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THE ASSABET RIVER REPORT

PART B

Massachusetts
Water
Resources
Commission
Division
of
Water
Pollution
Control

Thomas C. McMahon, Director

ASSABET RIVER STUDY

PART B: LIST OF WASTEWATER DISCHARGES

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MASSACHUSETTS WATER RESOURCES COMMISSION

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FOREWORD

This report is part B of a series entitled the Assabet River Study. Part A, a data record on water quality was published in December 1969 and republished in September 1970. Part C will discuss these results and recommend measures for attainment of the desired water quality in the river basin. The information for this publication was compiled by the Department of Public Health and the Division of Water Pollution Control.

Samples were collected in 1965, 1969 and 1970 and analyzed at the Lawrence Experiment Station. Department of Public Health. The analyses were condu ted in accordance with Standard Methods for Water and Wastewater Analysis, APHA using the latest edition available at the time of sampling. Data were tabulated and checked by engineers of the Division of Water Pollution Control.

Although the Marlborough westerly plant is a major source of wastewater, it was not in operation at the time of the 1969 river survey and is not included in this report.

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MASSACHUSETTS WATER POLLUTION CONTROL PROGRAM

HISTORICAL BACKGROUND

As early as 1884 the Massachusetts General Court recognized that governmental control was needed to safeguard the waters of the Commonwealth, thus it established a State Board of Health to examine and advise 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. An additional 5% was available if the area is a part of a regional planning district.

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 amounts of various pollutants allowed in the waters so that the desired uses may be realized and they 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 $150 million bond issue for this purpose. This amount was increased by $250 million by legislative action in 1970. 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 of 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 been found 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 basin surveys and also directs the pilot plant studies for treating industrial wastes. A bill providing $25 million in low interest loans was signed into law on August 24, 1970 and should add incentive to industrial cooperation.

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 water 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. The quality of plant operation should be upgraded by the recent mandatory certification of operators.

Research and Training - The Massachusetts Clean Waters Act authorized $10 million over a ten year period from the original $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.

MEASURES OF WATER POLLUTION

The following discussion should assist in interpreting the data on pollution in this report. Pollution degrades the physical quality of water and creates an ecological imbalance in the normal ratio of aquatic plants and animals. If the pollution is severe enough, the waterbody becomes malodorous and unsightly and its uses are sharply limited. There is the ever-present danger of water-borne diseases. These intangible characteristics are difficult to measure so certain physical, chemical and biological parameters have been established in order to quantify the level of pollution. The most direct measures of pollution are dissolved oxygen, biochemical oxygen demand (BOD), suspended solids and coliform bacteria of fecal origin. Phosphates and nitrates may also indicate pollution since they stimulate excessive plant growth. The presence of materials such as cyanide, copper and chromium is another measure of pollution since these toxic materials are lethal at low concentration to fish and other aquatic organisms.

Certain bacteria are capable of decomposing the organic matter contained in sewage. But the bacteria (aerobic) require oxygen to function, so as they decompose the organic matter, they remove dissolved oxygen from the water. The BOD of a waste therefore refers to the amount of oxygen required to stabilize the organic matter in that waste. The BOD of a waste is gradually exerted and generally consists of two stages: a first stage in which it is largely the carbonaceous matter that is oxidized and a second stage in which nitrogenous substances are stabilized. Most of the carbonaceous BOD is exerted within five days so the carbonaceous BOD is measured by the 5-day Biochemical Oxygen Demand test. The 30-day Biochemical Oxygen Demand would essentially include the BOD from both carbonaceous and nitrogenous matter. The Immediate Oxygen Demand (IOD) refers to the BOD that is exerted in the first fifteen minutes.

Some of the organic material in a wastewater cannot be decomposed by microorganisms, but it can be broken down by chemical oxidation. The Chemical Oxygen Demand (COD) refers to the amount of oxygen required to chemically oxidize the organic matter in a wastewater. The COD will generally be higher than the BOD and is a particularly important measure in analyzing an industrial waste which may contain a large amount of non-biodegradable material.

Phosphorous appears in waterbodies in combined forms known as ortho, complex and organic phosphorous. The major sources of phosphorous are from domestic sewage (60% from detergents), industrial wastes, and agricultural runoff where fertilizers are used. Phosphorous is essential for plant growth and provided other essential nutrients are present, excessive amounts of phosphorous will result in nuisance growths of algae and aquatic plants. Algal blooms often develop in lakes when the average concentration of inorganic phosphate as P exceeds 0.01 mg/l. The Division of Water Pollution Control has established a maximum allowable total phosphate concentration of 0.05 mg/l as P in class B and C rivers.

Domestic sewage and many industrial wastewaters contain varying amounts of nitrogen compounds. Nitrogen is in the form of organic nitrogen before any decomposition of the wastes occurs. The organic nitrogen is then converted successively by microorganisms to ammonia nitrogen, nitrite nitrogen, and nitrate nitrogen. Since each decomposition reaction is dependent on the preceding one, the progress of decomposition of a nitrogenous waste can be determined in terms of the relative amounts of the four nitrogen compounds.

Ammonia nitrogen is a product in the decomposition of organic nitrogen. It also can be formed when nitrites and nitrates are reduced. Ammonia nitrogen is particularly important since it has a high oxygen demand, and is toxic to fish. The Division has set allowable concentrations of 0.5 mg/l in Class B waters and 1.0 mg/l in Class C waters.

Nitrite nitrogen is the oxidation product of ammonia. It has a fairly low oxygen demand and is rapidly converted to nitrate. The presence of nitrite generally indicates that active decomposition is occurring.

Nitrate nitrogen is important since it is the end product of the decomposition of nitrogenous matter. Nitrate is the principal form of nitrogen which is readily available to plants. If phosphorous and other essential elements are present, excessive amounts of nitrate may result in severe algal growth.

Although natural waters can vary widely in composition, the following table indicates the range and substance in headwaters 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
BOD 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
Total Coliform per 100 ml	290	430	215
Ammonia as Nitrogen in mg/l	0.09	0.01	0.04
Nitrite as Nitrogen in mg/l	0.00	0.000	0.006
Nitrate as Nitrogen in mg/l	0.0	0.0	0.5
Total Phosphates in mg/l (as P)	0.13	0.03	0.10

Coliforms are a group of non-pathogenic bacteria found in the intestinal tract of warm-blooded animals. This group can be detected in water by relatively simple procedures. The presence of coliforms in water offers significant evidence of the potential presence of pathogens, such as the typhoid bacillus. The rate of destruction or removal of coliforms from water and sewage is substantially parallel to that of pathogenic bacteria. Therefore, coliforms are used as indicators of the possible presence of contaminating organisms.

The two members of the coliform group found in water are the so-called fecal coli (which make up 90% of the coliforms discharged in fecal matter) and the non-fecal coli, which usually originate in soil, grain and decaying vegetation.

Dissolved Oxygen

Dissolved oxygen readings (generally in mg/l) measure the amount of oxygen in the water at that moment. The D.O. readings give an instantaneous picture of the condition of the water.

Composite Samples

Composite samples are samples taken over a period of time at specific intervals. From these samples tests can be made to measure pH, alkalinity, BOD, COD, suspended solids, nitrates, phosphates, color, and turbidity. Composite samples give general trends of the water quality.

ASSABET RIVER

WATER POLLUTION ABATEMENT PROGRAM

In the Assabet River Basin four municipalities and two industries have been placed on implementation schedules to abate their respective sources of pollution. The status of these projects is as follows:

1) The Town of Hudson has received approval of final plans for the Cherry Street pumping station and is currently advertising for bids on its construction.

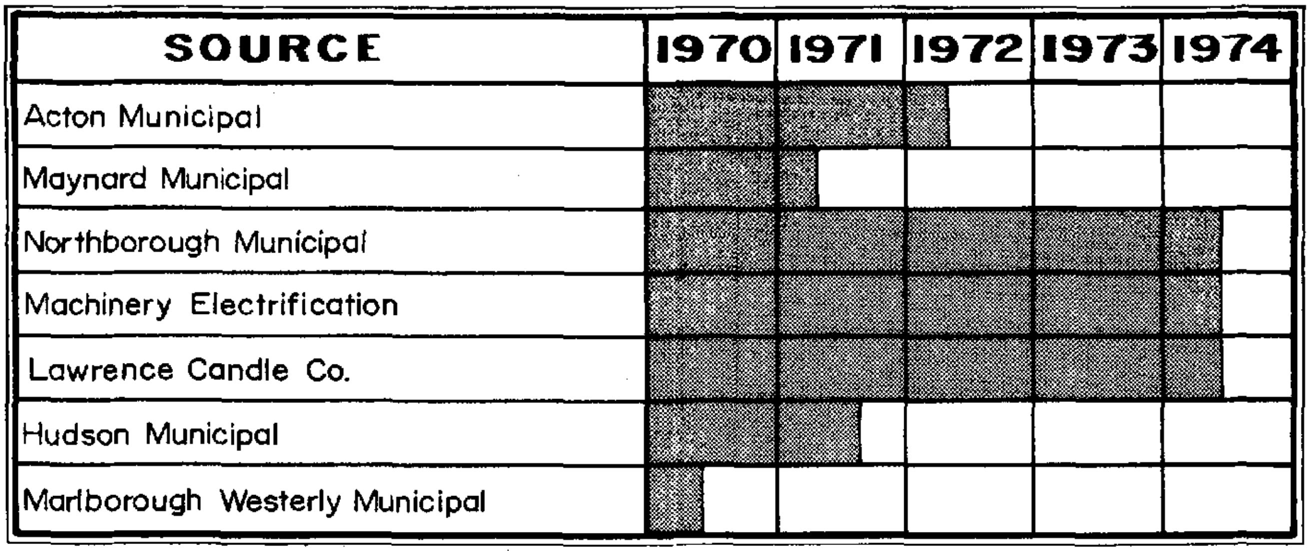
2) The City of Marlborough's westerly sewage treatment plant has been recently completed and is in operation. Enlargement of its easterly plant is under design.

3) The Town of Maynard has received approval of its report and preliminary plans and has submitted an application for a planning advance.

4) The Town of Northborough is currently negotiating an agreement with the City of Marlborough for acceptance of the Town's wastes into the City's sewerage system.

5) Machinery Electrification, Inc., has completed a subsurface disposal system for treatment of its sanitary wastes, and plans to tie its industrial wastes into the municipal system when it becomes available.

6) E. F. Lawrence & Company, Inc. will connect to the municipal system when it becomes available.



ASSABET RIVER

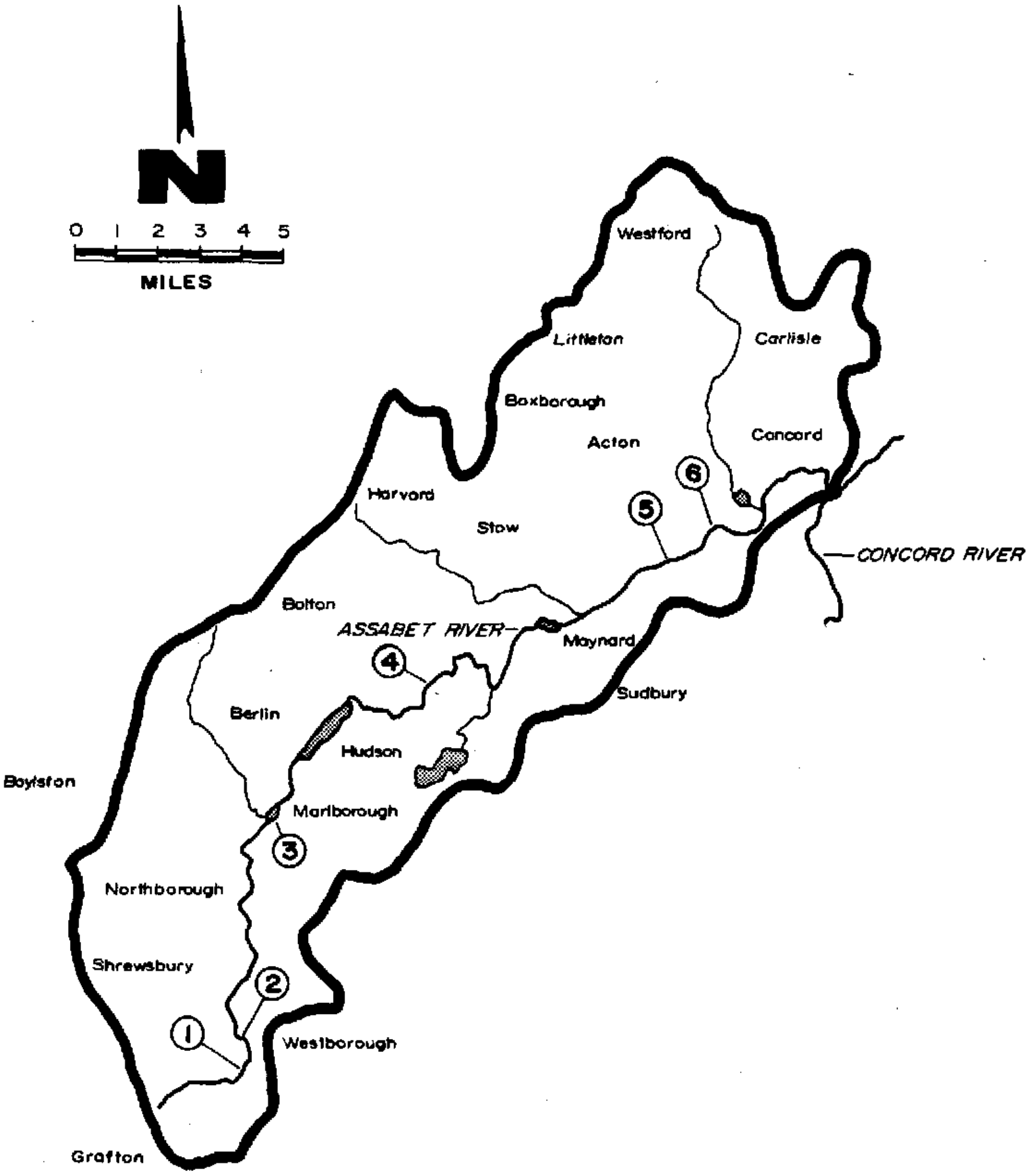
Schedule for Completing Water Pollution Abatement Programs

FIGURE 1

TABLE 1

Definition of Wastewater Discharges

Source		
1	Westboro S.T.P.	31.8
2	Shrewsbury S.T.P.	31.0
3	Marlboro Westerly S.T.P.	25.0
4	Hudson S.T.P.	16.8
5	Maynard S.T.P.	7.1
6	Mass. Correctional Institution Concord Reformatory S.T.P.	2.4



ASSABET RIVER

Location of Major Wastewater Discharges

FIGURE 2

TABLE 2 CHARACTERISTICS OF DISCHARGE 1

ASSABET RIVER STUDY

Town	Westboro
Source	Municipal Wastewater
Treatment	Settling and Sand Filtration
Flow	0.6 Million Gallons per Day
Receiving Waterbody	Assabet River
Date of Sampling	May 5, 1965
Type of Sampling	Composite plus 4 grabs
Time of Sampling	7:00 a.m. to 4:00 p.m.
Location of Sampling	1) Influent
	2) Effluent

Composite-Characteristics of Wastewater in mg/l

Source	1	2
pH	6.4	6.5
Biochemical Oxygen Demand	177	99
Chemical Oxygen Demand	368	200
Suspended Solids - Total	132	60
S.S. - Loss on Ignition	104	30
Alkalinity - Total	120	150

Grab Samples - Influent Only in mg/l

Biochemical Oxygen Demand	Time	pH
92	7:00 a.m.	6.1
149	10:00 a.m.	6.7
207	1:00 p.m.	6.5
221	4:00 p.m.	6.5

Grab Samples - Effluent Only in mg/l

Biochemical Oxygen Demand	Time	pH
82	7:00 a.m.	5.8
93	10:00 a.m.	6.1
100	1:00 p.m.	6.1
107	4:00 p.m.	6.2

TABLE 3 CHARACTERISTICS OF DISCHARGE 1

ASSABET RIVER STUDY

Town	Westboro
Source	Municipal Wastewater
Treatment	Settling and Sand Filtration
Flow	0.6 Million Gallons per Day
Receiving Waterbody	Assabet River
Date of Sampling	May 5, 1965
Type of Sampling	Grab
Location of Sampling	1) Influent 2) Effluent

Type of Analyses - Total Coliform per 100 ml

Time of Collection	1	2
7:00 a.m.	$50x10^6$	$0.62x10^6$
7:30 a.m.	$27x10^6$	
8:00 a.m.	$35x10^6$	$0.75x10^6$
8:30 a.m.	$17x10^6$	
9:00 a.m.	$42x10^6$	$0.31x10^6$
9:30 a.m.	$36x10^6$	
10:00 a.m.	$23x10^6$	$0.42x10^6$
10:30 a.m.	$54x10^6$	
11:00 a.m.	$70x10^6$	$0.37x10^6$
11:30 a.m.	$18x10^6$	
12:00 noon	$65x10^6$	$0.32x10^6$
12:30 p.m.	$40x10^6$	
1:00 p.m.	$49x10^6$	$0.27x10^6$
1:30 p.m.	$55x10^6$	
2:00 p.m.	$54x10^6$	$0.28x10^6$
2:30 p.m.	$98x10^6$	
3:00 p.m.	$25x10^6$	$0.15x10^6$
3:30 p.m.	$70x10^6$	
4:00 p.m.	$52x10^6$	$0.18x10^6$

TABLE 4 CHARACTERISTICS OF DISCHARGE 2

ASSABET RIVER STUDY

Town	Shrewsbury
Source	Municipal Wastewater
Treatment	Primary Settling, Trickling Filters, Secondary Settling and Chlorination
Flow Rate	1.30 million gallons per day design flow for 1975
Total Flow	1.09 MGD for the sampling period
Type of Sampling	Composite and Grabs
Location of Sampling	1) Influent 2) Primary Effluent 3) Secondary Effluent
Date of Sampling	September 25, 1968 September 26, 1968

Composite - Characteristics of Wastewater in mg/l

Source	1		2		3	
Time	9am 9pm	9pm 9am	9am 9pm	9pm 9am	9am 9pm	9pm 9am
pH	7.0	7.0	7.2	7.1	7.1	6.9
Biochemical Oxygen Demand	209	167	59	66	19	19
Suspended Solids Total	200	182			20	20
S.S. Loss on Ignition	184	164			13	18
Alkalinity Total	185	150				
Total Solids	630	530				
T.S. Loss on Ignition	320	290				
Settleable Solids	8.0	8.0	0.1	0.1	0	0
Total Phosphates as P	14	11			13	13
Organic Nitrogen	14.8	13.2			5.0	5.3
Ammonia Nitrogen	20.4	17.4			4.7	6.2
Nitrite Nitrogen					0.400	0.150
Nitrate Nitrogen					9	10
Turbidity					13	12
Dissolved Oxygen Average					5.3	6.2
Dissolved Oxygen Minimum					3.2	5.2
Temperature Average					66°F	65°F
Coliform per 100 ml					5700	1400

TABLE 5 CHARACTERISTICS OF DISCHARGE 2
ASSABET RIVER STUDY

Town	Shrewsbury
Source	Municipal Wastewater
Treatment	See Table 4
Location of Sampling	1) Final Effluent 2) Assabet River above outfall from Shrewsbury Treatment Plant 3) Assabet River below outfall from Shrewsbury Treatment Plant
Date of Sampling	September 25, 1968

Grab - Characteristics of Wastewater in mg/l

Source	1		2		3	
Time	10am	3:30pm	10:45am	3:30pm	10:45am	3:30pm
pH	6.8	6.8	6.7	6.8	7.0	7.0
Biochemical Oxygen Demand	11	22	11	13	6	6
Suspended Solids Total	8	33	51	43	7	5
S.S. Loss on Ignition	5	30	33	28	5	3
Alkalinity Total	58	60	95	94	72	70
Total Phosphates as P			5	5	5	5
Organic Nitrogen			3.4	3.9	2.5	6.2
Ammonia Nitrogen			10.6	10.9	6.2	5.9
Nitrite Nitrogen			.005	.000	0.030	0.050
Nitrate Nitrogen			0.0	0.0	2.0	2.5
Turbidity			16	15	5	5
Coliform	100	1800	60,000	40,000	8500	3500

TABLE 6 CHARACTERISTICS OF DISCHARGE 4

ASSABET RIVER STUDY

Town	Hudson
Source	Municipal Wastewater
Treatment	Primary Settling, Trickling Filters, Secondary Settling, Chlorination
Flow	2 million gallons per day design flow
Receiving Waterbody	Assabet River
Date of Sampling	April 27, 1965
Type of Sampling	Composite and Grabs
Time of Sampling	8:00 a.m. to 4:00 p.m.
Location of Sampling	1) Influent
	2) Effluent Primary System
	3) Effluent Secondary System
	4) Final Effluent after Chlorination

Composite - Characteristics of Wastewater in mg/l

	1	2	3	4
pH	6.8	7.0	6.7	6.6
Biochemical Oxygen Demand	180	65	19	13
Chemical Oxygen Demand	450	230	130	125
Suspended Solids Total	204	84	45	52
S.S. Loss on Ignition	160	68	32	35
Alkalinity - Total	135	150	120	105

Grab Samples
(Biochemical Oxygen Demand and pH only)

	1		2		3		4	
	BOD	pH	BOD	pH	BOD	pH	BOD	pH
8:00 a.m.	115	6.5	85	6.3	16	6.1	11	6.5
10:00 a.m.	300	7.2	58	6.7	16	6.4	4	6.7
10:45 a.m.	360	6.8						
1:00 p.m.	185	6.6	81	6.8	18	6.6	7	6.7
4:00 p.m.	160	6.5	77	7.0	25	6.7	12	6.8

TABLE 7 CHARACTERISTICS OF DISCHARGE 4

ASSABET RIVER STUDY

Town	Hudson
Source	Municipal Wastewater
Treatment	(See Table 6)
Date of Sampling	April 27, 1965
Type of Sampling	Grab
Location of Sampling	1) Influent
	2) Effluent after Chlorination

Type of Analyses - Total Coliform per 100 ml

Time of Collection	1	2
8:00 a.m.	17×10^6	< 100
8:30 a.m.	10×10^6	
9:00 a.m.	22×10^6	< 100
9:30 a.m.	25×10^6	
10:00 a.m.	85×10^6	< 100
10:30 a.m.	38×10^6	
11:00 a.m.	15×10^6	< 100
11:30 a.m.	33×10^6	
12:00 noon	30×10^6	< 100
12:30 p.m.	42×10^6	
1:00 p.m.	38×10^6	< 100
1:30 p.m.	33×10^6	
2:00 p.m.	14×10^6	2900
2:30 p.m.	23×10^6	
3:00 p.m.	16×10^6	< 100
3:30 p.m.	7×10^6	
4:00 p.m.	29×10^6	5800

TABLE 8 CHARACTERISTICS OF DISCHARGE 4

ASSABET RIVER STUDY

Town	Hudson
Source	Municipal Wastewater
Treatment	(See Table 6)
Flow Rate	1.11 million gallons per day from 9:00 a.m. to 9:00 p.m. on 2-19-69 0.93 million gallons per day from 9:00 p.m. to 9:00 a.m. on 2-19-69 and 2-20-69
Total Flow	2.04 million gallons for the sampling period
Type of Sampling	Composite
Location of Sampling	1) Influent 2) Effluent Primary System 3) Effluent Secondary System

Composite - Characteristics of Wastewater in mg/l

	1		2		3	
Time	9 am 9 pm	9 pm 9 am	9 am 9 pm	9 pm 9 am	9 am 9 pm	9 pm 9 am
pH	7.8	7.2	8.2	7.6	7.7	7.7
Biochemical Oxygen Demand	147	129	180	144	29	26
Chemical Oxygen Demand	509	257				
Suspended Solids Total	164	102	90	65	28	27
S.S. Loss on Ignition	152	86	80	56	25	22
Alkalinity - Total	138	85	156	122	150	145
Total Solids	610	446				
T.S. Loss on Ignition	314	226				
Settleable Solids ML/L	10	6	0.4	0.1	0.3	0.1
% Volatile Solids	51.5	50.7				
Ammonia - Nitrogen					24.4	23.2
Organic - Nitrogen					5.6	5.0
Nitrite - Nitrogen					0.160	0.190
Nitrate - Nitrogen					0.6	0.9
Total Phosphates as P					10	10

TABLE 9 CHARACTERISTICS OF DISCHARGE 4

ASSABET RIVER STUDY

Town	Hudson
Source	Municipal Wastewater
Treatment	(See Table 6)
Date of Sampling	2-19-69 and 2-20-69

Time	Flow Rate M.G.D.	pH	Influent Temp. F°	Influent D.O. mg/l	Effluent D.O. mg/l
9:00 a.m.	1.0	7.2	48	5.3	8.0
9:20	0.8	9.2	46	5.9	6.4
9:40	1.4	7.7	46	7.6	6.5
10:00	1.0	9.4	46	6.0	6.0
10:20	1.5	7.8	46	6.1	6.1
10:40	1.0	7.8	46	4.5	4.5
11:00	0.9	7.5	48	3.8	5.0
11:20	0.9	9.6	46	5.5	6.0
11:40	0.9	8.7	46	5.0	5.5
12 noon	1.5	8.3	46	5.1	6.4
12:20	1.4	7.5	46	6.3	7.6
12:40	1.2				
1:00	1.2	7.6	46	6.2	8.4
1:20	0.9	8.6	46	7.4	8.6
1:40	0.9	7.4	46	6.0	9.0
2:00	1.2	7.6	46	5.3	9.0
2:20	0.9	7.3	46	6.7	9.0
2:40	1.0	7.6	46	5.5	8.8
3:00	0.8	7.2	46	6.1	9.0
3:20	0.8	7.0	46	4.5	8.0
3:40	1.0	7.0	46	5.8	8.5
4:00	1.6	7.1	46	4.6	9.1
4:20	1.0	7.1	46	4.5	9.1
4:40	1.0	7.0	46	4.7	9.1
5:00	1.0	7.1	46	5.6	8.9
5:20	1.6	7.1	46	4.2	9.5
5:40	1.0	7.0	46	4.6	8.8
6:00					9.0
6:40	0.9	7.0	46	6.1	9.2
7:00	1.5	6.9	46	4.5	8.7
7:20	1.5	7.1	46	5.5	9.0

TABLE 10 CHARACTERISTICS OF DISCHARGE 4

ASSABET RIVER STUDY (Continued)

Time	Flow Rate M.G.D.	pH	Influent Temp. F°	Influent D.O. mg/l	Effluent D.O. mg/l
7:40 p.m.	1.0	7.1	46	4.4	8.7
8:00	1.0	7.0	46	5.6	9.4
8:20	1.5	6.9	46	4.1	9.0
8:40	1.0	7.0	46	5.0	8.7
9:00	1.0	7.0	46	5.1	8.5
9:30	0.95	7.0	46	5.0	8.6
10:00	0.90	7.0	46	3.5	8.1
10:30	0.95	6.8	46	3.4	8.1
11:00	0.95	6.9	46	3.3	8.1
11:30	0.95	6.8	46	3.5	8.4
12 midnight	0.95	6.9	46	2.9	
12:30	0.90	6.8	46	2.6	9.8
1:00	0.95	6.9	46	2.1	7.4
1:30	0.90	6.9	46	4.1	7.6
2:00	0.90	7.0	46	2.7	7.4
2:30	0.95	6.9	46	3.0	7.3
3:00	0.95	6.9	46	2.4	7.6
3:30	0.90	6.7	46	2.4	7.4
4:00	0.95	6.9	46	3.4	7.6
4:30	0.95	6.9	46	2.8	7.0
5:00	0.95	6.8	46	4.4	7.5
5:30	0.95	6.8	46	3.3	7.1
6:00	0.90	6.7	46	3.4	7.1
6:30	0.95	6.8	46	3.0	7.1
7:00	0.65	6.7	46	3.7	7.0
7:30	0.95	6.7	46	3.1	6.7
8:00	0.95	6.9	46	3.5	7.5
8:30	0.95	7.1	46	3.5	8.0

Dissolved Oxygen

	Influent	Effluent
Maximum	7.6	9.8
Minimum	2.1	4.5
Average	4.5	7.8

TABLE 11CHARACTERISTICS OF DISCHARGE 5

ASSABET RIVER STUDY

Town	Maynard
Source	Municipal Wastewater
Treatment	Primary settling, trickling filter, secondary settling
Flow	Average daily 0.75 M.G.D.
Date of Sampling	April 13, 1965 April 14, 1965
Receiving Waterbody	Assabet River
Type of Sampling	Composite and Grabs
Time of Sampling	7:00 a.m. to 4:00 p.m.
Location of Sampling	1) Influent 2) Effluent Primary 3) Effluent Secondary

Composite - Characteristics of Wastewater in mg/l

Date	4-13-65			4-14-65		
Source	1	2	3	1	2	3
Biochemical Oxygen Demand	308	248	42	324	326	260
Chemical Oxygen Demand	790	510	205	890	610	75
Suspended Solids Total	180	72	60	152	120	68
S.S. - Loss on Ignition	140	40	40	128	105	64
Alkalinity - Total	160	150	150	160	160	180
pH	7.4	7.1	6.9	7.0	6.9	6.8
Color	Red	Red	Red			

TABLE 12 CHARACTERISTICS OF DISCHARGE 5

ASSABET RIVER STUDY

Town	Maynard
Date of Sampling	April 13, 1965
	April 14, 1965
Type of Sampling	Grab
Location of Sampling	1) Influent
	2) Effluent

April 13, 1965

	1			2		
Time	Temp. °F	D.O. mg/1	Coliform 100 mlx10^6	Temp. °F	D.O. mg/1	Coliform 100 mlx10^6
7:00 a.m.	42	1.6	2	51	1.1	0.47
7:30	42	3.4	6	51	5.3	0.65
8:00			6			0.57
8:30	42	0.0	30	51	5.3	0.64
9:00			14			0.80
9:30	42	1.5	7	51	5.5	0.70
10:00			6			1.1
10:30	54	1.5	7	51	5.2	1.4
11:00			15			1.8
11:30		1.5	13	52	4.6	1.9
12:00 noon			11			2.0
12:30 p.m.	51	1.9	12	54	4.4	2.5
1:00			20			1.7
1:30	55	1.9	9	52	4.4	1.9
2:00			9			1.9
2:30	55	2.3	10	52	4.0	1.5
3:00			9			1.5
3:30	56	2.3	5	52	4.2	1.3
4:00			3			1.7

April 14, 1965

	1			2		
7:00 a.m.			30			1.8
7:30	51	3.1	23	50	5.3	1.9
8:00			14			1.2
8:30	50	2.1	45	50	5.5	1.3
9:00			60			1.8
9:30	52	0.0	55	52	5.7	2.5
10:00			2			5.0
10:30	54	1.4	80	52	5.0	2.8
11:00			95			4.0
11:30	55	1.0	85	54	4.3	3.7
12:00 noon			95			4.0
12:30 p.m.	55	1.6	55	54	3.5	6.0
1:00			36			5.8
1:30	54	1.8	40	54	3.4	7.0
2:00			39			8.5
2:30	54	1.6		55	3.6	
3:30	55	1.1		55	2.8	

TABLE 13 CHARACTERISTICS OF DISCHARGE 5

ASSABET RIVER STUDY

Town	Maynard
Source	Municipal Wastewater
Treatment	See Table 11
Date of Sampling	July 30, 1969 July 31, 1969
Type of Sampling	Composite
Flow	0.82 million gallons per day
Location of Sampling	1) Influent
	2) Effluent Primary System
	3) Effluent Secondary System

Composite - Characteristics of Wastewater in mg/l

Source						
pH	6.3	6.9	6.6	6.7	6.9	6.8
Biochemical Oxygen Demand	144	106	108	102	78	79
Suspended Solids - Total	154	84	86	64	80	64
S.S. - Loss on Ignition	126	70	70	58	64	60
Alkalinity - Total	63	76	85	72	120	110
Settleable Solids ML/L	9.0	3.0	0.2	0.2	0.2	0.1
Ammonia Nitrogen					24.6	16.5
Organic Nitrogen					10.1	8.7
Total Phosphates as P	20.0	11.0	19.6	14.2	23	13
Ortho Phosphates as P					15	12
Turbidity					45	43

TABLE 14 CHARACTERISTICS OF DISCHARGE 5

ASSABET RIVER STUDY

Town	Maynard
Source	Municipal
Treatment	See Table 11
Date of Sampling	July 30, 1969 July 31, 1969

Time	Flow Rate MGD	pH	Influent Temp. °F	Influent D.O. mg/1	Effluent D.O. mg/1
9:00 a.m.	82	6.7	67	9.1	1.7
9:30	82	7.0	67	0	2.0
10:00	82	7.3	68	4.4	2.0
10:30	82	7.0	68	3.7	2.1
11:00	82	6.9	68	3.0	2.1
11:30	82	2.0	70	4.3	2.4
12:00 noon	82	6.2	70	5.0	1.8
12:30 p.m.	82	6.7	70	3.8	1.3
1:00	81	6.5	70	2.9	1.7
1:30	82	6.4	70	9.9	1.4
2:00	82	6.5	70	3.3	1.2
2:30	82	6.7	70	4.3	1.0
3:00	82	6.5	70	3.1	1.9
3:30	82	6.4	70	4.5	1.2
4:00	82	6.5	70	4.1	1.2
4:30	82	6.3	70	4.5	1.3
5:00	82	6.7	70	4.2	1.1
5:30	82	6.4	70	3.8	1.1
6:00	82	6.8	70	4.5	1.0
6:30	82	6.9	70	4.4	1.1
7:00	82	6.7	70	3.5	0.9
7:30	82	6.7	70	3.3	0.9
8:00	82	6.8	70	3.4	1.2
8:30	82	6.8	70	3.2	1.1
9:00	82	6.8	70	3.2	1.3
9:30	82	6.9	69	2.4	0.9
10:00	82	7.0	69	3.0	1.6
10:30	82	6.9	69	3.6	1.1
11:00	82	6.4	67	2.8	1.5
11:30	82	6.9	68	3.2	1.1
12:00 midnight	82	6.7	68	3.0	1.1
12:30 a.m.	82	6.8	68	3.2	1.2
1:00	82	7.3	68	3.8	1.3
1:30	82	7.0	67	3.5	1.2
2:00	82	6.8	68	3.7	1.1
2:30	82	7.0	68	4.2	1.3
3:00	82	6.9	68	4.4	1.2
3:30	82	7.1	68	4.8	1.3
4:00	82	6.9	68	4.4	1.4
4:30	82	6.9	67	4.4	1.9
5:00	82	7.0	66	4.4	1.8
5:30	82	6.9	66	4.2	1.7
6:00	82	6.8	66	3.9	1.4
6:30	82	7.1	66	4.3	1.2
7:00	82	7.2	67	3.3	1.3
7:30	82	7.0	68	3.0	1.2
8:00	82	7.3	68	2.9	1.1
8:30	82	7.2	67	2.5	1.3
9:00	82	7.5		1.5	[illegible]

TABLE 15 CHARACTERISTICS OF DISCHARGE 6

ASSABET RIVER STUDY

Town	Concord
Source	Concord Reformatory
Type of System	Settling and Sand Beds
Type of Sampling	Grab
Date of Sampling	June 17, 1970
Location of Sampling	Drain to Assabet River

Grab - Characteristics of Wastewater in mg/l

Time	10:15 am
pH	5.9
Biochemical Oxygen Demand	72
Chemical Oxygen Demand	156
Suspended Solids Total	58
S.S. Loss on Ignition	22
Alkalinity Total	45
Total Solids	260
T.S. Loss on Ignition	134
Total Phosphate as P	7.0
Ammonia Nitrogen	3.0
Coliform MPN	4.6×10^6
Fecal Coliform MPN	2.4×10^6

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