REPORT

OF THE

COMMITTEE

ON THE

BEST METHOD OF SUPPLYING

NORTHAMPTON and FLORENCE

WITH

PURE WATER.

NORTHAMPTON, MASS.:
TRUMBULL & GERE, STEAM PRINTERS.
1870.

At a Meeting of the Town of Northampton, held July 20th, 1870, it was

VOTED.—That a Committee of three persons be appointed to nominate a Committee of five, to examine and report to the Town at a future meeting, the best method which the Town can legally adopt of supplying the villages of Leeds, Florence, and Northampton, with Water for the extinguishment of fires, or for domestic uses, or for both;

That said Committee be authorized to employ a competent Engineer to assist them in their examination, and in estimating the expense of such methods as may seem suitable;

And that a sum not exceeding $1000 be appropriated for the purpose of paying the necessary expenses of said Committee;

That the Report of said Committee be printed and circulated among the voters of said Town, at least seven days before the day of the meeting to which said Report is to be made.

The following persons were chosen as such Committee:

D. W. BOND,
LUKE LYMAN,
J. S. LATHROP,
L. DIMOCK,
M. M. FRENCH.

REPORT.

To the Town of Northampton:

Having been appointed a Committee "to examine and re-"port to the Town at a future meeting, the best method "which the Town can legally adopt, of supplying the villages "of Leeds, Florence, and Northampton, with Water for the "Extinguishment of Fires, or for Domestic Uses, or for both," and completed our labors, we hereby report:

That they might ascertain what had been done in other places in this respect, in order to enable them to form a better opinion of what was best for the Town, your Committee obtained Reports concerning Water Works in other localities, and corresponded with men acquainted with the history of the same. After an examination of the Reports and information received, it was thought best by the Committee to visit and examine the Water Works of Waterbury and New Britain, Conn., as something similar to their respective works was believed to be needed here. Having examined the works at these places and procured such information as they could with reference to their construction and utility, your Committee next visited Hartford, to obtain such suggestions as they could from those having charge of the Water Works there, which might be of use in deciding what ought to be done here, and the best way to proceed.

Your Committee also took steps to obtain information which would enable them to select a competent Engineer, to assist them in their examination. Choice was finally made of Messrs. Welton & Bonnett, Civil Engineers, of Waterbury, who were highly recommended by various parties. They were employed by your Committee, and have done their work in a manner creditable to themselves and satisfactory to the Committee. They were found to be men of ability and integrity, who have had considerable experience in this kind of work. Their report is based upon actual examinations and surveys, and the profile and detailed estimates are in the hands of your Committee. Their Report is hereto appended, and your Committee, feeling that the statements therein made are reliable, adopt the plan by them recommended as the most suitable for the wants of the Town. Your careful attention is therefore asked to that report.

Cost of the Works.

It is estimated that this will not exceed $200,000. Your Committee have taken considerable pains to ascertain the cost of pipe, which forms a large part of the estimate of the Engineers, and they are satisfied that quite a reduction can be made on this item, as well as upon some of the other items in the estimates, by proper care and management. This is admitted by the Engineers themselves; but they were charged again and again not to place their estimates too low, and that it would be more satisfactory to have them too high, that the Town might know the outside line of expense.

Plan.

An Aqueduct Company has been organized under the Gen. Statutes of the Commonwealth, and has secured the land necessary for a dam and reservoir, the right of way, and the right to take the water from the Roberts' Meadow Brook, so-

called, at the place recommended by the Engineers, by written agreements with the several parties in interest.

By the Act of 1870, Chap. 93, Towns are authorized to purchase of any Aqueduct Company its water rights, estates, properties, franchises, and privileges, provided it be done with the consent of a majority of their Selectmen, sanctioned and ratified by a majority of the voters present and voting thereon at a legal meeting duly called for that purpose, and may issue the bonds of the Town in payment therefor, at a rate of interest not exceeding seven per cent., payable semi-annually, and redeemable at some time not exceeding twenty years from the date thereof. This Corporation has voted to transfer all its rights, estates, properties, franchises, and privileges, to the Town, at the sum for which they have been secured. The requisite consent of a majority of the Selectmen has been obtained, and there remains only the necessary sanction and ratification by the voters of the Town.

The Town is also authorized by said Act of 1870, in case it makes such purchase, to issue additional bonds, as above specified, for the purpose of purchasing materials, laying pipes, and doing other work necessary in order to supply its inhabitants with pure water for domestic use, and for the extinguishment of fires. This course if adopted by the Town, will not add to the cost of the Works, while it will save delay, and the expense of legislation.

Your Committee therefore recommend the Town to make said purchase of said Aqueduct Company, and to issue the bonds of the Town, of the par value of $100 each, for a sum not exceeding $20,700, redeemable in twenty years from date, with interest not exceeding seven per cent. per annum, payable semi-annually; and that the Town also issue its similar bonds for the further sum of $179,300, for the purpose of purchasing material, laying pipes, and doing all work necessary in order to supply the water, according to the plan, recommended by said Engineers, to the inhabitants of Northampton and Florence.

This plan will be examined by many persons with reference to what it will pay in moneyed returns, and possibly some will be at first inclined to adopt or reject it upon the result of such an examination. The Committee have no fears of the result of a candid examination of it in this particular. At the same time we must consider that but few expenditures made by individuals, pay directly. How many are there, who, if they examine their own expenditures, can justify them on the ground of their returns in money? Dwellings, furniture, horses, carriages, gardens, and very many things, deemed necessary by a cultivated people, do not always, if often, make moneyed returns. The food we eat, the clothes we wear, and the books we read, are not purchased upon principles of economy, so much as they are on account of the taste and means of the individual. This is true with reference to nearly all personal expenditures.

Other places, where a supply of water has been brought in by such a plan, have found their returns, after a few years, to equal the interest on the money expended, and that the receipts are constantly increasing, so they are able to provide a sinking fund to pay off the debt. In the city of Waterbury the present year, which is the third year of the Works, the Board inform us they will receive a sum equal to the annual interest on the original investment. This is better than they expected when the Works were built.

The following are the annual Rates charged in Waterbury:

FAMILIES.—For each tenement with inside fixtures, occupied by one family not exceeding five persons, $5; for each additional person, $1. For each tenement occupied by two families, or any number of separate occupants not exceeding five persons, $7; exceeding five and not exceeding eight persons, $8; for each additional person, $1. For each tenement occupied by three families or any number of separate occupants, not exceeding ten persons, $10. For any greater number of *families or separate occupants, such rate as may be fixed by the Commissioners.* Families not exceeding eight persons supplied from outside hydrants, $5; for each additional person, 50 cents.

BOARDING HOUSES.—Boarding houses, minimum rate, $6, and a greater rate according to size and occupancy.

HOTELS.—Hotels, minimum rate, $25, and a greater rate according to size and occupancy.

STORES AND OFFICES.—For stores and offices, from $2 to $10; restaurants and saloons, etc., $5 to $30; markets, $5 to $15; photograph galleries, $10 to $25.

WATER CLOSETS.—For each family not exceeding eight persons, $3; for each additional water closet, $1; for hotels, stores, and all other buildings, from $2 to $8.

BATHING TUBS.—For each family not exceeding eight persons, $2; for hotels, barber shops, and all other buildings, from $2 to $6.

HOSE.—For street, sidewalk or garden sprinkling, such rate as shall be determined by the Commissioners, not less than $3. When two or more tenements or stores use the same hose, the rate shall be fixed by the Commissioners. Fountains and jets—rates fixed by the Commissioners.

STABLES.—Livery and private stables for each horse, including water for washing carriages, $2; for each cow, $1.

BAKERIES.—Not exceeding 500 barrels of flour per annum, $5; for each additional barrel used, 1 cent.

BUILDING PURPOSES.—For each barrel of lime or cement used, 6 cents.

MISCELLANEOUS.—Steam engines worked not over twelve hours per day, for each horse power used, $6. For any purpose when the price is determined by the quantity used, the rate shall be as follows:—For any quantity not exceeding 500 gallons per day, per each 100 gallons, 3 cents; for any quantity exceeding 500 and not exceeding 1000 gallons per day, per each 100 gallons, 2½ cents. For any quantity exceeding 1000 gallons, and not exceeding 2000 gallons per day, per each 100 gallons, 2 cents. For quantities greater, such rates not less than one cent for each 100 gallons, as shall be fixed by the Commissioners.

The Commissioners reserve the right to vary from the foregoing list when the amount of water is greater than is usually required for the use specified.

In all cases where water is required for purposes which are not specified in the foregoing tariff, the rate shall be fixed by the Board of Water Commissioners.

If this can be done here in five or even ten years, it would seem to be satisfactory, and the returns will be sufficient to pay a portion of it the first year, and will pay more and more of it till the amount received equals the entire interest. Of course this will depend, to a great extent, upon the amount of the Water rate, which will be regulated by a Board of Water Commissioners, and the rate should be made large enough for this purpose, and at the same time not so large as to amount to a prohibition upon the use of the water. It will also depend upon the amount of water used, the supply being abundant for all uses for which it will be wanted. Of course all will not take the water at first, but it will be more and more generally taken as the advantages of it are seen and felt. And as the places are built up, the additions will depend entirely upon these Works for water. If we are to have as severe drouths in the future, as the one we have just passed through, (and no one doubts that we are to have them even more severe,) we shall be forced to provide some means for water, over and above all that we now possess; all will be obliged to use this water to some extent if it is brought in. Hence the Committee feel that Northampton will not prove an exception to those places whose Water Works pay *directly*.

By some it may be urged that, although it will be a great

benefit to carry out this work, and that it ought to be done, still it should be done so as not to tax those who are not directly benefitted by it.

Some would urge a plan which has for its basis a Fire District. But such a plan will present a complicated question as to where the boundaries of such a District should be. At present our fire extinguishing apparatus is all located in the villages of Northampton, Bay State, Florence, and Leeds. It would seem that a Fire District should include these villages, and it is feared that this would not be satisfactory in all respects. Then it is to be considered, that while the extinguishment of fires by the use of this water is one of the uses which is to be made of it, and a very important one too, yet it is in its uses for other purposes that its great benefit is to be felt, and so much is this the case that to take the Fire District as a basis for the plan, would be improper. This plan however, does not overcome the objection urged, that it taxes those, or renders those liable to taxation, who derive no direct benefit from the Works. Persons must be included in a Fire District who have property of such a nature, that it will be liable to taxation, who would get no direct benefit from the Works, any more than persons residing in the most remote parts of the town; such, for instance, as have only personal property, and that out of the State. Then again there would be those who have landed property, where the water might not be needed. There would also be those with real estate, who would be included in the District, whose property would be so situated as to be practically shut out from its use for the present. No plan on this basis will overcome the objection urged in this respect. It can only be done by leaving the water to be brought in by a private corporation, and this plan has been urged by some, who admit that the work should be done.

With reference to this plan, *i. e.*, a private corporation, we have to consider whether it will ever be done in this way, and while it is believed by the Committee that it would be a good investment, yet as the undertaking is

so large, and one from which no immediate income would be derived, it is very doubtful about its ever being done in this way, and it is a generally admitted principle that the people should do in their corporate capacity what will not be done by individual action. We must also keep in mind that no private corporation would perform this work in the manner it is proposed by the plan recommended. It would be done on a much smaller scale, and not so generally distributed; protection from fires would not be so fully provided for; in short, the aim would be profits and not convenience. But a more serious objection to this plan is found in the fact that such a plan, if carried out, would give to a large corporation a practical monopoly of the supply of one of the most essential wants of life. We should never have two aqueduct companies, and when one is fairly under-way, say in ten or twenty years, it would demand its own rates, and the people would be so dependent upon it, that they would grumblingly submit to it. We may rest assured, however we may say we could avoid the exercise of this monopoly in an abusive manner, that it is never good policy to allow a corporation, or an individual, to obtain a monopoly of one of the most essential wants of life. It will be found far better to *keep* such things in the hands of the people, than any checks which can be devised to restrain an abuse which all agree is liable to follow if they are left to an individual.

In adopting a plan for the work, the Committee have kept in mind the principal uses which will be made of this water. These are for the purposes of

Irrigation,	Extinguishing Fires,
Manufacturing,	Domestic Use.

This division is only made for the purpose of considering these uses separately; strictly speaking, "Domestic use" includes "Irrigation" and "Manufacturing."

Irrigation.—In the larger part of the village of Florence the water will be of great benefit for this purpose. The soil there is naturally dry; it is early on account of the water's drying out of it so soon in the spring, and the gardens can be started there earlier than in most places about here. The soil yields a good return for the fertilizers and labor bestowed upon it, if we can have frequent rains to keep the ground from becoming too dry. But it is the same year after year: by the time the crops are well started, the usual dry weather sets in, and this continues with more or less severity till all prospect of much of a crop is gone, and the work done and expense incurred is nearly lost. With the amount of water which the plan recommended would afford, this result could be prevented, and that at a cost which would be trifling compared to the benefit derived. What is true of Florence in this respect is true of Northampton to some extent, to say nothing of the demand in the latter place for the purpose of watering lawns, shrubbery, and grounds, which form so important an element in the beauty of Northampton, and which are kept up there as matters of taste by those who would gladly pay a liberal sum to be able to keep up the green and freshness of spring during the months of July, August, and September. Considerable use will undoubtedly be made of it for the more directly useful purposes of irrigation, as well as for watering streets, that now no one feels like doing at the great expense necessary under the present method.

Manufacturing.—At present it may not be that this water will be used for this purpose, to any great extent, yet its superior quality over any that can be obtained within our limits outside of the streams for manufacturing, makes it seem certain that it will be demanded immediately to some extent for this purpose, and its use in this direction will be constantly increasing. In other places this is the case, and it is reasonable to suppose that, where a supply of water so well adapted for this use, can be obtained at a reasonable rate, it will be an

inducement to persons to engage in manufacturing. It may not be entered into on a large scale, but a hundred small boilers will be used then where there is one used now. So important a means to encourage the development of manufacturing interests within our limits, ought not to be overlooked by the community. It is stated that in New Britain, "the "late increase of business is manifestly due, in connection with "railroad facilities, to the advantages which the Water Works "invite to the manufacturing interests."

The quality of the water which is to be furnished is of importance in this respect. For general manufacturing purposes the greatest possible degree of purity is desirable. For bleaching purposes, for dyeing, and for manufacturing chemicals, the importance of pure water is such as to control the location of works for such purposes, and gives great advantage to those which are most successful in obtaining it. For steam boilers, the importance of pure water in order to avoid incrustation and dirt is too well known to need mention. The quality of the water is given, and compared with that of other Water Works in another part of this report, and it will be seen that it is unusually pure.

Extinguishing Fires.—One of the great objects of Water Works is protection from fire. A serious conflagration in the business portion of any community is not soon repaired; in most cases the pecuniary loss is much greater than the amount of insurance. The value of property depends greatly upon the protection afforded from destruction by this element. The advantage of this protection is felt by all who have money invested, or to invest, in buildings and in business. Some means of protection are always provided by individuals who have money so invested; besides ladders, buckets, and water near at hand, any place of size has an organized Fire Department. Yet what Fire Department compares in efficiency with works of this kind, when the water and power are *always* at hand at the place of the fire, ready and eager to be set at work the first moment of the discovery? No fire company is exhaust-

ed, no machinery gives out in the work, but a constant pouring of water can be kept up for hours, if necessary, without the least abatement. In the city of Waterbury, your Committee witnessed the efficiency of such a plan, which put all doubts upon this point at rest. There a solid stream of water was thrown, horizontally, 150 feet, through a nozzle 1 1-2 inches in diameter. Two streams from the same hydrant, at the same time, 1 1-8 inch each, were thrown the same distance. This was in the middle of the day, when there was a great use of the water over the city. To apply the hose, kept at convenient places about the city, is but the work of a moment, and when the number of streams which may be, are brought to bear upon a fire in any portion of the city, no fire can make headway. Since your Committee were there a large building was discovered on fire in the night, and at the time of the discovery, the fire, which originated in the first story, was coming out of the second story windows. Four of these mighty streams of water, sufficient to break in any window as soon as turned against it at a distance of one hundred feet, were put upon that fire, and, notwithstanding its great headway at the time it was discovered, it never reached the room on the third floor. We were told in that city, and in New Britain, the same story that is told in all places supplied with such a power, that property equal in value to the entire cost of the Works, had been saved from destruction again and again, by this never failing means of extinguishment which their respective Works afforded. It was stated that in New Britain, no fire, within the limits of the Works, had extended beyond the building where it originated, and no building had been entirely destroyed, since their completion. No fire department ever was organized, or ever can be organized, which will be as efficient as the plan now proposed for the protection of property from fire, and the saving in the expense between this plan and any other which would be deemed at all adequate, will be equal to the interest on a large portion of the original outlay, while it is believed that the increased value of property resulting from such a protec-

tion from fire, and from its other advantages, will be greater than the entire cost.

Should not this protection be provided? This question can not be answered by saying we may not have any very serious fires in the future, that we never have had till the last summer. There is always the *liability* which is recognized by all who keep their property insured. The expensive buildings which have been erected, those which are building, and those which are soon to be built, all demand the best protection which can be afforded, and it is for the interest of the Town to provide it. No one is misled by the word "*insured;*" this does not mean "*protection.*"

It is for the interest of those who have property to insure to provide this protection. By such a course a large amount will be saved in the amount of premiums paid for insurance. This will bring in a better class of companies, and at lower rates. In Waterbury it is estimated that Ten Thousand Dollars is saved annually in insurance. The President of one of the largest Insurance Companies in Hartford, stated that they reduced their rates *one-fourth of one per cent.* at New Britain, on account of the Water Works there, on all except detached risks. This is the rate of reduction at Waterbury, on account of their Water Works. Responsible Insurance agents have advised your Committee that the rates will be reduced here in the same way, if the Water Works are built.

Domestic Use.—Notwithstanding the great benefits which are to be derived from the use of this water for the purposes of Irrigation, Manufacturing, and for Extinguishing Fires, it is believed by your Committee that the greatest benefit of all is to be found in its use for Domestic purposes. The benefit from this source cannot be over-estimated. It is on account of the comfort and convenience derived from such use, that the inhabitants of those places where water is provided in this way, speak so universally in praise of such a project. This is no theoretical benefit, but one which they actually feel. It is on this account that, in such places, the Works

would be re-built, if from any cause they were to be destroyed, even though the cost of re-building were double the original outlay.

At the present time no one is satisfied to bring water from a spring twenty-five or thirty rods from the house, and not many are content to draw water from a well near the door. For what sum would any one agree to draw the water used by a family for one year? Many persons in building provide tanks in their houses, and take the water from the roof, while others spend comparatively large sums of money in bringing water into their houses from springs, or join with their neighbors, to some extent, in doing this. All this shows the advantages which are felt from such conveniences. These advantages are not forgotten by the owner of property thus supplied, when he comes to sell, and the purchaser, even though he may not admit it before purchase, really knows that these advantages cannot be over-estimated, and he takes them into account in deciding where to purchase. There can be no doubt that the property supplied with this water, will be worth more, be more desirable and more saleable on this account. People will be more likely to select a town, supplied with such water, in which to build a house, than one, though otherwise more desirable, (if such a town can be found,) where there is no such privilege. Such a means for the growth of our town, in this respect, should not be overlooked, in our action upon this matter.

Some one made the remark in the Town meeting, at which this Committee were appointed, that he hoped to see the time when there would be a public place where he could water his horse in the streets of Northampton. This suggestion is worthy of attention; and we feel that this use may well be referred to in this report. Every teamster or traveller, who is about the town with horses, knows the great accommodation and advantage of a convenient place to refresh his team with water. While we have laws upon our statute books to punish cruelty to animals, let us show our regard for the welfare of such animals by providing water for them to drink. They

cannot speak to thank us for the provision, but if they could we know what they would say.

The following extract, taken from the Report of Mr. J. Herbert Shedd, of Boston, to a Committee on the supply of Water for the city of Providence, 1868, shows the importance of pure water for domestic use :—

"In household economy, besides the question of what is agreeable and wholesome to drink, and of what is easy to wash with, it is important to consider that the waste of materials which it is desired to infuse, or dissolve, such as tea, coffee, soap, etc., is very great in hard water. The effect of hardness, or the presence of lime, in water, is well understood, as increasing the difficulty of washing with it, but the actual waste of soap in hard water is greater than may be supposed. A certain quantity is expended in neutralizing the lime before the soap will dissolve freely, and make a lather. The loss is ten grains of soap to one grain of lime. One grain of lime in an Imperial gallon of water is called 1 deg. of hardness. In water, then, from the softest well analyzed by Prof. Appleton, of 4.90 deg. hardness, about 50 grains of soap must be wasted in each gallon of water ; and that from the hardest well, of 22 deg. hardness, 220 grains. At the Bolton-Union Workhouse, England, about $5 a week, or about half the former cost, was saved in soap, by changing from water of 5 deg. to water of 2 deg. hardness,—that is, from water similar to the softest well water in Providence, tested by Prof. Appleton, to water similar to that of either of the neighboring rivers. Taking the English experiments of Prof. Clark and Mr. Donaldson, and assuming that each family in Providence uses, from the wells, only five gallons of water per day, for purposes requiring the use of soap, and that the saving in the city by substituting river water for well water, would be equal to the difference between the average hardness of the well waters and river waters as ascertained by Prof. Appleton, we should have an annual saving of $42,000 to the citizens, in the item of soap alone, by the public supply of river water. Writers upon this subject say the saving of wear and tear of clothes is fully equal to the saving of soap. In the making of tea and other infusions of costly material, the loss is very great, from the fact that hard water will not readily absorb the flavor. Mr. Soyer concludes, from his experiments, that the same quantity of tea will make five cups with soft water, and but three cups with hard water. He also finds great difference in favor of soft water, in the cooking of vegetables and meats, when it is desired to soften them, or to extract their juices."

Quality of the Water.

The Committee were not satisfied with the prevailing opinion that the water in Roberts' Meadow Brook is unusually pure, or with the evidence of its purity found in the fact that it is inhabited by speckled trout, but have had some of it analyzed by Prof. Charles A. Gaessmann, whose statement of the result is appended to this Report.

We have also procured an analysis of a sample of water from the well on the place now owned by Dr. Roberts, which has long been considered as a well of very pure water, the certificate of which is also appended to this Report.

The following table gives the comparative purity of various river and pond waters, used or proposed to be used by various cities :—

Source.	Supplied to or Proposed for.	Grains of Solid Matter in Wine Gallon.
Pawtuxet River,	Providence,	2.14.
Connecticut River,	Hartford,	2.56.
Mystic Pond,	Charlestown,	4.08, (1859.) 3.22, (1862.)
Lake Cochituate,	Boston,	3.37.
Roberts' Meadow Brook,	Northampton,	3.39.
Mill River,	New Haven,	4.00.
Pine River,	New Haven,	5.60.
Jamaica Pond,	Brooklyn,	4.40.
Lake Ontario,	Rochester,	4.16.
Patron's Creek,	Albany,	4.72.
Hudson River,	Albany,	7.24.
Schuylkill River,	Philadelphia,	5.50.
Jones's Falls,	Baltimore,	5.85.
Potomac River,	Washington,	5.59.
Detroit River,	Detroit,	5.72.
Fresh Pond,	Cambridge,	6.32.
Ohio River,	Cincinnati,	6.74.
St. Charles River,	Quebec,	6.75.
Burlington Bay,	Hamilton, C. W.,	7.03.
Ottawa and St. Lawrence,	Montreal,	7.04.
Passaic River,	Jersey City,	7.44.
Mohawk River,	Troy,	7.88.
Lake Michigan,	Chicago,	8.01.
Croton River,	New York,	10.60.
Genesee River,	Rochester,	11.31.

From this table it appears that the average amount of impurity in River and Pond water, is about six grains in the gallon, while, from tables of analyses the average is about forty grains in the gallon of well water.

The Committee, therefore, in view of the great advantage which will result from the adoption of the method recommended, believing that it is the best for the Town under all the circumstances, and realizing the importance of the undertaking, have no hesitation in urging that the same be adopted.

Before closing our Report, we wish to acknowledge the valuable services rendered to us by Mr. Nathan Dikeman, of Waterbury, (formerly of this town,) Mr. F. T. Stanley, of New Britain, and Mr. Bissell, President of the Board of Water Commissioners of Hartford, Conn., and the kind attention which we received from them, which made our visit to these places beneficial to the Town, and at the same time pleasant to ourselves.

D. W. BOND,
LUKE LYMAN,
J. S. LATHROP,
LUCIUS DIMOCK,
M. M. FRENCH.

REPORT OF THE ENGINEERS.

To the "Town Committee on Water Works,"

Northampton, Mass.

GENTLEMEN:

In conformity with your instructions, we have made careful examinations and surveys, to determine the practicability and probable cost of supplying Northampton and Florence with pure water, and submit the following Report.

Several plans suggested themselves, but only three proved to be worthy of an extended examination.

FIRST.—*To obtain the supply from "Beaver Brook," at Leeds.*

In this case the quality and quantity of the water were satisfactory, and the place presented some advantages in security from damage in times of freshet. But these advantages were neutralized by the formation of the land about it, which would necessitate a very large expenditure to lay the conducting pipes in a proper manner.

SECOND.—*To pump into Reservoirs a supply from Mill River."*

To this plan there are a number of objections. The impurity of the water, it having been already used by a number of factories, and deleterious substances being discharged into it. The impossibility of locating a reservoir to supply Florence with water under a sufficient head, within a reasonable distance. The great original cost of Reservoirs, Pumping Engines, and Buildings, and the constant large current expense of running and repairs to the machinery.

THIRD.—*To obtain a supply from "Roberts' Meadow Brook."*

This plan appears to be the best and most practicable, and we recommend its adoption.

On the first of September, after the long continuance of dry weather, we made a careful measurement of the quantity of water flowing in the stream, and found it to be about 800,000 gallons in 24 hours. This gives a certainty of an adequate supply under all circumstances for domestic uses, manufacturing purposes, irrigation, and extinguishing fires. The water is very clear and pure, and has hardly a perceptible taste. The formation of the land at the point proposed for the reservoir, is peculiarly favorable for its construction, both in point of the expense of constructing the work, and its security from damage by freshets. It will furnish water with a sufficient head at the highest point proposed, to deliver, (the head at the Railroad Depot at Florence being about 90 feet, and at the Railroad Depot at Northampton about 240 feet,) on Main street, in case of fire, a stream of water to the distance of at least 150 feet from the discharge pipe of the hose. The formation of the ground is favorable for laying the conducting pipe.

This plan, offering such great inducements, we have devoted the most of our attention to it, and submit detailed estimates of construction and probable cost.

We propose to construct a dam across the brook at a point about one third of a mile above its junction with "Mill River," where the new highway crosses, making it of sufficient width and height to carry the highway across the top, (as per accompanying plan,) and to carry off the surplus water through an artificial channel, about 150 feet North of the North End of the dam, to the original bed of the brook at a short distance below. To lay in the dam a waste pipe of 24 inch diameter, and the main conducting pipe of 16 inch diameter, both furnished with gates, and terminating in a well and filter placed above the dam. To lay a main conducting pipe of 16 inch diameter to Florence, a distance of about 13,600 feet, where will be connected distributing pipes, about 1800 feet of 6 inch, and 13,000 feet of 4 inch diameter, with 20 Fire Hydrants. The main pipe from Florence to Prospect street, opposite Dr. Denniston's, to be of 14 inch

diameter, a distance of about 5600 feet, thence through Elm and Main streets, to corner of Main and Pleasant streets, of 12 inch diameter, about 8900 feet, thence to corner of Bridge and Hawley streets, of 10 inch diameter, about 600 feet, with the necessary distributing pipes in Northampton, requiring about 13,500 feet of 6 inch, and 18,000 feet of 4 inch diameter, with 50 Fire Hydrants and necessary gates. These number of Hydrants in Northampton and Florence will furnish a supply of water, in case of fire, within an available distance of almost any necessary point.

The estimated cost of the Works complete, is, if laid with wrought iron and cement pipes, $180,000, and if with cast iron pipes, $220,000, and the work can be contracted for with responsible parties at these figures. To this must be added the amounts to be paid for land and water damages.

WELTON & BONNETT, C. E.

NORTHAMPTON, Sept. 30, 1870.

APPENDIX.

Quantitative results of an analysis of a sample of Water, marked No. One.

[WATER FROM ROBERTS' MEADOW BROOK.]

One United States Gallon of that water contains 3.400 grains of solid residue at 212 deg. Farenheit. This residue consists of

Sulphate of Lime,	0.346	Grains.
Bicarbonate of Lime,	1.746	"
Bicarbonate of Magnesia,	0.544	"
Bicarbonate of Protoxide of Iron,	0.243	"
Silica,	0.513	"
	3.392	"

With but a trace of Organic matter.

This water is remarkably soft, and is thus well suited for domestic and manufacturing purposes.

CHARLES A. GAESSMANN,
Prof. of Chemistry, Mass. Agricultural College.

AMHERST, Oct. 5, 1870.

Quantitative Analytical results of a sample of water, marked No. Three.

[WATER FROM DR. ROBERTS' WELL..]

One United States Gallon of that water contained

Bicarbonate of Lime,	16.6170	Grains.
Bicarbonate of Magnesia,	4.9630	"
Bicarbonate of Protoxide of Iron,	0.2599	"
Salziate of Soda,	2.9367	"
Chloride of Magnesium,	1.8980	"
Chloride of Sodium, (Salt,)	20.8723	"
Silica,	0.4089	"
Lime Matter,	47.9558	"

This sample differs widely from Samples No. One and Two. It is hard, and might be called a weak mineral water.

CHARLES A. GAESSMANN,
Prof. of Chemistry, Mass. Agricultural College.

AMHERST, Oct. 15, 1870.