FIRE AND WATER ENGINEERING

FIRE PROTECTION AND WATER SUPPLY

Vol. LXII. SEPTEMBER 5, 1917 No. 10

NEW ENGLAND WATER WORKS ASSOCIATION

Its Steady Growth in Thirty-five Years Due to the Efficient Work of its Officers. Big Increase of Membership During Past Two Years Brings the Total up to 1043. Places Where Past Conventions Were Held and Names of Presidents. Hartford Gets Convention for Second Time. Big Program of Subjects and Entertainments Arranged and a Large Attendance Expected.

If James W. Lyon and his faithful associates who organized the New England Water Works Association thirty-six years ago could see the work they begun with so little ostentation grow to its present prominence and power, they would, no doubt, be greatly surprised. From forty to one thousand and forty is a long step and one that required earnest effort to accomplish. Yet this is the membership record of the Association and it steadily keeps growing from year to year, both in numbers and usefulness, a sturdy member of the technical organizations of the time. In looking over the names of the men who have piloted the Association since its inception the story of its success is easily told. There was Coggeshall, one of the charter members, secretary from 1882-1884 and again from 1887 to 1895, in all twelve years at the helm, and as president in 1885-1886 he made a most efficient officer. It might not be invidious to say of Coggeshall that the part he played in the building up and management of the Association was invaluable from first to last. Then Brackett proved a most able officer and constant worker through the long years he belonged to the Association. His four years as editor and one term as president, besides his constant attention to the business of the Association, showed him to be one of its faithful friends and promoters. The long service of Richards, of New London, as junior editor from 1891-1899 must not be forgotten. As an advisor his influence in all that concerned the welfare of the Association was always felt and his advocacy of the things that led to its progress were greatly appreciated. Looking at the work of Glover nothing could have been more substantial. He was one of the pioneers of the Association and served for three years from 1884-1887 as secretary, from 1887-1889 as treasurer, from 1884-1886 as editor, as junior editor from 1889-1891, and he must be considered one of the most earnest men on the roll of membership. Passing over the long list of able men who presided at the annual meetings, presidents and other officers who gave such excellent service and coming down to later years, the present secretary, Willard Kent, must commend himself to everyone for his constant work. Kent joined the Association in 1885 and it is on record that he missed very few meetings in all these years. It is not a wonder then that the affairs of the Association are so prosperous when such earnest effort is given to its affairs. An important fact well proven in this case is that the longer a man serves his constituents the better service may be expected of him. For eighteen years this officer has plodded along in a uniform way working with all the undoubted ability he is known to possess, accomplishing much and yet someone may wonder at the success of the Association. It is this united work of the officers that is accountable for the steady growth and permanence of the organization. It is this team work, in fact, that keeps the ball rolling; that replaces a member that resigns and hunts out those who can and will furnish matter for the Journal. Such joint co-operation may, for the most part, be set down as tending to keep the Association in its present prosperous condition.

When Frank E. Hall was elected the second president of the Association in 1884 it had 48 active and 9 associate members, while in Burlington, Vt., ten years later there were 401 active and 81 associates on the roll, showing a very substantial increase in that time. Ten years later there were 538 active and 58 associates and in 1916 the membership had increased to 942 active and 84 associates. These figures show that the work of the officers was very thorough and was performed in a regular and not spasmodical fashion. The most noticeable changes were made among the sociate members: for instance, in 1895-1896 there were 82 names on the list in good standing which decreased to 49 in 1908 and again increased from 60 in 1913 to 84, which large increase was evidentally the work of the men in charge in 1916.

The Conventions.

The annual conventions have been held more than once in some New England cities and Hartford had it in 1890-1 when Albert F. Noyes presided. That meeting was most successful and the third convention in Portland, Me., last year was so well attended that the committee no doubt selected Hartford again as the most suitable for this years meeting. Its location, good hotel accommodations and attractive surroundings, besides the new work now under way and its water system, all attended to its choice. Since the Association was formed in 1882, the annual conventions were held 26 times in New England cities and 9 outside. Of the nine held in other states, New York and Washington proved most successful. Altogether three meetings were held in New York, the last one in 1915, when there were 215 active and honorary members present, being only second to Portland last year in attendance.

The Program.

The program arranged by the local committee in Hartford and the Executive Committee of the Association embraces many features that will appeal to the delegates and visiting guests.

On Tuesday, September 11, the opening day, the meeting will open in the afternoon with addresses of welcome by Mayor Frank A. Hagarty, former Senator Morgan G. Bulkley, president of the Aetna Life Insurance Company; Maj. Frank F. Macomber, president of the Chamber of Commerce, and others, and response by the president of the Association.

In the evening an informal reception and dance preceded by an illustrated talk on Hartford's Park and Recreation System and an entertainment presided over by Mr. Chas. H. Eglee. This reception is to be held at the Hartford Club on invitation of the Hartford Chamber of Commerce.

Wednesday, September 12, three sessions for members devoted to papers on water works experience and construction matters. On this day opportunity will be given members to inspect some of the large manufacturing establishments in Hartford.

In the afternoon ladies will visit Hartford's Parks and in the evening, through courtesy of the Water Works Manufacturers' Association, they are invited to attend the Majestic Theatre where some of the highest class moving pictures will be shown.

Thursday, September 13. All day session for members, devoted to papers and reports on water works matters. Entertainment will be provided through courtesy of the Water Works Manufacturers' Association, by an invitation to a Bridge Whist Party at the Hartford Club, presided over by a committee of ladies affiliated with the Chamber of Commerce.

Friday, September 14. An all day automobile trip on invitation of the Hartford Water Board, through Hartford's Water Supply System. The new works, which are about two-thirds completed, will be visited and lunch will be served before return. The party will reach Hartford about 4 p. m., and in the evening there will be a business session. Papers on Rapid and Slow Sand Filters, Construction and Operation; Metering of Cities; U. S. Army Cantonments; Leadite and Universal Pipe Joints; Water Works Shop Construction; Water Rates and Financial Matters, and several papers on special features of Hartford's New Supply Works will be read and discussed by Delos Wilcox, New York; John T. Alvord, Chicago; Geo. A. Johnson, New York; Robert Spurr Weston, Boston; S. E. Killam, Boston; H. R. Turner, Windsor, Conn.; John Walsh, East Hart-

THE HARTFORD WATER WORKS

Past, Present and Future.

Previous to 1855 the water supply of Hartford, Conn., was derived from wells and a few small wooden conduits furnishing little water under light pressure During the years 1854-5 a distributing reservoir holding about 8,000,000 gallons was built on the highest land within the then city limits, into which water was pumped from the Connecticut River, something less than one mile distant.

The capacity of these works becoming inadeqaute, owing to the growth of the city and increased demands from the consumers and, moreover, the quality of the water being questioned, it was decided by a vote of the citizens, October 3, 1864, to adopt a gravity supply. The source was to be from the eastern slope of a low mountain range west of the city and distant about six miles from its center. It was at that time supposed and asserted that the damming of a small mountain stream would, with the laying of a main pipe over the intervening distance, afford an ample supply, if not for all time, at least for a long term of years. With one auxiliary storage reservoir and frequent resort to the river pumps, which had been kept in working order, this supply answered the more pressing demands of increased consumption until about the year 1873. In that year it was determined to develop and increase if possible the watershed to such an extent that water from this source could be furnished in greater abundance, and the use of the pumps at the river be dispensed with. The additions, however, were only sufficient to stave off an immediate shortage.

From time to time subsequently a number of small increases were made in the storage capacity of the water works reservoirs until around 1890, when the rapid growth of the city pointed out the necessity for either conservation of the existent supply or an increase in the water supply sources. As late as 1893 the daily press at Hartford was much opposed to installation of meters, and the "Hartford Times" went so far as to express the following opinion:

"The primary and chief object of the founders of the Hartford water works was to afford the people an abundant supply of good water at a merely nominal cost. It was not deemed best to measure the supply to individuals and firms by a water meter, and charge for the amount used, just as a grocer would charge for the measured quantity of kerosene and molasses. It was felt that water, next to air itself, was Nature's most abundant gift to her children, and that it was desirable to keep as long as possible from selling it for a price—for any price, if it could be helped—but it was, of course, necessary to fix some water rate, and this was made as low as possible. The people were treated liberally."

The fruits of this attitude were reaped in the Fall of 1899, when Hartford's plight was a sad one. So low had the supply of water fallen that it was necessary to pump raw water from the Connecticut River, a circumstance which undoubtedly added to, if not the sole cause of, the great increase in typhoid and allied diseases at that time. It was recognized and admitted that the chief cause of the water famine was the enormous waste of water. The magnitude of the waste may be inferred from the fact that for its 90,000 inhabitants the daily consumption was 10,000,000 gallons.

By taking the problem firmly in hand, carefully checking waste and introducing methods of conserving supply, the city was able to keep sufficient water in sight and was in condition to guard against a recurrence of the 1899 drought.

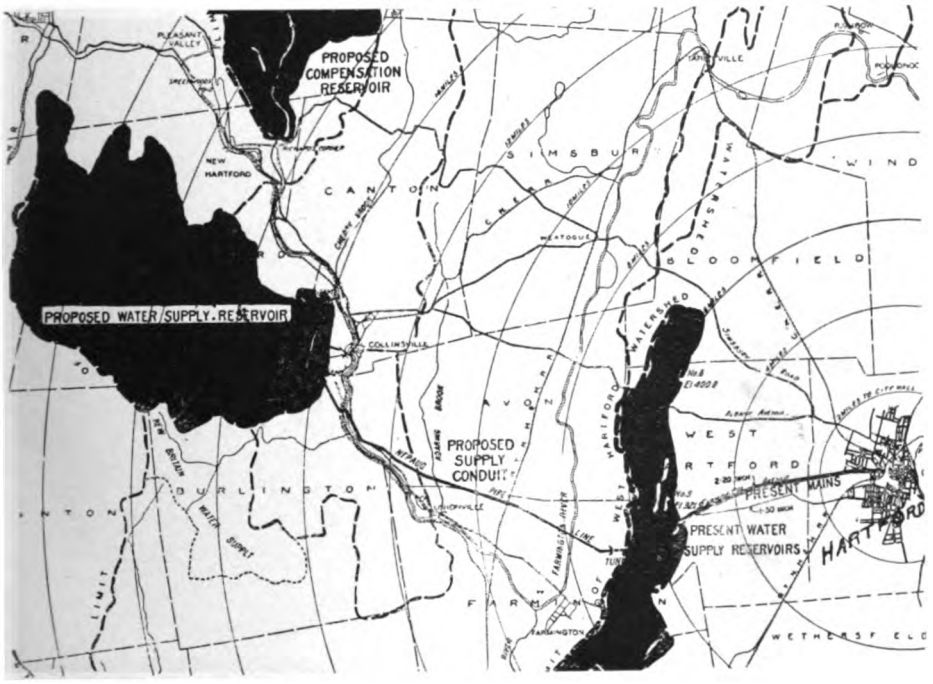


Diagram of the Hartford, Conn., Water Works, Showing Present and Proposed Reservoirs.

In 1903 the water department officials began considering plans for improvement and enlargement of the water works. Some were satisfied with the water of the Connecticut River, while others opposed this on the ground that the methods of purification at that time were not sufficiently perfected to completely eliminate all bacteria. Other plans called for a supply from Farmington River, and still others from brooks at various distances from the city. The rea of the Hartford watershed at this time was around 10 square miles, with little opportunity for increasing this area, and preliminary reports on additional supply were made at different times by Allen Hazen and Rudolph Herring. Little definite attention, however, was given to the matter until late in 1911, when the Board took up the question and adopted the Nepaug project for its additional water supply. To form a reservoir it was necessary to build two dams, one on the lower Nepaug River; the other on the Phelps Brook. Both of these streams are tributary to the Farmington River near the village of Collinsville, Conn. The reservoir was to be so constructed as to form one basin and utilize the drainage area of both streams.

During the drought in 1908 the city had made every preparation to lay a pipe line from the Farmington River to the Reservoir and to install pumps at the former sufficiently powerful to force the water over the mountain to the reservoir. The drought was broken by rains and 6,000 feet of pipe purchased for the pipe line was used in necessary extensions elsewhere. During 1908 the drainage area of the southernmost of the six city reservoirs was increased by two square miles by the construction of about 5,000 feet of canal along the east front of Rattlesnake Mountain in the Town of Farmington. In 1908 the department also made a beginning for reforesting the watershed area, and the work has been carried on since to some extent. In spite of the careful use of water and precautions calculated to promote economy, the supply proved to be inadequate to meet the requirements of the growing population and many important industrial interests. Again in 1914 there was threat of shortage and a million gallon pumping station operated by electric power was established at the Farmington River to supply water to the distributing reservoir through the 42-inch pipe line and conduit just finished in connection with the additional supply works.

The adequacy of the proposed supply is stated as follows in a report by the Water Board: "The city has reached a plan for her water supply that ought to be sufficient for her long needs in the far future. * * * The purpose is to go nearly 20 miles to the northwest of the city to the valley in which lies the village of Nepaug in the town of New Hartford. Through this valley flows the Nepaug river, which rises at the foot of the Berkshire Hills in northwestern Connecticut, and empties into the Farmington river in the lower part of Canton. The valley there affords a natural basin, requiring only the building of two great dams to make it a completely inclosed lake bed. The water is notably pure, its flow ample, and seldom affected by

drought. Another stream, Phelps Brook, will also flow into this basin and materially add to the supply of water. The village of Nepaug, containing some 20 houses, a church and a cemetery, would have to disappear, as did villages that went to the making of the Massachusetts metropolitan supply reservoir near Clinton, in that State. Water from this great Connecticut reservoir would be taken through a 42-inch main, which would have to be carried eight miles to the nearest point in thte present Hartford water system. An incidental feature will be the building of a compensating reservoir in Barkhamsted, to make up to the owners of water and power rights on the Farmington river what they will lose through the diversion of the waters of the Nepaug River. The execution of this plan will mean the increase of Hartford's water supply from its present potential 7,500,000 gallons a day to a possible 35,000,000 gallons a day, sufficient to allow a city of 350,000 people 100 gallons a day for each person. The city's water pressure would also be increased about 10 pounds. It is also intended that part of the ultimate plan is to create a great State park at the watershed that will contain one of the most beautiful lakes in the State.

The Present Supply of Hartford.

As stated, twelve square miles of watershed located on the easterly slope of Talcott Mountain, principally in West Hartford, has been used for the source of the City's present supply up to this time and on this a system of six collecting reservoirs has been developed. During dry weather this source will safely furnish 7,500,000 gallons of water and for the past seven years this amount has been annually exceeded. Three cast-iron mains bring the water from the distributing reservoir to the city. One is 30 inches in diameter and each of the other two is 20 inches. The original 20-inch main was laid in 1877, but has been relaid from time to time so that its age may be said to be about 25 years. The second 20-inch main was laid in 1875. The 30-inch main was laid in 1896. In 1909 the daily average consumption was at a rate of 7.35 m.g.d.; in 1912, the average daily draft was 8,650,000 gallons, and the average for 1916, 10,590,000 gallons daily. The highest maximum ever recorded in the city was 13.94 m.g.d. on July 31, 1917.

The distribution system has 200 miles of main pipes supplying Hartford, West Hartford, Wethersfield and Bloomfield. The pipe is principally cast-iron, and includes 20 and 30 inch supply lines, 57,172 feet; 14-inch and over distributing mains, 182,683 feet; 12-inch, 99,672 feet; 10-inch, 87,038 feet; 8-inch, 196,617 feet; 6-inch, 390,515 feet; 4-inch, 46,557 feet; 3-inch and under, 14,650 feet. There are now in service 15,404 service connections, of which 15,077 are metered. Fire hydrants in use total 1,775, and gate valves, 4,042.

The New System.

The actual beginning for Hartford's additional water supply was made by the Water Board in the latter part of 1911 with the selection of Mr. Caleb Mills Saville, Mem. Am. Soc. C. E. and president of the New England Water Works Association, as Chief Engineer. Early in 1912, investigations and surveys were made looking to the presentation of a definite plan and estimate of cost for the development of the Nepaug project, which up to that time had existed in a more or less chimerical way. The plans

Site of the Richards Corner Dam.

The Phelps Brook Dam, Corewall and Outlet Conduit, October, 1914.

Principal Contracts Relating to Additional Supply.

No.	Contract.	Contractor.	Description.	Contract Bid.
1.	Borings	Sprague & Henwood Co.	Borings at dam sites	$16,350
2.	Filters for Collinsville	Norwood Engineering Co.	Pressure filters	2,690
2A.	Filter house	C. J. Burgess & Co.		3,075
3.	Nepaug Conduit	Stobaugh Contracting Co.	3,653′ 4′9″ x 5′0″ C. & C 1,333′ 5′4″ x 6′0″ tunnel	129,965
4.	Nepaug Pipe Line	Hanover Contracting Co.	40,060′ 42″ C. I. Pipe	442,170
4A.	Furnishing 42-in. Cast-Iron Pipe	U. S. C. I. Pipe & Fdy. Co.	10,760 tons 42″ and smaller	251,390
5.	Nepaug Dam	Fred T. Ley & Co., Inc.	Arch masonry dam	510,000
6.	Phelps Brook Dam	Pierson Eng. & Const. Co.	Curved earth dam	234,000
7.	Burlington Road	Louis Longhi & Bro.	10,300′ new gravel road	29,990
8.	Nepaug Road	Pierson Eng. & Const. Co.	7,300′ new gravel road	37,450
9.	East Dike	Leonardo Suzio	Small earth dam, 32,000 cubic yds.	29,200
10.	Richards Corner Dam	C. W. Blakeslee & Sons	Earth dam	357,800
11.	Grading cemeteries	A. D'Ambrosio	Two new cemeteries	3,700
12.	Removing bodies	Joseph D'Esopo	Removal of bodies from basin	4,200
13.	Removing bodies	J. J. & F. A'Hern	Removal of bodies from basin	2,700
14.	Clearing Phelps Brook Basin	Fred T. Ley & Co., Inc.	Clearing basin; grubbing 20′ below and 5′ above flow line	21,900
15.	Clearing Nepaug River Basin	L. I. Fletcher	Clearing basin; grubbing 20′ below and 5′ above flow line	25,800
16.	Barkhamsted Road	Louis Longhi & Bro.	13,400′ new gravel road	44,015
17.	Supply Pipe Line	U. S. C. I. Pipe & Fdy. Co.	Furnishing 42″ C. I. Pipe, 3,675 Tons	148,996
18.	Supply Pipe Line	O'Neil & Sternberg	Laying C. I. Pipe, 23,000 lin. ft.	120,780
19.	Supply Pipe Line	Warren Fdy. & Mch. Co.	Furnishing 36″ and smaller C. I. Pipe, 3,675 Tons	148,652
20.	Supply Pipe Line	O'Neil & Sternberg	Laying C. I. Pipe, 7,950 lin. ft.	30,186
21.	Supply Pipe Line	Pratt & Cady Co., Inc.	Valves, 36″ and smaller	9,414
22.	Richards Corner Bridge	C. W. Blakeslee & Sons	Concrete highway bridge, 80′ span	22,090

and estimate prepared and submitted by Mr. Saville were approved by the Board and the construction of the additional supply works has proceeded rapidly along these lines.

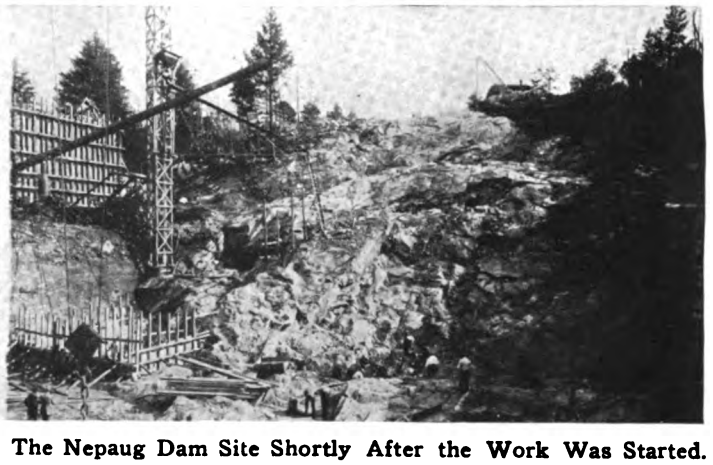
The new system consists of a reservoir formed by the damming of two streams, Nepaug River and Phelps Brook. Separate dams have been built across these streams at points two miles distant from each other. This reservoir is now connected to the existing system by a 42-inch diameter cast-iron pipe line, a conduit, and a tunnel through Talcott Mountain. In 1912, the contract was let for the construction of the tunnel and conduit. Work continued throughout the entire year, and this work was completed in January, 1914. The total length of the tunnel and conduit is 5,962 feet. The conduit is in two sections, one 2,297 feet long on the westerly side of the mountain, and the other about 1,330 feet long on the easterly side of the mountain. This structure is a grade conduit of cut and cover type. It is of horseshoe shape, with general dimensions five feet high by four and three-quarters wide. The tunnel through Talcott Mountain is about 2,335 feet long and lined with concrete. This also has a horseshoe shape in both sections with a height of six feet and a maximum width of five and one-third feet. The pipe line has a capacity of 30,000,000 gallons per day, and the grade conduit a capacity of 40,000,000 gallons per day under ordinary conditions of flow. The ultimate capacity under slight pressure is 69,000,000 gallons per day for the conduit. The tunnel has a normal capacity of 59,000,000 gallons per day and under pressure a capacity equal to that of the grade conduit. The contract for the pipe line was let in July, 1915, and all work was finished by November, 1914. The principal item was the laying of about 39,850 feet of 42-inch pipe connecting the outlet of Nepaug Reservoir at Phelps Brook dam with the westerly end of the concrete conduit near Talcott Mountain. After completion the entire pipe line was subjected to a water test equivalent to about 100 feet more pressure than can be put upon the line. The total leakage was at a rate of 19.17 gallons per minute, which was about 37 per cent. of that allowed under the specifications.

Contract for construction of the Nepaug Dam was awarded to Fred T. Ley & Co., Inc., in March, 1914. Although considerably delayed by labor and material troubles, this contract is now fully completed and there are about 90 feet depth of water against the dam.

The principal items of work included in the contract were 30,000 cubic yards earth excavation, 15,000 cubic yards embankment, 79,000 cubic yards concrete masonry and 80,000 barrels of cement. The total cost of this work will be about $532,000. The Nepaug Dam is of so-called "cyclopean" masonry, that is, concrete masonry with large stones or "plums" imbedded therein. The length of the dam on the top is 650 feet, its height above the present valley bottom 113 feet, with a total maximum height from the bottom of the lowest excavation to the surface of the roadway of 156 feet. The dam is curved upstream to a radius of 400 feet, is about 90 feet thick at the bottom of the valley and 20 feet thick at the elevation of high water in the reservoir. The spillway for the entire reservoir is located in the center of the dam and the discharge will be through five arched openings down a stepped face to a dead water pool at the bottom. The five arches over the spillway will carry the relocated Nepaug road to take the place of the present highway, which will be abandoned. To carry the river, while the excavation was in progress, a wooden flume was built just west of the old bed of the river. In December, 1916, the river was turned through an opening left for this purpose in the dam and the flume mentioned above removed, so that the loose rock, which was under the flume, could be excavated, and this section of the dam completed.

The contract for the construction of the Phelps Brook dam was awarded to the Pierson Engineering and Construction Company on March 31, 1914, and the installation of plant was commenced on April 8. The Phelps Brook dam is an earth structure containing a concrete masonry core wall. This dam is about 1,200 feet long on top, about 67 feet high above the lowest part of the valley and has a maximum height of about 100 feet above the lowest part of the excavation. The embankments on each side of the core wall are built of materials excavated in the valley above the dam. The outer portion is of gravelly materials and a very flat slope has been given in order to guard against possible slipping. Between the masonry corewall and the gravelly embankment is a thick soil core composed of selected materials free

The Nepaug Conduit Looking West.



The Nepaug Dam Site Shortly After the Work Was Started.

The Coffer Dam, 42-Inch Pipe, Upper Crossing on Farmington River.

West Portal of Talcott Mountain Tunnel as It Appeared in October, 1913.

from stones and carefully compacted in place. In itself this soil core would probably make a perfectly watertight embankment. The masonry core wall is 8 feet thick at the bottom and tapers to 2 feet thick at a point 5 feet above the flow line. A concrete masonry conduit horseshoe in section and 6½ feet high passes through the embankment. During construction this conduit was used for passtion of the conduit serves as an intake and the outer portion as a tunnel through which to bring the pipes connecting the supply pipe line with the gate chamber in the dam.

A wooden flume carried the water of the brook across the dam site while the concrete conduit was being constructed and the material in a deep hole south of the brook excavated. The total cost of this dam was about $247,000. The principal quantities were earth excavation, 24,000 cubic yards; rock excavation, 5,800 cubic yards; refill and embankment, 243,000 cubic yards; concrete masonry, 9,300 cubic yards; barrels Portland cement, 11,944, and paving and riprap, 8,000 cubic yards.

Under construction at the present time is a large earth dam with a concrete core wall at Richards Corner, New Hartford. The object of this dam is to create the Compensating Reservoir mentioned previously in this article, which will supply a sufficient amount of water to the Farmington River during periods of low flow to compensate for the amount held back in the Nepaug Reservoir for Hartford's Water Supply. This dam has a length of about 1,200 feet at the flow line and its top is to be about 75 feet above the bed of the present stream. The corewall is of concrete masonry 8 feet thick at the bottom and solidly backed with thick walls of loam on each side. The masonry corewall is founded on solid rock for its entire distance across the valley and in the deepest parts a depth of excavation to 40 feet below the river bed was required.

In the construction of this dam the principal quantities of work to be done were the following: Earth excavation, 170,000 cubic yards, rock excavation, 24,000 cubic yards; refilling and embanking, 300,000 cubic yards; concrete masonry, 20,000 cubic yards; barrels Portland cement, 25,000. The estimated cost of this work on the basis of the preliminary estimate of quantities was $357,766. On the basis of payments this contract is about one-half completed, excavation in the main dam is done, the large concrete conduit for stream regulation is completed and the core wall and soil refill are now a little higher than the bed of the river.

Besides the above work about 7.1 miles of new highway have been constructed to take the place of country roads flooded by the construction of the reservoirs. Two cemeteries having an aggregate of 372 bodies have been removed and a pressure filtration plant of 150,000 gallons daily capacity has been built for the town of Collinsville whose private water supply reservoir was required by the new works. The Nepaug Reservoir is now entirely completed and is filled to a point about 6 feet below the crest of the overflow at the Nepaug Dam. When filled to capacity it will hold 9,600,000 gallons, have a water surface of 850 acres, a shore line of about 11 miles, a maximum length of 2¼ miles, an average depth of 34 feet

Statistics Relating to the Nepaug and East Branch Reservoirs.

	Nepaug Reservoir.	East Branch Reservoir.
Elevation Surface High Water (Above M. S. L.)	485	422.5
Area of Water Surface (Acres)	851	437
Area of Water Sruface (Sq. Miles)	1.33	0.68
Total Contents (Gallons)	9,560,000,000	3,000,000,000
Maximum Length (Miles)	2 3-16	3¼
Maximum Width (Miles)	9-16	⅜
Total Length of Shore Line (Miles)	11	11
Maximum Depth (Feet)	97	62
Average Depth (Feet)	34	21
Length of Roads Abandoned (Miles)	7	5.8
Length of Roads Constructed (Miles)	4.1	3.0
Character of Area Flooded (Acres):		
Cultivated Land	343	235
Timber Land	168	20
Sprout Land	205	100
Pasture Land	122	80
Swamp Land	13	..
Additional Area Acquired Around Margin of Reservoir (Acres)	1,615	1,246
Total Area Purchased (Acres)	2,466	1,683
Area of Water Shed Tributary (Sq. Miles)	32.2	62
Number of Individual Farms Purchased.	42	38
Number of Houses, Barns and Principal Buildings Removed	60	45
Cemeteries Removed	2	..
Bodies Reinterred	372	..

Statistics Relating to Dams of Additional Water Supply.

	Nepaug Dam, Contract 5.	Phelps Brook Dam, Contract 6.	East Dike, Contract 9.	Richards Cor. Dam, Contract 10.
Character of dam	Cyclopean masonry	Earth fill with concrete corewall backed with soil	Earth fill with concrete corewall backed with soil	Earth fill with concrete corewall backed with soil
Name of contractor	Fred T. Ley & Co.	Pierson Const. Co.	Leonardo Suzio	C. W. Blakeslee & Sons
Amount of contract bid	$510,028.50	$234,020.00	$29,180.50	$357,766.50
Work began	Mar. 25, 1914	April 1, 1914	July 10, 1915	Sept. 1, 1915
Elevation of top of dam	498	497	497	435
Elevation of water surface	485	485	485	422.5
Height, maximum from bed rock	157′	90′	56′	115′
Height from bed of river	112′	67′	27′	75′
Depth, maximum below original surface.	45′	30′	34′	55′
Width, at top	20′	15′	15′	15′
Width, maximum (at base)	98′	365′	200′	390′
Length of dam	600′	1,200′	600′	820′
Slopes, upstream	...	1 on 3	1 on 3	1 on 3
			1 on 10	....
			1 on 2	....
Slopes, downstream	...	1 on 2½	1 on 2½	1 on 2½
			....	1 on 2½
			....	1 on 3
Principal Items of Materials in Structure:				
Excavation, earth cu. yds.	25,000	20,000	3,900	170,000
Excavation, rock cu. yds.	18,000	5,400	200	25,000
Embankment, cu. yds.	17,000	250,000	34,500	310,000
Masonry, cyclopean, cu. yds.	80,000	.....	.....	.....
Masonry, corewall, cu. yds.	.....	7,800	1,600	16,000
Slope paving and riprap, cu. yds.	.....	8,000	.....	15,000
Length of spillway	180′	.....	.....	290′

and a maximum depth of 97 feet at the Nepaug Dam. Included in the additional supply works is the construction of a filtration plant so that the supply may be uniformly pure and safe and may be supplied to the city at all times.

Hon. Frank A. Hagarty is Mayor of the City of Hartford, Conn. Mr. C. M. Saville, Mem. Am. Soc. C. E. is Manager and Chief Engineer of the Hartford Water Works. The Board of Water Commissioners consists of Messrs. F. E. Howard, Pres.; J. P. Berry, A. C. Bill, J. L. Dower, A. J. McManus and B. L. Newton. Mr. Fred D. Berry is Secretary of the Board.

The Nepaug Reservoir Dam as It Appears at Present.

The Board of Water Supply of New York has during the past four years been fencing in water works property taken up by the Catskill Aqueduct and reservoirs. Fences have also been placed to mark rights of way and note courses through city property. The posts are of concrete and are cast in thin sheet metal forms. Wire is passed along the fence encircling every post. The fences so constructed are very durable and neat.

New Water Rule in Springfield

A new rule passed by the water commissioners of Springfield, Mass., which taxes all owners of automobiles in that city $1.60 a year for water rent, is in effect this quarter for the first time and some dissatisfaction has been displayed by motorists who claim that it is not the amount as much as it is the principle of the rule that they object to. It was claimed recently that the matter will be placed before the Holyoke automobile club for action and that a test case will be made. The water commissioners state that if the tax is refused the water will be shut off. The motorists state that where water is used they have no objection to the tax, but where an automobile is kept in a public garage and cared for there they can see no legal way in which the water department can make the owner pay a tax of $1.60 for water which he does not use. With the discount off from the bill will only total $1.44 a year for 36 cents a quarter and it is probable the small charge rather than the strict legality of the rule will cause it to be observed.

The Springfield, Mass., Water Department makes a practice of taking samples of dissolved oxygen directly from the small under drains at the filter plant so as to get a sample of the water after it has passed through the bed and before it has had any aeration.

St. Louis Rate Bill

A bill putting water consumers on a sliding rate scale is before the Board of Aldermen of St. Louis, Mo. It provides for service to the manufacturer at 12 cents per 100 cubic feet for the first 10,000 and diminishing to 5 cents per 100 cubic feet for all water consumed over 150,000 cubic feet for the semi-annual period. The domestic consumer is down for a charge of 15 cents per 100 cubic feet for the first 3,000 feet, reduced to 9 cents per cubic feet for quantities between 150,000 and 260,000 cubic feet.

Frank E. Howard, President, Board of Water Commissioners, Hartford, Conn.

Water Conservation Device for Swimming Pools

In order to conserve water, G. F. Barnes, an engineer located at Helena, Mont., has devised a system whereby swimming pools need not require a constant flow of fresh water into them. The system is now being used in that city and has proven very satisfactory. By the arrangement perfected by Mr. Barnes the water is kept in constant circulation much after the plan of a hot water system, with the result that the same water may be used for months at a time. Before the arrangement was installed the flow of tanks went into the sewer, but now the drain pipe carries the water into a filter.

MEMBERS OF HARTFORD, CONN., BOARD OF WATER COMMISSIONERS.

From Left to Right: John L. Dover, Burton L. Newton, Albert G. Bill, James P. Berry, Arthur J. McManus, Fred D. Berry, Secretary.