

including all that is required for municipal and trade purposes; but this is evidently not large enough; for in London, in 1855, it was 33 gallons, in Boston, 63 gallons; in 1852, in New York, 108 gallons, and in Philadelphia 37 gallons for each inhabitant. Since then it has increased ten per cent. per annum. The great increase is chiefly owing to the great number of baths, washing of pavements, &c. &c. Therefore, taking the geographical position of Saint Paul into consideration, 30 gallons for each person will be sufficient for all purposes, which would make a daily demand of 1,600,000 gallons, (assuming, as before stated, the number of inhabitants at 50,000).

The size of the reservoir has been calculated for 9,000,000 gallons, sufficient for six days' consumption, to meet any casualties that might take place between reservoir and lake. The accompanying map shows the routes surveyed from the lake; the one, colored green, which is about two miles in length, and the most direct, but, owing to the elevated and rough nature of the ground, would prove very expensive—the other, which is colored red, and, although running a more circuitous course, would be the most feasible, and the least expense.

The distance in the latter named route will be three miles, and the expense of constructing it, including reservoir, will be as follows:

To prepare the ground for receiving the pipes, excavation and embankment.....	\$13,200
Drainage and artificial foundation....	6,000
Reservoir, containing 9,000,000 gallons	60,000
Three miles of 12 inch pipe, filling reservoir in about ten hours, including cost of insurance and freight.....	60,405
Laying pipe.....	2,000
Experiments, engineering expenses and other contingencies.....	9,000
Purchasing land, damages, &c.....	10,000
<b>Total.....</b>	<b>\$140,000</b>

Lake Como is situated about two and a half miles from the proposed site of the reservoir, near Summit avenue, and is supplied by subterranean communication with inland lakes and springs; the bed of the lake is of the purest gravel, devoid of all vegetable matter, making the water pure and limpid, as the gravel acts as a natural filter. In fact Lake Como can be considered as a large reservoir, receiving the water of the surrounding country. The construction of a reservoir could be dispensed with, if it were not for avoiding accidents which pipes are subjected to. Two main pipes, brought into the city, would meet those casualties; but as the expense of laying these additional main pipes would be nearly equal to the construction of a reservoir, I advise the latter mode as the most secure.

On referring to the accompanying maps, are distinguishing lines of red and green; the green line I have abandoned, to avoid swamps, and have adopted the second or red, which is less expensive, without increasing the distance. The Lake, 89 feet above the base of the Capitol, and 196 feet above the high-water mark of the Mississippi river, covers about 130 acres, with an average depth of 10 to 25 feet, containing 710,000,000 gallons of water, a quantity more than sufficient to supply a city of 200,000 inhabitants, as the quantity consumed would be replenished by its numerous hidden tributaries, they being more or less effected, which the strata of the surrounding grounds and the bottom of the Lake sufficiently indicate.

**ESTIMATED COST OF CONSTRUCTION FROM LAKE COMO TO RESERVOIR.**

To prepare the ground for receiving pipes, excavation, and embankment..	\$18,150
Drainage and artificial foundation.....	6,000
Reservoir.....	60,000
Two and a half miles 12 inch pipe, including cost of freight and insurance....	41,990
Laying of pipe.....	1,700
Experiments, engineering expenses, and contingencies.....	9,000
Purchasing lands, damages, &c., &c....	10,000
<b>Total.....</b>	<b>\$136,840</b>

The foregoing statements have shown the estimated cost, &c., of the Water Works to the Reservoir, we have now to add the expense of the pipes, and laying the same in the city proper.

The length of the gas pipes through the city only extends a distance of three miles, six miles of water pipe will be, therefore, amply sufficient to answer all reasonable demands at present. I would therefore propose to have two main pipes, nine inches in diameter and two miles in length, two miles 6 inch pipe, and two miles four inch pipe.

**COST OF THE SAME TO WIT:**

Two miles 9 inch pipe, discharging in 24 hours, 2,160,000 gallons, (allowing for friction, service pipes, &c., &c.....)	\$20,038
Two miles 6 inch pipe.....	13,770
Two miles four inch pipe.....	9,266
Digging trench to receive pipe, &c.....	12,000
<b>Total.....</b>	<b>\$55,074</b>
Add to this previous estimates, say.....	\$140,000
<b>Making a grand total of.....</b>	<b>\$195,074</b>

By the above statements, it will be seen that the expense of construction from either lake will be about the same; I therefore respectfully recommend that you obtain the supply of water from Lake Como, for the following reasons:

- 1st. Lake Como is 29 feet higher than Phalin's, making it possible to supply the whole city by natural flow, and reducing the size of the pipes in the lower part of the city, as the additional head will overcome the increase of friction.
- 2d. As before stated, the bed of the lake being of clear gravel and sand, will add a great deal to the purity of the water, and deprive it, to a great extent, of the salts of lime, iron and sulphate, making it better adapted for domestic purposes; and as the surface of the lake is of less magnitude compared with Lake Phalin, it increases the oxygen, which is an essential element to the salubrity of water. There is really no objectionable feature to Lake Como, as the demand upon it will be amply met by its natural resources, a theory which has been proved by the experience of previous geological researches.

The foregoing estimates have been very carefully compiled; at the same time, I would respectfully recommend thorough experiments to be made, as the severity of the climate requires that all precautions be taken to bring this work to a successful issue. It is also possible that the expenses may be considerably diminished by a careful examination of the surrounding heights, in the selection of a site for the Reservoir, by which means the amount of masonry could be reduced.

I embrace this opportunity to express my obligations to Arthur B. Morris, Esq., and J. T. Kennedy, Esq., Engineer of the Saint Paul Gas Works, for furnishing details of cost for pipes and freight.

I am also indebted to T. S. Moncure, Esq., Assistant Engineer, for the efficiency displayed in making the surveys.

All of which is respectfully submitted.  
ARNOLD SYBERG, C. E.

**CAPT. SYBERG'S REPORT TO THE WATER COMPANY.**—Following this our readers will find an interesting report from Capt. Syberg, Civil Engineer, made to the Board of Directors of the St. Paul Water Company, and by them accepted. There are several additional facts, in this report, more than we gave in our yesterday's issue, and they will repay an attentive perusal. Capt. Syberg's report, is plain and to the point:

OFFICE OF THE ST. PAUL WATER COMPANY. }  
Saint Paul, July 8th, 1857. }

Captain Arnold Syberg, Engineer of St. Paul Water Company,

DEAR SIR: You will please make surveys from the different Lakes and Springs, in the vicinity of the city of St. Paul, for the purpose of the introduction of water into the same, with an estimate of the probable cost of construction, calculated to furnish fifty thousand inhabitants with sufficient water for all domestic and other purposes; also include in your estimate the amount of pipe to be laid in the city proper for present demand, and report your action to this office as soon as practicable.

By order of the Board of Directors of the St. Paul Water Company. Signed,  
B. W. LOTT, Secretary.

ENGINEER'S OFFICE, ST. PAUL WATER CO. }  
Saint Paul, July 20th, 1857. }

To the President and Board of Directors of the St. Paul Water Company:

GENTLEMEN: Agreeable to instructions, received through your Secretary, B. W. Lott, Esq., I have the honor to lay before you the result of my surveys, with a view of supplying St. Paul with pure water; also the estimates of the cost of the same.

Before commencing the survey, I thought it proper to select, if possible, such source of supply, the most desirable for domestic use. Notwithstanding all that has been said, respecting hard and soft water, there is still a great uncertainty as to the precise qualities to be distributed in cities. Unquestionably, very hard water is an objection as a source of supply, but some of the chemical combinations which give rise to this character, if they only act within certain limits, are, according to the best authorities, better adapted for human consumption than any other. Soft water again, is pleasanter for domestic use; but its very softness may be owing to the presence of ingredients able to effect slowly, but surely, the physical organization of those using it. In selecting a source of supply it is important to consider the temperature of the same; also, vegetable and animal matter should be removed, because they absorb the oxygen in the water and cause the latter rapidly to putrify.

After a thorough examination I found it too hazardous to make use of the springs in the vicinity (estimating the number of inhabitants to be supplied at 50,000) especially as it would be necessary to concentrate supplies of this kind, one spring not being sufficient for the demand; but a source obtained in that way could not be kept up, as the drainage attending future cultivation of the soil would diminish, or perhaps entirely cut off some of the contributing springs. All constructions of this kind are most effectual where nature assists, which is another reason for limiting my surveys to two lakes, as their elevations are sufficient to supply the greater part of the city by natural flow.

To enter more fully into the results of my investigations, I will give the peculiarities of each lake as I found them:

**Lake Phalin**, situated about two miles from the city limits, is the lower basin of a chain of lake, extending northward and connecting through Phalin's Creek with the Mississippi river. This lake, with a depth of 36 to 81 feet, discharges 2,400,000 gallons of water per hour, which overcomes to a great extent the disadvantages this lake possesses, namely: If the discharge was smaller, it would lessen the agitation of the water and consequently increase the growth of vegetable matter to such an extent as to make it unfit for domestic uses, as its bed and the surrounding shores are of an alluvial nature.

Starting the levels at the base of the Capitol, we find that the surface of the lake is 60 feet above it, and 167 feet above high watermark of the Mississippi river.

The quantity of water to be distributed in a town has been ascertained by English and French engineers to be at the rate of 20 gallons per diem—calculated upon the whole population—