the ASSABET RIVER report

part A | data record on water quality

DIVISION OF WATER POLLUTION CONTROL

THOMAS C. Mc. MAHON, Director

WATER RESOURCES COMMISSION

COMMONWEALTH OF MASSACHUSETTS

ASSABET RIVER STUDY 1969

PART I: DATA RECORD ON WATER QUALITY

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L. MASSACHUSETTS WATER POLLUTION CONTROL PROGRAM

HISTORICAL BACKGROUND

As early as 1884 the Massachusetts General Court recognized the governmental control was needed to safeguard the waters of the Commonwealth, thus it established a State Board of Health to examine and adivse on public health problems related to water. The control of water pollution was strengthened in 1945 when the Massachusetts Department of Public Health was established and authorized to adopt water pollution regulations.

Finally, in 1966 the General Court passed the Massachusetts Clean Waters Act which established a Division of Water Pollution Control under the Water Resources Commission. The Division was given comprehensive responsibilities, including the establishment of Water Quality Standards and classification of all waters of the Commonwealth.

The water pollution control program in the Commonwealth receives strong financial support from the Federal Water Pollution Control Act of 1956. It provided for financial aid by the Federal Government to communities constructing pollution abatement facilities. The 1966 amendments liberalized the grants program so that the Federal share of the cost of a pollution abatement facility could reach 50 percent if the State agreed to pay not less than 25 percent and had established enforceable Water Quality Standards.

WATER QUALITY STANDARDS

After public hearings in 1967 the Commonwealth established water quality standards for all its streams and coastal waters. The standards include three essential parts. They reflect the desired uses for each stretch of water. They establish critical limits of the amount of various pollutants allowed in the waters so that the desired uses may be realized. And thirdly, the standards contain a plan for the implementation and enforcement of the water quality criteria adopted.

ORGANIZATION OF THE DIVISION OF WATER POLLUTION CONTROL

The Division has four regional offices; in Boston, at the University of Massachusetts, at Merrimack College, and in Pembroke. Their function is to handle local problems and afford quick communications with cities, towns, and industries. The Division's central office in Boston consists of an administrative staff, a legal council and seven sections to administrate the broad functions of the program.

ENFORCEMENT

The Division has developed an implementation plan which established dates by which each polluter must accomplish the several steps of an abatement program. The Enforcement Section is responsible for maintaining the implementation schedules of some 550 known municipal and industrial polluters by cooperative action or through legal enforcement measures, if necessary.

CONSTRUCTION GRANTS

One of the greatest needs in the State Water Pollution Control Program is to provide adequate financial assistance to the municipalities for the construction of pollution abatement facilities. Legislation enacted concurrently with the Massachusetts Clean Waters Act included a $400 million bond issue for this purpose. The Construction Grants Section reviews engineering reports, final plans and specifications and makes grants to municipalities for developing a plan for abatement of water pollution and for financing a portion of the construction.

WATER QUALITY

Massachusetts is blessed with abundant water resources including 5,600 miles of streams, 2,000 miles of coastline, and 1,215 ponds of ten or more acres. The Water Quality Section has the responsibility for surveying, analyzing and reporting on the condition of all the Commonwealth's natural waters. The Section develops basin plans in order to effectively control water pollution. Several extensive river surveys have been conducted to obtain sufficient data to be used in mathematical models of the rivers. The models simulate the dissolved oxygen levels along the entire length of the stream to determine the necessary degree of treatment for municipalities and industries.

INDUSTRIAL WASTES

To date over 400 industries have beenofound that are discharging to the waters of the Commonwealth. The large number as well as the diversity of wastewater discharges requires critical review of engineering reports. In reviewing proposed designs, engineers of the Industrial Waste Section meet with the industries and their consulting engineers to insure installation of the most efficient pollution abatement facilities. This Section assists in conducting investigations of industries during river basins surveys and also directs the pilot plant studies for treating industrial wastes.

OIL POLLUTION

Increased concern with the detrimental effect of oil pollution on our marine resources and on recreational use of Massachusetts waters led to the passage of the Oil Pollution Control Act of 1968. The Oil Pollution Section of this Division is responsible for investigating and cleaning up oil spills and for licensing marine oil terminals and waste oil collectors. The Section also has a continuing program of research to develop and evaluate new methods for oil pollution abatement.

OPERATION AND MAINTENANCE

Supervision of the existing waste treatment facilities is an essential feature of the water pollution control program. The Operation and Maintenance Section, through plant inspections and the review of monthly operating records, endeavors to insure that plant efficiency does not suffer as a result of inadequate funds, poor operation, or general neglect. The Section works toward developing an awareness on the part of those operating treatment facilities of the importance of maintaining adequate treatment in order to ultimately enhance water quality

RESEARCH AND TRAINING

The Massachusetts Clean Waters Act authorized $10 million over a ten year period from the $150 million bond fund for a Research and Demonstration Program. The overall program is intended to provide direction in developing more efficient wastewater treatment systems. Most studies are conducted by consulting engineering firms or research institutions. Training activities refer primarily to the training of wastewater treatment operators but also include in-service training of Division Personnel and a scholarship intern program for engineering students.

II. MEASURES OF WATER POLLUTION

The following discussion should assist in interpreting the data on pollution in this report. A polluted waterbody can be used for only limited activities, contains an imbalance in the normal ratio of aquatic plants to animals, and is generally offensive to the senses. Since such characteristics cannot be measured easily, chemical and biological parameters are used to quantitate the level of pollution. The most direct measures of pollution are dissolved oxygen, biochemical oxidation demand (BOD), suspended solids and coliform bacteria of fecal origin. Nutrients such as phosphates and nitrates stimulate excessive plant growth and thus indicate the potential for nuisance condition. Metals such as cyanide, copper and chromium are lethal at low concentration to fish and other organisms and may create sterile conditions in a stream that would otherwise be productive.

Although natural waters can vary widely in composition, the following table indicates the range of substances in unpolluted reaches of rivers in Massachusetts. These figures may serve as a reference to evaluate the levels of pollution reported from the enclosed study.

PARAMETER	HOUSATONIC RIVER	CHARLES RIVER	TEN-MILE RIVER
B.O.D. in mg/l	1.4	0.5	2
Dissolved Oxygen in mg/l	5-10	4-8	5-9
Suspended Solids in mg/l	3	1	7
Fecal Coliform per 100 ml	290	430	215
Total Phosphates in mg/l	0.13	0.03	0.10
Ammonia Nitrogen in mg/l	0.09	0.01	0.04
Nitrate Nitrogen in mg/l	0.0	0.0	0.5
Nitrite Nitrogen in mg/l	0.00	0.000	0.006

III. ASSABET RIVER STUDY 1969

This report lists data obtained on three water quality surveys of the Assabet River in central Massachusetts. The purpose of the surveys was to determine the river conditions for comparision with water quality classification assigned in 1967. In addition to the survey on water quality, a study was made in 1969 of pollution sources on the river (Part B). A subsequent report, Part C, contains an analysis and graphical presentation of the important water quality parameters. Periodic summary reports on the Assabet and other rivers present the major findings of these surveys. Original data is available from the Division, filed by river basin.

The survey was conducted on August 18 through 29 and October 9 through 15 with river sampling being conducted on August 19, 21 October 21 & 23. It covered the 32 miles of the Assabet River from the headwaters in Westboro to the confluence of the Assabet and Sudbury Rivers in Concord. The Assabet River drainage basin has an area of approximately 177 square miles and includes all or parts of the following 20 towns in Worcester and Middlesex Counties in central Massachusetts; Acton, Berlin, Bolton, Boxborough, Boylston, Carlisle, Clinton, Concord, Grafton, Harvard, Hudson, Littleton, Marlborough, Maynard, Northborough, Shrewsbury, Stow, Sudbury, Westborough and Westford. The population of the river basin is approximately 150,000.

The samples were collected by personnel of the Division of Water Pollution Control of the Massachusetts Water Resources Commission and analyzed at the Lawrence Experiment Station of the Massachusetts Department of Public Health. Procedures followed in collection and analysis of samples are described in "Standard Methods for Water and Wastewater Analysis of the APHA" 12th Edition, 1965, New York.

This report also includes data from a survey conducted in 1968 by the Division of Water Pollution Control and from a survey conducted in 1965 by the Department of Public Health. Data was tabulated and verified by engineers of the Division of Water Pollution Control. The format of the tables gives a comprehensive picture of water quality in the Assabet River for the summer and fall of 1969.

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TABLE 1

DEFINITION OF RIVER SAMPLING STATIONS

ASSABET RIVER STUDY 1969

STATION NO.	LOCATION	*RIVER MILES
1	Outlet of Hocomoco Pond, Westboro	32.1, 0.4
2	Maynard St, Westboro	32.7
3	Rt. 9, Westboro	31.4
4	Rt. 135, Northboro - Westboro Line	30.3
5	Rt. 20, Northboro - above dam	27.7
6	Allen Road, Northboro	26.7
7	Boundary Street, Marlboro - Northboro Line	25.1
8	Chapin Road, Hudson	20.7
9	Rt. 85, Hudson - above dam	19.4
10	Cox Street, Hudson	17.4
11	Rt. 62, Stow - above dam	15.4
12	Outlet Lake Boone - Stow	12.6
13	Rt. 62 and Rt. 117, Maynard - above dam	9.2
14	Rt. 27, Maynard	7.9
15	High Street, Acton - above dam	6.9
16	Rt. 62, West Concord	5.0
17	Off Lowell Road at Darkins Brook, Concord	0.8

* River Mile 0.0 is measured from the confluence of the Assabet and Sudbury Rivers.

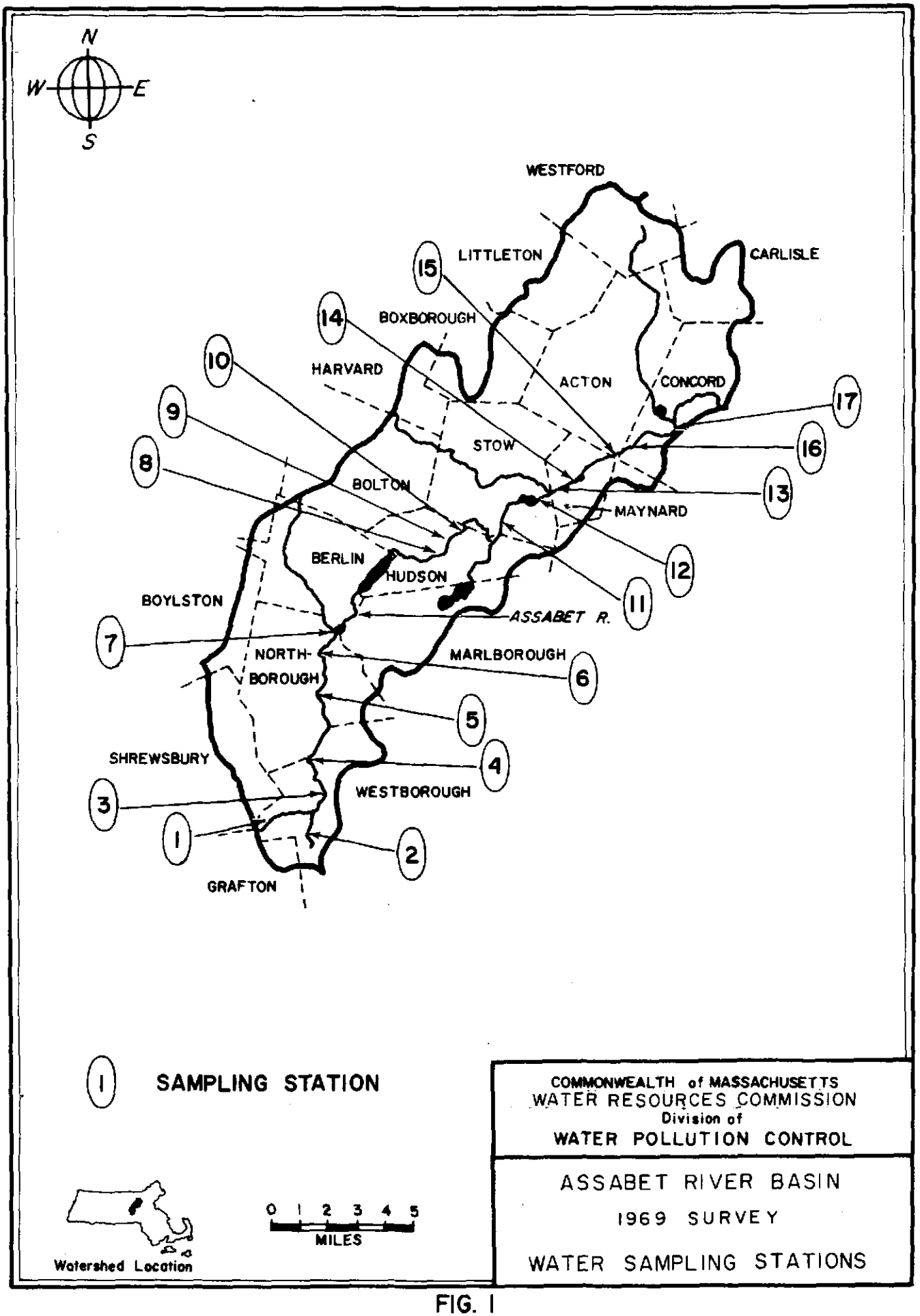
N
W
E
S
WESTFORD
LITTLETON
CARLISLE
BOXBOROUGH
HARVARD
ACTON
CONCORD
STOW
BOLTON
MAYNARD
BERLIN
HUDSON
BOYLSTON
ASSABET R.
NORTH-
BOROUGH
MARLBOROUGH
SHREWSBURY
WESTBOROUGH
GRAFTON
1 SAMPLING STATION
Watershed Location
0 1 2 3 4 5
MILES
COMMONWEALTH of MASSACHUSETTS
WATER RESOURCES COMMISSION
Division of
WATER POLLUTION CONTROL
ASSABET RIVER BASIN
1969 SURVEY
WATER SAMPLING STATIONS

FIG. 1

PG11

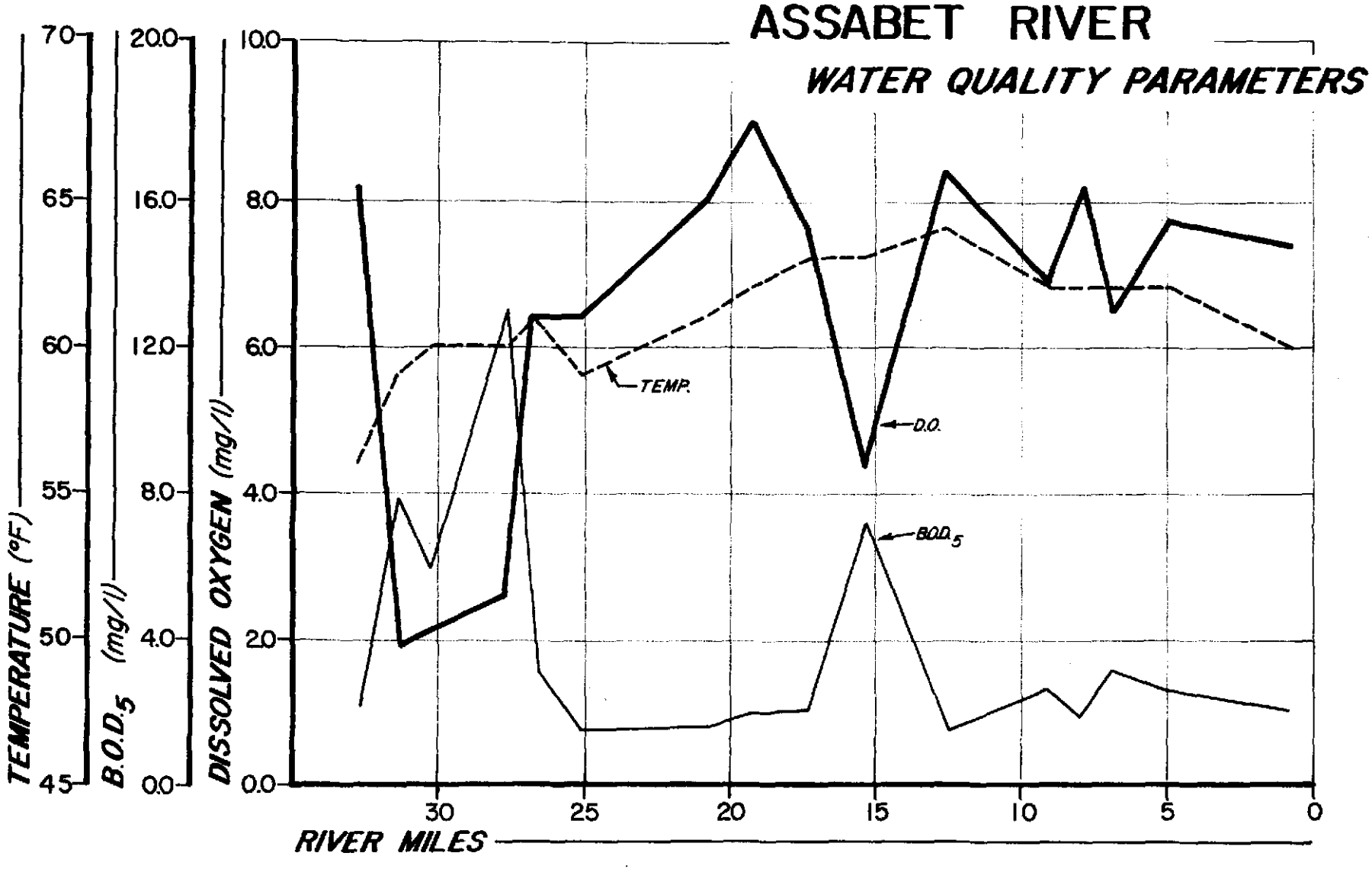
ASSABET RIVER
WATER QUALITY PARAMETERS
TEMPERATURE (°F)
B.O.D.5 (mg/l)
DISSOLVED OXYGEN (mg/l)
70
65
60
55
50
45
20.0
16.0
12.0
8.0
4.0
0.0
10.0
8.0
6.0
4.0
2.0
0.0
TEMP.
D.O.
B.O.D.5
30
25
20
15
10
5
0
RIVER MILES

FIG 2
PG 12

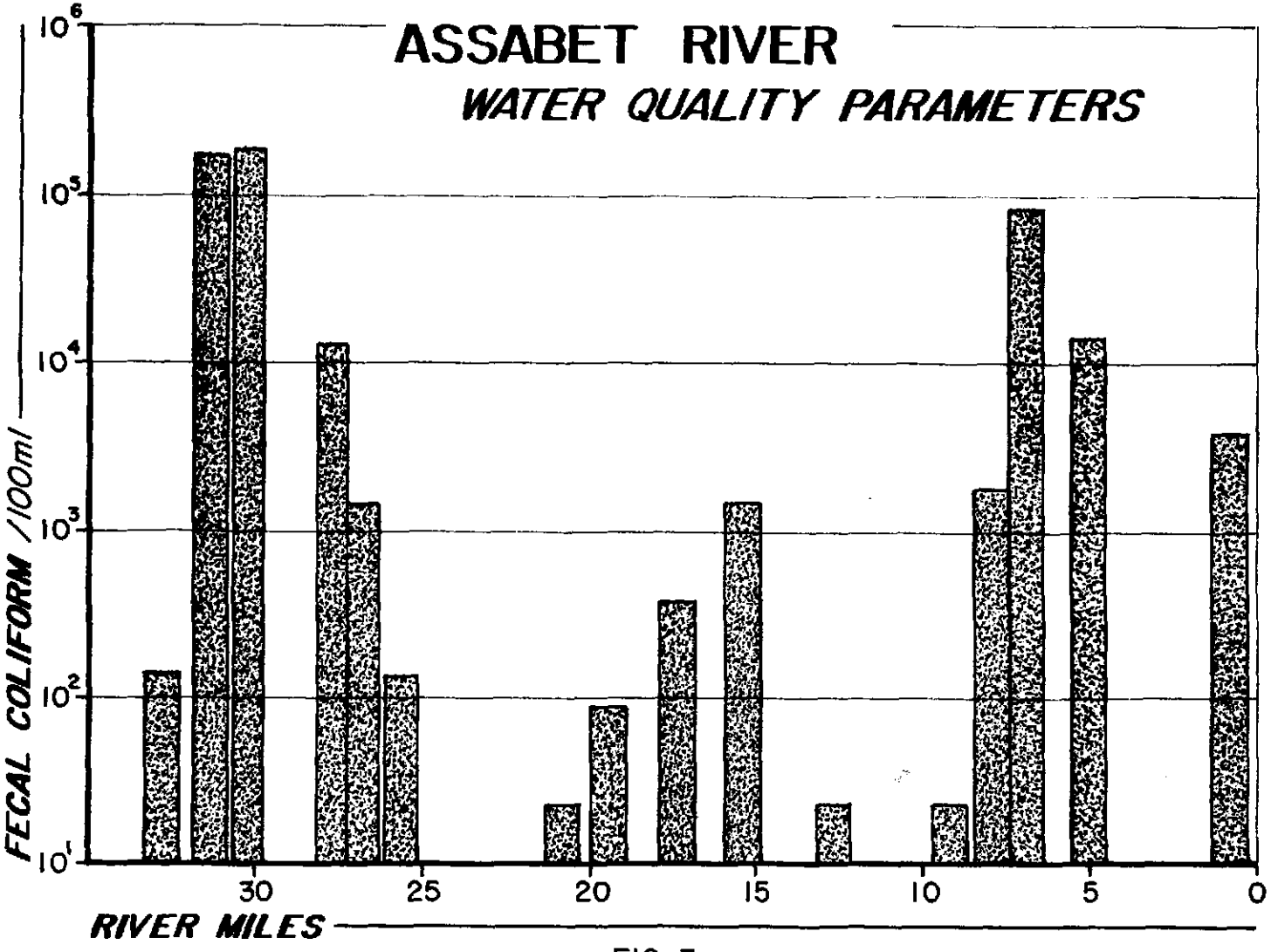
ASSABET RIVER
WATER QUALITY PARAMETERS
FECAL COLIFORM /100ml
10^6
10^5
10^4
10^3
10^2
10^1
30
25
20
15
10
5
0
RIVER MILES

FIG 3

PG13

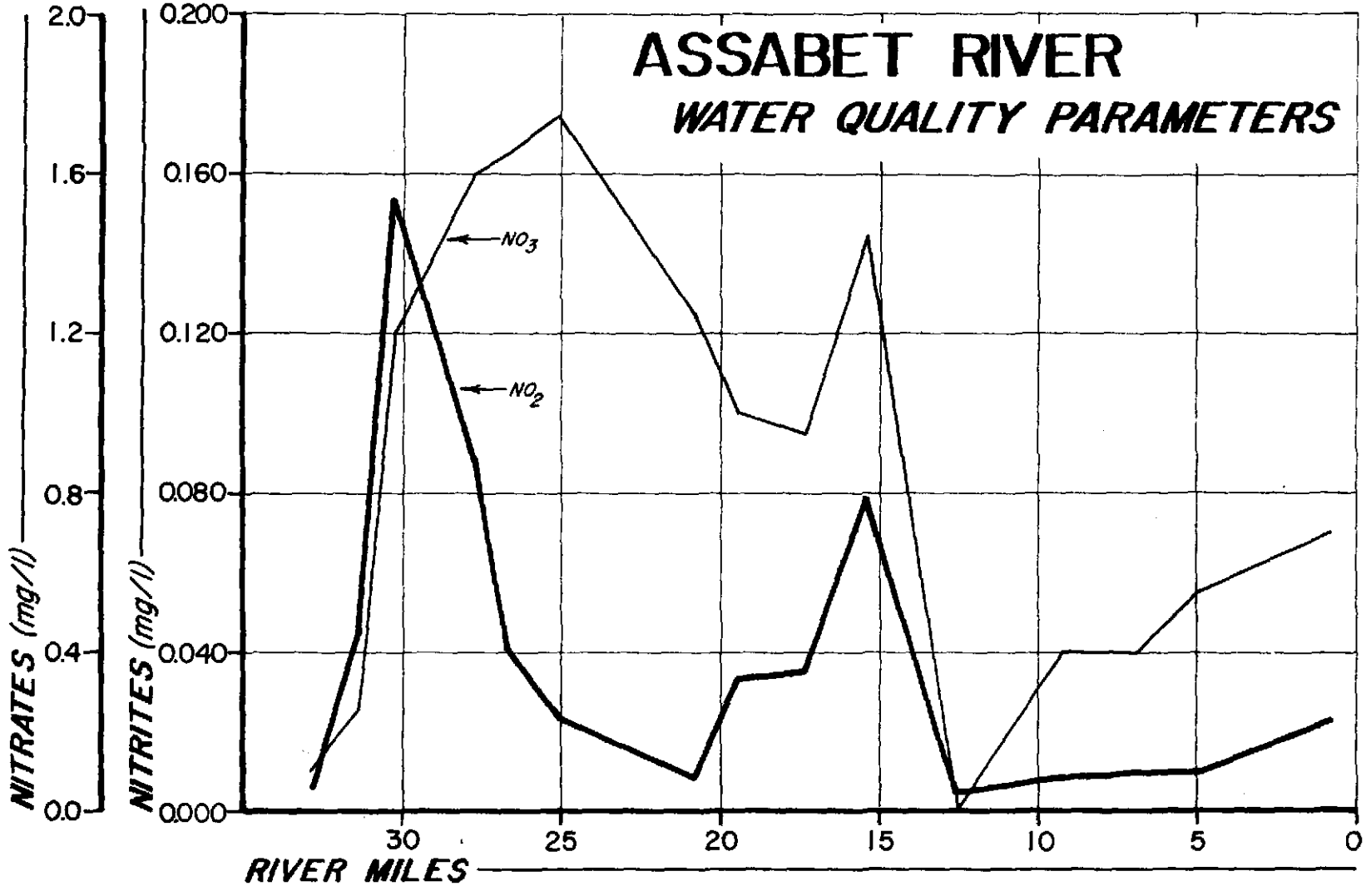
ASSABET RIVER
WATER QUALITY PARAMETERS
NITRATES (mg/l)
NITRITES (mg/l)
2.0
1.6
1.2
0.8
0.4
0.0
0.200
0.160
0.120
0.080
0.040
0.000
NO3
NO2
30
25
20
15
10
5
0
RIVER MILES

FIG 4

PG14

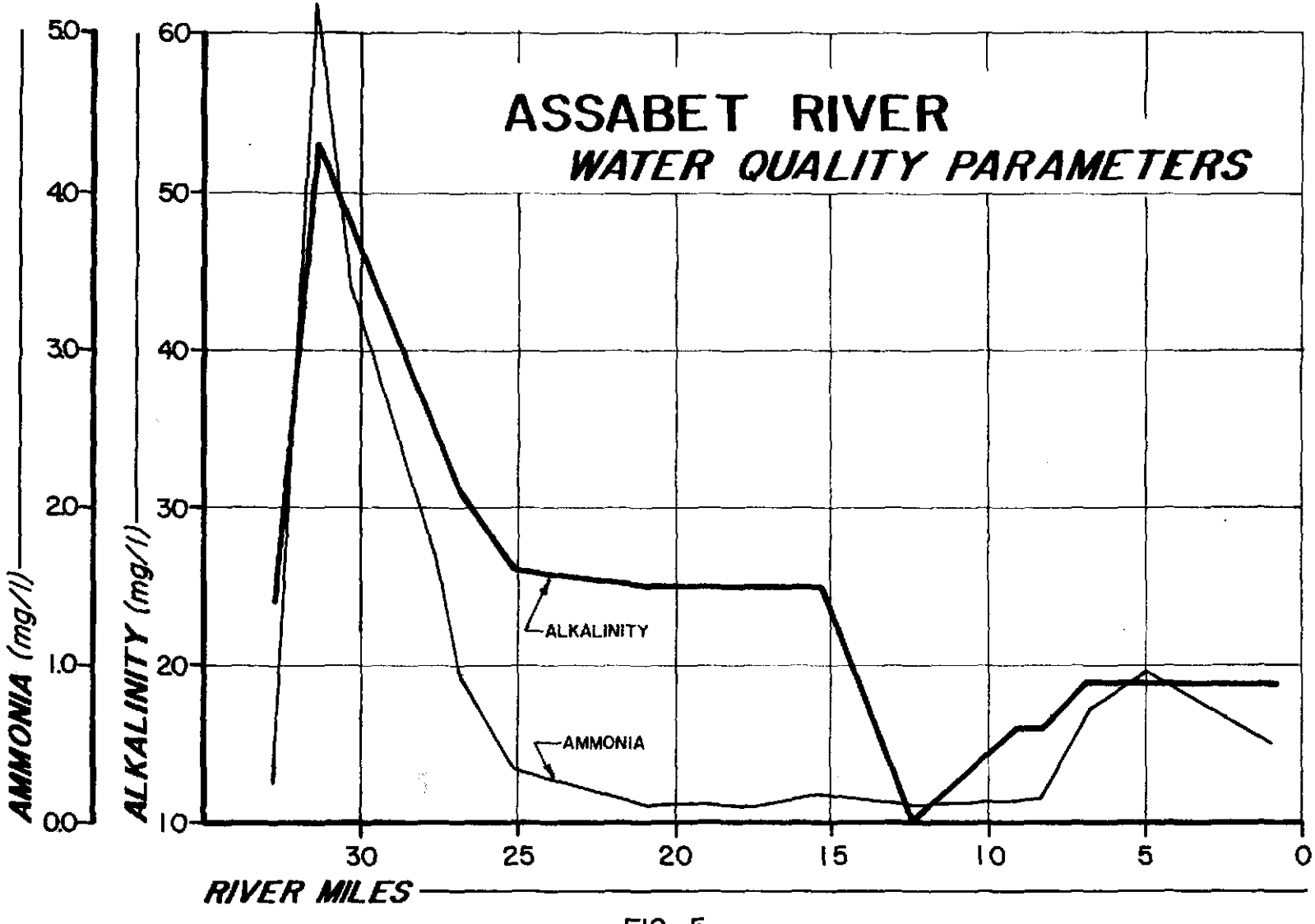
ASSABET RIVER
WATER QUALITY PARAMETERS
AMMONIA (mg/l)
ALKALINITY (mg/l)
RIVER MILES
ALKALINITY
AMMONIA
5.0
4.0
3.0
2.0
1.0
0.0
60
50
40
30
20
10
30
25
20
15
10
5
0

FIG 5

PG15

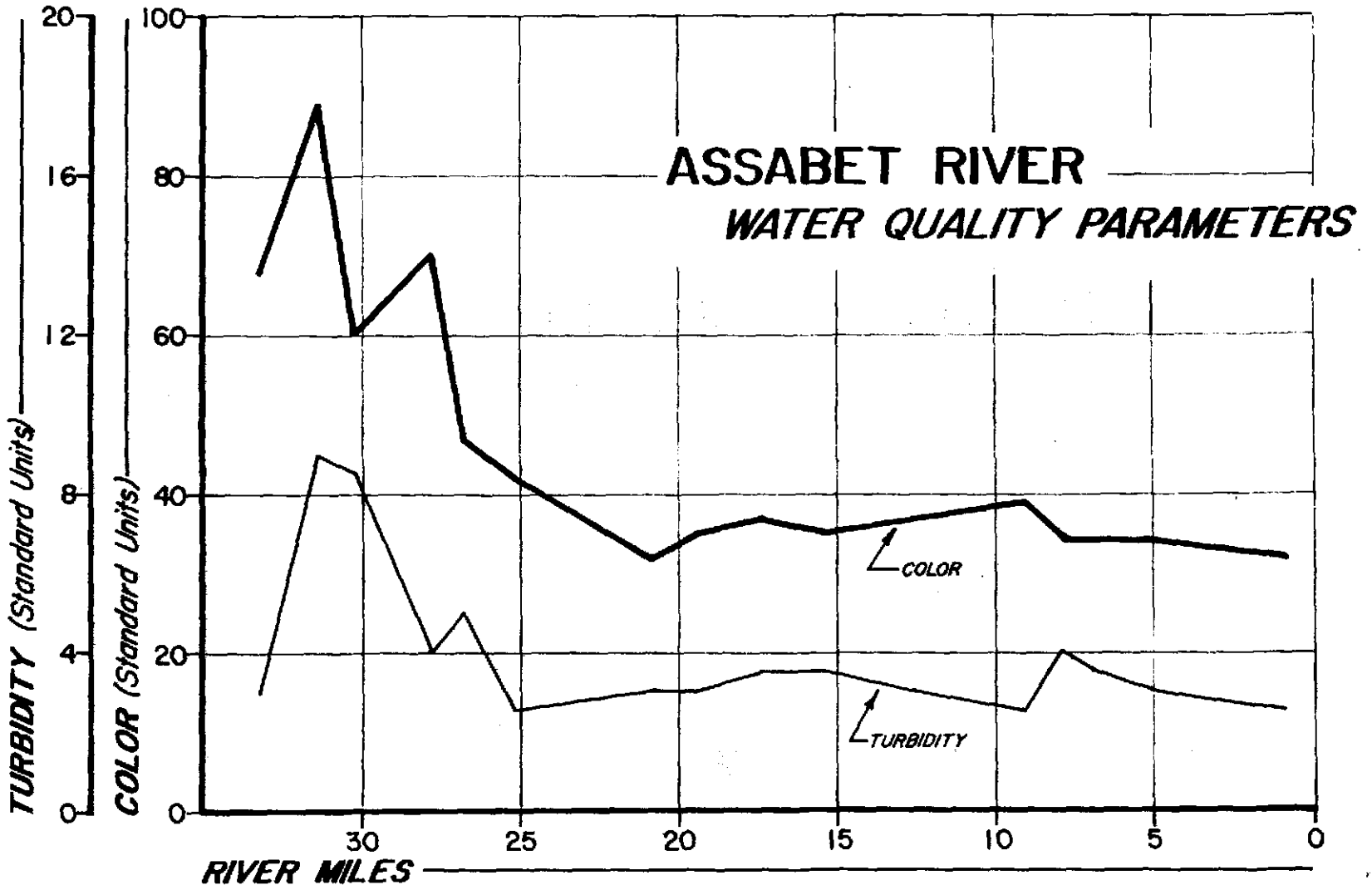
ASSABET RIVER
WATER QUALITY PARAMETERS
TURBIDITY (Standard Units)
COLOR (Standard Units)
RIVER MILES
COLOR
TURBIDITY
20
16
12
8
4
0
100
80
60
40
20
0
30
25
20
15
10
5
0

FIG 6

PG16

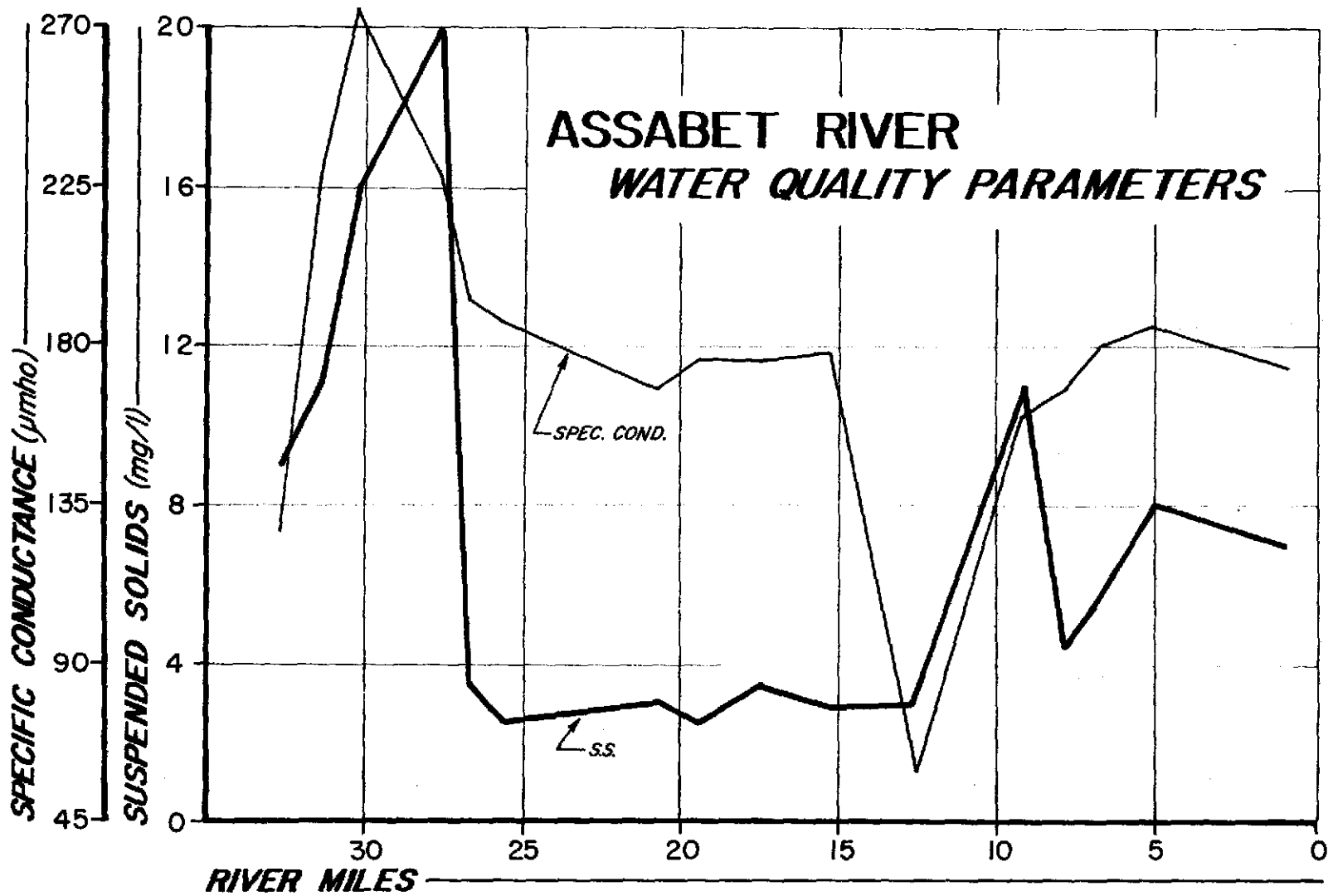
ASSABET RIVER
WATER QUALITY PARAMETERS
SPECIFIC CONDUCTANCE (µmho)
SUSPENDED SOLIDS (mg/l)
RIVER MILES
SPEC. COND.
S.S.
270
225
180
135
90
45
20
16
12
8
4
0
30
25
20
15
10
5
0

FIG 7

PG17

TABLE 2

SUMMARY OF FIELD DATA - STATION 1

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp. °F MAX	Temp. °F MIN	Temp. °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0300	8-19	70	3.8	8-21	68	4.7	10-21	54	6.5	10-23	44	8.2	70	44	59	8.2	3.8	5.8
0900		74	3.9		65	1.7		53	6.3		38	10.7	74	38	58	10.7	1.7	5.7
1500		79	5.9		74	6.2		59	8.9		46	10.3	79	42	64	10.3	5.9	7.8
2100		74	4.8		71	5.9		56	5.7		44	10.3	74	40	60	10.3	4.8	6.7

ECTION B: COMPOSITE OF SAMPLES FROM 3, 9, 15 AND 21 HOURS

ate	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alka-linity mg/l	Susp. solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb. Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
0/21	2.0	2.8	3.2	4.4	5.4	8.0	6.6	26	10	.85	.15	.000	0.1	.13	55	5	105	430	91
0/23	*1.0	1.2	1.8	2.6	4.6	5.4	6.8	27	1	.60	.14	..010	0.0	.07	38	2	137	11000	430

BOD_3
mg/l

TABLE 3

SUMMARY OF FIELD DATA - STATION 2

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp. °F MAX.	MIN.	AVG.	D.O. mg/l MAX.	MIN.	AVG.
0300	8-19	69	6.1	8-21	58	7.3	10-21	54	7.4	10-23	40	9.9	69	40	55	9.9	6.1	7.7
0900		68	6.9		56	8.0		51	7.5		42	8.3	68	42	54	8.3	6.9	7.7
1500		72	7.4		64	8.5		60	9.3		42	10.8	72	42	60	10.8	7.4	9.0
2100		68	6.5		60	7.6		57	8.8		40	10.3	68	40	56	10.3	6.5	8.3

TION B: COMPOSITE OF SAMPLES FROM 3, 9, 15 AND 21 HOURS

e	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alka-linity mg/l	Susp. solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100ml MPN	Fecal MPN
'21	1.6	2.6	3.0	4.2	5.4	6.8	6.9	24	5	.55	.28	.000	0.1	.07	60	5	95	4600	150
'23	*1.6	1.8	2.2	3.0	3.2	7.6	6.9	23	13	.90	.20	.010	0.1	.10	75	1	160	930	91

BOD_3
mg/l

TABLE 4

SUMMARY OF FIELD DATA - STATION 3

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp.°F MAX	Temp.°F MIN	Temp.°F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0300	8-19	70	0.8	8-21	62	0.4	10-21	55	2.0	10-23	43	2.8	70	43	58	2.8	0.4	1.5
0900		71	0.4		60	0.4		53	2.4		41	4.1	71	41	56	4.1	0.4	1.8
1500		75	1.4		66	1.7		60	2.3		44	4.8	75	44	61	4.8	1.4	2.6
2100		72	0.8		64	0.6		58	1.6		46	3.8	72	46	60	3.8	0.6	1.7

ECTION B: COMPOSITE OF SAMPLES FROM 3, 9, 15 AND 21 HOURS

ate	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alka-linity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb. Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
0/21	5.0	8.2	9.6	13	>39	>39	6.7	55	13	2.0	5.1	.070	0.4	2.7	100	16	190	240000	240000
0/23	*5.8	7.4	8.4	11	25	>42	6.7	50	8	1.2	5.3	.020	0.1	1.6	78	2	265	460000	240000

BOD_3
g/l

TABLE 5

SUMMARY OF FIELD DATA - STATION 4

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp. °F MAX	Temp. °F MIN	Temp. °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0300	8-19	71	3.4	8-21	64	1.8	10-21	55	0.9	10-23	44	2.1	71	44	59	3.4	0.9	2.1
0900		72	1.2		68	2.4		53	1.0		42	2.4	72	42	59	2.4	1.0	1.8
1500		73	2.2		66	3.0		59	1.4		45	3.4	73	45	61	3.4	1.4	2.5
2100		72	1.2		64	1.5		56	1.3		44	3.7	72	44	59	3.7	1.2	1.9

SECTION B: COMPOSITE OF SAMPLES FROM 3, 9, 15 AND 21 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
10-21	2.8	7.2	9.2	12.	21.	28.	6.7	48.	24.	3.5	4.3	.190	1.2	3.7	65	14	250	$1.5X10^6$	460000
10-23	*3.8	4.8	7.4	11	38	41	6.8	47.	7	1.4	2.5	.118	1.1	2.4	55	3	300	460000	93000

* BOD_3 mg/l

TABLE 6

SUMMARY OF FIELD DATA - STATION 5

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp. °F MAX	Temp. °F MIN	Temp. °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0400	8-19	72	1.4	8-21	65	2.6	10-21	54	2.7	10-23	44	1.6	72	44	59	2.7	1.4	2.1
0900		73	1.5		67	2.0		53	1.9		43	2.1	73	43	59	2.1	1.5	1.9
1600		73	4.1		67	4.4		58	2.6		44	3.1	73	44	61	4.4	2.6	3.6
2100		72	2.7		63	2.8		56	1.3		44	3.5	72	44	59	3.5	1.3	2.6

ECTION B: COMPOSITE OF SAMPLES FROM 4, 9, 16 AND 21 HOURS

ate	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alka-linity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Fecal MPN
.0-21	3.2	11	16	26	30	>30.	7.0	43	13	2.2	2.1	.078	2.0	3.1	60	18	180	24000	24000
.0-23	8.0	14	16	18	35	>41.	6.9	41	27	1.8	1.3	.100	1.2	2.3	80	8	275	46000	2000

* BOD_3 mg/l

TABLE 7

SUMMARY OF FIELD DATA - STATION 6

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0400	8-19	73	6.9	8-21	68	4.7	10-21	53	6.6	10-23	48	4.5	73	48	61	6.9	4.5	5.7
0900		74	6.4		68	8.6		52	5.8		46	4.6	74	46	61	8.6	4.6	6.4
1600		76	7.5		70	6.8		56	6.4		44	5.2	76	44	62	7.5	5.2	6.5
2100		73	6.4		64	8.2		57	6.5		46	6.6	73	46	60	8.2	6.4	6.9

SECTION B: COMPOSITE OF SAMPLES FROM 4, 9, 16 AND 21 HOURS

Date	BOD_2 mg/l	BOD_3 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Fecal MPN
10-21	1.6	3.4	5.2	10.	11.	12.	6.9	28.	3.	1.3	.83	.040	2.0	2.0	55.	6.	145.	9300	930
10-23*	1.8	2.8	6.4	11.	13.	14.	6.9	34.	4.	1.0	1.0	.042	1.3	2.0	38.	2.	240.	2400	2400

* BOD_3 mg/l

TABLE 8

SUMMARY OF FIELD DATA - STATION 7

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp. °F MAX	Temp. °F MIN	Temp. °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0400	8-19	70	2.4	8-21	66	2.8	10-21	53	4.4	10-23	44	6.1	70	44	58	6.1	2.4	3.9
0900		75	4.0		62	5.6		52	5.2		42	7.5	75	42	58	7.5	4.0	5.6
1600		75	9.0		68	11.0		57	11.1		44	11.9	75	44	61	11.9	9.0	10.8
2200		72	3.5		65	5.4		57	5.3		42	7.9	72	42	59	7.9	3.5	5.5

CTION B: COMPOSITE OF SAMPLES FROM 4, 9, 16 AND 22 HOURS

te	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alka-linity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Fecal MPN
-21	0.6	1.6	3.4	5.0	6.2	7.6	7.0	25.	1.	.31	.15	.016	2.0	1.5	45.	8.	140.	930	230
-23	*1.2	1.4	2.6	5.8	8.0	9.2	6.9	27.	4.	.92	.55	.030	1.5	1.5	38.	2.	235.	210	36

OD_3

g/l

TABLE 9

SUMMARY OF FIELD DATA - STATION 8

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0400	8-19	74	4.9	8-21	68	6.0	10-21	53	10.2	10-23	45	6.7	74	45	60	10.2	4.9	7.0
1000		74	4.9		68	4.9		52	9.0		44	7.9	74	44	60	9.0	4.9	6.8
1600		76	8.9		70	8.6		58	10.5		48	9.9	76	48	63	10.5	8.6	9.5
2200		74	7.1		66	8.0		58	10.4		46	9.5	74	46	61	10.4	7.1	8.8

SECTION B: COMPOSITE OF SAMPLES FROM 4, 10 16 AND 22 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. Nitrogen mg/l	Amm. Nitrogen mg/l	Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Fecal MPN
10-21	1.2	1.6	2.4	3.2	5.4	7.6	7.0	25.	3.	2.7	.13	.005	1.3	.90	35.	3.	130.	210.	36.
10-23*	1.2	1.5	1.8	2.6	5.4	6.4	6.7	25.	3.	.83	.10	.012	1.2	1.0	28.	2.	205.	91.	36.

* BOD_3 mg/l

TABLE 10

SUMMARY OF FIELD DATA - STATION 9

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERAUTRE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0400	8-19	72	7.8	8-21	70	8.4	10-21	53	9.9	10-23	47	8.8	72	47	61	9.9	7.8	8.7
1000		76	8.3		70	8.5		52	9.3		46	8.3	76	46	61	9.3	8.3	8.6
1600		76	9.3		72	10.1		57	8.6		48	8.7	76	48	63	10.1	8.6	9.2
2200		74	9.0		69	9.9		54	10.1		46	9.8	74	46	61	10.1	9.0	9.7

SECTION B: COMPOSITE OF SAMPLES FROM 4, 10, 16 AND 22 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec Cond Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
10-21	1.2	2.4	2.8	4.0	4.6	8.0	7.1	25	2	0.89	.11	.054	1.1	.73	35	3	140	4600	150
10-23	*1.0	1.6	2.4	2.6	5.6	6.8	6.9	25	3	1.3	.12	.012	0.9	.70	35	3	210	750	36

* BOD_3 mg/l

TABLE 11

SUMMARY OF FIELD DATA - STATION 10

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0400	8/19	75	3.5	8-21	70	4.7	10/21	56	6.5	10-23	46	7.9	75	46	62	7.9	3.5	5.7
1000		75	3.7		70	4.7		54	6.4		44	9.0	75	44	61	9.0	3.7	6.0
1600		79	8.6		74	9.3		58	10.3		46	11.9	79	46	64	11.9	8.6	10.0
2200		76	7.0		71	8.1		56	9.2		48	10.3	76	48	63	10.3	7.0	8.7

ECTION B: COMPOSITE OF SAMPLES FROM 4, 10, 16 AND 22 HOURS

ate	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alka-linity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec Cond. Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
0-21	1.2	2.6	3.6	4.0	6.0	9.4	6.8	23	4	1.3	.10	.048	1.0	0.50	40	4	140	46000	430
0-23	*1.2	1.6	1.7	2.2	5.2	13	6.8	26	3	0.64	.10	.022	0.9	0.6	33	2	210	4600	750

BOD_3
mg/l

TABLE 12

SUMMARY OF FIELD DATA - STATION 11

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp. °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp. °F MAX	Temp. °F MIN	Temp. °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0500	8-19	76	1.1	8-21	70	3.4	10-21	54	6.4	10-23	48	4.0	76	48	62	6.4	1.1	3.7
1000		76	2.3		70	2.9		54	4.9		46	4.4	76	46	62	4.9	2.3	3.6
1700		76	4.4		71	4.7		60	6.2		50	5.5	76	50	64	6.2	4.4	5.2
2200		74	4.5		69	4.6		58	5.7		46	5.5	74	46	62	5.7	4.5	5.1

CTION B: COMPOSITE OF SAMPLES FROM 5, 10, 17 AND 22 HOURS

te	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
-21	6.2	12	17	24	30	>30	6.8	25	56	4.4	.25	.080	1.5	2.0	35	5	135	24000	1500
-23*	1.2	2.6	4.8	7.2	8.8	9.6	6.7	25	3	.45	.10	.078	1.3	1.0	35	2	220	46000	2300

BOD_3
mg/l

TABLE 13

SUMMARY OF FIELD DATA - STATION 12

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	TEMP °F MAX	TEMP °F MIN	TEMP °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0500	8-19	76	7.5	8-21	70	7.7	10-21	56	8.5	10-23	52	8.9	76	52	64	8.9	7.5	8.2
1000		76	7.9		70	8.2		56	8.6		53	9.1	76	53	64	9.1	7.9	8.5
1700		76	8.0		74	8.1		60	8.7		50	9.3	76	50	65	9.3	8.0	8.5
2300		75	7.9		73	7.8		59	8.7		50	8.7	75	50	64	8.7	7.8	8.3

SECTION B: COMPOSITE OF SAMPLES FROM 5, 10, 17, 23 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
10-21	0.6	1.8	2.0	3.4	5.6	6.6	6.7	10	2	.76	.07	.000	0.0	.15	20	6	45	36	<36
10-23	*0.8	1.4	1.6	2.8	4.8	6.8	6.6	10	4	.40	.15	.008	0.0	.13	10	1	73	36	<36

* BOD_3 mg/l

TABLE 14

SUMMARY OF FIELD DATA - STATION 13

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0500	8-19	74	5.0	8-21	70	3.6	10-21	53	5.2	10-23	47	7.9	74	47	61	7.9	3.6	5.4
1000		75	5.8		70	4.0		52	8.5		47	8.2	75	47	61	8.5	4.0	6.6
1700		77	7.0		74	8.6		57	9.9		50	9.5	77	50	65	9.9	7.0	8.6
2300		74	4.9		69	4.7		57	9.1		46	9.1	74	46	62	9.1	4.7	7.0

SECTION B: COMPOSITE OF SAMPLES FROM 5, 10, 17 AND 23 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrate mg/l	Phosphorous mg/l	Color Units	Turb Units	Spec. Cond. Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
10-21	2.2	4.4	5.0	6.4	8.0	10	6.7	15	20	1.7	.15	.005	0.4	.43	50	3	125	230	36
10/23	*0.6	1.0	1.4	2.0	4.4	5.0	6.6	16	1	.45	.10	.010	0.4	.33	28	2	195	230	<36

* BOD_3 mg/l

TABLE 15

SUMMARY OF FIELD DATA - STATION 14

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0500	8-19	74	5.4	8-21	68	5.8	10-21	52	8.3	10-23	46	9.5	74	46	60	9.5	5.4	7.3
1000		76	7.4		68	8.0		53	9.8		46	10.7	76	46	61	10.7	7.4	9.0
1700		76	7.2		72	8.5		58	9.5		50	11.1	76	50	64	11.1	7.2	9.1
2300		72	5.1		68	5.7		56	8.4		46	9.4	72	46	61	9.4	5.1	7.2

SECTION B: COMPOSITE OF SAMPLES FROM 5, 10, 17 AND 23 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. Nitrogen mg/l	Amm. Nitrogen mg/l	Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond Units	Coliform Bacteria per 100 ml MPN	Fecal MPN
10-21	1.6	2.4	3.0	4.2	4.4	5.0	6.6	15	7	1.3	.13	.005	0.4	.37	40	6	140	4600	2400
10-23	*1.0	1.4	1.6	1.8	4.4	5.8	6.5	16	2	.57	.17	.010	0.4	.40	28	2	195	4600	2400

*BOD_3 mg/l

TABLE 16

SUMMARY OF FIELD DATA - STATION 15

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0500	8-19	75	5.6	8-21	70	4.2	10-21	54	8.4	10-23	47	7.5	75	47	62	8.4	4.2	6.4
1100		75	5.9		70	4.3		54	7.8		47	7.2	75	47	62	7.8	4.3	6.3
1700		76	4.6		73	6.4		59	7.6		48	8.6	76	48	64	8.6	4.6	6.8
2300		74	4.6		69	5.3		50	7.5		48	8.2	74	48	60	8.2	4.6	6.4

SECTION B: COMPOSITE OF SAMPLES FROM 5, 11, 17 AND 23 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. Nitrogen mg/l	Amm. Nitrogen mg/l	Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond Units	Coliform Bacteria per 100 ml MPN	Fecal MPN
10-21	1.6	3.6	4.2	5.6	6.8	7.8	6.6	18	7	1.5	.60	.006	0.4	.67	40	6	150	$1.1X10^6$	93000
10-23	1.8*	2.6	3.2	4.8	6.0	8.6	6.6	20	4	.74	.83	.012	0.4	.70	28	1	210	460000	93000

* BOD_3 mg/l

TABLE 17

SUMMARY OF FIELD DATA - STATION 16

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0500	8-19	73	3.8	8-21	68	3.6	10-21	54	6.5	10-23	44	8.5	73	44	60	8.5	3.6	5.6
1100		78	8.8		70	9.0		54	8.7		44	10.0	78	44	62	10.0	8.7	9.1
1700		78	9.7		75	11.7		59	9.5		50	10.5	78	50	66	11.7	9.5	10.4
2300		71	3.3		66	4.3		52	7.0		44	9.2	71	44	58	9.2	3.3	6.0

SECTION B: COMPOSITE OF SAMPLES FROM 5, 11, 17 AND 23 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Org. Nitrogen mg/l	Amm. Nitrogen mg/l	Nitrite mg/l	Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond Units	Coliform Bacteria per 100 ml MPN	Fecal MPN
10-21	1.8	2.8	3.6	8.2	10	12	6.9	19	7	1.5	.70	.009	0.5	.63	40	4	140	460000	23000
10-23	*2.0	2.4	3.2	4.8	8.0	13	6.5	18	9	1.0	1.2	.012	0.6	.70	28	2	230	240000	9300

* BOD_3 mg/l

TABLE 18

SUMMARY OF FIELD DATA - STATION 17

ASSABET RIVER STUDY OF 1969

SECTION A: TEMPERATURE AND DISSOLVED OXYGEN

Mean Time	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Date	Temp °F	D.O. mg/l	Temp °F MAX	Temp °F MIN	Temp °F AVG	D.O. mg/l MAX	D.O. mg/l MIN	D.O. mg/l AVG
0600	8-19	75	3.3	8-21	—	4.4	10-21	55	6.3	10-23	45	7.6	75	45	58	7.6	3.3	5.4
1100		76	5.1		68	5.5		54	6.8		43	8.8	76	43	60	8.8	5.1	6.6
1800		76	8.7		71	9.3		59	9.0		46	10.3	76	46	63	10.3	8.7	9.3
2400		72	6.8		67	7.6		58	8.4		44	10.0	72	44	60	10.0	6.8	8.2

SECTION B: COMPOSITE OF SAMPLES FROM 6, 11, 18 AND 24 HOURS

Date	BOD_2 mg/l	BOD_5 mg/l	BOD_7 mg/l	BOD_{10} mg/l	BOD_{15} mg/l	BOD_{20} mg/l	pH	Alkalinity mg/l	Susp. Solids mg/l	Nitrogen Org. mg/l	Nitrogen Amm. mg/l	Nitrogen Nitrite mg/l	Nitrogen Nitrate mg/l	Total Phosphorous mg/l	Color Units	Turb Units	Spec. Cond Units	Coliform Bacteria per 100 ml MPN	Coliform Bacteria per 100 ml Fecal MPN
10-21	1.6	2.6	3.6	4.0	4.6	8.0	7.0	19	1	1.0	.60	.013	0.7	.53	35	4	135	110000	7500
10-23	* 1.0	1.4	2.4	3.8	7.8	8.0	6.8	19	13	0.7	0.4	.032	0.7	.40	28	1	215	110000	4300

* BOD_3 mg/l

TABLE 19

SUMMARY OF BIOLOGICAL DATA

ASSABET RIVER STUDY OF 1969

STATION	ALGAE (a.s.u.)*	PREDOMINANT FORM	TOTAL AMORPHOUS MATTER STANDARD UNITS PER CC
1A	50	Diatoms	1000
2A	100	Green	900
3A	1090	Rotifers and Green	1300
4A	25	Diatoms	2000
5A	10000	Diatoms	1000
6A	500	Diatoms	1000
7A	50	Diatoms	1000
8A	265	Diatoms	900
9A	125	Diatoms	850
10A	500	Diatoms	600
11A	10000	Diatoms	1200
12A	1200	Diatoms	1200
13A	3000	Diatoms	4000
14A	1000	Diatoms	1000
15A	500	Diatoms	500
16A	500	Diatoms	1250
17A	250	Diatoms	700

*Areal Standard Units

TABLE 20

SUMMARY OF TIME OF TRAVEL AND FLOW MEASUREMENT

ASSABET RIVER STUDY OF 1969

TIME OF TRAVEL DATA

AUGUST 18 - 29, 1969

STATION		ELAPSED TIME	
3A	4A	14hrs.	20 min.
3A	5A	48 hrs.	45 min.
3A	6A	64 hrs.	45 min.
3A	7A	71 hrs.	50 min.
3A	8A	140 hrs.	15 min.
3A	9A	183 hrs.	25 min
3A	10A	209 hrs.	45 min.
3A	11A	267 hrs.	35 min.

OCTOBER 9-15, 1969

11A	13A	118 hrs.	50 min.
11A	14A	121 hrs.	20 min.
11A	15A	139 hrs.	10 min
11A	16A	142 hrs.	10 min.
11A	17A	153 hrs.	50 min.

FLOW MEASUREMENT DATA

AUGUST 29, 1969

STATION	DISCHARGE (c.f.s.)	CROSS SECTIONAL area (ft^2)	MAXIMUM depth (ft)
3A-Rt.9, Westboro	0.65	5.8	0.8
7A-Boundary St., Northboro	5.9	53.7	2.3
10A-Cox St., Hudson	4.0	43.8	1.7

TABLE 21

Definition of Photosynthetic Study Sampling Stations and Dam Locations
Assabet River Study 1969

Station #	Location	*River Miles
A	Hocomoco Pond, Westboro	32.1, 0.5
B	Rt. 135, Northboro-Westboro Line	30.3
C	Off Rt. 495, Marlboro	23.0
D	Boone Rd., Stow	12.2
E	Off Barrett Mill Rd., Concord	1.8
F	Dam at Rt. 20, Northboro	27.7
G	Dam at Hudson St., Northboro	26.7
H	Dam at Rt. 85, Hudson	19.4
I	Dam at Rt. 62, Stow	15.4
J	Dam at Rts. 62 & 117, Maynard	9.2
K	Dam at High St., Acton	6.9

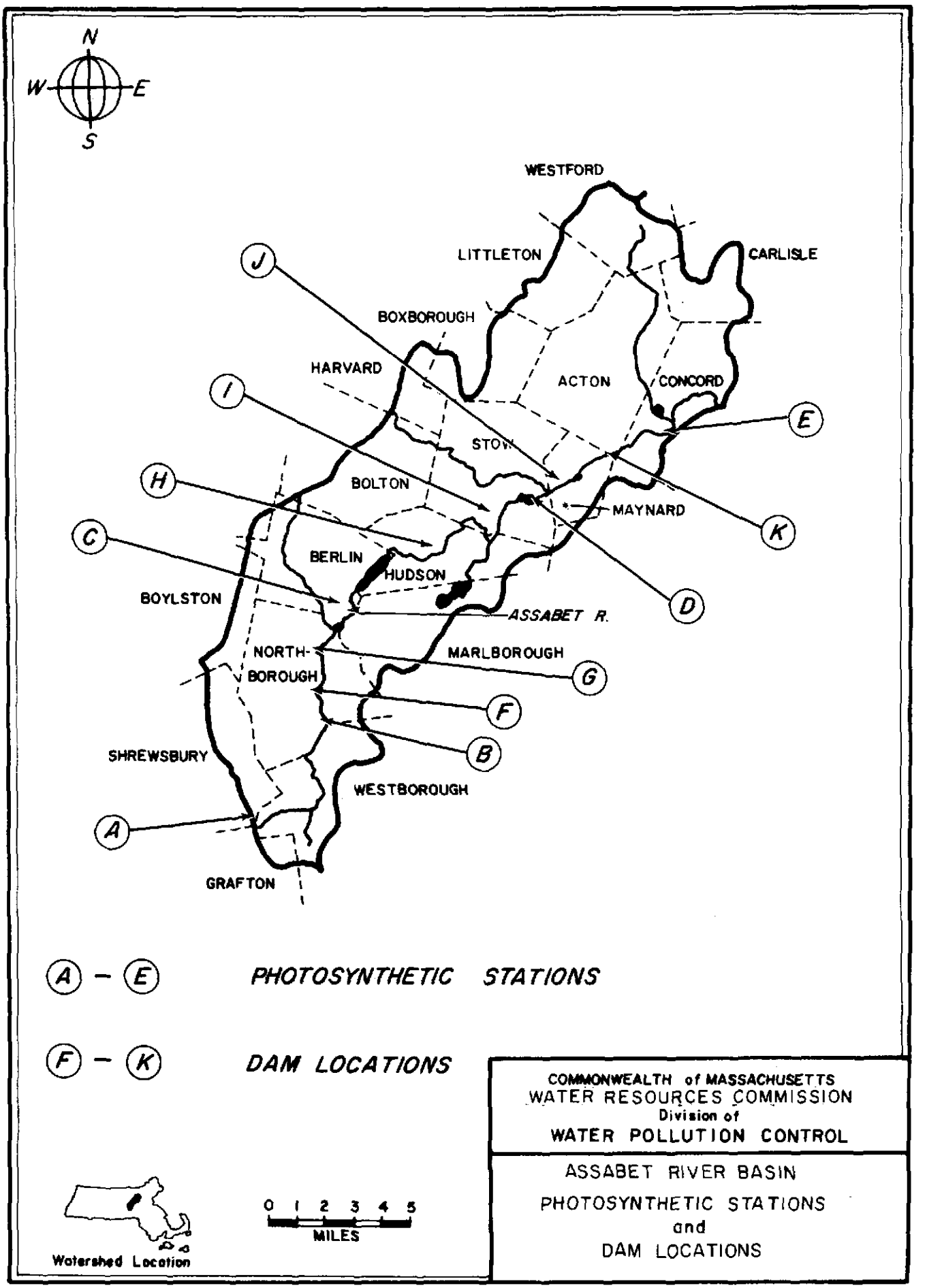
N
W
E
S
WESTFORD
LITTLETON
CARLISLE
BOXBOROUGH
HARVARD
ACTON
CONCORD
STOW
BOLTON
MAYNARD
BERLIN
HUDSON
BOYLSTON
ASSABET R.
NORTH-
BOROUGH
MARLBOROUGH
SHREWSBURY
WESTBOROUGH
GRAFTON
J
I
H
C
K
E
D
G
F
B
A
(A) – (E) PHOTOSYNTHETIC STATIONS
(F) – (K) DAM LOCATIONS
Watershed Location
0 1 2 3 4 5
MILES
COMMONWEALTH of MASSACHUSETTS
WATER RESOURCES COMMISSION
Division of
WATER POLLUTION CONTROL
ASSABET RIVER BASIN
PHOTOSYNTHETIC STATIONS
and
DAM LOCATIONS

FIG 8

TABLE 22
Assabet River Study 1969
Summary of Field Data
Photosynthesis Study

8/25/69

	Station (1) River Miles	Depth (2) (Feet)	Time (3) In	Time (4) Out	Initial (5) DO	Temp (6) °F	Light (7) Bottle DO	Dark (8) Bottle DO	River (9) Depth	Secchi (10) Disk
A	32.1, 0.5	1	10:40	9:45	9.0	74	9.5	8.5	7	> 7*
		3			9.1		9.3	8.9		
		5			6.7		5.6	4.3		
B	30.3	1	12:15	11:30	0.8	69	0.6	0.4	7	5
		3			1.0		0.4	0.1		
		5			5.7		0.5	0.3		
C	23.0	1	14:15	13:15	7.3	72	7.2	6.7	5	> 5
		3			7.3		7.5	7.0		
		5			8.5		8.0	6.8		
D	12.2	1	16:30	15:10	5.7	73	7.3	5.3	7	> 7
		3			5.5		6.6	5.4		
		5			5.4		5.7	5.0		
E	1.8	0.5	18:00	16:30	10.9	78	10.7	9.7	3	> 3
		2			10.7		10.6	10.0		

8/26/69

Station (1) River Miles	Depth (2) (Feet)	Time (3) In	Time (4) Out	Initial (5) DO	T °F (6)	Light (7) Bottle DO	Dark (8) Bottle DO	River (9) Depth	Secchi (10) Disk
32.1, 0.5	1	9:45	10:30	8.4	73	8.7	8.2	7	> 7*
	3			8.5		8.6	8.2		
	5			8.1		8.1	6.5		
30.3	1	11:30	11:30	5.7+	72	5.0	4.5	7	5
	3			5.5+		4.0	3.7		
	5			5.6+		1.2	3.0		
23.0	1	13:15		6.7	72	6.8	6.6	5	> 5
	3			6.5		6.9	6.0		
	5			6.6		7.0	5.0		
12.2	1	15:10	15:30	4.5	74	vandalized		7	> 7
	3			4.1		vandalized			
	5			3.9		vandalized			
1.8	0.5	16:30	16:30	9.9	73	11.3	7.6	3	> 3
	2			9.7		7.9	7.0		

TABLE 22 (cont.)

8/27/69

Station (1) River Miles	Depth (2) (Feet)	Time (3) In	Time (4) Out	Initial (5) DO	T °F (6)	Light (7) Bottle DO	Dark (8) Bottle DO	River (9) Depth	Secchi (10) Disk
32.1, 0.5	1	10:30	10:45	8.0	70	7.9	7.2	7	> 7*
	3			7.9		7.7	7.2		
	5			7.7		7.2	7.1		
30.3	1	11:30	12:00	1.0	68	0.4	0.0	7	5
	3			0.9		0.0	0.0		
	5			0.6		0.0	0.0		
23.0	1	--	13:30	7.2	--	7.0	6.2	5	> 5
	3			6.8		6.9	--		
	5			7.6		10.0	6.0		
12.2	1	15:30	15:00	4.4	72	4.5	4.1	7	> 7
	3			3.6		4.4	2.8		
	5			3.0		2.5	1.4		
1.8	0.5	16:30	16:30	12.6	70	13.3	11.0	3	> 3
	2.0			12.3		13.3	10.9		

* Heavy growth of aquatic weeds caused the bottom to be in shade even though the water was clear enough for light to penetrate the full depth.

+ Artificially aerated

TABLE 23

ASSABET RIVER STUDY 1969

DEFINITION OF PHOTOSYNTHESIS COLUMN HEADINGS

1. Location of station is by river miles from the confluence of the Assabet and Sudbury Rivers.
2. Depth of each set of bottles from surface - in feet
3. Time station put in (EDST)
4. Time station removed (EDST)
5. Initial Dissolved oxygen at particular depth (mg/l)
6. Temperature of water at time of initial D.O. (^{o}F)
7. D.O. (mg/l) in uncovered glass bottle after approximately 24 hours.
8. D.O. (mg/l) in taped glass bottle after approximately 24 hours.
9. River depth at station in feet
10. Light penetration in feet based on secchi disk; (>) indicates light penetration reached bottom. Based on one measurement per station

ASSABET RIVER SURVEY (AUGUST 25-29, 1969)

TIME

SOLAR RADIATION INTENSITY (gm cal/cm²/min)

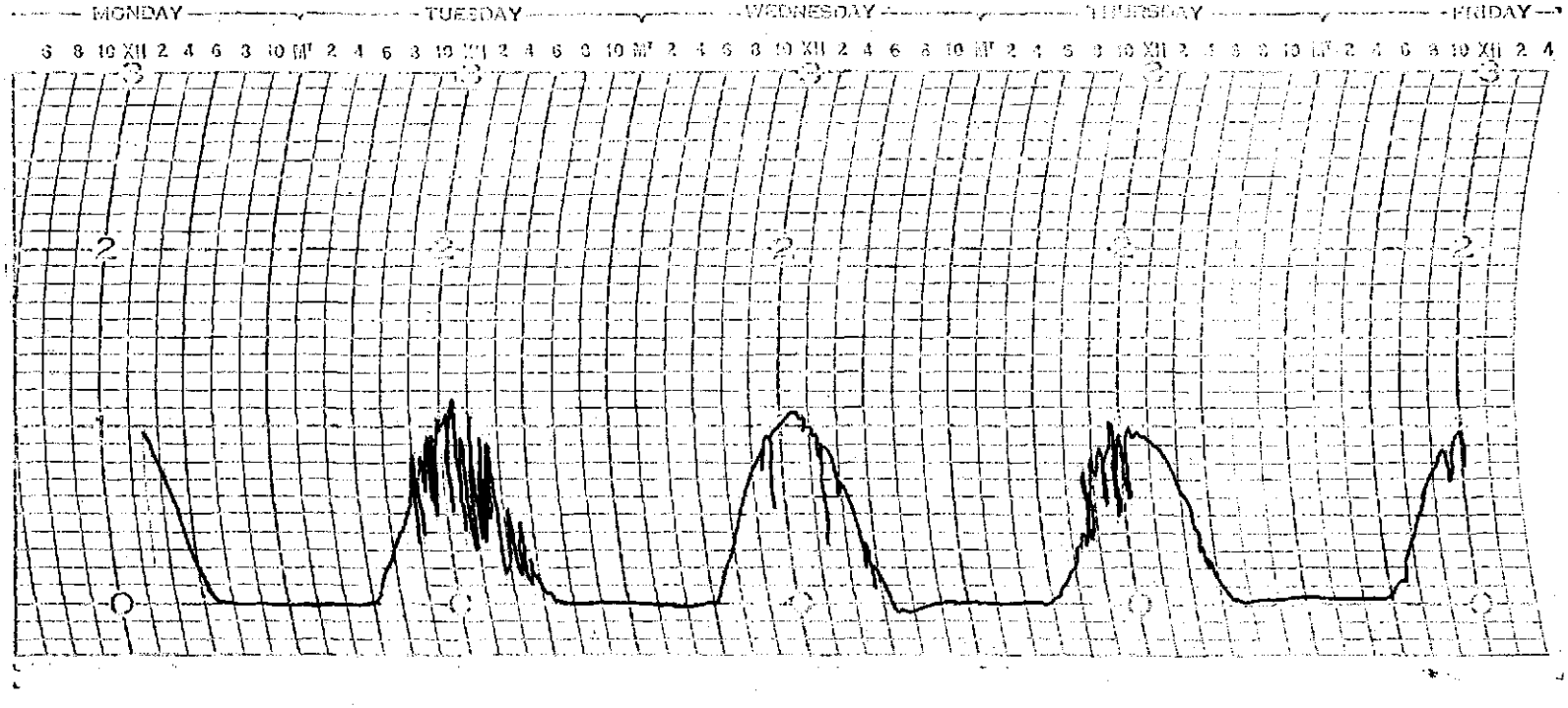

figure 9

PYRHELIOMETER RECORDING OF VARIATION IN SOLAR RADIATION INTENSITY

TOWN OF HUDSON

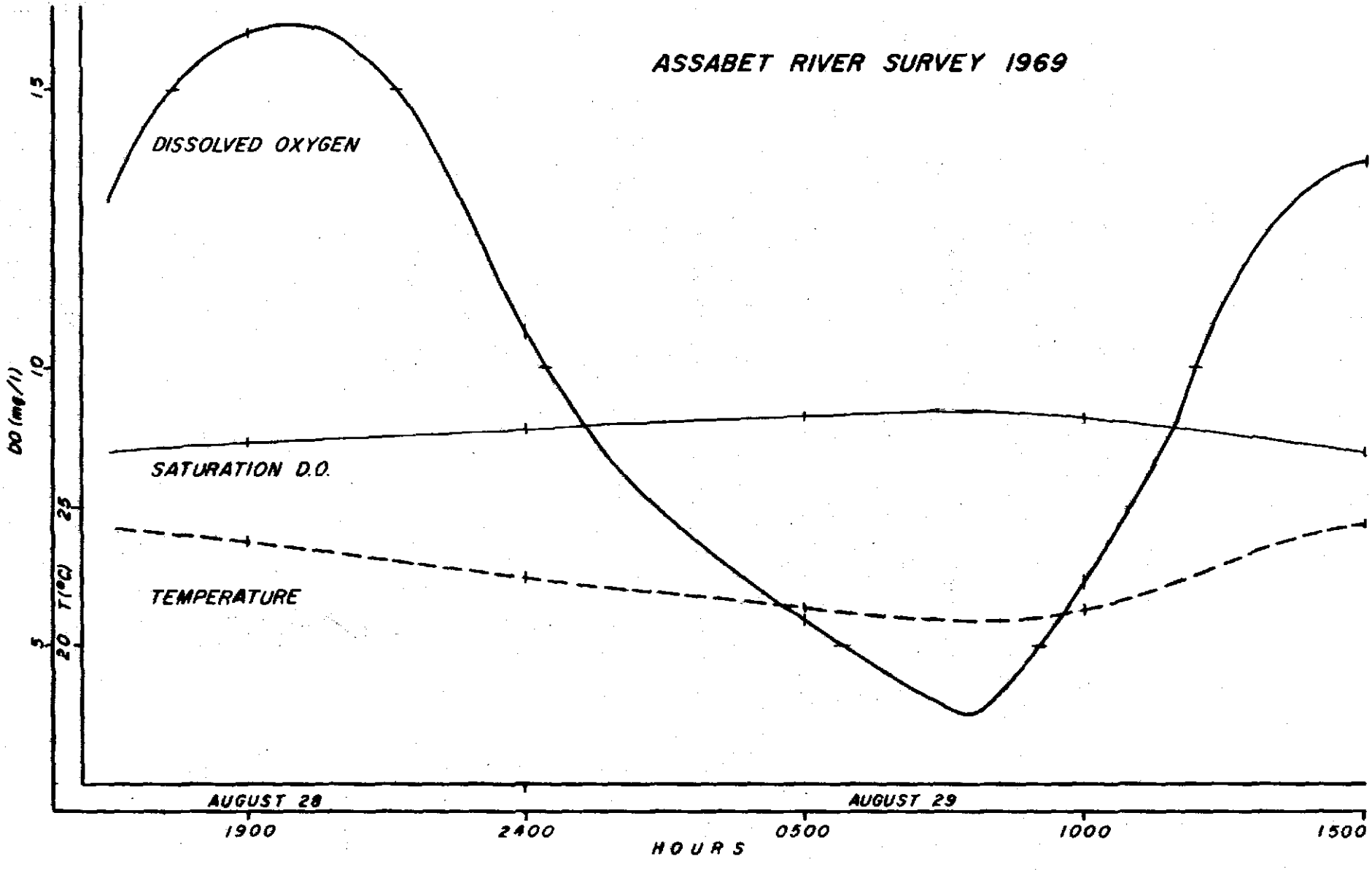

figure 10

DIURNAL VARIATION OF DISSOLVED OXYGEN AND TEMPERATURE
FROM A CONTINUAL RECORDING ———— MILE 6.9
ONE FOOT DEPTHS

TABLE 24

Assabet River Survey - 1969
Effects of Dam on Dissolved Oxygen

Dam (River Mile)	D. O. Above	D. O. Below	Temp °F	Fall (Feet)	Remarks
Acton 6.9	9.8	7.3	74	11	Fall composed of 4' - 4' - 3' cascades
Maynard 9.2	13.0	8.0	73	5	Not much water going over Bloom of Lemma all over
Stow 15.4	2.7	6.7	72	8	
Hudson 19.4	7.4	7.7	72	11	Not much water going over
Northboro 26.7	6.2	7.7	70	7	Water diverted around dam via channel which has two drops: 3 feet and 4 feet. None of water going over dam. Dam itself is 8' high.
Northboro 27.7	2.4	6.0	72	7	Very little going over dam Lot of Lemma above and below dam

TABLE 25

DEFINITION OF RIVER SAMPLING STATIONS

ASSABET RIVER STUDY DECEMBER 1968

STATION LOCATION	STATION DESCRIPTION	STATION LOCATION SUMMER & FALL SURVEY 69	RIVER MILE
100A	Above dam at junction Rts 62 & 117, Maynard	13A	9.2
200A	Dam at High St., Acton	15A	6.9
300A	Bridge at Cold Storage Warehouse, Rt. 62, West Concord	16A	5.0
400A	Bridge at Main St., Rt. 62, West Concord		3.6
1-M-STP	Effluent of Maynard Sewage Treatment Plant		7.3

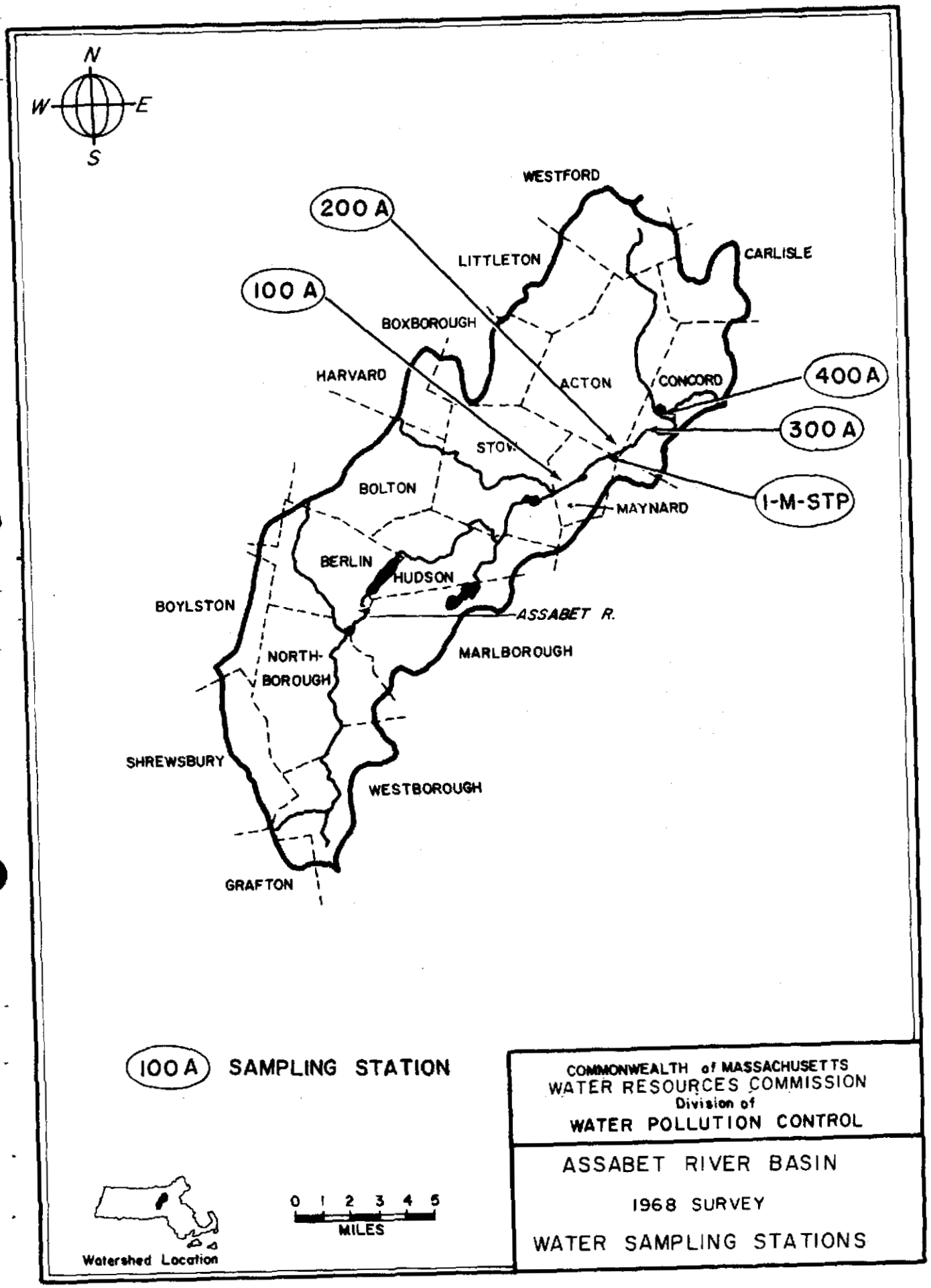
N
W
E
S
WESTFORD
200 A
LITTLETON
CARLISLE
100 A
BOXBOROUGH
HARVARD
ACTON
CONCORD
400 A
300 A
STOW
BOLTON
MAYNARD
I-M-STP
BERLIN
HUDSON
BOYLSTON
ASSABET R.
NORTH-
BOROUGH
MARLBOROUGH
SHREWSBURY
WESTBOROUGH
GRAFTON
100 A SAMPLING STATION
Watershed Location
0 1 2 3 4 5
MILES
COMMONWEALTH of MASSACHUSETTS
WATER RESOURCES COMMISSION
Division of
WATER POLLUTION CONTROL
ASSABET RIVER BASIN
1968 SURVEY
WATER SAMPLING STATIONS

FIG 11

TABLE 26

COMPOSITE RIVER SAMPLING STATIONS ANALYSES

ASSABET RIVER STUDY DECEMBER 1968

Analyses mg/l	Sta 100A	Sta 200A	Sta 300A	Sta 400A	Sta 1-M-STP
BOD_5	2.1	3.0	2.7	2.7	130.
Susp. Solids	2.	3.	9.	7.	65.
pH	6.6	6.6	6.7	6.7	7.5
Alkalinity	9.0	9.0	10.	10.	139.
Coliform Bacteria per 100ml-MPN	110000	46000	46000	24000	$24X10^6$
Fecal Coliform Bacteria per 100ml-MPN	4300	9300	24000	9300	$2.4X10^6$

TABLE 27

SUMMARY OF TIME OF TRAVEL AND FLOW MEASUREMENT DATA

ASSABET RIVER STUDY, DECEMBER 1968

TIME OF TRAVEL DATA

DECEMBER 11, 1968

100A - 200A	8 hrs	20 mins
100A - 300A	10 hrs	30 mins
100A - 400A	12 hrs	15 mins

FLOW MEASUREMENT DATA

DECEMBER 11, 1968

STATION	DISCHARGE (c.f.s.)	Cross Sectional Area (ft^2)	Maximum Depth (ft)	Temp (^oF)
Bridge at Rts.62 & 117, Maynard	115	51.9	1.5	35
Gaging Station @ Rts.62 & 117, Maynard	126	84.6	2.6	35
Rt. 62 Bridge @ Nashoba Eng. CO., Concord	128	46.5	1.7	35
Rt.62 Bridge, Main St, West Concord	160	139.	4.1	34

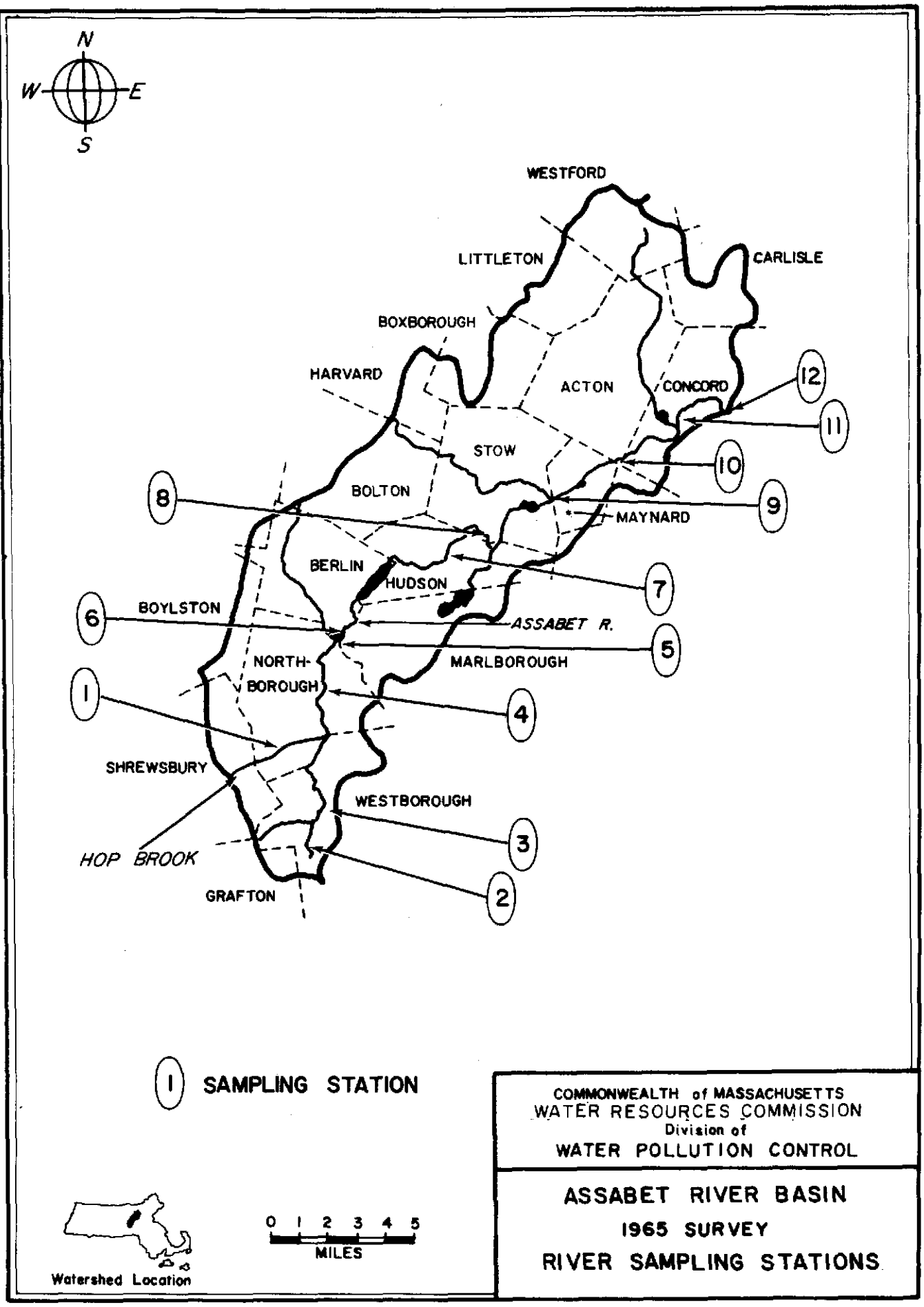
N
W
E
S
WESTFORD
LITTLETON
CARLISLE
BOXBOROUGH
HARVARD
ACTON
CONCORD
STOW
BOLTON
MAYNARD
BERLIN
HUDSON
BOYLSTON
ASSABET R.
MARLBOROUGH
NORTH-
BOROUGH
SHREWSBURY
WESTBOROUGH
HOP BROOK
GRAFTON
1
2
3
4
5
6
7
8
9
10
11
12
1 SAMPLING STATION
Watershed Location
0 1 2 3 4 5
MILES
COMMONWEALTH of MASSACHUSETTS
WATER RESOURCES COMMISSION
Division of
WATER POLLUTION CONTROL
ASSABET RIVER BASIN
1965 SURVEY
RIVER SAMPLING STATIONS

FIG 12

PG49

TABLE 28

DEFINITION OF RIVER SAMPLING STATIONS

ASSABET RIVER STUDY 1965

STATION	LOCATION	RIVER MILE
1	Bridge on West Main St., Northborough (Hop Brook)	30.8, 1.5
2	Bridge on Maynard St, ,Westborough	32.7
3	Bridge on Rt.9,(.4 mile west of Rt 135 intersection) Westborough (Assabet River)	31.4
4	Bridge on Brigham St, Northborough	29.1
5	Hudson St.(1.2 miles above Northborough)	26.7
6	Bridge on Bigelow St.at Berlin, Marlborough town line	22.9
7	Bridge on Main St. east of Hudson Center	17.8
8	Dam above mill at Gleasondale	15.4
9	Bridge on Puffer Road at Stow, Maynard town line	9.6
10	Bridge on High Street northeast of Maynard Center	6.9
11	Bridge on Rt.2 east of Concord Reformatory, West Concord	2.4
12	Bridge on Rt.126 northeast of Concord Center, (.2 mile beyond confluence of Assabet & Sudbury River)	

TABLE 29

Temperature (^{o}F)
Assabet River Study June 1965

Station	6-22-65 Run A	Run B	Run C	Run D	6-24-65 Run A	Run B	Run C	Run D
1	*0450 ** 62	0935 64	1450 70	1945 68	0450 64	0945 64	1445 66	1950 66
2	0505 64	0950 66	1500 74	1955 72	0505 67	1000 69	1450 70	2000 68
3	0515 66	1010 68	1510 75	2005 75	0515 70	1010 70	1510 74	2010 72
4	0525 69	1020 71	1525 75	2015 75	0525 71	1025 72	1520 74	2020 72
5	0550 68	1040 72	1535 76	2030 75	0545 74	1035 73	1535 74	2030 71
6	0605 68	1055 72	1550 76	2040 74	0600 72	1050 72	1545 73	2040 71
7	0620 70	1120 75	1605 79	2055 76	0610 73	1105 75	1600 78	2055 74
8	0630 71	1130 76	1625 79	2105 76	0620 74	1115 75	1610 75	2100 75
9	0650 70	1155 75	1635 78	2120 75	0635 73	1130 74	1630 75	2115 73
10	0705 72	1210 78	1650 79	2130 76	0650 75	1145 77	1645 76	2130 75
11	0720 79	1240 75	1705 76	2145 75	0705 72	1200 73	1700 75	2145 72
12	0735 72	1255 76	1720 75	2155 75	0715 74	1210 73	1715 74	2155 74

* Time of Sample
** Temperature

TABLE 30

Dissolved Oxygen - mg/l
Assabet River Study June 1965

Station	6-22-65 Run A	Run B	Run C	Run D	6-24-65 Run A	Run B	Run C	Run D
1	*0450	0935	1450	1945	0450	0945	1445	1950
	** 6.9	8.0	9.1	8.1	6.8	7.9	8.1	7.9
2	0505	0950	1500	1955	0505	1000	1450	2000
	7.6	8.4	8.2	7.1	6.8	8.0	8.1	7.2
3	0515	1010	1510	2005	0515	1010	1510	2010
	1.1	1.6	2.9	1.6	1.2	1.0	1.4	1.2
4	0525	1020	1525	2015	0525	1025	1520	2020
	1.2	3.0	6.6	4.7	1.2	2.0	4.6	2.4
5	0550	1040	1535	2030	0545	1035	1535	2030
	6.8	7.5	7.3	6.0	6.5	7.1	7.6	6.2
6	0605	1055	1550	2040	0600	1050	1545	2040
	4.8	7.5	10.3	8.7	4.4	5.7	8.6	8.4
7	0620	1120	1605	2055	0610	1105	1600	2045
	1.8	6.0	7.5	4.7	1.2	4.0	6.0	4.3
8	0630	1130	1625	2105	0620	1115	1610	2100
	3.5	3.9	4.5	4.8	3.4	3.0	3.6	3.5
9	0650	1155	1635	2120	0635	1130	1630	2115
	7.1	8.0	9.0	9.3	6.8	7.9	9.1	8.8
10	0705	1210	1650	2130	0650	1145	1645	2130
	7.9	10.0	10.3	9.7	8.1	9.3	10.1	9.3
11	0720	1240	1705	2145	0705	1200	1700	2145
	5.0	9.6	9.5	6.8	3.8	7.6	8.8	6.7
12	0735	1255	1720	2155	0715	1210	1715	2155
	8.4	10.3	8.3	9.3	6.6	6.8	6.4	6.4

* Time of Sample
** Dissolved Oxygen

TABLE 31
Biochemical Oxygen Demand (BOD_5) - mg/l
Assabet River Study June 1965

Station	6-22-65 Run A	Run B	Run C	Run D	6-24-65 Run A	Run B	Run C	Run D
1	*0450	0935	1450	1945	0450	0945	1445	1950
	** 2.8	2.8	6.7	4.0	2.0	1.6	4.4	4.4
2	0505	0950	1500	1955	0505	1000	1450	2000
	1.9	1.2	2.8	2.6	1.8	1.8	3.2	3.2
3	0515	1010	1510	2005	0515	1010	1510	2010
	7.2	6.9	7.8	9.0	11.	12.	9.2	11.
4	0525	1020	1525	2015	0525	1025	1520	2020
	6.0	4.5	9.9	4.1	7.8	8.4	7.6	8.6
5	0550	1040	1535	2030	0545	1035	1535	2030
	2.5	2.6	3.5	2.3	2.8	2.6	3.2	2.8
6	0605	1055	1550	2040	0600	1050	1545	2040
	2.0	1.8	2.2	2.0	3.0	1.8	2.4	1.8
7	0620	1120	1605	2055	0610	1105	1600	2055
	2.0	1.7	2.3	2.3	3.4	2.2	3.0	2.8
8	0630	1130	1625	2105	0620	1115	1610	2100
	2.6	2.7	3.1	1.9	2.4	2.4	4.6	3.6
9	0650	1155	1635	2120	0635	1130	1630	2115
	1.9	2.0	3.4	2.3	2.6	3.6	4.0	3.2
10	0705	1210	1650	2130	0650	1145	1645	2130
	3.3	7.8	11.	4.4	4.4	6.4	7.2	7.2
11	0720	1240	1705	2145	0705	1200	1700	2145
	1.5	2.2	3.4	2.6	6.6	2.4	3.4	1.2
12	0735	1255	1720	2155	0715	1210	1715	2155
	4.1	5.0	3.2	3.6	4.4	3.4	3.4	2.8

*Time
**Biochemical Oxygen Demand (BOD_5)

TABLE 32
pH
Assabet River Study June 1965

Station	6-22-65 Run A	Run B	Run C	Run D	6-24-65 Run A	Run B	Run C	Run D
1	*0450	0935	1450	1945	0450	0945	1445	1950
	** 6.5	6.8	6.9	6.9	6.8	6.8	6.7	6.7
2	0505	0950	1500	1955	0505	1000	1450	2000
	6.8	6.9	7.0	6.9	6.8	6.9	6.9	6.9
3	0515	1010	1510	2005	0515	1010	1510	2010
	6.7	6.6	6.7	6.7	6.6	6.6	6.6	6.7
4	0525	1020	1525	2015	0525	1025	1520	2020
	6.7	6.8	6.9	6.8	6.8	6.9	7.0	6.8
5	0550	1040	1535	2030	0545	1035	1535	2030
	6.9	7.0	7.0	6.8	6.9	7.0	7.0	6.9
6	0605	1055	1550	2040	0600	1050	1545	2040
	6.7	6.9	7.2	7.1	6.6	6.7	7.0	6.9
7	0620	1120	1605	2055	0610	1105	1600	2055
	6.5	6.6	6.7	6.5	6.3	6.4	6.5	6.4
8	0630	1130	1625	2105	0620	1115	1610	2100
	6.5	6.6	6.5	6.6	6.5	6.5	6.5	6.5
9	0650	1155	1635	2120	0635	1130	1630	2115
	6.7	6.8	6.9	6.9	6.7	6.8	6.9	6.9
10	0705	1210	1650	2130	0650	1145	1645	2130
	6.8	7.0	7.2	7.0	6.9	7.0	7.2	7.0
11	0720	1240	1705	2145	0705	1200	1700	2145
	6.7	7.0	7.1	6.8	6.5	6.8	6.9	6.8
12	0735	1255	1720	2155	0715	1210	1715	2155
	7.1	7.5	7.0	7.2	6.8	6.9	6.8	6.8

* Time of Sample
** pH

TABLE 33

Coliform Bacteria/100 ml
Assabet River Study June 1965

Station	6-22-65 Run A	Run B	Run C	Run D	6-24-65 Run A	Run B	Run C	Run D
1	*0450	0935	1450	1945	0450	0945	1445	1950
	** 700	2100	200	500	300	1500	800	1200
2	0505	0950	1500	1955	0505	1000	1450	2000
	400	1700	1200	1300	1000	8000	2400	3500
3	0515	1010	1510	2005	0515	1010	1510	2010
	20000	25000	150000	160000	140000	150000	70000	420000
4	0525	1020	1525	2015	0525	1025	1520	2020
	500	700	900	900	1400	2500	300	1500
5	0550	1040	1535	2030	0545	1035	1535	2030
	5500	1800	11000	15000	12000	3500	6500	3800
6	0605	1055	1550	2040	0600	1050	1545	2040
	500	500	500	300	900	800	800	200
7	0620	1120	1605	2055	0610	1105	1600	2055
	1000	400	1100	1000	2300	1200	500	400
8	0630	1130	1625	2105	0620	1115	1610	2100
	200	200	800	400	1400	500	300	700
9	0650	1155	1635	2120	0635	1130	1630	2115
	50	100	100	100	2300	2000	100	800
10	0705	1210	1650	2130	0650	1145	1645	2130
	50000	30000	38000	30000	80000	50000	50000	20000
11	0720	1240	1705	2145	0705	1200	1700	2145
	600	3500	2300	2500	800	100	500	1200
12	0735	1255	1720	2155	0715	1210	1715	2155
	700	400	400	1200	1500	2000	900	400

* Time of Sample
** Coliform Bacteria

TABLE 34

Composite Analysis 6-22-65
Assabet River Study June 1965

Station	C.O.D.*	$B.O.D._2$*	$B.O.D._5$*	S.S.*	pH	Alk.*
1	26.	1.9	3.7	11.	6.8	21.
2	52.	1.4	2.4	16.	6.9	19.
3	36.	4.5	7.8	18.	6.8	55.
4	26.	3.1	7.2	21.	6.9	37.
5	21.	1.6	3.4	6.	6.9	24.
6	10.	1.4	1.8	8.	7.0	23.
7	26.	1.4	2.1	5.	6.8	19.
8	26.	1.5	2.8	6.	6.6	23.
9	36.	1.6	2.4	5.	6.9	18.
10	21.	4.0	6.1	14.	7.0	20.
11	21.	1.7	2.8	10.	6.8	18.
12	41.	2.2	4.2	15.	7.1	19.

* Concentrations in milligrams per liter

TABLE 35

Composite Analysis 6-24-65
Assabet River Study June 1965

Station	B.O.D.$_3$*	B.O.D.$_5$*	S.S.*	pH	Alk.*
1	1.7	2.9	10.	6.8	24.
2	1.3	2.1	6.	6.8	22.
3	8.4	10.	18.	6.6	68.
4	3.1	6.3	7.	6.9	50.
5	1.7	2.6	0.	6.9	23.
6	1.4	2.0	5.	6.8	22.
7	1.3	2.1	5.	6.4	19.
8	2.0	3.0	3.	6.5	23.
9	2.2	3.1	3.	6.9	19.
10	4.0	7.0	6.	7.0	20.
11	2.3	3.3	0.	6.8	17.
12	2.3	3.6	10.	6.8	19.

* Concentrations in milligrams per liter

TABLE 36

SUMMARY OF FIELD DATA

MICROSCOPICAL EXAMINATION - STANDARD UNITS PER C.C.

ASSABET RIVER STUDY JUNE 1965

STATION 1		STATION 2		STATION 3		STATION 4		STATION 5	
Anabaena	600	Closterium	75	Oscillatoria	1410	Cyclotella	500	Microcystis	2000
Microcystis	8800	Asterionella	120	Euglena	30	Melosira	150	Coelastrum	45
Amorphous Matter	100	Melosira	4850	Peridinium	18	Diatoma	100	Asterionella	200
		Synedra	520	Melosira	275	Amorphous Matter	2000	Amorphous Matter	1500
		Diatoma	375	Infusoria	240				
		Amorphous Matter	2000	Amorphous Matter	1000				

STATION 6		STATION 7		STATION 8		STATION 9		STATION 10	
Cyclotella	50	Amorphous Matter	300	Aphanocapsa	30	Cosmarium	900	Aphanocapsa	200
Amorphous Matter	300			Coelastrum	30	Pediastrum	315	Coelastrum	45
				Pediastrum	30	Synura	2630	Cosmarium	750
				Scenedesmus	10	Amorphous Matter	200	Protococcus	400
				Mallomonas	30			Scenedesmus	70
				Cyclotella	15			Pleurococcus	510
				Melosira	50			Synura	5000
				Diatoma	45			Melosira	75
				Stephanodiscus	10			Synedra	150
				Amorphous Matter	300			Amorphous Matter	1000

STATION 11				STATION 12			
Closterium	30	Synura	1495	Anabaena	375	Volvox	780
Cosmarium	350	Rotifer	75	Aphanizomenon	675	Synura	200
Pediastrum	145	Amorphous Matter	300	Microcystis	200000	Infusoria	300
Protococcus	150			Cosmarium	625	Amorphous Matter	300
				Pediastrum	45		

TABLE 37

SUMMARY OF FIELD DATA

BIOLOGICAL EXAMINATION OF SEDIMENT

ASSABET RIVER STUDY JUNE 1965

STATION	% VOLATILE SOLIDS	MACROORGANISMS #30 Sieve - % by volume	REMARKS
1	5.9	No living organisms 15% sand & gravel 20% organic debris	Black Silt Septic odor
2	21.	4 blood worms 20% sand & gravel 35% organic debris	Black silt Very septic odor
3	2.0	1 blood worm 4 sludge worms 40% sand & gravel 15% organic debris	Black sand & gravel Septic odor
4	1.6	10 blood worms 70% sand & gravel 2% organic debris	Black sand & gravel Septic odor
5	5.4	10 blood worms 32% sand & gravel 8% organic debris	Brown sand, gravel & silt Non septic
6	3.6	5 blood worms 19% sand & gravel	Brown sand & gravel Septic odor
7	3.6	33 sludge worms 15% sand & gravel 6% organic debris	Brown silt Septic odor
8	33.	10 sludge worms 2% sand & gravel 43% organic debris	Brown silt Septic odor
9	1.0	No living organisms 89% sand & gravel @.5% organic	Heavy stone & gravel Non septic
10	1.7	No living organisms 75% sand & gravel 5% organic debris	Black sand & gravel Septic
11	5.1	No living organisms 55% sand & gravel 10% organic debris	Sand & gravel Septic odor
12	5.2	No living organisms % sand & gravel 3% organic debris	Black silt Non septic