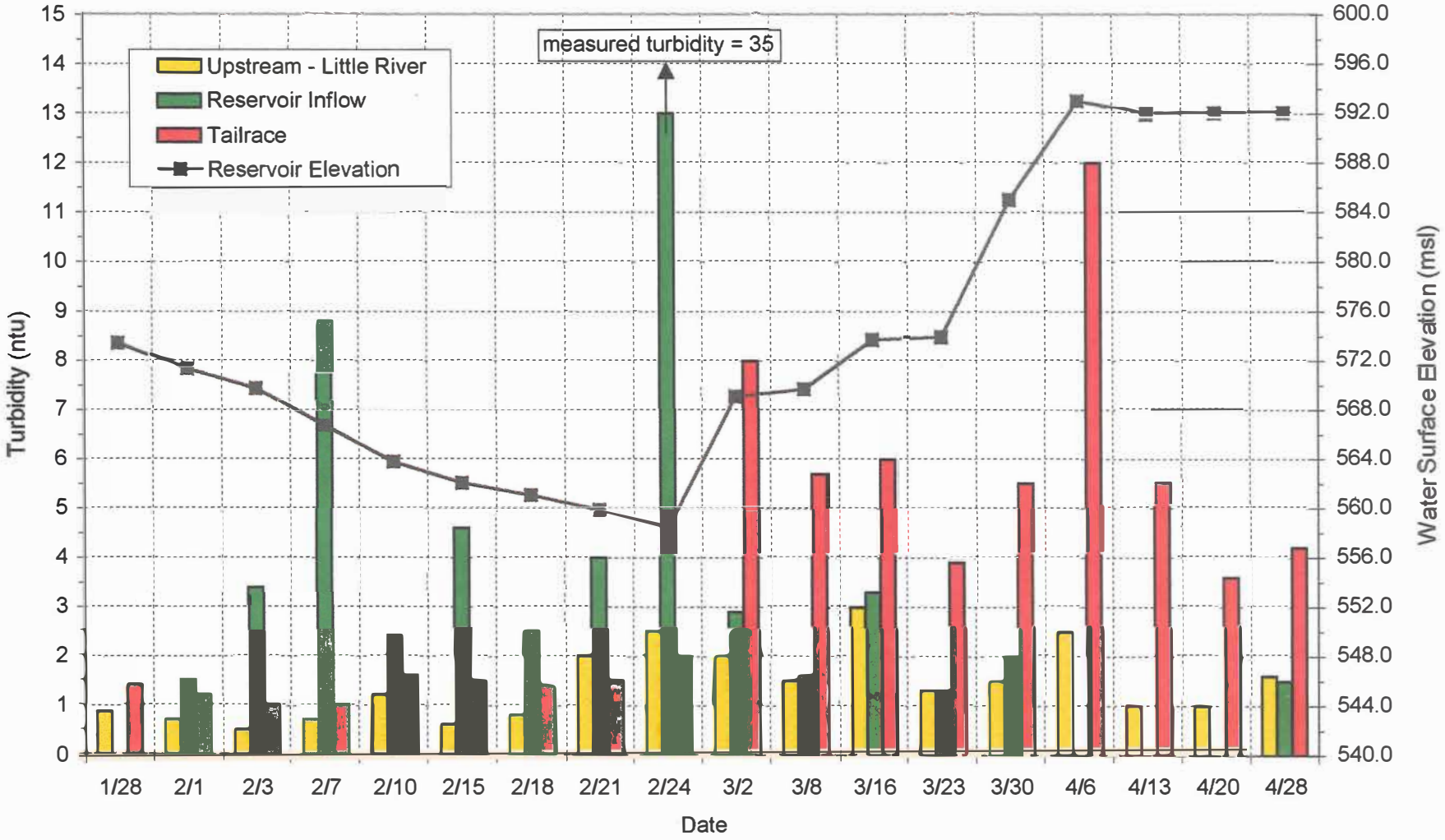


Figure 4.2-1. Turbidity dynamics of the Little River relative to water surface elevations of Waterbury Reservoir, Waterbury, Vermont, winter/spring 2000. The actual turbidity measured on 2/24 was 35 ntu, but was plotted as13 ntu due to potential measurement error (see text).

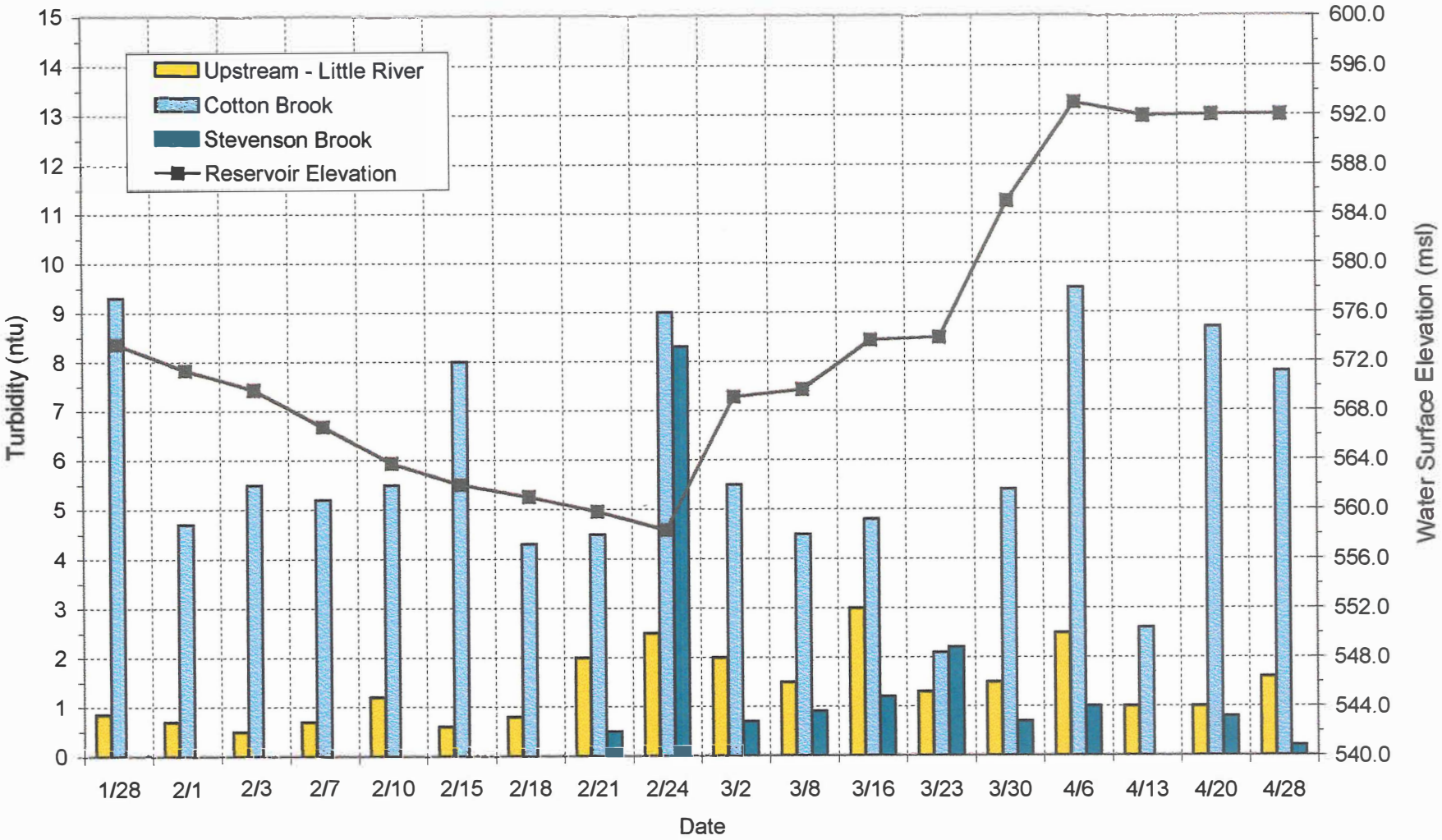


Figure 4.2-2. Turbidity dynamics of inflows relative to water surface elevations of Waterbury Reservoir, Waterbury, Vermont, winter/spring 2000.

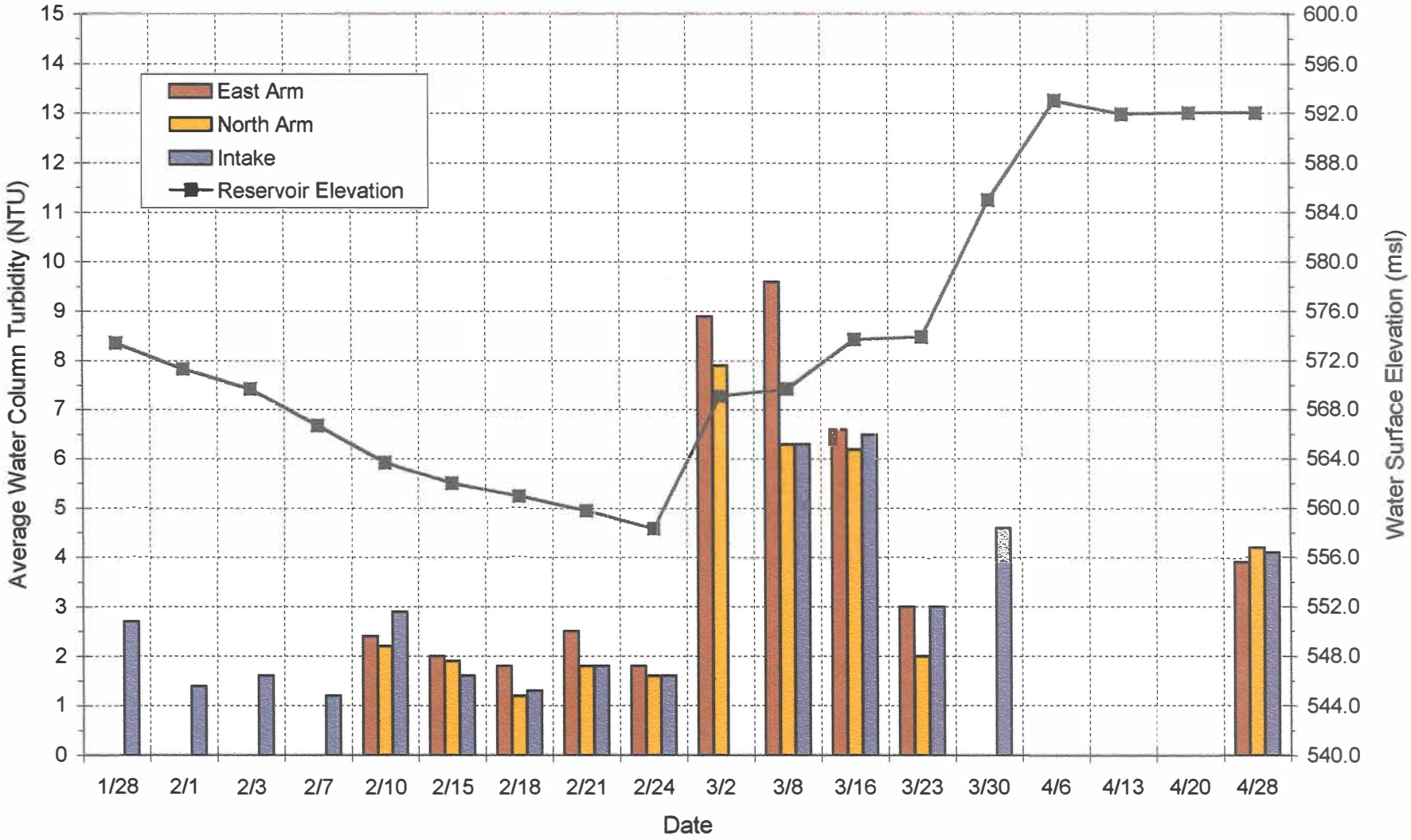


Figure 4.2-3. Average water column turbidity levels of Waterbury Reservoir, Waterbury, Vermont, relative to water surface elevations, winter/spring 2000.

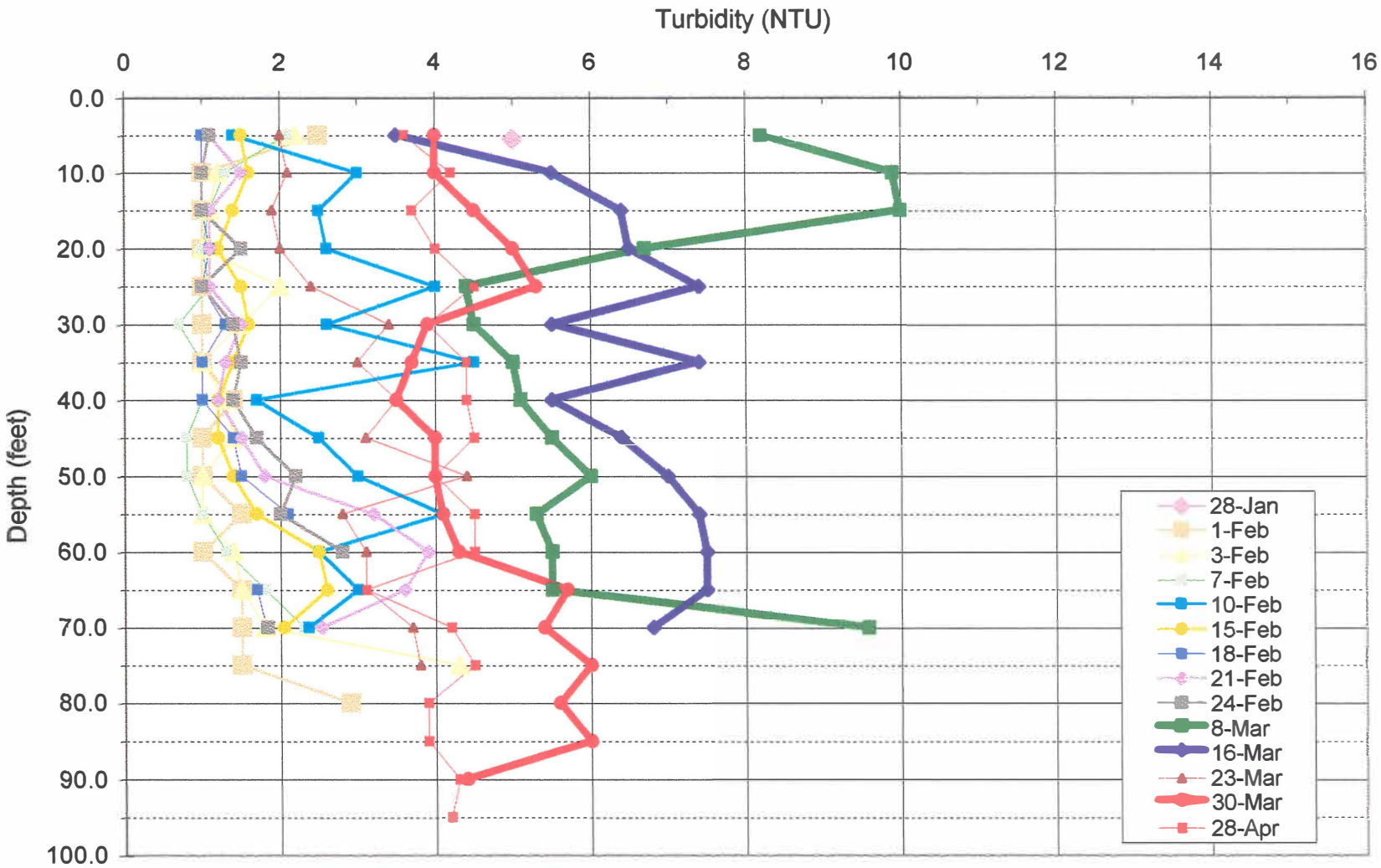


Figure 4.2-4. Turbidity profiles of Waterbury Reservoir at the intake to the Waterbury Hydroelectric Project, Waterbury, Vermont, winter/spring 2000.

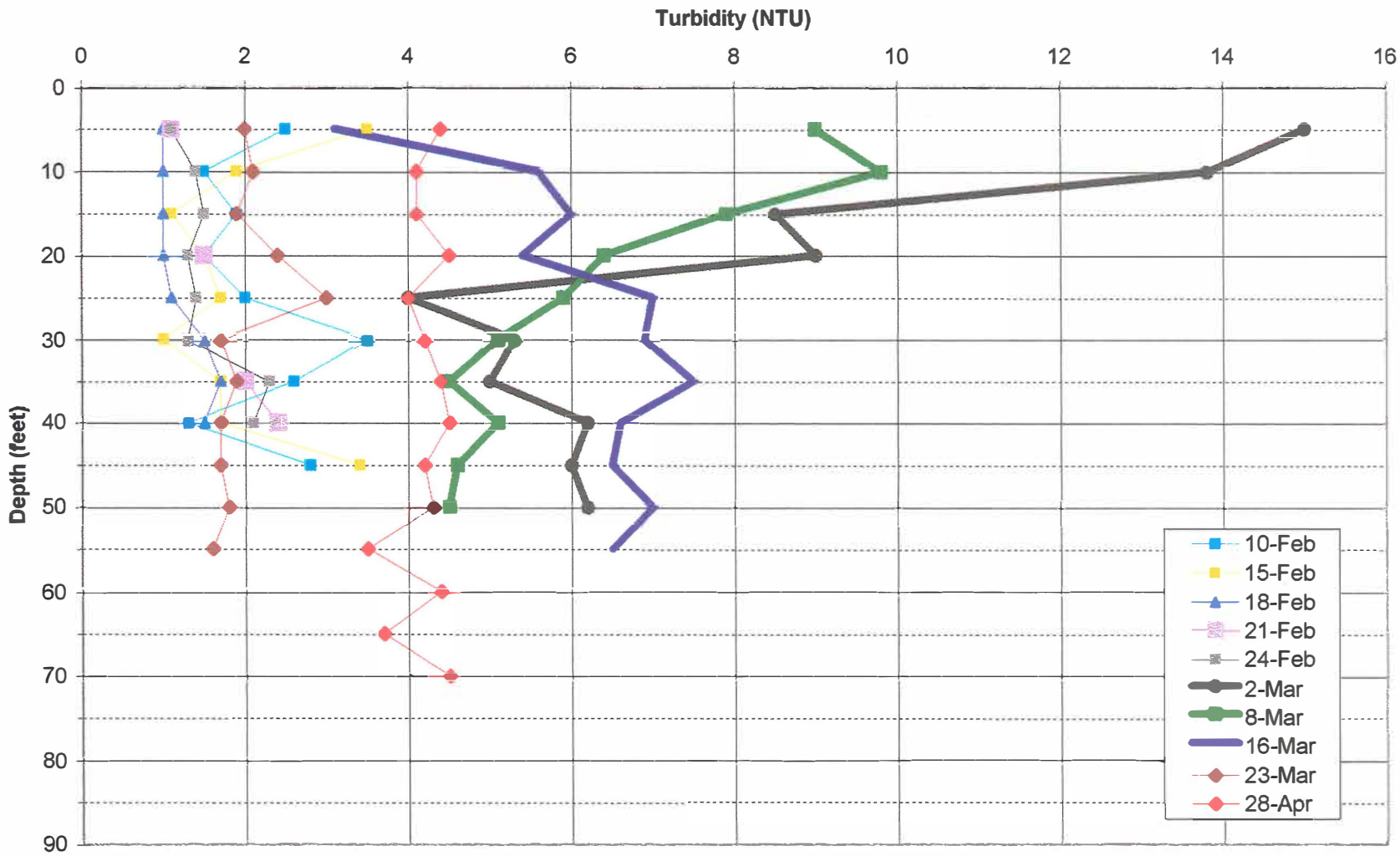


Figure 4.2-5. Turbidity profiles of Waterbury Reservoir at the North Arm, Waterbury, Vermont, winter/spring 2000.

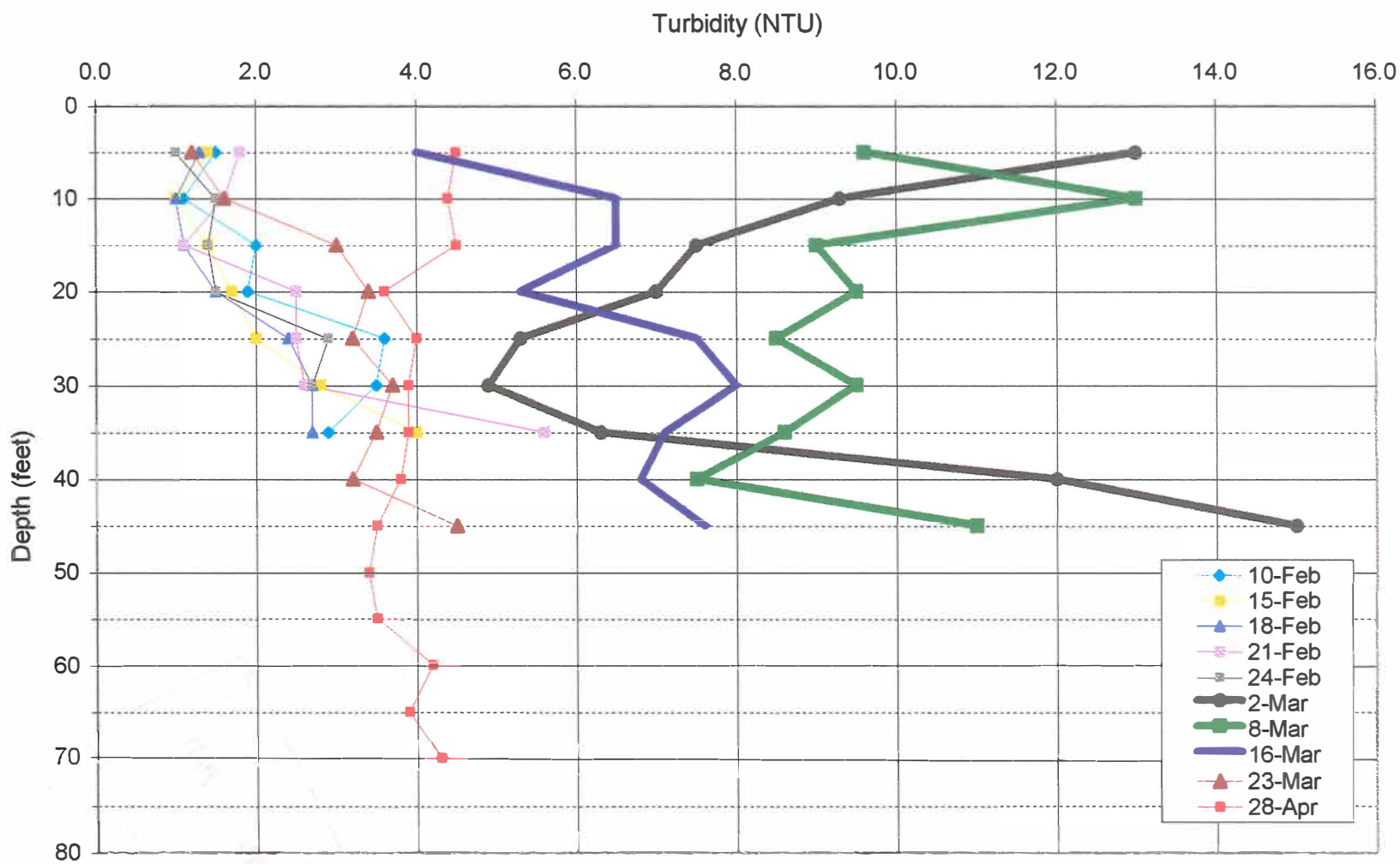


Figure 4.2-6. Turbidity profiles of Waterbury Reservoir at the East Arm, Waterbury, Vermont, winter/spring 2000.