

REPORT
on
IMPROVEMENTS TO THE WATER SYSTEM
of the
TOWN OF SOUTHBOROUGH, MASS.

1959

WHITMAN & HOWARD, INC.

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ENGINEERS

CHANNING HOWARD
PAUL F. HOWARD
C. ROGER PEARSON
EDWIN M. HOWARD
C.R. WICKERSON
L.M. PITTEDREIGH

89 Broad Street, Room 514 · Boston 10, Massachusetts

Hancock 6-1633

April 18, 1959

Board of Water Commissioners
Southborough,
Massachusetts

Gentlemen:

In accordance with the terms of our contract, dated September 28, 1958, we submit herewith our "Report on Improvements to the Water System of the Town of Southborough, Massachusetts."

May we express our gratitude for the sincere cooperation granted us in the preparation of the report by Mr. Thomas Boland, Superintendent of the Southborough Water Department.

Respectfully submitted,
WHITMAN & HOWARD, INC.

By _____

Our 91st Year of Continuous Service

REPORT ON
IMPROVEMENTS TO THE WATER SYSTEM
OF THE
TOWN OF SOUTHBOROUGH, MASS.

THE PROBLEM IN GENERAL

The problem facing the Town of Southborough is two-fold in that the present supply of water is at times of poor quality and the western portion of the Town in which development of both industrial and residential nature is taking place is inadequately served by the present water distribution system. If the Town is to continue to grow and attract the industrial development, which it can because of its location relative to the new Massachusetts Turnpike, it must embark on a program to reinforce and augment the existing water supply system.

POPULATION AND WATER CONSUMPTION

At the time of our last report on Improving Water Supply Works of the Town of Southborough, Mass., dated January 21, 1952, the population trend indicated a marked change upward starting in the year 1948. At that time it was not known to what extent or how long this trend would last. The Curve Water Consumption and Population, Figure 1, of this report also shows the estimated future population and estimated future consumption average day curves

taken from the January 21, 1952 report. A comparison of these curves with those resulting from the experience of the intervening years indicates a sharp and distinct change in the trend of population in the Town of Southborough. This upturn in population has been experienced in a great many towns in Massachusetts and all predictions are that it will continue in those towns which have large areas of undeveloped land.

Southborough is in an excellent position with respect to growth in having an exit and entrance to the Massachusetts Turnpike. There are other express highways under study that will also pass near or through Southborough and if the experience with other roads of that nature is considered they cannot fail to improve the position of the Town as an industrial center and as a residential community. There are hundreds of acres of highly desirable industrial and residential property yet to be developed. In fact a large proportion of this acreage is now in the hands of large scale developers. The owner of the land west of Flagg Road and Lovers Lane has already subdivided that portion of his property that lies in the Town of Westborough.

A study of the growth of Southborough and other cities and towns lying between Boston and Worcester indicates that the most desirable and available land in the key municipalities has been absorbed. The movement has been towards the suburbs. It is this movement that has been largely responsible for Southborough's accelerated rate of growth during the past decade.

Water consumption in Southborough hit a peak in 1955 and has dropped off somewhat in the past few years as indicated on curve Figure 1, Water Consumption and Population of this report. Inasmuch as the population increase is consistently rising it can be assumed that the water consumption will increase at the same rate even though some years it will fall off. The increase in population, industrial expansion and expanding use of such appliances as automatic dishwashers, clothes washers and air conditioning equipment can only increase the consumption of water.

The following table shows the past and estimated future water requirements for the Town of Southborough.

<u>Year</u>	<u>Consumption Average Day (Gallons)</u>	<u>Consumption Maximum Day (Gallons)</u>
1950	240,000	355,000
1955	290,000	650,000
1960	325,000	590,000
1965	395,000	710,000
1970	460,000	820,000
1975	515,000	910,000
1980	510,000	990,000
1985	600,000	1,050,000

It must be borne in mind that these figures are estimated and that these consumptions may be experienced before or after the years shown above.

QUALITY OF PRESENT WATER SUPPLY

Analysis made by the Massachusetts Department of Public Health shown in Table I contained herein of the Southborough Water Supply shows that the quality of the water taken from the Sudbury Reservoir, the Towns only source of water supply, is of rather poor quality.

TABLE I
WATER ANALYSIS BY
MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

Turbidity	11-13-51	3-5-52	7-15-52	3-11-53	6-17-53	11-23-53	6-21-54	9-14-54	12-22-54	6-22-55	4-9-57
Color	4	1	3	5	1	5	40	3	1	3	6
Odor	38	25	25	30	32	17	55	45	22	22	14
Hardness	1-veg.	1-musty	1-veg.	2-veg.	1-veg.	0	1-veg.	1-veg.	1-veg.	3-veg.	2-boeg.
Alkalinity	20	20	14	30	26	16	20	14	26	16	18
P.H.	13	12	11	10	4	7	3	6	5	4	4
	6.5	6.2	6.3	6.7	6.2	6.4	5.8	6.5	6.3	7.0	

The main source of supply to the Sudbury Reservoir is its watershed, and as the Towns within which it lies continue to grow that growth will of necessity encroach upon this watershed. In fact so long as the Sudbury Reservoir is used for water supply the restrictions imposed on development of adjacent land will tend to retard a normal and profitable use of available land. The M.D.C. no longer uses the Sudbury reservoir as part of their main supply line to Boston, thus eliminating the flow of Quabbin Reservoir water through the reservoir. The quality of water has been such in recent years that some Quabbin Reservoir water has been diverted through the Sudbury reservoir for the sole purpose of improving the quality of the water contained therein. When the new M.D.C. tunnel, now under construction, is completed the use of the existing open channels and Sudbury Reservoir as part of the M.D.C. supply works will be for all practical purposes eliminated. Under these conditions we would expect the quality of the water to deteriorate.

It is imperative that the Town of Southborough construct the necessary works to obtain a supply of water from a new source for the following reasons:

1. The evident poor quality of the water from the existing source of supply.
2. The continuing growth of the Town of Southborough which in turn will create greater demands for water.
3. Abandonment of the Sudbury Reservoir as part of the Metropolitan District Commission supply works.

WATER DISTRIBUTION SYSTEM

The major elements of the water distribution system are shown on accompanying plan entitled "Water System Southborough, Mass."

The fire flow tests made during this investigation show that for the most part the existing distribution system is adequate insofar as the portion of the Town it serves. There are a few instances where lengths of 6-inch pipe beyond that generally recommended have been installed and that the minimum flow of 1,000 gallons per minute for fighting a fire cannot be met. The present policy of laying nothing smaller than 8-inch pipe except for short stretches, no more than 600 feet in length, will prevent further inadequacies of this nature.

AVAILABLE FIRE FLOW

A number of tests were made in Southborough in 1958 and 1959 by us to determine the flow available for fire protection purposes. The results of these tests are shown in the enclosed Table II. These tests were conducted under normal operating conditions at points originally tested by the New England Fire Insurance Rating Association in 1938, and at points selected to cover the additions made since that time.

If the flow available is compared with the recommended flow it becomes apparent that the existing system is in most instances able to deliver adequate quantities of water for fire fighting purposes.

The fire flow tests made for this study have been compared with those made in 1931 and 1938, by the New England Fire Insurance Rating Association, and the results indicate that the carrying capacity of the mains has not depreciated over the years. It might be well to note here that almost all of the pipe in the distribution system is cement lined, cast iron pipe. Experience has shown that except in a few isolated cases this type of pipe will maintain a very high carrying capacity for many years.

WATER STORAGE

Water storage for Southborough is provided by a 400,000 gallon standpipe located on Newton St., 40 feet in diameter and 42.5 feet to the overflow; a 275,000 gallon standpipe, located on Oak Hill Road, 25 feet in diameter and 75 feet to the overflow; and a 150,000 gallon elevated tank located on Atwood Street, 25 feet in diameter and 75 feet to the overflow, all as shown on the plan of the water system.

The New England Fire Insurance Rating Association has no specific requirement for the amount of storage to be provided in a water system. Instead, the normal ability of the source of supply, including storage reservoirs, to deliver the maximum daily consumption rate plus the required fire flow is considered. In the case of Southborough in 1985 the standards would require that the water supply and storage facilities be able to deliver

TABLE II
FLOW TESTS ON ENLISTING SYSTEM

Test No.	Static P.S.I.	Residual Hydrant P.S.I.	Residual Pressure Hydrant Open P.S.I.	Flow G.P.M.	Available Fire Flow *Residual Pressure of 20 P.S.I.	NEFIRA Recommended Flow
1	77	66	1280	2930	1500	1500
2	92	77	1400	3080	1500	1500
3	93	77	1350	2890	1500	1500
4	80	64	1890	1720	1000	1000
4-A	67	28	700	770	1000	1000
5	91	65	1020	1830	1000	1000
6	78	62	1250	2350	1000	1000
7	74	67	1290	3480	1500	1500
8	80	56	1160	1830	1000	1000
9	75	54	1010	1640	2000	2000
10	53	21	640	650	1000	1000
11	74	32	820	930	1000	1000
12	72	52	1040	1650	1500	1500
13	82	52	1080	1540	1000	1000
14	88	63	1260	2080	1000	1000
15	119	23	770	780	1000	1000

2,700,000 gallons of water to the Town over a period of 10 hours. The pumping station, as proposed further in this report, and existing storage reservoirs can deliver only about 1,400,000 gallons in 10 hours, or about 52 per cent of the recommended total. It is obvious that by the usually accepted standards the existing water storage facilities are inadequate.

An hydraulic analysis has been made for the purpose of studying the feasibility of eliminating the 275,000 gallon water storage reservoir on Oak Hill Road. The 6-inch main in Woodland Road was assumed to be replaced by an 8-inch main and it was further assumed that a 10-inch main would be laid from Oak Hill Rd. to Edgewood Rd. in Walnut Drive, Right-of-way and Oregon St. The water available at the intersection of Oak Hill Road and Walnut Drive using the above assumptions would be about 760 gallons per minute at a residual pressure of 20 pounds per square inch. As this quantity does not meet the requirements of the New England Fire Insurance Rating Association it is recommended that the Oak Hill Standpipe be maintained in service.

CONCLUSIONS

The conclusions drawn from the results of the investigation made on the existing water system of the Town of Southborough may be summarized as follows:

1. The existing source of water supply is of poor quality to the point where any permanent future use of

this source would require the construction and operation of a water treatment plant.

2. The existing water distribution system, except for a few isolated cases is adequate for that portion of the Town it now serves. Major additions and reinforcement will be required in the western part of the Town of Southborough if it is to continue to develop.

3. The existing storage facilities are inadequate under present and future requirements, to deliver the water required for fire protection and domestic consumption according to the standards of the New England Fire Insurance Rating Association.

RECOMMENDATIONS

The conclusions of our study point up the necessity of the Town of Southborough acquiring a new source of water supply, constructing additional storage facilities and reinforcing and adding to the distribution system in the Western part of the Town.

Of first importance is the acquisition of a new source of water supply. For the purpose of design the requirements of the year 1985 have been used in this study for capacity source and also for sizing storage and distribution facilities. The estimated future consumptions indicate a maximum day consumption of 1,050,000 gallons (730 gallons per minute) in 1985. To meet this requirement it is proposed to construct pumping facilities capable of furnishing water at the rate of 850 gallons per minute through an electric

motor driven pump and at the rate of 1,000 gallons per minute through a gasoline engine driven standby pump.

The present source of supply, the Sudbury Reservoir, lacks water of a quality satisfactory for future consumption by the Town of Southborough unless a filter plant is constructed and maintained for the purification of the waters contained therein. This method of supply has been considered but as other supplies are available at a much reduced cost per million gallons it is not deemed practical for the Town to use the Sudbury Reservoir as its permanent future source of supply.

Another means of satisfying the needs of the Town would be to attempt to locate a ground water supply with sufficient yield to meet the demands outlined herein. It is proposed to defer any action on this uncertain method as a better method is available.

The appropriate method of furnishing the water requirements for the Town of Southborough is a direct connection to the Miltman Aqueduct of the Metropolitan District Commission, which passes through the Town. When this aqueduct was constructed a 20-inch connection was left at Shaft No. 3 at a point about 2,500 feet north of the junction of Boston Road and Central Street. It can be assumed that this connection was left for the Town with the purpose in mind of furnishing water to Southborough from the pressure aqueduct when the Sudbury Reservoir was unsatisfactory for further use.

It is recommended that the Town proceed to acquire a new source of water supply by means of constructing a pumping station adjacent to the Hultman Pressure Aqueduct and pumping therefrom. Under the alternate plans for proposed improvements outlined further in this report consideration is given to making a connection at Shaft No. 3 and also to the grade line pressure aqueduct at Ward Rd. or Chestnut Hill Road.

The existing agreements with the Metropolitan District Commission with regard to quantity of water available from M.D.C. supply works and the cost of same are based on taking water from the Sudbury Reservoir. Prior to the actual construction of the proposed connection negotiations with respect to quantity and cost of the water from the aqueduct would have to be completed and an agreement, satisfactory to both parties, consummated. We have been advised that a recent, similar agreement was made with the cost of the water to Marlboro set at sixty-five dollars (\$65.00) per million gallons. There is every indication that if Southborough proceeds at this time with the proposed works this same price will prevail.

Our studies have indicated the need for additional storage capacity of at least 1,300,000 gallons. It is recommended that a reservoir be constructed at one of the following locations:

1. On high ground about 1000' northwest of Flagg Rd.
2. On high ground about 2000' southwest of the intersection of Boston-Worcester Turnpike and Parkerville Road.

The hydraulics of the existing system and the improvements proposed will adequately serve the Westerly end of the Town up to Elevation 430, that is to fulfill the requirement at 1,000 gallons per minute at 20 pounds per square inch of the New England Fire Insurance Rating Association. There is considerable land in this area above Elevation 430 presently in the hands of a very aggressive developer. If this land is developed it will require the need of establishing a high water service system for that portion of the Town. Thus it is recommended that the proposed water storage reservoir be constructed 20 feet higher than required by the present hydraulic conditions of the water system.

To furnish storage capacity of 1,300,000 gallons at either location it would be necessary to construct a reservoir about 50 feet high to the overflow and about 67 feet in diameter. This reservoir would contain about 26,400 gallons of water per foot, and would have an available capacity of about 800,000 gallons when used with the existing system and its full capacity of 1,300,000 gallons would be available when the high service system is established.

The distribution system improvements required are for (1) the purpose of conveying the water from the proposed pumping station into the distribution system (2) Connecting the proposed water storage reservoir to the distribution system and (3) Reinforcing and adding to the distribution system in the westerly end of the Town where considerable development is underway or in the planning stages. Several

means of doing the above have been studied with the purpose in mind of accomplishing as much as possible with the least amount of expenditure. The methods considered are listed as follows:

METHOD I

Method I as shown in heavy solid black lines on plan entitled "Proposed Improvements, Water System, Southborough, Mass." attached to this report proposes to locate and construct the required pumping station adjacent to the grade line pressure aqueduct off Ward Road in the Westerly end of the Town; construct the 1,300,000 gallon water storage reservoir at the location previously described west of Flagg Road; a 12-inch main in Ward Road and Main Street from the proposed pumping station to the end of the existing 10-inch main in Main Street west of Sears Road; and a 12-inch in Lovers Lane, Flagg Road and Right-of-Way from Main Street to the proposed reservoir.

The pumping station as shown on plan entitled "Proposed Pumping Station, Southborough, Mass., accompanying this report would contain one 850 gallons per minute electric motor driven centrifugal pump; one 1,000 gallon per minute gasoline engine driven centrifugal pump for standby service; all necessary electric controls for automatically or manually operating the electric motor driven pump; and a separate room with outside entrance for chlorine feed equipment. It is proposed that the electric motor driven pump and the chlorine feed equipment would operate automatically using the water level in the proposed reservoir as the

controlling medium. The water level of the reservoir would be sensed at the reservoir and then transmitted over leased telephone lines to a level recorder located in the control cubicle at the proposed pumping station. This instrument would then function as the control for starting and stopping the electric motor driven pumping unit and the chlorine feed equipment. This equipment should incorporate several safety devices for complete shutdown in the event of equipment failure or failure to operate properly. As the equipment proposed does not require full time attendance by an operator an alarm device located in the Police or Fire Station should be installed to warn of equipment shutdown for failure to operate properly or if low water is recorded at the reservoir.

The architecture of the pumping station building would be of a residential type rather than the conventional municipal type of building, inasmuch as this location is definitely residential and a commercial type building might tend to affect the value of nearby residential property. Along with a pump room the building would contain an office room for record storage, etc. and a chlorine feed and storage room with a separate outside entrance.

Although a new source of water could be acquired for less money by utilizing the existing connection at Shaft No. 3 of the Hultman Pressure Aqueduct other factors must be considered. Additional storage facilities are required

and if the Western part of the Town is to develop, distribution mains of a size adequate to serve the needs of industrial development must be constructed.

The location of the proposed pumping station and storage facilities as proposed under this method would require the laying of connection piping in such a way as to create the backbone of the distribution system for properly servicing the Western part of the Town. There are no water mains in the above streets except a part of Lovers Lane and Flagg Road. Under this plan the existing 8-inch main Lovers Lane would be removed and salvaged.

The estimates of cost of construction for Method I, based on present day costs, doing the work by the usual contract methods and allowing for all contingent expense such as cost of acquiring rights-of-way, legal, engineering, etc. are as follows:

1.	Building, furnishing and equipping a pumping station complete with a connection to the M.D.C. Hultman Pressure Aqueduct, grading, access roadway, etc.	\$ 80,000
2.	1,300,000 gallon water storage reservoir with necessary piping, valves, etc.	75,000
3.	12-inch pipeline from proposed pumping station to end of existing 10-inch pipeline in Main St. west of Sears Rd., in Ward Rd. and Main St.	140,000
4.	12-inch pipeline from Main St. to proposed water storage reservoir in Lovers Lane, Flagg Road and Right-of-way.	75,000
	Total	\$ 370,000

METHOD I-A

Method I-A would consist of all of the work proposed under Method I except that the existing 8-inch main in Lovers Lane would be utilized and the construction of a 12-inch main in its place would be deferred.

The estimate of cost for Method I-A is the same as Method I, less the cost of laying a 12-inch pipeline in that part of Lovers Lane where there is an existing 8-inch main, and is as follows:

1. Total estimated cost of Method I	\$ 370,000
2. Deduct for eliminating the construction of a 12-inch pipeline in a part of Lovers Lane	<u>25,000</u>
Total	\$ 345,000

METHOD II

Method II insofar as it differs from Method I is shown as heavy dashed black lines on the plan entitled "PROPOSED IMPROVEMENTS, WATER SYSTEM, SOUTHBOROUGH, MASS." attached to this report. This method propose to locate and construct the required pumping station adjacent to the grade line pressure aqueduct off Chestnut Hill Road in the westerly end of Town; to construct the 1,300,000 gallon water storage reservoir at the location previously described west of Flagg Road; construct a 12-inch main in Chestnut Hill Road and Main Street from the proposed pumping station to the end of the existing 10-inch main west of Sears Road; and a 12-inch main in Lovers Lane, Flagg Road and Right-of-way from Main Street to the proposed reservoir.

The pumping station building superstructure and pumping equipment would be identical to that described under Method I. The foundation, and site development at this location would require more extensive work than the Ward Road location.

This method has the same advantages as Method I except that there would be no main laid in Main Street west of Lovers Lane and in Ward Road. As these streets are now being developed it will not be long before these mains would have to be installed.

The estimates of cost based on the same conditions as under Method I are as follows:

1. Building, furnishing and equipping a pumping station complete with a connection to the M.D.C. Hultman Pressure Aqueduct, grading, access roadway, etc.	85,000
2. 1,300,000 gallon water storage reservoir with necessary piping, valves, etc.	75,000
3. 12-inch pipeline from proposed pumping station to end of existing 10-inch pipeline in Main Street west of Sears Road, in Chestnut Hill Road and Main Street.	70,000
4. 12-inch pipeline from Main Street to proposed water storage reservoir in Lovers Lane, Flagg Road and Right-of-way.	<u>105,000</u>
Total	\$ 335,000

METHOD II-A

Method II-A would consist of all of the work proposed under Method II except that the existing 8-inch main in Lovers Lane would be used and the construction of a 12-inch main in its place would be deferred.

The estimate of cost for Method II-A is the same as Method II less the cost of laying a 12-inch pipeline in that part of Lovers Lane where there is an existing 8-inch main, and is as follows:

1. Total estimated cost of Method II	\$ 335,000
2. Deduct for eliminating the construction of a 12-inch pipeline in a part of Lovers Lane.	<u>25,000</u>
Total	\$ 310,000

METHOD III

Method III as shown in heavy dot and dash black lines on plan entitled "PROPOSED IMPROVEMENTS, WATER SYSTEM, SOUTHBOROUGH, MASS." attached to this report proposed to locate and construct the required pumping station adjacent to Shaft No. 3 of the Hultman Aqueduct about 2,500 feet north of the junction of Boston Road and Central Street; construct the 1,300,000 gallon water storage reservoir at the location previously described southwest of the intersection of Boston-Worcester Turnpike and Parkerville Road; construct a 12-inch pipeline from the proposed pumping station to Boston Road in Right-of-way on Metropolitan District Commission property; construct a 12-inch pipeline from the intersection of Boston-Worcester Turnpike and Breakneck Hill Road to the proposed water storage reservoir in Boston-Worcester Turnpike and Right-of-way; and to construct and furnish altitude valve chambers at the existing Newton Street and Oak Hill Road standpipe.

The pumping station building and pumping equipment would be similar to that described under Method I. The pumps at this location would operate against a much higher head because of the small pipes in Boston Road and Oak Hill Road through which the water would be pumped into the distribution system. This additional head required makes it necessary under this method to

install altitude valves at the existing Newton Street and Oak Hill Road standpipes.

Although this method would take care of the required new pumping facilities and storage facilities as well as the previously outlined methods it does not satisfy the need for pipelines in the western part of the Town as there would be no pipelines laid in Flagg Road, Lovers Lane and Main Street.

The estimates of cost based on the same conditions as under Method I are as follows:

1.	Building, furnishing and equipping a pumping station complete with a connection to the Hultman Aqueduct, grading, access roadway, etc.	\$ 75,000
2.	1,300,000 gallon water storage reservoir with necessary piping, valves, etc.	75,000
3.	12-inch pipeline from proposed pumping station to Boston Road in Right-of-way on M.D.C. property.	30,000
4.	12-inch pipeline from the intersection of Boston-Worcester Turnpike and Breakneck Hill Rd. to proposed water storage reservoir in Boston-Worcester Turnpike and Right-of-way.	110,000
5.	Building and equipping two altitude valve chambers, complete with valves, piping, etc. at the Newton Street and Oak Hill Road standpipes.	<u>15,000</u>
	Total	\$ 305,000

METHOD III-A

Method III-A would consist of constructing, furnishing and equipping a pumping station in the same location as under Method III with the 12-inch pipeline from the pumping station to Boston Road. It would also include the construction of a 1,300,000 gallon reservoir at the location previously described west of Flagg Road; the construction of a 12-inch pipeline from the intersection of the Boston-Worcester Turnpike and Breakneck Hill Road to the proposed reservoir and the construction and equipping of altitude valve chambers at the Newton Street and Oak Hill Road standpipes.

This method accomplishes much the same as Alternate III except that it caused large mains to be laid farther into the western end of the Town and would connect to the 8-inch main in Flagg Road eliminating an existing dead end, but would still not give the Town large pipelines in Lovers Lane, Flagg Road and Main Street.

The estimates of cost based on the same conditions as under Method I, are as follows:

1. Building, furnishing and equipping a pumping station complete with a connection to the M.D.C. Hultman Aqueduct, grading, access roadway, etc. \$ 75,000

2.	1,300,000 gallon water storage reservoir with necessary piping, valves, etc.	\$ 75,000
3.	12-inch pipeline from proposed pumping station to Boston Road in Right-of-way on M.D.C. property.	30,000
4.	12-inch pipeline from the intersection of Boston-Worcester Turnpike and Breakneck Hill Road to the proposed standpipe in Boston-Worcester Turnpike, and Rights-of-way.	175,000
5.	Building and equipping two altitude valve chambers, complete with valves, piping, etc. at the Newton Street and Oak Hill Road standpipes.	<u>15,000</u>
	Total	\$ 370,000

A summary of the total cost of each of the above methods is as follows:

* Method I	\$ 370,000
Method I-A	\$ 345,000
Method II	\$ 335,000
Method II-A	\$ 310,000
Method III	\$ 305,000
Method III-A	\$ 370,000

*See Appendix A, attached, for "Cost Analysis Method I"

Each of the above listed Methods are feasible depending on what the Town of Southborough desires to accomplish in constructing major water system improvements.

If the western part of the Town is to be developed as is indicated at this time then Method I and I-A or Method II or II-A should be considered. If the Town feels the proposed development at this area will not materialize then the construction should proceed on Method III.

It is recommended for the following reasons, that the Town proceed with the construction program described under Method I:

1. Almost all of the land in the western end of Southborough is in the hands of developers, both residential and industrial. A portion of the land encircled by Boston-Worcester Turnpike, Flagg Road and Deerfoot Road is in an advanced state of development. The land west of Flagg Road and Lovers Lane is a part of a parcel that extends into Westborough and the Westborough part of the property is also in an advanced state of development. The land encircled by Boston-Worcester Turnpike, Parkerville Road, Gilmore Road and Westborough-Southborough Town Line is also in the process of being developed.

2. Almost all of the pipelines constructed under this method will be in streets in which no pipelines exist at present.

Under Method I, proposed for construction, it is further proposed that the 12-inch pipeline from Flagg Road to the intersection of Boston-Worcester Turnpike and Parkerville Road in right-of-way and Boston-Worcester Turnpike shown on the plan entitled "PROPOSED IMPROVEMENTS, WATER SYSTEM, SOUTHBOROUGH, MASS." as part of Method III and III-A be constructed, in the future as part of the overall reinforcement of the distribution system, when development in the area requires.

FINANCING PROPOSED IMPROVEMENTS

The total estimated cost of Method I recommended for construction is \$370,000 of which \$155,000 is for the water storage reservoir and pumping station; and \$215,000 is for the 12-inch pipelines. Existing Massachusetts legislation requires that money borrowed for constructing water storage reservoirs and pumping stations be repaid in a period not exceeding 20 years and that money borrowed for the construction of 12-inch pipelines be repaid in a period not exceeding 15 years.

Table III entitled "FINANCING PROPOSED PROJECT" contained herein is based on the following:

1. Time to repay as stated above.
2. An assumed interest rate of three and one-half percent (3-1/2%).
3. The curve entitled "INCOME AND OPERATING EXPENSES" shows that consumption, income and expenses have risen at approximately the same rate. It is our understanding that the water department of the Town of Southborough is required by law to use their surplus income to reduce any outstanding debt.

TABLE III
FINANCING PROPOSED PROJECT

Year	Debt	Principal Payment to Retire Debt	Interest Payment at 3½%	Total Principal & Interest	Income Available for Debt Retirement	Balance to be Raised by other Means
1960	370,000	22,000	13,000	55,000	13,700	21,300
1961	348,000	22,000	12,200	34,200	14,300	19,900
1962	326,000	22,000	11,400	33,400	15,000	18,400
1963	304,000	22,000	10,600	32,600	15,600	17,000
1964	282,000	22,000	9,900	31,900	16,200	15,700
1965	260,000	22,000	9,100	31,100	16,800	14,300
1966	238,000	22,000	8,300	30,300	17,400	12,900
1967	216,000	22,000	7,600	29,600	18,000	11,600
1968	194,000	22,000	6,800	28,800	18,600	10,200
1969	172,000	22,000	6,000	28,000	19,100	8,900
1970	150,000	22,000	5,300	27,300	19,700	7,600
1971	128,000	22,000	4,500	26,500	20,300	6,200
1972	106,000	22,000	3,700	25,700	20,800	4,900
1973	84,000	22,000	2,900	24,900	21,300	3,600
1974	62,000	22,000	2,200	24,200	21,800	2,400
1975	40,000	22,000	1,400	23,400	22,400	1,000
1976	18,000	18,000	600	18,600	22,800	0

Existing legislation stipulates that when the Town of Southborough takes water from the Hultman Aqueduct there will be no charge for the first 150,000 gallons per day. If the Town had taken water from this source in 1958 the operating expenses would have included an additional \$2,300 for the cost of water. Thus the total expenses would have been about \$28,860 and the income was about \$41,045 leaving \$12,185 available for debt retirement or about 30% of income. The column of figures "INCOME AVAILABLE FOR DEBT RETIREMENT" on Table III is based on 30% of the estimated future income shown on the curve Figure II entitled "INCOME AND OPERATING EXPENSES" being available for debt retirement.

4. For the purpose of averaging the bond payments the 20-year money and 15-year money has been averaged to 17 years.

As the proposed improvements recommended herein are of a nature that will be of value to all consumers within the Town of Southborough and will affect the value of most of the undeveloped land in the Town, the most appropriate and recommended means of raising the balance of money needed beyond available income is by means of the real estate tax levy rather than an increase in water rates. An increase in water rates would not be an equitable solution to the retirement of the financial debt to be incurred.

APPENDIX A

COST ANALYSIS METHOD I (Recommended Project)

(Note: The following cost analysis is set up to conform to the information required in Item 7. Estimated cost of Proposed Public Work of Housing and Home Finance Agency form for Request for review and approval of planning documents.)

CONSTRUCTION COSTS

1. Building, furnishing and equipping a pumping station complete with a connection to the M. D. C. Hultman Pressure Acqueduct, grading, access roadway, etc.	\$ 69,000.00
2. 1,300,000 gallon water storage reservoir with necessary piping, valves, etc.	61,000.00
3. 12-inch pipeline from proposed pumping station to end of existing 10-inch pipeline in Main St. west of Sears Rd., in Ward Rd. and Main St.	120,000.00
4. 12-inch pipeline from Main St. to proposed water storage reservoir in Lovers Lane, Flagg Road and Right-of-way.	<u>65,000.00</u>
Total construction costs	\$315,000.00
Contingency allowance	<u>13,000.00</u>
Total	\$328,000.00

APPENDIX A. (Cont.)

PROJECT COSTS

Plan Preparation

1. Engineering design services	\$13,000.00
2. Field surveying services	<u>4,000.00</u>
3. Preliminary planning costs	<u>4,000.00</u>
Total plan preparation	\$21,000.00

Land and Rights-of-Way

5,000.00

Construction Costs and Contingencies

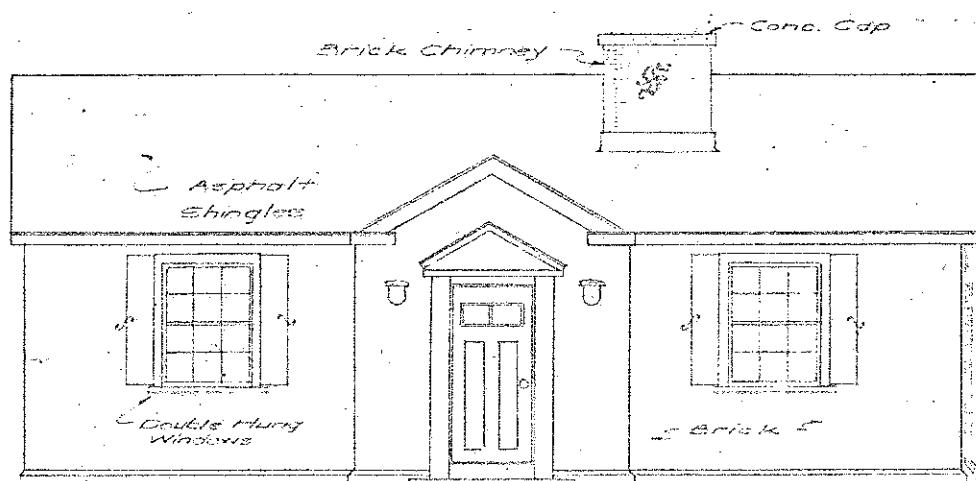
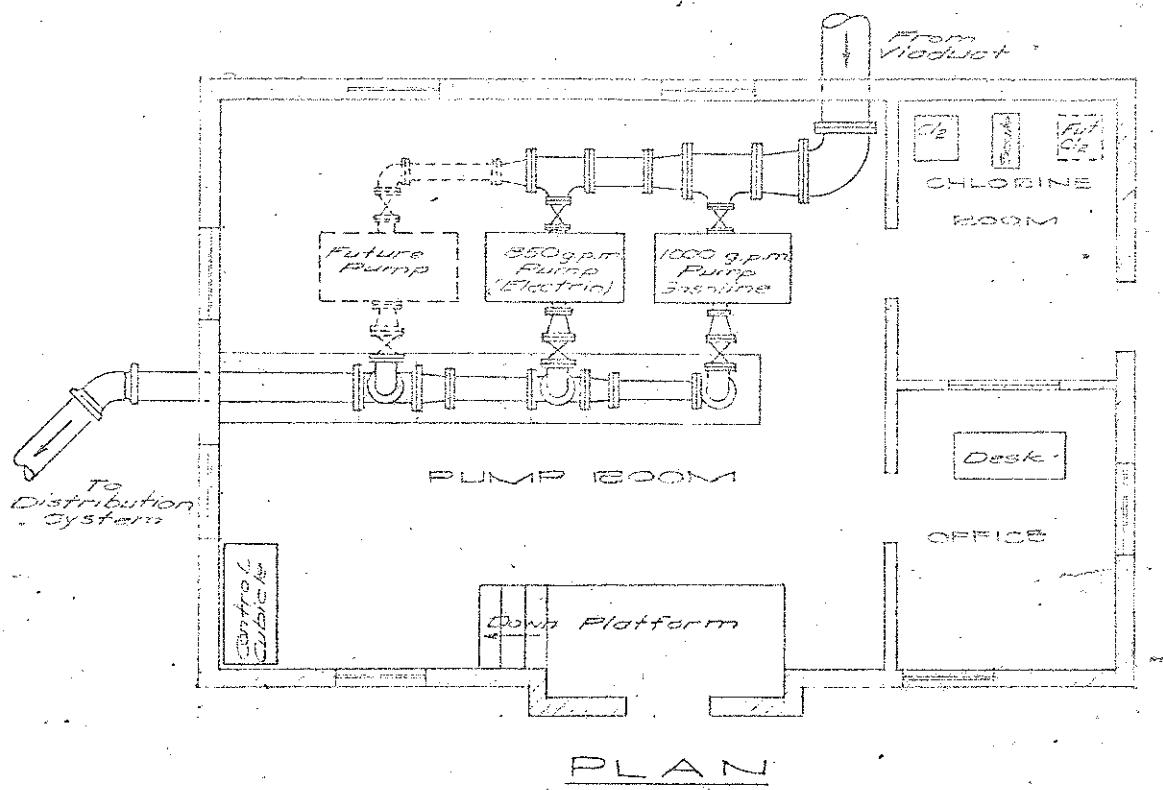
(See above) 328,000.00

Supervision of construction

13,000.00

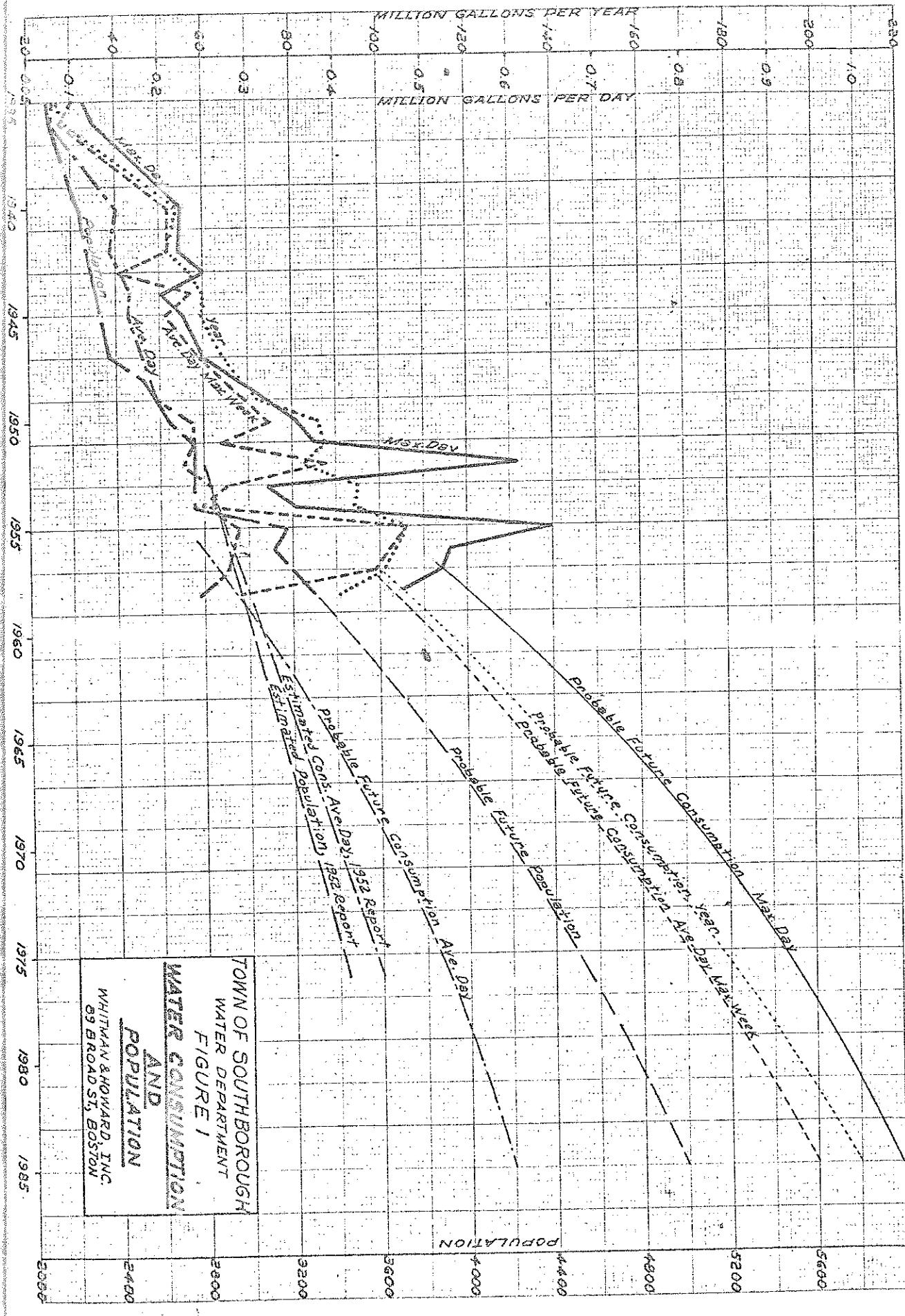
All Other

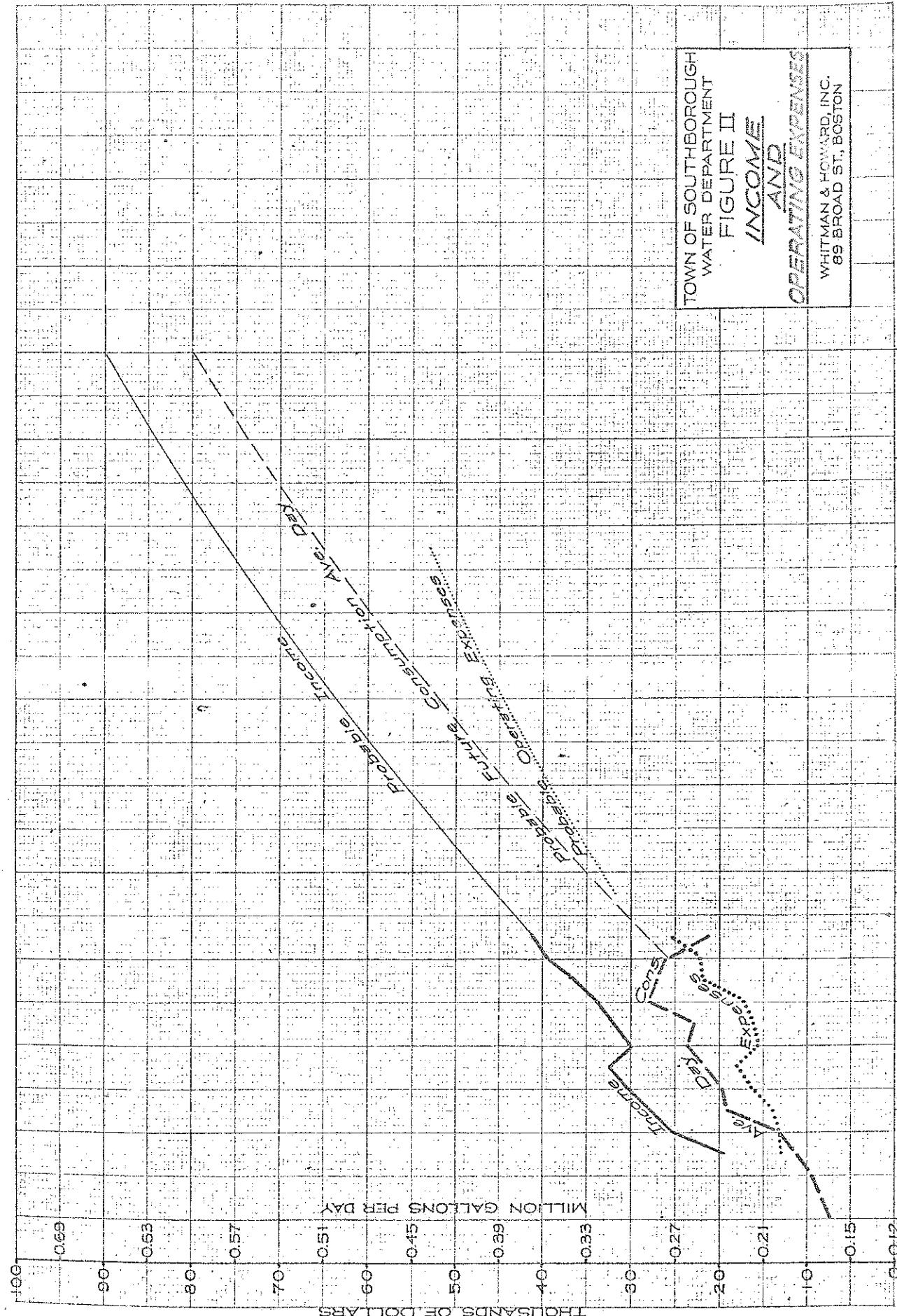
1. Legal	\$2,000.00
2. Administrative	<u>1,000.00</u>
Total all other	<u>3,000.00</u>
Total project costs	\$370,000.00

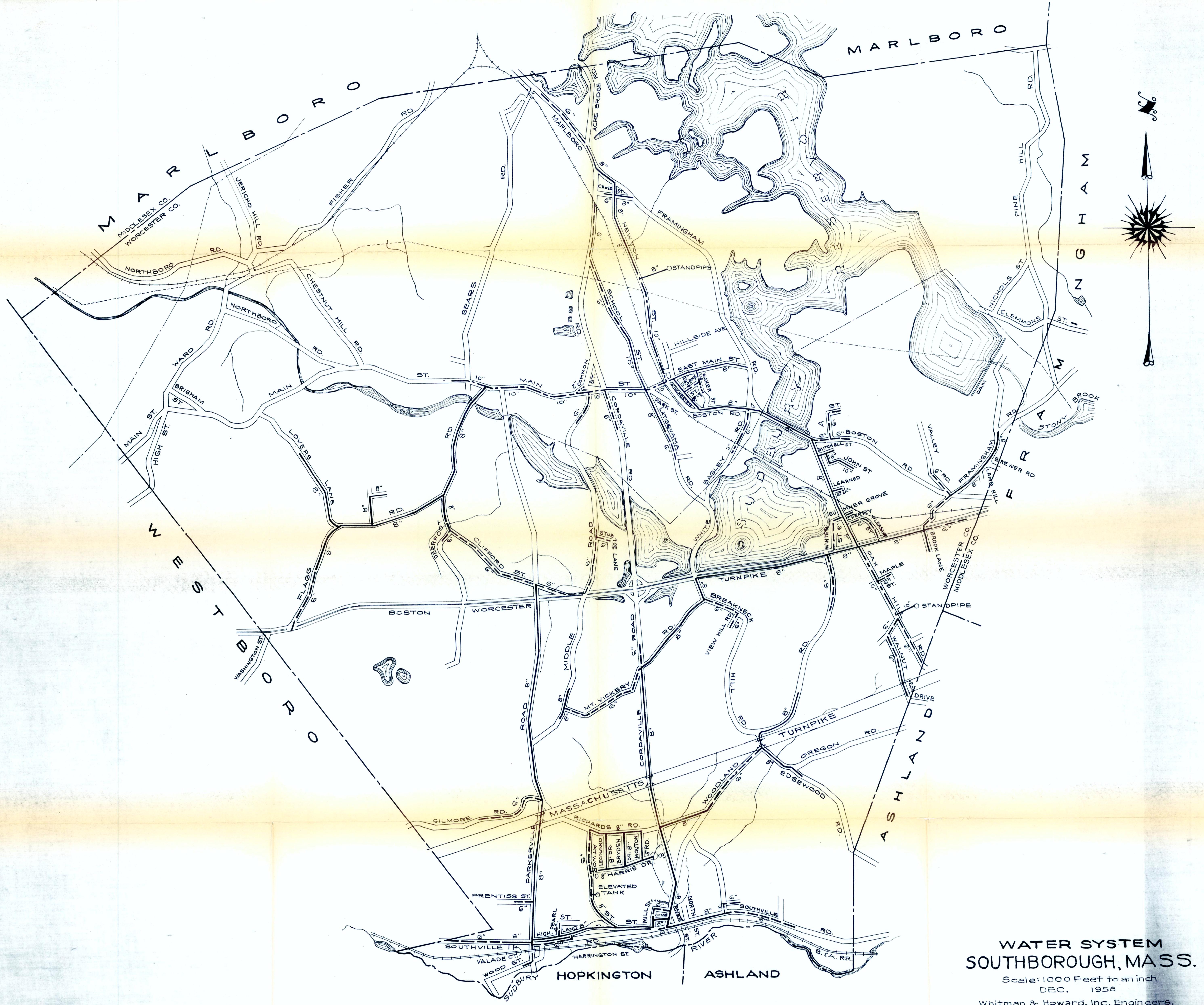


FRONT ELEVATION
PROPOSED
PUMPING STATION
SOUTHBORO, MASS.

Boggs, Shambaugh
Wentworth Howard Inc., Engineers
April, 1959







**WATER SYSTEM
SOUTHBOROUGH, MASS.**

Scale: 1000 Feet to an inch.
DEC. 1958

Whitman & Howard, Inc. Engineers.
89 Broad St., Boston, Mass.



PROPOSED IMPROVEMENTS
WATER SYSTEM
SOUTHBOROUGH, MASS.

Scale: 1000 Feet to an inch.
DEC. 1958

Whitman & Howard, Inc. Engineers.
89 Broad St., Boston, Mass.