

JOURNAL
OF THE
New England Water Works
Association.

VOLUME XXII.

1908.



PUBLISHED BY
THE NEW ENGLAND WATER WORKS ASSOCIATION,
715 Tremont Temple, Boston, Mass.

AN OLD AQUEDUCT AND ITS DEVELOPMENT.

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[Read September 24, 1908.]

The water-works system of Haverhill, Mass., is one of the ten oldest in point of organization in the entire area comprised in our Association. There is in our city hardly an institution or business existing to-day that at all approaches it in antiquity of origin, and it is and ever has been most intimately connected with the history and development of the city.

The first municipal water system of which we find record was established at Boston in 1652, consisting of a reservoir about twelve feet square, to which water from springs in the vicinity was conveyed through wooden pipes.

Of the 140 places in Massachusetts having water works in 1890, all but 9 had been built later than 1840, and for the most part since 1870. In the year 1800 there were but 16 places in the United States that had water works, and not one in Canada; and even as late as 1850 there were but 83.

As a matter of record, the sixteen built up to 1800 are enumerated as follows: Boston, 1652; Bethlehem, Penn., 1754; Providence, 1772; Geneva, N. Y., 1787; Salem, 1795; Plymouth, 1796; Hartford, 1797; Portsmouth, Worcester, and Albany, 1798; Peabody, New York City, Morristown, N. J.; Lynchburg, Va., and Winchester, Va., 1799; and Newark, N. J., 1800.

All of these, with the exception of Winchester and Morristown, were built by private companies, but passed into the control of the respective municipalities from time to time up to 1860. The aqueduct at Winchester was built by the municipality; that at Morristown is still owned by a private company.

Of course with a scattered population, where the houses had plenty of surrounding land, wells of pure water were able to amply supply the needs of the people. The denser growth of the towns, the introduction of sanitary plumbing, appendicitis, and the multitude of germs that make life miserable for us to-day, necessitated a corresponding development in the water supply.

It was perfectly natural that the citizens of old Haverhill should have been pioneers, for there are few places that have such an abundance of pure water on all sides, while the situation of the original village, clustered on the waterside, with a natural rise to the three great ponds, offered no problems requiring engineering skill; it was simply to provide an outlet and let the water flow downhill. In fact, we may well suppose that the existence of these natural reservoirs had much influence with the first settlers in the choice of a location for their homes; and certainly there could have been few locations with a more abundant supply of water.

The town of Haverhill, or, as it was originally called, Pentucket, was settled in 1640 by a band of twelve men from Newbury and Ipswich, joined soon after by Rev. John Ward, who became the leader of the settlement, and whose original house is still standing and in the care of the Historical Society. I have a facsimile of the deed from the Indians, Passaqua and Saggahew, in which they made a grant of the lands for the sum of three pounds and ten shillings. As first laid out the town was nearly in the form of a triangle, and included a large portion of the territory now forming the towns of Salem, Atkinson, Hampstead, and Plaistow in New Hampshire, and Methuen in Massachusetts. From the river side the land gradually rises till we come to the large ponds. The nearest, and also the smallest, was Plug Pond, now Lake Saltonstall, and formerly called Ayers Pond from the fact that several people of that name settled near its western end and owned a large part of the adjoining land. This pond has an elevation of 122 feet and covers 70 acres. At the southern extremity was a dam called the "plug dam" in one of the old documents, from which, doubtless, the name of the pond.

Next came Round Pond, with an elevation of 152 feet and containing 80 acres. Round Pond is remarkable from the fact that not a single stream, even of the smallest kind, flows into it, it being supplied, with the exception of the flowage from the surrounding hills, by subterranean springs. Except at one place at the northwest corner, it has a clear, sandy bottom. The natural outlet was toward the southwest into Little River, but the direction of this outlet was long ago artificially changed to secure the surplus water for the mills on the mill brook.

Kenoza Lake, formerly known as Great Pond, was the largest, covering 225 acres, at an elevation of 110 feet, with a large watershed and surrounded by beautifully wooded hills. Its outlet was Fishing River. In 1859 a number of the leading citizens formed a club, purchasing a lot of land on the shore of the lake to be used for picnics and social gatherings.

To John G. Whittier was intrusted the honor of selecting a new name for the pond, and the result was his beautiful poem, "Kenoza," in which he refers to the change of name and to the rare beauty of its natural setting.

"Lake of the pickerel! let no more
The echoes answer back 'Great Pond,'
But sweet Kenoza, from thy shore
And watching hills beyond.

"Kenoza! o'er no sweeter lake
Shall morning break or noon cloud sail;
No fairer form than thine shall take
The sunset's golden veil."

Crystal Lake, formerly called Creek Pond, was situated about three miles away to the west, and covers 159 acres, with an elevation of 152½ feet. Its shores, quite irregular, are beautiful in spots, the water remarkably clear and transparent, and the bottom for the most part even and sandy. Its outlet is Creek Brook, emptying into the Merrimac.

It was not, however, until about 1799 that any steps were taken to bring the water by gravity to the cluster of houses on the banks of the river, in the fork of the roads formed by the intersection of Main and Water streets. Mr. David How, who at the commencement of the last century was one of the leading citizens of the town, was the first to enter on the project of laying a pipe to bring water from Round Pond to his farmhouse. Iron and even clay pipes were then unknown in this country, and the only method for the conveyance of water was by the use of wooden conductors or bored logs. Mr. How's farmhouse was directly back of that portion of our main thoroughfare now occupied by retail business houses. Here, directly in the center of the town, was his house, and around it were clustered his cow yard and pigpens. There

are some old residents who remember the house as it stood in 1835. Mr. How was still living, but old and infirm. His establishment was then regarded as a nuisance; the dilapidated buildings were reeking with filth, and the stench from his pigpens was an annoyance to all in the little village. To this place Mr. How was desirous of bringing water, and with the assistance of neighbors, green pine logs were bored with a two-inch auger, and a line of pipe was laid to Round Pond.

The idea of an aqueduct appears to have appealed to others of the townspeople, and in 1798 the following petition was presented to the legislature then in session in Boston:

TO THE HONORABLE THE SENATE & HOUSE OF REPRESENTATIVES
OF THE COMMONWEALTH OF MASSACHUSETTS IN GENERAL COURT
ASSEMBLED.

The petition of Timothy Osgood of Haverhill in the County of Essex & Commonwealth aforesaid in behalf of himself & others Humbly Shews they have in contemplation sinking an aqueduct taking the water at & from the round pond so called in Haverhill & conveying it through the several streets of said Haverhill for the use & convenience of themselves and others who may be desirous of becoming concerned therein & for their greater convenience & security they pray your Honors would grant to them & such others as my associate with them an act of Incorporation Impowering them by the name of Haverhill Aqueduct Company to convey water into the streets in said Town through aqueducts with all such powers rights & priviledges as the subject matter may render necessary & as in Duty bound will ever pray.

TIMOTHY OSGOOD *in behalf*
of himself & others.

HAVERHILL Jan^y 8th, 1798.

There were, however, some who did not favor the innovation, for we find in the records of the same year that the town's representative, Mr. Nathaniel Marsh, was instructed "to oppose Osgood's petition for an aqueduct to take water from Round Pond." The petition was evidently granted, however, and in 1801 we find in the town records the steps taken for the formation of the company which from that time on furnished the water supply of the town. This petition was referred to a committee, of which Bailey Bartlett, who for several years was sheriff of the county, was chairman,

who reported that leave ought to be granted provided that a book for the subscription to the stock was opened to all who chose to take a share; that no one should be allowed to take more than one share until ninety days after the book was opened, at the end of which time the remaining shares might be taken by any of the subscribers; and that the rules of the company be offered to the town for approbation. The following is a copy of the advertisement inviting subscriptions to the stock of the new company.

AQUEDUCT COMPANY.

Notice is hereby given, a subscription open at the store of Benja. Willis Jun. for Subscribers to the Aqueduct Company, which will be kept open for ninety days agreeable to a vote of the Town, for any person who may wish to become a proprietor.
HAVERHILL June 10, 1802.

We might wonder why it was that the first water was taken from Round Pond instead of going to Lake Saltonstall or Plug Pond, which were so much nearer. At that time the outlet of Plug Pond was the mill stream that came down the valley between the old cemetery and the road, entering the Merrimac at the foot of Mill Street, and known as Mill Brook. This brook was about one third of a mile long and had a fall of one hundred and twenty-two feet in that distance, which, with the dam before mentioned, gave ample water power. On this stream was situated the first gristmill of the early settlement. Along the stream at the date of the incorporation of the aqueduct were several manufactories, a tannery, a bark mill, a hat factory, a sawmill, a gristmill, and, at a somewhat later date, a woolen mill; and of course the drawing down of the pond to any great extent would affect the water rights of these mills. In fact, in 1815 a suit was entered against the aqueduct company because they were taking water from Round Pond.

In 1814 Leonard White had conveyed land on the brook and the mill privilege connected with the same to the Haverhill Cotton and Wool Manufactory. A mill was started and cloth manufactured. The next year the company, in the name and with the assent of Leonard White, brought action in which they set forth that by

1800. Oct-11th The Aqueduct Company consisting of thirty
 six Subscribers viz. Bailey Wastlett, James Duncan Jun^r Jun^r
 Nath^l Jun^r Charles Tucker, Moses Wood, Daniel Brackett,
 Nathan Ap^r, David Baris, Peter Osgood, Jesse Harding, Tom^s
 Osgood, Nath^l Saltonstall, James Duncan, Caleb P. Libosquitt,
 Daniel Appleton, Abel Abbot, Joseph Barrod, Israel West-
 lett, Leonard West, Jun^r & Sargant, Galen R. Fay, Nath^l
 Bell, Dudley Potter Jun^r, Moses Brackett, James Barcliffe, &
 Sam^l Walker met at Mr. Barrod's, when
 Hon^{ble} Bailey Wastlett was chosen Moderator.
 And
 1st That Leonard West be Clerk to the Company pro tempore.
 2nd That Leonard West be Treasurer to do so pro tempore.
 3rd That the Aqueduct be divided into one hundred
 Shares.
 4th That J. Tucker, B. Wastlett & J. Duncan Jun^r Esq^s be a Com^{tee}
 to prepare bye Laws & report them at next meeting.
 5th That J. Tucker Esq^r Sep^r & Brewster be a Com^{tee} to find
 where & at what rate Logs can be procured & make report
 at next meeting.
 6th That the Clerk call on the absent Members for their pro-
 portion of the apportionment to be made this evening & those
 Shares they do not pay for shall revert to the Company.
 7th That an apportionment of none, shall be made on each
 Share.
 8th That the Treasurer pay Mr. Barrod's bill of \$1.50 Cont^d.
 9th That this meeting be adjourned to the 18th current at
 7 O'clock P.M. to meet at this place.

THE FIRST PAGE OF THE MINUTES OF THE AQUEDUCT COMPANY.

supplying the inhabitants of Haverhill with water from Round Pond the company unlawfully diverted the waters which were a part of Plug Pond and to which the owners of this land and mill privilege were entitled. The manufacturing company was awarded judgment, and from that time until 1849 the aqueduct company used the waters of Round Pond, under an agreement whereby they paid the owners of the land compensation for doing it. Later the company purchased all the land between Plug Pond and the Merrimac River, paying sums ranging from \$200 to, in a single instance, \$10 000. The Leonard White referred to above was the first treasurer of the aqueduct company, and was placed in the position of bringing suit against his own company on account of having sold the land to the woolen mill.

Having received their charter, the parties interested soon took steps to organize the company, and on October 11, 1802, met at Harrod's Tavern, which stood on the site of our present city hall. I have here the records of that first meeting; this and the records and accounts for many years being in the clear, legible writing of Mr. Leonard White, the clerk, who was, I believe, later the first cashier of the Merrimack National Bank at its incorporation in 1814. (Plate I.)

I ought, as a careful historian, to call your attention to the fact that if they did not at once begin to water the stock, they did at this first meeting mix rum with their water, to the success of the new company, in the good old West India variety, and here is the bill of Landlord Harrod covering the same. (Plate II, Fig. 1.) And I regret to say that this is not all of the sad tale, for as the company got under way their thirst increased in quantity and quality. Let me give you another sample. (Plate II, Fig. 2.)

The managing directors of the company were Hon. Bailey Bartlett, Benjamin Willis, and James Duncan, Jr., and in looking over the records of these early days I have been impressed by the very businesslike way in which all was done. Although the town was small and these men must have seen each other daily, every order to the treasurer for the payment of money is in the writing of the directors; and Mr. Harrod, who was one of the incorporators, never forgot to put in his bill for liquor consumed. When James Duncan went to Boston and brought out the iron for binding the logs, we

find his bill for thirty-five cents, and there is a bill from Bailey Bartlett of thirteen cents for a paper book and other items, concluding with a charge of forty dollars for overseeing the laying of the logs. They all appear to have cheerfully paid out of one pocket assessment after assessment on their stock, and then as cheerfully got the most of it back into the other pocket in the shape of bills and sundry small dividends declared from time to time.

We have heard considerable at some of our meetings about specifications for iron pipe, and you may some of you like to hear the original contract and specification for pipe made in 1803:

Articles of Contract and agreement made this 26th. day of Jan. 1803 Between Bailey Bartlett, Benj. A. Willis and James Duncan Jr. in behalf of Haverhill Aqueduct company on the one part and Enoch Noys of Barr in New Hampshire on the other part witnesseth

The said Enoch Noys for the consideration hereafter expressed does hereby contract and engage to deliver at some landing near Haverhill Bridge on or before the 20th day of May next, eight thousand feet in length of good sound white or yellow pine timber of the following dimentions; no stick to be less than fifteen feet in length; one third of the quantity to measure at the top end nine inches; one third ten inches, and one third twelve inches, the same to be straight and sound and said measure is to include the heart only.

And the said Bartlett, Willis and Duncan in behalf of said proprietors do hereby engage to pay said Noys at the rate of twenty shillings for each and every ton the same shall measure, reconing the same as measured at the top end and free from sap and of the three several dimentions as above stated, the same to be paid on delivery of the whole timber.

Signed in the presence of	ROBERT MCGREGOR	BAILEY BARTLETT BENJ. WILLIS ENOCH NOYES
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CONTRACTS TO BE MADE FOR THE AQUEDUCT COMPANY IN
HAVERHILL.

1803

- May 3. First for Digging the Ditch to lay the Logs from a Stake & Stones near the Pond Brook to a Stake & Stones by Sam Walkers land about 150 Rods — the ditch to be not less than 3½ feet Deep and wide enough to lay the logs, the bottom of the Ditch to be level, sufficient for the logs to lay fair on the same.

Oct. 11. 1802 - The Aqueduct Company
 Dr. To Joseph Harrod for some of brandy
 to _____ \$1.50
 Rec^d by J. Harrod White Treasurer
 Joseph Harrod

FIG. 1. FIRST BILL PAID BY THE AQUEDUCT COMPANY.

Aqueduct Company to Joseph Harrod Dr.
 To 1/2 mugs flip @ .20 1.00
 To 5 mugs Laddy @ 1.00
 Rec^d payment of J. Harrod White Treasurer \$2.50
 Wmth Dec. 13th Joseph Harrod

FIG. 2. ANOTHER EARLY BILL.

May 14th 1803 J. Kinners Emoryson
 to the Proprietors of the Water-duct
 For 1 year of Oxen one day 0.60
 15 for one hand & four Oxen 1 Day 0.18 0
 Voted, to be allowed at the same price of other work May 1808. 1. 4 0

FIG. 3. BILL FOR HAULING LOGS.

- No. 2 Contract — beginning at the lower End of N^o. 1 — and continue to Caleb Bosquets House opposite the Front Door.
- No. 3 From the above mentioned Door to Hav'll Bridge.
- N. B. In case, the Contractors in digging any part of the ditch abovementioned, should come across any Rocks of more than ten hundred Weight or Fast ledge of Rocks they shall have liberty to dig round the same, or to remove the rocks at the direction of the Directors, in which case the Directors will pay the extra expense. Where it is necessary to take down any walls in the prosecution of the work, they shall be put up by the directors at the expense of the aqueduct Company.
- No. 4 Contract for covering the Logs when laid; the whole dirt taken out, to be thrown upon the Logs as fast as they are laid, and ready for covering. From the Pond to the Bridge the same to be by the Rod.
- No. 5 Boring Fixing & laying the logs Fit for Covering, the Proprietors to find the Iron Hoops to put on the ends of the logs. 4000 feet of Logs with a two Inch Augur 4000 feet Do 1½ Inch bore — to be well rimmed out. the whole to be done in a workman like Manner and to the approbation of the directors and to Include the logs to extend from the main logs to the Houses

The contractor evidently had good luck, for here is the bill of Moses Emerson, dated May 14, 1803 (Plate II, Fig. 3), against what he terms the "Accuduck" for the use of oxen in hauling the logs from the landing. But I must stop no longer with these interesting relics of the past.

Returning again to the log aqueduct, let me refer to some of the early trials and tribulations that even to the present day are connected with water-works administration. After the water had been let on, the pressure was so great that the log pipes, unable to stand the strain, burst. This was a grave difficulty, and all the hydraulic skill of the times was brought to bear on the problem. At last the idea was hit upon of making a break in the pipes half way down the hill, by digging a pit, and thus relieving the pressure. This pit was placed nearly opposite the Unitarian Church and remained there for nearly forty years.

In the early stages of the company no water was carried above

the first story of the houses, and no lead or metal stop cocks were in use. The logs were brought directly into the kitchens and cow yards, and an upright bored log with wooden faucet held the water for use. A curious device was used on Main Street, near the North Church, to elevate the flowing water so as to bring it into the kitchens of the houses. It was found that the water would flow through the logs all right, but it would not stop to be taken on the way; and to remedy this evil, an upright log was interposed and bored double, so that the water was forced to ascend one tube to the top and flow over for its passage down town. This held the water back so that customers on the level street could get a supply. This was considered a great piece of engineering skill, and some elderly citizens might doubtless recall how as boys they jumped on the log and listened to the murmur of the water as it flowed over.

It has been said that various evils result from indulgence in strong drink, and in the case of the aqueduct company it took the form of — betting! The hydraulics of the working plant of the company caused differences of opinion as to pressure, etc., and at last, doubtless after a business meeting held by the open fire at the hospitable Harrod's, the discussion grew heated, there was a division among them, and the following bet was made:

The bet is in the form following, viz.:
 a barrel being filled with water and set on the ground a tube of $\frac{1}{2}$ inch bore & 40 feet long inserted into the barrel & made tight, and filled with water and a funnel on the top of the tube filled also with water, the barrel will burst.

Burst.
 B. Bartlett
 D. How
 L. White
 O. Tucker
 M. Brickett
 C. Kimball
 J. Harrod
 T. Jordan
 T. Brickett
 N. Marsh
 E. Hale

Will not Burst.
 J. Duncan
 B. Willis, Jr.
 M. Atwood
 P. Osgood
 B. Willis
 N. Ayer
 D. Brickett
 D. Portor Jun.
 H. West

October 25. 1809

to fetching a wrast of logs
two hundred feet two dollars

for going again myself and another
hand Mr Danford thinks it ought
to be nine shillings

\$3.50

Jonas Luffkin
Rec^d above of Leonard Water
Jonas Luffkin

FIG. 1. BILL FOR RAFTING LOGS FOR PIPE.

To the Aqueduct Corporation, Dr.

DOLLS. CTS.

To the Use of the Water of the Aqueduct from } 2.25
~~1800~~ *1st* 1804 to *May 1st* 1805

The Conditions on which said Corporation agree that said *James*
Meredith shall draw water from the Tube fixed in his house or
yard, are—That he shall not draw or suffer to be drawn any water except
for the use of his family only, (but by special license from the Direc-
tors)—That he will not suffer any waste of water, nor permit any drain,
outlet or under-ground communication, by which the water may be wasted,
under the penalty of One Dollar, for each offence.—The Corporation
promise to keep the Main Tube, leading through the Streets, in repair;
and those persons who take the water, shall, at their own expence, keep the
branches that convey the same from the Main Tube in good repair.

Received Payment,

[Signature] TREASURER.

FIG. 2. AN EARLY BILL FOR WATER RATES.

As the town grew, the two-inch logs were found insufficient to supply water, and about 1830 four-inch logs were substituted, and the aqueduct was extended to some of the streets intersecting with Main Street. The price at first charged was \$4.50 for houses and beasts, providing subscription for taking the water was made before the logs were laid, otherwise it was to be \$5, and an additional charge was made for each additional post. There appears to have been no printed rate sheet until 1822. In making this the proprietors evidently took as a basis the rules and rates of the Salem and Danvers aqueduct as established in 1797, which I have altered in several places, and marked "adopted by the Haverhill Company." The rules as finally adopted and printed were as follows:

RULES AND REGULATIONS of the
HAVERHILL AQUEDUCT COMPANY, AS AGREED
ON BY THE PROPRIETORS, JUNE 14, 1822.

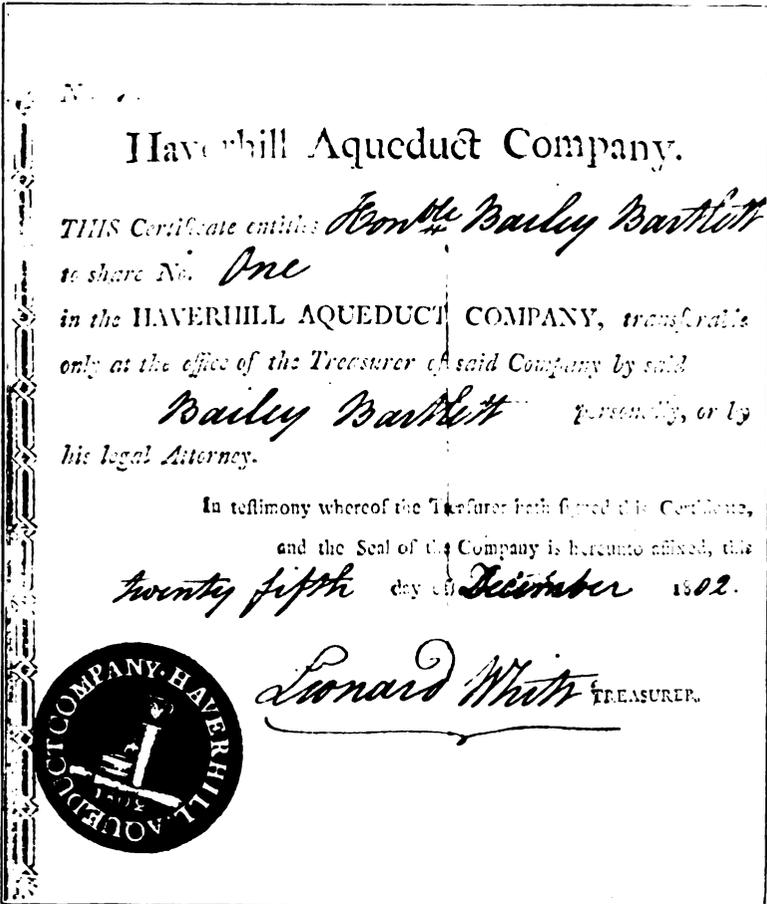
- Article 1. — The Proprietors engage to support the expence of maintaining the main tube from the Pond, and ten feet offset from the same, measuring from the centre of the street; the remainder of the branch and vent-stock shall be made and supported by the person who takes the water, under the care and direction of the Agent of the proprietors, or of one of the directors.
- Article 2. — The Annual sum to be paid for the use of the water from said Aqueduct, shall be as follows . . . viz.
- | | |
|--|------------------|
| For all families less than nine persons in a family, | Eight Dollars. |
| For all private families of nine persons, or more, | Nine Dollars. |
| For a Tavern or public Boarding house, | Eleven Dollars. |
| And if for a House and Stable, | Fifteen Dollars. |
- One half to be paid to the Treasurer in Six months, and the remainder in Twelve months from the time of taking the water.
- Article 3. — The Annual sum to be paid by Distilleries, Manufactories, or other persons not included in the above, shall be such a sum, and under such regulations as may be agreed on with the Directors, to be paid in the times above specified.

- Article 4. — No person taking the water from said Aqueduct, shall suffer a waste of water, or permit any person other than his own family to take the same.
- Article 5. — Every person having a branch shall be subject to have the drawing place therefrom, and everything appertaining thereto, inspected at the direction of the Agent, or one of the Directors, whose duty it shall be to superintend the works generally.
- Article 6. — Should there be a deficiency of water, on notice thereof being given to the Agent or one of the Directors, the pay for such time shall cease, if occasioned by a want of water in the main tube; but the proprietors will in no case be responsible for defects in the offsets or ventstocks, arising from frost or other causes.
- Article 7. — In order to prevent freezing, all persons taking water for family use will have liberty (at their own expence) to take it into their cellars, as well as above stairs.
- Article 8. — Each person taking the water from said company, shall be furnished with a printed copy of these rules subscribed by the Clerk, and shall also subscribe a like copy to be kept by the Clerk of said company, stating that they will conform to these regulations and also stating the number of persons in his family and the use he expects to make of the water.

CHARLES WHITE, Clerk to Props.

The prices for water varied somewhat until 1845, when a uniform tariff was made for ordinary family use, and the rates were not materially changed thereafter until the works were taken over by the city.

An old man by the name of Jordan had sole charge of the works, and the boys were in the habit of calling the aqueduct the "River Jordan." He bored the logs, put them down, attached faucets, made repairs, thawed out the stream when it was frozen, made out the bills, and collected the money as well as he could. He was the one who "ran the machine." His services were in constant demand, especially on frosty mornings, and old boys have told the story of being called out in the cold gray of the morning to hunt up "old Jordan" to thaw out the frozen logs. His house was at



FIRST STOCK CERTIFICATE ISSUED BY HAVERHILL AQUEDUCT COMPANY.

the corner of Main and Pond streets, and an elderly gentleman told me within a year that he well remembered the piles of logs stored by the roadside, and watching the boring process carried on. I have two samples of the log aqueduct (Plate V). This large section is undoubtedly a piece of one of the very early logs laid, as it was dug up at the corner of Main and Water streets. The other section is of a much later vintage, being dug up on Kenoza Avenue. You will note the marks where it was strengthened by hoops of iron.

About 1840 the old aqueduct was found to be inadequate to supply water, and Charles Minot, Esq., a well-known lawyer, took it in hand, raised money, and extended the pipes. The number of shares was one hundred and the par value, I believe, was \$25. With the funds obtained he laid some iron pipe and put the works in better repair. After a few years Mr. Minot was called to act as superintendent of the Boston & Maine Railroad and the aqueduct was purchased to a large extent by Hazen Haseltine, an active business man of the times. His business career was, however, terminated by a failure, and among his assets was a majority of the stock of the company, which passed into the hands of his brother, Ward B. Haseltine, of Philadelphia, who took it, much against his inclination, as security for money loaned to his brother.

Soon after 1845 it was found that more water was needed, and Plug Pond was tapped. Quite a controversy took place at this time over the so-called encroachment of a soulless corporation in planning to take water from this pond, and so destroy forever the beauty and utility of the old mill brook. The culminating point was perhaps reached in the following communication, published in the *Tri-Weekly* by one who signed himself "Mill Street":

"More beautiful to my youthful eyes were the buttercups and thistles which grew on the borders of this much-talked-of brook than the rarest exotics in the parterres of the wealthy and great. The fairy-like music of its crystal waters, as they roared and rippled and seethed and surged and tumbled over its stony bed, was ever suggestive of elves and water-nymphs.

'I envied the brook as it glided along,
Thro' its beautiful banks in a trance of song.'

But there is one point your correspondent has failed to notice,

which would, 'I apprehend,' be more regretted by lovers of art than words could express. I refer to the sweet and pathetic music of the frogs. Have you ever, Messrs. Editors, on a calm, moonlight midsummer's eve, seated yourself on the grassy bank of the upper Mill Pond and drank in the beauty and inspiration of the scene? the majestic rock-ribbed hills in the distance, the stately poplars, the regal sycamores, and the graceful elm reflecting every limb, and twig, and leaf, in the glassy mirror below; the whole scene, so tranquil and soothing, undisturbed by any earth-born sound, save the dulcet melodies of the frogs. The deep diapason of the masculines, the soft, tender responses of the lady frogs, the sweet baby trills of the pollywogs, and the blending of the three in one harmonious whole, produce such a 'concord of sweet sounds' as to make one feel in his heart of hearts the sentiments of the immortal poet, 'linked sweetness long drawn out.'

"I, in company with appreciative friends, have often listened in charmed ecstasy, and the memory of such evenings is 'a joy forever.' And are we, and our children, and our children's children, to be deprived of this exquisite source of enjoyment, so refining and exalting in its nature, for the accommodation of a 'few individuals' who, under the pretence of 'supplying the town with pure water,' are committing acts of vandalism on Mill Street that *no* necessity ought to justify?

"MILL STREET."

Again, in 1867, the two sources of supply proved inadequate, and the owners went to the legislature for permission to draw water from Kenoza Lake. An act was passed, with certain restrictions:

1. Private property was safeguarded by preventing the raising of the ponds *above* high-water mark or lowering them below low-water mark.

2. The water of none of the ponds could be used to drive machinery.

3. A plan was provided by which the city could take over the works.

In 1848, at the town meeting, a proposition was made for the town to pay the difference between a 5-inch and 8-inch iron pipe from Round Pond to the top of the hill on Main Street, the Aqueduct Company being about to replace the old logs with a 5-inch pipe of iron. A committee to whom it was referred reported in favor of a 6-inch pipe, which was laid, the town paying the difference in cost. Soon after this Mr. James H. Carleton obtained



FIG. 1. PIECE OF LOG PIPE.

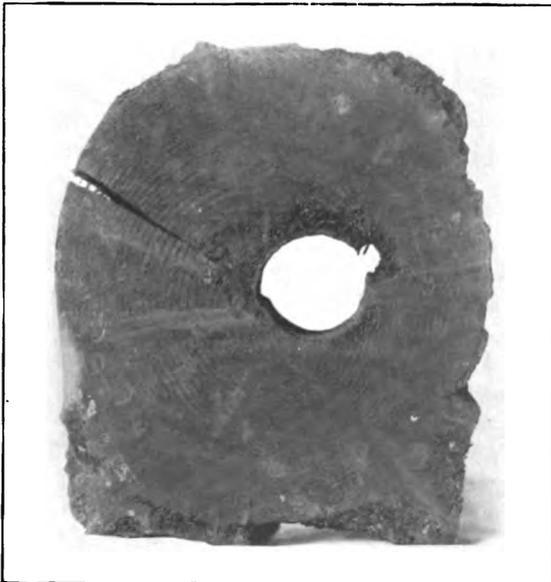


FIG. 2. SECTION OF LOG PIPE.

control of a number of shares held by various local people. For more than forty years the stock was owned by the two previously-named gentlemen, the rest being divided up among five prominent citizens. Mr. Carleton was for many years treasurer and superintendent, being succeeded later as superintendent by Mr. Charles W. Morse, who continued until the city took possession in 1891.

In 1871 a small pump was erected at Kenoza Lake and water was pumped into Round Pond, the system still being gravity. In 1879 the growth of the city had extended greatly and buildings were being erected on the high lands of the city, and the company then added what is now known as the old pumping station, erected a standpipe on Kenoza Avenue, and began to supplement the gravity system by a high-service system. At the same time there was in the western part of the city a reservoir on Silver Hill, or Mt. Washington. This was supplied from springs and was the property of the Silver Hill Aqueduct Company, and was used for the purpose of supplying a little settlement of houses in that vicinity. The Haverhill Aqueduct Company at this same date acquired by purchase and deed this property.

In 1882 it became apparent that there was a permanence in the growth of the city which would require a greater supply than they were then enjoying, and the same year they went up to Crystal Lake and acquired the mill sites on the stream flowing from the lake. In 1884 the legislature granted them the right to use the water of Crystal Lake as a source of supply, and the company immediately laid its line of 16-inch cement pipe from Crystal Lake into the city. In 1889 the growth of the city on the high lands of Mt. Washington had continued and it was again necessary that the high-service system should be supplemented. Another standpipe was erected on a tract of land acquired for the purpose on Grove Street.

In 1884, owing to the dissatisfaction of some of the large water takers with rates, an agitation was made looking to the purchase of the plant by the city, under the Act of 1867; hearings were held by a committee of the city government, but nothing was at this time done. In 1890, however, another committee was appointed, with an appropriation of \$500, to investigate and report on the advisability of acquiring the property and franchises of the Aqueduct

Company. After an exhaustive hearing, the formal order of taking was passed by both branches of the city government, and the order was approved by Mayor Burnham July 10, 1891. By this order the mayor was directed to apply to the Supreme Judicial Court for the appointment of three commissioners who were to determine the price of the franchise, rights, and property of the company. The Court appointed Hon. George O. Shattuck, John E. Sandford, and Weston Lewis as commissioners. They held their opening session May 14, 1892, and on the 17th day of October, 1892, the commissioners reported that the price to be paid by the city was \$637 500, with interest from the 6th day of July, 1891; the city was also to pay the fees of the commissioners, which were fixed at \$7 655.

The Aqueduct Company was represented by Hon. William Gaston, E. T. Burley, Esq., Boyd B. Jones, Esq., and Frederick E. Snow, Esq.

The counsel for the city were Hon. George D. Robinson, Hon. William H. Moody, and Edward B. George, Esq.

The total cost to the city of the hearings, including experts and counsel fees, was about \$22 000.

The authority under which the works were taken by the city and have since been conducted was an act of the legislature, passed in 1891, and two supplementary acts passed in 1892 and 1896. These acts were drawn by Hon. William H. Moody, now one of the justices of the United States Supreme Court, who at that time was chief counsel for the city, and on the formal taking of the works was appointed one of the water commissioners. The original act was different from other acts regarding water supply in several particulars. Mr. Moody writes me that "the main purpose which I sought to accomplish, carrying out in this respect the wishes of the mayor and city council then in office, was to separate completely the water department from all other affairs of the city. It was hoped thus that the department would be managed upon strictly business principles without regard to politics. To that end it was provided that the water commissioners should be appointed for a term of five years, that only one should be appointed each year, and that the city be left to pay for the water which it used like any other consumer. The power of management of the

department was vested exclusively in the commissioners, subject to removal by the city council for cause." Mr. Moody further writes that "in the Act of 1892, which referred to the taking of lands for the protection of the water supply, I put into it the provision that any land taken for the protection of the water supply might be managed, improved, and controlled by the water commissioners in such manner as they should deem for the best interests of said city. The purpose of this provision was to enable the land thus taken to be used for the purpose of a public park, as it has since been. I hoped for good results, but I didn't realize that the result would be a most beautiful park in which all our people may justly delight."

Under this act the water board has taken 623 acres of land, at a cost of \$157 432, the larger portion of this being about the storage basin and Kenoza Lake. A portion of this is placed under the control of the park department at the discretion of the water board.

For five years the city paid for the water used in all public buildings and drinking fountains. Then came the same trouble that so many water works have had to meet, — a city council short of money, — and the question was raised why, as the city owned the works, any rates should be paid. The matter dragged along for several years, but no adjustment was ever made, and the city has since then not paid a penny for water. In our case it has seemed particularly unjust, since not a dollar has ever been paid by the city towards buying the plant, operating it, or toward the sinking fund. We charge the owners the entire cost of putting in the service, and the city pays all bills of this kind for the different departments of the city.

Early in 1882 Haverhill was visited by a disastrous fire that reduced almost the entire "shoe district" to ruins. The next year the city council appointed a committee on water supply, authorized "to cause to be laid by contract or otherwise cast-iron pipe 12-inch in diameter, to be connected at the North Church with the high-service pipe of the Haverhill Aqueduct Company." This pipe was to be used exclusively for fire service, and was laid through the main streets of the city, taking in the retail section and that portion occupied by shoe factories. An appropriation of

\$30 000 was made covering the cost, and the work was done under the direction of the committee. As the manufacturing district has expanded, calls have been made for extension of the high service in various parts of the city, to be used exclusively for fire protection, and appropriations have been made by the city council, the water department doing the work.

The hydrants are all under the control of, and are furnished by, the fire department, but are set by our department and the expense paid by the city.

The water commissioners have the right to fix the water rates; the income, after deducting all expenses and charges of distribution, is applied, first, to the payment of the interest on the bonds; second, to the payment of the sinking fund requirements (two per cent. of the total amount of the bonds); third, to the payment of all current expenses; fourth, the balance, if any, may be applied to the sinking funds in the discretion of the commissioners. We are also allowed to expend not exceeding twenty thousand dollars in any one year for the purpose of new construction. In case the surplus should not equal the two per cent. required for the provision of the sinking fund, the city must raise such sum by general taxation.

Our department receives all money from rates, etc., and pays its own bills, the only connection with the city being the appointment of a commissioner each year by the mayor, the auditing of the books of the department by the city auditor, and the payments for interest and sinking fund, which are made to the city treasurer. The result aimed at has been achieved, the department having been so far kept entirely out of politics.

None of the commissioners, with the exception of the chairman, receives pay, and up to the present the members of the board have all been leading citizens who have freely given of their time, and have been reappointed as long as they desired to remain upon the board.

The improvement and development of the system since its acquisition by the city have been on the lines laid down by the consulting engineer, the late Freeman C. Coffin, who in January, 1895, submitted an exhaustive report on the needs of the plant, and the sources of additional supply; and the result is a system

fully equipped and capable of supplying an abundance of pure water, at a cost to the consumer comparing favorably with other cities of the country. At the present time, a large section of the city is supplied by gravity from Crystal Lake, Round Pond, and Lake Saltonstall. Kenoza Lake supplies those portions of the city that are dependent on high service, and also furnishes water for the fire service, the water being pumped to a reservoir of 9 000 000 gallons capacity, built in 1898. As an auxiliary supply we have Millvale storage basin, which was built in 1894-5 by damming East Meadow River, and which has a capacity of 118 000 000 gallons. A Worthington engine with a capacity of 8 000 000 gallons per day is installed at Millvale, and the water is pumped through a 24-inch pipe into Kenoza Lake, a distance of one mile, as required to keep that lake at a proper height. A 16-inch pipe connects Kenoza Lake and Round Pond. At the new Kenoza station, erected in 1900, are two pumps, one made by the Barr Company, of Philadelphia, with a capacity of 6 000 000 gallons; another of like capacity made by the Platt Iron Works Company, of Dayton, Ohio.

In 1896 the town of Bradford, situated on the south bank of the Merrimac River, was annexed to Haverhill, and the Water Board took in charge the water system of that town, which had been installed by Messrs. Goodhue & Birnie, of Springfield, as a private enterprise, and later taken by the town. The water for this portion of the city is furnished from Johnson's Pond, with an area of twenty-two acres, and is all high-service, pumped to a reservoir of 1 000 000 gallons capacity by a two-million-gallon Deane pump. The water board is about to install a second pump at the plant, and eventually will probably lay a pipe across the river, which would be of use to either section in case of emergency.

We supply an estimated population of 37 600, our consumption being 134 gallons per day to each consumer. This high consumption is due to the fact that outside of the business portion of the city the use of meters has been optional, and at the present time we have in use only eight hundred meters. We have eighty-four miles of main pipe, cement lined and cast iron, ranging in size from two to twenty-four inch. The pressure on the low service ranges

from thirty-five to forty pounds, while the high service is from eighty to one hundred and twenty. The original cost of the works in 1891 was \$720 504.17. The cost of the works December 1, 1907, which, of course, includes all the improvements above mentioned and the land purchased, was \$1 466 594.51, while the net debt at that same date was \$646 491.

And in addition, what is after all of the most importance to the water takers of the city, is the fact that since 1892 the rates have been year by year decreased. After several reductions in the tariff of rates, the commissioners adopted the policy of a discount of 5 per cent. for prompt payment of bills, and this has been increased to 10, 15, 20, and 25 per cent.

Like many another of the old landmarks, the log aqueduct long since passed away, and except perhaps as a matter of history, is no longer interesting. But the main fact remains, that we have to-day an institution that has survived since 1802 and has developed to its present condition. Started by some of the leading men of the time, identified with the growth of the old town, it certainly was not altogether for what there was in it. For years its earnings were small and less than the expenses, and even after its reorganization, for a long period no dividends were paid, and assessments on the stock were made. And not only that, but the task was a thankless one. The community viewed the venture as chimerical, and the individuals engaged in it as foolhardy in the extreme. The town scoffed at the idea, and the multitude believed that there was not then nor ever would be any use for such a contrivance as an aqueduct.

Who can say to-day how much the existence of the facilities for water afforded through the past history of the town and city, and due largely to the enterprise of these townsmen, has contributed to its progress and present prosperity?

DISCUSSION.

MR. M. N. BAKER. Mr. President, I think we are all agreed that this is a unique contribution to the history of American water works, and that the author of the paper is to be thanked for having taken so much pains to bring together such a large amount of valuable historical matter. It would be a very fine thing if others

in position to do so would follow his example and put on record the history, in so far as it has not yet been done, of at least those water works that were built up to the early part of the nineteenth century. The number of works, as has been stated in the paper, in operation up to the close of 1800 is small. Even well into the nineteenth century, there were only thirty-two works. I hope that it will be feasible to reproduce in the JOURNAL some of these very interesting historical documents which Mr. Sawyer has shown us. I am sure they would be of great interest to all the members of the Association, and of value to others outside of the Association who may wish to refer to the JOURNAL in the years to come for just such matter as this. Those of us who have attempted to make similar investigations know how difficult it is to bring together material of this sort, and I think it is very rare indeed to find such complete records, covering a period so long past.