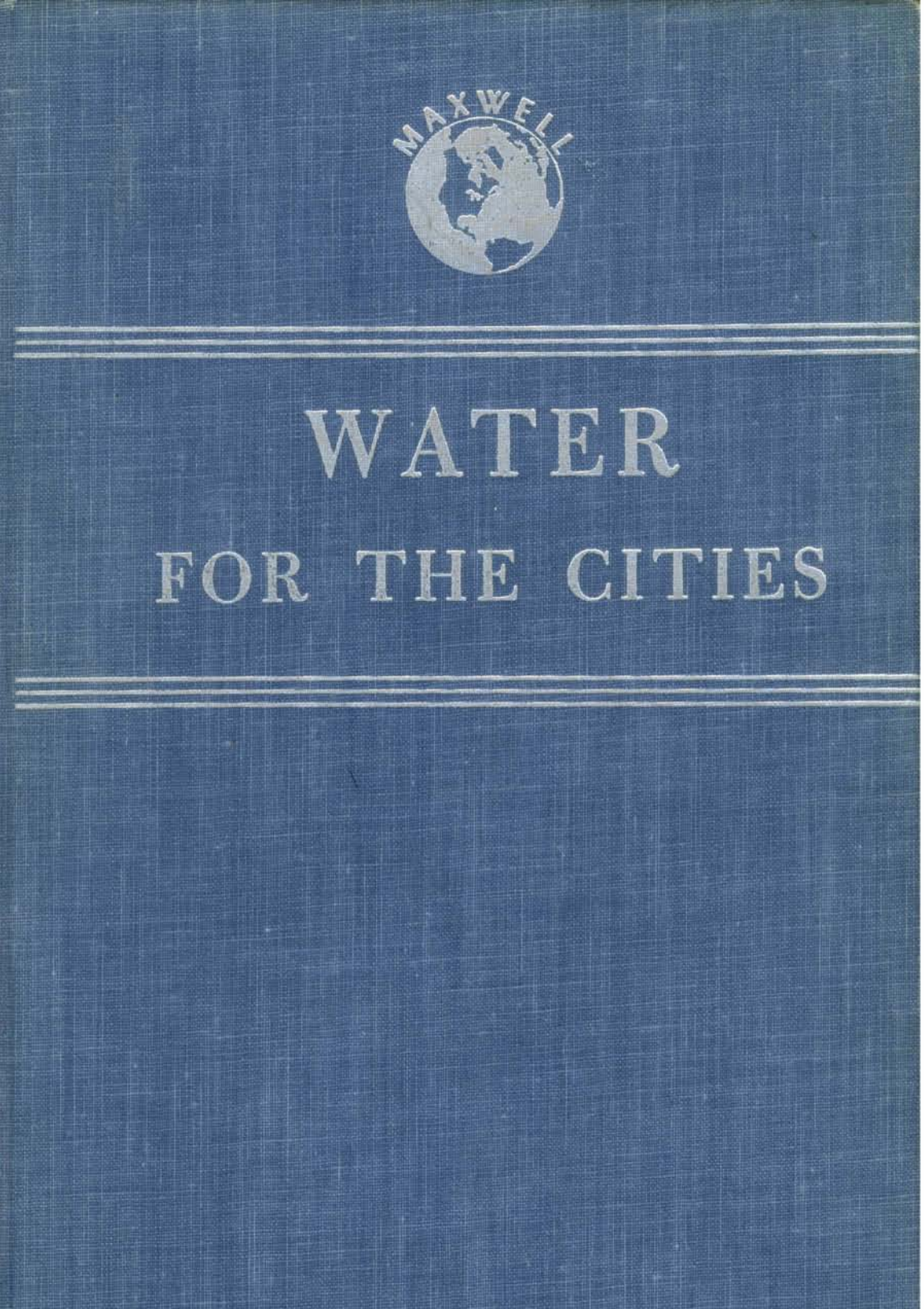


WATER FOR THE CITIES

A History of
The Urban Water Supply Problem
In the United States

NELSON MANFRED BLAKE
Syracuse University

MAXWELL SCHOOL SERIES—111

SYRACUSE UNIVERSITY PRESS—1956

To

Betty

All titles in the Maxwell Series have been approved by the Publications Committee of the School and carry the colophon of the Series. They are published under a grant, furnished in part, by the Maxwell School of Citizenship and Public Affairs of Syracuse University.

Preface

This book tells the story of how American cities came to recognize their need for a central water supply and what they did to meet that need. No problem was more vital to urban life. Villagers could safely draw their water from local wells and cisterns. City dwellers could not, and the decision to spend the large sums of money necessary to bring in a supply from outside sources was a vital one in the history of each urban community. Most American cities first faced up to this problem during the decades between 1790 and 1860 when they underwent a rapid growth of population.

My study started out as one of strictly limited scope—an investigation of the water supply problem in the four largest eastern cities, New York, Philadelphia, Baltimore, and Boston, during the years 1790 to 1860. This is still the central theme. But as so often happens in a work of this kind, my interests broadened as I proceeded, and this is reflected in what I have written. This book therefore includes not only a full account of how these particular cities first recognized and provided for their water needs, but also a brief discussion of similar developments in other cities. In the last two chapters the story is brought down to the present with an account of how the urban water supply problem has developed in the period since 1860.

Research for this study was made possible by a leave of absence from Syracuse University and a generous grant from the Penrose Fund of the American Philosophical Society. Everywhere I went in my search for materials I was given courteous treatment and invaluable assistance. I should like to express my gratitude to the staffs of the following institutions: Historical Society of Pennsylvania, Library Company of Philadelphia (Ridgway Branch), Free Library of Philadelphia, American Philosophical Society Library, New York Historical Society, New York Public Library, Columbia University Library, New York Municipal Reference Library, Maryland Historical Society, Enoch Pratt Free Library, Baltimore Legislative Reference Library, Library of Congress, Massachusetts Historical Society Library, Boston Public Library, Massachusetts State Library, Jervis Library of Rome, New York, Syracuse University Library, and the Court of Appeals Library in Syracuse, New York.

For helpful advice and information I am greatly indebted to Mr. K. H. Schamberger of the Baltimore Bureau of Water Supply, to Commissioner Samuel S. Baxter and Mr. Elbert J. Taylor of the Philadelphia Water Department, to Mr. Charles Hughes, City Archivist of Philadelphia, to Dr. Edward M. Riley of the Independence National Historical Park Project, and to Mr. R. J. Faust and Mr. Harry E. Jordan of the American Water Works Association. Mrs. F. C. Latrobe II of Baltimore, Maryland, very kindly arranged for me to use the Benjamin H. Latrobe Letter Books.

My understanding of the public health problems involved in water supply was clarified by discussions with Professors R. H. Shryock and C. W. Krusé of the Johns Hopkins University Medical School. My colleague, Dr. W. P. Hotchkiss, read part of the manuscript and made valuable suggestions. Mr. Theodore Oberlander drew the maps.

Finally, I owe a special debt of gratitude to my wife, Elizabeth May Blake, who typed the entire manuscript and helped in many other ways.

Nelson Manfred Blake
Syracuse University

Contents

List of Maps

INTRODUCTION

> And the rest of the acts of Hezekiah, and all his might, and how he made a pool, and a conduit, and brought water into the city, are they not written in the book of the chronicles of the kings of Judah?
>
> II Kings 20:20

IN AN ANXIOUS AGE when civil defense workers practice caring for the victims of an imagined atomic attack and science fiction magazines speculate on the horrid possibilities of an invasion from outer space, the suggestion of still another conceivable disaster will hardly be welcome, but—

Just suppose that through an act of sabotage or a sudden assault New York City or any other great city were to be deprived of its entire water supply. The results would not be as instantly horrifying as the explosion of a hydrogen bomb, but over a short period of time the disaster would be almost as demoralizing to urban life.

The first affliction to be dreaded by a waterless city would obviously be thirst. The fretful child would cry out in vain for a drink. The feverish sick would toss in thirsty anguish. The office water cooler would stand empty. The glass of water which the hungry had always taken for granted with their meals would be unavailable. Without water, coffee and tea would also disappear from the menu, together with locally manufactured beer and soft drinks.

With the water supply knocked out, city dwellers would discover that their choice of foods was shockingly limited. Whatever was usually cooked in water—vegetables, soups, stewed meats, and the like—could not be prepared. The baker and the housewife would have no water to make their breadstuffs and pastries.

To add to the discomfort of beverageless and monotonous meals, the fastidious diner would recoil from unwashed dishes and tableware. Indeed, the water famine would completely upset the whole pattern of habits by which modern man keeps himself clean. Workers would have to go to and from their jobs unbathed; clothes would get dirtier and dirtier; floors would remain unscrubbed. Defenses against man's most

deadly enemies, the disease-causing germs, would be dangerously lowered. And the fact that not a toilet in the whole city would flush would open up another fatal breach in the walls of public health. Without water the whole sewerage system by which a great city rids itself of human and industrial wastes would fail.

Thirst, malnutrition, and disease would not be the only dangers menacing the population. The fire department would be left without weapons to fight any but the most minor conflagrations. Automatic sprinkler systems would no longer function. Millions of dollars worth of property would be exposed to grave jeopardy.

The purpose of suggesting the complete confusion and fear into which a modern city would be plunged by the loss of its water supply is not to create alarm about an imaginary and improbable disaster. Rather, this desolate picture has been described to emphasize the fact that urban life, and this is now the life of a majority of Americans, is peculiarly dependent upon water. Without it, cities simply could not exist.

If this be true, the indispensable precondition to the great growth of American cities during the nineteenth century was a recognition of the vital importance of water supply and the taking of adequate steps to meet this need. In 1790 American cities drew their water almost exclusively from springs, wells, and cisterns, sources that became steadily more inadequate in quantity and quality as the population grew. By 1860, after resorting to many unsatisfactory makeshifts, most cities had learned a great lesson. No longer could they depend upon internal sources of supply; at whatever expense or difficulty they must impound the waters of outlying lakes and rivers and bring this lifegiving stream through aqueducts and pipes into the very homes of their citizens.

The Hebrew historians recorded the deed of good King Hezekiah in building water works for the city of Jerusalem. But American historians have usually been too much interested in describing high politics at Washington or high living at Brook Farm to give attention to such prosaic themes. Many more people now know that the Whigs passed a tariff act in 1842 than that Croton water was introduced into New York City in that same year. Yet the latter may well have been the more significant event.

This account of how American cities have dealt with their water problem is written in the conviction that municipal statesmen and engineers who preserve and enrich life through providing an essential service deserve to have their names and deeds recorded in the history of the nation no less than do presidents, generals, and philosophers.

CHAPTER ONE

Perils of the City

> I wondered at the contrariety that exists between the scenes of the city and the country; and fostered, with more zeal than ever, the resolution to avoid those seats of depravity and danger.
>
> Charles Brockden Brown, *Arthur Mervyn* (1799) [1]

> Why should cities be erected, if they are to be only the tombs of men?
>
> Noah Webster (1796) [2]

On the afternoon of May 10, 1790, the Common Council of the city of Philadelphia convened in special session at the City Hall. The occasion was a solemn one. The Aldermen and Common Councilmen had gathered to hear extracts from the last will and testament of Doctor Benjamin Franklin, who had died some three weeks earlier. Francis Hopkinson, one of the executors of the great man's estate and himself a famous Philadelphian, read to the councilors the extraordinary codicil that Franklin had added to his will on June 23, 1789, leaving one thousand pounds each to the town of Boston, where he had spent his boyhood, and to the city of Philadelphia, where he had passed most of his long and useful life.[3]

The two municipalities were to keep the funds constantly invested in loans to "young married artificers" of good character, who were to pay them back in ten annual installments with interest at five per cent. Thus compounded, the funds would each grow to £131,000 over the course of a hundred years. Of this amount each city was then to expend £100,000 on useful public works and to employ the balance in further loans to artisans.

At the end of two hundred years, according to Poor Richard's shrewd calculations, the bequests would amount to £4,061,000 for each city. These sums were to be finally divided between the city of Boston and the state of Massachusetts, and the city of Philadelphia and the state of Pennsylvania, respectively.

No less interesting than the ingenuity with which Franklin undertook to provide princely bequests out of his relatively modest fortune was his advice on how Philadelphia's £100,000 might be expended to make the city a safer place to live. The wise old man had written these words:

> And having considered that the covering of the ground-plot of the city with buildings and pavements, which carry off most of the rain, and prevents its soaking into the Earth and renewing and purifying the Springs, whence the water of wells must gradually grow worse, and in time be unfit for use, as I find has happened in all old cities, I recommend that at the end of the first hundred years, if not done before, the corporation of the city Employ a part of the hundred thousand pounds in bringing by pipes, the water of the Wissahickon Creek into the town, so as to supply the inhabitants, which I apprehend may be done without great difficulty, the level of that creek being much above that of the city and may be made higher by a *dam*. I also recommend making the Schuylkill completely *navigable*.[4]

As so often in the past—when he had initiated steps to provide Philadelphia with educational institutions, with a circulating library, and with better protection against fire—Franklin had perceived earlier than most citizens the needs of his adopted city.

By twentieth-century standards Philadelphia in 1790 was little more than an overgrown town. Within the boundaries of the old city some 28,522 inhabitants lived; in the adjoining districts of the Northern Liberties and the Southwark there were 13,998 more, making a total of 42,520 persons, the largest concentration of population in the new nation. Philadelphia's principal rivals were New York with 33,131 inhabitants and Boston with 18,038. Other busy ports were Charleston and Baltimore with populations of 16,359 and 13,503 respectively.[5]

Although a period of economic crisis had followed the Revolution, the young cities were now flourishing. American ships were renewing many of the lines of trade disrupted by the struggle for independence and were finding their way into new markets as well. Merchants were once again growing wealthy, and expanding maritime activity was giving employment to shipwrights, sailmakers, and manufacturers of ships' hardware. Within the cities resided ambitious professional men—lawyers, doctors, clergymen, and teachers—as well as thousands of sturdy representatives of the artisan class from which Franklin had risen.

Quite as important as the function of the cities as centers of commerce and industry was their service in stimulating the intellectual life of the country. In the towns, books and pamphlets were published, clubs and societies flourished, schools and colleges educated the young, and lending libraries served the needs of the old. Ideas were exchanged and minds were sharpened through lively talk in taverns and coffee houses.

But the appeal of city life was not alone to the serious-minded. Dancing assemblies, playhouses, concerts, and card games helped the rich to pass their days pleasantly, while the humbler classes amused themselves in tippling, brawling, and betting on cock fights.

City life in the 1790's was not, however, all profit and pleasure. Life and property in the urban communities were none too safe. Although the cities were growing rapidly, their institutions of local government were still those of villages. Constables and marshals by day and watchmen by night provided little protection against crime. Thefts and assaults were frequent, and occasional riots threw the cities into an uproar and resulted in much damage to property.

Even more serious was the danger of fire in the closely-built streets and alleys. The great Boston fire of 1711 left a hundred families homeless; the New York fire of 1776 destroyed 493 houses, about one-quarter of all those in the city. Serious conflagrations that gutted five or six buildings broke out again and again. To combat these, volunteer fire companies had been organized, but their activities with buckets and primitive hand pump engines were often ineffective. Sometimes, especially during summer droughts or winter freezes, the firemen were badly handicapped by a shortage of water in the wells and rivers. In 1791, Philadelphia was thrown into a panic by a report that arsonists were at work. Rewards totalling one thousand dollars were posted for the arrest of the criminals, and special patrols were organized to guard the city day and night.[6]

The greatest threat of all to the lives of the city dwellers came from disease. Long before 1790, American towns, like those of the Old World, had been periodically scourged by epidemics of smallpox, yellow fever, and other fatal maladies. But all previous American experience was overshadowed by the great yellow fever epidemic of 1793 which terrified Philadelphia for three months. Over four thousand deaths, amounting to almost ten per cent of the population, were charged to the deadly pestilence. The shocking mortality was only one part of the story. Business in the nation's leading port, then serving as both the capital of the United States and of Pennsylvania, came to a standstill as twenty-three thousand inhabitants, almost one-half of the population, fled the city to find whatever accommodations they could in the surrounding countryside. Most of those who remained in the city avoided all contact with their neighbors, hoping somehow to save themselves from the prevailing malady. Only a heroic few risked their lives in such desperately needed services as attending the sick, moving them to an emergency hospital on the city's outskirts, burying the dead, and providing food and shelter for the orphans and other destitute victims of the great disaster.[7]

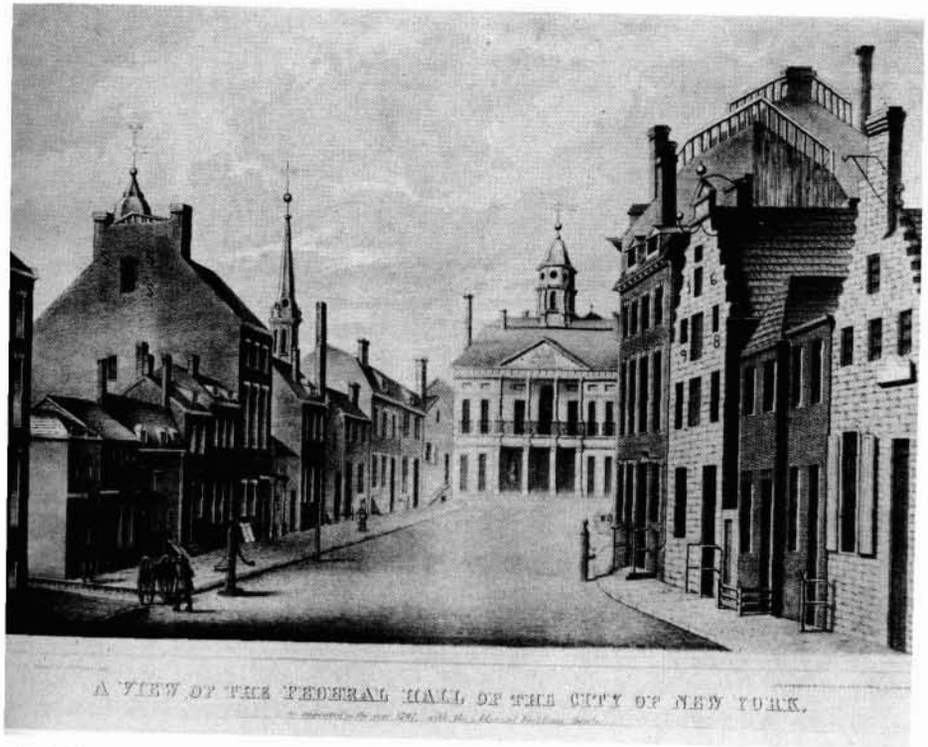
Philadelphia's tragic ordeal attracted the horrified interest of her sister cities. To protect themselves from infection they improvised strict quarantine measures against travelers from Philadelphia, but they demonstrated their humanity by raising funds and sending shiploads of emergency supplies to the stricken capital. Most of the other cities gained their own first-hand acquaintance with yellow fever before the decade was over. In 1794, the pestilence attacked Baltimore and New Haven, while appearing in less serious degree in Philadelphia again. In 1795, the rapidly growing port of New York was attacked, together with Baltimore and Norfolk; in 1796, the afflicted cities included Newburyport, Boston, and Charleston.

Philadelphia suffered a third visitation of the fever in 1797, a year in which Norfolk, Baltimore, Bristol, and Providence were also infected. The agony of the decade reached a terrifying peak in 1798. In Philadelphia the devastation approached that of 1793; thirty-five hundred victims died, and forty thousand persons, three-quarters of the population, fled the city. The situation in New York, where over two thousand deaths were recorded, was almost as bad, while the disease also invaded Boston and seven of the smaller port cities. In 1799, yellow fever continued its ravages with visitations to Philadelphia, New York, and Charleston, as well as other places.[8]

The epidemics of these years provoked bitter controversy. On the matter of proper treatment the doctors were divided between the disciples of Philadelphia's famous Dr. Benjamin Rush, who believed in attacking yellow fever through a ferocious counter-offensive of bleedings and purgings, and the anti-Rushites, like Dr. William Currie of Philadelphia, who advocated milder remedies.[9]

More significant than the dispute over treatment was the difference of opinion over the cause of the disease. Currie and others insisted that yellow fever was a distinct and special disease, brought into American ports periodically through ships from the West Indies and other disease-ridden foreign areas. The Rushites hotly denied this, pronouncing that the malady "commonly called the yellow fever" was only "the bilious, remitting fever of warm climates excited to a higher degree of malignity."[10] The cause was "putrid exhalations from the gutters, streets, ponds and marshy grounds in the neighborhood of the city."[11] In Charles Brockden Brown's *Arthur Mervyn*, one of the earliest American novels, one character refers to another thus: "He combatted an opinion I had casually formed respecting the origin of this epidemic, and imputed it, not to infectious substances imported from the East or West, but to a morbid constitution of the atmosphere, owing wholly or in part to filthy streets, airless habitations, and squalid persons."[12]

Fire fighting methods in 1750. Details from an engraved notice of a meeting of the Hand-in-Hand Fire Company. (*New York Public Library*)



Public pumps in the vicinity of Federal Hall, New York City, 1797. (*New York Public Library*)

Paper money issued in 1774 to finance the Christopher Colles Water Works Project. The drawing on the back represents the steam engine. From *Valentine's Manual*, 1849.

So deep did the division between the two professional factions run that the doctors of Philadelphia grouped themselves in separate societies. Those who believed that yellow fever was imported from foreign sources associated with the College of Physicians, while their rivals who insisted upon the domestic origin of the fever joined the Academy of Medicine.[13]

When harassed public officials appealed to the doctors for advice on practical measures to prevent a return of the pestilence, the answers that they received inevitably mirrored the rival theories. The College of Physicians placed its emphasis on strict inspection of incoming ships and quarantine for all sailors and passengers who had been exposed to disease.[14] The Academy of Medicine recommended energetic steps to purge the city of refuse and filth.[15]

Today we may smile at the pundits' quarrel, complacent in our knowledge that both parties were wrong. Few episodes in the history of science are more familiar than the experiments in which Dr. Walter Reed and his heroic colleagues demonstrated that yellow fever is transmitted by the female mosquito of the species *Stegomyia fasciata*. Gorging itself on the blood of a person ill with the fever, the insect carries within its tiny body the virus of the fatal disease and injects it into the blood stream of the next person whom it bites.[16]

Indeed, much of the fascination of reading the yellow fever literature of the 1790's derives from the fact that we find frequent allusions to the unrecognized villain lurking upon the scene of her crimes. Thus, we read in Dr. E. H. Smith's description of the New York epidemic of 1795 that there were "clouds of musketoes, incredibly large and distressing: and these continued to afflict us, long after the time when they commonly depart. . . . The irritation, restlessness, and consequent watchfulness and fatigue, occasioned by these animals, no doubt predisposed the well to be affected by the fever; while they extremely harassed the sick, and retarded their recovery."[17]

How close observers might come to a major truth without drawing the essential inference is suggested by the words of Dr. Valentine Seaman, who wrote in 1796: "It has been observed by Dr. Rush, in Vol. 1 of his Med. Observations, as well as by Dr. Lind, that musquetoes generally attend a sickly season—the same was observed here during the last summer: the cause is very clear, for circumstances favoring the rise of putrid miasmata, equally favor the generation of these insects."[18]

But if both medical factions missed the truth about the transmission of yellow fever, both correctly apprehended some of the secondary causes. Those who believed that the disease was to be attributed to foreign sources were partly right, since the initial cases from which the mosquitoes carried on their deadly propagation were probably brought into

the port cities on ships from foreign ports. Those who believed in the domestic origin of the fever had also grasped a portion of the truth, since the fetid marshes and the stagnant pools to which they so much objected must have provided breeding places for the disease-carrying insects.

Fortunately, the municipal authorities, unwilling to choose between the rival theorists, decided to take the advice of both. Out of the yellow fever horrors of the 1790's emerged clearer concepts of public health. State legislatures passed stringent quarantine laws to regulate the ports, and Boards of Health were created to deal with these and other matters.[19] Of equal importance was the new determination to cleanse the cities of their dangerous accumulations of filth. Many citizens, shocked out of indifference by the great terror, began to look at—and smell of—the neighborhoods in which they were living. On May 3, 1799, the *Aurora* thus described the situation in Philadelphia:

> Persons who are disposed to visit the environs of this city, and more particularly on a warm day after a rain, are saluted with a great variety of fetid and disgusting smells, which are exhaled from the dead carcases of animals, from stagnant waters, and from every species of filth that can be collected from the city, thrown in heaps as if designedly to promote the purposes of death. . . . It must be evident that an atmosphere impregnated with putrid exhalations, not only generates pestilential diseases, but tends to render them more contagious. And with regard to yellow fever, it is immaterial whether it is imported, or of domestic origin, the danger in each case is equal, and the disease when once introduced is rendered more contagious by the noxious qualities of the air.

But the nuisances were not confined to the outskirts of the city. Equally offensive odors were to be encountered in the most heavily settled districts of Philadelphia, near the wharves or in the vicinity of open sinks that had been dug to receive the flow from the gutters. "Two of these, which are the most remarkable, are situated in Market-street, at the corner of Fourth-street. They, like the apertures to the Dock-street sewer, exhale the most noxious effluvia; for dead animals and every kind of nausea are thrown into them, and there remain till they become putrified."[20]

The very fact that houses were built so closely together was believed to contribute to the ferocity of the yellow fever epidemics:

> Much of its violence may be ascribed to the wretched practice common in Philadelphia, as well as in all other large towns, of jamming and heaping houses together, as if the surface of the country did not afford room for holding them. Nothing can be more completely ridiculous, than that, in a continent twelve hundred leagues wide, and where land is so extremely plenty, contagion should be promoted by the narrowness of the streets. In 1793 only thirty-nine persons died in the whole extent of Market-street, from the Delaware to the Schuylkill; whereas, in Pewter-Platter-Alley, containing perhaps forty houses, thirty-two persons died; in Elfrith's Alley, twenty-three; in Combes's-Alley, twenty-nine; and in Moravian-Alley, thirty-seven. These make, in whole, an hundred and twenty-one deaths in only four alleys. If each of them had been as wide as Market-street, the chance is, that at least half of these lives would have been saved . . . ventilation is an evident preventative.[21]

If filth vitiated the air and caused disease, the obvious counter-measure was to remove the filth. "All the large towns," observed *Claypoole's American Daily Advertiser* in 1798, "are turning their most serious attention to maintaining CLEANLINESS in their houses, yards and streets. Their suffering experience has not been learned in vain."[22] Even the anti-Rushites who believed that the most effective preventative measure was to quarantine incoming ships conceded that civic cleanliness would help. In 1799, Dr. Currie gave this advice:

> My observations however incline me to believe, that although the yellow fever is never generated in this country, it is communicated from one to another more readily and certainly when the atmosphere is replete with putrid exhalations, than when it is more pure or free from such exhalations. Prudence, therefore, dictates the propriety of removing from the city and its vicinity all putrifiable substances, and to promote coolness and ventilation during the hot season, as far as practicable. . . .[23]

Moralists were particularly zealous in urging their fellow-citizens to clean themselves up. Noah Webster stated the matter thus:

> I am persuaded that the Americans may be convinced by *facts*, that even in our climate, Epidemic and Pestilential Maladies may be generated by local causes. If they can be convinced of this, that sources of disease and death may be found among themselves created by their own negligence, it is a great point gained; for until they learn this, they will never attend to the means of preserving life and health. They will still wallow in filth, croud their cities with low dirty houses and narrow streets; neglect the use of bathing and washing; and live like savages, devouring, in hot seasons, undue quantities of animal food at their tables, and reeling home after midnight debauches.[24]

The new passion for civic cleanliness obviously demanded a liberal use of water. One of the earliest suggestions for combatting the Philadelphia epidemic of 1793 was that the fire companies should flush the streets daily.[25] In January, 1794, the City Council ordered that five water carts be provided for the regular watering and cleaning of the streets, particularly during hot weather.[26] In an unsuccessful attempt to guard Philadelphia against yellow fever in July, 1798, the City Commissioners issued orders to wash the gutters and to wet the streets three times a week.[27] Nor was Philadelphia alone in this new ambition to use water freely in cleaning the streets. Similar exhortations appeared in the newspapers of New York and Baltimore.[28] Noah Webster advised:

> Water is perhaps the best purifyer of the houses and streets of cities, as well as of infected clothes. The use of water cannot be too liberal; but care must be taken that none of it remains to stagnate about or near buildings.[29]

Not content to preach cleanliness as a virtue in itself, some venturers in science attempted more elaborate explanations of the relationship between water and health. Dr. Joseph Browne of New York believed that putrefying animal and vegetable matter decreased the amount of "animal vital air" in the atmosphere and increased the proneness that animals had to contract diseases of a putrid nature. "If this theory be just, it is of utmost importance to remove from the houses, streets, and docks, every species of animal and vegetable matter when in a putrefactive state, to which nothing so effectually contributes as a plentiful supply of water."[30] Dr. Browne also believed that less animal vital air was present in the atmosphere when the city pavements were overheated during the summer months. Sprinkling the streets would cool the air and render it more healthful. "I do not presume to say that the introduction of a large quantity of water into the City, would alone prevent the rise and spreading of putrid diseases, but I am well warranted in saying that, under providence, it would more than all other things, contribute to this most desirable end."[31]

A similar line of reasoning led John Sevier, once a famous Tennessee frontiersman, to suggest the possibility of what in the twentieth century would be called air-conditioning. Noting that yellow fever regularly abated under the influence of autumn's cool and refreshing breezes, Sevier wrote to Dr. Benjamin Rush that could some substitute as near in effect as possible be constructed, it would be the most sure and likely means to eradicate the dreadful disorder.

> I now beg leave to suppose for a moment constructing what we call in Tennessee a water blast, such as we now blow our Furnaces and Forges with. . . . A machine of this kind, I am induced to believe, would sufficiently ventilate the largest Hospital, or building erected for the Reception of the sick. . . .
>
> I have conjectured that could the water . . . be elevated high enough for to afford strong blasts of the kind I have mentioned, that you might then have as many erected in different and suitable stations as might be a ventilation sufficient to disperse great parts of the floating contaminated mists and vapours; also purify, cool and refresh the vicinity in which they might be placed.[32]

Less ambitious were frequent suggestions that the air might be cooled and rendered more healthful by public fountains.[33]

Although primary importance was placed in increasing the quantity of water so that it might be more freely used, men of intelligence began to insist that the water supply should be pure as well as copious. In his will Franklin had pointed out the danger that Philadelphia's wells might ultimately become contaminated as had those of the cities of the

Old World. As yellow fever scourged the city again and again, it was only natural to suspect that this had already happened. In October, 1798, the Board of Managers of the Marine and City Hospitals recommended that the city commissioners "have the pumps frequently and copiously worked, as the water is extremely offensive and unwholesome."[34]

The proximity of Philadelphia's wells to graveyards and privies began to arouse concern. The writer of a letter to one of the newspapers complained that Philadelphia had more church yards than any city he had ever known. Drainage from these, added to "the local putrefaction of the necessaries," would breed pestilence forever if not removed or altered. "The pumps of the city are deprived of air; the necessaries are dug above the depth of the pumps. Therefore the situation of the poisons the above things contain are communicated to the water, and poison is drank as well as breathed. . . ."[35]

The suspicion grew that most of the water of the city was no longer safe. Visiting Philadelphia in 1798, the brilliant young engineer, Benjamin Henry Latrobe, speculated on the terrible ravages of yellow fever. The city's streets were mostly wide and straight, so the cause of disease could not be lack of ventilation. There were, to be sure, very filthy alleys, while the backyards of most of the houses were littered with refuse. But, he reasoned, some cause, more powerful and specific, must be at work.

Each house had its privy and its drain which discharged its contents into a boghole sunk into the ground. In every street close to the footpath was a range of pumps from which all the water used for drinking or cooking was drawn. The water of each of these pumps, Latrobe concluded, must be contaminated by the sewage. Dramatic evidence that such was the case appeared to be provided when a number of persons were reported to have fallen dead in the streets, immediately after drinking from the pumps. Some doctors explained these sudden deaths as the result of gulping down excessively cold water while the body was overheated from exercise; others thought that they were simply cases of apoplexy brought on by the summer heat.

But Latrobe had his own characteristically ingenious explanation. Above the water in the pump, he believed, there was confined a quantity of noxious gas. When the innocent water drinker put his mouth to the spout and raised the pump handle, he took this fatal effluvium into his system. This theory seemed to Latrobe to be confirmed by the fact that no further deaths were reported after the pumps were provided with iron ladles chained to the stocks so that drinkers no longer had to put their mouths to the spouts.[36] (It was left, of course, for our own germ-conscious generation to speculate on how much disease was now communicated by this common drinking vessel!)

Commenting on the probable contamination of the wells, the editor of *Aurora* wrote:

> Another most preposterous and baneful custom prevails among us, it is that of digging privies twenty or thirty feet deep, whereby magazines of putrefaction are maintained for a hundred years together; as by means of the absorbent powers of the gravel that is generally found at a certain distance beneath the surface of the earth, they must naturally communicate their excrementious qualities to the waters of the city. Common sewers properly constructed, through which the water is made to flow, would be the most salutary mode of discharging the contents of privies; but such arrangements will very probably be referred to our posterity.[37]

Rising demand for a pure and plentiful water supply drew attention to the inadequate sources upon which the American cities were dependent. For the most part, these were still the familiar resources of rural communities: springs, wells, and cisterns. Townsmen living close to some spot where water bubbled to the surface of the earth considered themselves fortunate and filled their buckets regularly from these favorite springs. In Baltimore, for example, a familiar landmark as early as 1752 was Cool Spring, situated near the western bank of the harbor.[38] Here water was drawn for both townspeople and ships; here, too, was a natural meeting place for housewives, servants, and youthful lovers.

Water from mineral springs was sometimes enthusiastically offered for sale. In 1787, an advertisement in the *Pennsylvania Gazette* described three different kinds of medicinal water available at Harrowgate, four miles from Philadelphia:

> The subscriber submits it to the judgment of the physicians of Philadelphia, when, in what diseases, and in what quantity, to recommend the use of these mineral waters. He will only observe that the Harrowgate waters have rendered essential service to persons afflicted with diseases and obstructions of the stomach, bowels, and kidneys. It has also removed worms, and relieved the irregular gout and chronic rheumatism. Externally applied, these waters in many cases cured ulcers and other eruptions of the skin.[39]

The most common means by which town dwellers obtained a supply of water were through wells and pumps. Although many inhabitants provided for their own supply in this way, provision for water was not exclusively left to individual enterprise. Public wells and pumps were institutions of long standing. In 1658, the Dutch of New Amsterdam dug a public well in front of the old fort, situated just south of New York's present-day Bowling Green. After the English conquest of the colony, six more wells were ordered "for the public good of the city."[40] Boston's famous town pump had its origin in 1774 when a town meeting resolved that a well should be dug in Dock Square as a project to give work relief to the poor who were suffering unemployment through the operation of the Boston Port Bill.[41]

By the end of the eighteenth century it had become a common occurrence for the inhabitants on a certain street or in a special locality to join in petitioning the municipal authorities that a public well should be dug and a pump erected at some convenient place. If the petition was granted, the cost of the improvement was assessed against the residents who would benefit. In Baltimore, for example, the records of the Special Commissioners for 1789 reveal that to pay for a new pump at the corner of Gay and Second Streets nine property holders were assessed sums ranging from eight shillings to £6 5s. The total cost of the well and pump was £12 19s 5d.[42]

Public pumps were particularly characteristic of Philadelphia. In 1796, an investigating committee reported that there were in the city about three hundred public pumps and wells. The City Commissioners were authorized to sink as many new wells as might, in their opinion, contribute to the convenience of the citizens. About fifteen new wells were dug and pumps fixed therein each year.[43] The purity of the well water had once been a matter of civic pride. The Swedish traveler, Peter Kalm, visiting the city in 1748, had written: "The good and clear water in Philadelphia is likewise one of its advantages. For although there are no fountains in the town, there is a well in every house and several in the streets, all of which furnish excellent water for boiling, drinking, washing and other uses."[44] But in 1794, the reputation of the wells was quite different. The French colonial lawyer, Moreau de St. Méry, reported that none of the water was particularly good; some of the pumps had a better reputation than others, but this was only relative. In rainy weather, seepage from the cemeteries drained into the water.[45]

New York also provided an increasing number of public pumps. By 1809 there were 249 of these.[46] But the New York well water was notoriously bad. As early as 1748 Peter Kalm remarked that even the horses balked at drinking it. The only good water, he noted, was obtained from a large spring a short distance from town, which the inhabitants used for their tea and kitchen purposes. So much in demand was the water from this source that shortly before the Revolution a pump was placed over the spring and ornamental grounds were laid out. The Tea Water Pump Garden became a popular resort, where tea and other beverages could be purchased. Still later, sale of the Tea Water developed into a thriving private enterprise. Jedediah Morse's *American Gazeteer* of 1797 thus described it:

> Most of the people are supplied every day with fresh water, conveyed to their doors in casks, from a pump near the head of Queen street, which receives it from a spring almost a mile from the centre of the city. This well is about 20 feet deep and four feet diameter. The average quantity drawn daily from this remarkable well, is 110 hogsheads of 130 gallons each. In

> some hot summer days 216 hogsheads have been drawn from it; and what is very singular, there is never more or less than about 3 feet water in the well. The water is sold commonly at three pence a hogshead at the pump.[48]

Two horses driven by a boy operated the pump, and the distribution of the water to individual householders was in the hands of some twenty-four carters, whose margin of profit was ample since they purchased the water by the barrel at a price of about six cents for 130 gallons and sold it by the bucketful at about one cent a gallon.[49]

Even the purity of the famous Tea Water, however, was not above suspicion. It was located dangerously near the filthy body of water known as the Collect or the Fresh Water Pond. However appropriate the latter name may have been in earlier days, by the 1780's the Collect was notorious as "a very sink and common sewer," where housewives did their washing and threw their slop buckets, and other people threw dead dogs and cats. A competing New Tea Water Pump on Magazine Street was available, but this was even closer to the Collect.[50]

Many households obtained their water for bathing, washing dishes, scrubbing floors, and laundering by collecting rain water from the roofs in cisterns. Water from this source was perfectly soft and was easily worked into lather. But cistern water, like well water, tended to deteriorate with the growth of the towns. Housewives complained that dust and cinders often spoiled the water for washing clothes.

Growing discontent with the water situation would have developed in any case, and the yellow fever panic only hastened and dramatized this development. Gentlemen, well-read in the Latin classics, were keenly aware that men had not always and everywhere been dependent on the local supplies of water that springs, wells, and cisterns could provide. They knew that one of the essential foundations for the urban civilization of the Roman Empire had been a bold system of aqueducts conveying pure water from distant sources into the great metropolis.

A detailed description of these was available in *De Aquis Urbis Romae*, written by Frontinus, appointed superintendent of the aqueducts at Rome in 97 A.D. By this time the Roman water system had been in the process of development for over four hundred years; nine aqueducts had been built, some of them more than fifty miles long; the total length of the aqueducts exceeded 255 miles and the average daily supply of the city was probably about thirty-eight million gallons.[51] Built of stone and lined with cement, these structures demonstrated extraordinary engineering skill. Sometimes they ran beneath the surface of the earth; sometimes they were supported on structures of solid masonry; sometimes they were carried across valleys on magnificent arched bridges. Within the city, water was distributed, in part through lead

pipes, to public baths and fountains, to the shops of artisans, and to the private houses of the wealthier citizens. Even more remarkable were some of the aqueducts which had been built to supply the cities of the Roman provinces. Many of these still stood, sturdy and firm, sixteen hundred years later in countries like France and Spain.

The Romans had not been the only aqueduct builders. Before Roman times, people like the Phoenicians and the Greeks had often shown boldness and imagination in providing for their water needs. In later years Constantinople was supplied with water by aqueduct, while the Renaissance Popes recognized the needs of the city of Rome and took steps to restore some of the ancient works. To provide water for the gay fountains of Versailles, Louis XIV spent vast sums of money on machinery to raise the water of the Seine by water wheels and convey it to his palace grounds by canals and conduits.

With much of this previous experience eighteenth-century Americans had little contact, but the example of London was more familiar. In 1609, Hugh Middleton began the work of supplying London with water from sources some thirty-eight miles to the north by means of an open canal, the so-called New River. Management of this system was vested in a private corporation, the New River Company. A second private concern, the Chelsea Water Company, began operations in 1721; a third, the Lambeth Water Works, entered the field in 1783. Between 1805 and 1822, five more water companies were organized. The total daily supply from these sources was over twenty-eight million gallons. Of this, about thirteen million gallons was drawn from the River Lea and other distant sources through the New River Canal; the rest was pumped by water wheels and steam engines from the Thames close to the city.[52]

Even in colonial America a few attempts had been made to improve the water supply. One of the earliest incorporations in the colonies was that of the Water-Works Company by the Massachusetts General Court in 1652. The proprietors of this Boston enterprise constructed the so-called Conduit, a reservoir some twelve feet square into which water was conveyed through bored logs from nearby wells and springs. This supply served the convenience of neighboring families and was valuable in time of fire. But it never fulfilled the expectations of its promoters and eventually fell into disuse.[53]

In 1754, Hans Christopher Christiansen began the construction of a system of water works for the Moravian colonists at Bethlehem, Pennsylvania.[54] An English traveler in 1796 reported:

> Every house in the town is supplied with an abundance of excellent water from a spring, which is forced through pipes by means of an hydraulic machine worked by water, and which is situated on the banks of the creek.

> Some of the houses are supplied with water in every room. The machine is very simple, and would easily raise the water, if necessary, several hundred feet.[55]

When a group of Moravians moved to Salem, North Carolina, they apparently carried their interest in water works with them, because a visitor to that town in 1786 noted that every house was supplied with water, brought a mile and a half in conduits.[56]

In 1772, two private water companies, the Providence Water Company and Rawson's Fountain Society, were organized to supply the inhabitants of Providence, Rhode Island. Each of them drew water from springs about a mile from town and conveyed it through bored wooden logs.[57]

The most ambitious project of colonial days was that of Christopher Colles, an Irish-born engineer, whom the Common Council of New York commissioned in 1774 to construct a system of water works. To finance the enterprise the municipality issued bonds and paper money to the amount of £11,400.[58] By April, 1776, the project had been carried far enough to amaze a young Yankee officer in Washington's army. Although a Harvard graduate, Lieutenant Isaac Bangs had obviously never heard of steam engines before:

> The work already accomplished is to convey water from the side of a hill, nigh a pond, to the top of the hill, from which, being higher than any part of the city, the water is to be conveyed in pipes. The well is 40 feet in diameter and 30 feet down to the surface of the water. In this well is an engine which forces the water almost to the top, and from thence through a wooden tube up to the top of the hill, which is a distance of about five rods. At the top of the hill is a pond covering one quarter of an acre, and being about from 8 to 11 feet deep. Thus far I could easily comprehend the operation of the works; but now the mystery was, how the machine in the well was first actuated and kept in motion. This (as I at length discovered with surprise,) was done by the power of boiling water. I found that, by means of a large copper boiler, the steam or vapor of the water is conveyed from thence into a strong copper tube of 18 inches diameter and 10 feet long, which stands in a perpendicular position. The lower part or end of this tube is light, but the upper end has in it a movable stopper which may move upwards or downwards with as much ease as possible, and at the same time keep the air without from entering into the tube. In order to keep it tight, another part of the works constantly supplies the top of the tube, above the stopper with a small jet of water. The steam of the hot water (as I take it) entering into the tube, rarifies the air therein to a great degree, when the stopper is let loose and flies upward with rapidity to the upper end of the tube, and immediately is thrown back by the pressure of the air from without. When it gets to the bottom, it is again driven upwards by the same cause as before, and repelled downward in like manner by the air, causing a constant motion. To this stopper a stout lever is fastened in the middle upon an axis. This lever is moved up and down in the tube, and thus works the engine in the well, forcing the water up to the top of the hill.[59]

Lieutenant Bang's description is clearly that of a steam engine of the Newcomen, or atmospheric type, like those which had been used for pumping water from English mines since about 1711. Before Colles could complete his system by laying wooden distributing pipes through the streets, the whole project was brought to a halt by the British occupation of New York and other vicissitudes of the Revolutionary War. After the long conflict was over, little was left of the water works except the well and numerous unpaid bills embarrassing both to the city and to Colles.[60]

American city dwellers, shocked by the yellow fever epidemics into taking steps to improve their water supply, could therefore draw upon the earlier experience of other peoples and even to some extent on their own experiments. What was perhaps more important, they could call upon the technical knowledge of a growing number of engineers who had learned to make surveys, take levels, construct water-tight masonry, fashion steam engines, and build embankments, bridges, and tunnels. Many of these men had learned the lessons of practical engineering by working on the turnpikes and canals of England; others were gaining the same information during the first considerable construction of similar works in the United States during these very years of the 1790's.

The technical knowledge for the building of water works was thus available. What was now required was for citizens long accustomed to rural institutions to accept the necessity of making the more complicated provisions required by urban life. And when the city dwellers had finally accepted the fact that great water works were necessary, the question must then be answered: should these large investments be made by the municipalities themselves or by private corporations? Should the example of Rome or that of London be followed?

CHAPTER TWO

The Ingenuity of Benjamin Latrobe

> A number of country men, who happened to witness this first introduction of the water, gaped with astonishment, as at the tenth wonder of the world. They will speedily return home to communicate the marvelous tidings; and it will be well if they are not dubbed liars, when they come to relate what they saw to their credulous neighbors and friends.
>
> *Poulson's American Daily Advertiser* (1801) [1]

EVEN BEFORE the great yellow fever epidemics, measures had been taken which seemed to promise a better supply of water for the city of Philadelphia. On April 10, 1792, Governor Thomas Mifflin gave his approval to an act of the Pennsylvania Legislature incorporating the Delaware and Schuylkill Canal Company. This project was intended to serve as one link in a chain of improvements that would eventually join Philadelphia with both Lake Erie and the Ohio River.[2] By its charter the new company received the additional right

> . . . to supply the city of Philadelphia, and the neighborhood thereof, with water, by means of pipes and other conductors, under the public roads, streets and alleys, conveying water from thence to the use of such persons as will agree to pay for the same, such annual price as shall be established by the said president and managers. . . . Provided also, That the said company shall not be entitled to any greater price for water to supply the city and neighborhood thereof, than will create the annual profit of ten per centum on the capital that may and shall be expended for that particular purpose, exclusive of the general expense of the canal.[3]

At first the project appeared to prosper. A committee of prominent Philadelphians, including David Rittenhouse, astronomer and Director of the United States Mint, and the well-known Episcopal clergyman and educator, Dr. William Smith, sat at the State House to receive stock subscriptions.[4] Under the direction of William Weston, an English engineer, a canal route sixteen miles long was staked out from Norristown to Philadelphia to carry navigation past the rocks and rapids known as the Falls of the Schuylkill and bring water to Broad Street, Philadelphia, on a level high enough to distribute drinking water throughout the city. From this point the canal was to descend to the Delaware through a

series of locks. Construction was begun at the Norristown end, where some three miles of canal were dug by 1795. Another three miles were shortly thereafter constructed at the Philadelphia end.[5]

By this time, however, so many difficulties had arisen that some observers began to wonder whether the project would ever be completed. The Duc de la Rochefoucault Liancourt, traveling through this district in April, 1795, noted that only fifty workmen were employed on the canal and that progress was slow in cutting through the marble rock that lay below Norristown. Elsewhere the canal appeared to the French nobleman to be badly planned, some of it being dug through sandy soil which would not hold water. He heard that the engineer had recommended building the canal on the west bank of the Schuylkill where the terrain was more favorable, but that the directors of the company had insisted on the east bank, since it would serve their personal interests to have the canal pass through their estates. Therefore, he concluded, "the canal is now executed on the most difficult and most circuitous plan, with little prospect of success." What the Frenchman may not have realized was that the canal company's choice of route was decidedly limited by its ambition to have the waterway serve the dual purpose of inland navigation and urban water supply.

However this may be, the early difficulties of the company had a catastrophic effect upon its finances. Like most corporations of the day, this one had received only a small part of its needed capital at the time of the original stock subscription. Subsequent installments were to be paid by the stockholders as the work progressed. But nervous investors showed great reluctance to fulfill their subscriptions. Even at the hazard of forfeiting what they had already paid in, many stockholders ceased their payments.[6]

As private capital began to falter, the promoters of the canal became insistent that either the state of Pennsylvania or the city of Philadelphia should come to their assistance. They pointed out that the governments of neighboring states had aided similar projects and expressed a willingness to accept any form of help—loan, gift, or stock subscription—that might be offered. In 1795, the Pennsylvania Legislature, following the fashion of the day, authorized a lottery for the benefit of this company and the closely-related Schuylkill and Susquehanna Canal Company.[7] But the lottery was a failure, work on the canal was suspended, and the cries for aid from the distressed company became more and more anguished, since by the terms of its charter its privileges would be forfeited unless the canal were completed by 1802.

When yellow fever returned to Philadelphia in 1797, the need for improving the city's water supply began to take precedence over the needs

of navigation in the Canal Company's memorials. In December, 1797, the Company officers prepared an Address and Petition to the Legislature in which they asserted that the ablest medical opinion agreed that to guard against future visitations of pestilence or to allay its severity a copious supply of water was required. The "surest and readiest means" for accomplishing this was to finish the canal. If duly aided by government, the whole project might be carried through in two years.[8]

Prospects for aid now looked bright. Governor Thomas Mifflin in his annual message to the Legislature on December 9, 1797, dealt at length with the yellow fever problem. He regretted that there was a difference of opinion among physicians as to the cause of the disease, but he noted that there was substantial agreement on preventative measures. Extensive revision of the quarantine laws was required and also energetic steps to keep the city clean. "But," declared the Governor, "the interposition of the Legislature will also be indispensable in order to ensure such a supply of water, through the medium of canals, as appears to have become essential to the general convenience, as well as to the health of the community."[9]

The Philadelphia City Council was likewise under pressure to do something about the water problem. An unprecedentedly large number of the most respectable citizens joined in a petition to the authorities:

> While the sufferings and distress of our city, occasioned by the late contagious sickness, continues fresh in our memory . . . and finally, while we are devoutly to acknowledge that kind Providence, which spared our own lives from the shafts of mortality which flew thick around us and hath restored our city to its usual state of health and prosperity, we ought not to be unmindful of the means which, under the favour of Heaven, may appear the most effectual to prevent or mitigate the return of the like calamities.[10]

Even before receiving this petition, the city fathers had been pondering the problem. A Joint Committee of the Select and Common Councils, appointed on November 2, 1797, to consider means of bringing water to the city, soon concluded that the best way to achieve this end would be through the completion of the Delaware and Schuylkill Canal.

The Committee invited the managers of the Company to confer with it, and on December 19 the latter offered a concrete proposal to the city. If adequate funds were available, they said, water could be brought by April, 1800, into a grand reservoir in Broad Street a little to the north of Callowhill Street. From thence the canal would be cut from north to south along Broad Street the whole breadth of the city with bridges at each street crossing. The water would be at such a level that it could be turned into the gutters of each of the streets in sufficient volume to overflow and wash the streets themselves. It would also be available for the use of the fire engines in case of emergency,

> . . . and thus the first great object of cleansing the streets and subduing the rage of fire might be accomplished, in a few months and with a very inconsiderable expense. The distribution of the water in pipes and conduits and fountains, etc. will follow of course, and at ten per cent. clear profit on the work will amply promote the undertaking. For if fifty thousand pounds as calculated were to be expended this way according to the calculation, the clear income would be five thousand pounds, and if two thousand five hundred families or houses only on an average, were to be supplied at 5⅓ dollars per house or family it would produce five thousand pounds, amount of the tax or toll.[11]

The canal managers proposed that the city should purchase one-quarter of the stock of the Company for fifty thousand pounds with the privilege of appointing four out of the six managers, or directors.

But at this point negotiations struck a snag. Unwilling to associate the municipality as a minority stockholder in a private corporation expecting to earn ten per cent on its water-works investment, the Joint Committee proposed that in return for a payment of fifty thousand pounds the Company should give up its right to supply water to the inhabitants and should instead sell and deliver to the city one-half the water of the canal. The city would then build its own distributing system. Or as an alternative, the committee proposed that the canal stockholders sell to the city either three-quarters or all of their shares.[12] Thus early did the issue develop: whether control of the water system should rest in the hands of a private company or in the municipality itself.

Although the canal managers went so far as to offer either to sell the city a half interest in the Company or to surrender their rights to supply the inhabitants with water for seventy-five thousand pounds, no settlement was achieved. The final recommendation of the Joint Committee was that the city should acquire all the stock of the Company. In order that this might be accomplished, the Committee proposed that the Legislature grant to the municipality the duties upon sales at auction. This was a tax collected by the state entirely within the city and county of Philadelphia, amounting to over twenty thousand dollars in 1797 and probably more in years when business was not interrupted by the yellow fever.[13]

Confronted with rival appeals from Canal Company and city, a Senate committee attempted to satisfy both parties by recommending that the auction duties be granted to the city to be applied toward the completion of the canal and the introduction of water. When this proposal came before the full Senate, however, it was defeated.[14]

So Philadelphians continued to draw their water for another summer from the suspect pumps and wells, cleaning the streets as best they could with the now familiar water carts. Such was the situation when yellow

fever again devastated the city for three horrible months. In its impact on the civic authorities, the epidemic of 1798 surpassed all earlier ones. The very existence of the city seemed to be at stake. Either the annual visits of the fever must be halted or the inhabitants must abandon the port and find new homes and occupations away from the coast.

By this time the city's need for water appeared so urgent that the idea of linking the water works to the canal project lost much of its appeal. Even in the optimistic estimates of the Company no hope was offered that water could be supplied to the city sooner than two years after construction of the canal was resumed. Was there not some nearer source and simpler means by which water could be made available before another summer's hot weather brought on the threat of pestilence?

Quietly—almost secretly—as was natural for men steeling themselves to challenge a vested interest, certain members of the city government began to explore other possible sources of water. In July, 1798, three members of the City Council visited Spring Mill. Here, some eight or nine miles northwest of the city, several springs of excellent water issued from the earth in sufficient volume to provide power for small mills. Believing that this might afford a supply which could be brought in conduits to the city, the exploring councilmen induced several of their fellow members to see the place for themselves.

On August 9, the Common Council passed a resolution calling for the appointment of a new joint committee. This committee was to have the power to employ an engineer to ascertain the quantity of water available from this source or from any other source within the city limits or in the neighboring suburbs, and to survey routes by which the water might be brought to the city. This resolution died for want of action by the Select Council. The severity of the epidemic and the general exodus of the inhabitants paralyzed the city government for several weeks. On November 12, however, the Common Council revived its proposal by passing a resolution similar in intent to the earlier one. This time the Select Council concurred, and a Joint Committee on Supplying the City with Water was appointed.[15]

Meanwhile, steps were taken to mobilize public opinion on the water issue. As early as September 19, while the epidemic was still raging, *Claypoole's American Daily Advertiser* asserted: "With what little expence and trouble might our city be preserved from the calamity which overwhelms us almost every year—an Aqueduct, which might be established at a moderate tax upon every inhabitant would render Philadelphia as healthy as the smallest country village in the state."

Tho meetings of the city's leading citizens were convened during November. These resulted in a memorial to the State Legislature, bearing

hundreds of signatures. After describing the horrors of the yellow fever, the petition declared:

> If means can be adopted that will prevent a return of this desolating malady, commerce may again flourish; but if, by supineness and inattention, the necessary precautions are neglected, and the fever shall become an annual visitant, our cities must be abandoned, commerce will desert our coasts, and we, the citizens of this great metropolis, shall all of us suffer much distress, and a great proportion of us be reduced to absolute ruin.
>
> Looking forward, therefore, with trembling solicitude to the next summer, and resolving in our minds what human prudence can devise upon this most interesting occasion, we conceive it to be of essential import to the health of the city to introduce pure and wholesome water for drinking and culinary purposes, and also currents of water along the streets. . . .[16]

The Legislature was entreated to grant to the city such powers and aid as might be necessary to effect this purpose. With an evident eye to rural prejudices, the petition argued that water for Philadelphia was not the exclusive concern of the city-dwellers. Unless there were merchants to export the produce of the farms, agriculture would languish.

The water campaign received reinforcement from the activities of the managers of the Marine and City Hospitals who had been studying the yellow fever problem. Included in a long list of recommendations to Governor Mifflin was this item: "The introduction of wholesome running water for domestic purposes, and for washing the streets, and common sewers, is in our judgment, an object of primary importance."[17] In a subsequent memorial to the Legislature, the hospital managers urged that the necessary steps be taken.[18]

The opening of a new session of the Legislature brought to a point of convergence all the different forces operating around the water issue. On December 7, 1798, Governor Mifflin's annual message referred in grave terms to the yellow fever menace and asked for action.[19] Four days later the Legislature received the memorial and petition of the Select and Common Councils of Philadelphia, describing the ravages of the latest epidemic:

> Whether this destructive enemy is introduced among us from foreign places with which we have commercial intercourse, or whether it originates from local causes at home, divides the opinions of our physicians, and the same diversity of sentiment prevails in some degree with other classes of citizens.
>
> In this state of uncertainty, prudence dictates the propriety of guarding, in the best possible manner against both sources, & it seems generally agreed (be the origin foreign or domestic) that the introduction of good and wholesome water for drinking and culinary purposes, and for the occasional flooding of the streets of this city, will be the best means of promoting the health of its inhabitants, and of correcting the state of our atmosphere, so as to render it less recipient of contagion.[20]

The Councils prayed that the Legislature would grant to the city the necessary powers to introduce water into the city and also the revenue from the auction duties. Special committees were appointed in both the Senate and the Assembly to consider the question.[21]

To these committees went also a long memorial from the struggling Delaware and Schuylkill Canal Company.[22] This reviewed the history of the project, attributing the company's difficulties to the increased cost of labor, scarcity of money, and lax laws which permitted faint-hearted stockholders to renege on their subscriptions. Philadelphia's water needs, it was argued, could best be answered by completing the canal. The state should make this possible by purchasing enough shares in the Company to supply the needed capital. Among the resources which might be pledged to raise the necessary funds were the duties on sales at auction, the house built by the state at Philadelphia for the President of the United States which would not be needed when the capital was moved to Washington, and the state's holdings in the Bank of Pennsylvania.[23]

Spokesmen for the Philadelphia City Councils lost little time in expressing their opposition to the Canal Company proposal. In a communication addressed to the Legislature on December 29, the councilmen acknowledged the importance of improving inland navigation, but asserted that Philadelphia's desperate health problem demanded that priority be given to water supply. They renewed their request for the auction duties and asked that the city be given a free hand in choosing sources of supply and modes of conveyance. If after investigation the canal proved to be the best means, the Councils desired to be at liberty to purchase the whole stock of the Company.[24]

Meanwhile the city had for the first time in the controversy discovered a promising alternative to the canal project. Since its appointment in November the Joint Committee on Supplying the City with Water had been looking about for a competent person to make the necessary surveys. Such men were still scarce in America, but, happily for the committee, Benjamin Henry Latrobe, an engineer not only adequately trained but possessed of much rarer qualities of boldness and imagination, had taken up residence in Philadelphia at just this time.

Although only thirty-four years old, Latrobe was already rich in experience. His family background was a curious one. His father was Bishop Benjamin Latrobe of Huguenot descent, pastor of a Moravian parish in England; his mother was Ann Margaret Antes, daughter of a well-known leader among the Pennsylvania Moravians. Young Benjamin had passed some of his early years in England and some in Prussia. He had studied architecture under Samuel Pepys Cockerell, a pioneer in the Greek Revival, and engineering under John Smeaton, a competent

builder of lighthouses, canals, waterwheels, and machines. Latrobe's independent career had had a promising beginning in the building of English country houses and canals, but in the 1790's he had lost his wife and suffered other misfortunes that had resulted in his emigration to Virginia in 1796. Making a fresh start in life, Latrobe had soon graduated from minor commissions to more important ones. In March, 1798, he had made his first visit to Philadelphia, where he had met some of the leading citizens, speculated on the relationship between yellow fever and the public wells, and submitted plans for the proposed new building of the Bank of Pennsylvania. Learning after his return to Richmond that these plans had been accepted, Latrobe had wound up his Virginia affairs and moved to Philadelphia in December to supervise construction.[25] He was obviously just the man to advise the Philadelphia Councils on their water problem.

On December 29, 1798, Latrobe made his recommendations in a long letter to John Miller, the chairman of the Joint Committee. Considering that the young engineer had received his assignment only a week or two earlier and that severe winter weather had made explorations of the countryside difficult, the report, soon published under the title *View of the Practicability and Means of Supplying the City of Philadelphia with Wholesome Water,* was an extraordinary document. Its analysis of the problem necessarily had its basis more in common sense and logic than in actual surveys.

The indispensable requisites, as Latrobe arranged them in order of importance, were: first, the works must be in full operation before the end of July, 1799; second, they must be certain in their effects and permanent in their construction; and finally, they must not be liable to interruption from ice or freshets, but must be equally useful in the severest winter and in the wettest summer. The nearest possible sources were the Delaware and Schuylkill Rivers. "It is evident that the exertions of only seven months, cannot in this country bring water from a greater distance."[26]

Latrobe judged the water of the Delaware to be impure because of the action of the tide, the passage of the river over fetid marshes, and the contamination arising from ships, wharves, and public sewers. But the Schuylkill water was of "uncommon purity"; its bed was everywhere narrow and rocky, its sources lay entirely in the limestone country, and the tide opposite the center of the city did little more than raise the water by accumulation. To elevate water from this river to a level commanding every part of the city, very powerful machinery would be required: "I am very certain, that human ingenuity has not hitherto invented anything capable of producing the proposed effect with constancy, certainty and adequate force, excepting the Steam-engine."[27]

Latrobe proposed to use not one, but two steam engines. The first would pump water from the Schuylkill into a basin near the head of Chestnut Street; thence the water would pass through a tunnel to Centre Square, a site occupying high ground at the junction of Broad and Market Streets, where Philadelphia's City Hall today stands. Here a second engine would pump the water into a reservoir for distribution throughout the settled districts, which still lay well to the east of Centre Square.

In Latrobe's optimistic estimate, water from the Schuylkill could thus be made available by July, 1799, before the next yellow fever season, at a cost of about $75,000 for the pumping works and $52,000 for the initial distributing system. Apparently the engineer had some doubts concerning the suitability of the Schuylkill water for drinking purposes, because he went on to propose that the cool water of Spring Mill should also be conducted into the city. This could be done later by a masonry culvert, some twelve miles long, to be covered by at least three feet of earth—Latrobe had a healthy respect for American frosts that cold December—and carried across valleys on light aqueducts of segment arches. This would cost, he estimated, not more than $275,000.

The report attempted to demonstrate not only that the Schuylkill-Spring Mill plan was feasible, but also that there was no other alternative. Latrobe disposed of the Delaware and Schuylkill Canal project by pointing out that the work could not be done quickly enough and that a water supply from this source would in any case be interrupted by ice during the winter months. When the engineer examined Wissahickon Creek, the source suggested in Franklin's will, he found it almost entirely frozen; moreover, he considered the quantity of water inadequate and the terrain over which it would have to be conducted unfavorable. The idea of pumping by water-wheels instead of steam engines was dismissed on the basis of what Latrobe knew about the operations of such works at London, Versailles, and Bremen.[28] The suggestion that wooden or iron pipes might be used to bring in water by gravity from some more distant source was also rejected. "To bring water, in pipes of any description, a yard further than necessity requires, is very bad economy. . . . The inconvenience attending them in distributing the water must be borne, because it cannot be avoided, but where it can be avoided, it ought not to be borne."[29]

Latrobe's lively imagination foresaw Philadelphia as an American Rome ornamented with fountains and public bath houses. Of fountains he declared:

> They are the only means of cooling the air. The air produced by the agitation of water is the purest kind, and the sudden evaporation of water, scattered through the air, absorbs astonishing quantities of heat, or to use the common phrase creates a great deal of cold.[30]

By building bath houses Philadelphia might gain an advantage over its upstart rival, the new federal capital at Washington.

> We retain indeed both in our buildings, our diet, and our modes of life, the habits of our Northern ancestors, and have not learned how to live healthily in a hot climate. In the city of Philadelphia I think baths almost an absolutely necessary means of health. . . . Such baths would be a source of a large revenue and perhaps it might not be a bad policy in the citizens of this primary metropolis of North America to counterbalance the fashionable inducements which point to the Potowmac, by conveniences and advantages which cannot be thought of in a city, which is at present almost destitute of dwellings.[31]

Latrobe's vigorous document made a strong impression, and on January 3, the Joint Committee reported the proposal to the councils for consideration.[32] The engineer was meanwhile dispatched to New York to investigate the possibilities of obtaining the necessary steam engines from the foundry of Nicholas Roosevelt. This enterprising man, eventually to become Latrobe's son-in-law, had for some years been occupied in northern New Jersey, mining copper, rolling sheet copper, constructing steam engines, and experimenting with steam boats. Roosevelt professed an ability to construct the steam engines that would be required for the Philadelphia project, and Latrobe placed the order conditionally.[33]

Knowledge of what was in the wind naturally brought a sharp reaction from the Canal Company. In an Address to the Committees of the Senate and the House of Representatives the canal spokesman complained bitterly of the present hostile attitude of the city. If the Councils wished to spend $75,000 for works to pump Schuylkill water as a temporary measure, the Company managers had no objection to the city's receiving modest assistance from the state. But they ridiculed Latrobe's contention that the canal could not provide for long-term needs.

> The Legislature, near seven years ago, passed an act for connecting the watering of the city by the medium of the canal, with the other great objects of public improvement, contemplated by that act. An immense sum of money has been expended in carrying on the work. The *completion* of it is in near prospect. Public faith requires the inviolability of the *charter*, and public good, encouragement in the prosecution of its objects; but this *desire* of the Committee of the City Councils *tends* to its *repeal*, or at least, leaving it *orphan'd*, and all its objects, for the benefit of city and country, frustrated or long procrastinated, for want of public aid and patronage.[34]

Latrobe promptly issued a pamphlet replying to the Address of the Canal Company. He defended his examination of the sources as necessarily hurried but adequate for his purposes. He explained the engineering principles on which he based his opinion that a dependable supply could be obtained from the Schuylkill and Spring Mill, whereas the

canal would not deliver enough water during the winter. The latter project, Latrobe argued, could not be completed before the end of 1802.[35]

Latrobe's second pamphlet brought an almost immediate response from the Canal Company. The young engineer was denounced for his "officious interference and ostentation of *professional abilities.*" His report was condemned as "a confused and enormously expensive project of '*aerial Castles,* and elevated *Reservoirs,* of different *stories,* Fountains, Baths, &c.' (held up, on the ground of *professional abilities,* yet *unknown,* and *untried,* so far as the history of any thing in his works in *America* has come to the public knowledge)—and all this he has done in a way that cannot be otherwise considered than as inimical to a great public work, sanctioned by law, carried on at great expence. . . ."[36] Particularly ridiculed were the notions of hydraulics on which Latrobe based his arguments. Although unsigned, there is little doubt that this latest volley from the Canal Company—and probably the earlier ones as well—had come from the pen of Dr. William Smith, a dangerous antagonist in any controversy.[37]

Dr. Smith was now in the last phase of a career that had begun with a boyhood and education in Scotland, had reached its apex in pre-Revolutionary Philadelphia where he had been the city's most prominent Anglican clergyman and first provost of the College of Philadelphia. Now in his seventies, he lived on an estate at the Falls of the Schuylkill and occupied himself largely with land and canal speculations. In his personal journal Latrobe wrote:

> Dr. Smith, so well known for his talents, & his abuse of them, for his famous political sermons at the beginning of the revolution & his Canal exertions since the war, is now an old decrepid Man, worn down by age & hard drinking. He rides a miserable broken winded pot bellied mare, whose figure is as grotesque as that of the Doctor.[38]

This portrait might be discounted on the grounds of Latrobe's natural prejudice, did it not agree with other contemporary descriptions. The reverend doctor's addiction to the bottle was so notorious that it had deprived him of one of his great ambitions—to be elected a bishop of the newly organized Protestant Episcopal Church. Drunk or sober, however, Smith could hold his own in any argument.[39]

Beset by these conflicting pleas, the legislators reacted like good politicians by attempting to satisfy both parties. On January 12, 1799, the Senate water committee reported that "a plentiful supply of wholesome water has become absolutely necessary to the prosperity, and, perhaps to the existence of Philadelphia" and that "a completion of the Delaware and Schuylkill canal will effectually answer this valuable end." The committee recommended that the state raise a loan on the credit of the auction duties and the house intended for the President, and employ the proceeds to purchase one thousand shares of the Canal Company's stock. But the committee also proposed an enlargement of the municipality's powers to levy taxes and to borrow for public improvements, powers that might enable Philadelphia to invest in steam engines, if it so inclined.[40]

The idea of allowing the city to build temporary works along the Schuylkill was acceptable to the promoters of the Canal Company so long as it did not prevent the granting of liberal state aid for their own project. But when in its consideration of the committee report, the Senate postponed the first recommendation relating to a state subscription of the canal stock in order to take up the recommendations for enlarging the powers of the city, the canal managers took alarm. On January 28 they proposed that the Legislature compromise the issue by granting to the city a portion of the auction duties "for the express purpose of a *supply* of water, by such means as they might judge best calculated to answer their *present exigencies,*" and that the rest of the auction duties and the President's house should be used as the security for a loan to enable the state to purchase shares in the Canal Company.[41] The managers of the Company obviously believed that their whole investment would be lost if the city succeeded in divorcing the water issue from the canal project.

During January the Company sought to interest the municipality in a succession of proposals. They would sell one-half the water of the canal to the city for $200,000; they would convey all the stock of the Company to the city for the amount of the stockholders' actual investment plus interest; finally, they offered to convey all their stock at first cost without interest. If the councils would agree to the purchase, the Canal Company would unite with the city in soliciting the Legislature for aid in carrying through the transaction.[42]

But interest in the Latrobe project was increasing, and the proposals of the Canal Company were regarded with suspicion. A letter in *Aurora* on February 2 described the bringing in of water by means of steam engines as the only measure immediately practicable.

> The opposition to this salutary measure is said to originate with the proprietors of the canal, who appear desirous of forcing the State to subscribe for a number of shares in that work, to enable them to draw interest for the money the company has laid out, and rather than lose sight of their own interest in this respect, they appear willing that the City should be ravaged by the Yellow Fever for three or four years to come, by which time, with the assistance of the state they may perhaps be able to supply us with a sufficient quantity of water, on being well paid for it. But they are in general rich men and can flee to their country houses on the first approach of danger.

To this charge the Company made a long defense, reviewing all the negotiations with the city and the latest proposals which had been made to the Legislature.[43] The attempt of the City Councils to gain control of all funds granted for the purpose of water supply was vigorously denounced. This would permit them "either to negotiate on their own terms with proprietors of the Canal, or frustrate the execution of the work, annihilate the remaining stock, as well as destroy the fruits of former expenditures, which might otherwise become beneficial to the whole state."[44]

Convinced that Philadelphia's salvation depended on immediate action, the City Councils determined to push ahead without waiting to see what the outcome of the fight in the Legislature would be. On February 7, 1799, a memorable ordinance was passed:

> Whereas the speedy introduction of a copious supply of wholesome water is deemed essential to the health and preservation of this city, and, from information communicated to the select and common councils, there appears sufficient reason to believe an adequate supply thereof can be introduced within the compass of the present year, if the necessary sum, or capital, for defraying the expenses can be obtained. And though there is reason to hope, a liberal aid will be granted by the legislature, towards enabling the city to complete this important work: Yet the speedy accomplishment thereof appears to require the immediate exertions and resources of the citizens of Philadelphia, for producing the benefits, contemplated thereby, within the course of the approaching summer season.[45]

Commissioners were appointed to receive subscriptions for one-hundred-dollar shares in a loan of $150,000. The bondholders, who were to pay their subscriptions in installments over the course of six months, would receive interest at the rate of six per cent and be entitled to a free supply of water for three years. On February 11 a notice in the newspapers, signed by the presidents of the two Councils, appealed for the support of the citizens:

> Until the Legislature shall, in its wisdom and humanity, extend some effectual relief to its capital, your Councils believe the most eligible, if not the only practicable mode of procuring the necessary sum will be by loan. . . . It rests with you to say whether this work shall or shall not, be undertaken. If encouragement be given, by a prompt and liberal subscription, it will be commenced.[46]

Despite bad winter weather that prevented the loan commissioners from calling upon the citizens as generally as intended, the campaign appeared to make satisfactory progress. By the end of the month over six hundred shares had been subscribed, and the Councils were emboldened to take further action.[47] On March 2 Latrobe presented another report, more explicit in describing the proposed works on the Schuylkill and at Centre Square. Nothing further was said about the

Spring Mill aqueduct; the Joint Committee had decided that this project would cost too much and take too long to complete. Aware that many Americans were still doubtful of the practicability of steam engines, Latrobe took particular care to combat this prejudice:

> The many attempts which have been made in this country to adapt steam engines to the navigation of boats against the stream, and which have miscarried, have occasioned a prejudice against them, which does not exist in Europe, where also every attempt to apply them to the same purpose has failed, but where, in every other respect, they have completely succeeded.[48]

Soon after they were invented, Latrobe observed, steam engines were justly considered as dangerous; man had not learned to control the immense power of steam, and now and then they did a little mischief, but he concluded: "A steam engine is, at present, as tame and innocent as a clock."[49]

On this same March 2, the Councils made their final decision that the city should proceed with the great experiment. By concurrent resolution a joint committee of the two branches of the Council together with the Mayor was authorized to make contracts, to appoint and employ agents of execution, to purchase materials, and to order payments from the water fund.[50]

This brave decision to plunge ahead by no means meant that the city had abandoned hope of receiving aid from the Legislature. On February 13, a bill for granting the auction duties to the city was introduced in the Senate.[51] But the Canal Company vigorously opposed the measure, contending that to grant public money to the city for the purpose of building permanent water works would be a violation of the company's corporate rights and would result in the loss of large sums of money already expended, in hampering the inland navigation of the state, and in giving to neighboring states the principal part of Pennsylvania's inland commerce.[52] The Senate granted the Company the hearing that it requested, and for three days, beginning March 5, the legislators listened to the arguments of lawyers representing the Company and the city respectively.[53] When the bill to aid the city came to a vote on March 15, it was defeated eight to fourteen.[54] But the victory for private enterprise was a hollow one, for on April 6 the Senate also rejected a bill to grant aid from the auction duties to the Canal Company, this time by a vote of eight to twelve.[55]

The Joint Committee, charged with responsibility for carrying out the water-works project, encountered many perplexing problems. The most active committee members appear to have been Henry Drinker, Jr., cashier of the Bank of North America, and Thomas Cope, young Quaker merchant. An elaborate contract between the city and Latrobe,

the chief engineer, stipulated that the works were to be in operation on or before October 2, 1799, and entirely completed by July 1, 1800, provided the necessary funds did not fail, the sub-contractors completed their work on time, and there were no floods nor excessive rains. For his services Latrobe was to receive $6,350 and an allowance for reasonable expenses.[56]

More complicated were the arrangements between the city and Nicholas Roosevelt, which required negotiations as delicate as those between two foreign powers. On May 23 a first contract between the parties provided that on or before September 1, 1799, Roosevelt should deliver and erect within engine houses to be built by the city "two perfect double steam engines," each of which should be of power sufficient to raise to a height of fifty feet, three million gallons of water every day. For the term of five years Roosevelt was to attend and keep in repair the engines. The city was to pay him $30,000 in installments ending fourteen days after the engines should have been erected. Thereafter Roosevelt was to receive $3,000 per annum for each engine for raising one million gallons a day and larger sums, if more water were required, up to a maximum of $6,000 for each engine for raising three million gallons. On December 24, 1799, a second agreement was concluded between the city and the foundryman, stipulating that Roosevelt was to have a lease for forty-two years of certain lots along the Schuylkill together with the free use and occupancy of the Schuylkill engine house and the right to apply for his own benefit all power from the engine not required for pumping water. For these rights he was to pay the city $500 a year for the first seven years and larger amounts thereafter to be deducted out of the amounts which would periodically come due to Roosevelt for maintenance of the engines.[57]

The simple explanation behind these bewildering arrangements is that the city had ordered steam engines intended to be considerably larger than those required to supply the immediate needs of the city. A surplus of power would thus be available to meet the requirements of years to come. Roosevelt was meanwhile to have the right of using this surplus power in a mill for rolling iron and copper sheets. It seemed a happy marriage of the interests of the city and those of an ambitious young entrepreneur, but a better recipe for concocting future trouble could hardly have been devised.

Construction of the water works began on March 12, 1799, with the breaking of ground in Chestnut Street for the tunnel which would connect the two engine houses. Bad weather retarded operations for a month, but thereafter the project was carried forward with a considerable show of energy, although any hope that water would be flowing

through the streets that summer must soon have been abandoned. Much of the excavation had to be done through stone; logs for the pipes were difficult to accumulate; Roosevelt was unable to deliver the steam engines at the agreed time.[58]

The most perplexing difficulties, however, were financial. Total subscriptions to the water loan achieved less than half the goal of $150,000. As an investment, the city's six per cent bonds were less attractive to the monied classes than the eight per cent bonds of the United States government, which by unfortunate coincidence went on the market at just this time. Also damaging to the loan was the hostility of the Delaware and Schuylkill Canal Company, which scared investors by contending that the city's water project infringed its charter rights. Quite apart from all this, Latrobe's ideas appeared visionary to many practical citizens, the more so because of the large sums of money which had been lost recently in canal ventures and other speculations. In order to continue construction individual members of the Joint Committee were soon compelled to make advances to the city out of their own resources.[59]

In July, 1799, the financial difficulties of the Joint Committee reached a crisis. Its resources were exhausted, and the next installment from the subscribers to the water loan was not due until September. In an attempt to obtain further money, a new solicitation for subscriptions was made. A report by Latrobe on the progress of the works was published in the hope of reviving interest in the project.[60] But the campaign failed, and on July 29 the municipal authorities had to make a hard decision: whether to abandon the execution of the plan, or to levy an immediate tax to raise the sum needed to carry on until the end of the year.

Against abandonment, weighty arguments were framed: "the dispersion, and, perhaps, irretrievable loss of able and well approved subordinate agents of execution"; the difficulty, and perhaps, impracticability of recommencing the work at some later date, in which case all the expense already incurred would be a dead loss to the city; finally, "the disgraceful impair of the city's credit" which would be incurred, "by neglecting to provide means for the faithful fulfilment of existing engagements." Against laying a tax, it was argued that the city was already overburdened with taxation, that those who had subscribed to the water loan would protest against being taxed for the same purpose, and that the tax could not be collected in time to save the project.[61]

Once again the city officials decided to damn the torpedoes and run full speed ahead. On August 5 the Councils passed an ordinance levying a special tax of $50,000 on estates, real and personal, and authorizing the Mayor to anticipate by loans any part or all of the revenue.[62] On the basis of this, the Bank of the United States loaned $10,000 on a note of

five members of the city corporation on August 9, and $10,000 more on the note of five other city dignitaries on August 27.[63]

But the financial crisis was far from over. A new epidemic of yellow fever gripped the community during the late summer and fall. So many citizens fled the city that collection of the special tax was postponed, and even the September installment from the subscribers to the loan went unpaid for the most part. Although construction of the water works slowed down to snail's pace, it did not entirely stop.[64] Latrobe moved out of the city to stay with friends in the country, but he ventured back each day to supervise the work.[65] When other funds were not forthcoming, he made advances from his own resources—the income from a modest estate inherited from his father.[66]

Those responsible for the water works project had to carry on their activities in the face of much criticism and ridicule. The writer of a letter to the *Philadelphia Gazette* on March 14, 1799, scolded:

> Surely no man unprejudiced, or who had not an expectation of a job, would ever think of taking water from a river whose bottom is muddy, and constantly stirred up by the ebbing and flowing of the tide, when clear and pure water can be procured at so short a distance as the Falls or Wissahickon Creek, unless it can be proved that the water is more *wholesome* by the plentiful supply of mud with which it abounds below the Falls. . . . Of what use will be all this immense burthen on the city, already much impoverished, of erecting and feeding a devouring fire engine?

Naturally, the Councils' decision to levy a special tax intensified the opposition. Commenting on an improvement in the plans which Latrobe suggested in December, 1799, Henry Drinker, Jr., wrote to Thomas Cope: "Any Increase of Expence must however be matters of serious concern to the Committee, considering the difficulty of raising the Means to meet the Charges of their Undertaking and the Clamor and Discontent excited against the Corporation for burthening the City with Taxes."[57] On July 31, 1800, a letter to the *Philadelphia Gazette* referred to the water works as "a ridiculous project" and declared:

> I hope the good people of my native city will no longer be duped by such chimeras, but that they will turn out of Councils those men who have actively, or, by suffering themselves to be duped by others, passively contributed to saddle the city with an unheard of expense to accomplish that which when finished, will be a public nuisance, and the probable cause of general calamity to our city, to wit: *a reliance upon steam-engines in the proper supply of water*. They are machines of all machinery to be least relied on, subject to casualties and accidents of every kind.

The job which the young engineer had hopefully estimated to complete in seven months at a cost of $127,000 required twenty months and expenditures of over $220,000, including a bill of $898.44 for liquor for the workmen. The raising of these funds continued to tax the ingenuity

of the authorities. The water loan of 1799 realized but $72,000, and the special tax of the same year only $49,000 more. To find the balance of the necessary money the city sold a public bridge and ferry to a private bridge company, appropriated the income of certain municipal properties, and resorted to other devices. In 1801, new subscriptions to the water loan were authorized, and some $27,000 worth of bonds were sold.[68]

But the project rode out every storm, and on January 27, 1801, the Mayor and members of the Councils attended the formal opening of the works at Centre Square. Skeptics were confounded as the thumping engines pushed the water of the Schuylkill into the reservoir, from which it ran through wooden pipes and came gushing out of the hydrants in the streets. The water was at first turbid from the filth that had collected in the pipes during construction, but it soon cleared. "This is a joyful circumstance to the citizens at large," pronounced *Poulson's American Daily Advertiser,* "and must be particularly gratifying to those gentlemen of the Corporation who have, through varied and multiplied difficulties, persevered to the completion of an object of the first magnitude, both as it respects the health and convenience of the city."[69]

As finally constructed, the pioneer Philadelphia waterworks had its source in a marble-paved basin, eight-four feet wide and two hundred feet long, extending eastward from the Schuylkill River at the foot of Chestnut Street. This was provided with a set of tide-lock gates, so that the turbid waters of high tide could be excluded and the clearer water of ebb tide admitted. From this primary basin the water passed through sluice gates into a second and somewhat smaller basin and then into an oval-shaped tunnel, three hundred feet long, cut through solid rock nearly the whole distance. From this, the water emptied into a well ten feet in diameter and thirty-nine feet deep.

Above this well stood the so-called Lower Engine House, which raised the water into a brick tunnel six feet in diameter and 3,144 feet in length, extending down Chestnut Street to Broad Street and thence to the Centre Square, or Upper, Engine House. Here the water was pumped fifty feet from the bed of the tunnel, into two wooden tanks with a total capacity of over twenty thousand gallons. From these reservoirs the water descended into an iron chest on the outside of the building, to which the wooden mains were connected that supplied the city. Two 6-inch mains ran down Market Street; one 4½-inch ran down Arch Street and one 4½-inch down Chestnut Street; from these the water was distributed in the cross streets through 4-inch and 3-inch logs.[70]

The Centre Square Engine House was a handsome marble building, designed by Latrobe. The lower story was sixty feet square and twenty-

five feet high; above this rose a circular tower forty feet in diameter, capped by a flat dome and circular chimney sixty feet above the ground.[71] With its dome and porticoes the structure suggested the classical monuments of Rome; yet it was well adapted to its utilitarian functions: the housing of the offices of the engineer and the Watering Committee, together with the steam engine, pump, and reservoir tanks of the water works themselves. In the attractive grounds laid out about the building a fountain was eventually constructed, for which William Rush, Philadelphia's pioneer sculptor, executed one of his most famous works in wood, a nymph rather inadequately draped for the taste of the more prudish citizens.[72]

Artistically Centre Square was a success. It was one of the places to which visitors to the city were invariably taken. Yet, financially the water works continued to be a heavy burden to the city. In December, 1801, there were only seventy customers for the Schuylkill water; of these, thirty-six were subscribers to the water loan, entitled to receive the water free for three years; the other thirty-four had contracted to pay an aggregate of $278 in water rent, only $65.15 of which had actually been collected.[73] A year later the number of water-takers amounted to only 154, exactly half of whom were paying customers. The annual revenue of the works was only $537.[74]

Since Latrobe had estimated the probable number of water-takers at four thousand and the annual revenue at $40,000, the citizens had reason to be disappointed. Indeed there was serious danger that the whole project would be abandoned. In January, 1802, a request by the Watering Committee for authority to purchase three hundred thousand additional feet of logs to be bored for conduit pipes was defeated by a close vote in the Common Council. A strong faction in the city government appeared ready to write off the whole experiment as a failure. But public opinion rallied to overcome the defeatists. Although a proposed water tax was voted down, the city officials were finally given authority to negotiate a further loan of $250,000.[75]

The continuing financial difficulties of the water works stemmed from a variety of causes. As the episode of 1802 illustrated, the project was far from complete at the time of the formal opening of the works. The expensive and exasperating task of laying wooden conduits through all the various streets and alleys of the city required years of effort, and until the distribution system was well advanced water rents would inevitably be small. This part of the work was handicapped by scarcity of money, difficulties in obtaining logs, frequent leaks and failures in the pipes already laid down, and the return of yellow fever to the city in 1802, 1803, and 1805.

Even in the streets where Schuylkill water was available the number of paying customers remained small. The city continued to offer water free for three years to those who subscribed to the recurrent water loans. Other citizens displayed a reluctance to pay water rent. One Philadelphian, writing to another just before the Centre Square works were opened, had commented, "I presume it will be some time before the citizens will be reconciled to buy their Water,"[76] and so it proved to be. The habit of filling buckets at the familiar pumps was not easily broken. Contributing to this stubborn preference for the old sources was the fact that Schuylkill water seemed tepid and unappetizing to tastes accustomed to the cool—if impure—water of the wells.[77] Moreover, those who were afraid of the pumps could easily obtain the new water without paying for it. Partly out of the humanitarian conviction that water should be free to the poor, partly to enlist public support for the Latrobe plan, the City Councils had stipulated by ordinance on February 7, 1799, that the water at the conduits emptying into the streets should be for "the free use of all persons."[78] In short, anyone wanting a pailfull of Schuylkill water need go no farther than the nearest hydrant.

At first, relatively few Philadelphians regarded the convenience of having water available in their own kitchens or cellars as worth the expense of making the necessary connections and paying the flat rate of five dollars a year established by the city. But this inertia was gradually overcome. On December 24, 1804, an application was filed on behalf of Charles Willson Peale for the introduction of water into his famous museum. On August 7, 1805, Matthew Carey asked permission to introduce the water into his well-known printing office. In 1808 the proprietors of Warren & Robbins New Theatre introduced this modern improvement.[79] By 1811, ten years after the opening of the works, the number of water takers had risen to 2,127. Of these 1,947 were private dwellings, schools, bottling establishments, and similar institutions, paying the minimum rate of $5 a year; thirty-three were dwellings north of Vine and south of Cedar Streets that were charged $7.50 a year; the rest were various taverns, industrial establishments, and public institutions paying special rates that ranged from $8 for small distilleries to $34 for large breweries. There were now two bath houses in the city, one paying $30 and the other $50 annually for water. The Pennsylvania Hospital was charged $50 a year; the almshouse, $100.[80]

Although the total revenues in 1811 had climbed to $12,163, the water works were still being operated at a heavy loss. Expenditures for the same year amounted to $29,702.[81] In part, these heavy annual expenses were unavoidable. Philadelphia was growing rapidly—it doubled in population between 1790 and 1810—and the distributing system had

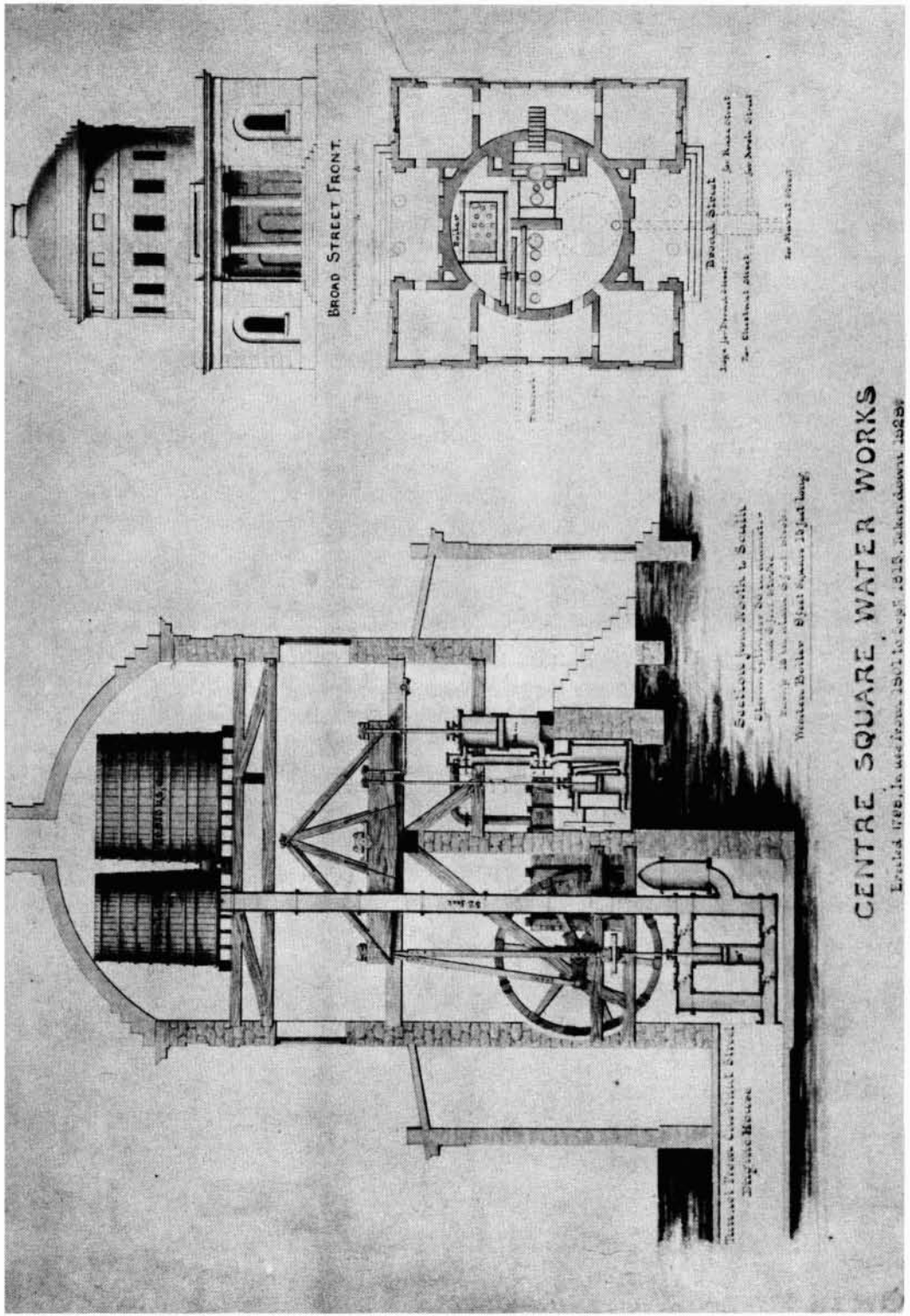
to be extended every year. Moreover, the fact that the water was conducted through mile after mile of bored logs involved the city in heavy repair bills from the beginning. The wooden pipes easily developed leaks—especially at the joints where one log was tapered and driven into another and held in place by an iron band. As early as 1802, the Watering Committee sought information on ways and means of combatting these frequent failures. The engineers made numerous recommendations—the use of yellow pine instead of white oak, better bands, keeping the logs under water until they were used, and filling them with water as soon as they were laid—but troubles continued. The Committee purchased fourteen sections of iron pipe in 1801, and experiments in developing better means of joining such pipe were conducted at Centre Square. The advantages of metal were recognized but the Committee believed that it would be impossible to purchase sufficient quantities of iron pipe in time to meet the city's needs.[82] In 1804, however, the authorities ordered the use of three-inch cast iron pipe in Water Street, where the water pressure was too great for the bored logs.[83] Another suggestion of the day was for the use of earthen conduit pipes, but the Watering Committee decided against the experiment.[84]

The steam engines were also a great source of expense. Although they were double-acting engines with separate condensers of the type made famous by the English firm of Boulton and Watt, they were inefficient by later standards and consumed coal voraciously. Moreover, they were made largely of wood, the lever beams, arms and shafts of the fly wheels, bearings, and even the steam boilers, all being of this material.[85] Consequently, breakdowns of the machinery and hasty repair jobs were frequent. A pathetic surviving letter is that written in 1807 by Frederick Graff, chief engineer at the water works, to his bride of less than three weeks:

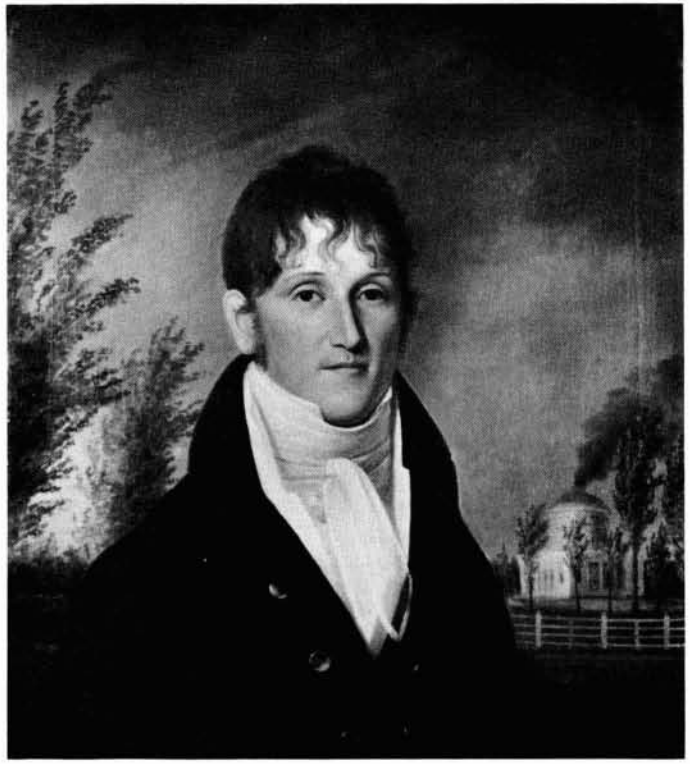
> After a pleasant ride this morning I arrived safe home, where I had not been long before I received marching orders to attend my old plague the Engine. This old torment together with that of not having it in my power of visiting you again before tomorrow evening perplexes my old head confoundedly. . . .[86]

Poor Graff had been separated from his wife by trouble at the engine house another night only nine days before.[87]

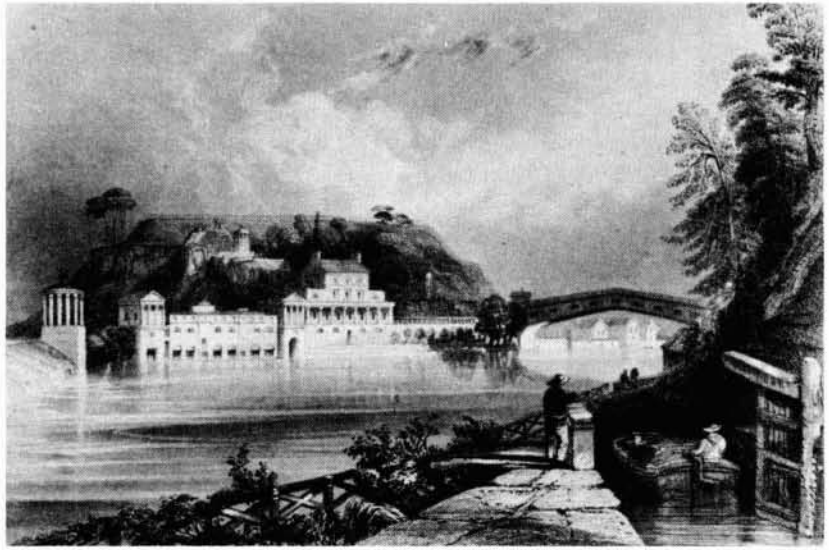
One or the other of the engines was always requiring a heavy outlay of money. Iron boilers were presently substituted for the troublesome wooden ones, but they too sprang leaks and needed expensive repairs. The wooden reservoirs at Centre Square required replacement as early as 1806.[88] In all these difficulties an unfortunate aspect of Latrobe's original plan became more and more evident. The system depended on



Centre Square Water Works, Philadelphia. Sectional drawings by Frederick Graff, Jr. (*The Historical Society of Pennsylvania*)



Frederic Graff, 1774-1847. Portrait by James Peale, 1804. The Centre Square Water Works are depicted in the background. (*The Historical Society of Pennsylvania*)



Fairmount Water Works, Philadelphia. Engraved by J. C. Armytage after a drawing by W. H. Bartlett. (*Philadelphia Free Library*)

two pumps working in series. A breakdown of either of them deprived the city of water almost immediately. Frequent interruptions of service did not add to the popularity of the water works. Over the city, moreover, hung the threat that the water supply might fail just when it was needed most to fight some serious fire.

Both with Latrobe who had designed the system and with Roosevelt who had built the engines, the city's relations were unhappy. Not until 1805 did the city finally settle its accounts with Latrobe.[89] Even in gratitude the City Councils were niggardly. In 1801 a motion to thank the engineer for his services was defeated by one vote.[90]

Meanwhile, Latrobe and Roosevelt had become involved in a morass of financial difficulties. The two had joined with other partners in building a rolling mill to exploit the surplus power of the Lower Engine House.[91] From the promotional point of view, the arrangement appeared to be an advantageous one. Latrobe had important friends, among them President Thomas Jefferson, and his services as architect were being increasingly employed in building the new public buildings at Washington. Orders came to the Philadelphia concern to provide sheet iron for roofs for Jefferson's home at Monticello, for the White House, and for other famous buildings.[92] But the distinguished character of the rolling mill's clientele did not assure financial success. First one, then another of the partners became bankrupt, thereby saddling Latrobe with crushing debts. The unfortunate engineer, who had already lost heavily through the thefts and forgeries of an absconding clerk, had to sell his patrimony at a loss in order to keep his own credit.[93] Roosevelt's financial difficulties were even more serious.

The struggling partners avowed that the rolling mill could yet be saved, if only the city of Philadelphia would pay Roosevelt $6,000 per year for operating and maintaining the two steam engines, as stipulated in the contracts of 1799. But this the city authorities refused to do. They claimed in the first place that the steam engines were not up to specifications: they were incapable of pumping three million gallons of water in twenty-four hours. Moreover, Roosevelt had not actually maintained the Centre Square engine since the early days of the water works. This had been operated by the city, and consequently the Watering Committee asserted that Roosevelt owed the city substantial sums for the fuel and repairs that had been required. To complicate the matter still further the manufacturer complained that he lost $47,000 on the original construction of the engines: they had cost him $77,000 and the city had paid only the contract price of $30,000.[94]

The dispute became highly acrimonious. In 1804 Latrobe advised Roosevelt that a threat should be made to cut off the water unless the

city made its annual payments.[95] Affairs reached a crisis the next year. In August, the city offered Roosevelt $10,000 for all his claims, his rights to the surplus power of the Lower Engine House, and his forty-two year lease of the Schuylkill lots. Roosevelt held out for more and warned that the water might be cut off. But such threats succeeded only in steeling the resolution of the city authorities.

Great public indignation was aroused by the failure of the water supply during a serious fire in September. When the emergency arose, according to a report of the affair in *Aurora,* messengers were at once dispatched to the Lower Engine House with pleas to start the pumps, but the workmen were so little prepared to do so that they even had to send a wagon out for fuel. Intimating that Roosevelt had chosen this unfortunate occasion to carry out his threat to stop the water and that he had even talked of using gunpowder to blow up the engine house, the newspaper warned:

> Occasions of great public danger require promptness and energy. What measures ought to be pursued in this case we will not presume to suggest—but certainly some steps should be taken, to protect the public from purposes so diabolical, as he has menaced—and which must be deprecated in whatever view they are considered, whether with a view to an exaction of enormous and unreasonable terms from the corporation, or any other.[96]

The news from Philadelphia shocked Latrobe profoundly: a threat to cut off the water was one thing; to actually do so was something else entirely.[97]

On September 26, 1805, the city brought the issue to a showdown by obtaining a writ of attachment against Roosevelt. Armed with this, the sheriff of the county formally took possession of the Lower Engine House and turned it over to the custody of the Watering Committee.[98] Acknowledging defeat, Roosevelt accepted the city's final terms—a payment of $15,886 for all his rights and claims. Even before this denouement, Latrobe had expressed his bitterness: "But with that profligate selfishness—the character & the disgrace of all our public bodies, the corporation take advantage of the distress of the concern to make a bargain."[99] Bargains, however, were sorely needed by the Watering Committee, which had more than enough financial troubles of its own. Moreover, the city was immediately put to considerable expense in making overdue repairs on the newly-acquired machinery.[100]

Reviewing these early years from the vantage point of 1875, a historian of the Philadelphia Water Department wrote:

> The cost of the Schuylkill and Centre Square Works, with yearly expenses added, from March 1799, to September 1, 1815 . . . was $657,398.91, the whole gross receipts amounting to but $105,351.18, leaving a deficiency of $552,047.73, without interest.

> Yet it cannot be said this sum has been lost to the City, as many indirect advantages have arisen from it, character and impetus was given to the City, much was done to improve the sanitary condition, an important feature which added to its many attractions as a place of residence. Nor was the early experience thus acquired by her mechanics a small matter, for perhaps to their pumping engines and the practical knowledge derived from them, may be attributed much of the pre-eminence which this city has always enjoyed in the construction of machinery. . . .[101]

The importance of the Philadelphia experiment from the point of view here suggested could be stressed still further. In days when no formal training in engineering was available in America such projects served a vital educational function. Latrobe took on as his chief clerk young John Davis who had come to America from England some six years earlier. Davis watched every stage of the construction of the works and was thus well prepared to take over as chief engineer when Latrobe gave up the post to devote his energies to other commissions. In 1805 Davis resigned at Philadelphia to take charge of the construction of a water works system at Baltimore. Subsequently he was employed on important canals and other engineering projects.[102]

When Benjamin Latrobe first heard of Frederick Graff, the latter was a shy young mechanic of 18 who had recently been lamed by an accident. Latrobe gave the unfortunate youth a job as draftsman on the water works project "without expecting much from him." But by 1804, the famous architect could write: "I have however now the pleasure of considering him as the first of my élèves,—and as my friend. . . ."[103] Graff had been given increasingly important responsibilities, first, in connection with excavating the Schuylkill basin and tunnel, then, in the construction of Latrobe-designed buildings at Philadelphia and Norfolk. In 1804, the young engineer was given his first independent commission on a canal in South Carolina. The next year Davis selected him as his successor as superintendent of the Philadelphia Water Works.[104] Graff remained at this post from 1805 until his death in 1847, a period of forty-two years. During this time he became the best known authority on water works in the country, frequently consulted on the problems of other cities.

Painful trial and error at Philadelphia taught much about the administration of water supply systems. By ordinance of April 1, 1809, the mayor and members of the Joint Watering Committee of the City Councils were formally vested with the powers necessary for conducting the water works, purchasing materials, distributing the water, and the like.[105] The assumption of administrative duties by council committees violated the American principle of separation of powers and was the source of some confusion, since the councils were elected annually with

consequent changes in personnel and policy. But at Philadelphia the system worked better than might have been expected because of the high quality of citizens who served on the Watering Committee. Henry Drinker, Jr., and Thomas Cope have already been mentioned; equally influential in the early years was Samuel M. Fox, president of the Bank of Pennsylvania. Later the city benefited from the services of William Rush, the sculptor, of Joseph S. Lewis, prominent attorney and business man, and of John Price Wetherill, member of a leading firm of paint manufacturers.

Early mistakes in water policy were inevitable and were gradually corrected. The rates, especially for manufacturing establishments which consumed much larger quantities of water than had been estimated, had been set too low and had to be raised in 1806.[106] The system of collecting water rents was at first so inefficient that almost four thousand dollars of arrears had accrued by 1807.[107] In 1809 a city ordinance required payment in advance and provided that the supply of water should be discontinued in cases of delinquency.[108]

Free water continued to be supplied in the streets, but the method of dispensing it was improved. It was entirely too easy to set the water running from the original hydrants. An English traveler recorded: "I have seen boys, who run all day uncontrolled about the streets, playing with them for hours together opposite to the window of my lodgings; passengers would sometimes attempt to *persuade* them to discontinue their abuse of the water, but not until some other plan of mischief was agreed upon, would they desist a moment."[109] In addition to the waste involved, the resulting pools of water froze during the wintertime, threatening the limbs of pedestrians, and the hydrants themselves were frequently frozen up or in need of repairs.

In 1803, the Watering Committee began to replace each hydrant with a small pump so placed as to receive the water from a cistern sunk in the ground below the action of the frost; the cistern in turn received its supply through a pipe and ball cock from the log in the street. If Philadelphians wanted free water in the future, they would at least have to pump it. At the same time, cast iron fire plugs were installed to supply water for the fire engines and for washing the streets.[110]

From the beginning, the Philadelphia authorities struggled with the perennial problem of all urban water supply systems—that of willful waste. In 1806, allowing the water to flow unnecessarily was made a misdemeanor punishable by a five-dollar fine.[111] In a notice explaining the necessity for strict enforcement of this ordinance, the Watering Committee estimated that the total annual amount of water raised by the steam engines was 250,000,000 gallons. Since the annual expense was

about $20,000, the water cost eight cents per thousand gallons. If the water from one house ran only half an hour a day every day this would amount to 94,500 gallons a year. Since this would cost the city $7.56 and the annual water rent was only $5, the loss to the city would be $2.56. Losses from fire plugs left running unnecessarily would of course be much greater, amounting to as much as 15,000 gallons in an hour.[112]

Despite all perplexities, Philadelphia had taken a great step forward. The provision of an adequate water supply for the inhabitants had been recognized as one of the responsibilities of an adequate city government. Perhaps an outsider could see the significance of the Philadelphia venture more clearly than could the citizens of the city themselves. The English traveler, James Melish, wrote:

> It is of great importance to these works, that they are the property of the public, and not subject to individual speculation, in consequence of which the supply is liberal, and there are fountains in every street to which the whole public have access. The water can be used for watering the streets, or extinguishing fires, as often as may be necessary; while every householder, by paying a reasonable compensation can have a hydrant in any part of his premises that he pleases, even to the attic story. In short, this water is a great luxury, and is, in my opinion, of incalculable advantage to the health, as it certainly is to the convenience and comfort of the community.[113]

CHAPTER THREE

The Strange Birth of the Manhattan Company

> Our purpose can only be effected by making it the pecuniary interest of the rich to contribute to the general happiness. . . . To gain an excellent purpose we must profit by the avarice and selfishness of mankind. . . . We are reduced in this, as in most other cases, to a choice of evils—and tho the evils of a joint stock company are great, those of pestilence and war are greater.
>
> *The Spectator*, May 4, 1799

> . . . I challenge any man to produce an act of incorporation, that ever passed in any civilized country, which conferred power so entirely without definition, limitations, or control.
>
> *New York Commercial Advertiser*, May 1, 1799

The need of the city of New York for a public water system had been recognized before the Revolutionary War. Only the misfortunes of that long struggle had prevented Christopher Colles from completing the works which were well advanced in 1776. Soon after the restoration of peace the Common Council began to receive proposals for building a new system. In April, 1785, a committee was appointed to confer with Samuel Ogden on a plan which he had formulated for erecting water works.[1] In January, 1786, Chancellor Robert R. Livingston, ever eager to promote steam engine projects, endeavored to secure a contract to supply the city with water.[2]

Stirred to action by these overtures, the City Council in February, 1786, ordered the printing of advertisements, inviting the submission of sealed proposals for supplying the city with water.[3] Three such bids were received, but the Council decided to postpone action. The idea of entrusting the management of the water works to private enterprise had encountered strong opposition. At a council meeting on April 19, the aldermen and assistants reported that they had conferred with many of the citizens in their respective wards, and it appeared to be the sense of a majority of these that the city ought not to grant the privilege of supplying water to individuals, but that this service ought to be undertaken by the municipality itself.[4]

Although reluctant to grant the water franchise to private contractors, the city officials could not bring themselves to the point of deciding on other measures. As usual in the history of American cities, the taxpayers were groaning under their burdens, and politicians had to calculate the risks of creating a large municipal debt. In February, 1788, the issue was raised again, when a large number of inhabitants signed a petition to the City Council, complaining of the inconveniences which arose from the lack of an adequate water supply and praying for the adoption of measures for supplying the city by means of pipes.[5] The petition was referred to a special committee, which allowed the matter to die.

A year later momentary interest was aroused by a letter from the Rumsian Society of Philadelphia, announcing that the well-known inventor, James Rumsey, had developed an engine "far superior to any other for supplying Towns with Water" and suggesting that the city of New York take advantage of this new contribution to science. On January 30, 1789, the City Council resolved that Rumsey's invention ought to meet with every due encouragement, but that the state of the municipal finances forbade the making of an immediate contract.[6]

For a decade more the City Council continued to receive memorials regarding the water supply, to appoint committees, and to consider courses of action, but it arrived at no decision. In 1794, a proposal was received from Zebina Curtis and others; in 1795, there were two separate propositions presented by Amos Porter and Benjamin Taylor respectively.[7] In 1796, the Council authorized a special committee to solicit further proposals. This resulted in the formulation of two or three plans—including one from Dr. Joseph Browne, destined to be a key figure in New York water politics—but still no action.[8] Still more proposals were forthcoming in May, 1797, when the City Council opened the sealed proposals that had been submitted in response to an advertisement. Among those now hopeful of receiving a contract were Christopher Colles, the builder of the abortive project of 1774, and Nicholas Roosevelt, soon to be involved in Philadelphia water projects.[9]

In 1798, the citizens began to exhibit some impatience with the dilatoriness of their representatives. On March 2, the *New York Gazette* published the letter of "A Subscriber," complaining:

> I have, for a long time past, heard our Corporation have received several proposals, and plans, for supplying our city with Water through the streets, by works, etc. But as I have heard nothing of late about it, I conclude they have given it up. I pay for Tea Water Only about Six Pounds Per Annum; which, I think a great tax for one small family: for I am of opinion, that if such works were erected (which there is no difficulty in doing) and each house was taxed, from two to six pounds per year, calculating 4,000 houses in the city, it would produce forty thousand dollars per annum, which, in

my opinion, would, in a very few years, pay for All the possible expences such an undertaking would amount to, as well as do that body of City Guardians much honor—and preserve the city from the great danger of fire. . . .[10]

About the beginning of August yellow fever attacked the city in a terrible epidemic that took over two thousand lives. Dr. S. L. Mitchill wrote to Noah Webster: "New York this time has got a plague indeed. The Scourge is applied severely and cuts deep. . . . It seems to be admitted on all sides to be a home-bred Pestilence. The Inhabitants have really poisoned their City by the accumulation of Excrement, putrid Provisions, and every unclean thing.[11] As in Philadelphia, the water supply problem, toyed with so long, now seemed to be of desperate urgency. In the *Commercial Advertiser* of September 5, a correspondent ridiculed the complacency of those who pretended that the city's water was pure:

> The Collect behind the Tea-water Pump is a shocking hole, where all impure things center together and engender the worst of unwholesome productions; foul with excrement, frogspawn, and reptiles, that delicate pump is supplied. The water has grown worse manifestly within a few years. It is time to look out some other supply, and discontinue the use of a water growing less and less wholesome every day. . . . Can you bear to drink it on Sundays in the Summer time? It is so bad before Monday morning as to be very sickly and nauseating; and the larger the city grows the worse this evil will be. . . . Take the matter into consideration, and resolve every man for himself, to leave no stone unturned to have this grand object of watering carried thro. . . . For plague will make a yearly slaughter until you furnish better water.[12]

News that the rival cities of Boston, Philadelphia, and Baltimore were all either building water works or proposing to do so, aroused the *New York Daily Advertiser* to warn: "Citizens of New York, what are you doing? . . . If you procrastinate, you are ruined; while you are immersed in business or sunk in pleasure, careless of the future, other towns, your rivals in trade, have vigorously begun the most effectual measures of precaution."[13]

Meanwhile, discussion of the problem had come to focus largely on the proposals of Dr. Joseph Browne. On July 2, 1798, this versatile physician, scientist, and engineer had presented to the City Council a lengthy document entitled *Memoir of the Utility and Means of Furnishing the City with Water from the River Bronx*. In it Dr. Browne had stated his ingenious theories on the cause of yellow fever and the need for a copious water supply. "It may be laid down as a general rule," he declared, "that the health of a city depends more on its water than all the rest of the eatables and drinkables together."[14]

The Collect was hopelessly contaminated; all other water sources on Manhattan Island would soon be equally bad. The only satisfactory solution was to obtain a supply from some pure running stream to the north. Dr. Browne urged that a dam should be built across the Bronx River to divert a part of its water through a canal into the Harlem River at Morrisania. Another dam would be built across the Harlem below this point; from this source of supply a water wheel and pumps would raise the water into a reservoir on high land in the northern part of Manhattan Island. At a cost of $200,000 according to the *Memoir*, the city could be supplied with 362,000 gallons a day.

To carry out his plan Dr. Browne suggested that the Legislature charter an "Aqueduct Company of the City of New York." The Company should receive two dollars a year from every house on streets where water pipes were laid for the advantage of fire protection and having the streets washed; if householders wanted to introduce the water into their homes, an additional payment of eight dollars a year should be charged. Revenue from these sources would provide the stockholders in the Company with profits of about thirteen per cent a year on their investment.[15]

Stirred to action after the yellow fever abated, the City Council made an important decision on December 24, 1798. Adopting the report of a special committee, the Council declared its opinion that the Bronx River would afford the best source of supply and that Dr. Browne's plan for conveying the water was "with some few variations, the most eligible that can be adopted." Since mistakes might be attended with "incalculable Mischief," however, the Council ordered that careful surveys of the Bronx and other possible sources should be made by William Weston, well-known English engineer then employed on canal projects in Pennsylvania and New York.

The Council rejected Dr. Browne's suggestion that the water works should be built by private enterprise: ". . . considering the immense Importance of the Subject to the Comfort & Health of their fellow Citizens, that it will not be undertaken by a Company unless upon the Prospect of considerable Gain; and that such Gain must be acquired at the Expence of the City, your Committee have at length agreed that the Undertaking ought to be pursued by and under the Controul of the [municipal] Corporation as the immediate Representatives of the Citizens in general."[16] To effect this "great End," the Council ordered that a bill be drafted and presented to the Legislature investing the municipality with the necessary powers and granting as an aid the tax upon sales at auction in the city. The New York City Council was thus requesting from the state legislature special powers and aid identical with those requested by the Philadelphia Councils the same month.

The policy thus laid down gained considerable public support. The *Commercial Advertiser* thought that the project would cost more than Dr. Browne's estimate, "but were it to cost three times as much it must be done." Two days later it added: "In a measure that must combine such numberless conveniences, and incalculable benefits, as the one in contemplation, we believe every heart that wishes well to the City will cheerfully concur."[17] On January 21, 1799, the water project was given important support in a report prepared by a committee of Council members and representatives of the Chamber of Commerce, the Medical Society, and the Health Office appointed to investigate the yellow fever problem. Tenth in a long list of recommendations was this:

> In suggesting the means of removing the causes of pestilential diseases, we consider a plentiful supply of fresh water as one of the most powerful, and earnestly recommend that some plan for its introduction into this city, be carried into execution as soon as possible.[18]

Controversy over the water issue centered not on the need for a new supply, but on ways and means of obtaining it. Some citizens warned that the Bronx River was deficient both in quantity and quality.[19] To critics accustomed to well water, the Bronx tasted warm and insipid. Water from the Collect would at least be cool; could not this ancient pond be cleaned out and put to use?

The arrival of William Weston in the city early in February, 1799, promised to bring expert advice to bear on these problems.[20] On March 16, the Mayor presented to the Council a report of Weston's surveys and recommendations. Although the engineer acknowledged that the general bias of opinion seemed to lean toward the Collect, he advised against using this source. If the springs which fed the pond were not yet contaminated, they soon would be, as the inevitable result of the growing population of the city. Pointing out that most European cities drew their water supply from rivers, Weston argued that the prejudice against using the Bronx was ill-founded. Although he agreed with Browne that this was the best source, Weston calculated the daily needs of the city at a much higher figure. Taking very seriously the stipulation of the city officials that the supply must be ample to keep the streets clean, the engineer proposed a daily total of three million gallons—enough to provide a stream of water through all the streets of the city for at least twelve hours a day.

Weston suggested a plan for conducting water from the Bronx without the machinery which Browne had stipulated. The supply would be carried by canal from the Bronx to a reservoir on the north bank of the Harlem River, across that river in iron cylinders, thence by canal along the shore of the North River, and finally through more iron cylinders into a distributing reservoir in the upper part of the city (near the present City Hall). The most unusual feature of the plan was Weston's description of the filtration works which would purify the water in the reservoir, a proposal far in advance of its day.[21]

But the $799.67 which the city paid to Engineer Weston for this survey was wasted. Through the sleight of hand of Assemblyman Aaron Burr the bill sent to Albany to empower the municipality to build its own water works came out of the legislative hat a charter for a private water company. Mayor Richard Varick had his first warning that such a trick was in progress on February 22 when he received a delegation that included Burr, Alexander Hamilton, and four other leading citizens. Burr informed the Mayor that great difficulties had arisen in the minds of the members of the Legislature regarding the powers requested by the city and suggested that the City Council should modify its proposal to a request that the Legislature use its own judgment in providing for the needs of the city. Varick requested that the delegation put their proposition in writing and this was done in the form of an unsigned memorandum.[22]

When this document was presented to the City Council, that body refused to consider it unless the propositions were sanctioned by the signature of the party recommending them. On February 26, Hamilton—Burr's strange partner in these dealings—wrote to the Mayor acknowledging authorship of the memorandum. "I have no objection to authenticate them by my Signature—and I freely add that the changes in the Plan of the Corporation which they suggest have the full concurrence of my Opinion."[23] Hamilton objected to the municipality undertaking to build its own water works on the grounds that the Legislature was unlikely to grant the auction duties for a long enough period to pay for a project which might cost a million dollars and that it would be difficult to raise such a sum by loans and taxes. These obstacles might be overcome by a resort to private enterprise on some such plan as the following:

> Let a Company be incorporated of all those who shall subscribe to the fund with a Capital not exceeding a Million of Dollars to be composed of Shares of fifty Dollars each, the affairs of which to be managed by seven directors annually chosen by the Subscribers, except that the Recorder of the City for the time being shall always be one.
>
> Of this Capital a privilege to be reserved to the Corporation of the City to subscribe for any Number of Shares not exceeding a third; to enable them to do which a Grant of the Auction duties to continue to be solicited, and a power to be asked to raise on the City an annual revenue equal to the interest and gradual reimbursement of the Principal of such additional Loans as may be found necessary.
>
> The Company to have Powers similar to those which the draft of the Bill contemplates to be given to the Corporation. Further details need not be specified.

By this expedient the success will become certain and the enterprise can be carried on with energy and dispatch.[24]

Overawed by these pronouncements from the leading personalities of both the Democratic-Republican and Federalist parties, the City Council retreated from its earlier position. On February 28, the members passed a meek resolution stating that they would be "perfectly satisfied if the objects in View are pursued in any Way that the Legislature may think proper by which their fellow Citizens may be benefitted in the most easy, safe and effectual method, and the Charter rights of the City remain inviolate."[25]

Back in Albany, Assemblyman Burr held his fire until the last few days of the session. Then with dazzling speed he obtained the passage of "an act for supplying the city of New-York with pure and wholesome water." On March 27, the bill was read a first and second time, referred to a special committee composed of Burr and two other members, and reported back with amendments the afternoon of the same day. The next morning the bill was passed by the Assembly and sent to the Senate.[26] Consideration there was equally perfunctory, and the bill was finally passed on March 30.[27]

The act of incorporation, thus hastily approved, deserved much closer scrutiny. It was, in fact, an extraordinary document. To the end that Daniel Ludlow, John B. Church, and other associates might be encouraged to carry into effect their "laudable undertaking, which promises, under the blessing of God, to be conducive to the future health and safety of the inhabitants of the said city," they were created a body corporate and politic by the name of "The President and Directors of the Manhattan Company." The capital stock was not to exceed two million dollars; shares were to be fifty dollars each. The city was empowered to subscribe for any number of shares not exceeding two thousand. Management was to be in the hands of thirteen directors, of whom the Recorder of the City of New York was always to be one *ex officio*. The first directors were named in the charter; later boards were to be elected by the stockholders. The powers of the Company to obtain and conduct water were almost without limitation. It could enter upon and freely make use of any land which it deemed necessary; it could dam and divert the water of any stream, use the water power of any stream, dig whatever canals and lay whatever pipes it saw fit. If the company and the owners of land and mill rights could not agree on the compensation to be paid for damages in erecting the water works, either party might apply to the Supreme Court of New York which would appoint three indifferent persons to assess the amount. By comparison with other water company charters of the day, this one was lax in not requiring the company to put

the city streets back into satisfactory condition after it laid its pipes, in not stipulating that water should be provided free for use in fighting fires, and in not providing any limitation on the power of the company to fix its own rates. The only provision promising any protection at all to the public was a proviso that unless the company should within ten years from the passing of the act "furnish and continue a supply of pure and wholesome water sufficient for the use of all such citizens dwelling in the said city as shall agree to take it on the terms to be demanded by the said company," the corporation should be dissolved.[28]

The most controversial section in the act of incorporation was one inconspicuously placed near the end of the document:

And be it further enacted, That it shall and may be lawful for the said company to employ all such surplus capital as may belong or accrue to the said company in the purchase of public or other stock, or in any other monied transactions not inconsistent with the constitution and laws of this state or of the United States, for the sole benefit of the said company.[29]

Upon these few words the Manhattan Company was destined to build a great banking business—and this had been Aaron Burr's intention from the beginning. Yet, for a bank to be chartered by indirection violated all the traditions of the day. Other bank charters were obtained only after prolonged political jockeying. They ran for a limited period of years; the state usually reserved an option to subscribe a portion of the stock; there was some provision for state inspection of the books. The Manhattan Company charter was perpetual and included none of the usual safeguards.

After it passed the Assembly and the Senate, the bill had still one more hurdle to leap, and here it was almost tripped. On April 2, when it was under consideration in the Council of Revision, Chief Justice John Lansing, a Republican, objected to the unusual power of the corporation to divert its surplus capital into moneyed transactions; the result of this would be speculative and uncertain; it was a violation of the policy "which has heretofore uniformly obtained, that the powers of corporations relative to their money operations should be of limited instead of perpetual duration." But the Council overruled these objections and allowed the bill to become law.[30]

Quite apart from the clause which permitted the Manhattan Company to engage in monied transactions, the new law obviously departed widely from the bill which the Common Council had originally requested. To be sure, the Council had later given grudging assent to the suggestion of a private water company. But a comparison between the corporation proposed in Hamilton's memorandum and the text of the final act shows striking differences. Hamilton had proposed a capitalization

of one million dollars; the charter authorized two million dollars. Hamilton would have given the municipality an option on one-third of the stock; the charter reduced the municipal interest to one-twentieth. Hamilton had suggested that the Legislature grant the auction duties to help the city in purchasing its shares; no such aid was provided.

How is the Legislature's cavalier treatment of the wishes of the city to be explained? The Federalists offered a simple answer. It was all the fault of Aaron Burr!

> The Corporation of your city, anxious for its welfare, framed a petition the last winter . . . requesting the aid of a grant of the Auction duties, amounting to about 30,000 dols. per ann. to enable them to bring pure and wholesome water into the city, and to furnish every family with it free of all further expence. . . . But the majority of your representatives were prevailed upon to withhold the petition and to conceal the Bill. In place of it Mr. Burr, by means of erroneous statements and false representations, procured an act of incorporation to himself and to his associates, empowering them to raise the enormous sum of *Two Millions of Dollars* for erecting works and supplying the city with water, and those who receive the water are to pay the proprietors the interest of their money. As this capital must yield at least 7 per cent, amounting to more than ONE HUNDRED AND FORTY THOUSAND DOLLARS per ann., no person in the city rich or poor can enjoy the privilege of one of the indispensable necessaries of life without contributing yearly, his proportion of that immense sum, which *far exceeds all your highest City Taxes.*
>
> And now you are called on to vote again for Mr. Burr as your Representative; but he is a dangerous man! . . .[31]

Responding to a stream of Federalist propaganda and other high-pressure tactics, the voters of the city rejected Burr and his fellow-Republican candidates in the ensuing elections to the Legislature.[32]

Although Burr did not attempt to defend himself against these charges at the time, Matthew Davis, one of his lieutenants, made a persuasive case for the Republican leader in later years. Burr, according to Davis, did not conceal his intention to create something more than a water company. The only two banks in New York City, the Bank of New York and a branch of the Bank of the United States, were both under Federalist control; Burr wanted a new institution with Democratic-Republican affiliations. He allowed the Manhattan Company bill to ride through the Legislature with as little discussion of its details as possible, but, when questions did arise, he frankly acknowledged that one of its clauses was intended to give the directors full power to have a bank, an East India Company, or anything else that they deemed profitable.[33]

Whether or not Burr was as candid as this with his fellow-legislators, there is no question but that the Federalists bore a heavy share of responsibility for the outcome of the water project. Their party controlled the Common Council and both houses of the Legislature. If they regarded the brilliant young Republican as a dangerous man, they certainly had the responsibility of scrutinizing his proposals more carefully. Instead of doing so, leading Federalists collaborated with Burr in the enterprise. Hamilton's part in these transactions has already been described. Perhaps he was deceived by Burr as to the real purpose of the Manhattan Company proposal, but this seems unlikely in view of his usual shrewdness in money matters. Moreover, the John B. Church whose name appears in the act of incorporation as one of the petitioners for the bill and as an original director of the company was Hamilton's brother-in-law. Another of the directors was John B. Coles, who obtained election as state senator in the subsequent Federalist landslide. Coles' conduct is further complicated by the fact that he was a member of the Council committee that had recommended municipal ownership of the water works in December. John Watts was a third prominent Federalist who accepted a directorship in the Republican-dominated Manhattan Company.

By what tactics did Burr enlist the help of so many Federalists in a scheme whose ulterior purpose was to break the Federalist monopoly of banking in New York City? One of the newspapers of the day offered an interesting explanation. When the original city petition reached Albany, according to this story, Burr contrived to suppress the document and to institute a whispering campaign among the legislators to the effect that the citizens of New York did not want municipally-owned water works, but favored a resort to private enterprise. Professing concern at these reports, Burr then proposed to his colleagues that he should return to the city and ascertain the true state of opinion. But instead of making any such inquiry on his visit to New York, Burr assembled "a knot of gentlemen of different complexions in their politics" and represented to them that the opinion of the legislators at Albany was strongly opposed to the municipal project. "Every one present," the story continued, "was ready to say, if we cannot have water on the terms we wish, let us have it on the best we can get." The Manhattan Company prospectus was then brought forward, and subscriptions by "respectable persons" were obtained for some hundreds of shares. "Back my gentleman goes to Albany, represents that he had found every body in the city opposed to entrusting the [municipal] Corporation, and pulling the subscriptions out of his pocket, shews what seems positive proof of the fact."[34] This account is obviously of partisan origin and not susceptible of proof, but internal evidence indicates that it contains a large element of truth.

Although the Federalists presented a united front in denouncing the iniquity of Burr and appealing to the voters to throw him and his fellow-rascals out of the Legislature, some members of the party could not conceal their disgust with others who had allowed the Manhattan Company bill to become law. The well-known Federalist lawyer, Robert Troup, reported on the situation to Rufus King, United States Minister to Great Britain: "The most respectable mercantile and monied interests in the City are decidedly opposed to the measure; and they attach much blame as well to the counsel of revision as to the assembly and senate."[35] In a later letter, he commented on Hamilton's brother-in-law with obvious disapproval: Mr. Church as director of the Manhattan Company and as an underwriter was most actively employed; "the directorship is far from being disagreeable to him."[36]

Having defeated Burr at the polls, many aggressive partisans hoped to destroy his banking project as well. When the public subscription for Manhattan Company stock began, the Federalist press endeavored to embarrass the new enterprise with unfriendly publicity. But the effort failed. Even though conceived in iniquity, the new corporation appeared likely to make money, and its stock was promptly oversubscribed.[37] The Common Council was sharply divided on the issue of whether the city should exercise its option to subscribe for two thousand shares, but finally resolved to do so by a vote of eight to seven.[38]

The opponents of the new company continued their attacks over the next two months. They accused the promoters of having no intention of supplying the city with water. "Will . . . the funds thus created," demanded Noah Webster's *Spectator*, "be applied to the salvation of the city, or have we been cheated by nefarious artifices into a grant by which eight or ten persons will be made richer by some thousands than they are at present, and by which the crafty and prodigal will be supplied with new materials for fraud and new means of dissipation? Is this to be the issue of our toils and lucubrations?"[39]

On May 22, the *New York Commercial Advertiser* began the publication of a long communication headed thus:

> Interrogatories to be administered to Aaron Burr, Esquire, Ex-Representative of the people, Candidate for the Presidency and Vice-Presidency of the United States, and of Governor of the State of New York, and unsuccessful Candidate together with Matthew L. Davis and others to Represent the City of New-York in the next Assembly.
>
> (Socrates observes that he is not personally desirous of inculpating Mr. Burr, but only wishes to investigate the origin of the Manhattan Company, which he considers the most outrageous insult ever offered to an afflicted city. This Company must and will be destroyed, or else confined to some justifiable object. . . .)

Among the questions asked by "Socrates" were the following: Was the Manhattan Company instituted for the purpose of bringing water into the city, or, of banking and speculation? Were not three quarters of the directors Democrats? Was not the company in a position to carry on speculations for ten years without spending one cent on water works? Could not proceedings to dissolve the company be protracted for several years thereafter? "If in the mean time our city should be ravaged by yellow fever, is it not perfectly in the power of your company to EXCLUDE any supply of water from abroad for the space of 12, 15 or 20 years, provided they should find stockjobbing more profitable than the introduction of water?" Would not the company run the risk of forfeiture of its privileges if it should invest funds in banking before it built water works? Would it not be prudent for stockholders to give up their shares lest the company "attempt to set up banking, stockjobbing, Jewing, or any other monied operation?"[40]

Die-hard opponents of the Company hoped to kill it either by an attack at the next session of the Legislature or by shaming its Federalist stockholders and directors into withdrawing their support. On May 25, a letter from "Julius" in the *New York Commercial Advertiser* expressed grief that respectable men and even the corporation of the city itself had been drawn into the scheme. Some gentlemen, "shocked with frightful consequences to be apprehended," had voluntarily forfeited their first payments to hungry vultures who stood ready to receive them. "I confess my unaffected disappointment that their example has not been more universally followed, and I hesitate not to say I did not expect to find the name of John B. Coles still lent to support such an institution."

Unable to break up the corporation by these tactics, the opposition at length focused its efforts on an attempt to convince the Manhattan Company directors that it would be the course of prudence for them to concentrate on water works and not to antagonize public opinion by going into banking. Such a policy would prevent an assault on the charter in the Legislature. "The public opinion of the merchants, fairly and fully expressed, will, I think, produce this effect and will convince the Directors that by this conduct and by not aiming at too much, they may secure a great deal and risk little."[41]

To demonstrate the purity of their intentions, the Manhattan Company directors took the unusual step of ordering the publication of extensive extracts from their early minutes. These revealed that at the very first directors' meeting on April 11, Samuel Osgood, John B. Coles, and John Stevens were appointed a committee to report with all convenient speed the best measures to be pursued to obtain a supply of

pure and wholesome water. On April 29, the directors unanimously adopted the following resolution:

> . . . that at every meeting the committee to consider and devise the most effectual measures for procuring a supply of pure and wholesome water, shall be first called on to make a Report of their proceedings to the Board, and as this is the primary object of the charter that it shall be a standing rule that this subject shall always be first discussed.[42]

On May 8, they resolved to give water needs the same priority in the use of their funds that it had been given in their discussions:

> . . . this Board will from time to time adopt every measure that may be deemed expedient for obtaining and continuing a supply of pure and wholesome water . . . and they will at no time employ any part of the Capital of the Company, in such manner, as in any degree to interfere with, or defeat this important and primary object of their Incorporation.[43]

These repeated pledges to fulfill the corporation's obligation to the public were undoubtedly sincere, but they certainly did not reflect an intention to make water supply the Company's only business. On May 15, the directors voted to employ their surplus funds in discounting paper securities and to open for this purpose an office of discount and deposit. On September 1, 1799, this office was officially opened on the Wall Street site where the Bank of the Manhattan Company still maintains its headquarters.[44]

Only the most bitter partisans believed that the Manhattan Company would fail to make some provision for the water needs of the city. The real question was whether the provision would be adequate. Implicit in the act of incorporation was the assumption that water would be taken from the Bronx or some other source beyond Manhattan Island. This was the only reason why so much capital was authorized and such sweeping powers were granted. The inclusion of Dr. Joseph Browne among the original incorporators also strongly suggested that the Manhattan Company plans were based upon his well-known project of going to the Bronx for a supply. Once the charter was obtained, however, less ambitious plans began to take precedence. The basic reason for this was obvious. If the Company plowed all its resources into a major engineering project, little, if any, would be available for the banking business. Moreover, the cast for postponing the Bronx project gained strength from the very urgency of the water situation. In New York as in Philadelphia, the community was less interested in how water might be obtained after two or three years, than in securing an immediate supply to combat the menace of yellow fever.

On April 19, an alarmed citizen took note of reports that the Manhattan Company directors were thinking of erecting a steam engine on the banks of the Collect as a temporary expedient to obtain water for

cleaning the streets and sewers. Such a policy would expose the black, slimy muck on the bottom of the pond and create a new menace to health. "You are placed in a very delicate situation," he warned the officers of the new company, "the powers that you possess were sought for by the municipal Corporation, but the Legislature thot them better confided to you—your decision on the subject of the Collect will determine the propriety of the appointment; or the death of thousands of useful citizens may arraign their *peu de soin*."[45]

The officers of the Company had not, in fact, decided what they should do. On April 20, the water committee invited the public to submit suggestions. Two days later Elias Ring offered a plan for obtaining water from the Collect. He contended that this source was really pure; it had become contaminated only because streets drained into it and dead animals were thrown in. It needed only to be cleaned out, banked, and fenced. "The above plan, if entered on with spirit, and briskly pursued, may be compleated by the beginning of July or of August next, at the farthest; and it is needless to observe to you, that bringing plenty of good and wholesome water into the City, is of such consequence that it should not be delayed beyond that time."[46] Even Dr. Browne conceded that his Bronx project was too ambitious to provide water for the present summer. The Collect would do to wash and cool the streets and to preserve the city from fire. It was not impossible, moreover, that "the water taken from the vicinity of the Collect, after it has been renewed by a constant pumping, for a few months, might be thought sufficiently pure for culinary purposes."[47]

The advertisement of the Manhattan Company also brought responses from Nicholas Roosevelt, William Weston, and Christopher Colles. Roosevelt offered to erect a steam engine capable of raising 300,000 gallons every twenty-four hours for $9,500.[48] Weston suggested a plan for obtaining an immediate supply by means of a well, steam engine, reservoir, and iron mains.[49] Colles warned of the obstacles to be anticipated in going to the Bronx and advocated the revival of his project of 1774:

> But why encounter so many difficulties; why despise and reject so many advantages, by going to the Bronx river, when Water so excellent in quality, so ample in quantity, can be procured in the old station, where every desirable benefit may be obtained, without the smallest risque.[50]

The water committee of the Company made its decision promptly. Water was needed without delay. The only practical course of action, therefore, was to obtain a supply from some well in the vicinity of the city—preferably on the old Colles site—and to contract with Nicholas Roosevelt for a steam engine.[51] On May 6, the directors authorized the

water committee to negotiate for the necessary ground and purchase logs suitable to be bored for pipes.[52] The City Council granted permission to the Company to occupy the Colles site until it could ascertain whether water from the old well would be pure and abundant enough to supply the city.[53]

During the months that followed, the Manhattan Company embarked upon its water project with great energy. Even the critics of the corporation gave it grudging credit. On June 12, Noah Webster's *Spectator* reported:

> It gives us pleasure to learn that the measures for supplying the city with water are going into immediate effect. A number of laborers are busily employed in clearing out the spacious well adjoining the Collect, which was dug and stoned for the same purpose previous to the revolution.
>
> We believe it will be a source of infinite gratification to the citizens, provided they find the current of water is made to keep pace with the current of discounts.

News of the speedy progress of the New York enterprise was published in the newspapers of Philadelphia, where the Latrobe project was at this time involved in a morass of delays. On August 31, the *Gazette of the United States* noted:

> The Water-Works of the Manhattan Company progress with astonishing rapidity. Pipes are already laid through Chapel-street nearly down to Pearl-street—a distance of half a mile from the source—and in a month hence we may expect that Pearl, from Chapel-street down, will be completely supplied with pure water.[54]

Dr. Joseph Browne, who had so lately dreamed of a great aqueduct that would bring water into the city from the Bronx River, was employed as engineer of this more modest project at a salary of fifteen hundred dollars a year. The plan, as finally carried out, provided for forcing water up from the old Colles well with a horse-powered pump. The directors had at first authorized the purchase of a steam engine, but later changed their minds. From the well and pump located near the intersection of Reed and Centre Streets, the water was conveyed to a reservoir on Chambers Street, behind the present City Hall. Once again considerations of economy intervened, and the original plan for a reservoir of 1,000,000 gallons capacity was modified to provide one of 132,600 gallons instead. When finally completed in 1800, the Manhattan Company Reservoir was an imposing structure built of flagstone, clay, sand, and tar. Adorning its front were four doric columns and a recumbent figure of Oceanus. Although Weston had recommended iron mains, the Manhattan Company adopted the cheaper expedient, universal in America at the time, of using bored wooden logs. The distributing system took advantage of the geographical structure of the

district. The principal main followed the spine of the island downtown along Broadway with lateral pipes descending through the side streets to the edges of the Hudson and East Rivers.[55]

On November 14, 1799, the Company announced that it was ready to serve customers:

> . . . Notwithstanding the intervention of a malignant fever, which occasioned so great and so large a desertion of the city, the works have never been suspended: and although not more than seven months have elapsed since their first meeting, the directors are happy in announcing to their fellow citizens, that conduit pipes are laid in several of the principal streets, and that water is now ready to be furnished to many of the inhabitants and to all the shipping in the harbour. From actual experiment there is no doubt that one of the wells already opened will yield to five thousand families a daily supply of at least fifty gallons each, of a quality excellent for drinking and good for every culinary purpose.[56]

Rates were based on the size of the houses as measured by the number of fireplaces that they contained. For a house or building with not more than four fireplaces the charge was $5 per year; for every fireplace exceeding four the owner was to pay an additional $1.25, provided that not more than $20 per year should be charged for any private house or building. Separate arrangements would be made for the supply of manufacturies, stables, and taverns. Ships would be supplied at a rate of twenty cents per hogshead from several fountains located along the water front.

The water works gained some unexpected publicity in January, 1800, when the body of Juliana Sands, a beautiful young woman who had disappeared a few days before, was discovered in the Manhattan Company well. How and why the young victim had come to this tragic fate constituted a mystery which tantalized curious New Yorkers for many years.[57]

For some months the Manhattan Company continued to enjoy a favorable press. On June 11, 1800, the *New York Gazette and General Advertiser* reported:

> The rapidity with which the Manhattan Water works in this city go on, is worthy of remark—already six miles of pipes are laid through the principal streets—and upwards of four hundred houses are supplied with water.[58]

To improve its service in 1803, the Company substituted a steam engine for the horse-powered machine used in earlier years.[59]

The honeymoon period of the water operations did not last long. Repair of the wooden mains involved the company in frequent expense, while revenues fell short of expectations. Although there were no public hydrants like those of Philadelphia, many inhabitants continued to use

well water from the old pumps that still stood in the streets. Others found ways of helping themselves to Manhattan water without paying for it. Although strictly against the rules, water takers generously allowed their neighbors to fill their buckets from their taps. Grocers gave away Manhattan water in order to attract trade. On the water front they provided free water to the ships; in other parts of the city they gave it to their customers, to the great indignation of the Company.[60]

But the customers of the Company had equally bitter complaints. On July 21, 1803, a subscriber wrote to one of the newspapers:

> Not long since I discharged my tea-water man, and had a Manhattan Cock introduced into my cellar, and for the first ten days I was highly pleased with it, as it afforded me good water—But, alas! for the last fourteen days, I have turned my cock repeatedly, but nothing comes from it—I have therefore been obliged to use the water which comes from the pump opposite the Marshall's door in Pearl street.[61]

Relations between the Common Council with its Federalist majority and the Democratic-dominated Manhattan Company followed an uneven course. To pay for its one hundred thousand dollars of stock the city relied on loans from the Manhattan Company itself.[62] This was profitable, since the municipality paid only six per cent interest on its borrowings while it shared in the regular dividends of the Company, which were much larger.

But neither the fact that the city owned one-twentieth of the stock, nor that the Recorder of the city was one of the directors of the Company, nor that Joseph Browne was both Superintendent of the water works and street commissioner of the city was sufficient to prevent collisions between the two bodies. On July 6, 1801, the Common Council appointed a committee to confer with the Manhattan Company on the subject of the bad condition of the pavements in many of the streets, which was attributed to the negligence of the Company in breaking them up to lay its pipes and then failing to put them back properly.[63] This was the beginning of a controversy that continued over many months. In November, 1803, three commissioners appointed by a justice of the Supreme Court to assess the amount of damages due the city reported a sum of $6,881.14.[64] The Company rejected this award, and the controversy continued for nine months more until the parties at length accepted the findings of a new panel of arbiters, who fixed the damages at $5,500.[65]

When the community had been considering its water problem in 1798, highest priority had been given to the need for an abundant supply to wash the streets and gutters of the city and to fight fires. The facilities provided by the Manhattan Company were not very satisfactory. During the summer of 1802 the city arranged to buy Company water for the daily flushing of the gutters.[66] But this policy was considered either too expensive or unsatisfactory on other grounds, because two years later the Council ordered the streets to be washed with water taken from public and private wells.[67] None of these measures were adequate, and New York continued to have the reputation of being a dirty and unhealthy city. "The common sewers are incomplete," wrote John Melish in 1806, "and there is no supply of fresh water to sweeten and purify the streets; but, beyond all, they have adopted the system of sinking necessaries, which accumulates such a collection of latent filth, that the steams of it are sometimes perceptible at two miles distance."[68]

The Manhattan Company's policy on fire prevention was more liberal. It allowed its water to be used by the fire companies without charge, even though large quantities were drawn and much was often wasted after the fire was out. In the early days the water was sometimes taken directly from the wooden pipes by drilling holes into them. The wounded water arteries would then be closed by driving wooden plugs into them—which may be the origin of the present-day word "fireplug."[69] Much more satisfactory were the wooden hydrants placed at many convenient points after 1807.[70] But the Manhattan supply was never adequate to meet the complete needs of the city, and at many fires the engines had still to be supplied by bucket brigades from nearby pumps or from the rivers that bordered the city.

As early as 1804, the Common Council decided that the supply provided by the Manhattan Company was inadequate for the needs of a rapidly growing city. On August 6, 1804, a committee was appointed to devise an effectual plan for furnishing "a more abundant supply of water for public exigencies."[71] Shortly thereafter new surveys were made of the Bronx River and Rye Pond in Westchester County.[72] Not for many years, however, were effective steps actually taken to obtain a new supply.

The city, therefore, continued to suffer from Aaron Burr's devious course in 1799. By contriving the chartering of a private water company instead of a municipally-owned system, Burr and his collaborators involved the community in an unhappy situation that became increasingly difficult to resolve. As a financial institution, the Bank of the Manhattan Company was highly successful from the start, providing useful services to the community and avoiding the irresponsible course of speculation that its Federalist critics had predicted. But the more successful its banking operations, the less enthusiasm the Company had for its water business. The latter was more troublesome than profitable.

and there is good evidence that the directors would have been glad to turn their responsibilities over to the city. Such a transfer was, however, difficult to arrange, since it would not only require satisfactory arrangements with the city government but also the consent of the Legislature. After all, the Company had been chartered primarily to supply the city with water and authorized to employ only its surplus funds in banking. What would its legal position be, if it went out of the water business? These were issues that involved the corporate life and death of the Company.

In condemning Burr for involving both the city and the Company in this unhappy predicament, one or two mitigating considerations should be offered. The city of New York might not have obtained a municipal system in 1799 even if Burr's conduct had been strictly honorable. To build adequate water works would have been expensive, and the city would have encountered many financial difficulties in carrying through the project. Moreover, the technical problems involved in bringing water from the country north of Manhattan Island across the Harlem River and down into the city were of a serious character—enough to challenge the abilities of the best engineers of a later generation. It may well be doubted whether the time had come to carry through projects as ambitious as those proposed by Dr. Joseph Browne and William Weston. If this is so, it must be conceded that the supply provided by the Manhattan Company—although never adequate for the needs of the community—was better than nothing.

CHAPTER FOUR

Rise of the Private Water Companies

> The object of individuals, when they act by themselves, or when they act as a company, in investing money, is to make the most profit out of it that circumstances will permit them to make. . . . If this be true, it follows of necessity, that the chief view of the Water Company was to make money out of the necessities of the people of Baltimore.
>
> *Report of the Water Committee to the City of Baltimore,* 1830

> Your memorialists did always consider themselves as having two distinct objects in view; the one, to give the greatest convenience and advantage to the public, and at the same time to give small dividends to their Stockholders. . . .
>
> *Memorial of the Baltimore Water Company,* 1830

When the New York Legislature entrusted the responsibility for supplying water to the city of New York to a private company rather than to the municipality itself, its action was consistent with the trend of the times. Except in Philadelphia, the widely-felt need for urban water supplies during the 1790's and early 1800's was everywhere met by private enterprise. Mayors and city councils often investigated the possibilities of building municipal works, but almost always drew back in view of the heavy expenses involved. When private water companies were proposed, on the other hand, capital was usually available for a type of enterprise which was certain to benefit the community and might at the same time provide dividends to stockholders.

The chartering of water companies was one phase of a much broader movement in business organization. Before the Revolutionary War charters of incorporation had been granted to American groups both by the English crown and by the colonial assemblies. Most of these, however, had been for the purpose of establishing either municipalities or religious, educational, and charitable institutions. Business corporations, although not unknown in colonial America, were rare. But the establishment of independence brought a decided change. Congress chartered the Bank of North America in 1781; to strengthen its legal

position this pioneer financial corporation also obtained charters from Pennsylvania and other states. The state of Massachusetts chartered a bank in 1784; Maryland took the same step in 1790, and New York in 1791. In 1791, also, Alexander Hamilton's famous Bank of the United States was incorporated by Congress over the opposition of James Madison and Thomas Jefferson. Meanwhile, corporations were being chartered to go into the fire insurance business, to build canals, toll bridges, and turnpikes, and to manufacture various products.

Until 1790 the corporate birth rate was still low, but it jumped sharply thereafter. Between 1781 and 1790, only 33 charters to business corporations were granted; between 1791 and 1800 there were 295. Among these new corporations, twenty-nine were created for the purpose of supplying water to the inhabitants of cities and towns.[1]

In June 1794, a group of investors petitioned the Massachusetts Legislature to be incorporated for the purpose of bringing fresh water from Jamaica Pond into the town of Boston by means of "subterraneous pipes."[2] This project had a somewhat curious genesis. The idea apparently originated with Abijah Wilder and Luther Eames, both of Keene, New Hampshire, who had formed a partnership earlier in the year for the building of aqueducts. Wilder was a Congregational deacon and a skillful craftsman in wood; Luther Eames was an innkeeper and village capitalist. These two enlarged their enterprise to admit Nathan Bond and William Page of Lebanon, New Hampshire. Eager to build an aqueduct for New England's largest town, the group enlisted the support of James Sullivan of Boston, an ambitious lawyer, politician, and businessman, who was already prominently connected with the Middlesex Canal and other enterprises.[3]

Jamaica Pond, to which the promoters of the aqueduct looked for a supply, was a beautiful sheet of water, nearly seventy acres in area, located about four miles to the southwest of Boston. Surrounded by hills, in a district abounding in springs and brooks, the pond had long been a favorite resort for townspeople seeking the country air. Elegant country seats were built along its shores. During the Revolutionary War the Count de Grasse had ordered water casks for the French fleet to be filled from this source. Some of the water that still remained after the ships returned to France was subjected to chemical analysis and pronounced to be unusually pure. News of this episode had been carried back to America, and thereafter the water of Jamaica Pond had enjoyed a high reputation.[4]

The initial application for an aqueduct company charter was opposed by the town of Roxbury, in which Jamaica Pond was located, but through the political management of James Sullivan this obstacle was

surmounted the following year. From a Boston town meeting on February 2, 1795, Sullivan procured a resolution approving the project, provided that the act of incorporation should require the company to restore to their former condition the streets opened for the purpose of laying pipes, and that such other restrictions should be made "as will secure the Town from injury by undertaking the Business."[5] This victory was quickly followed by one in the Legislature, where an act of incorporation was passed on February 27, 1795.[6]

By their new charter Luther Eames, Nathan Bond, and William Page were incorporated into a Body Politic for the purpose of bringing fresh water into Boston by subterraneous pipes. The company was to have full power and lawful authority to bring water from any part of Roxbury into any part of Boston. Streets were not to be opened in such ways as to obstruct passage, and were to be put back in good repair under penalty of prosecution for maintaining a nuisance. The corporation was empowered to choose its own officers and to acquire real estate, provided the amount so held did not exceed thirty-five thousand dollars in value. Two significant safeguards were written into the charter. The towns of Boston and Roxbury were to have the privilege of tapping the water mains at such points as might be necessary for fire protection, and of drawing water for this purpose without paying the corporation. Furthermore, the Legislature stipulated that "nothing in this Act shall be construed to restrain the General Court from hereafter regulating the price of the said water to the said inhabitants, if the said Court shall judge fit."[7] By a strange omission the new company was not provided with a name, but this was remedied by a supplementary act, passed June 10, 1796, christening it "The Aqueduct Corporation."[8]

Meanwhile, the promoters of the enterprise were endeavoring to raise the necessary capital. The charter had provided for one hundred shares, but had not specified either the par value or the total authorized capital. The corporation was vested with power to assess its stockholders and to sell the shares of those who were delinquent in their payments. Over the next several months the newspapers published frequent notices of assessments and warnings to delinquents that their shares were about to be forfeited.[9] On July 27, 1795, at the Bunch of Grapes Tavern, the corporation, then composed of only thirteen stockholders, held its first election of officers. James Sullivan became president and Nathan Bond was named treasurer and engineer.[10] From this time on, Sullivan and Bond became the most active leaders in the enterprise, and the entrepreneurs from Keene faded out of the picture. In 1796, Deacon Wilder was back in his home town, building a small aqueduct to supply himself and his neighbors.[11]

The Boston project was carried forward with energy. In November, 1795, Sullivan and his associates advertised for hard pine logs to be delivered on or before January 1, 1796.[12] The following February, they solicited bids for laying these wooden pipes.[13] By July, assessments totalling $120 a share had been made on the stockholders,[14] and the work of boring and laying the pipe had begun. Three months later the *Columbian Centinel* reported: "The *Aqueduct* in our vicinity is prosecuting with vigor."[15]

The aqueduct appears to have been sufficiently completed to begin 19, 1796, the *Columbian Centinel* declared:

> The *Aqueduct* now constructing to supply the houses and shipping in this metropolis with pure water, will be a great advantage to the citizens—it may save half the expence in soap, and half the labour in washing, and the ease with which the linen is washed may make another saving in the wear of it during the operation nearly equal to both the above. The additional security from fire is another circumstance of great importance. But the most interesting consideration and important benefit, is its tendency to increase the means to preserve HEALTH. . . . To have it [water] pure and plenty in great cities, by every way increasing the means of cleanliness, as well as rendering the system of nutrition more wholesome, must be of the highest consequence to prevent putrid and pestilential fevers and other fatal diseases. . . . Boston will be the first large city in the United States thus accommodated.

The aqueduct appears to have been sufficiently completed to begin supplying customers about August 1, 1798. On that date fourteen rules governing rates and the distribution of the water were published. Houses were divided into three classes. Those having five or fewer residents were to pay eight dollars a year; those having from six to twelve were to pay ten dollars; and those having twelve or more were to pay twelve dollars. "West India stores" were to pay from eight to fifteen dollars; taverns and manufacturing establishments might be supplied on special terms to be arranged with the company.[16]

On December 21, 1799, the newspapers reported resolutions of the Aqueduct Corporation relative to the use of its water for extinguishing fires. In case a building should be on fire within the town of Boston, customers of the Aqueduct who were fortunate enough to be remote from the conflagration were to cease drawing water. Those who were nearby were to allow the firewards to have access to their premises and to take any steps that would render the water useful during the emergency.[17]

In 1803, the Aqueduct Corporation received additional powers from the Legislature. According to the preamble of the new law, lack of authority to enter upon private estates without their owners' consent had exposed the Corporation to many inconveniences so that the important purposes of the association had been "greatly retarded and embarrassed." The Corporation was now authorized to enter upon any estate within certain specified boundaries. Where necessary rights could not be obtained through voluntary agreement, damages were to be estimated and settled by a committee appointed by the Court of General Sessions.[18]

Any hope that the Aqueduct Corporation would make its promoters rich must soon have been dissipated. For twelve years the stockholders received no return on their investment and were meanwhile assessed $1,000 on each share. A number became discouraged and sold out at a loss, sometimes receiving no more than $300 a share. The first dividend was declared in 1807. Since only $20 was paid on shares valued on the books of the Corporation at $1,300, the rate of return was only about one and one-half per cent. After this difficult beginning the financial affairs of the Aqueduct improved. Over the next thirty years annual dividends averaged $51.76, or slightly less than four per cent, rating the shares at $1,300. The price of the stock varied from $500 to $600, but sales were infrequent.[19]

Not many descriptions of these early Boston water works have survived. An English traveler of 1807 remarked that the town was supplied with "excellent water" conveyed from Jamaica Pond to a reservoir on Fort Hill and thence distributed through the principal streets.[20] More details were given in a guide book of 1817. Four main logs led from the Pond to the town and thence through most of the principal streets. Two of these were of four-inch bore, and the other two of three-inch. The lateral pipes were of only one and one-half-inch bore. Forty miles of logs had been laid and about eight hundred families were supplied. The smallness of the pipes was one deficiency of the system; another was the fact that they had not been laid deep enough to prevent freezing in severe winter weather.[21] The works had to be partially reconstructed in 1820 at a cost of twenty thousand dollars.[22]

While the Boston Aqueduct Corporation was struggling with such difficulties as these, many similar enterprises had been attempted elsewhere. Two days before the Boston company was chartered in 1795, the Massachusetts Legislature incorporated the "Proprietors of the Waterworks in the middle of the town in Pittsfield."[23] Aqueduct companies were incorporated for four other small Massachusetts towns in 1796, for six in 1797, and for four in 1798.[24]

On February 21, 1799, the Legislature passed a general incorporation act for aqueduct companies. Any number of persons might organize such a corporation by the simple process of applying in writing to some justice of the peace for a warrant directing one of the proprietors to call a

meeting. The proprietors were given power to elect officers, assess shareholders, hold real estate up to thirty thousand dollars, and dig up highways to lay pipes. Shareholders were liable for all contracts in case of the company's dissolution, and the town authorities were empowered to draw water from the aqueducts in case of fire.[25] Occasionally the Legislature granted the right of supplying water to individuals rather than to companies: such rights were granted to Calvin Whiting of Dedham in 1796, and to Daniel Goulding of Worcester in 1798.[26]

Most of the eighteen water works specifically authorized by the Massachusetts Legislature between 1795 and 1800 must have been small affairs. With few exceptions, the communities that they served were villages and small towns. Fifteen of them had fewer than twenty-five hundred inhabitants according to the census of 1790.[27] No important engineering problems were involved. Usually the water of one or more springs was collected in a small reservoir and conducted through bored wooden logs to the homes of the customers, most of them stockholders in the company. Although the form of organization was that of a business corporation, the enterprise was more like a neighborhood cooperative in function.[28] More successful than most of the others was the Salem and Danvers Aqueduct Company, chartered in 1797, which raised a substantial initial capital and continued to expand until it had some thirty-four hundred customers in 1859.[29]

Although water works ventures were more common in Massachusetts than elsewhere, the movement was by no means confined to that state. In 1798, the building of an aqueduct to bring pure spring water three miles into Portsmouth, New Hampshire, was reported.[30] Two successful water companies were organized in New Jersey: the Morris Aqueduct Association, authorized to supply Morristown, was chartered in 1799; the Newark Aqueduct Company, in 1800.[31] The Connecticut Legislature chartered a Hartford Aqueduct Company in May, 1797, but the project was never carried into effect. The Gleason & Cowles Aqueduct Company, also intended to supply Hartford, operated only briefly after its incorporation in 1801, and another Hartford Aqueduct Company, founded in 1803, never functioned.[32] The Connecticut Legislature incorporated the Proprietors of the Aqueduct at New London in 1800 and two or three other small companies at about the same time. A water company to serve Charleston, South Carolina, was chartered in 1799.[33] The water company movement seems to have invaded New York State somewhat later than its neighbors, but between 1799 and 1820 twenty-five "aqueduct associations" were authorized by the Legislature, most of them simple village corporations.[34]

Among the most successful of the early service corporations was the Baltimore Water Company, organized in 1804. Before this enterprise was initiated, the citizens of Baltimore had struggled with their water problem for a dozen years. The Baltimore Insurance Fire Company, chartered in 1787 and reorganized in 1791 as the Maryland Insurance Fire Company, had a natural interest in promoting a better water supply as a means of fire protection. In 1792, the Legislature amended its charter to empower the directors to open a subscription for shares in a proposed water company.[35] However, no use appears to have been made of this authority. On April 26, 1797, the City Council, during its first session following the incorporation of the city in 1796, resolved that "whereas, a due supply of water is a convenience to the inhabitants, and of the utmost importance in times of fire," commissioners were to be empowered to sink wells and maintain pumps.[36] Even more challenging than the menace of fire was the fear of yellow fever. Although the epidemic of 1798 was much less severe in Baltimore than in Philadelphia and New York, the city officials had reason to be worried. The community had suffered four visitations of the fever since 1794.

On December 8, 1798, the City Council appointed a committee to view all the neighboring springs and streams of water and to report on the practicability of conveying these into the city.[37] Mayor James Calhoun gave strong support to the project in a message to the Council on February 7, 1799. Although the digging of public wells had provided a partial supply of water, the only really effectual policy would be to conduct water through the streets in pipes. "This will no doubt be attended with a considerable expense," the Mayor declared, "but when we reflect on the magnitude of the object, both as to preservation from contagion and fires, as well as for culinary uses, who will hesitate in contributing his proportion of the money wanted to effect so desirable a purpose?"[38]

In its report on February 13, the water committee advised against reliance upon springs. These would provide an inadequate quantity for the three great needs of the city: water for domestic use, for cleaning the streets, and for fighting fires. But an abundance of water might be taken from any one of three streams in the Baltimore area. From Gwynns Falls to the west, water could be conveyed about two miles to the city; from the most desirable spot on Jones Falls to the north, the distance was about the same; from Herring Run to the northeast, a longer conduit, one of about three and one-half miles, would be required. From any of these sources water could be brought in with sufficient pressure to rise to the upper stories of most of the houses. This would permit not only running water in the upper apartments, but would enable the firemen to

use hose without resort to bucket brigades or engines, at least in the lower parts of the city. Although it had not been able to estimate the cost, the committee was confident that the citizens were eager to have some such project undertaken. Baltimore should draw a lesson from the unhappy experience of plague-ridden Philadelphia:

> To us the mournful situation of a neighboring much admired city is an awful lesson. From it we are taught with sorrow, that procrastination may be attended with a sacrifice of lives invaluable. But independent of the superior considerations of humanity, let it be remarked that the actual *pecuniary* loss resulting from the suspension of business even one season, occasioned by a malignant contagious fever, would be equal—nay, would exceed all the expenses of the proposed improvement.[39]

The City Council gave prompt approval to the committee's recommendations. On February 26 an ordinance was passed authorizing the Mayor, aided by a special committee of seven prominent citizens, to contract for water rights, build necessary works, and borrow money subject to the approval of the City Council. A preliminary appropriation of five hundred dollars for necessary surveys was provided.[40] To raise further funds the Council authorized a lottery.[41]

The Mayor and his associates proceeded to put their powers to use with more haste than prudence. Instead of utilizing one of the three streams recommended in the earlier report, they decided to take water from springs rising on high ground to the west of the city on property belonging to a Mr. Wignals. After he had obtained, as he believed, the consent of this gentleman and neighboring property owners, Mayor Calhoun contracted with workmen to lay the necessary pipes.

But the hastily-contrived project immediately became ensnared in difficulties. When Wignals was requested to sign written instruments conveying the necessary water rights, he balked and demanded that the city pay him five hundred dollars a year. Rather than comply, the Mayor and the special committee decided to take water from the stream at a point below Wignals' property. Work was accordingly begun and considerable progress had been made when a new embarrassment arose. "To my great mortification," the Mayor lamented to the Council on June 10, "I now find that the gentlemen south of the turnpike road mean to prevent us from continuing the business unless they are paid for the supposed damages they will sustain by lessening the stream passing through their lands. . . ." Confronted with these demands, Calhoun called the Council back into special session to seek advice on what course he should follow. To add to his troubles, the Mayor had advanced money out of his own pocket to carry the project thus far.[42]

Sad experience thus taught the Baltimore officials the lesson subsequently confirmed in other cities: that it was virtually impossible to

construct a water works system unless provision were made for taking property through exercise of the right of eminent domain. On June 13, the City Council voted to halt the local project and to apply to the Legislature for the necessary powers.[43] A week later an appropriation of one thousand dollars was passed to reimburse the unhappy Mayor for the money that he had advanced.[44]

The fiasco of 1799 was followed by three years of similar frustrations. The Legislature failed to act until it was shocked into doing so by a serious recurrence of yellow fever in 1800. On December 19 of that year a statute was enacted bestowing on the Mayor and Council the right to condemn property, and other powers necessary to provide a water supply for the city.[45] On February 9, 1801, Mayor Calhoun called this statute to the attention of the City Council and requested that immediate steps be taken to implement it.[46]

But now it was the turn of the Council to procrastinate. Although the newspapers urged action, municipal finances were in such shaky condition that nothing was done during the next two years. On February 14, 1803, Mayor Calhoun once again raised the issue in his annual message:

> Every mode hitherto devised to regulate the sinking of wells and erecting and repairing pumps has proved unsatisfactory to many of the Citizens; whether any other plan can be fallen upon that will give satisfaction is with you to decide. It is greatly to be lamented that no measure for supplying the City with water from springs or fountains has been adopted by the Corporation; offers for this purpose have been made by individuals, how far it would be proper to encourage such an undertaking in a private company will be with you to determine.[47]

The Council ignored the Mayor's suggestion that the water problem might be turned over to private enterprise and passed, instead, an ordinance "for introducing a copious and permanent supply of wholesome water into the city of Baltimore." Twelve prominent citizens were appointed Commissioners for this purpose and given broad powers to examine sources within ten miles of the city and to make contracts subject to the approval of the Mayor and the Council.[48] Since the powers granted by the Legislature had lapsed on January 1, 1803, this action was at least a year too late. Nevertheless, the Commissioners made extensive investigations and reported their findings on February 21, 1804. An abundant supply of pure water, they asserted, might be obtained from springs in the immediate vicinity of the city. But it was impossible for them to estimate the expense of such a project, since the water rights were owned by so many persons, part of whom might be minors or absentees. If the Council wanted to proceed further, a new act of the Legislature would be indispensable.[49]

Like a hunter lost in the woods, the city government had wandered in a great circle, returning in February, 1804, to the precise point from which it had departed some five years earlier. In obvious discouragement the City Council now authorized the Mayor to give public notice "that proposals will be received at his office until the first day of June next for introducing a copious and permanent supply of water into the City of Baltimore or into any part thereof by any individual or Company."[50]

Even after the Council made this appeal to private capital, two months elapsed before effective steps were taken. Finally on April 20, 1804, the *Federal Gazette* published a long communication from "A Citizen of Baltimore" entitled "Sketch of a Plan for Supplying the City of Baltimore in Every Part of it, with an abundance of GOOD WATER, without any expence to the corporation, or to individuals, except such as they may choose to incur." The author proposed the introduction of the whole stream of Jones Falls into the city, taking it from the tail race of the lowest mill, conducting it by means of a tunnel to a point directly under the hill which lay north of the Roman Catholic chapel, and raising it by means of a steam engine into a reservoir on the top of the hill, from which it would be conducted to every part of the city by pipes laid in the streets.

Many benefits would follow: there would be fire plugs along the streets, public fountains for the ornament and refreshment of the city and for the supply of the poor, and water conveyed into the houses of those able to pay for it. In the lower parts of the city, it would even be possible for every man to have a cistern full of water on top of his house to check fire.

The plan was obviously inspired by the very similar Centre Square works at Philadelphia, with the important difference that at Baltimore a private company was to build and manage the system. The cost was estimated at $150,000 and this was to be raised by selling fifty-dollar shares. "The object of making the shares so small is that every head of a family, or owner of an house, may have an opportunity of purchasing an interest in the water-works, equal to the annual expence which it may probably require to bring the water into his house." A man in good circumstances would probably have to pay $6 or $8 a year for water. Let him subscribe for two shares, which would cost $100. If these shares yielded dividends of six or eight per cent, this would meet his annual water bill. "Thus by advancing one hundred dollars he obtains the use of the water forever. Who is there that would not pay down one hundred dollars, to have a constant stream of good water brought into his house?" All citizens willing to aid this project, or to propose a better one, were invited to attend a meeting at Bryden's Tavern that evening.

The meeting at Bryden's attracted a large attendance, and resulted in the appointment of a committee of seven, including such civic leaders as General Samuel Smith, Colonel John Eager Howard, and Robert Goodloe Harper, to draw up specific plans for a water company. The recommendations of this group, made public a week later, followed the general lines laid down by the "Citizen of Baltimore" except that a larger capital was proposed:

> Perhaps it might be accomplished for 150,000 dollars; but as this sum might prove insufficient, the committee think it advisable to open a subscription to a larger amount, 250,000 dollars for instance; and as the subscription will be payable in instalments to be called for as the money may be wanted, the payments will of course cease when the work is finished; and if the whole sum is not wanted, it will not be called for.[51]

The committee report included a draft constitution, articles of association, and a plan that would encourage small subscriptions by limiting to four the number of shares that any one person could purchase during the first two days that the books were open.

On May 2, another citizens' meeting ratified these plans,[52] and two days later commissioners, sitting at Bryden's Tavern, opened the subscription book. Results were so disappointing that at the end of the second day, the *Federal Gazette* scolded the community severely:

> We must confess that we are not greatly surprised at the small number of adventurers in the Water Company. Every enterprize of this kind, in a city so devoid of public spirit as ours, must depend upon a few. It is left for the rest to plod on in their own dull way; but after they *see that money is to be made by the scheme*, we hope they will be made to pay roundly for the honor and advantage of becoming members of an association, on the success of which the welfare of the city, and the convenience of families so essentially depend.
>
> In the introduction of pure and wholesome water into the city, the ladies at least the heads of families, and those who expect to be so, are particularly interested, and we sincerely wish them to exert their influence on this occasion—Indeed, any husband who would refuse his wife the moderate request of subscribing for a few shares in the Water Company, deserves not the title of an *husband*, since it is the only instance wherein the public ever have been or ever will be probably concerned, for the LADIES—or which is the same thing, for female convenience, domestic comfort and family economy. . . . But let these short-sighted, miserly mortals, should the undertaking succeed in spite of their sordidness, burst with spleen and envy, if in the space of eighteen months they find the city purged of disease, secured from fire, and flourishing beyond all former example—and the WATER STOCK too, as it may be, more valuable than any other in the market.[53]

After this bad start the subscription book was moved from Bryden's Tavern to the office of the Maryland Insurance Company. The transfer was symbolic, since the puny infant now received a saving blood transfusion from companies vitally interested in the water supply problem.

The Maryland Insurance Company subscribed 250 shares; the Marine Insurance Company and the Baltimore Equitable Fire Insurance Company each took 200; and the Union Insurance Company 100. The famous Charles Carrol of Carrolton also subscribed 200 shares.[54] Despite these encouraging developments the promoters had to work hard to reach the goal of 5,000 shares. They continued to appeal for the support of small investors:

> Without a charter the company will not probably commence its operations, and without a long list of names to lay before the legislature, that body will not, in all likelihood, grant a charter. A thousand names for 2000 shares will therefore do more good than 100 names for 5000 shares.[55]

After two weeks of effort all the shares were finally subscribed and directors were elected on May 24.[56]

President John McKim and other officers of the new company wrestled for some time with the practical problem of where the water supply should be taken and how it should be distributed. Extensive surveys were conducted by Jonathan Ellicott, one of the directors. For a time opinion inclined toward an ambitious plan for buying all the mill rights along the lower reaches of Jones Falls so that the water of that stream might be conducted into a reservoir on high land to the north of the city. But fear that the company's resources would be overtaxed led eventually to the adoption of a much more modest scheme.[57]

The new plan was drafted by John Davis, superintendent of the Philadelphia water works, whom the company directors engaged to advise them during the fall of 1804. This provided for taking a supply from Jones Falls at a lower elevation much closer to the city. Advantage could thus be taken of the mill race of Kellar's Dam, which supplied power for the Salisbury Mills located near the old Belvedere Bridge. A pumping station would be erected on a site at the southwest corner of present-day Calvert and Center Streets. Water from the mill race would be raised seventy-five feet to the top of the tower on the pumping station and then conducted by gravity into a reservoir on the hill directly to the west (the present site of the Enoch Pratt Free Library). From this place the supply would be carried through bored wooden logs into the homes of the customers.

The directors adopted Davis' plan and induced him to move to Baltimore to supervise operations. In the spring of 1805 after he had turned the direction of the Philadelphia works over to Frederick Graff, Davis made the transfer.[58]

Although citizens of Baltimore eventually had reason to regret the decision to use a source so easily contaminated by a growing city as Jones Falls, this stream was in these days largely unspoiled. Moreau de St. Méry, who visited Baltimore in 1794, left this description:

> But what gives Baltimore a pleasant air, peculiar to itself, is the hill which dominates it on the north. This belongs to Colonel Howard, whose residence and outbuildings are situated on the front portion. The rear is beautified by a park. . . .
>
> On the eastern slope of this height is a rivulet called Jones Falls, the sound of which is as charming as its appearance. Its rocky bed, the mill which it turns, the combination of rustic simplicity with the nearby commerce and marine activity of the city, constantly fascinate one who follows its course back to the city. It flows into the basin east of the great market.[59]

For the first four years of its existence the Baltimore Water Company operated under the handicap of having no corporate charter. An act of incorporation passed the Legislature on January 19, 1805, but it contained provisions so unsatisfactory to the investors that it was rejected. This abortive charter specified that the capitalization of the Company must be increased from $250,000 to $500,000 and that the stock book of the company must be kept open until 5,000 additional shares should be subscribed. In choosing directors no stockholder was to have more than twenty votes—a provision highly unsatisfactory to the individuals and companies who had subscribed such large blocks of the original stock. The Company was prohibited from engaging in any form of banking or commerce, and the corporate powers were to expire in twenty years.[60] The Maryland Legislature was obviously opposed to creating any such corporate monster as New York's Manhattan Company.

After rejecting this charter, the officers of the Water Company undertook to clarify the situation by coming to an agreement with the city. In November, 1805, the Mayor called the Council into special session to deal with the Company's requests, and the whole water problem was once more reviewed. Apparently there was still strong sentiment for municipal ownership of the new works, because on November 13 a special committee recommended that the city make application to the Legislature for authority to buy up the Water Company stock.[61] Further study, however, indicated that this idea was impracticable. After discussion with the Company directors the committee reported that it would be necessary to come to terms with some five hundred individual stockholders, not all of whom were likely to agree to the transfer of ownership to the city. The committee concluded that:

> . . . it appears to be a prevailing opinion that the great object of watering the city is full as likely to be effected by the present Water Company if suitably encouraged, as it can possibly be by the Corporation with the present means.[62]

After some delay the City Council passed an ordinance on February 14, 1806, granting full power and authority to the Water Company to

convey water under the streets and to break up and restore the pavements at its own expense. Injuring the pipes or machinery was made an offense punishable with a twenty-dollar fine.[63]

The Company continued its efforts to obtain a satisfactory charter from the Maryland Legislature. In 1806, a new act of incorporation was passed, less prejudicial to the original stockholders than that of 1805, but still unacceptable because it was limited to thirty years and authorized the city to purchase the works at any time during that period.[64]

Finally, on December 24, 1808, the Legislature granted a charter which the Company was willing to accept. The capital was now limited to the original $250,000, and the discrimination against large stockholders in voting for the directors was relaxed to the extent of setting up a system whereby for every one share and not exceeding two shares the holder was to have one vote; for every two shares above two and not exceeding ten, one vote; and so forth. The highest bracket provided that for every eight shares above sixty the holder was to exercise one vote, but that no one should be entitled to more than eighty votes. The city government was to have the right to erect and maintain as many fire plugs as it deemed necessary at its own expense, but free from any charge for the use of water. The charter contained no time limit and no provision for purchase of the water works by the city.[65] Despite the inclusion of a prohibition on banking activities, the promoters of the Company had good reason to rejoice. Their persistence had won them a liberal charter under which they might hope to operate a profitable business for many years.

The Water Company's difficulties with the Legislature had not undermined the confidence of investors. As the project approached completion, the price of the stock jumped dramatically. On January 13, 1807, it was quoted at $175. Three months later it had fallen back to $90, but this was still $40 above par.[66] In Baltimore, as elsewhere, the profits to be realized in selling water were grossly over-estimated. In 1811, four years after the Company began to supply its first customers, the annual water rents amounted to less than $9,000.[67] Thereafter, receipts gradually increased, but dividends continued to be modest. The average annual return to the stockholders over the first twenty-four years of the Company's history was only three per cent.[68]

Although private enterprise never provided the sparkling fountains and the abundant streams to cleanse the gutters that had been dreamed of in the days of the plague, a modest supply for fighting fires did result. The first fire hydrants were erected at the Company's own expense, but on February 28, 1809, the City Council appropriated eighteen hundred dollars for purchase of these plugs and the erection of new ones.[69] The

next year six hundred dollars more was provided for this purpose.[70] On February 11, 1811, Mayor Edward Johnson gave the Council an optimistic report on the situation:

> Agreeably to a resolve of the City Council at their last session the number of fire plugs has been augmented to forty and by an annual appropriation for this object, and a careful distribution of them throughout the City, they will certainly afford such a supply of water as to enable the many well regulated fire companies already established to arrest the progress of any fire that may take place. . . .[71]

Thus at Baltimore, as at New York and elsewhere, the private water company served a useful function in providing a measure of fire protection and a supply of water for domestic use that was more convenient and probably more healthful than that available from neighborhood wells. As a permanent solution of the water problem, however, dependence on private enterprise was unsatisfactory. Water works involved a large initial outlay of capital and heavy subsequent expenditures in maintenance and extension. But the actual and prospective profits of the companies were rarely great enough to induce the directors to build systems adequate to provide all needs. The companies laid their pipes through the districts that promised the largest returns and left the poorer or more remote districts without a supply. The larger the cities grew, the more serious this lag in providing an essential service became. Moreover, the companies naturally gave priority to the needs of their private customers. Some provision, though rarely adequate, was made for fire hydrants; water for other important civic purposes was usually not available.

Although the private water companies dominated the scene during the early years of the nineteenth century, they eventually became unpopular in all the larger cities. Everywhere the high rates and inadequate service of the private companies were contrasted with the lower rates and larger supply provided by Philadelphia's pioneer venture in municipal water works.

CHAPTER FIVE

IMPROVEMENTS AT PHILADELPHIA

> Our city has expended near three millions of Dollars in various experiments until the present works were completed & I am very sure the Citizens would not consent to sell them for 10 millions. We have been pioneers for the other cities & the result of our experience is heartily at their service.
>
> Joseph S. Lewis, chairman of the Philadelphia Watering Committee, to Mayor Josiah Quincy of Boston, May 28, 1825[1]

IN THE DAYS WHEN John Davis was superintendent of the Philadelphia water works, from 1802 to 1805, it was already evident that a better system would eventually have to be contrived. The heavy expense of feeding coal to two steam engines, the frequent breakdowns of one or the other, the inconvenience and fire danger to the city consequent upon these interruptions to the water supply were already matters of serious concern. Davis thought about the problem, as he explored the countryside in the vicinity of Philadelphia.

One spot in particular fired his imagination. Close to the Schuylkill about a mile above the Lower Engine House was the rocky elevation which had been called Fair Mount in William Penn's day and had been more recently known as Morris' Hill. (Today the stately Philadelphia Museum of Art occupies this site.) Davis spent many hours here, as agent for the Bank of North America, which owned property on the hill and was selling stone to the private company then building a bridge across the Schuylkill. Munching his lunch on the rocky summit, he would enjoy the fine view with the familiar dome of the Centre Square Engine House clearly recognizable about two miles to the southeast. To the eye of an engineer, Morris' Hill was ideally situated for a reservoir. If water were pumped to the summit from the Schuylkill, which ran past the foot of the hill, gravity would readily push it through the pipes of the entire city. Davis discussed this idea with members of the Watering Committee and particularly with Henry Drinker, who was both a member of that committee and cashier of the Bank of North America.[2]

For the time being, there was nothing to be done. The citizens of Philadelphia were too much burdened with the expense of constructing the Centre Square works to welcome the proposal that a new system should be built. John Davis moved on to Baltimore, and Frederick Graff took over the struggle with the balky engines.

By 1811, however, the inadequacy of the old system was too notorious to be tolerated much longer. Even when both engines were operating satisfactorily, the capacity of the water works was too small for a rapidly growing city. On October 24, 1811, the Councils directed the Watering Committee to investigate the situation and make recommendations. The Committee entrusted the task of making new surveys to Frederick Graff and John Davis, who took leave from his duties at Baltimore for this commission. Accompanied by William Rush of the Watering Committee, the two engineers made a careful examination of the old works, explored the east bank of the Schuylkill to a point above the Falls, and finally investigated the possibilities of Wissahickon Creek.[3]

The report of Davis and Graff, submitted on December 18, 1811, proposed a number of alternatives for the Watering Committee's consideration. The existing works might be overhauled at a cost of some $7,330, but they would still be expensive to operate, requiring some $18,000 a year, and subject to the serious objection that two engines must be kept constantly in operation.

A second alternative was to keep the reservoir at Centre Square, but to change the system so that both engines would be installed on the Schuylkill. This plan, estimated at $82,434 for initial expense and $11,886 for annual maintenance, would be much safer, since there would always be one engine available to pump while repairs were being made on the other.

The possibility of completing the old Delaware and Schuylkill Canal was considered, only to be quickly dismissed for a reason that had surprisingly enough not been suggested during the controversy of 1799: the level of the canal was less than three feet above the higher levels of the city and would provide an obviously inadequate head for a water supply. More promising was the idea of using the clear water of Wissahickon Creek, Franklin's suggestion of twenty years before. Expensive water power machinery and long iron mains would be necessary, however, bringing the initial cost to some $359,718 and annual maintenance to $23,783. Against this and against other proposals to harness the water power of the Schuylkill, the engineers raised the serious objection that ice might interrupt or injure the works during severe winters.

The obvious preference of Davis and Graff was for the plan that had captured Davis' imagination in earlier years, that of building a new

steam plant on the banks of the Schuylkill to raise the water into two reservoirs on nearby Morris' Hill. With two engines—one new, the other removed from the present works—interruptions in pumping would be avoided; while the construction of two reservoirs with an aggregate capacity of one million gallons would provide an additional margin of safety. The initial cost of this plan was estimated at $148,938; the annual maintenance would be only $8,360.[4]

The Watering Committee pondered the report of its engineers, made additional investigations of its own, and finally made its recommendations to the Councils on May 2, 1812. The Latrobe system, only eleven years old, was dismissed as hopeless: "So sensible indeed are your committee of the radical defects of the present works, that they believe no alteration or improvement can render them efficient."[5] After reviewing the other possibilities, the Committee concluded that the Morris' Hill plan was the one most likely to answer the needs of the City.[6] The Councils accepted this recommendation, the necessary property was purchased, and construction began on August 1, 1812.[7]

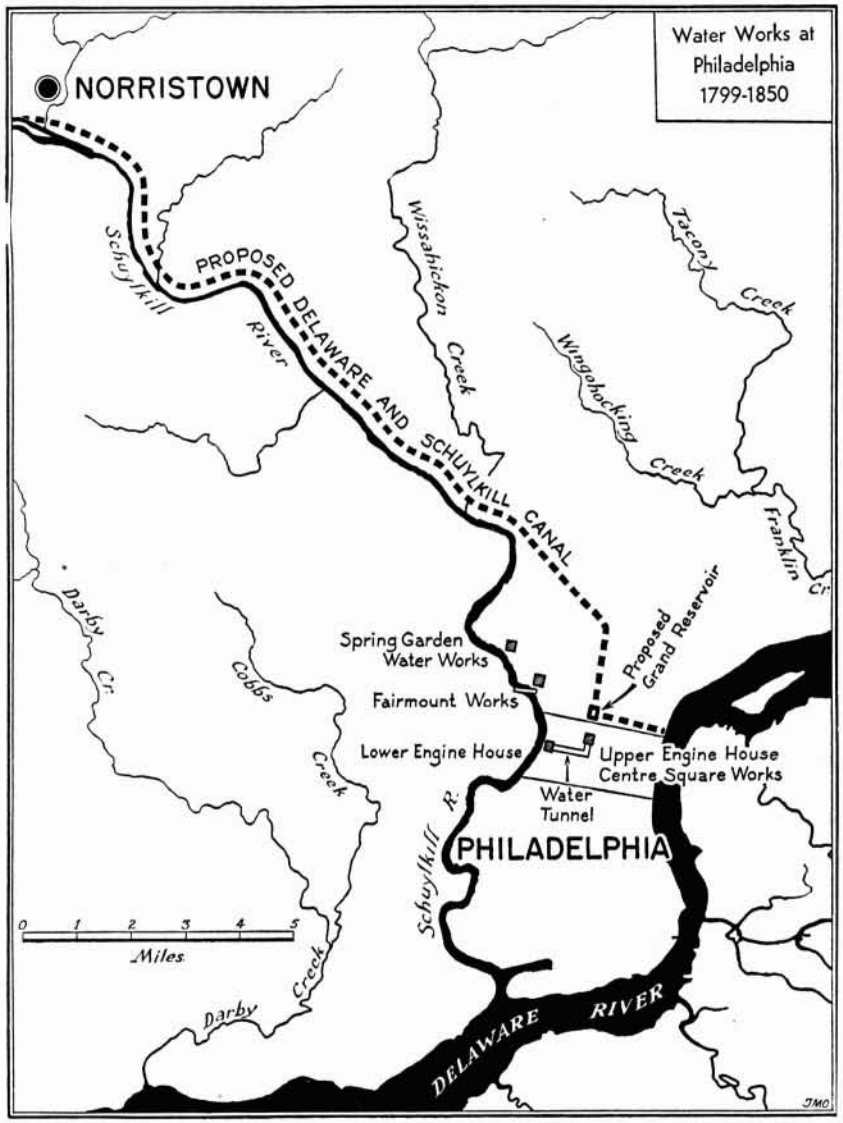
The new project did not escape criticism. On August 7, a letter in *Aurora* deplored the fact that sources had not been chosen which would permit the city to be supplied by gravity without resort to machinery. The writer also regretted that the water would still be taken from the Schuylkill, the purity of which he doubted. These same points were elaborated in another letter a few days later:

> To prove that the waters at present distributed are objectionable, it is only necessary to evaporate a small quantity in a clean vessel, and if they are so now, they will be so at Morris's hill, and continue to be still more impure, as the population increases on the banks of the Schuylkill, all the arguments of the most subtle and ingenious logicians and sophists to the contrary notwithstanding.[8]

On August 26, Edward Clark addressed the citizens of Philadelphia through the columns of *Aurora*, criticizing the decision to continue taking the water of the Schuylkill within the influence of the tides. He advocated taking the water of the same river, but higher up, and using water power from Wissahickon Creek instead of steam to work the pumps. Still another proposal for the use of water power was contained in a letter published November 12:

> . . . the plan I would propose to supply the city with water, is to obstruct the Schuylkill by a permanent dam near Morris' Hill, and thus acquire a power neither expensive nor liable to fail, and which might be ramified to a very great extent and would give birth to innumerable manufacturers at our very doors.[9]

This was exactly the idea which the city finally adopted seven years later.



Despite these misgivings on the part of some of the citizens, the construction of a new pumping station and a reservoir on Morris' Hill, now called by its old name of Fairmount, went forward. A new steam engine was laboriously cast and put together by Philadelphia foundry men. The machine was of the same Boulton and Watt type as the engines built for the earlier works by Nicholas Roosevelt. Its supposed superiority lay in its larger size and the substitution of iron for wood in important parts.[10]

The new system was put in operation September 7, 1815. Four months later the Watering Committee sadly reported:

> The experience thus far afforded by the use of the Reservoir warrants the opinion that it is in all respects perfect, no leak or defect having at any time appeared. But with respect to some other parts of the Works the Committee regret to be obliged to state, that they believe justice has not been done to the City. Both the boiler and pump appear to be leaky and defective, but whether these deficiencies are occasioned exclusively by bad or negligent workmanship, or arise in part from other causes, they are not at present able, with certainty to determine.[11]

Although the populous parts of the city were "much more generally and regularly supplied with water than at any former period," yet the Committee acknowledged that a smaller quantity than planned was flowing through the distributing pipes.[12]

To remedy these shortcomings the authorities counted upon two measures. By adding a sixth wooden main to the original five from the reservoir to the city they hoped to increase the effective supply. To provide a more dependable pumping service, they had ordered a second steam engine, to be built by Philadelphia's famous mechanic, Oliver Evans. This would operate upon radically different principles. Whereas the earlier engines had all employed low pressures from two and one-half to four pounds to the square inch, Evans' engine was designed to utilize pressures of two hundred pounds or more to the square inch[13]

The high-pressure engine was finally ready for use on December 15, 1817. In its trials it showed greater capacity for work than any of its predecessors, pumping 3,072,656 gallons in twenty-four hours. But its capacity to consume fuel also exceeded that of earlier engines. The annual operating charges for the new works exceeded $30,000, while annual receipts from the water rents were only about $20,000.[14] As though this were not trouble enough, the monster built by Oliver Evans exploded twice—once in 1818 and again in 1821—killing three men.[15]

Also disquieting was the fact that even with the sixth wooden main in use the citizens complained that the supply was inadequate. It was exasperating: the new engine could pump 3,000,000 gallons a day and the new reservoir had a storage capacity of 3,226,126 gallons, but no more than 1,000,000 gallons a day would flow through the pipes to the thirsty city dwellers. The Watering Committee acknowledged that at least twice that amount was required. Families living on high ground were without water in the summer months when they needed it most.[16] Frederick Graff confessed that the usual formulas for calculating the capacity of pipes had made far too little allowance for the friction encountered over long distances and with many angles at the street corners. When the new works were begun, the original plan had been to lay down a single

cast iron main of 14-inch diameter, but smaller wooden pipes—five of 6-inch diameter and one of 4½ inches—had been substituted because of fear that the iron pipe could not be obtained in time and that it might leak at the joints from expansion and contraction. That this continued reliance on wooden pipes had been a mistake was now all too obvious.[17]

In November, 1818, the Watering Committee recommended that a large iron main be substituted for the six small wooden ones between the reservoir and the heads of the principal streets.[18] The following month the Councils authorized a loan of $70,000 for this purpose. To procure the nearly two miles of 22-inch and 20-inch iron conduit pipe required for the job, contracts had to be made both in the United States and in England.[19] The Councils memorialized Congress to remit custom duties upon the foreign pipe, but no such breach in the tariff wall was permitted.[20] The new main was completed in 1820, and results were so satisfactory that plans were at once made to substitute iron for wooden pipes in the important mains that ran down Chestnut and Market Streets.[21] From this time on, the city of Philadelphia became an avid customer for iron pipe, laying down over 10,000 feet a year for over a decade. The high point came in 1827 when 41,000 feet—almost eight miles—were put in place. But the old bored logs continued to be used in many of the side streets. As late as 1832 there is a record of 220 feet of wooden logs being laid.[22] The substitution of iron for wooden pipe did not become complete until 1849.[23]

Through trial and error the city had finally found the road to an efficient distributing system. But the water works could not be really considered a success until some more dependable and less expensive means had been developed to pump water into the reservoir. Even in Latrobe's day one school of Philadelphia thought had strongly favored proposals for the use of water power. The various engineers whom the city had employed had not considered any of the earlier schemes feasible, but after 1815 the situation was radically changed.

Curiously enough, the story of Philadelphia's water supply, which had been so closely entwined with that of the Pennsylvania canal projects during the 1790's, picked up this theme again a decade later. Stockholders in the two moribund canal companies—the Schuylkill and Susquehanna, and the Delaware and Schuylkill—never gave up hope that these projects could be revived. As early as 1808 they applied to the Legislature for a new charter, which would merge the two old companies into one new one and grant some form of state aid. They still dreamed of supplying the city of Philadelphia with water. A pamphlet of 1808 declared: "The supply of pure water, and in greater quantity than can now or hereafter be supplied by means of the water works is,

from experience, now wished in every part of the city and neighborhood of Philadelphia; and no other mode, than by a canal, can be devised."[24]

On April 2, 1811, the Legislature complied in part with these requests. The Union Canal Company of Pennsylvania was chartered with the stockholders of the two old companies receiving shares in the new. Among the powers granted was that of contracting with the municipality of Philadelphia to supply the city with water; the new corporation might contract for the same purpose with the suburb of Northern Liberties or with bodies corporate or individuals elsewhere.[25]

The Union Canal Company never had an opportunity to utilize these water supply privileges. The state had nothing more in the way of tangible aid to offer than the familiar privilege of selling lottery tickets, and canal lotteries were now regarded with well-founded suspicion by the public. Not until 1827, after many vicissitudes, did the Union Canal Company finally complete a waterway from Middletown on the Susquehanna to Reading on the Schuylkill. The idea of extending the canal to the Delaware had to be abandoned.[26]

Meanwhile, a different type of inland waterway was being developed by the Schuylkill Navigation Company, chartered by the Legislature on March 8, 1815. The new idea was to make the Schuylkill itself navigable by a system of dams, locks, and short canals. In addition to ample powers to construct such works, the Legislature granted the Company extensive rights to harness the water power of the river and to use, lease, or sell this power.[27]

Disillusioned with steam engines, the Philadelphia Watering Committee began to investigate the possibility of coming to some arrangement with the Schuylkill Navigation Company, whereby the city might obtain water power to pump its supply into the Fairmount reservoir while the Company would obtain the dam and locks that it needed for its waterway. In November, 1818, the Committee employed Captain Ariel Cooley of Chicopee, Massachusetts, to examine the banks and bed of the Schuylkill near Fairmount and ascertain whether a dam at that point would be feasible.[28] The report was favorable, and the Committee then undertook to obtain the necessary water rights.

The Schuylkill Navigation Company, hampered by an insufficiency of funds in carrying its waterway past the Falls of the Schuylkill, gladly signed an agreement, whereby the city was granted the right to erect a dam across the river. To accommodate navigation past this barrier, the city was to construct and deliver to the Company a canal and locks. The Company was to draw as much water from the dam as it deemed necessary for navigation; all the remainder of the water might be used by the city.[29]

Before it could proceed with the new plans, the city also had to come to terms with Josiah White and Joseph Gillingham, whose valuable mills at the Falls of the Schuylkill would lose their power if the new dam were built. To purchase these rights, the city agreed to pay $150,000.[30]

After having made these tentative arrangements through the shrewd bargaining of Joseph S. Lewis, its chairman, the Watering Committee appealed to the City Councils for authorization to proceed with the new project. In reports dated February 5 and March 8, 1819, the Committee argued that the substitution of water power for steam might cost the city in the first instance as much as $346,000, but that it would reduce the operating costs from over $30,000 a year to less than $23,000. In addition, a much larger supply would be available.

> The committee are sensible, that the cost of the contemplated work is large; but when it is considered, that a safe and an economical means of obtaining 10,000,000 of gallons of water can be had, in lieu of a costly and precarious supply of but little more than 2,000,000, and at the cost of not much more than one half, without calculating on the sale of a gallon to our neighbors in the districts; it is conceived that councils should not reject a plan so long sought for; hitherto unattainable; and if now suffered to escape from our grasp, never to be reclaimed. The committee believe, that their fellow citizens view with anxiety the accomplishment of a measure so important to the health of this great city; already combining so many advantages, and which if this plan be carried into effect, will, at so small an expense, be better watered by artificial means, than any other in the world.[31]

On April 8, 1819, the Councils authorized the expenditure of $350,000 on the new works,[32] and on April 19 construction began under the direction of Captain Cooley. The news of these proceedings occasioned some criticism. In a letter published in *The Union* on April 27, "Economy" reviewed the "errours" which had cost so much money. Mr. Latrobe's error in building the Centre Square Works instead of taking water from the Wissahickon had cost $200,000; the error of building the Fairmount steam works had cost $150,000; the error of laying wooden pipes and having to replace them with iron had cost $70,000. "Errour the 4th," "Economy" argued, was this latest project: "valuable works at the Falls are to be ruined; a vast deal of valuable land to be flooded, and the health of a beautiful district to be endangered, for the purpose of making a new experiment, which is to cost $350,000." He concluded with these suggestions:

> Now, sir, to remedy all these evils, and save a vast deal of this money, let the Watering Committee establish their water wheel at the Falls and construct a basin for head water there, and conduct it to town down the old canal; or let them set the engine at the Centre Square in operation, in conjunction with those at Fair Mount, and the two together will give an ample supply for the present.

By a division of labors within the Watering Committee, the responsibility of supervising the construction of the new works was entrusted to a building committee headed by William Rush. Captain Cooley appears to have been a builder of the old school, who improvised his solutions to difficulties as they arose. In order to get the Captain's inspirations committed to paper, the building committee had to call upon the drafting ability of the faithful Frederick Graff. In the spring of 1820, after construction had been in progress for a year, Rush and his associates became so worried about the adequacy of Cooley's dam that they required the builder to pull down several hundred feet of it already completed and rebuild on a more substantial plan.[33] The Watering Committee also became nervous lest the dam not be high enough to provide all the power that was wanted. The agreement with the Schuylkill Navigation Company was renegotiated in 1820 to permit the city to add eighteen inches to the height of the dam over that originally planned.[34]

By still another enlargement of the project the city decided to build a second reservoir on the hill at Fairmount. This would give an additional storage capacity of 3,500,000 gallons and would enable the city of Philadelphia to offer a supply to such neighboring districts as Spring Garden and Northern Liberties. The same wish to construct the new works on a scale to meet future needs was evident in the decision to erect mill buildings large enough to house eight water wheels and pumps even though only three were to be immediately installed.[35]

As finally executed, the new water works were impressive in their massive strength and beauty. Although the Schuylkill was a stream of moderate size—only about 900 feet in width—the problem of erecting a dam had been complicated by several factors. At one point the river was about thirty feet deep, but the bed was highly irregular. Near the eastern bank a thick layer of mud covered the underlying rock; near the western shore the river was so shallow as to leave the rocky bottom exposed during low tide. The Schuylkill, moreover, had a bad reputation for sudden and violent floods. To confine this unruly stream, Captain Cooley built a barrier of logs, earth, and stone, which for most of its length crossed the river in a long diagonal line. This gave an overfall of 1204 feet and greatly reduced the danger that the dam would be carried away by a freshet. This long overfall was joined on the west to the horizontal pier that stood at the head of the two locks and the canal built for the Schuylkill Navigation Company; on the east it was connected to a short earthen dike and beyond that to the head arches of the mill race for the water works. In all the dam and its adjuncts extended for 1600 feet; water was backed up the river for six miles.

The mill race and mill buildings were built on a site blasted out of solid rock at the point where Fairmount Hill rose sharply from the bank of the river. This was before the age of dynamite, and the contractor had to explode twelve thousand dollars worth of gunpowder in this part of the work. Through three head arches water from above the dam was admitted into the mill race, 419 feet long and 90 feet wide. Between the race and the river stood the stone mill buildings which housed the water wheels and pumps. Water was carried through the mills in flumes that joined the mill race at right angles. After passing over the great wheels, fifteen or sixteen feet in diameter and fifteen feet wide, the water was discharged through arches into the river below the dam. Cranked by the water wheels were powerful double forcing pumps, designed by Graff, which pushed water from the water wheel flumes into an iron main that passed under the mill race and thence up the rocky hill to the reservoirs.

The new buildings were given the familiar cloak of the Classical Revival. Seen from across the Schuylkill, the water works suggested the cluster of temples and porticoes surrounding some ancient Greek acropolis. Equally striking was the vista presented on the other side, where a railed terrace and steps formed a handsome walk along the side of the mill race and across the top of the head arches and the earthen dike out to the charming colonnaded pavillion, from which one could look down on the water passing over the dam.[36] Once again, as at Centre Square, the authorities had sought to serve the aesthetic needs of the city while assuaging its thirst.

The new works proved a great success. Even before they were opened the dam was thoroughly tested in February, 1822, by the highest water that men remembered along the Schuylkill. The water rose nine feet above the overflow, but the dam held and misgivings about the new project were thereby quieted. On July 1, 1822, the first of the water wheels was put into operation; the second and third were added in September and December respectively. On October 24, 1822, the steam engines, which had caused so much trouble, were finally stopped.[37] For the first time, the city possessed a system that not only supplied immediate needs but provided a comfortable margin for future expansion. The Watering Committee was happy to discover that it had underestimated the lifting power of its water wheels: instead of requiring forty gallons on the wheel to raise one gallon to the reservoir, thirty gallons proved more than ample; each of the three wheels was capable of pumping 1,250,000 gallons in twenty-four hours.[38]

Financially, the investment appeared to be eminently sound. The new works had cost $432,512, and the annual interest charge thereby

incurred was $24,230. Operating expenses were small: two men were employed to attend the works twelve hours at a time, alternately day and night; their pay, and the cost for fuel to heat the mill building, light, tallow, and incidentals amounted to only four dollars a day, or less than fifteen hundred dollars a year. Thus the combined interest and operating costs of the new works were substantially lower than the annual expense of $30,000 on the old steam plant. But the real advantage of the water power system was that the supply could be greatly increased at only a small increase in the costs. The greater the gallonage, the greater the ratio of advantage over steam, according to calculations made by the Watering Committee in 1824. If additional machinery were to be installed so that the Fairmount works would deliver their full potential of ten million gallons a day, operating costs would only increase to ten dollars a day, whereas to pump this amount by steam would cost $550 a day.[39]

Under these circumstances, the Philadelphia authorities were eager to increase water revenue by supplying the neighboring districts. But these townships, jealous of their independence and fearful of new tax burdens, were reluctant to come to terms. Whether or not to take the Fairmount water became a hot issue in local politics. The first significant victory for the water faction was won in Spring Garden. On April 26, 1826, the commissioners of this district agreed to a contract with the city of Philadelphia, whereby the district would lay its own distributing mains to connect with the Fairmount reservoirs. Water users were to pay rates fifty per cent higher than those established for the city; the commissioners of Spring Garden were to collect these rents and retain six per cent of the revenue. A similar agreement between the city and the district of Southwark was signed June 1, 1826.[40]

In the Northern Liberties the need for water was dramatized when a fire in May, 1825, destroyed almost thirty houses—the third serious conflagration in the district in a period of three years. Even with this warning the voters in the fall election again rejected candidates pledged to introduce the Philadelphia water. But the example of Spring Garden inspired the water faction to a new effort the following spring. Public meetings were organized, and sufficient pressure was brought to bear upon the commissioners to induce them on June 6, 1826, to enter upon an agreement with the city, similar in terms to the Spring Garden contract.[41] Kensington began to take the Fairmount water in 1833.[42]

With these new arrangements completed and promptly carried into execution—Spring Garden had over one hundred water takers as early as January, 1827[43]—the Fairmount Water Works entered upon its golden age. With revenues increasing rapidly and expenses declining, with

an ample supply for present needs, and with surprisingly little suspicion expressed concerning the purity of a supply taken so close to the city, the Watering Committee had no major worries. In 1830, for the first time receipts from the water works exceeded expenditures. The receipts were $60,036.82; the expenditures were $35,660.84. There were over ten thousand water takers that year, and the average daily consumption exceeded two million gallons.[44]

In January, 1837, the Watering Committee enlarged upon its regular annual report to review the extraordinary progress achieved since 1823, the first year in which the water power works were in full operation. In 1823, three wheels and pumps were in operation; 6½ miles of iron pipes had been laid; 4,844 tenants were supplied with 1,616,160 gallons of water daily; and the annual revenue was $26,101.05. In January, 1837, six wheels and pumps were in operation; 98 3/4 miles of iron pipes had been laid, 19,678 tenants were supplied with 3,122,164 gallons of water daily; and the annual revenue was $106,432.37.[45] The two reservoirs of 1823 with their total storage capacity of seven million gallons had grown by 1837 to four reservoirs with a total capacity of twenty-two million gallons.[46] In 1837, 1,492 Philadelphians enjoyed the luxury of bathrooms with running water; three thousand citizens, on the other hand, still patronized the free pumps in the streets.[47] "Blessed as we are," declared the Watering Committee, "above every other city of the Union, and perhaps not excelled by any in the world in the cheap and abundant supply of pure and wholesome water we now enjoy, the preservation of the Water Works becomes a matter of individual interest to every citizen."[48]

General satisfaction with the Fairmount system during these years did not prevent a succession of controversies in which the Water Works were involved. William Rush, the strong-minded sculptor who had served on the Watering Committee for many years, did not trust the Fairmount Dam. In 1823, he urged the expenditure of a large sum of money in strengthening the structure by throwing loads of stone in front of it. The proposal was strongly opposed by Joseph S. Lewis, chairman of the Committee.[49] In 1826, Rush was dropped from the Committee, but his criticisms of the dam continued. In 1828, the issue became so controversial that several engineers were commissioned to examine the structure and make their recommendations. On the basis of these findings, the Watering Committee concluded that the dam was safe, but recommended annual inspections.[50] Rush stubbornly clung to his position: the dam should be strengthened. "Why keep it in such a state," he demanded, "that would make it requisite to employ competent men extraordinary to watch it? Why not secure it amply while we have it?"[51]

The crotchety sculptor also protested against the attempt of admirers of Joseph S. Lewis to give all the credit for the Fairmount works to that gentleman. In a long communication to the *Philadelphia Gazette* on January 8, 1830, Rush reviewed the history of the project and claimed that the glory should go to the whole Watering Committee of those years, himself obviously included.

The able and aggressive Lewis was a storm center of controversy. For eight years, from 1817 through 1825, Lewis worked unremittingly to improve the city water supply. His administrative talents apparently impressed the stockholders of the Schuylkill Navigation Company, because in 1825 they elected Lewis president of their corporation.[52] Thereafter he fought to advance the interest of the Company as vigorously as he had previously battled for the city.

While the Schuylkill Navigation Company was weak, it was glad to transfer some of its rights to the city in return for needed assistance. In 1824, the two parties came to an agreement whereby the city was to pay the Company twenty-six thousand dollars and receive in return all the water power at Fairmount. The city might use all this power itself or sell a portion of it to manufacturers. In order to prevent waste of water the city was to have charge of the locks and canal at Fairmount, although any tolls collected were to be turned over to the Company. As an important safeguard to the purity of the supply, the Navigation Company promised to introduce a covenant in all its future sales of water power on the stretch of the Schuylkill immediately above the dam. This covenant would prohibit the discharge of dye stuffs and other injurious industrial wastes into the river.[53]

Joseph S. Lewis, in his first incarnation as chairman of the Watering Committee, was chiefly responsible for making this agreement to protect the water works. The same Joseph S. Lewis, as president of the Schuylkill Navigation Company, successfully torpedoed the rights that the city had purchased. After the completion of its waterway in 1825, the Company suddenly rose from rags to riches. By 1832, trade was crowding its canals; dividends were high; and the stock of the Company was selling at a large premium. To make the enterprise even more profitable, President Lewis and his fellow-managers decided that enlarged facilities were needed. On October 2, 1832, Lewis bluntly notified the Watering Committee that the Company deemed it necessary to build an additional lock past the Fairmount dam. "In doing this, it will be necessary to remove the present lock-tender's house, and measures are taking to erect another of larger dimensions in lieu of it."[54]

Disturbed by Lewis' assumption that the Company had the right to proceed with its plans without further preliminaries, John Price Wetherill, the new chairman of the Watering Committee, sent a warning reply: the Committee could not assent, without further explanation, to an additional lock at Fairmount; having been put in possession of the locks and canal as well as the toll house, the city was believed to have rights which would be invaded if the Company should proceed without its previous assent. But Lewis rejected the city's demand to be consulted. On November 27 he wrote:

> The Board do not suppose that their right to use the water and water power of the river for the purposes of navigation to the extent they may deem necessary, is subject to any question, nor that the alterations in the use of it at Fair Mount are such as make it proper for them to communicate these alterations to the city councils for their approbation. They are not aware that the management of the locks and canal at Fair Mount is to be classed among the rights of the city, but rather that it is a duty, which in relief of the Navigation Company, the city covenanted to perform.[55]

Startled by this extraordinary interpretation of the agreement of 1824, the Watering Committee sought the advice of the city solicitor. The opinion of this gentleman was that the city was entitled to the use of all the water of the Fairmount dam except that required for the existing canal and locks, that the Canal Company was not entitled to water for any additional locks, and that, except in case of neglect by the city to make repairs, the Company had no right to alter the condition of the locks, canal, toll-house, or ground adjacent thereto.[56]

The Company, however, was prepared to return fire, volley for volley. Three of the biggest guns of the Philadelphia bar, John Sergeant, Horace Binney, and Charles Chauncey, obligingly provided an opinion which sustained the right of the Navigation Company to draw as much water from the dam as they deemed necessary, to build another lock and canal, to remove the lock-keeper from the toll-house, and to remove the toll-house. The Company lawyers based their case on the primacy of navigation over every other use of the river. The charter of the Company had given it the right to sell water power only to the extent that this did not impede navigation. In its conveyances to the city, the Company had, whether explicitly or implicitly, reserved the use of as much of the water as might be necessary for the purpose of navigation.[57]

The city offered to submit these important legal issues to the courts, but the Company refused to wait for the slow processes of the law. The impatient Lewis wanted his new lock and proceeded to get it. Despite the protests of the city officials, excavations for the new canal were begun in December. The keeper, whom the city had employed to tend the locks, received notice from the Company that he must vacate the toll-house on or before December 22. The city ordered the keeper to stick to his post and employed another man to help guard the premises. By January 2,

1833, the besieged keeper notified Graff that the Company was digging close to the steps of the toll-house, which had come to symbolize the whole conflict of interests between the city and the Company.[58]

Lewis defeated the city and seized control of the disputed citadel by a dazzling maneuver. On the statute books of Pennsylvania stood an act of 1826 which provided that if any lock-keeper or other employee should be discharged from his employment by the managers of a canal company and should refuse to deliver up possession of the office or property of the company, he might be removed from the premises by a constable or other peace officer acting upon a warrant issued by any justice of the peace.[59] On January 24, the Navigation Company gave notice that the Mayor, Aldermen, and Citizens of Philadelphia were "hereby discharged from the present care and attendance of the locks at Fair Mount." In a contemporary pamphlet the audacity of this step is thus described:

> It was a modest resolution and was well worth reading twice over. The mayor, Aldermen and Citizens of Philadelphia are DISCHARGED from attendance of the locks at Fair Mount: how summary! how modest! The City have paid $26,000 to secure to themselves a right, and the Navigation Company DISCHARGE THEM from the trouble of enjoying it.[60]

But the action was not too absurd to deter a cooperative justice of the peace from issuing the warrant for which the Company applied. On February 4, 1833, Joseph Lewis, accompanied by a constable and fifteen or twenty employees of the Company, entered the toll-house, and compelled the keeper to remove his furniture and to leave the premises. To make the *coup de main* complete, the Company promptly tore down the toll-house and proceeded to build its new lock.[61]

The Watering Committee was indignant. To the City Councils it voiced its solemn warning that deprivation of all power to prevent wastage and diversion of the Schuylkill water might deprive the municipality of its water supply. "The agreement of 14th June 1824, between the City and the Company, has become practically a dead letter; and the sum of twenty six thousand dollars, paid by the City, in good faith, according to its terms, is worse than thrown away."[62] To Lewis, Chairman Wetherill protested that his high-handed policy was threatening the security of the city. The Company's bland assumption that there was a surplus of water in the Schuylkill available for its new works was unfounded.

> In the months of August, September, and October last two-thirds of the top surface of the dam was dry, and there was not water enough in the river to drive six wheels and pumps, without drawing down the water below the top line of the dam. . . . A diminution of water, therefore, occasioned by the increased demand of the Company for their locks, will render the City water works unfit for use. It will be recollected, that during the months referred to, the water in the river is always at its lowest ebb, and at the same time the demands of the City, even in healthy seasons, are the greatest. A return of the epidemic, which during a part of the last season prevailed, and is believed to have been assuaged by a free distribution of water in the City and Districts, would be attended with consequences too mournful to be contemplated without alarm.[63]

The epidemic referred to was the great cholera plague of 1832. The mortality in Philadelphia was considerably lighter than in New York and other cities, and this partial deliverance was attributed to the liberal use of water in keeping the streets clean.

Some of the Philadelphia citizenry shared the Watering Committee's indignation. One writer complained bitterly that "we wash our faces and boil our tea-kettles by sufferance of the Schuylkill Navigation Company."[64] But the Company had become a powerful political influence, and the city's attempts to defend its rights were lacking in vigor.

On April 4, 1833, the City Councils directed the Watering Committee to bring suit against the Company and to apply to the Legislature for a law to clarify the city's rights at Fairmount. But neither of these steps brought results.[65] The Legislature took no action, and the law suit remained pending for years. Periodically, the Watering Committee would enter upon negotiations with the Company in an attempt to settle the issue. In 1841 and 1842 there seemed a good possibility of coming to an agreement on the basis of raising the dam sufficiently to provide the additional water needed both for navigation and the water supply. But the negotiations broke down, and the Watering Committee concluded that "so long as the Company be permitted to hold the property wrested from the City, and to make use of the weighing-lock (which last summer consumed 5,000,000 gallons of water per day, contrary to agreement), it will not feel any disposition for the reconciliation so much desired by the City."[66]

The city had better success in defending the water works against other threats. Since Fairmount was located beyond the city limits in the district of Spring Garden, the struggle to protect the works often centered in the Pennsylvania Legislature. In December, 1828, the Philadelphia authorities were disturbed by reports that the commissioners of Spring Garden intended to lay out new streets through the Fairmount property. On December 11, a memorial from the Mayor and Councils praying for the passage of a law to prevent this was presented to the House of Representatives.[67]

Frederick Graff made a trip to Harrisburg to urge upon the legislators the importance of protecting the water works. The frustrations of an engineer turned lobbyist were reflected in Graff's letters to his wife. "The rascals from the country whom we treated so well at F. Mount are

all against us," he reported, "in fact they are a set of cut throats."[68] And a few days later he added: "When I last wrote to you I did expect that our bill would have been brought up yesterday but alas instead of hearing some arguments in favour of Fair Mount I was obliged to sit and listen to a sett of Lincompoops [*sic*] from the woods arguing what is best to injure Philadelphia. I say injure, because they have not judgment to do it a service."[69]

Despite the cut throats and Lincompoops Graff's efforts were eventually successful. On February 13, 1829, an act was passed which prohibited any person from surveying or laying out any street, road, lane, court, or alley over or through any part of the property of the city of Philadelphia situated at Fairmount.[70] Later in the session further protection to the water works was provided in the act incorporating the Northern Liberties and Penn Township Rail Road Company, intended to link the Delaware and Schuylkill rivers and to connect with the new state railroad from Philadelphia to Columbia. The charter provided that "the said rail-road shall not be carried through the property of the city of Philadelphia at Fair Mount, without the consent of the select and common councils of the city."[71]

Less than a year later, however, the water works were threatened by another development. The earlier surveys for the state railroad had provided for it to cross the Schuylkill at Peters' Island some two miles north of the Fairmount dam, but in the fall of 1829 the Board of Canal Commissioners recommended another route which would carry the railroad along the west bank of the Schuylkill to a point opposite Fairmount and then across the river a short distance below the dam. Frederick Graff reported that the new plan would seriously jeopardize the water works. The piers for the railroad bridge would so seriously obstruct the river that ice and water would back up and cause floods. Continued high water over a period of hours would make it impossible to use the water wheels for filling the reservoirs and might cause a failure in the water supply, thereby exposing the city to danger from sickness and fire.[72] The Watering Committee added its warning:

> The works are superior to any similar ones in the civilized world, and do honour to the enterprise of Philadelphia; and your Committee cannot for a moment suppose the legislature of the state will place them at the mercy of a rash experiment, which may, nay *will*, destroy the comforts of 200,000 people.[73]

The Councils unanimously passed resolutions remonstrating to the Legislature against authorization of a railroad bridge at Fairmount and urging the Peters' Island route, instead.[74]

This danger was averted, but similar issues arose within the next few years. In 1835 and 1838, the city found it necessary to oppose proposals

which would have diverted the Schuylkill water into a new canal to be built upon the west bank of the river.[75]

Much more serious was the controversy that arose after 1840 between the city of Philadelphia and the neighboring districts. Earlier contracts had provided that the water rents should be fifty per cent higher in the districts than in the city. Presumably this had been considered equitable to compensate the citizens of Philadelphia for the expenditures and risks that they had taken in connection with building their various water works. But, as the water revenues of the city mounted, the differential in the rates became a source of resentment.

Unsuccessful in obtaining a reduction, the commissioners of Spring Garden appealed to the Legislature for authority to build their own water works on the Schuylkill above Fairmount. The Philadelphia Councils instructed the Watering Committee to take whatever steps they deemed expedient to prevent the passage of such a bill.[76] On January 23, 1843, the Councils approved a long memorial to the Legislature, contending that any diversion of the water above the Fairmount dam would violate the water power rights that the city had purchased from the Schuylkill Navigation Company and other owners. To obtain these rights and to build the water works with their numerous enlargements and repairs, the city had now expended over two million dollars.

> Your memorialists further state, that by the means and expenditures aforesaid, they have furnished to the City and Districts an ample supply of pure and wholesome water for the extinguishment of fires, the supply of manufactories, for the cleansing of streets, lanes and alleys, necessary to the health and comfort of the inhabitants, and for domestic and culinary purposes at a fair and reasonable price, as low, and it is believed lower than in any other City or town in the United States.[77]

The Philadelphia memorial denied Spring Garden's contention that it was necessary to authorize new water works because the Fairmount reservoirs were not high enough to supply some sections of the district. If such a necessity existed, "no application has ever been made to your memorialists to supply the want of water of which they complain—such an application would have met with a prompt reply and been responded to on terms more easy and liberal than the same could be done by the said District in the manner now proposed."[78]

To strengthen its case before the Legislature, the city asked two leading Philadelphia lawyers, W. M. Meredith and Horace Binney, to write opinions on the important legal issues involved. In view of the state's previous grants to the Schuylkill Navigation Company and the city's purchase of water power rights from that corporation, did the Legislature now have the right to grant Spring Garden authority to draw its water supply from the pool above Fairmount dam?

Meredith argued that a navigable river was a highway, under the control of the Legislature for purposes of improvement. The rights of fishing, washing, and drinking were merely incidental. When they were so used as to impede the navigation, the use became unlawful. The Legislature had incorporated the Schuylkill Navigation Company for the purpose of improving the river as a highway. As part compensation for the expense incurred in these improvements, the water power created by the improvement beyond what could be used for navigation had been granted to the Company. The Company had in turn conveyed these water power rights to the city of Philadelphia, which now held them "by a tenure as sacred and inviolable as that by which any citizen holds his lands under the patent of the Commonwealth."[79] The district of Spring Garden therefore had no right to diminish the water power by taking a water supply from the pool above the dam. Horace Binney concurred in Meredith's reasoning and concluded that "if the bill passes, it will infringe the rights of the City of Philadelphia, derived from a contract and grant of the Commonwealth."[80]

But the petition of the city and the ponderous arguments of its counsel were brushed aside at Harrisburg. On April 18, 1843, an act was passed authorizing the incorporated districts to construct their own water works on the Schuylkill. The law was not to go into effect if the city of Philadelphia within three months should reduce water rents in the districts to the same rate charged citizens of the city.[81]

Convinced that the courts would uphold the city's exclusive rights, the Watering Committee advised against any reduction in the rates. "Whatever our rights are," the Committee declared, "we prefer that they should be ascertained by the proper judicial tribunal, rather than make them the subject of capricious assault, or legislative coercion."[82] Yet the door was left open for compromise: the city would reduce its rates if the districts would agree to long-term contracts.[83]

The commissioners of Spring Garden showed no disposition to accept these terms. Instead they continued to make plans for a steam plant to supply both their own district and the adjoining district of Northern Liberties. On September 29, 1843, the Philadelphia Councils directed the Watering Committee to notify these neighboring townships that it was the purpose of the city to maintain its exclusive right to the use of the water of the Schuylkill above Fairmount dam. The Committee, however, was authorized to reduce the water rents of any district which would contract to receive its supply from the city for twenty years.[84] On November 9, a Joint Special Committee of the Councils was appointed to confer on the problem with committees from the districts of Spring Garden and Northern Liberties.[85]

As a result of these negotiations, the city offered new concessions in January, 1844. The districts might receive water at the same rates that were charged in the city, provided they would contract to take the water for ten years. The problem of a supply for the high portion of Spring Garden and Northern Liberties would be met by a new reservoir. This would be constructed at the expense of the districts, but the city would pay five per cent interest to the districts on the amount thus expended.[86] The Councils stipulated that this offer would be withdrawn unless it were accepted on or before March 7, 1844.[87]

The two districts allowed the time limit to expire without agreeing to a settlement.[88] The project for a Spring Garden and Northern Liberties Water Works was put into active execution. Water Commissioners for the two districts had reported that the cost of building a steam plant, reservoir, and necessary conduits would be about $173,000. Annual costs would be from $23,000 to $26,000 and annual revenues not less than $42,000.[89] The site chosen for the pumping station was on the east bank of the Schuylkill just above Girard Avenue. Construction proceeded rapidly and the new supply was put into use in December, 1844. A year later the district Water Commissioners reported that the works were a complete success. Construction costs had somewhat exceeded estimates, but the annual operating expenditures were less than expected and the enterprise showed a profit for its first year of operation.[90] Kensington contracted to take its water from the new works; Southwark alone continued to draw its supply from Fairmount, having entered upon a new ten-year agreement in 1843 under which water rents were reduced to the level of those charged in the city.[91]

The Philadelphia officials refused to acknowledge that the battle was lost. Counsel for the city applied to the Court of Nisi Prius for an injunction to restrain the Commissioners of Spring Garden and Northern Liberties from diverting or using water from the Fairmount pool. On August 25, 1845, the court granted this petition, but the districts appealed from this decision to the Supreme Court of Pennsylvania.[92]

While this appeal was pending, the Philadelphia Councils attempted to capitalize on their victory in the lower court. On August 28, they proferred an olive branch to the districts in the form of a resolution offering to receive and entertain favorably any just and fair proposition for an equitable adjustment of the controversy. But the Spring Garden and Northern Liberties authorities ignored this overture.[93]

On February 3, 1847, the Pennsylvania Supreme Court finally handed down its decision. The injunction of the lower court was set aside on grounds important for the future of American water works. The use of water, flowing in its natural channel, declared Chief Justice John B.

Gibson, "has been held by every civilized nation, from the earliest times, to be common by the law of nature."[94] The domestic uses of water were its natural and primary ones. No one, therefore, could have an exclusive right to the water of a river without contravening one of the most peremptory laws of nature. Coming to the crux of the controversy, the Chief Justice said: "Now, a grant of water-power is not a grant of the water for anything else than the propulsion of machinery; and it consequently does not exclude the use of it by any one else, in a way which does not injure or decrease the power."[95] In the opinion of the court, Philadelphia had suffered no actual damage either to its water power or to its water supply from the construction of the new water works. The districts were drawing only about 2,000,000 gallons a day from the Fairmount pool, while 150,000,000 to 500,000,000 gallons a day were permitted to tumble over the dam. With extraordinary optimism the Chief Justice predicted that the Schuylkill would provide water to spare, even if Philadelphia grew to the size of London.[96]

Defeated both in the Legislature and the courts, the city had to reconcile itself to the loss of its water revenues from the districts. The bitterness of the controversy was lessened when the Philadelphia authorities found an opportunity to repay good for evil in a dramatic gesture of Christian forgiveness. On the night of November 11, 1848, the Spring Garden reservoir suddenly gave way, releasing a flood of water that pushed its way through the walls and grounds of Girard College back into the Schuylkill.[97] In an instant thousands of houses were bereft of water, and the districts were exposed to the danger of widespread destruction if fire should break out while the hydrants were empty. The district Water Committee had to swallow its pride and humbly request Frederick Graff, Jr., who had succeeded his famous father as superintendent at Fairmount upon the latter's death in 1847, to allow the city water once again to flow through the pipes of Spring Garden, Northern Liberties, and Kensington. Graff immediately complied, and by ten o'clock in the morning the districts had the supply so necessary to their safety and comfort.[98] Two weeks later repairs on the reservoir were sufficiently completed for the neighboring authorities to dispatch a note remarkable for its Quaker bluntness:

> Friend Graff,—We are ready to let in our own water now, and propose that the stops between the City and the Districts should be closed precisely at 1 o'clock this day—our Superintendent will be at Sixth and Vine at that hour precisely.
>
> Respectfully,
>
> 11th month 25th, 1848 Baker & Neal
> Committee[99]

Although Philadelphia's pride had been wounded by what was regarded as the unfilial behavior of the districts, the building of additional water works was really a good thing. The population of both the city and the districts was increasing rapidly. In 1840, the population within the city limits was 93,665; that of the districts was 112,185; by 1850, this had increased to 121,376 for the city and 218,439 for the districts.[100] The facilities at Fairmount were scarcely adequate for those still dependent upon them. In February, 1851, Graff reported to the Watering Committee: "It is well known that we now have our mill house filled with machinery to its utmost capacity, and moreover, that we cannot do much more than keep pace with the demand for water at present."[101] Later in the year the engineer advised against complying with the request of West Philadelphia to be supplied with water: "The rapidly increasing consumption of water by the city and lower districts and the limited power of our present works, should, I think, admonish us to observe very great caution in extending the bounds of our supply. . . ."[102]

By 1850, therefore, the period of Philadelphia's freedom from major water supply worries was almost over. Average daily consumption was now about five million gallons and during the hot summer months it rose above seven million gallons. The reservoirs would hold only about three days supply, a totally inadequate reserve for a system where floods sometimes stopped the water wheels and pumps for periods of fifty hours or more.[103] The city once again stood in need of radical improvements in its water works, and it was indeed fortunate that Spring Garden and Northern Liberties had provided for their own supply and that Kensington had followed their example by building water works on the Delaware River in 1850.[104]

CHAPTER SIX

New York Wrestles With the Water Problem

> The creation and existence of this monied incorporation will at least, it is hoped, be of this advantage—that it will prove, that the *comforts and necessities* of life should never be placed under the control of individual associations or monopolies, ever intent to comply with so much of their charters as will make for themselves good dividends, while they generally disregard all beneficial objects which induced the Representatives of the People to create their incorporations.
>
> Report of Committee on Fire and Water to the Board of Aldermen of the City of New York, 1831.[1]

The Manhattan Company, upon which the Legislature had placed responsibility for supplying New York with water, did not long remain under the control of Aaron Burr. Between 1801 and 1808, this brilliant but unprincipled man suffered a series of political disasters that plunged him from a position of extraordinary power to ruin and exile. The first of these defeats came when President Jefferson, distrusting Burr, gave the New York patronage to his rivals, the Livingstons and the Clintons. The second soon followed when Burr was dislodged from the board of directors of the Manhattan Company, now one of the citadels of power in New York politics. Financial difficulties forced him to sell most of his stock in the corporation, and in 1802 both he and his faithful lieutenant, John Swartwout, were dropped from the board.[2]

As Burr's sun began to set, that of De Witt Clinton rose rapidly. Nephew of George Clinton, perennial governor of the state, the younger Clinton possessed a strange combination of talents: intelligence, creative imagination, humanitarian impulses, unbounded ambition, and political cunning. In his long struggle to gain and exercise power he waged war not only upon the Federalists but upon rival factions within his own Democratic-Republican party, upon Burr men, Tammany men, and Livingston men. Involved to some extent in this struggle was the Manhattan Company and the New York City water problem.

In 1803, De Witt Clinton became Mayor of New York. The office was not at this time elective, but was filled by the powerful Council of Appointment at Albany. Some estimate of the political importance attached to the mayoralty is the fact that Clinton resigned a seat in the United States Senate to accept this appointment. The new Mayor frankly sought to build closer relations between the city and the Manhattan Company, of which he was a director. In January, 1804, a resolution, introduced in the City Council, proposed a transfer of the municipal deposits from the Bank of New York to the Bank of the Manhattan Company. The motion was lost eight to ten, a reflection of continued Federalist influence in the city government.[3] But, the elections of the following November gave the Republicans control of the City Council for the first time,[4] and one of the fruits of victory was an ordinance of December 3, 1804, directing the city chamberlain to keep all city funds in the favored bank.[5]

The position of the Manhattan Company—so strong financially and politically—had one disturbing weakness. The famous charter of 1799 had stipulated that, unless within ten years the Company should furnish a supply of pure and wholesome water sufficient for the use of all the citizens who might wish to subscribe, the corporation would be dissolved. De Witt Clinton believed that the modest water works already built did not satisfy the requirements of the charter. In 1804, he drafted a memorial for presentation to the Legislature requesting an extension of time. Although the memorial does not appear to have been sent to Albany, it is interesting as a summary of Clinton's ideas. He said, in part:

> As it is a subject of complaint that the duration of the Manhattan Company is unlimited while that of similar institutions is comprised within short periods your memorialists consent to limit the continuance of their charter to fifty years provided that the period for bringing Water into the City is extended to twenty one years and that the Company are empowered to sell or lease the Water works without affecting their Charter in any other respects. When it is considered that altho' water has been conducted upwards of twenty one miles thro' the City and that the Company have devoted and are still devoting large sums of money and great attention to this subject and that still but a comparatively small portion of the City is supplied this provision cannot be deemed unreasonable and the latter arrangement especially with the Corporation of the City might remove the collisions which now exist between that body and the Manhattan Company and might greatly facilitate the important object in view.[6]

The suggestion that the Manhattan Company might sell its water works to the city reflected the conviction of Clinton and other directors that this was the best solution to the problem. The water business provided more perplexities than profits to the Company, and the officers were eager to restrict their activities to banking. Such a course of action,

however, was impossible unless in the first place, the Legislature would consent to a revision of the charter and, in the second, the City Council would agree to the purchase.

Steps toward this objective were initiated during the year 1804. In August, the City Council, concerned by a recurrence of yellow fever during the preceding year and dissatisfied with the existing water situation, appointed a special committee to consider the Bronx River, the Sawmill River, and other possible sources for a new supply and to confer with the directors of the Manhattan Company as to the terms under which its right to supply water might be transferred to the city.[7] In December, the Company responded to an overture from this committee and appointed representatives to carry on negotiations.[8]

But the legal and political complications of the water problem were too great to be easily overcome. The negotiations of 1804 had no result, and the situation remained much the same until December, 1807, when the issue was raised anew. Once again the City Council appointed a committee to confer with a similar group from the Manhattan Company.[9] On January 18, 1808, the committee reported that the Company appeared to be favorably disposed to the idea of transferring the water works to the city, but that nothing could be done without an act of the Legislature.[10]

The committee's recommendation that immediate application should be made to Albany for the necessary authority aroused indignant protests from the Federalist minority in the Council. They asserted that the water works were not a subject of profit but of loss to the Company; rather than the city paying the Company, the Company should pay the city for taking the water works off its hands.[11] This argument was sufficiently disturbing for the Council to order the water committee to investigate whether the Manhattan Company works "produce any and what annual revenue or any and what annual loss."[12] A week later the committee reported that the Company had 2,316 customers and a total revenue of $18,561. Operating expenses were $8,500, leaving a net income of $10,061, or 6¾ per cent on the Company's total water works investment of $172,261.19. Once again the committee urged that the city should make haste to purchase this excellent property, an establishment "that never ought to be in the hands of any private company."[13]

Not only the Federalists but a faction of Republicans remained unconvinced. It was alleged that the figures showing a profit for the water operations of the Company were misleading in that they made no adequate provision for depreciation and repairs. As an alternative to purchase of the existing works, the Federalists moved that an application be made to the Legislature to vest in the City Council the right of supplying

the city with good and wholesome water, provided the Manhattan Company should not effect the same within the time specified in its charter. This measure was defeated by a vote of five to eleven, but a rival motion providing for an application to the Legislature for authority for the city to purchase the existing water works failed also. On the latter question, the vote was tied and the issue was decided by the casting vote of Mayor Marinus Willett, an anti-Clinton Republican.[14]

The *New York Evening Post,* strongly Federalist at this time, denounced the proposed purchase of the Manhattan Company water works as an outrage upon the taxpayers. The misdeeds of Aaron Burr were again reviewed, and the subsequent history of the corporation was thus summarized:

> Some wells have been dug in the filthiest corners of the town; a small quantity of water has been conveyed in wretched wooden pipes, now almost worn out, for family use; and in a manner scarcely, if at all preferable to the former method of supplying water by the carts. The stockholders have gained both profit and political influence by the Bank—Our heaviest public calamity has been wickedly made the pretence for a knavish speculation—The Legislature has been cheated, and the City has ever since suffered.

The present scheme was condemned as a measure for laying upon the city "an unexampled burden" for the purpose of "aiding certain political combinations, and of enriching certain worthless individuals." The Bank had sprung from the water works, "and like many other upstarts soon grew ashamed of its origin—In short a project or rather plot is found to put the Water works upon the parish, and then enjoy the inheritance."[15]

To these unpleasant allegations the *American Citizen,* a newspaper closely allied to De Witt Clinton, replied that the initiative for the sale had come from the City Council rather than from the Company. Much was made of the civic spirit exhibited by the Bank in allowing the city to use its water without charge in fighting fires. The editor also explained how the Manhattan Company had loaned the city one hundred thousand dollars at six per cent to purchase its stock and then paid it nine per cent dividends: an annuity to the city of three thousand dollars a year. "Surely for so many benefits the Manhattan Company deserves something better than misrepresentation of their motives and conduct. . . ."[16]

In February, 1808, De Witt Clinton was restored to the mayoralty of New York, from which he had been removed the year before by a rival faction of Republicans.[17] A purge of the principal city offices took place at the same time, much to the disgust of the *Evening Post,* which reported: "The politics of this city are now governed by a JACOBIN CLUB—an organized JACOBIN CLUB which holds its nightly orgies

at a certain public house, and there dictates to those of its own party in power, and controuls their conduct at its pleasure."[18] However this may have been, the close alliance between Clinton and the Manhattan Company was again obvious. On February 22, by a vote of eleven to five the Common Council now decided to memorialize the Legislature for a law authorizing the city to purchase the Company's rights to supply water.[19]

The struggle was thereby transferred to Albany. To this scene the Manhattan Company had already dispatched James Fairlie as agent to present to the Legislature the application of the Company for an alteration of its charter. De Witt Clinton, as one of the Bank's directors, had drafted Fairlie's instructions. It might be objected, the agent was warned, that the existing charter was unlimited in duration. The Company was willing, if better could not be obtained, to limit it to fifty years, and, as a last concession, it might be limited to twenty years, provided the time for introducing water was extended and authority for possible sale to the city was granted. The Company would have no objection to the state becoming a stockholder to the amount of one thousand additional shares.[20]

The conflict of interests revealed here borders on the fantastic. On an issue involving a possible transfer of valuable rights from the Manhattan Company to the city of New York, De Witt Clinton participated on one side as mayor of the city and on the other as the most active director of the Company. But this was not the full extent of Clinton's involvement. He was also a senator from the southern district and thus a powerful figure in the Legislature, which had the power to grant the needed authority to the city and the Company. Finally, be it noted, that the Bank of the Manhattan Company held De Witt Clinton's notes for at least $8,900.[21]

The progress of the new proposal through the legislative mill can best be followed through letters written by Clinton to Henry Remsen, the Manhattan Company president. On March 16, Clinton reported that a highly satisfactory bill had passed the Senate and would soon be taken up in the Assembly:

> I congratulate the Board on this auspicious state of things. Our bill goes before all the other applications which are suspended. . . . The tongue of calumny will be silenced by the limitation of the charter and as that will not in all probability expire until most of us have bid adieu to this transitory world, we must leave our example as a lesson to posterity to imitate us in supporting the cause of republicanism which is certainly intimately connected with the prosperity of our institution.[22]

In the Assembly more serious opposition, led by such Federalist stalwarts as Stephen and Jacob Van Rensselaer and Johan Dietz, developed,

but the bill was nevertheless carried by a good majority.[23] Clinton's letter to Remsen was exultant:

> Let me now tell you and the Board, that nothing but a singular concurrence of circumstances and let me add not a little good management could have carried us through so triumphantly. The Bank is now placed on ground from which she may look down upon her enemies and put them at defiance. . . .[24]

Once again the Manhattan Company had done extraordinarily well. Its officers were given power to lease or sell all their water works and all their rights to supply water to the city government. If the transfer took place, the Company was to retain all its other rights and might employ all its capital in monied transactions, subject only to a few minor restrictions now added to its charter. "In case the sale authorized by this act is made," the new law read, "the duration of the Manhattan company shall be limited to the term of thirty years from and after the completion of such sale." In any event the period of time within which the Company was required to furnish a supply of water to the citizens was extended for ten years more. The state was to have the option of subscribing up to one thousand shares of the Company stock—a right which was subsequently exercised to the full amount.[25]

De Witt Clinton at once pointed out to Remsen the most remarkable thing about the revised charter: "The thirty year limitation attaches only when *the sale takes place* and it is in all conscience long enough."[26] If the city did not buy the water works, moreover, the new grant of corporate powers, like the old one, was perpetual. The only cloud on the horizon was the possibility that legal action might sometime be brought for the dissolution of the company for failure to provide an adequate water supply—and that evil day was postponed at least ten years.

Since an early sale of the water works to the city would now only hasten the terminal date of the Manhattan Company charter, it is not surprising that the transaction which the Legislature had authorized was never completed. The Company continued to supply its customers with water, not because the directors found the business profitable but because this appeared to be the condition which the corporation must perform if it were to retain its valuable banking privileges.

Scarcely a year went by without serious criticism of the Manhattan Company service. In 1806, complaints of inadequate supply and dirty water resulted in action by the management in repairing the steam engines and cleaning out the pipes.[27] Two years later the deficiencies of the system were blamed for a serious fire in which five lives were lost and a number of buildings destroyed. The newspaper *L'Oracle* complained:

> The pitiful nature of the Manhattan regulations has been lately glaringly displayed. It is a public abuse which calls loudly for redress, and we hope,

the late alarming circumstances and the injustice sustained by our fellow citizens on such occasions will induce the Corporation of the City to adopt measures to remedy the evil.[28]

In 1809, a letter to the *New York Commercial Advertiser* complained that no water at all was running through the pipes in the lower part of the city; the writer himself had been without water for four months. The editor of the paper added the comment that complaints about the service were universal:

> We know of no family which is regularly supplied with Manhattan water. . . . The Manhattan Company are a gross imposition, a flagrant fraud, upon the inhabitants of New York. . . . Let the company fulfil their contract of supplying us with such water, or let them relinquish the Charter of their institution, which, by this neglect, they have long since justly forfeited.[29]

Once again, the Company made repairs in an attempt to pacify the community. On July 28, 1809, the superintendent of the water works reported that some of the pipes had been completely stopped with poplar roots, but that these had now been removed and the steam engines had been overhauled.[30]

In 1811, however, the old cycle of customer complaints and Company apologies began all over again. The *Commercial Advertiser* reported on August 28:

> The inhabitants of the southern part of our city have not had a pitcher of Manhattan water for the last five or six days. The extreme heat of the weather, and the parching drought which at present afflicts the city, have made this unaccountable deprivation doubly afflicting. We are informed that the northern parts of the town have been amply supplied: how then does it happen that the southern parts are entirely neglected? There must be an unpardonable fault somewhere. The citizens pay a high price for the necessary article of water, and to be deprived of it when it is most wanted is not only extremely vexatious, but it actually endangers the health of the people.[31]

On April 11, 1812, the Company announced that the supply of water would be discontinued for fifteen days while a new engine was installed.[32] When the interruption in service proved to be much longer, indignant citizens arranged a protest meeting to demand that the Legislature repeal the Company's charter. The bitterness of public opinion was once again reflected in letters to the newspapers:

> It is high time that there was some steps taken to compel the Manhattan Company to supply this city with good and wholesome water. Agreeably to their charter the Recorder is duly to see that the company does supply the inhabitants with water. The water works are farmed out to a contractor. For five weeks we have received no water, and the collectors call and insult the inhabitants for not giving them the money for water which they do not receive. It is abominable indeed for the city to be thus trifled with and abused by the company.[33]

The close alliance that Clinton had built between the city government and the Manhattan Company gradually broke down. Municipal finances were in chronic crisis, and the city abused its privileges at the Bank. Not only did it make no attempt to reduce the principal of the loan under which it had purchased its Manhattan Company stock, but it sometimes withdrew its dividends without paying the interest due the Bank. By January 29, 1810, the city's indebtedness to the Manhattan Company had increased to $160,000, and Henry Remsen felt compelled to request the municipal authorities to pay some of the bonds then falling due. The City Council considered selling some of the city's Manhattan Company stock for this purpose, but decided instead to borrow money from other financial institutions.[35] This policy, however, was soon reversed, and between 1811 and 1814 the city gradually sold its stock. No doubt the divorce of the municipality and the Bank was hastened by the circumstance that the Federalists, who had never loved the Manhattan Company, controlled the City Council from 1809 to 1816.[36]

Years later a champion of the Bank made public some interesting figures summarizing "the dividends and profits received by the Corporation of the city of New-York, from their joint interest with the Manhattan Company." During the fifteen years of their alliance the city had received $131,800 in dividends and premiums on the sale of its stock; it had meanwhile paid the Bank in interest $73,200, leaving a net profit to the city of $58,600.[37]

Meanwhile, De Witt Clinton's personal relations with the Manhattan Company had also been significantly altered. In 1813, he declined reelection as one of the directors of the Bank; in 1816, he sold his stock.[38] One reason for this action may have been Clinton's political maneuverings of these years: out of favor with the Madison administration and bitterly opposed by Tammany Hall, he had allied himself to a considerable degree with the Federalists. Another reason was undoubtedly the poor condition of Clinton's personal finances and his need to raise cash.

Changing political circumstances obviously made the privileges of the Manhattan Company more vulnerable to attack, but no serious attempt to challenge its position was forthcoming for several years. In 1814, the inadequacy of the water supply for the purposes of fire protection led the City Council to recommend to the various religious congregations of the city that they construct large cisterns to collect the rain water from the roofs of their churches.[39] When these bodies failed to act, the Council obtained authority from the Legislature to build public cisterns, assessing the expense against all nearby houses and lots.[40] From

1817 to 1829, forty such public cisterns were built, but their utility for fighting fires obviously depended entirely upon the amount of rain water that Nature provided.[41]

From time to time the Council gave fleeting consideration to the basic water problem. In 1816, a committee was appointed "to consider and report upon the propriety of making an application to the Legislature at their present session to invest the Mayor, Aldermen, & Commonalty of this City with all necessary powers" to secure an abundant supply.[42] No action was taken, however. In August, 1819, Robert Macomb presented a proposal for supplying the city from Rye Pond in Westchester County.[43] After some delay the Common Council on March 6, 1820, approved a resolution permitting Macomb and his associates to lay down pipes in the roads and streets of the city, whenever a sufficient quantity was collected in a reservoir at the Harlem River. The city was to reserve the right to purchase the water works at cost after forty years.[44] But this project also failed to materialize.

While the city officials continued to put off serious consideration of the water problem, the urgency of municipal needs steadily increased. From 60,489 in 1800, the population of the city grew to 123,706 in 1820 and 202,589 in 1830.[45] Whenever the community grew complacent, an epidemic or a devastating fire would occur to dramatize anew the need for water.

In a message to the Legislature on January 4, 1820, De Witt Clinton, now governor of the state, dealt gravely with the yellow fever menace which had threatened New York City the previous year. Dispute over the cause of the disease still persisted, but it was universally admitted, said the Governor, that the danger of pestilence was aggravated by want of cleanliness. The establishment of public baths and common sewers would have a most salutary influence. This led Clinton to a brief but sagacious analysis of the city's water needs:

> A populous city like New York can never furnish, within its own limits, the sources of pure and wholesome water. Aqueducts conveying water from a distance have been used in all cities where the public health and the general comfort have been duly consulted. At different times the river Bronx and the Sawmill Creek in the county of Westchester have been explored and examined in reference to the accommodation of the city of New York, and there is little doubt but that both if not either of those streams. will be amply sufficient. Whatever measures you may devise or whatever assistance you can render to promote the health and comfort of that important portion of our population, will, I am confident, be cheerfully performed.[46]

But the Legislature could give little help until the officials of the city decided what they really wanted to do. Most of the politicians of the day

lacked the ability to deal imaginatively with the situation, but a man of larger vision was appointed mayor by the Council of Appointment on March 6, 1821.

Stephen Allen, the new chief magistrate, personified the American success story. He had learned the sailmaker's craft as a boy, worked industriously, and risen in the world until he became the proprietor of one of the largest sail-lofts in the city. Having acquired a considerable fortune, he devoted himself increasingly to politics and civic affairs. He became one of the most powerful Tammany leaders and an influential member of the Common Council. In the latter post he exerted a much needed influence on the city's finances, insisting upon economies and a more businesslike conduct of municipal operations. Strong-willed, rough in manners, and blunt in speech, Allen was never popular with his fellow-politicians, but he enjoyed a high reputation for integrity.[47]

On December 24, 1821, the Common Council authorized the appointment of a committee to inquire into the best and most practicable means of providing the city with an ample supply of pure and wholesome water.[48] Mayor Allen himself served as chairman, and the resulting investigation of the water problem was more thorough than any preceding one since 1798. On April 1, 1822, the committee reported its tentative findings based upon an examination of the two Rye Ponds and the Bronx River. From these connecting bodies of water, it was believed, an adequate supply might be secured, possibly utilizing the plan which Robert Macomb had suggested three years earlier. Briefly, this consisted of diverting the water of the Bronx River into the Harlem River, then damming the latter stream, and raising the water by water-power pumps to a reservoir on Manhattan Island. Since the committee did not consider itself competent to pass upon the feasibility of this or any alternative plan, it recommended the employment of Canvass White, one of the engineers on the Erie Canal, to make a careful survey of possible sources and means of conveyance. The Council accordingly voted an appropriation of five hundred dollars for this purpose.[49]

Before White could find time to make his survey, still another epidemic of yellow fever scourged the city from late July to early November, 1822. Mayor Allen presented a written communication to the Common Council on November 25, detailing measures which he hoped would prevent a return of this persistent enemy of the city. Prominent among these was "the bringing in of good and wholesome water, which ought never to be lost sight of until its accomplishment was consummated."[50] The following March, Allen was in communication with Joseph S. Lewis, the chairman of the Philadelphia Watering Committee,

who was always generous with advice to the officials of other cities struggling with a water problem.[51]

While the Mayor and the Council were still waiting for White to make his long-delayed survey, a radically different approach was proposed in a communication to the Council on February 12, 1823. A group of promoters had petitioned the New York Legislature for a corporate charter and state aid for a canal company proposing to build a waterway from the Hudson River to Sharon, Connecticut, where it would connect with a projected canal from Sharon to the Housatonic River. Obviously hoping to strengthen their position both financially and politically, the petitioners now suggested that the canal be extended to the vicinity of New York City and that it serve the dual purpose of transportation and water supply. "It may not be improper to state," added the letter to the Council, "that we have this day seen Col. Young the Canal Commissioner who unhesitatingly gave us his opinion that the Canal water will be good for City use by settling and filtering in a Reservoir."[52]

On recommendation of Mayor Allen's water committee, the City Council accordingly voted to memorialize the Legislature for the incorporation of the New York and Sharon Canal Company with power to supply water to the city. The city government should have the right to subscribe stock in the company. To help raise the necessary funds, the Council asked the Legislature for a privilege reminiscent of earlier water projects, the right "to levy a duty not exceeding half per cent on the Sales at auction in this City in addition to the duty now paid the State & that said duty be continued for 25 years & be applied to the supplying this City with pure and wholesome water & to no other purpose whatever."[53]

Despite this action by the Council, Mayor Allen was careful to avoid too deep an involvement on the part of the city. He wrote a long personal letter to Ogden Edwards, one of the assemblymen, instructing him on the policy that he should follow in the Legislature. The municipal authorities wanted to be left entirely free to invest or not to invest in the enterprise as they saw fit:

> The reasons for this requirement must be obvious,—we are entirely destitute of information on the subject and shall require time to examine the ground, to have surveys and profiles executed, to ascertain the practicability of the project, to have estimates entered into of the expense, and to ascertain the means for defraying this expense. It cannot be expected therefore, that we should bind ourselves to engage in an undertaking of such magnitude, under present circumstances. . . .

Allen was particularly insistent that the city should have a free hand in the appropriation of special auction duties, in case there were granted:

> We have already been at some expense in surveys etc. and should we find on examination, that water may be brought from a preferable source than from the Canal, it is our wish that we may not be bound in the application of the money. . . .[54]

Although the Legislature passed the bill incorporating the New York and Sharon Canal Company, the clause granting the city power to levy special auction duties was rejected.[55] Neither this nor any other kind of public aid was forthcoming for the company, and the result was great difficulty in raising the necessary capital. In February, 1824, Stephen Allen declined a directorship in the new corporation. It would be highly improper, he said, for him to act in a concern the success of whose operations he doubted.[56] To add to the difficulties of the Canal Company, its first president was accused of misconduct, several of its directors failed in business, and it became involved in an expensive law suit.[57] Despite these damaging blows, the corporation continued in existence as a complicating factor in the water situation for the next six or seven years.

In January, 1824, the City Council, recently vested with the power of electing the mayor, chose easy-going William Paulding over the gruff and less popular Stephen Allen. The latter was therefore no longer in office, when the long-awaited report of Canvass White was finally presented to the Council on April 12, 1824. By connecting the Saw Mill River with the Bronx, the engineer estimated that a supply of 9,600,000 gallons a day might be provided—more than sufficient for a future population of 355,000. Four different plans for conveying the water to the city were suggested, but White's preference was for one which would take a supply at an elevation high enough for the water to be carried across the Harlem River on a bridge or dam without resort to machinery. The total expense for this project was estimated at just under two million dollars.[58] This sum was considered so large that the city officials took no further action. Once again interest turned to the schemes of private speculators.

On March 12, 1824, the Legislature received the petition of John Griscom and others, citizens of the city of New York, praying for the passage of a law to incorporate them and their associates for the purpose of supplying the city with pure and wholesome water.[59] A select committee of the Assembly, appointed to consider the petition, brought in a favorable report:

> The committee have carefully examined the bill proposed. Its provisions are expressly confined to the single object of introducing pure water into the city, by conduits or pipes, of iron or other metal. It saves all existing rights, and it grants no exclusive privilege; nor does it contain the power

usually granted to other aqueduct companies, to take for their own use, the property of individuals, without their consent.

The bill strictly confines the company to its declared objects, and prohibits the employment of its capital, or any part of it, for the purposes of banking, or any other business. If the company should succeed in their laudable enterprise, other associations may hereafter from the rapid increase of the city, engage in similar attempts. In the city of London there are several incorporated companies; and in many of the cities of Europe, similar associations exist—thus producing a competition highly beneficial to the public.[60]

To prove the contention that the water supplied by the Manhattan Company was unfit for use, certificates were gathered from fifteen physicians of the city. Doctor David Hosack gravely warned that the present supply:

abounds in earthy and saline materials, highly injurious to the constitution, when so constantly taken into it by our daily beverage . . . frequently productive of diseases of the stomach and bowels, especially with strangers upon their first use of it. Gravel, and other complaints of the kidneys, are of frequent occurrence among our citizens, and I believe are oftentimes attributable to the water as their source. From my long experience of the unwholesome qualities of the New-York water, I long since, when holding the office of resident physician, addressed to the corporation of the city a discourse relative to the improvement called for in our medical police and urged upon them the necessity of introducing an abundant supply of pure and wholesome water. . . .[61]

Evidently believing that another season of stomach complaint and gravel in the kidneys would do the citizens of New York City no irreparable harm, the Legislature took no action on the bill to charter the New York Water-Works Company during the 1824 session. A year later, however, the proposal was pressed with much greater energy. Governor De Witt Clinton alluded to the issue in his annual message on January 4, 1825:

The police of the city of New York is excellent in relation to crimes, but in reference to health it has no distinguished merit. Without good water there cannot be good health; and no effectual provision has been made for that object. It may be laid down as an incontrovertible truth, that no dense population can furnish from within its own limits, an adequate supply of this indispensable accommodation, with reference to quality and quantity. As there is nothing to prevent your favorable interposition, I trust that you will dispense it with a liberal hand to all laudable attempts, whether by the local government, by private associations, or by enterprising individuals, to furnish a sufficiency not only for all domestic purposes, but for public baths, for cleansing the streets, and for the general purification of the city.[62]

The prospect of a new water company alarmed both the officers of the Sharon Canal Company and the Manhattan Company. The promoters of the canal contended that the current proposal infringed upon the

privileges granted to them only two years before. They now petitioned the Legislature for an amendment to their charter to permit them to engage in banking, thus providing an inducement for investors to put up the money needed for the canal and water works. Although this maneuver was supported in the Senate by a vote of eighteen to thirteen, it failed for lack of the two-thirds majority needed to amend charters.[63]

To the Manhattan Company, the current proposals embodied a serious menace. All its valuable banking privileges were contingent upon supplying the citizens of the city with wholesome water. If a rival corporation offered a superior service and won over all its customers, might not the Bank's charter be voided in the courts? In fighting to maintain its rights, the Manhattan Company employed a variety of weapons. For one thing, it endeavored to appease its customers by repairs and improvements. In a notice published in the newspapers on April 19, 1824, the Company claimed that it could now supply some thousand houses more than formerly. "The quality of the water is as good as can be found; and the Company having lately replaced many of the old pipes with new ones, the water will be received clearer and in better order than heretofore."[64] The Company also sought new sources of supply. It was still unwilling to invest the large sums that would be necessary to take water from the rivers of Westchester County, but it did expend money in drilling a new well, hoping that somewhere deep in the rocks underlying the city would be found abundant supplies of pure water to assuage the thirst of the citizens and perpetuate the banking privileges of the company.[65]

Meanwhile, Henry Remsen and his fellow officers had the delicate task of trying to convince the Legislature that the Manhattan water was not really as bad as it tasted. One M. N. Haight, whose occupation as a dye and carpet manufacturer appeared to qualify him as an expert on chemistry, wrote a pamphlet to disprove charges that the Manhattan water contained poisonous matter resembling putty or white lead. This was not true, according to this chemist; the solid matter in the water was only lime and soda. Nevertheless, one of the experiments which Haight was known to have performed, that of mixing the residue of the Manhattan water with copperas and oil and painting the door of his factory with it, was far from reassuring to the community.[66]

Remsen tried to recruit the support of his old ally, Governor Clinton. In a long letter of February 10, 1825, the president of the Manhattan Company argued that the wells from which the Company water was drawn must be fed by distant springs and that they therefore contained very little, if any, of the impurities of the city. To be sure, the water held a small portion of lime and soda, which rendered it unpleasant to the

taste, but experience had proved that it was not unhealthy. Remsen commented unfavorably on the Sharon Canal project, pointing out that water from this source would certainly be contaminated. He blamed Stephen Allen for directing the water investigations of his mayoralty toward new sources of supply instead of negotiating for a purchase of the Manhattan Company water works:

> If there had been a different man presiding in the municipal Corporation at that time, who would or could have stated & explained matters properly to that Body, a transfer of the Company's right & water property might have been made to the Corporation on such terms, as would have made the water revenue an object of profit to them, even had they reduced the present rates from 25 to 50 per cent. I do not think that any private Company or Companies can, perhaps for a Century, make it a profitable business.[67]

Certainly an extraordinary reversal of the usual assumptions regarding the comparative efficiency of public and private enterprise!

Governor Clinton's reply was not comforting:

> When I was associated with you in the direction of the Manhattan Company, I not only entertained but inculcated an opinion that it was for the interest of the institution to dispose of the water works—and this idea was engrafted in the Act of 1808—Your capital is not sufficiently extensive for the combined operations of banking and supplying the City with water—nor did I suppose until recently that you were desirous of retaining the latter power for if you exercise it to the needful extent, your banking faculties must be impaired if not destroyed.[68]

To the remonstrance of the Manhattan Company against the chartering of a new water corporation, the promoters of the New York Water-Works Company prepared a vigorous reply. No water drawn from wells in the city could be pure, but the Manhattan Company nevertheless objected to any attempts to furnish water from outside sources. The Manhattan Company had alleged that, if the present bill passed, it would affect its interest and render its works useless. "This objection in truth amounts to this: *There must be no competition.* To be sure, we have a bank charter and unlimited in duration, with a capital of two millions for which we paid nothing; but we have invested about three hundred thousand dollars in works and property in the city of New-York, and for the last twenty-four years have been trying to supply pure and wholesome water *from wells* in the city: Therefore, no persons ought to be permitted to try and do better than we have done; and we must, in effect, have a monopoly, although not granted by law."

The petitioners for the new charter detailed particulars in which their water works would be superior to those of the Manhattan Company: the older Company had always exercised the right to open the public streets without the consent of the city government, the new Company would act only in concert with the city authorities; the Manhattan Company pipes were of wood, the new ones would be of metal; the Manhattan Company charter was perpetual, the proposed New York Water-Works Company charter would be subject to repeal or modification by the Legislature. "No doubt other companies may, and probably will be incorporated hereafter, and the greater the competition the more the public interest will be promoted."[69]

As this three-sided battle involving the Manhattan Company, the Sharon Canal Company, and the proposed New York Water-Works Company raged at Albany, what was the attitude of the city government? Considerable confusion on the issue was apparent. On January 17, the Common Council instructed its water committee to inquire into the expediency of applying to the Legislature for a law which would vest in the city government the exclusive right of supplying the city with water.[70] On February 14, the water committee made an interim report, warning the Council that the rights of the city government to regulate its streets and to perform other functions might be jeopardized by the proposed New York Water-Works charter. Accordingly the Council voted to send a memorial to the Legislature, requesting it "to adopt such measures as will most effectually guard and protect the Corporate rights of the City."[71] Two weeks later, however, the Council reversed itself and by a vote of fifteen to five passed the following resolution:

> . . . that his Honor the Mayor be requested on behalf of this Board to inform the Members of Assembly representing the City as also the Senators that this Common Council did not by their late Resolution on the subject of Incorporating a Company to introduce good & wholesome water into this City intend to oppose the passage of such Law, but that on the Contrary this Board approve thereof, provided the work be commenced & completed within such time as this Board shall determine to be reasonable.[72]

The bill granting a charter to the New York Water-Works Company was finally enacted on March 24, 1825. The *New York Evening Post* was delighted. "The present filthy state of our wells, occasioned by the numerous cess pools that have been dug within these few years, and the impurity of the water now brought to this city," the *Post* asserted, "have been long and justly the subjects of complaint, and would likely have continued so for many years to come, had not a few spirited individuals undertaken to remedy the evil; not by applying for banking privileges, but by asking for a charter which will enable them to apply their money in safety, and realize a fair and honorable compensation for its use."[73]

For a time the new water company appeared to be in flourishing condition. On April 18, 1825, when its books were opened for stock subscriptions, over nine million dollars were offered by eager investors.[74] Since

the charter permitted a capitalization of only two million dollars, the stock had to be rationed to the would-be purchasers. News that Canvass White and Benjamin Wright, another of the Erie Canal engineers, had been engaged by the new corporation increased confidence that the city's water problem was at last in the process of solution. The *New York Evening Post* remarked complacently:

> We are gratified to learn, that the Water Works Company are adopting the most efficient measures to supply the city with an abundance of pure and wholesome water. They have engaged two of the most experienced engineers in the country, Messrs. Wright and White, to complete the surveys, and to superintend the work; and not the slightest doubt exists, that the important object in view will be fully attained with as much expedition as practicable. Neither zeal nor ability of any kind will be wanting.[75]

Benjamin Wright became president of the new company, and on November 26 he issued a reassuring announcement to the newspapers. All was going well. The directors had contracted for a number of valuable water rights, especially around Bryam and Rye Ponds. The plans and estimates being prepared by Canvass White were not complete, but they were sufficiently so to justify an assurance that no unforeseen difficulty existed and that a supply of water of the best quality equal to six million gallons every twenty-four hours could be obtained. The directors, Wright added, had given notice of an intended application to the next Legislature for an amendment to the company charter "to grant them powers similar to other aqueduct companies of this state."[76]

This cautious admission that the charter of the company was in some way defective precipitated furious controversy. Two bitter letters signed "Guess Who" appeared in the *New York Evening Post*. Where, the writer asked, did the new company intend to get its water? Not from Manhattan Island, for the privilege of bringing water from this source had been granted exclusively to the Manhattan Company. Not from any stream in Westchester County, because the Legislature had made an exclusive grant of the sources in that area to the Sharon Canal Company. The new company had in truth been granted no right to take water at all; ". . . we know that such privilege was designedly expunged from the statute, at the instance of the Manhattan Company and those connected with it; thereby rendering the charter absolutely nugatory. . . ."[77] So great had been the enthusiasm for the project that no one had troubled to examine the charter carefully. "Guess Who" charged that the only beneficiary of the scheme had been a certain bank, where the large fund of money collected from investors had been deposited. Something irregular in the proceedings of the new company had been suspected since the days of the stock subscription, when

one group of citizens had been favored over another in the assignment of the stock. Given the continued hostility of the Manhattan Company and the newly-aroused opposition of the company's own stockholders, it was absurd, this critic asserted, to expect that the Legislature would amend the charter.[78]

On December 13, rebellious stockholders held a meeting at the famous Tontine Coffee House. A spokesman for the management pleaded for patience: if the investors would only wait for the engineer's report, they would be satisfied that the object of the company could be accomplished. But many of the stockholders had had enough; they wanted their money back. By an overwhelming vote, it was resolved that, whereas it had been discovered that the act of incorporation was wholly inadequate and doubts were entertained whether the necessary amendments could be procured, it was the sense of the meeting that the interests of the stockholders would be best promoted by a dissolution of the company and a division of funds.[79]

Wright and his fellow-officers defended themselves as best they could. They asserted that the demand for dissolution originated with speculators who had purchased the stock of the company below par and were trying to profit by panicking the rest of the shareholders.[80] On January 18, Canvass White's report was released. The engineer proposed taking the water of the Bronx River a distance of 13¼ miles through a closed canal or tunnel to a reservoir north of the Harlem River. Then the water would be conveyed in iron pipes across a stone bridge onto Manhattan Island and thence south to the city following the line of Third Avenue. The cost was modestly estimated at $1,325,000.[81] But the real difficulties of the company were legal and political, and the engineer's report failed to halt the demand for a dissolution.

To add to the troubles of Wright and his associates, the promoters of the Sharon Canal were busily promoting their own scheme. They had engaged an engineer to make a survey and now claimed that their combined canal and water works could be completed for only $1,200,000. They gave notice that they were utilizing powers granted in their charter to take possession of the very streams that their rivals were depending upon.[82] Once again they appealed to the Legislature for banking privileges to enable them to raise capital.[83] A letter to the *New York Evening Post* appealed for the support of the citizens:

> In this way and this way alone, can this great and rapidly increasing city ever be supplied with a sufficient quantity of water. And instead of other projects being played off to prevent or retard the operations of the Canal Company, it would be well for the citizens to enquire if they are not deeply interested in the successful accomplishment of this plan and this only?[84]

The utter confusion into which the water issue had now been plunged was worse confounded by disturbing reports that the water of the Rye Ponds and the Bronx River upon which both the Sharon Canal and the New York Water Works projects depended was insufficient to supply the city. A factory, dependent on water power from these sources, had only been able to use one of its three wheels during the preceding six months. "Here," asserted the editor of the *Evening Post*, "is a single fact of more value than ten thousand arguments."[85] Moreover, the landowners and manufacturers of Westchester County, alarmed at the proposed diversion of their water, were petitioning the Legislature to rescind the powers already given to the Canal Company.[86]

Such was the situation, when the Legislature returned to a consideration of the city water problem during the session of 1826. Stephen Allen, now representing the city in the Assembly, favored an amendment to the charter of the New York Water-Works Company to grant it the power to take water rights and land by condemnation. As chairman of a special committee, he described the growing impurity of all the well water in the city, including that supplied by the Manhattan Company. "It has, therefore, long been the opinion of those who have examined the subject, that a sufficient supply of pure and wholesome water could only be obtained from some foreign source, and none has appeared so eligible, although at a great distance from the city, as the Croton, Sawmill, and Bronx rivers, in the county of Westchester." He described the municipal surveys made between 1822 and 1824, "but," he continued, "the changes which annually occur in the board of the common council, and the fears of incurring a heavy debt, or some other cause has prevented the measure from being further prosecuted by that body. . . . It is the opinion of your committee, therefore, that there is little or no prospect of this interesting project being carried into effect except through the means and with the funds of private individuals. . . ."[87]

Allen's support, however, was not enough to get the charter amendments through the Legislature, and this defeat was fatal to the Water-Works Company. On July 13, 1826, the directors voted to abandon the project and take the necessary steps for a dissolution of the company.[88] The following month the stockholders assented to this procedure. Liquidation was completed with very little loss to the investors, and the charter was surrendered in 1827.[89]

Other promoters were bold enough to believe that they might succeed where the Sharon Canal Company and the New York Water-Works Company had failed. The same session of the Legislature, which

had refused new concessions to these corporations, granted a charter to the New-York Harlaem Spring Water Company with an authorized capital of five hundred thousand dollars. This newest corporation was empowered to supply the city with water drawn from wells located on Manhattan Island above 75th Street.[90] In September, 1826, the company was reported to be in operation in Yorkville, one of the suburbs, but the enterprise was never successful enough to provide a supply for the city itself.[91]

In view of the long-continued condemnation of New York well water in general, and Manhattan Company well water in particular, it may seem strange that proposals for supplying the city from underground sources were still being made. The truth is, however, that new techniques for boring deep wells had recently given rise to highly inflated ideas of the limitless quantity and sparkling quality of these subterraneous resources. On March 28, 1825, a long letter to the *New York Evening Post* gave an enthusiastic report of the writer's success with a well bored to the depth of 253 feet. The water discharged at the rate of two gallons a minute into his kitchen, providing such an abundance that it could be piped to troughs in the cattleyard and the piggeries. "Boring for water is not a new thing," he explained. "In Italy, and in the south of France, and in Yorkshire in England, it is an affair of every day occurrence to bore; but bringing the water above the surface so as to flow spontaneously has never, I believe, been thought of until now."[92]

The new theories were given extended treatment in a long pamphlet entitled *An Essay on the Art of Boring the Earth for the Obtainment of a Spontaneous Flow of Waters,* published in New Brunswick, New Jersey, in 1826. The author claimed that although deep wells had been drilled in Europe for fifty or sixty years, important improvements in the process had been developed in the salt well districts of the United States. By driving tubes into the drilled wells, two great advantages had been obtained: the water rose high in the tubes, often overflowing the top, and, equally important, the fresh water from the higher levels was shut out and only the salt water from the deeper sources was taken. Impressed by seeing these techniques used in the salt districts, an eastern mechanic named Levi Disbrow had begun using similar methods to drill fresh water wells in northern New Jersey and New York. His first great success was in drilling 175 feet to provide water for a New Jersey distillery in 1824. Following this demonstration, he received numerous contracts, several of them for manufacturers and merchants in New York City. It was Disbrow who drilled the new Manhattan Company well mentioned above. Quite as important as the

empirical success of the well drillers was the theory that they developed to explain it. They denied the dictum of the scientists that water flowing beneath the surface of the earth obeyed the laws of gravity. On the contrary, according to the *Essay on the Art of Boring:*

> . . . *there is an innate expansive power in the earth, which not only keeps matter from gravitating too near to the centre, but which forces fluids and gases to the surface;* consequently, as Water is forever forced upwards, a spontaneous flow can be obtained from any point that the borer chooses. . . .[93]

This water, moreover, was superior in quality to surface water collected in reservoirs. "Water, thrown in reservoirs for daily use, loses its vitality; as soon as the vivifying gases have escaped, it becomes putrid, and engenders miasmata and animalculae. Water, to be pure, should have certain gases always present; in what way, therefore, can this be obtained but by a running stream?"[94]

Although such ideas were ridiculed by the orthodox scientists of the day, they gained a number of devoted converts. Over the next ten years debates on the water problem both in New York and elsewhere involved not only the issue of whether water should be supplied through private or public enterprise, but on whether supplies should be sought in the streams and lakes of the countryside or in the bowels of the earth.

New York citizens gained considerable amusement from one of the experiments with bored wells. It occurred to Jacob Lorillard, a well known tanner, and certain other citizens that water might be obtained by drilling in Beekman's swamp near Lorillard's shop on Jacob Street. Sure enough, the borers struck a promising vein 128 feet below the surface. The extraordinarily bad taste of the water, however, ruled out any possibility that it could be sold for ordinary household purposes. Determined to turn a liability into an asset and recoup their expenses, the proprietors of the well promptly advertised their water as possessing marvelous medicinal qualities. Business at "Jacob's Well" was brisk during the summer of 1827, until word got about town that the evil tasting mineral water contained nothing but the usual proportions of native alkalies fortified with liberal quantities of extract from old boots and tan bark.[95]

But the general water situation in New York was far from humorous. Still another warning of the dangers threatening the city was provided by the shocking fire losses of 1828, which amounted to at least six hundred thousand dollars.[96] Private enterprise had failed to provide an adequate supply of water for the city; it remained to be seen whether municipal statesmanship could formulate an adequate policy.

CHAPTER SEVEN

The Great Croton Project

> Nothing less than a river, distributed through thousands of channels, and brought to the premises of every house holder, will be commensurate to the wants of a population such as the city of New-York contains, and will contain.
>
> *Report of the Water Commissioners,* 1835[1]

> The Committee humbly trust that the period has now arrived when the disgrace of her water shall be wiped from this proud City; and if the last to act, she shall no longer be considered the least in the splendour and magnificence of the work by which one of the greatest of human blessings shall be secured to her present and future generations.
>
> *Report of the Committee on Fire and Water,* 1835[2]

In later years, when New Yorkers were proud of their world-famous Croton Aqueduct, there was great jealousy among the politicians as to who had first conceived the project. Myndert Van Schaick asserted that the revelation had been vouchsafed to him when he was a member of the Common Council in 1832.[3] Samuel Stevens insisted that the water works had their real beginnings in recommendations that he made in 1829.[4] Stephen Allen ridiculed both these claims and declared that the initial steps had been taken during his mayoralty in 1822 and 1823. His own preference, he claimed, had always been for the Croton even though the engineer, Canvass White, had centered his surveys on the Rye Ponds and the Bronx River.[5]

The truth seems to be that, although the Croton was sometimes mentioned during the 1820's, discussion focused on the Bronx. From time to time critics warned that water from the latter source would be unsatisfactory in quantity and quality, but these objections were not taken very seriously. After 1830, however, the needs of the city increased so rapidly that attention shifted almost inevitably to the Croton. Since this river was forty miles away, the expense of conveying it to the city seemed almost forbiddingly high. Only the twin scourges of fire and disease could force the citizens to the painful decision to build an adequate water system no matter what the cost.

The Manhattan Company, threatened by competition from other private water companies during the 1820's, had taken steps to improve its service. Month after month, Levi Disbrow bored into the rock at the corner of Bleecker Street and Broadway in search of better water. By 1832, his well was 442 feet deep, but the water thus obtained was not yet distributed to customers.[6] In the summer of 1828 the Company began to substitute iron mains for the wooden pipes which had caused so much trouble.[7] These reforms, however, were too little and too late to bring popularity to the old water works. To denounce the Manhattan Company in the Common Council or in the Legislature became increasingly popular.

Skirmishing between the city authorities and the Company began late in 1828. On December 15 of that year, the committee on the Fire Department recommended to the Common Council that the city enter into a contract with the Manhattan Company to keep the public cisterns full at all times. This proposal, involving regular payments to the disliked Company, aroused bitter opposition. Alderman Samuel Stevens of the Third Ward countered with a resolution instructing the Street Commissioner to report the probable amount of injury and expense sustained by the public by reason of the Company's breaking up pavements to lay down or repair its pipes.[8] The Council adopted Stevens' resolution, and the Street Commissioner presently reported that the damage had amounted to perhaps ten thousand dollars over the course of the preceding twenty years. He gave the Company credit, however, for replacing the pavements much more carefully in recent years and suggested that once the substitution of iron for wooden pipes was completed, this particular annoyance would largely cease.[9] The brief battle may be judged a draw, since the Company received no contract to supply water for the public cisterns, while the city took no further action on the claims for damages to the pavements.

In his inaugural address of January 5, 1829, Mayor Walter Bowne discussed the menace of fire as one of the most serious problems confronting the city:

> A full supply of water for all purposes is an object of the most vital importance to the health, comfort and safety of the City; and I have the accomplishment of this great object much at heart.
>
> Our whole faculties ought to be directed to attain the inestimable advantage of an abundant supply of pure and wholesome water, that the poor may enjoy it free, and other citizens at moderate charge.[10]

A special Council committee on water was thereupon appointed with Mayor Bowne and Peter Cooper, the glue manufacturer and future philanthropist, as two of its members. Even more important, as it turned out, was the appointment of a strong committee on the Fire Department

that included Aldermen Samuel Stevens and James Palmer.[11]

On March 16, 1829, the committee on the Fire Department made an important report. Since the water pipes of the Manhattan Company extended only to such parts of the city as had promised to be profitable, all the district north of Pearl Street on the east side and Grand Street on the west were totally unsupplied. The island was about two miles wide in this area, and it was impossible to obtain enough water for fighting fires by pumping it out of the rivers with hand engines. There were now forty public cisterns, but adequate fire protection would require the construction of sixty more at a cost of thirty-six thousand dollars.

It would be much more satisfactory, in the opinion of the committee, to build a large wooden reservoir near 14th Street in the northern part of the city. This could be kept full by a horse-driven pump drawing water from nearby wells. Water from the reservoir could be conducted through iron mains laid under Broadway and the Bowery, with hydrants at convenient intervals. This plan would provide a more dependable supply than that to be obtained from cisterns; it would make the work of the firemen less arduous—an important point since the city was still dependent on a volunteer system. Moreover, it would provide the beginnings of a distributing system for general water works.

> Your Committee, would remark, that the plan herein proposed, of laying down permanent iron tubes through the two main entrances into the City, does contemplate the time as not far distant, when the City will be ready to meet the expense of introducing good and wholesome water sufficient for all purposes into the City. If the present plan of tubes is adopted, every dollar of the expenditure may be used for that most desirable object. Whereas if we went on with the plan of cisterns, we should soon find the City with 100 Cisterns which in the contemplated state of things would be worse than useless.[12]

After a lively debate, the Common Council adopted this report and authorized the building of a reservoir and the laying of iron mains. In later years, Samuel Stevens used this night's good work as the basis for his claim to be the true father of the New York water works. As Stevens recalled the debate, one of his opponents ridiculed the plan, charging that water enough could not be procured to fill a tea-kettle, much less the proposed reservoir and pipes. To this, Stevens and his allies had replied: "Give us the tank and pipes, and we engage to fill them, if we have to carry the water in quart bottles."[13]

A year later the Council received an encouraging report of progress. A stone tower forty-four feet in diameter and twenty-seven feet in height had been built on 13th Street; on this there was being placed an iron tank forty-three feet in diameter and twenty feet high, which would hold over three hundred thousand gallons of water. A well had been dug and

the quantity of water available would be ample to supply the reservoir. In keeping with the more ambitious character which the project had now developed, the Council authorized the erection of a steam engine to raise the water into the reservoir. The project was completed in 1831 and added materially to the city's resources for fighting fires.[14]

Meanwhile, proposals for dealing with the larger water problem continued to be discussed without decisive results. The Joint Committee on Fire and Water once again investigated the familiar rivers and ponds of Westchester County in the fall of 1829.[15] On January 11, 1830, when Mayor Bowne was inaugurated for a second term, he reported that engineers had estimated the cost of building water works at not more than two million dollars. Would not the city cheerfully encounter that much expense, asked the Mayor, to provide an ample supply of water to provide for all wants of the citizens, to furnish shipping and manufacturing, to clean streets, and to extinguish fires? He recommended to the Common Council an immediate application to the Legislature for the necessary powers to proceed.[16]

Although the Council was not ready to take this step, it did screw up its courage to challenge the special privileges of the Manhattan Company. On March 15, 1830, the Council adopted a resolution, introduced by Alderman Samuel Stevens, that provided for the appointment of a special committee to investigate whether the Manhattan Company had any obligation to pay damages for injury to the pavements, whether the Company had the right to cut off and discontinue fire plugs, and lastly "whether this Company chartered for the sole and express purpose of introducing into the City pure and wholesome Water, and having enjoyed a valuable consideration in Banking privileges claimed in perpetuity, have fairly or substantially complied with the Conditions of their Charter."[17]

A week after this offensive had been launched by the Common Council, an attack upon the Manhattan Company began on the Albany front. On March 24, the Senate received the petition of one Edmond C. Genet —none other than the famous "Citizen" Genet of Washington's day— protesting against the usurped corporate privileges of the Manhattan Company. On April 20, the Senate referred the petition to the Attorney-General to examine and "take such proceedings thereon, as he shall consider to be legal and proper."[18]

On May 31, Alderman Stevens presented to the Council the report of the special committee that had been investigating the Manhattan Company. Reviewing the history of its water operations, the committee estimated that a supply was available for only about one-third of the paved and built-up parts of the city. It was doubtful whether the digging of a

well fulfilled the Company's obligations in the first place; that it had never developed any other source of supply was scandalous:

> But if the company had the right to procure their water from a populated part of the city, and a pretty filthy one too, they certainly were by the first act, creating their company, bound within ten years to supply water of a quality *pure* and *wholesome*. That water is supplied of this quality, it is believed, none will contend. In fact the use by our citizens of the water from the street wells, and the purchase of water from cartmen who carry it through the city, may be considered strong evidence of the estimation which the water is held in by them.

The committee then passed to the issue of the fire protection provided by the Manhattan Company. Until the last year or two the Company had provided hydrants whereby the city had been able to draw water without charge for extinguishing fires. Since the substitution of iron pipes for wood, however, the Company had altered its policy and had discontinued hydrants on all streets where the new pipes were laid. In the old days when the city received free water for fires but refrained from charging the Company for damages done to the pavements, a rough equity had prevailed. "But a new claim is now set up; that we furnish the use of the streets gratis—that we make good damage to the pavements —be at the expense of the fire plugs or hydrants, and also pay some two or three thousand dollars to keep the water in the reservoir at night. These demands of the company bring up the whole subject for consideration of the board." Because of the Company's failure to provide an adequate supply of water, the city had been put to the expense of building public cisterns and the new 13th Street reservoir. The Water Committee, moreover, had recommended the introduction of water from outside the city at the cost of two million dollars.

> Now, if this company has performed the objects of its charter—the introduction of *pure* and *wholesome water,* then we are not required to make the expenditure referred to. . . . Your Committee remark, that until the powers of the Manhattan Company relating to the introduction of water, are either limited, or stricken out of the charter, it would be improper for the Corporation to undertake to procure for our citizens the great public blessing set forth in the preamble of the charter of that company, the health and security of this great metropolis.

The committee recommended that the Corporation Counsel furnish the Attorney-General of the State with proofs that the Manhattan Company had not fulfilled the obligations of its charter.[19]

The discontent of the community with the water situation found expression in some of the newspapers. The *New York Evening Journal* asserted that the working classes were more concerned in the matter than the rich, because the former were unable to bear the expense which the want of good water obliged them to pay.

> We are at present supplied with spring water carted round in carts and brought from the upper parts and suburbs of the city. This water, although far from good, is much better than that obtained from wells in the city; for this we pay at the rate of two cents per pail, three pails per day is but a moderate quantity for a family, and three pails per day cost twenty dollars per annum. This amount is paid for warm water—water that has been carried several miles in a hot sun, and if we would have cold water, or water approximately fresh, we must have ice; this is another tax.[20]

One of the evils related to the water situation was intemperance. In order to make bad water palatable, it had become customary to spike it with ardent spirits.

A letter from "A Water Drinker" published in the same paper described the Manhattan Company water in vitriolic terms:

> . . . I have no doubt that one cause of the numerous stomach affections so common in this city is the impure, I may say poisonous nature of the pernicious Manhattan water which thousands of us daily and constantly use. It is true the unpalatableness of this abominable fluid prevents almost every person from using it as a beverage at the table, but you will know that all the cooking of a very large portion of this community is done through the agency of this common nuisance. Our tea and coffee are made of it, our bread is mixed with it, and our meat and vegetables are boiled in it. Our linen happily escapes the contamination of its touch, "for no two things hold more antipathy" than soap and this vile water. . . .[21]

The attack on the Manhattan Company subsided momentarily, but was soon resumed. On October 18, 1830, the Attorney-General filed a case against the corporation, charging that it was exercising corporate privileges without lawful warrant.[22] The issue was not decided for many months, but meanwhile the Common Council front became active again. Once more the lead was taken by the aggressive Alderman Stevens, who on January 24, 1831, moved that a memorial to the Legislature be prepared, setting forth the failure of the Manhattan Company to fulfill the terms of its charter and requesting a repeal of all the water powers of the Company and a vesting of these powers exclusively in the Corporation of the City of New York together with an authorization for the city to raise by loan a sum not exceeding two million dollars for introducing an ample supply of pure and wholesome water.[23]

When the Stevens resolution came before the Common Council for action in February, it provoked several evenings of heated debate that ranged over the whole water problem. Stevens repeated the customary indictment of the Company and added the charge that the use of Manhattan water had contributed more to intemperance than any other cause. The subject of water, in his opinion, was of too much importance to be in the hands of any company, particularly when that company cared more for its banking privileges than it did for the objects

of its charter. Alderman Brown presented a petition from New York brewers complaining that in consequence of bad water the value of New York beer was rapidly depreciating, while that brewed in Philadelphia gained a preference. The beer business amounted to $460,000 annually, and it would soon collapse unless better water was supplied. Alderman Palmer, a close ally of Stevens, declared: "Our water is very bad—travellers all speak against it, and often therefore they will not reside in this city longer than they possible can."[24]

The most telling blows against the Manhattan Company were struck by Dr. P. S. Townsend, a physician and assistant alderman from the Sixth Ward. To support his contention that all city well water was injurious to health, he presented a long communication from the Lyceum of Natural History of the City of New York, a body composed of well-known doctors, chemists, and other scientists. These learned gentlemen described the geological formation of Manhattan Island and asserted that no water was to be found by boring into the solid gneiss which lay beneath the city. "All the water which falls on this island is . . . first absorbed by the sand through which it trickles until it meets with solid rock, which it softens to the depth of a few feet, and then makes no further progress. . . . It is in this sand, that all our wells are sunk. . . ."[25] Chemical analysis revealed that all the well water of the city contained minerals like carbonate of lime, sulphate of lime, muriate of sodium, and muriate of magnesium. From where did these foreign ingredients come? Largely from graveyards and privies, was the shocking answer of the Lyceum:

> Into the sand bank, underlying the city, are daily deposited quantities of excrementitious matter, which were it not susceptible of demonstration, would appear almost incredible. With our present population, there is put into this sand about 100 tons of excrement every 24 hours. In these deposits we may find all the ingredients detected by analysis, and which destroy the purity of our waters.[26]

In speculating on the effects of this situation the Lyceum report was cautious, but indicated a belief that bad water was one of the causes of dyspepsia and "those bowel complaints of children, which carry off so many annually." The unanimous opinion of the committee was that *"no adequate supply of good or wholesome water can be obtained on this island for the wants of a large and rapidly increasing city like New York."*[27]

The Manhattan Company was not without friends in the Common Council. The recorder, Richard Riker, an *ex officio* director of the Company, testified that, although he did not belong to a temperance society, he drank a pint of Manhattan water every morning and en-

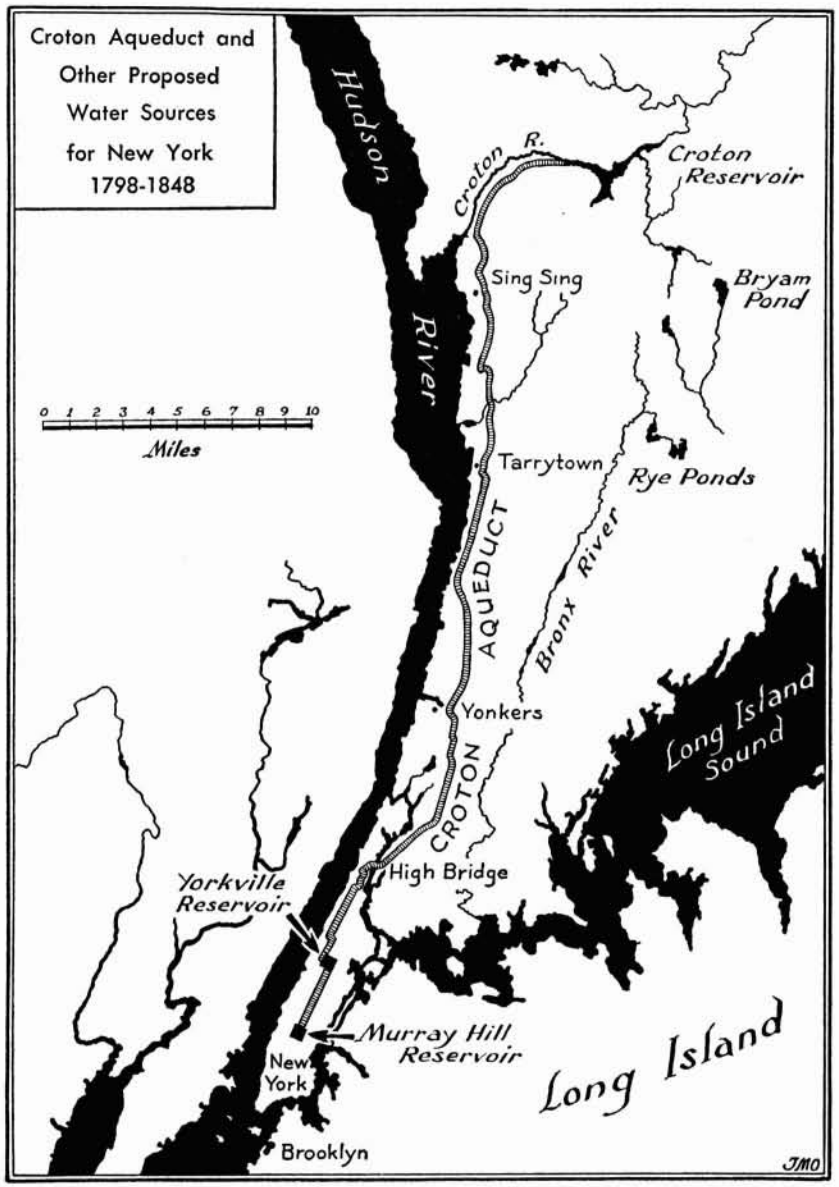
joyed good health.[28] For years after this occasion, the fortitude of this public official who could imbibe such a notorious beverage—straight and upon an empty stomach—remained something of a New York legend.

Less open to ridicule was the long and able defense of the Manhattan Company delivered by Assistant Alderman Fyler Dibblee of the Eleventh Ward. Dibblee reviewed the whole history of the city's relations with the Company, emphasizing the profit that the city had made on its stock transactions, the free water that had been provided for extinguishing fires, and the many public services that the Company had performed. Insofar as the Manhattan water had a bad taste, he attributed it to the old wooden pipes. The substitution of iron mains would correct this; eight miles out of forty miles of pipe had already been changed and the rest soon would be. Almost $10,000 had been spent in boring the Bleecker Street well, and the experiment encouraged a hope that a plentiful supply of excellent water would be obtained. But Dibblee refused to concede that the water already supplied to the citizens was in any way injurious to health:

> That this water is pure and wholesome, is proved by the daily use of two thousand five hundred families, many of whom have had thirty years to use and test, and experience the quality of this water; and who would not in a city like this, where water is abundant, continue to use it, if they did not believe it to be healthy.[29]

Dibblee scoffed at the findings of Dr. Townsend and the Lyceum of Natural History. Experience had already proved that water could be obtained by deep boring. Mineral salts in well water were harmless. Within three feet of the wall of the Trinity Church burial ground, which contained 160,000 graves, there was a well furnishing pure and wholesome water to the whole lower part of the city. "The earth, and such too as we inhabit," Dibblee asserted, "is the natural filter to purify and render pure and healthy the water which passes through it."[30]

When Alderman Stevens' resolution finally came to a vote on February 28, there was a striking difference of opinion on its various parts. The first section, which merely set forth the general desirability of a full and ample supply of water, was carried by a vote of twenty to four; the second section requesting a repeal of the water powers of the Manhattan Company and a vesting of these same powers in the city government, was passed seventeen to five; but the third section praying for authorization to raise two million dollars by loan for introducing water was rejected eight to fifteen.[31] In this amended form the memorial of the Mayor and Council was finally presented to the Legislature,[32] but



the latter took no action—perhaps because the legal position of the Manhattan Company was already in the process of testing before the courts.

On December 28, 1831, the Committee on Fire and Water presented an important report to the Common Council, reviewing the history of

the water question and making new recommendations. Once again the corporation organized by Aaron Burr was sharply criticized:

> . . . as early as 1799, an association of gentlemen was incorporated under the name of the Manhattan Company, for the purpose of supplying the city of New-York with pure and wholesome water; who have been more intent on making money by their banking operations, than accomplishing the avowed objects of their charter, and have left the city totally unsupplied with water which can be called pure and wholesome; and even four-fifths of the paved streets of the city without *any supply* whatsoever; in fact, all those parts of their charter which authorize them to take and divert streams to the city or *to introduce water* have never been used. . . . In reference to this Company your Committee remark, that among the principal documents will be found an analysis of the Manhattan Water, by which it will appear that it is unfit for the use of man; that as to their carrying on their banking business under a perpetual charter, on the ground of their rendering the city a valuable service, your Committee only wish to disabuse the Legislature as to the supposed worth of the consideration, and to leave to *their sense and judgment,* all which relates to *this part* of the subject.[33]

The Committee considered the possibility of supplying the city from deep wells, but recommended against any reliance upon such sources. Too many wells and steam engines would be required; moreover, the continued growth of the city would diminish the quantity of underground water and destroy its purity. The Committee acknowledged that an increasing number of citizens favored the use of the Croton River, but it emphasized the engineering difficulties that would be encountered in conveying a supply from this distant source over the rough terrain that lay between it and the city. The least expensive and most feasible plan would be to draw a supply from the Bronx River into which the waters of the Rye Ponds already ran and to which additional water from Wampus Pond and Bryam Pond could be diverted. In later years when still more water was needed, it could be taken from the Saw-Mill River and eventually from the Croton. The Committee recommended that the Council apply to the Legislature for permission to raise two million dollars by loan for the purpose of introducing water.[34]

Once again the water question was the subject of heated debate. Since the Council had recently become a bicameral body through a revision of the city charter, both chambers had to approve the Committee report. The Aldermen did so on January 19, 1832, by a vote of nine to four; the Assistants concurred on January 30 by a vote of nine to five.[35] Just why the Legislature failed to take favorable action on this memorial was a matter of subsequent controversy. A select committee of the Assembly reported a bill to grant the city the powers that it requested,[36] but the measure never came to a vote. Myndert Van Schaick and others later alleged that Stephen Allen, then a state senator, had used his influence to kill the measure.[37] Allen, proud of his record on the water question, denied that this had been so. He did not, however, conceal his opinion that the bill of 1832 had been badly drafted in that it placed too much responsibility for building the water works with the Common Council, a body whose membership changed from year to year and which was always subject to suspicion of favoritism in the awarding of valuable contracts.[38]

Whoever was to blame, the politicians had once again failed to take effective action to meet the city's water problem. And once more the community suffered cruelly from a visitation of disease. This time the killer was not yellow fever, but Asiatic cholera—all the more terrifying because it was new to Europe and America. As early as January, 1832, anxious reports in the New York newspapers noted the spread of cholera through Egypt, Austria, Germany, and the British Isles.[39] In June came the sickening news that the disease had crossed the Atlantic and appeared in Quebec and Montreal.[40] A week later cases were being reported in the towns of northern Vermont and New York State.[41] The city of Albany posted guards along all the roads and waterways to prevent emigrants and travelers from entering the state capital, where a frightened Legislature was hurrying through strong quarantine laws.[42] But to no avail. Cholera invaded Albany and swept on to the south.

In New York City the authorities took what steps they could to ward off the threatened blow. The Mayor presided over frequent meetings of the Board of Health, and the Aldermen and Assistants were clothed with authority to inspect dwellings, yards, and premises within their respective wards and to order the removal of filth.[43] The cause of cholera was unknown and subject to a controversy similar to that accompanying the yellow fever epidemics, but medical opinion inclined toward the idea that bad air either caused or aggravated the disease. At first the measures to clean up the city were not very effective. On June 23 the *Evening Post* moaned: "We give up all hope of ever seeing New York a clean city. The streets are now in a more deplorable condition than before the new plan of cleansing went into operation—if indeed it can be said to have gone into operation at all." However, a month later the situation was strikingly different. The *Evening Post* reported:

> The measures taken to clean the streets, and to disinfect places which are ordinarily the receptacles of corrupt air, have been so effectual, that he who perambulates the city is almost led to distrust at least one of his senses, that of smell, and to ask himself if this is really New York, and if the pure breezes which he breathes, really belong to that atmosphere which formerly in the summertime was so offensive.[44]

Although the city authorities were reluctant to admit that there were cases of cholera in the city, by July 4 the evidence was too clear to be denied.[45] The epidemic reached its peak on July 21 when 104 deaths occurred in a single day. Thereafter the number of cases slowly fell, but it was not until October that the terrible visitor finally left the city. The disease had taken the lives of 3,500 persons and had cost the city government about $110,000 in direct expenditures.[46] In indirect loss to the city's business the costs were much greater. In August it was reported that 100,000 persons had fled the city. So many fires in homes and factories were out that the usual cloud of smoke no longer hung over the city, and viewers from the New Jersey shore of the Hudson commented on the sharpness with which the houses of the city could be seen. The usual murmurs from the busy streets were scarcely to be heard.[47]

Although many respected citizens died from cholera, the full fury of the disease fell upon the slum districts, particularly upon the notorious Five Points in the Sixth Ward. Moralists were convinced that the bad habits of the poor had brought about their own punishment. "Let the reports be scrutinized, and it will be seen that it is the intemperate, the dissolute, and the poor creatures who are too ignorant to know what to do, or too destitute to procure needful attention, that chiefly fall victims to the destroyer."[48] A letter written to the *Evening Post* asserted that the inhabitants of the Five Points should be compelled to vacate their homes and disperse to the suburbs. "Then should begin a clearing out, not partial, but thorough—the matter should not be minced—turn out the inmates of the place, ventilate and purify (by fire, if best) the beastly hovels they inhabited, guard effectually against their return thither, fence up the streets, and ere long the city would be remunerated by the disappearance of Cholera."[49]

Contemporaries missed the real significance of this concentration of cholera cases in certain districts of the city. Twenty-two years later in a classical medical investigation Dr. John Snow was to demonstrate conclusively that scores of cholera cases could be traced to a single pump on Broad Street, London, and that the water of the pump had been contaminated by the wastes from nearby houses.[50] That the disease in New York was similarly transmitted can scarcely be doubted, when the city's reliance on well water and its noisome privies and cesspools are remembered. The idea that contaminated water was a direct cause of the disease apparently occurred to no one in 1832. Nevertheless the prevalent notion that bad air increased the danger did strongly support the contention that the city needed more water in order to keep itself clean. The *New York Evening Post* commented:

> The city of New York, notwithstanding all the exertions to purify it, yet contains filth enough to keep the disorder alive for some time. The privies are an abominable nuisance. The city is a sort of Augean stable, and whether it can be cleansed by any process short of that adopted with the Augean stable of old—turning a river through it—we cannot say.[51]

Although New Yorkers were reluctant to admit that they could learn anything from rival cities, they were impressed by Philadelphia's success in combatting cholera. The latter's record was far from perfect; the epidemic invaded the city and took almost 900 lives.[52] Nevertheless, by contrast with New York's mortality of 3,500, Quebec's of 2,218, and Montreal's of 1,210,[53] Philadelphia had done well. Modern scientific opinion would attribute this to the fact that most of the population was supplied with relatively pure Schuylkill water and had the protection of an adequate sewerage system. The city's record would probably have been better still, if old-fashioned wells and privies had not persisted in the poorer districts. But contemporary opinion attributed the city's deliverance not to pure drinking water but to copious flushing of the streets throughout the period of danger. During the fall of 1832 a delegation of New York Aldermen, Assistants, and other officers visited Philadelphia to examine its water works and sewers.[54]

The cholera epidemic had indeed spurred interest in the New York water problem. Several members of the Common Council had worked day and night on the Board of Health, consulting with the physicians of the city, visiting hospitals, and inspecting the afflicted districts. Everywhere they heard complaints of the inconvenience of caring for the sick without adequate supplies of water. Particularly impressed by all this was Alderman Myndert Van Schaick of the Fifth Ward, who served as treasurer of the Board of Health. Although Van Schaick was not a member of the Fire and Water Committee, which began a new consideration of the water problem in the fall, he managed to get himself invited to its meetings and was soon exerting a dominant influence.[55]

On October 15, the Fire and Water Committee obtained authority from the Common Council to expend one thousand dollars in new surveys.[56] Street Commissioner Benjamin Wright, one-time engineer on the Erie Canal and president of the abortive New York Water Works Company, was in general charge of the new investigation, while the field work was done by Timothy Dewey and William Serrell.

Despite the competence of these engineers, Van Schaick became convinced that they were going about their task in the wrong way. Still the captives of a line of thought going back to Dr. Joseph Browne, William Weston, and Canvass White, they were confining their surveys and plans to the Rye Ponds and the Bronx River. Van Schaick was con-

vinced that these sources were no longer adequate for the greatly increased needs of the city. In studying the earlier documents on the water problem, he had been much impressed by a statement written in 1830 by an officer of the ill-fated Sharon Canal Company. Trying to salvage something from the wreck of that venture by selling its water rights to the city, the company spokesman had asserted that it was clearly possible to carry water from the Croton into the city of New York, and only in this way could an adequate supply for the present and future wants of the city be obtained. Van Schaick became convinced that the Croton and not the Bronx was the answer to New York's water needs. The problem was to sell this bold idea to the Council.

The first step in Van Schaick's campaign was to convince the Fire and Water Committee that they ought to consult still another engineer. During a stay in Washington, Van Schaick had become impressed with the abilities of Colonel De Witt Clinton, the late governor's son, who was at this time a civil engineer in the employ of the Federal government. Appointed on November 10 to make a special investigation of the New York water problem, Clinton's first move was to accompany Van Schaick and two other interested aldermen, Palmer and Murray, on a trip to Rye Pond, the source of the Bronx River. Talks with the residents of the area convinced the four investigators that the quantity of water available in this district was annually diminishing and could by no means be depended upon for the supply of a great city.[57]

On December 22, 1832, Colonel Clinton submitted a long report, recommending that New York draw its water supply directly from the Croton River. Obviously in the short time since his arrival in the city, Clinton could not have made the careful surveys that the situation required. His report was based mostly upon the information of others, fortified by his own hasty trips through the countryside. The actual plan that Clinton suggested was vague and impractical. He thought that no dam on the Croton would be necessary and that the water could be conveyed for most of the distance through open canals with masonry aqueducts over intervening rivers and ravines. His estimate of the cost, only $2,500,000, was absurdly low.

Despite its inadequacy, Clinton's report was an influential document. For one thing, it supplied the faction advocating the Croton with persuasive arguments. For another, it provided a very useful summary of the whole water situation, demonstrating that the citizens were already paying a large sum annually for water and that this money might better be spent for an adequate municipal system. The Manhattan Company was collecting about $10,000 a year in water rents; carters selling spring water from door to door were taking in about $273,750 a year; vendors supplying water by the hogshead to ships in the harbor enjoyed an annual revenue of some $50,000. Moreover, Clinton estimated that an adequate water supply would save the community almost $250,000 a year in reduced losses by fire, savings on insurance premiums, and in eliminating the expense of pumping water into the new reservoir.[58]

During the year 1832 when so much else had happened to focus attention on the water problem, the New York Supreme Court contributed its share by rendering a decision in the case brought by the Attorney General against the Manhattan Company. The contention that the Company had failed to supply water according to its charter was over-ruled, because no individual citizens who had been denied water had been named in the proceedings. Moreover, the Court held that the state had recognized the Company as a bank in numerous acts of the Legislature and in depositing its own funds in the institution. While the decision favored the Company in that it upheld the validity of its charter and its banking privileges, there was nothing to suggest that the Manhattan Company enjoyed the exclusive privilege of supplying the city with water.[59]

Water politics were still confused in December, 1832. Before Colonel Clinton's investigation had been completed, Dewey and Serrell had reported a plan for using the Bronx River, on the basis of which the Assistants had passed a resolution requesting the Legislature for authority to borrow two million dollars.[60]

A number of reasons impelled the Aldermen to withhold their concurrence. One consideration, of course, was the determination of Van Schaick and his faction to build up support for their Croton plan. A second sobering thought was that the latest proposed request to the Legislature was almost identical with the one that had failed in the preceding session. A final reason was the knowledge among the more responsible members of the Common Council that the public was becoming increasingly suspicious of large public expenditures from which the politicians might make a personal profit. The *Evening Post* commented: "A proposal to borrow two million dollars to be expended in a project for supplying the city with pure water has been laid before the corporation of this city, and has excited a good deal of conversation out of doors. For our own part we hope that before any new plans are devised by that body for spending the public money, a full enquiry may be made into the amount already expended. . . ."[61]

Once again Alderman Van Schaick took it upon himself to tell the Fire and Water Committee what it ought to do. Van Schaick with one or two others drafted a report requesting the Legislature to enact a law under which the Governor, with the consent of the Senate, would

appoint five Water Commissioners.[62] These Commissioners should have careful surveys made and report their findings on or before November 1, 1833. By this procedure Van Schaick hoped to settle the question of the best source and to divorce the water question from the petty politics of the Common Council. During January, 1833, the Aldermen and Assistants gave their approval to this procedure.[63]

Fortunately for his project, Van Schaick had recently been elected a State Senator and was thus able to take charge of the bill in the Legislature. On February 26, the act providing for the appointment of Water Commissioners became law.[64] Van Schaick still had one more duty to perform: he told Governor Marcy whom the latter should appoint to the new body.[65] The men so nominated were all Democrats, who enjoyed a high reputation for honesty and practical business experience. The strongest individual among the Commissioners and the one promptly elected to the chairmanship was crusty old Stephen Allen.

Under the direction of this new agency, Major David B. Douglass, a former army engineer and veteran of the War of 1812, led a party of eleven into Westchester County in June and spent the next ten weeks in making careful surveys. The results fully supported the ideas of the Croton faction. Water from the Bronx watershed, although excellent in quality, was too limited in quantity to be depended on; the supply available from the Croton was equally pure and fully adequate at all seasons of the year. Moreover, it was perfectly feasible to conduct the Croton water into the city without the use of steam power or machinery of any kind. Douglass recommended the erection of a dam at the Muscott rapids about eleven miles from the mouth of the river and the construction of a closed masonry aqueduct through Westchester County, across the Harlem River, and down into the city. The cost, he estimated, would be $4,550,237 by one possible route and $4,718,197 by another.[66]

In a report to the Common Council of November 12, 1833, the Water Commissioners strongly recommended an aqueduct from the Croton. Several alternative suggestions were considered and dismissed. The Commissioners gave particular attention to the persisting theory that an abundant supply could be obtained by boring into the rock beneath the city. To supply the fourteen lower wards of the city in this manner, forty-two wells, each with its own steam engine and reservoir, would be necessary. This, the Commissioners believed, would be more expensive than the proposed Croton works. It would, moreover, subject the citizens to the noise and smoke of forty-two steam engines, to the possibilities of breakdown and failure of supply, and to the likelihood that the water would deteriorate and become unfit for use. Action on the

water problem was imperative. "The daily use of a fluid, containing a portion of mineral substance, which we are assured by eminent practitioners of medicine, is more or less injurious to health, imperceptibly undermining the whole animal system, and producing disease, which either shortens life, or makes it miserable, is a matter of too much importance, not to have attracted the attention of the visitors, as well as the residents of this city."[67]

Although the situation had been greatly clarified by the opinion of a competent engineer and the recommendations of a board of five leading citizens, there was still no unanimity of opinion. The proponents of the Bronx plan had not given up hope, and estimates that a supply from the Croton would cost in the neighborhood of five million dollars argued in some minds for a more modest project. Moreover, the field of discussion was still cluttered with miscellaneous proposals from private speculators. John L. Sullivan, an indefatigable producer of such schemes, bombarded the city government with communications. Having formed a partnership with Levi Disbrow, the well borer, Sullivan proposed in March, 1833, that a Rock-Water Company be organized with a capital of two million dollars, one-half to be invested in water works, the other half in banking. Referring to the horrors of the cholera epidemic, Sullivan urged that the pure water in the rock below the city should be tapped without delay:

> Things of this kind, however, must be always appreciated by their beneficial effects. Let us suppose that nothing had been known of these hidden waters, and that the angel of Death had, *last July*, revealed them to this distressed and scattered community, as among the means of healing and defence, and no means were known of reaching them, *would* you not have promised wealth to him who should open them up to the glad acceptance of the people?
>
> Perhaps, after a few such desolating, dispersing summers shall have passed over us, they may be more appreciated as a providential resource, better than far-fetched, and dear bought water of the Croton:—it is ours to offer; it is for you to decide.[68]

Sullivan renewed his proposals in January, 1834, when the Water Commissioners' plan was under consideration in the Common Council.[69]

Many other panaceas for the city's water problems were agitated. Sullivan and others suggested obtaining a supply of water from the Passaic River at Paterson, New Jersey, and carrying it to the city through iron pipes laid in the bed of the Hudson River. Another plan called for conducting water from the Morris Canal near Newark. A third group of enthusiasts believed that a supply might be taken from the Hudson at some point north of Poughkeepsie and conveyed to New York by iron mains laid along the banks of the river.[70]

Early in 1834 the Common Council voted to apply again to the Legislature for authority to raise the sum of $2,500,000 in loans for the purpose of supplying the city with water.[71] When this memorial from the city government was referred to a special committee of the State Senate, Myndert Van Schaick, still a senator, used his influence to have significant changes made.[72]

Strongly convinced that the Common Council, an annually elected legislative body, was not a proper agency for carrying out a major public works project, Van Schaick drafted a bill providing for the appointment of new Water Commissioners, who should re-examine the problem, prepare definite plans, and make estimates not only of the cost of the proposed works but of the probable income from water rents. If the Common Council approved the Commissioners' report, the issue was to be submitted to the voters of the city at the next regular election. If the voters ratified the plan, the city was authorized to issue Water Stock to the amount of $2,500,000. Construction of the water works would be under the direction of the Water Commissioners, who were given ample powers to acquire water rights and land by condemnation proceedings.[73]

This act, which became law May 2, 1834, provided the legal basis for building the great Croton Aqueduct. Governor Marcy, at Van Schaick's suggestion, reappointed the same Commissioners who had served in 1833, and Stephen Allen was once again elected chairman. Since the Common Council was already somewhat jealous of the new body, there was some delay in appropriating money for new surveys. But in July the Council voted $5,000 for this purpose.[74]

Because criticism of their 1833 report had focused largely on the high cost, the Water Commissioners requested Major Douglass to re-examine his surveys and calculations in search of a more economical route for the aqueduct or method of construction. Douglass suggested a different location for the dam and a few other changes by which savings could be made, but his principal findings both as to route of the aqueduct and probable cost were much the same as those of the preceding year.[75]

Meanwhile, the Commissioners engaged a second engineer, John Martineau, to make his own independent survey and recommendations. Martineau's estimate was lower—in the vicinity of $3,800,000. He proposed to save money by building the dam near the mouth of the Croton instead of at either of the sites suggested by Douglass. More important, instead of an expensive bridge which would carry the aqueduct high across the Harlem River at a grade uniform with the rest of the works, Martineau favored an inverted syphon of iron pipes to be supported

on a massive embankment. An arch through this structure would provide for navigation and the reflux of the tides.[76]

On the basis of the engineers' recommendations and with data collected from other sources, Stephen Allen laboriously put together a new Water Commissioners' report. First, he had to dispose of the latest crop of hare-brained schemes. There was, for example, the communication from Bradford Seymour of Utica, who proposed to erect a dam across the Hudson. This would exclude salt water from the river above the dam and provide enough power to pump water into a reservoir and provide a surplus for manufacturing. Ship locks could be built around the dam and the navigation of the Hudson sufficiently improved to permit ocean vessels to proceed up the river to Albany and Troy. The Water Commissioners patiently explained that locking vessels from the harbor up the Hudson would carry salt water into the river and pollute it as a source of drinking water. Construction of a dam at this site would be difficult, and, in the opinion of Philadelphia's Frederick Graff, not enough water power would be forthcoming to keep a reservoir full.

Dismissing all other suggested sources, the Commissioners again recommended the Croton. They proposed "that a dam of sufficient elevation be erected near the mouth of the Croton river, and from thence the water to be conducted in a closed stone aqueduct to Harlem river. The river to be crossed by inverted syphons of wrought iron pipes of 8 feet diameter, formed in the manner that steam boilers are. From the south side of the river, a line of stone aqueduct will again commence, and proceed across Manhattan valley to the distributing reservoir at Murray's Hill."[77]

To build such works would cost a large sum of money. Averaging the estimates of its two engineers, the Water Commissioners found that the probable expenditure to bring water from a dam on the Croton to a reservoir at Murray Hill (site of the present New York Public Library) would be about $4,150,000. To this must be added $1,262,000 for distributing pipes, making a total estimated cost of about $5,412,000. But the Commissioners believed that the water works would bring a large revenue to the city. They estimated that there would be over 30,000 water takers and annual receipts of over $310,000.

> It is upon these data, which the Commissioners have attempted to elucidate, they have founded their calculations and opinions, that when the project shall have been completed, the eventual receipts will more than pay the interest on the capital expended, and the annual cost of attending the works; and, in due time, leave a surplus for the redemption of the debt that may be incurred.[78]

The Commissioners were convinced that the water works should be municipally-owned. The example of London, so often cited by advocates of private enterprise, really proved that reliance on private companies in the distribution of water was a mistake. Much of the London drinking water was taken from the Thames into which 139 common sewers discharged their filth. The water was so evil-smelling and loaded with foreign matter that it had to be allowed to settle before it could be used. Instead of competing, the eight London companies had divided the city into eight districts in which each enjoyed its own monopoly. Water rates were unregulated and arbitrarily fixed; the supply was uncertain; and the companies exerted so much political influence that reform was impossible.

"Water is one of the elements, full as necessary to existence as light and air, and its supply, therefore, ought never be made a subject of trade or speculation."[79] The true model for New York to follow was Philadelphia. Why had there been so little cholera in the latter city in 1832, or again in 1834 when a second epidemic scourged the country?

> The only way we can account for this difference in the health of the two cities is, that Philadelphia is supplied with abundance of pure and wholesome water, not only for drinking and culinary purposes, but for bathing, and for washing the streets of the whole city, while New-York is entirely destitute of the means for effecting any of these purposes. . . . No disagreeable odour assails the persons who pass through the streets of that city; everything calculated to annoy the senses is swept away by the running stream; but in New-York a person coming in the city from the pure air of the country, is compelled to hold his breath, or make use of some perfume to break off the disagreeable smell arising from the streets.[80]

The long and able report of the Water Commissioners was submitted to the Common Council on February 16, 1835, and thereafter events moved steadily toward consummation of the great Croton project. On March 4, the Committee on Fire and Water gave the idea its full support. Once again the necessity of municipal ownership was strongly stated:

> The question remains, ought the Corporation of the City of New-York to embark in this great work? The Committee are firmly of opinion, that it ought to be done by no other body, corporate or personal. And in this they are sustained by every Committee which has preceded them. The control of the water of the City, should be in the hands of this Corporation, or in other words, in the hands of the *people*. From the wealthy and those who would require the luxury of having it delivered into their houses; and from the men of business, who would employ it in their work shops and factories, the revenue should be derived. But to the poor, and those who would be content to receive it from the hydrants at the corners and on the sidewalks, it should be as free as air, as a means of cleanliness, nourishment and health. In the hands of any other power than the Common Council, this free use would be restrained, and the experience of all other Cities (and our own may be included) teaches us the sad lesson that the trust of this power would be abused.[81]

The Committee's own estimate of the expense of bringing the Croton water to Murray Hill was $4,250,000. The Committee dealt with the need for a full supply of water both for the prevention of disease and the protection of the city against fire. During the year 1834 there had been 110 destructive fires in the city with losses estimated between $1,300,000 and $1,800,000. "It is firmly believed by those who are called upon to observe our fires, and have opportunities for observation, that from one-half to two-thirds of the losses by fire would be prevented by an ample supply of water. The losses by fire the last year, are equal to one-third of the whole estimated expense of bringing the water from the Croton, and delivering it at our doors."[82]

The legal machinery ingeniously contrived by Myndert Van Schaick ground on. The Common Council formally approved the plan proposed in the report of the Water Commissioners and ordered that at the next municipal election on April 14 the voters be given an opportunity to express their assent or refusal to allowing the Common Council to proceed in raising the necessary funds. In order to provide information to the voters twenty-five hundred copies of the Water Commissioners' report were printed and a summary of the document was published in the newspapers.[83]

The response to the proposal was generally favorable. The *New York Evening Post* asserted that it seemed "well deserving of the unanimous co-operation of our fellow citizens."[84] Needless to say, however, complete unanimity was not forthcoming. Interested parties, like the Manhattan Company and the proprietors of water carts, attempted to stir up an opposition. The promoters of well-boring projects argued shrilly that the Croton plan was expensive and uncertain, whereas their own proposals were sure to succeed. John L. Sullivan wrote a new pamphlet entitled *Exposition of Errors in the Calculation of the Board of Water Commissioners,* which undertook to demonstrate that "for about the expense of one million, and in one year, this city might be supplied generally with Rock Water, instead of waiting four, five, or six years, and expending six millions."[85]

Even more sweeping in its claims was the pamphlet of M. Hale, entitled *Spring Water Versus River Water.* Hale asserted that an ample supply for the city could be drawn from wells at an expense of only $500,000. He contrasted this with the cost of an aqueduct to the Croton, which he felt sure the Commissioners had under-estimated. "I am fully

convinced that $10,000,000 will fall short of the required expense. . . ."[86] Time was to prove the shrewdness of this comment, but Hale's other objections to the Croton project were less valid. He argued that the water in the aqueduct would freeze in the wintertime, that accidents to the line might deprive the city of water, that the supply might be cut off by an enemy in time of war, and that river water had a bad taste.

A final source of opposition was to be found in Westchester County. The landlords and farmers of this region were highly suspicious of a project that threatened not only their property rights but their peace of mind when an army of rough laborers should invade the countryside to build the great aqueduct. One doughty country squire, Theodorus C. Van Wyck, drove his one-horse wagon into the city during the voting period and distributed hand bills opposing the Croton project at each of the polling places.[87]

But the citizens of New York wanted no further delay. The Croton plan was ratified by majorities much larger than its sponsors had believed possible. When the polls were closed on April 16, 1835, after three days of voting, it was discovered that 17,330 votes had been cast in favor of the project and only 5,963 votes against.[88] The water faction had a majority in each of the city's fifteen wards except three: the ninth, tenth, and thirteenth, all uptown districts where the wells were still relatively good.

The Common Council promptly passed an ordinance instructing the Water Commissioners to proceed with the work of supplying the city and authorizing the creation of a public stock of one million dollars.[89] These water bonds were payable in 1860 and bore interest at five per cent. Stephen Allen, who had served as chairman of the Board of Water Commissioners for two years without salary, refused to continue in that post unless proper compensation was provided; the other Commissioners took a similar stand. Despite some opposition, the Council voted that the chairman should receive a salary of fifteen hundred dollars a year and the other four Commissioners one thousand dollars apiece.[90]

With these matters settled, the Water Commissioners began to organize the next phase of the work. Before construction could begin, many preliminaries had to be taken care of. Engineers had to locate the exact site of the dam and every foot of the aqueduct; they had to make elaborate maps showing each tract of land which would be needed over the whole forty-mile route and in the area that would be flooded by the dam. Only after these things had been done, could the Water Commissioners start the slow process of negotiating for the purchase of the land and letting the contracts for construction. On June 2, the Water Commissioners appointed Major Douglass chief engineer. The following month, Douglass took to the field with a party of sixteen assistants.[91] Progress was slow, but Stephen Allen was not dissatisfied when, in December, he reviewed the year's momentous achievements:

> The work is now progressing with all the speed that a project of so much importance and magnitude will warrant. We appointed Davis B. Douglas Esq. [*sic*] our chief engineer, with several assistants of acknowledged talent and character, and we entertain no doubt whatever, if our lives are spared, that we shall be enabled to complete what we have undertaken to the perfect satisfaction of our fellow citizens. The project is one of the most stupendous ever undertaken in this country, and when completed will be a credit to the corporation, a blessing to the inhabitants and a lasting honor to all who have lent their aid in carrying it into effect.[92]

But the great Croton Aqueduct was still a dream of the future when New York suffered the worst fire disaster of its history. Philip Hone, rich merchant and former mayor, described the event in a diary entry, dated December 17, 1835:

> How shall I record the events of last night, or how attempt to describe the most awful calamity which has ever visited these United States? The greatest loss by fire that has ever been known, with the exception perhaps of the conflagration of Moscow, and that was an incidental concomitant of war. I am fatigued in body, disturbed in mind, and my fancy filled with images of horror which my pen is inadequate to describe. Nearly one-half of the first ward is in ashes, five hundred to seven hundred stores, which with their contents are valued at $20,000,000 to $40,000,000, are now lying in an indistinguishable mass of ruins. There is not, perhaps in the world the same space of ground covered by so great an amount of real and personal property as the scene of this dreadful conflagration. . . .[93]

The *New York Herald* reported that nearly twenty blocks of valuable buildings were destroyed, including 529 stores, the Merchants' Exchange, and a church. Two thousand merchants were ruined; five to eight thousand clerks and workers were thrown out of employment. Almost all the insurance companies in the city had been bankrupted—a disaster not only to the widows and aged who had invested all their savings in insurance stock, but to the whole community which was left virtually without protection against another fire.[94] On the record of the fire department during the great conflagration, the *Herald*'s comment was laconic, but eloquent: "The engines were not of much service, so severe was the cold. . . ."[95]

The decision to bring a full supply of water into the city had obviously been delayed a little too long.

CHAPTER EIGHT

New York Builds Its Aqueduct

> No population of 300,000 ever before voluntarily decreed that they would execute such a work. No population but one of freemen would have conceived the idea. . . . The great Croton work . . . does not contemplate protection from external foes . . . but it looks to making our whole population happier, more temperate and more healthful, and does contemplate that the countless millions hereafter to enjoy the benefits of this water, will have clear heads, correct eyes, strong arms, and instead of walls, present breasts so strong and hearts so brave, that in a just cause our city may defy all foreign foes.
>
> *Report of the Water Commissioners*, 1842[1]

Seven years elapsed after the decision of 1835 before the citizens of New York marveled at the sight of the Croton water gushing fifty feet into the air from a fountain in the Park. Before the great engineering feat was successfully completed, a score of difficulties and discouragements were encountered. The technical problems were serious enough, but these were more easily solved than the problems that arose out of the crotchets of human nature: the avarice of landowners, the rivalries of partisan politicians, and the conflicting ambitions of jealous engineers and administrators.

The Manhattan Company was still a complicating factor. Back in October, 1833, when it became obvious that the city was going to build its own water works, the Company offered to transfer all its water rights to the municipality and allow the amount of compensation to be decided by arbitration.[2] In February, 1834, a committee of three Aldermen and three Assistants were appointed to negotiate with the Company but nothing came of the matter.[3]

Early in 1836 after the great fire, the city authorities gave serious consideration to the possibility of obtaining a temporary supply of water while the Croton Aqueduct was under construction. Mayor C. W. Lawrence suggested erecting steam engines either on the Hudson or the East River to pump water into the 13th Street Reservoir or the

proposed Murray Hill Reservoir, but Stephen Allen and Major Douglass advised against using salt water in the pipes that would eventually be employed for the distribution of the Croton water. It would be much better, they said, to obtain a supply of fresh water.[4] Negotiations were reopened with the Manhattan Company, which offered to lease all its water works and water rights to the city, but a special committee of Aldermen, appointed to consider the measure, brought in an adverse report. Since the Manhattan Company had totally failed to fulfill the obligation of its charter to supply the city with pure and wholesome water, it would be improper for the city to become the lessee of these disputed rights and privileges. Instead, the committee recommended that the city purchase the Company's water works and rights, "whatever they may be."[5] Once again the legal snarl seemed too difficult to unravel, and the proposal was allowed to drop.

Meanwhile, the Manhattan Company was subjected to a new attack in the Legislature. On April 18, 1836, an investigating committee of the Assembly reported as its unanimous opinion that the Company had failed to perform the object of its charter, for "it is notorious that the city of New-York is not now and never has been supplied with pure and wholesome water for the use of its inhabitants; nor with a sufficient quantity of water of any character for the purpose of extinguishing fires and irrigating the streets."[6] The narrow grounds of the decision in People v. the Manhattan Company were criticized, and a resolution to direct the Attorney-General to bring new proceedings was proposed. But this move also failed to bring any important result.

The city and the Manhattan Company never did settle the issues between them. In October, 1836, and in March, 1837, the Common Council again considered the question of whether the city should lease or purchase the Company's water rights; in November, 1839, the question of buying a supply of water from the Company was debated; but still nothing was done.[7] In 1840, the chances of the Manhattan Company selling its water works and rights to the city were materially diminished by a series of unsavory disclosures about its management and political connections.[8] With the opening of the Croton works in 1842, the private corporation lost its water customers, but for decades thereafter it retained its wells out of fear that its charter might be challenged if it gave up this last vestige of its ancient water works.[9]

The patience of the citizens was sorely tried by the long delay in bringing the Croton project to the point where construction could begin. On October 14, 1836, brash young James Gordon Bennett of the *New York Morning Herald* commented flippantly:

> About two years ago the city of New York was in awful state of excitement. After the lapse of two centuries they discovered all at once that there had been no supply of clear water in all that time—that their faces were atrociously dirty—that their hands were unnaturally foul—and that their health was immeasurably injured, equally by the miserable water taken from pumps, as well as the poison sold by the Manhattan Company. . . . A law was drafted with the haste of steam power. . . . Every body rejoiced. The whole city for six months were in an extacy of joy. . . . Five Commissioners were selected from the very *elite* of the democratic party—the very fathers of Tammany Society. . . . Two months passed on—three months—four months—a year—two years have now elapsed, and yet we hear nothing of the murmering Croton. . . . The Commissioners are in the regular receipt of their salaries, and that appears to be all they are doing or intending to do. . . .[10]

Bennett's charge that Allen and his fellow Commissioners were only interested in drawing their salaries was unjust. The truth was that no one in the city was more distressed by the delay on the Croton project than Stephen Allen. Unhappily, the chairman of the Board of Water Commissioners and his chief engineer, Major Douglass, had found it increasingly difficult to get along with each other. Douglass, regarding his surveys of 1833 and 1834 as merely preliminary and general, had requested permission to lead a large party into the field in the summer of 1835. Allen, anxious to save the public money, had permitted the engineer to employ only sixteen or seventeen men instead of the thirty or forty whom Douglass believed that he needed.

But these early differences of opinion were minor compared to the quarrels of 1836. Impatient to start purchasing land, Stephen Allen was angered by the failure of the engineers to provide the necessary maps until June. His exasperation was intensified by Douglass' contention that it was necessary to survey the line of the aqueduct for a fourth time in order to improve its location. Moreover, he considered the engineer's request for a corps of sixty to seventy persons to assist him in this task entirely unnecessary and limited him to a staff of only about one-quarter this size. Major Douglass considered himself hopelessly hampered by these restrictions.

The final showdown came in the fall of 1836. Having at last obtained the necessary maps, the Water Commissioners ordered the engineers to provide detailed specifications upon which they could invite bids from contractors. But once again delays and excuses were forthcoming. What particularly annoyed Allen and his colleagues was Douglass' persistent demand for more personnel. Justly or unjustly, they suspected that the engineer was incapable of preparing the specifications and was trying to hire somebody to do the work for him. The Major was given an opportunity to resign, and, when he refused to do so, he was removed.[11]

The new chief engineer, appointed October 11, 1836, was John B. Jervis. Although not quite forty-one years old, Jervis had already had an interesting career. In 1817, when he was twenty-one, he had been employed by Benjamin Wright as an axeman for a surveying party running the line for the Erie Canal through Rome, New York, his home town. Fascinated by the work of the engineers, young Jervis taught himself the art of surveying and was soon entrusted with larger responsibilities. In 1819, he became resident engineer in charge of constructing one of the divisions of the Canal. After the Erie was completed in 1825, Jervis became principal assistant to Benjamin Wright on the Delaware and Hudson Canal. Two years later he became chief engineer. From canal building he graduated to railroad engineering. He was in charge of constructing the Mohawk and Hudson Railroad, one of the earliest lines in the country, and later built the Schenectady and Saratoga. In September, 1836, when the Water Commissioners offered him the post of chief engineer of the Croton Aqueduct, he was engaged in the enlargement of the Erie Canal.[12]

The Commissioners had made an excellent choice. Although largely self-taught, Jervis was intelligent, hard-working, and honest. Many of the practical lessons that he had learned in building canals and railroads were applicable to the building of an aqueduct. Moreover, Jervis had a good head for business. He immediately reduced Douglass' staff of nineteen to five for the winter season[13] and directed the energies of this small corps so expertly that the first specifications were soon ready. On February 28, 1837, the Water Commissioners were able to advertise for bids for constructing the Croton Dam and the section of aqueduct between the dam and the village of Sing Sing.[14]

It was only natural that the professional pride of Major Douglass should have been deeply wounded by his dismissal. In later years he and his friends explained the episode in terms of party politics. Allen and all the Commissioners except one were Democrats and could not bear to see the credit of building the aqueduct go to a Whig like Douglass; hence his dismissal and replacement by Jervis, a protégé of the Albany Regency, the state Democratic machine. The Douglass faction further asserted that all the maps and plans for the aqueduct had been completed by the first engineer and that Jervis had merely carried these out.[15] Stephen Allen vigorously denied that Douglass' dismissal had been motivated by politics,[16] and Jervis was equally positive in denying that his predecessor should enjoy all the glory for having planned the aqueduct. Douglass was given credit for locating the line from the Croton to the Harlem River and for general suggestions on other problems, but all the technical details remained to be worked out. Jervis

claimed to have saved the city more than a million dollars by his modifications of Douglass' cross-section plans for the masonry conduit.[17]

Among the useful abilities of the new chief engineer was that of picking able assistants. His principal lieutenant was Horatio Allen, another shrewd man taught in the school of experience. Allen had been associated with Jervis on the Delaware and Hudson Canal and, after that, had built the famous South Carolina Railroad. Another valuable subordinate was Edward H. Tracy, who had been associated with Jervis on the Erie Canal.[18]

With country men's traditional suspicion of the city, the Westchester farmers fought the Croton project at every point. When the Legislature met for its 1836 session, it was besieged with demands that the powers granted the Water Commissioners should be reduced. Although the Commissioners put up a stout defense against hampering legislation, they sought to allay Westchester fears by assenting to an act which provided that any land taken for the aqueduct and not used for that purpose must be returned to its original owners and stipulated that necessary fences and convenient passes under and over the aqueduct should be built by the Commissioners.[19]

This olive branch was brushed aside, and on March 4, 1837, a meeting of Westchester citizens approved a new memorial to the Legislature, drafted by Theodorus C. Van Wyck, the same implacable foe of the Croton project who had distributed handbills during the election of 1835. The act under which the Water Commissioners were proceeding was condemned as extending the boundaries of New York City and "invading the historic manor of Cortlandt and county of Westchester."[20] It provided for depriving owners of their property without their consent and against their will, and was therefore repugnant to the Constitution of the United States and the Constitution of New York. The petitioners prayed that the act be repealed "and that your memorialists be left, as all good citizens should be left, free from any such intrusion or disseizin, peaceably to enjoy, retain, or dispose of their respective real estates and property, as to them, respectively, shall seem meet."[21] Once again the Water Commissioners had to hurry to Albany to prevent serious interference with the water works project.[22]

Westchester hostility also took the form of interference with the work of the engineers. Surveying parties were forbidden to cross certain properties and threatened with trespass suits. They were subjected to abusive language and, on one or two occasions, were actually assaulted. The stakes that they used in their work mysteriously disappeared.[23]

In such a climate of opinion, negotiations between the Water Commissioners and the Westchester property owners were difficult. There

were about two hundred owners involved in the area that would be flooded by the Croton Dam or along the line of the aqueduct. Each had to be seen in person. Some were not at home when the Commissioners called; others were out in the fields. Many wanted time to make up their minds, so that even when sales were amicably arranged the transaction often required two or three calls. Most of the property owners refused the Commissioners' offers, and then the slow machinery of condemnation had to go into motion.[24]

The Westchester residents were eager to get all the compensation that they could from the city. Speculators bought up farm land along the aqueduct route, divided the land into village lots, and sought to convince the appraisers that each of these lots was worth as much as would have been given for several acres of farm land a short time previously.[25] The property owners asserted that they would suffer grievous injury through the theft of fruits, vegetables, timber, and tools by the construction workers. At a hearing of the appraisers in the fall of 1837, affidavits were presented claiming extensive damages of this character and further alleging that "a residence near said aqueduct . . . is extremely unpleasant, by reason of the noises, riots, and drunken revels of the said laborers." Moreover, it was "unsafe and imprudent for a respectable female to walk on, or near, or along where said aqueduct is constructing."

The Water Commissioners indignantly denied these charges. Contractors had forbidden the sale of liquor among their gangs and discharged laborers accused of misconduct. Counter-affidavits were offered from farmers who testified that they had never lost any property or heard of ladies being insulted; "so far as their observation extends, the laborers are a civil people."[26]

In reality, the problem of keeping the laborers under restraint was not an easy one. When construction finally gained full momentum, over three thousand workers, mostly recent immigrants from Ireland, were employed. Despite efforts to prevent the sale of liquor to this thirsty army, the Commissioners admitted "that the love of lucre has induced certain individuals, regardless of the injury inflicted on others, to open places of resort for the laborers, where this *enemy of man* may be obtained, in any quantity for money."[27] The Commissioners charged that some of the Westchester farmers themselves had turned their houses into taverns and that the local magistrates had collaborated by granting licenses. Whisky was blamed for frequent riots among the laborers. In April, 1838, a desperate battle broke out between the "Corkites" and the "Fermanaghs," immigrants from different Irish counties. Bodies were maimed, heads were broken, and one man killed.

There were at least two serious strikes. In the spring of 1838, contractors offered unskilled laborers 81¼ cents a day, but the latter demanded more. They quit work in a body and proceeded along the line of the aqueduct from Croton Dam to Sing Sing, picking up recruits along the way. The demonstration was finally broken up by the local magistrates.[28] In July, 1838, the contractors raised wages to a full dollar a day, and this rate prevailed during the summer season of 1839. During slack winter seasons, however, wages were cut to 75 cents. In April, 1840, the laborers again demanded a dollar a day, but the contractors tried to continue the 75-cent rate. This time the strike extended all the way along the line and onto Manhattan Island. Mayor Isaac Varian attempted to overawe the rebellious Irish by ordering out the mounted militia. This imposing array of military might rode up the line of the aqueduct to the north end of the island and back again. It encountered no resistance and dispersed amidst the good-natured jibes of the Irish strikers.[29] But times were bad, and, in the end, the workers had to accept the lower wages.

Meanwhile, Westchester property owners continued to complain of the depredations of the laborers. In presenting a bill of $3,012 for various losses, one Joshua Purdy wrote:

> In making this estimate of damage I have made it for damages actually sustained and have not taken into consideration the inconvenience, trouble and anxiety of having between three & four hundred Irishmen upon my own farm and within a few rods of my dwelling house—for of that no estimate could be formed nor any calculation made—of this I do not now nor shall not hereafter make any charge. But I can assure you it is no pleasant thing to have . . . huts or shantees as they are called stuck up within a few rods of my dwelling and peopled with the lowest and most filthy of mankind, children nearly naked before your eyes, and that of your family.[30]

By vigorous assertion of actual and imagined injuries the Westchester residents gained a maximum of compensation from sympathetic appraisers. Stephen Allen complained that land for the aqueduct, which Douglass had estimated at $36,900, actually cost the city $165,786, while land for the Croton Reservoir, estimated at $28,500, cost $91,412.[31]

Raising the money for all these activities was the problem of the regular city government rather than that of the Water Commissioners. At first there was no difficulty. Times were booming, and the first issue of one million dollars of water stock was promptly sold at a premium of 12½ per cent above par.[32] Just as the first contracts were being signed for actual construction, however, the panic of 1837 completely demoralized the money market. On May 19, 1837, Jervis advised a would-be contractor that the situation had compelled the Water Commissioners to postpone the letting of further contracts.[33] Although bids had been solicited and received on twenty-three sections of work, the state of the city's finances would permit the letting of contracts on only thirteen of these.[34]

Times continued to be bad for the next two or three years, and work on the aqueduct was often hampered by money problems. In March, 1839, Jervis warned one of his assistants that a situation might arise "which would render the employment of the Engineer Department unnecessary."[35] Four months later he instructed his resident engineers to bear the sad tidings to the contractors that they would have to take some of their compensation in bonds.[36]

But the city managed to muddle through without suspending work. Between 1838 and 1840 it disposed of about $1,215,000 worth of water stock in Europe through the banking houses of N. M. Rothschild & Sons and Magniac Smith & Co.[37] When the initial authority to issue $2,500,000 in stock had been exhausted, the Legislature cooperated by empowering the city to issue additional amounts. Stephen Allen was not happy with the way the city officials handled these transactions. In his opinion, the stock was forced onto the market faster than was necessary with a disastrous effect upon its price. From a premium of eleven or twelve per cent the securities fell to par; then to a ten per cent discount. In December, 1841, Allen reported: "The water stock is now at the ruinous rate of $79 in money for $100 in stock."[38]

To Allen's disgust, the Common Council paid the interest on the water loan out of the proceeds to avoid levying a tax on the citizens. Still more reprehensible, the city borrowed heavily from the water fund to pay for opening new streets and other improvements. Faced with the need to replace these diverted resources, someone suggested that, since the city had been laying water pipe for years in connection with its fire prevention program, it would be proper to recover this expense from the water fund. The Legislature passed an act permitting the city to do this, and $400,000 was promptly charged against the water fund for pipes already laid. Allen found grim satisfaction in recording that this bit of financial jugglery was the work of the Whigs.[39]

Once begun in May, 1837, construction of the aqueduct continued to go forward despite all the difficulties created by uncooperative Westchester farmers and shaky finances. Jervis and the Water Commissioners organized the work in four divisions and 96 sub-divisions called sections.[40] After the work on each section had been carefully described in the specifications, the contract was awarded to the lowest responsible bidder. Jervis insisted upon vigilant inspection and the maintenance of strict standards. These were described in the Water Commissioners' Report of January, 1838:

> The foundation of the aqueduct is stone, upon which is laid a bed of concrete, composed of broken granite and hydraulic cement; the side walls are of hammered stone, laid up with cement; the floor is composed of an inverted arch of hard brick, eight inches thick; the lining of the side walls and the upper roof arch are of the same thickness and materials, all laid with hydraulic lime mortar. No common mortar is permitted in the whole structure. The culverts and bridges are of dressed stone, of great strength and suitable dimensions; all laid with hydraulic cement, which undergoes the usual tests before it is passed by the Engineer.[41]

After the first season of construction, the Commissioners reported that 2,455 feet of aqueduct had been completed and 635 feet of tunnels dug.[42] At the end of the second year, 11 1/5 miles of the aqueduct had been completed.[43] Two years later, in January, 1841, about 32 miles, or two-thirds of the waterway, were finished. By this time, the Croton Dam was nearly completed, a massive arch bridge had been built at Sing Sing, and twelve tunnels with an aggregate length of 4,406 feet had been dug.[44]

Brief contact with the hard realities of their project convinced the Water Commissioners that their earlier estimate of a cost of $4,250,000 to bring water from the Croton to the Murray Hill Reservoir was much too low. In their report of January 2, 1838, the Commissioners presented new estimates, showing that the probable cost would be $8,464,033.[45] This provided for a receiving reservoir at Yorkville (in present-day Central Park) and a distributing reservoir at Murray Hill. The two major engineering problems of crossing the Harlem River and Manhattan Valley were to be met by syphons of iron pipes, which would be less expensive than the alternative suggestion of high arched bridges.

On March 1, 1838, Jervis advised a contractor that the letting of new contracts was being delayed. "We are kept in suspense by the corporation in relation to the manner of crossing Harlaem river and this may defer our letting a few weeks."[46] At it turned out, the question of whether the Harlem should be spanned by a high or a low bridge was the most bitterly debated issue that arose during the construction of the aqueduct.

Residents of Westchester County again took the lead in opposing the plans of the Water Commissioners. Early in March, 1838, a meeting of Westchester citizens adopted a memorial to the Legislature, praying for legislation to compel the Water Commissioners to adopt some plan for crossing the Harlem River that would not interfere with navigation.[47] This was the opening shot in a campaign launched against the syphon, or low bridge, plan on three fronts—in the Legislature, in the Common Council, and in the newspapers.

A strong attack upon the Water Commissioners' plan was contained in an unsigned communication to the *New York American* on March 9, 1838. The low bridge, it was asserted, would "deprive the work of all that would render it an ornament to the city and to the age in which we live." Even as a measure for saving money, it was ill devised since iron pipes would not last for more than four or five years without corroding. It would, moreover, do irreparable injury to the navigation of the Harlem River. A high bridge, on the other hand, could serve the double purpose of aqueduct and highway bridge.

This criticism was answered in several communications. In a letter to the *New York American*, Jervis's old friend and chief assistant, Horatio Allen, praised the chief engineer for "the soundness of that practical judgment, which, not led away by the exciting magnificence of a structure on which to see one's name would be a justifiable object of ambition, wisely prefers a more humble, but more substantial, more certain, and more durable plan." To build the high bridge would cost at least $800,000 more than the low bridge and it would delay the completion of the aqueduct by at least a year.[48] The *Evening Post* quoted Frederick Graff of the famous Fairmount Water Works as writing: "The plan you have adopted in passing over Harlaem River with iron pipes, is, in my opinion, preferable to the high aqueduct; the manner you have planned the whole structure, together with the arrangement of the pipes cannot but succeed to give a copious supply of water."[49]

Some letters attacked the motives of the Westchester remonstrants and their New York allies. "Sixteenth Ward" ridiculed the idea that the Harlem was a navigable stream or could be made so. It was twisting and shallow and useless for boats because of dams and bridges already built. The Water Commissioners' plan to provide a span 120 feet wide and 61 feet high was adequate to provide for any navigation that the Harlem was likely to see, even if large sums were spent on its improvement. The trouble all came from "gentlemen speculators," who had bought up the property on both banks of the Harlem, and now wanted "a bridge of sufficient width for travelling over the aqueduct free of cost, to be built at the expense of the city of New York, by which they anticipate a favorable result to their speculations."[50]

At Albany the first skirmish was won by the Water Commissioners. An Assembly committee reported that the low bridge plan would not interfere unduly with the navigation of the Harlem. The proposed span would permit steam boats of large size with canal boats in tow to pass through and would be high enough for most sailing vessels except those with high masts. So far as the latter were concerned, the

committee doubted that any sensible sea captain would follow the tortuous Harlem River to save twelve miles when he could go by the broad deep water of the North and East Rivers.[51]

But the opponents of the low bridge were persistent. The Legislature was induced to revive the charter of a somnolent Harlem River Canal Company,[52] and grandiose plans for the improvement of this long-neglected waterway were set forth. The promoters of the Canal Company conveyed the members of the Common Council on a steamboat cruise along the streams involved in the controversy. After the party had dined at the Harlem River House, Richard Riker, president of the company and a well-known Tammany politician, denounced "the suicidal policy of the Water Commissioners" and proposed an appropriate toast: "The circumnavigation of the island of New York, derived from the God of Nature,—may it never be interfered with by any rude hand."[53]

On March 31, 1838, Jervis was summoned before the Aldermen's committee on roads and canals and questioned sharply. He was accused of having frightened the Water Commissioners with the idea that a high bridge would settle and go to pieces. The engineer denied this, declaring that he had never treated the high bridge as impracticable but merely as more expensive than the low bridge. The committee intimated that Jervis might be afraid to tackle the high bridge, but he rejected this idea indignantly.[54]

A majority of this committee signed a report vigorously condemning the Water Commissioners' plan:

> If the low structure should be adopted and carried out, the injury to the river is permanent and can never be removed; and those who are to succeed us in after years, can only express their unavailing regrets at the mistaken policy which would sacrifice the interests of this part of the island to avoid a portion of the necessary expenditure consequent in retaining the stream.[55]

The committee recommended that the Common Council declare it inexpedient to adopt the low bridge plan and request the Water Commissioners to build the bridge in such a way as to leave at least three hundred feet of the channel open. One committee member, however, wrote a minority report, ridiculing the project for improving the navigation of the Harlem as looking very much "like one of those wild and visionary schemes that are often projected by speculators, for the purpose of increasing the value of their property at the expense of the public."[56]

Before the Common Council undertook serious consideration of these reports, the Water Commissioners contributed another document to the controversy. They defended the low bridge plan as providing

adequate facilities for the kind of navigation to be expected on the Harlem River, even in the unlikely event of its improvement. They emphasized the expense and engineering difficulties of the high bridge alternative. Finally, they contended that it was Martineau's plan for crossing the river by inverted syphons which the voters had approved in the 1835 election. If the Common Council determined upon the high bridge, the Commissioners would feel bound to comply with the decision, but whatever was to be done should be done quickly. "The crossing of the Harlaem River, even by the plan proposed by the Commissioners, is a work of great magnitude, and its commencement ought not be delayed a moment more than what is absolutely necessary."[57]

The Common Council could not agree on a policy. On July 16, the Aldermen passed resolutions declaring that the Council should not interfere with the power and duties of the Water Commissioners by instructing them in what manner they should carry the aqueduct across the Harlem.[58] One week later the Assistants passed conflicting resolutions condemning the low bridge plan and demanding construction of the high bridge.[59] In neither board was the vote along party lines. The Whigs, then in a majority in the Council, were divided between high and low bridge partisans, and so were the Democrats.

The dispute provoked sharp comment. A correspondent calling himself "Westchester Farmer" wrote a letter to the *New York Evening Post* alleging that his fellow-citizens in Westchester had come to love the golden stream from the Croton expenditures so much that they were reluctant to see it stop through an early completion of the aqueduct. Hence the insistence upon the high bridge.

> This is the age of humbugs, but beyond controversy the high bridge will be the highest of all humbugs. For what purpose is it proposed to erect a stone bridge 1450 feet in length, with an elevation of 163 feet above the rock at the bottom of the river, which rock on which the pier must rest is in places 32 feet below the surface of the water? Why this most stupendous and unparalleled bridge must be erected to secure from interruption the navigation of Harlem river—a river that has never been navigated since the creation![60]

In the absence of any clear mandate from the Common Council, the Water Commissioners decided to push ahead with their own plans. On September 7, 1838, they advertised for bids for the construction of a low bridge. The high bridge faction opposed this vigorously. Advertisements were published warning contractors not to risk ruinous litigation by undertaking the work. The Water Commissioners were served with notice that their opponents intended to apply for a Federal court injunction forbidding the construction of any structure that would impede the navigation of the Harlem River. When a construction firm

did contract to build the low bridge, it received a letter warning it of serious legal consequences.[61]

The issue was finally decided at the state capital. Responding to memorials from citizens of Westchester County and from the Harlem River Canal Company remonstrating against the policy of the Water Commissioners, the Assembly passed a bill to compel the Commissioners to cross the Harlem either by a high arched bridge or by a tunnel. Stephen Allen and his associates were shocked by the way in which this was done. "That a measure of so much importance to the city, involving an additional expense of more than a million of dollars, should be permitted to pass into a law, by the immediate representatives of the people of this county, without seeking information from the Commissioners, or from some other disinterested source, is what we had no right to expect."[62]

Learning what was happening from the newspapers, two of the Commissioners and Jervis hurried to Albany in an attempt to prevent passage of the bill by the Senate. But the high bridge faction was too much for them. With only minor amendments, the bill was enacted into law on May 3, 1839. The Water Commissioners were given their choice of crossing the Harlem on a bridge supported by arches and piers, the arches to be at least eighty feet span and not less than one hundred feet high from the usual high water mark of the river, or by a tunnel under the channel of the river, the top of which must not be above the present bed of the channel.[63]

On June 1, Jervis presented a report on the two alternatives. He estimated the high bridge at $838,613 and the tunnel at $636,738. Despite the difference in cost, he recommended the high bridge. It would be difficult to build a tunnel sufficiently water-tight to prevent the percolation of salt water and damage to the pipes. Regular pumping would be required to keep the tunnel dry. As a temporary expedient to provide a supply of water while the high bridge was being constructed, Jervis suggested laying a 22-inch iron main across the river on piles.[64]

On June 15, the Water Commissioners advertised for bids to construct the high bridge. The contract, amounting to $755,130, was finally awarded August 13, 1839. The Commissioners commented grimly on the outcome of the long struggle. The victory of the high bridge faction, they asserted, would delay the introduction of water into the city by two or three years and would involve not only additional construction costs but also the payment of damages to the firm whose contract to build the low bridge had been cancelled. In all, these new expenses would probably amount to $1,500,000 and bring the total expense of the aqueduct up to $10,000,000.[65] Jervis took a more optimistic view

of the situation. As early as December 29, 1839, he had predicted in a letter to a fellow engineer that the high bridge faction would win. "I cannot say by any means that I regret this. As you know engineers are prone to gratify a taste for the execution of prominent works."[66]

As early as September, 1837, one of Jervis' brothers had written to him: "As the Whigs now rule N. York you do not probably feel very certain of retaining your charge of the Water Works."[67] But the fact that the Whigs controlled the Common Council during the years 1837 and 1838 resulted only in minor skirmishes with the Democratic Water Commissioners. Any purge on the Croton project was prevented by the comforting circumstance that William Marcy, a Democrat, still continued to hold the office of Governor. Even the election of the Whig, William H. Seward, to the governorship in November, 1838, did not bring any immediate change, because the Senate with which the Governor shared the appointing power was still Democratic.

The Water Commissioners first encountered heavy partisan attack during the summer of 1839. The *New York Morning Herald* informed its readers on July 18, that at great expense and difficulty it had sent one of its "trusty agents" to examine every part of the great Croton project and to collect every fact "relative to the monstrous management of this great locofoco job." Stephen Allen and his colleagues were condemned for their blunders in the High Bridge episode, which would delay completion of the aqueduct for five years and subject the city to heavy interest charges on the parts of the project already built. To hasten the introduction of the water, the *Herald* proposed—as though it were a new idea and not already suggested in one of Jervis' reports—the laying of a temporary iron main across the Harlem. By this means, according to the incorrigible James Gordon Bennett, the citizens might celebrate the introduction of Croton water on October 1, 1840:

> . . . peans to the Almighty would be poured forth from the lips of beautiful young girls, who would lave their lovely limbs from the same stream in their chambers, before getting in between their snowy white sheets on the evening of the same 1st of October, in the year of our Lord 1840, to whom be all honor and glory for ever and ever, from the hour we get good water to quench the thirst of the whigs, and to wash the filth from the locofocos!

According to the *Herald*, the wicked Democrats were constructing the Aqueduct so badly that much of it would have to be torn down and rebuilt. Moreover, proper management would have provided a truly Roman structure of ten thousand arches, all one hundred fifty feet high, down Manhattan Island. Instead of this, the Commissioners were hiding much of their aqueduct underground. "Therefore let the rallying cry next election be—'the removal of the Water Commissioners!' "[68]

In the state election of November 1839, the Whigs gained control of both houses of the Legislature. Stephen Allen commented sadly on the situation:

> You are aware no doubt that the politics of this state have changed hands, and instead of a Democratic-Republican administration we have now what is termed a Whig administration. This Whig party is composed of a large portion of the old Federal party and of discontented persons who at one time belonged to the old Republican party, a portion of those formerly called National Republicans and nearly all of those belonging to the Anti-Masonic party, and to them has lately been added a number of pretended Republicans who are great friends of banks and who call themselves Conservatives. You may see therefore that to define the principles of a party thus constituted would be a difficult if not impracticable undertaking. There is one thing however in which they all agree, viz—hatred and opposition to every Democrat that is in or out of office. The present Governor of this State and a majority of the Senate being opposed to the Water Commissioners in politics, except one of them, William W. Fox, who was formerly a Federalist and now a Whig, there is every reason to believe that he will be retained in his office while the rest of the Commissioners will be removed.[69]

Allen proved to be an accurate prophet. On March 17, 1840, Governor Seward removed the four Democratic Water Commissioners and appointed four good Whigs to the vacant posts. Fox was not removed, but declined to continue under the circumstances, so a fifth new Whig Commissioner was appointed also. Allen was bitter at his removal. The whole cause was political, "proceeding from the most rancorous and malignant party that ever existed in this country." He denied that his administration of the Croton project had been in any way political.[70] But the *Herald* exulted in the downfall of the old Commissioners and promptly offered the new appointees some pointed advice:

> The course of the new Commissioners, therefore, is a very clear one. If they avoid cabals, cliques, and rascally politicians, go ahead and do their duty, we shall support them; if they act otherwise, we shall cut them up, demand their dismissal, and remove them as surely as we have been the means of removing their predecessors, and putting them in the places thereof.[71]

Just as strongly as Stephen Allen had dominated the first Board of Water Commissioners, Samuel Stevens ruled the second. Stevens, elected chairman by his fellow Commissioners, will be remembered as the bitter foe of the Manhattan Company during the 1820's and the principal sponsor of the 13th Street Reservoir project of 1829.

Stevens and his colleagues at once began to consider how they might improve on the plans of their predecessors. In a special report to the New York Assembly on April 4, 1840, the new Water Commissioners suggested that the plan for two receiving reservoirs at Yorkville was unsound. Storage facilities of this magnitude would not be needed "for a century to come, if ever required."[72] Further investigation proved that work on the Yorkville reservoirs had proceeded too far to be halted, but the Whig Commissioners saved $75,000 by not excavating rock from one of these. By reducing the number of pipes between the Yorkville and Murray Hill reservoirs from three to two, a further $10,000 saving was effected, while by substituting solid masonry for three arched bridges at Clendinning Valley costs were cut by $52,800 more.

The most amazing economy suggested by the Whigs concerned the High Bridge, whose construction had been ordered by the Legislature over the objections of the Democratic Commissioners. Stevens condemned the plan as one involving an expenditure of $1,000,000 to build one of the largest bridges in the world, "while the only duty it is calculated to perform is the support of two, or at most, three lines of iron pipes of 36 inches diameter." He suggested reducing its height to fifty feet above the water line of the river and widening it so that it might be used as a road bridge.[73] But in advocating the low bridge instead of the high one, the Whig Commissioners were no more successful than their Democratic predecessors had been.

In a report written after the news of their removal the old Water Commissioners offered one item of advice to their successors:

> We leave with them our efficient and highly esteemed Chief Engineer, John B. Jervis, Esquire, for whose services in the successful prosecution of the work, the public are greatly indebted. The industry and ability with which he has conducted this great enterprize, will carry his name to future time, let who will be charged with its completion. We cannot forbear expressing the hope, therefore, that our successors will avail themselves of the talents and acquired knowledge of Mr. Jervis, for the further prosecution of a work of so much importance to this city.[74]

Whether the Whigs would remove or retain Jervis remained a matter of uncertainty for months. On July 18, 1840, the *New York American* urged that Major Douglass should be given back the job from which he had been removed in 1837. "That the late Board, while availing themselves of Major Douglass' talents in originating the plan of the work, and gaining all that they thought could not be obtained from inferior sources, should have considered an élève of the Albany Regency a more suitable instrument to subserve their political objects than a Whig, and an accomplished officer, is not surprising; but it is hoped that those who occupy the places of the former Commissioners, and who know how to appreciate the services of the illustrious Harrison, will not permit another old soldier to lie under any unmerited obloquy."

The real campaign to get Douglass back into his old job came during the fall of 1840. The newspapers published a long letter from the Major

to the new Water Commissioners detailing all his charges against the old Board. When the *Morning Courier & New York Enquirer* accompanied this with an assertion that Jervis' appointment had been on party grounds, the latter replied with a letter denying that he was a "political engineer."[75] Stephen Allen also issued a public letter denying that the replacement of Douglass by Jervis had been motivated by politics.[76]

These disclaimers made no impression on Jervis' critics. The *New York American* accused the chief engineer of maintaining a force of two or three thousand laborers on works not needed for two years simply to defeat at the polls the known views of ninety-nine out of one hundred of "those who contribute to the public treasury."[77] Years later Jervis remembered the tensions of this period and the outcome of the crisis:

> The criticisms of Major Douglass and others . . . made a strong impression on the Board of Commissioners. I well recollect one morning Mr. Samuel Stevens, the chairman of the Board, came into the office . . . with an expression that indicated much anxiety. . . . Casual conversation ensued, which soon brought up the aqueduct. Mr. Stevens with a significant sigh, remarked that it would be sad if, after spending so much money, the aqueduct should be a failure. I replied that it would be sad indeed. That I had no doubt of its success; that my experience and investigation gave me confidence. . . . That he must have faith, and if he did not think I was capable of conducting the work successfully it was his duty to engage an engineer on whom the commissioners could rely. Here was a clear case for re-installing Mr. Douglass if the Board had thought proper. They were of the same politics, and I was not. I took no measure to influence them other than by a strict attention to my duties as engineer of the works. It is well known the Board did not make the change, and the public will judge of the reasons.[78]

The most protracted battle provoked by the appointment of the Whig Water Commissioners concerned the construction of the distributing system. The old Commissioners had limited themselves to their own empire, that is, to the line of aqueduct from the Croton Dam to the Murray Hill Reservoir. The distribution of the water through the streets of the city, declared the Commissioners in 1840, "is the proper province of the Corporation, and will be performed under their special supervision."[79] This division of duties involved complications, however, since the city had been given permission to pay for the distributing pipes out of the proceeds of the water stock. When the city was compelled to seek authority to issue three million dollars in additional stock in 1840, the Whig Legislature had added a significant restriction:

> No part of the funds created by this act or any other fund raised for the purpose of constructing or completing the Croton aqueduct, and the works connected therewith, and distributing the water throughout the city, shall be diverted from such object; and no item of expenditure hereafter to be made by the corporation of the city of New-York, and not approved by the water-commissioners and comptroller of said city, shall be charged by the corporation of the said city to the debit of the said fund. . . .[80]

The new Water Commissioners considered this a mandate to extend their supervision over the laying of the distributing pipes. On May 4, 1840, they informed the Mayor and Common Council that they had directed the Croton engineers to examine the plans under which the city was proceeding and to make such suggestions to the Common Council as the subject might appear to require. As a first installment of criticism, the Commissioners pointed out that the city was proceeding too slowly. Only about 35 miles of pipe had been laid of the 165 miles that would be required when the Croton water was introduced into the city.[81]

The Common Council responded by appointing a Joint Special Committee on the Croton Aqueduct.[82] Chairman of this new body was Alderman Peter Cooper, manufacturer and philanthropist, a man cast in the same mold as those other masterful civic leaders, Stephen Allen and Samuel Stevens. Cooper's first move was to make the inevitable pilgrimage to Philadelphia to inspect the Fairmount works and consult with Frederick Graff. His second was to write a vigorous report to the Common Council, requesting authority to open a properly furnished office for the Committee and necessary powers to make contracts for pipes.[83] On August 3, 1840, the Council established a Croton Aqueduct Department to consist of the Croton Aqueduct Committee and a Croton Aqueduct Commissioner to be appointed by the Council and to receive a salary of $1,000 a year.[84] H. A. Norris was appointed to the post of Commissioner, but Peter Cooper remained the key man in the organization.

For a few weeks it seemed possible that the Croton Aqueduct Department and the Water Commissioners could establish harmonious relations. Jervis and his fellow-engineers were consulted on plans for laying the distributing pipes and made a general map for this purpose. But the honeymoon was short. On September 11, 1840, the Water Commissioner challenged various bills of the Aqueduct Commissioner and requested information about details of expenditure. No answer was forthcoming, and on September 24 the Common Council directed the Comptroller to charge the water fund with the Croton Aqueduct Commissioners' requisitions for all expenses south of the Murray Hill Reservoir. The authority of the Water Commissioners was to terminate at this point.[85]

The Water Commissioners refused to surrender. In a long communication to the Common Council they accused the Croton Aqueduct Department of permitting overcharges both on material and labor. The Commissioners continued to claim both an authority to pass upon the work of the rival department and power to make contracts of their own for laying mains below the Murray Hill Reservoir.[86]

The battle between the Whig Water Commissioners and the Democratic city government was now squarely joined. Peter Cooper's Croton Aqueduct Committee prepared a spirited defense of its activities against all the charges of the Water Commissioners. Item by item the Committee defended its expenditures. A new type of stop-cock adopted by the city was praised as far superior to the older type recommended by the Commissioners.[87]

The struggle between the rival authorities continued for months. At one level, it was merely a scramble for party advantage between Whigs and Democrats. At another, it appeared to be a sordid contest to control profitable contracts for labor and materials. But more important principles were at stake. A special committee of Assistant Aldermen investigating the controversy reported:

> If the Commissioners can disapprove and prevent the payment of bills legally chargeable to the fund, for any reasons they may assign—that Board exercises powers as fully legislative as any possessed by the Common Council, under their Charter of the city. They can virtually control the financial operations, and can affect at pleasure the credit of the city: they can continue or delay the great work of distributing the water of the aqueduct through the city, and bring the public authorities and the people into a state of subordination, to a Board of gentlemen not elected by or responsible to the people of this city, but independent of them and of their representatives in the Common Council. It certainly could not have been the intention of the Legislature to produce such a state of things or legalize a system so utterly hostile to every principle of a representative government.[88]

As the controversy developed, one of the main points in dispute involved an important technological issue. Soon after his appointment to the Croton Aqueduct Committee, Peter Cooper had discovered that savings as high as twenty per cent could be effected by purchasing pipe cast directly from ore at the blast furnaces rather than pipe made from remelted pig iron.[89] Although skeptical at first, since New York opinion strongly favored the use of remelted iron made at local foundries, Cooper became convinced that the cheaper pipe was actually stronger and better. The decision to use this provided the grounds for some of the strongest criticism of the Croton Aqueduct Department. Iron mains cast in this manner, the Water Commissioners charged, would lack both strength and durability.[90]

Cooper vigorously defended the use of pipe cast directly from ore. Frederick Graff had been using this kind in the Philadelphia system for many years and considered it fully as good as pipe made from remelted iron. An agent of the United States government, sent to Sweden to investigate the best methods of casting cannon, was said to have discovered that iron cast directly from the ore was stronger than it ever could be made by remelting the iron.[91]

In a long communication to the *New York Commercial Advertiser*, "S.R." [Samuel Richards] and others of his family, owners of blast furnaces in New Jersey, stated their opinion "that iron is never strengthened by remelting" and provided many interesting details about the American pipe business. This firm had been selling cast iron pipe to the city of Philadelphia since 1818; it had supplied about fifty out of sixty-two miles of pipe laid in that city. It had also sold its product in large quantities in some twenty-five other cities including Boston, New Orleans, Albany, Troy, and Trenton.

> There are in the United States, not less, probably, than 800 miles of our pipes, large and small, in use, and no complaint has ever been made of want of strength, though many have been tried for 15 or 20 years. . . . A large quantity were furnished the Manhattan water company, and these have long lain in the streets of New York. Other persons, too, have made and sold pipes cast from the ore, in Maryland, New Jersey, and Pennsylvania; these have been tried, both above and under ground, and found good. We believe there is no risk in saying that for every pipe cast from remelted iron, and placed under ground in the United States, there have been one hundred cast at furnaces from the ore, and probably two hundred.[92]

The battle between the Whig Water Commissioners and the Democratic city government ended in victory for the latter. In April, 1841, the Legislature passed an act limiting the authority of the Commissioners to the works north of and including the Murray Hill Reservoir.[93]

In the early morning hours of January 8, 1841, the Croton project received its most serious setback. For more than two days a heavy rain had fallen, melting the eighteen inches of snow that had covered the ground when the storm began. In the four hundred acres of lake backed up by the nearly-completed Croton Dam, the water rose at the dangerous and entirely unexpected rate of fourteen inches an hour. Since the waste gate at the dam was too small to accommodate so much water, an ever-increasing torrent rushed over the masonry overfall. This structure held, but when the water began to pass over the earthen embankment between the overfall and the north shore of the river, the dam was doomed. A youthful Paul Revere named Alfred Brayton, the son of one of the contractors, went hurrying off through the night to warn families sleeping in the path of the expected flood, but his mission was

handicapped by the high water that had already swept away some of the bridges below the dam. Three lives were lost when the embankment finally gave way at 4:30 A.M. The flood destroyed four bridges, three mills, and five or six houses.[94]

Despite the wrecking of the Croton Dam and the attendant losses, the Water Commissioners were able to make some comforting observations on the episode:

> This disaster, though calamitous and unexpected, comes at a period which will bring much less loss and inconvenience, than if it had happened after our works were in operation. It will enable us to guard against a recurrence of such an accident, for we have seen the Croton in its most dangerous and unprecedented condition; and we hope in the future plans to be better prepared to meet it.
>
> We are happy to say, that all the aqueduct work, on the line, has stood remarkably well, and the culverts have been found ample to discharge the water from the valleys and streams, and the embankments have been but little washed or damaged by this unprecedented storm.[95]

Thus instructed by bitter experience, the engineers rebuilt the dam upon a radically different plan. The earthen embankment, which had been the Achilles' heel of the old structure, was eliminated, and a continuous stone barrier was constructed across the river. The overfall now extended the full width, some 260 feet, or almost three times the width of the old one.[96]

Although the Croton flood involved the city in heavy additional expenditures, it did not delay the introduction of the water. By the summer of 1842, when a supply had been promised by means of a temporary pipe across the Harlem, the new dam was ready for use. On June 8, the Water Commissioners accompanied by the engineers began the final inspection of the Aqueduct, a three day journey on foot through thirty-three miles of masonry conduit from the Croton Dam to the Harlem River. At 5 A.M. on June 22, water from the Croton was admitted into the Aqueduct, and a small boat called the *Croton Maid,* capable of carrying four persons, began the first navigation of the artificial stream. Some twenty-two hours later water began to be visible to the anxious watchers at the Harlem River end of the line, and shortly afterwards the *Croton Maid* arrived at its destination.

On June 27, the Croton water was admitted into the Yorkville Reservoir. Present for the occasion were Governor Seward, Mayor Morris, and many other dignitaries, as well as a large crowd of curious citizens. A 38-gun salute from a detachment of artillery greeted the arriving waters. When the intrepid crew of the *Croton Maid* brought their craft into port in the reservoir, the spectators cheered enthusiastically, "as she afforded indubitable evidence that a *navigable* river was flowing into

the City for the use of its inhabitants."[97] The voyage of the *Croton Maid* from Croton Lake to Yorkville was somewhat deceptive, however, since long portages had been necessary at the Harlem River and the Manhattan Valley where the water was conveyed through iron pipes.

On the fourth of July, a second civic festival celebrated the introduction of water into the Murray Hill Reservoir. Few persons were on hand at sunrise to witness the actual opening of the valves, but the Mayor and many other leading citizens visited the reservoir during the day. As an additional attraction, the engineers had provided a jet which threw water forty or fifty feet into the air at the intersection of 47th Street and 5th Avenue. The city desperately needed the new supply. The tanks at 13th Street on which fire protection depended were dry, and at the Mayor's particular request the Croton water was immediately allowed to flow down into the distributing pipes of the lower city.[98]

When Philip Hone and his wife drove out to the Yorkville Reservoir on the afternoon of July 12, they found a great number of other visitors on the grounds—"pedestrians, horsemen, railroad travellers, and those who, like myself, came in their own carriages . . . —for it has become a fashionable place of resort; and well it may, for it is well worth seeing." The Hones then drove down to the Murray Hill Reservoir.

> The two basins here have about one-third of their quantity of water, and the distributing pipes are filled and the waters being supplied to such places in town as are prepared for it. This great enterprise will cost $10,000,000, and it is somewhat remarkable, and an evidence of its acknowledged utility, that with the certainty of a tremendous increase of taxation consequent upon it, to the present generation and its posterity, and in party times, too, when men are so hard to please, not a voice has been raised against it, and all parties hail the advent of the "pure and wholesome water," after its journey on the earth, and under the earth, and across the watercourses of miles, as a proud event for our city, and one which enables the Knickerbockers to hold their heads high among the nations of the earth.[99]

The festivities of June 27 and July 4 were only preludes to the great water celebration of October 14. Two days before the holiday Hone wrote in his diary: "Nothing is talked of or thought of in New York but Croton water; fountains, aqueducts, hydrants, and hose attract our attention and impede our progress through the streets. Political spouting has given place to water spouts, and the free current of water has diverted the attention of the people from the vexed questions of the confused state of the national currency."[100]

The great day began with the discharge of one hundred cannon and the ringing of church bells. Thousands of jubilant spectators crowded the windows, balconies, and sidewalks to watch a five-mile-long parade

pass by. First came an impressive military escort, then a dozen barouches bearing Governor Seward, Mayor Morris, Samuel Stevens, Stephen Allen, Philip Hone, and other dignitaries. These were followed by regiments of soldiers, by fifty-two companies of firemen with bright uniforms, banners, and well-polished machines, by the butchers on horseback, by numerous marching temperance societies, and by organizations of mechanics. On a press once used by Benjamin Franklin, a special ode in honor of the occasion was printed and distributed to the enraptured onlookers.[101]

George Templeton Strong, an aristocratic young lawyer, recorded the event with some condescension: "The procession was mighty fine. There was no end to the military men . . . so stuffed up that their arms looked like the inverted antennae of some strange insect—no end to the firemen and their red shirts, nor the Temperance Societies. On the whole it was much like the generality of these great civic processions; just the usual amount of claptrappery and stuff and humbug and rowdyism. Rowdyism dressed up and exhibiting its grandeur to the public is very amusing."[102] But Philip Hone, who had lived longer and seen more parades, was impressed.

> It was certainly a great affair; but nothing struck me with more pleasure and surprise than the perfect order and propriety which prevailed among the immense masses of male and female spectators on the route of the procession; not a drunken person was to be seen. The moral as well as the physical influence of water pervaded everything. Ardent liquors were not proof against its predominating power: there was no quarrelling, no resistance to authority, no unruly behavior; the people stood and looked on delighted and unfatigued during the three hours occupied in the passage of the pageant. It was a day for a New Yorker to be proud of.[103]

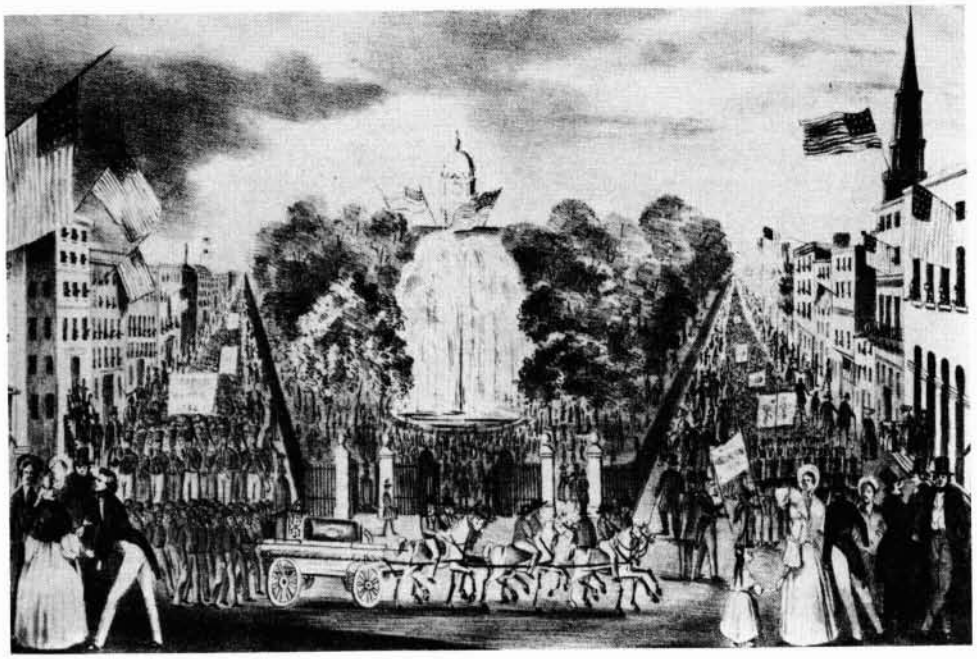
Not until five o'clock in the afternoon did the paraders complete the line of march and crowd into the park in front of the City Hall to hear orations by Samuel Stevens and other dignitaries. This was followed by a collation and more speech-making by the Mayor and the Governor. "By this time it was night, and the public gardens, theatres, and fountains completed the great celebration of the triumph of Croton water."[104]

The fountains were a special delight. Of one erected in Union Square, a contemporary newspaper declared: "It throws up a noble column of water to a height as great almost as the houses which surround the square. . . . In the evening, by the moonlight, the effect of the fountain showering its spray on every side, was exceedingly fine." Still more beautiful was the display provided near the City Hall:

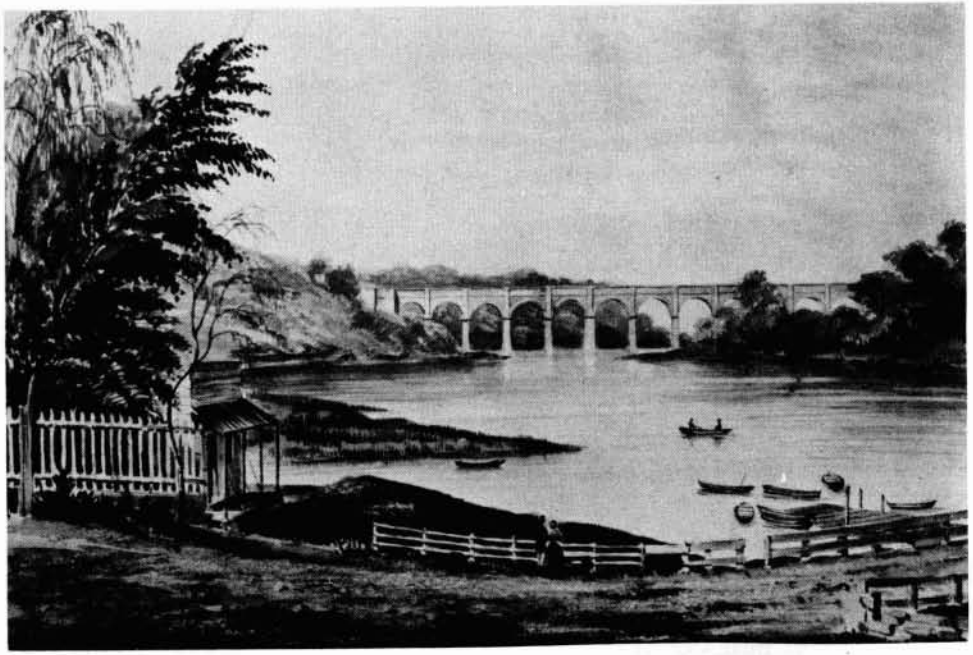
> The large basin in the Park, although merely the foundation of a magnificent structure to be completed at some future day yet presents great at-

Reservoir of the Manhattan Company Water Works, Chamber Street, New York City. From *Valentine's Manual,* 1855. (*New York Public Library*)

Street scene near City Hall, New York City. Note the hand-pump fire engines and the spring-water cart. (*New York Public Library*)



Croton water celebration, October 14, 1842. Scene near the City Hall. (*New York Public Library*)



High Bridge, New York, 1849. This structure carried the Croton Aqueduct across the Harlem River onto Manhattan Island. From a painting by Fanny F. Palmer. (*New York Public Library*)

> traction, not only from its novelty to our water sparing citizens, but from the beauty and magnificence of the fountain itself, that cannot be surpassed in this country. The basin is 100 feet in diameter, and the whole fountain is composed of one main centre jet, and twenty-four subordinates, all of which can be changed so as to present different views and forms. The cast iron plates already prepared for the centre jet present three changes—the first a close column fifty feet in height, called "The Maid of the Mist"; the second, with a centre and sides, called "The Croton Plume"; and the third in an expanded shape, termed "The Fan". The outside or subordinate jets, can be made to throw a stream from 15 to 20 feet in any direction desired. . . . [105]

Despite the general spirit of fraternal love pervading the events of the day, a few scars left from earlier political duels could not be concealed. Stephen Allen considered it a slight that he was asked to ride with the former mayors of the city rather than in a position that would recognize his unique contribution to the water project. He outwitted his Whig rivals by arriving early at the assembling point and capturing a position in one of the first carriages. By this maneuver, as he gleefully recorded in his memoirs, he had "a more conspicuous situation than those who succeeded me in conducting the water."[106]

John B. Jervis was also wounded in pride by the fact that Samuel Stevens had reserved for himself a prominent position in one of the barouches and left his chief engineer to plod along on foot with his subordinates. As a gesture of protest, the engineers and contractors threatened to boycott the whole affair, but Governor Seward set everything to rights by inviting Jervis to ride with him.[107]

Although fully appreciated as a novelty to gush skyward in fountains, the Croton water was regarded with some suspicion for more utilitarian functions. On August 1, 1842, George Templeton Strong set down his impression that the new water was "all full of tadpoles and animalculae," and flowed through an aqueduct "which I hear was used as a necessary by all the Hibernian vagabonds who worked upon it." One of Strong's friends had drunk some of it and was "in dreadful apprehensions of breeding bullfrogs inwardly."[108] But Strong's prejudices were soon overcome. On May 17, 1843, his diary reveals that he was building a new bathroom.

> In Greenwich Streets did G. T. S.
> A stately backbuilding decree,
> Where clear the Croton Water ran
> Through pipes impervious to man. . . .[109]

And by July 17, 1843, he had so far forgotten the Hibernians that he could record: "I've led rather an amphibious life for the last week—paddling in the bathing tub every night and constantly making new discoveries in the art and mystery of ablution. Taking a shower bath

upside down is the latest novelty. A real luxury, that bathing apparatus is . . ."[100]

While New Yorkers delighted in public fountains and shower baths, construction of the controversial High Bridge dragged along at tortoise pace. With an adequate supply for present needs brought across the Harlem by the temporary pipe, there was little pressure to complete the permanent structure. Indeed, in the early months of 1842 the Croton Aqueduct Committee seriously considered its abandonment. The engineers were once again consulted on the possibility of tunneling under the river, or crossing the stream in some other less expensive fashion.[111] A resolution to suspend construction of the bridge actually passed the Common Council, but failed to receive the Mayor's signature.[112] The contractors, worried by these evidences of indecision, performed their work one step at a time and wrangled incessantly over their compensation. Relations between the Whig Water Commissioners and the contractors were very bad, each party accusing the other of responsibility for the delays and frustrations in the work.[113]

A Democratic victory in the state elections of November, 1842, resulted in the reappointment of the old Water Commissioners on February 8, 1843. Again elected chairman by his fellow-Commissioners, Stephen Allen took up his duties with vigor. Ironically, his principal responsibility was now to complete the construction of High Bridge, for which he had no more love in 1843 than he had had in 1838:

> It is a sore reflection to us that by the influence of a parcel of interested speculators in land upon the members of the Legislature of this state, the city should have been forced into an expense of $500,000 or $600,000 more than the plan we had adopted, which was in every respect preferable to the present, as it not only saved the large addition to the city debt, but would have been completed long since, and thus lessened the taxes for interest.[114]

On May 30, 1848, the Croton water was finally admitted into the first of two pipes laid across High Bridge, and from that date the supply of the city passed over this route.[115] Several months of work were still required, however, to complete the structure, remove the coffer dams, and restore the navigation of the river. Despite the controversy that had focused on the High Bridge for more than ten years, New Yorkers were very proud of the completed structure. On October 29, 1847, George Templeton Strong recorded in his diary: "Rode to the High Bridge, now nearly finished. . . .Very great piece of work is the bridge, and very great city is this with all its absurdities."[116]

The completion of the great Croton project was marked by the passing from the stage of its principal protagonists. On January 21, 1848, Stephen Allen once more lost his job when the Democratic Water Commissioners were superseded with a new Whig board, headed by Philip Hone.[117] But by this time the Water Commissioners' work was nearly finished. The old state-appointed board was abolished on April 11, 1849, and the water works were brought under the unified management of a new Croton Aqueduct Department, appointed by the Mayor and Aldermen.[118] On June 30, 1849, John B. Jervis resigned his post on the Aqueduct to devote himself to railroads.[119]

The Croton system, as left to the city by these builders, was one of the most notable public works of the nineteenth century.[120] Croton Dam, erected about six miles above the junction of the Croton and the Hudson, was a masonry structure some 270 feet long and 50 feet high, backing up a lake five miles long and covering about 400 acres. From the dam to the Harlem River there stretched thirty-three miles of masonry aqueduct. The interior of this conduit was elliptical in form, about 8½ feet high and 7½ feet wide. To maintain a uniform grade, the aqueduct had been tunneled through hills and carried across valleys in earthen embankments. Over the deeper ravines and over numerous streams and highways, aqueduct bridges had been built. Some of these, like the bridge at Sing Sing with its span of 88 feet and its height of 76 feet, were structures of striking boldness.

The famous High Bridge across the Harlem was 1,450 feet long with arches 100 feet above the surface of the river. Of its fifteen arches, eight with a span of 80 feet each rose out of the stream itself, and the remaining seven of lesser span stood upon the shores. Grand though High Bridge seemed to most citizens, it was somewhat of a disappointment to others, since it had been built about twelve feet below the grade level of the aqueduct. The water was carried across the bridge in an inverted syphon of two 36-inch iron pipes, covered for protection with five feet of earth.

On the New York side of the Harlem, the stream from the Croton was raised again to grade level and conveyed seven and one-half miles more by masonry conduits and iron pipes, through the Receiving Reservoir at Yorkville and on to the aqueduct's terminus in the Distributing Reservoir at Murray Hill. The most notable engineering features on this part of the line were the crossing of Manhattan Valley by another inverted syphon of iron pipes four-fifths of a mile in length and the crossing of Clendinning Valley on an embankment of massive masonry 1,900 feet long pierced by arches for three prospective streets.

The Receiving Reservoir at Yorkville occupied a site extending from 79th to 86th Streets, between 6th and 7th Avenues. It was divided into two divisions so that one might be used to supply the city while the other was drained for inspection and repairs. The two divisions together had a capacity of about 150,000,000 gallons and composed a lake

of some thirty-one acres. Two, and later three, 36-inch iron mains conveyed water from this reservoir to the Distributing Reservoir at Murray Hill.

The Murray Hill Reservoir extended from 40th to 42nd Street and from 5th Avenue halfway to 6th Avenue. This massive structure was 420 feet square and some 49 feet high. It was divided into two divisions with an aggregate capacity of 20,000,000 gallons. Of all the works connected with the Croton Aqueduct this was the one most accessible to ordinary citizens. What they saw is thus described by a writer in *Harper's Magazine* in 1860:

> This huge structure is one of the most imposing portions of the Croton architecture. Its compact and massive walls, seemingly strong and enduring as the everlasting hills, with their quaint Egyptian cornices, give to the vast edifice a very sphinx-like aspect. No citizen passes it, pass often as he may, without a vivid consciousness of its presence, and no stranger fails to ask curiously of its character and purpose.[121]

The Reservoir's popularity was enhanced by a stone staircase by which sightseers might mount to the top of the wall. Here a walk protected by an iron railing permitted them to gaze down on the cool Croton water within the Reservoir and to look out over the city and the harbor that lay in an impressive panorama below.

Less interesting but scarcely less important were the iron pipes, some 266 miles in length by 1860, through which the water was distributed under New York's avenues and streets into fountains, hydrants, houses, and public buildings. Running water in the home was still sufficiently novel for the *Harper's* author to indulge in somewhat kittenish description:

> From the central channel-way in the streets the water finds its way readily into the houses right and left, where from cellar to attic, it is at all seasons and all hours instantly obedient to call. It needs but to turn the faucet when, presto! its sparkling drops rush forth in inexhaustible supplies. So willing, indeed, are the merry waters, and so much of their old mountain mischief do they still preserve, that without a care they may pay you a melancholy prank or two, and, escaping through an unguarded vent, may disport themselves over your carpeted floors as among their native rocks and sands. . . .[122]

How much had it cost the citizens of New York to enslave the sportive Croton? The project, which had frightened New Yorkers in 1833 when estimated at about $5,000,000, cost in the end over twice that amount. The aqueduct from Croton Lake to Murray Hill Reservoir required an expenditure of over $8,500,000; the distributing pipes some $1,800,000 more, making a total of over $10,300,000. Because of loose methods of financing—paying interest out of the proceeds of the loan and selling water stock at prices below par—the actual water debt was almost

$13,000,000. This involved serious fiscal problems, since revenue from water rents was at first somewhat disappointing.[123]

Despite these burdens, few New Yorkers regretted the decision of 1835. In the bombastic prose of Samuel Stevens, New York had been granted

> the greatest *material* for its growth, health and prosperity, which is possessed by any city in the world, embracing in its advantage, protection from fire, that most destructive element, and our city's worst foe—a *material* calculated not only to add riches and prosperity and health to our increasing population, but also to improve the morals, moderate the passions, introduce temperance and sobriety in place of indulgence and excess. If this brief statement of benefits is true, who can say that New York, when she spends millions for wines, spirits and luxuries of the most costly description, cannot afford her population pure and wholesome water?[124]

CHAPTER NINE

Water Debates at Boston

> Hail, thou fair Crystal Lake! sweet silver tide!
> Six miles from Boston, on its northern side!
> Thee, with pure water from internal spring,—
> A never-failing fount,—SPOT POND I sing!
> Thy beauteous reservoir I joy to see,
> Near my lov'd city, that has need of thee!
> May not this stream be turn'd to nobler use?
> Millions demand a more auspicious sluice!
>
> *A Voice in the City; to Water Drinkers* (1839)[1]

The citizens of Boston debated the water question for more than twenty years before arriving at a satisfactory decision. The issue was discussed with a vigor of statement that was worthy of the city's unique reputation. The civic leaders involved included members of such proper Boston families as the Quincys, the Eliots, the Hales, the Lymans, the Channings, and many others. The controversy was conducted in the City Council and the Legislature, in meetings at historic Faneuil Hall, in newspapers and pamphlets, in prose and in verse.

The beginning of the long debate may be traced back to April 7, 1825, when a great fire destroyed fifty-three houses and stores, causing losses of half a million dollars.[2] At the next meeting of the City Council the need for better fire protection was inevitably the principal subject for discussion. As one practical measure, the Council instructed the Mayor and Aldermen to purchase two new fire engines of the most approved construction. As another, a joint committee of the two branches of the City Council was appointed to consider additional ways and means of protecting the city.[3] A number of results followed in due course: the fire department was reorganized, new equipment was purchased, and reservoirs, or cisterns, were built in various strategic locations throughout the city.[4]

For advice on these matters Mayor Josiah Quincy wrote to Joseph S. Lewis, chairman of the Philadelphia Watering Committee. After inquiring about fire engines manufactured in the Pennsylvania city,

Quincy added the comment:

> My great wish is to abandon the system of forming lines of citizens & passing buckets at fires; and for this purpose to introduce hose companies upon the Philadelphia principle. Your water works, however, give you so great an advantage in the use of fire apparatus that I am dubious which system to adopt.[5]

Lewis dearly loved to advise the leaders of other cities, and an exchange of several letters on fire-fighting problems followed Quincy's overture. On May 20, 1825, the Philadelphia authority wrote: "I observe your anxiety to establish a system of a supply by hoses instead of Lanes and Buckets, but I should fear such a plan cannot be made complete without a reservoir at a commanding height." He went on to discuss how such a reservoir might be built and supplied, concluding with the comment:

> This calculation is founded on an Idea that you have only salt water at your command for the Reservoir. If you can bring fresh water to your mills for a general supply of the Inhabitants as we have it here then your pipes must pervade the whole city. . . .[6]

Lewis' delicate suggestion that what Boston really needed was an adequate water supply was written just one day after the City Council had come to the same conclusion. On May 19, 1825, it passed a resolution instructing the committee on fire protection to inquire into the practicability, expense, and expediency of supplying the city with good, wholesome, soft water, both for the general use of the inhabitants and for the purpose of extinguishing fire.[7]

Once again Mayor Quincy appealed to Lewis for advice. "I propose," he wrote, "to endeavour if possible to supply our city with fresh river water for culinary, protecting and general use." Suppose the water were taken from a source ten miles from the city. What would be the expense of works to raise it? How much would it cost per mile to bring it to the city? How much to distribute it?[8] Lewis replied that to make such estimates he would need more information, but he hazarded the opinion that if water were brought to the city in iron pipes and then raised into a reservoir by water power, the necessary works would cost about $596,000. Philadelphia's various experiments had cost nearly $3,000,000, Lewis wrote, but the citizens would not sell them for $10,000,000.

> We have been pioneers for the other cities & the result of our experience is heartily at their service. We began wrong & we never shall get right. I mean in point of revenue, because the water is free to every one from the hydrant Pumps in the streets & the rate for those who take it into their homes was fixed too low at 5 D's per house. As this work however belongs to the City alone it is of less consequence as all derive the benefit of the water.
>
> If you get a supply of water let no company supply you, let it be the property of the City & under the control of its corporate authorities.[9]

Mayor Quincy soon discovered that it would not be easy to lead the city toward this new objective. "The project of supplying our city with water," he reported to Lewis on June 6, "has many advocates here but whether we shall be able to raise the spirit to risque the expense is not yet certain. Nothing will be omitted on my part to effect it."[10]

The committee which had been studying the matter under Quincy's chairmanship made a report to the City Council on June 13. The members were agreed on the expediency of obtaining a supply of water, but they were divided on whether the task should be committed to private enterprise or undertaken by the city itself. Further information was obviously needed, and the committee recommended that some competent person be employed to examine possible sources and means of conveyance.[11] Daniel Treadwell, a local engineer, was appointed to make the surveys.

In his report, submitted to Mayor Quincy in November, 1825, Treadwell calculated the minimum daily requirements of the city at 1,600,000 gallons a day—a modest estimate which allowed only 100 gallons per family and assumed that when the water was needed to extinguish fires its use for other purposes would be forbidden. There were several places where a supply of this amount might be obtained, but the two most advantageous, in Treadwell's judgment, were the Charles River above the falls at Watertown and Spot Pond in the town of Stoneham. To use the Charles River, it would be necessary to pump the water by water wheels into a reservoir on Beacon Hill. Spot Pond, however, was at a sufficient elevation to supply the city without machinery. Treadwell's estimate for the Charles River plan was $514,842, and for the Spot Pond project, $558,353 or $615,469, depending on which of two alternative routes was followed.[12]

Mayor Quincy promptly forwarded a copy of Treadwell's report to Joseph S. Lewis in Philadelphia and asked for the latter's comments. The Mayor added:

> In your former letter, you pressed on me the importance of having water brought into the City *by the City itself* and not by private corporations. May I ask the favor of you to furnish me with your general reasons on that point. Although obvious enough, on some accounts, I think they would come with more weight from you than from me, supported as you would be by your acquaintance with the experience of Philadelphia. . . .[13]

Lewis in turn submitted Treadwell's report to Frederick Graff, the engineer of the Fairmount Works, who found several grounds for criticism. The Boston engineer's allowance of only 100 gallons a day per family was too small; the proper figure should be 150 gallons a day. "The Spot pond project," Graff wrote, "appears to be too uncertain as

regards the quantity of water in dry seasons."[14] Lewis transmitted these criticisms to Mayor Quincy together with a strong statement of his reasons for preferring municipal rather than private ownership:

> Scarcely a fire happens of any magnitude in London, without complaints of a deficiency of water, and I have in my possession a paper containing an account of a meeting of the Common Council of London, convened for the express purpose of inquiry into the cause, which it does not require much consideration to discover. It is from the fatal error of suffering interested individuals to have the supply of an article of the most indispensable nature and without which health and comfort cannot be enjoyed. Expence is not to be regarded; if a Company can supply your City, they will expect to profit by it, and this profit might as well be saved by your Corporation. On the other hand, if it is a losing business, individuals should not suffer by forwarding of a great public object; and if they do, the citizens will feel it by a pinched and partial supply. . . .[15]

Lewis' reasoning made a powerful impression on Mayor Quincy. Conservative in politics though he was, Quincy strongly opposed the idea of private enterprise in the water supply business. In his second inaugural address as Mayor, he warned that a group of highly respectable citizens were contemplating an application to the Legislature for a charter of incorporation as a water company. If such an attempt were made, he called upon the Council to oppose it resolutely. "If there be any privilege, which a city ought to reserve, exclusively, in its own hands and under its own control, it is that of supplying itself with water."[16] He bolstered his argument with an extended quotation from Lewis' letter. As further proof of the city's need for a public water supply, he also transmitted to the Council the contents of a letter written to him on November 25, 1825, by the well-known Boston physician, Dr. John C. Warren. The latter had asserted:

> The spring water of Boston is generally harsh, owing to its being impregnated with various saline substances. This impregnation impairs its excellence as an article of drink, and essentially diminishes its salubrity. In the course of my practice I have noticed many instances of disease, which have been relieved and cured by an exchange of spring water for pure water . . . and I have no doubt many complaints owe their existence to the use of the common spring water of Boston. . . . The introduction of an ample supply of pure water into this place would therefore contribute materially to the health and comfort of the inhabitants of Boston and would be one of the greatest blessings which could be bestowed on this city.[17]

When, as expected, a group of influential citizens petitioned the City Council to assist them in obtaining a water company charter, the Mayor was able to defeat the scheme. But his own plan for municipal water works ran into difficulties. He obtained options on water rights on the Charles River and elsewhere, but the high prices demanded by the

owners convinced cautious Council members that the project would be too expensive. Quincy at length concluded that the time was not ripe for action. Deeming it best to wait until "the urgent wants of the inhabitants should counteract the prevailing apprehension of a city debt," he did not press the matter further.[18]

Private capitalists made another move in 1827. On February 5, George and Thomas Odiorne, owners of Spot Pond, petitioned the City Council for the privilege of supplying Boston by aqueduct. They would be willing to compensate the city for the franchise, either by paying over a portion of the water rents, or by supplying free water for municipal purposes.[19] But Mayor Quincy continued to oppose all such projects. On November 12, a committee of which he was chairman reported that it would be "inexpedient" to take any action on the subject.[20]

In January, 1829, Quincy was succeeded as Mayor by another old-time Federalist, Harrison Gray Otis. In his inaugural address, Mayor Otis alluded to the need for water and endorsed the stand which his predecessor had taken.[21] A year later, however, Otis appeared to be less firmly committed to municipal ownership.

> A copious supply of fresh water is a convenience, the want of which becomes constantly more imperative. If, upon due consideration, it should not be determined expedient for the city to erect hydrants on its own account, the propriety of granting that immunity to a company will naturally engage the attention of the city government.[22]

During the administration of Otis' successor, Mayor Charles Wells, the water question continued to receive sporadic attention. In January, 1832, the City Council appointed a committee to consider the expediency of supplying the city with good and wholesome water.[23] No action was forthcoming, and a year later the Council again appointed a committee to study the problem.[24] This time the need apparently appeared more urgent, because on March 11, 1833, the Council instructed the Mayor to apply to the Legislature for an act authorizing the City Council to purchase such lands as might be necessary to bring soft water into the city and to take such other measures as might be required. But the city's application reached the Legislature too late in the session for consideration.[25]

Theodore Lyman, a Jacksonian Democrat, elected Mayor in December, 1833, felt the importance of the water issue even more keenly than his predecessors. Before his inauguration he began to prepare an elaborate communication to the City Council and wrote to Joseph S. Lewis for information, particularly on the manner in which Philadelphia safeguarded its supply from contamination by manufacturers along

the Schuylkill.[26] Lewis gave the requested data and again emphasized the importance of municipal ownership.

> I endeavored to impress upon Mr. Quincy the importance of a supply of water (if carried into effect in Boston) as a public measure & not by a separate Corporation or Company whose interest would be to furnish the smallest quantity of water at the highest possible price, while it would be the interest of the city to get the greatest supply at the smallest cost.
>
> No cost should deter you from having a copious supply of wholesome water & there can I think be no cost that would not pay an interest & probably a handsome revenue.[27]

Mayor Lyman's communication on the water problem explored every aspect of the subject. First, he considered the present sources from which the residents were drawing their water. "There is abundant reason to believe," he warned, "that the well water in the City, has generally speaking, become worse and from causes unavoidable, wherever a large and compressed population is assembled."[28] Cistern water also degenerated in proportion to the increase of population. "Not only a greater accumulation of soot, especially where the English or bituminous coals are used, takes place on the roof of houses, but dust and other foul matters blow up from the streets and lodge or collect in the gutters and stain and contaminate the water."[29] The old Aqueduct Corporation now furnished about one thousand families at an annual charge of from $10 to $12.50 per household. The company's water was soft and pure, but only certain sections of the city could be supplied. Several of the leading physicians were quoted to the effect that impure water was a cause of digestive complaints and other illnesses.[30]

The Mayor estimated that the present population of the city needed 1,750,000 gallons of water a day and that from 2,500,000 to 3,000,000 gallons would be required in the near future. Without committing himself to any particular plan, he discussed the possibilities of Spot Pond, the Charles River, deep wells, and other sources. The necessary works would probably cost $1,000,000 or more, but they would be well worth such an expenditure:

> It is true that we have thus far lived in health and comfort, getting water as we could, but I am persuaded that if we once had pipes running into our rooms, chambers, kitchens, entries, yards, passage ways, &c. yielding soft water without end, just by turning a fascet, not only no amount of money would induce us to give up the privilege, but we should think it impossible to exist without it.[31]

Lyman urged that the water works should be municipally owned.[32]

Transmitting a copy of this communication to Joseph S. Lewis, Mayor Lyman wrote: "The public sentiment here is openly and decidedly in favor of having water, but we shall be able this year to do

nothing more than obtain a full and careful survey and examination of the surrounding country."[33] Lewis replied: "Your views are very just & if you can enforce them you will be entitled to the lasting gratitude of your fellow citizens."[34]

On April 14, 1834, the City Council followed the Mayor's recommendations by instructing a special committee to employ "some competent person" to make a new survey of possible sources and modes of conveyance for "a steady and copious supply of pure and soft water."[35] The engineer selected for this task was Loammi Baldwin, well-known as the builder of the Middlesex Canal. This distinguished local expert prepared a lengthy report containing much interesting information about ancient and contemporary water works as well as upon the particular problems of Boston.

Baldwin included a survey of the city's wells, taken under his direction. Out of a total of 2,767 wells, only seven supplied water that was soft enough to be used in washing clothes. In 682 wells the water was too bad to drink.[36] "The smell in many cases is extremely offensive," reported Baldwin's assistant, "and I should think it probable that they have an injurious effect on the water of wells contiguous, and on the atmosphere."[37] The survey contained much evidence of the inadequacy of the supply. Forty or fifty pumps were discovered to be chained and locked.

> I inquired of one person if his well failed? his answer was "no, but if I did not keep it locked there would not be a drop of water in it in an hour's time." I am told that the owners of these wells, so locked, furnish to families a key for, say 3, 4, 5 to 6 dollars a year.[38]

Some streets of the city had no wells at all, others very few. The possibility that better and more abundant water might be found by drilling artesian wells was considered, but dismissed as impracticable.[39]

Baldwin estimated the needs of the city for the present and the near future at about five million gallons of water a day. He then undertook to investigate possible sources of such a supply within a radius of some twenty miles of Boston. Spot Pond, which had been favorably discussed by Treadwell in 1825, was considered to be too small. Baldwin also disapproved of the Charles River and other nearby streams and ponds. He favored instead more distant sources some twenty-five miles from Boston. In summarizing his conclusions, he said:

> From a consideration of all the sources I have examined in the vicinity of Boston . . . the most eligible are those of Farm and Shakum Ponds in Framingham, together with incidental ones dependent upon them and Long Pond, in Natick, and the mode of bringing the water to town is by an aqueduct, without the use of pipes, to the nearest point of sufficient height to allow it to flow through cast-iron pipes to the highest land in the City.[40]

The special committee, under whose authority Baldwin's survey had been made, submitted its report to the City Council on November 17, 1834. "A copious supply of pure and soft water," the committee concluded, "is one of those improvements in the state of society in modern times, that sooner or later will probably be adopted in this, as in other great cities of this continent." But the committee added that both on account of the great expense involved and the time required for the completion of the work the undertaking should not be decided "without the most patient deliberation and a free examination of all the facts connected with the matter."[41]

Baldwin's recommendation that the water supply should be drawn from faraway Framingham was highly distasteful to many Bostonians. Mayor Samuel T. Armstrong, a Whig elected in December, 1835, sympathized with this point of view, and soon after his inauguration the City Council appointed a new committee to study the problem with instructions to report not only on possible sources but on the best mode of attaining the object in view, "whether it shall be done by the City in whole or in part, or whether it is expedient that it should be referred entirely to individual enterprise."[42] The committee promptly employed a new engineer, one R. H. Eddy.

Eddy's report, dated June 13, 1836, reflected tight-fisted Yankee logic. His principal criticism of ambitious projects like those of Loammi Baldwin was that they were based on estimates of future rather than present needs. If water works were built on such a scale, it would be many years before water revenues would be large enough to justify the initial investment. It was, therefore, better to build smaller works and add to them later.[43]

In accordance with this analysis of the situation, Eddy recommended the use of Spot Pond to supply the immediate needs of the city. He believed that Treadwell's estimate of only 1,600,000 gallons a day from this source was unduly conservative; his own observations led him to estimate that Spot Pond could supply the city with 2,500,000 to 3,000,000 gallons a day. An aqueduct from this source to a reservoir on Bunker Hill and thence across the Warren Bridge into Boston would cost about $388,000,000. As demand increased, an additional supply from Mystic Pond in Medford could be raised into the system by steam engines. This would entail a further investment of some $218,000,000, but would provide a supply of almost 13,000,000 gallons a day "so that it will be perceived there can be no further question as to the ability of Mystic Pond to supply any quantity our city may ever require."[44]

Appended to Eddy's report was the charter of the Boston Hydraulic Company, incorporated by the Massachusetts Legislature on April 16,

1836. This company was given power to take any ponds or lands covered with water situated northwardly of the Charles River and within twelve miles of Boston for the purpose of conducting water therefrom through Charlestown and into and through the city of Boston. The latter city was to have the right to subscribe for one third of the stock, or any less proportion. It was, moreover, to have the right to purchase the corporation's franchise and property at any time by paying such a sum as together with the corporation's receipts would reimburse it for all its expenditures with an annual interest of ten per cent. The act of incorporation was to be void unless the City Council of Boston should within four months declare its assent thereto.[45]

Eddy's recommendation to draw a supply of water from Spot and Mystic Ponds, together with the Legislature's action in incorporating the Boston Hydraulic Company, presented highly important questions to the citizens of Boston. Did they want to take their supply from these nearby sources, or did they want to use those more distant but larger bodies of water that Baldwin had recommended? Did they want their water works to be municipally owned as Josiah Quincy and Theodore Lyman had urged, or did they want to rely on private water companies?

The City Council water committee was divided on the latter issue. According to its report of June 30:

> A majority of the Committee are of opinion that the City, in its corporate capacity ought *not* to embark in this enterprise, but that it should be left to individuals alone, or individuals in connexion with the City. A minority of the Committee were, however, of a different opinion; believing that so great and beneficial are the objects proposed that the public welfare demanded *certainty* and *despatch* in the execution of the business.[46]

The majority recommended that the City Council support the projected Boston Hydraulic Company. But the Council accepted this recommendation only in part. It voted to give assent to the incorporation of the new company, but rejected the proposed subscription of stock by the city.[47]

On August 16, 1836, the water problem was discussed at a general meeting of the citizens at historic Faneuil Hall, where several civic leaders urged that the city take immediate steps to build its own water works. A committee was appointed to formulate resolutions in this sense to be submitted to a vote of the citizens.[48] The first of these declared:

> That it is right and expedient for the City in its corporate capacity with its own means and credit, to undertake and prosecute to a speedy consummation the most favorable project for the introduction and distribution of pure soft water, in sufficient quantity to answer all the domestic and public purposes for which it may be required.[49]

Other resolutions recommended that the city authorities establish a board of three water commissioners to formulate and execute plans for the water works and that the Legislature be requested to grant the necessary authority.

The idea of public water works was opposed by both the new Boston Hydraulic Company and the old Aqueduct Corporation. The latter company had employed Loammi Baldwin to suggest means by which its service might be extended. He had recommended laying a new cast iron main from Jamaica Pond, tapping the source at a lower level, puddling the banks and bottom to reduce loss of water, and drawing upon additional sources of supply in Newton. By these means, Baldwin believed that the Aqueduct Corporation could supply several thousand customers instead of the one thousand who were then being served.[50] In a memorial to the City Council of August 20, 1836, the company asserted its willingness to make these improvements, if it could be assured that the city itself was not going into the water business.[51]

But the referendum on August 22 resulted in a thumping victory for the principle of municipal ownership. By a vote of 2,107 to 136 the citizens approved the resolutions drafted by the Faneuil Hall committee.[52] This decisive expression of public opinion deterred the Aqueduct Corporation from embarking upon any major program of expansion and also discouraged investment in the Boston Hydraulic Company.

Mayor Armstrong's administration continued to temporize with the problem. Making its last report on December 19, 1836, the water committee of the Council reviewed again the various suggestions that had been made for drawing a supply from the Framingham ponds or from Spot and Mystic Ponds. It mentioned also the proposals of the Aqueduct Corporation for enlarging the supply from Jamaica Pond and discussed the possibility that deep-drilled artesian wells might be the solution. Asserting that they had labored diligently to obtain information and that "nothing savoring of negligence" could be justly charged to them, the committee members bequeathed the whole problem to the incoming administration of Mayor-elect Samuel A. Eliot, another Whig.[53]

Under Mayor Eliot the City Council displayed new energy. On January 16, 1837, it appointed a committee to "consider and report what measures are necessary to be adopted for the purpose of carrying into execution the recommendations given to the last City Council contained in certain Resolutions passed at a legal meeting of the Inhabitants of Boston on the 22d day of August last."[54] Acting upon the recommendation of this committee, the Council authorized the appointment of water commissioners with extensive duties and directed the Mayor to apply to the Legislature for the powers that would be needed.[55] But

the usual delays soon developed. The Legislature took no action on the city's request.

More discouraging still, the Panic of 1837 threw its frightening shadow over Boston as over other cities. A committee which had been charged with exploring the financial aspects of the water problem reported on May 18 that "the disastrous effects of too great an extension of individual and corporate credit admonishes the City Council to exercise the strictest economy in its expenditures—and for the present to devise no new schemes whereby the expenditures will be increased or the City Debt augmented."[56]

These counsels of caution, however, did not prevent the appointment on March 16, 1837, of Daniel Treadwell, James F. Baldwin, and Nathan Hale as Commissioners to "devise a plan for supplying the city of Boston with pure water." The result of the Commissioners' labors was a long report submitted to the Council on November 23, 1837. The needs of the city were very conservatively estimated at 1,600,000 gallons a day immediately, 2,500,000 gallons at the end of five years, and 3,000,000 gallons at the end of ten years.[57] Since such a supply was considered to be too large to be obtained by artesian wells, the Commissioners had centered their studies on external sources. Some twenty ponds and streams had been considered. Some had been eliminated because of inadequate size or low elevation; others because chemical analysis had revealed impurity in their water.

Eventually the Commissioners narrowed their consideration to four possible sources: Spot Pond, Mystic Pond, Long Pond, and the Charles River. All of these were regarded as adequately pure, although the Charles River was somewhat less satisfactory on this score than the other three. Since the use of the Charles was also objectionable in that it depended upon machinery, the Commissioners considered the real choice to lie between using the water of Long Pond by a plan similar to that suggested by Loammi Baldwin in 1834 or drawing an immediate supply from Spot Pond and later supplementing this from Mystic Pond, as R. H. Eddy had urged.

The Commissioners found it impossible to agree among themselves which of these two alternatives should be recommended. The majority report, signed by Treadwell and Hale, advocated the plan of conducting water from Spot Pond to the city by iron pipes and adding Mystic Pond to the system later. Spot Pond was admittedly small, with an estimated average daily flow of only 2,100,000 gallons which might fall to 1,600,000 gallons in dry weather. But it was only eight miles from the city, its water was considered to be purer than that of its rivals, and the possibility of adding water from Mystic Pond and other sources would insure an adequate supply for the future.

Although Long Pond was capable of supplying some 8,700,000 gallons a day, its water was regarded as somewhat less pure than Spot Pond, and its distance of eighteen miles from Boston involved serious problems, since Treadwell and Hale feared that the water might be contaminated by the action of the cement in a masonry aqueduct. The cost of the Long Pond aqueduct was estimated at $1,118,294, exclusive of distributing pipes; the cost of building water works based on Spot and Mystic Ponds was estimated at only $850,006.[58]

James F. Baldwin, the third Commissioner, dissented from these conclusions in a vigorous minority report. He considered Mystic Pond to be an unsatisfactory source, because it would require pumping machinery and because it lay below the level of high tides. The majority plan contemplated a dam across the outlet of the pond to keep out the tide water, but Baldwin considered this to be of doubtful feasibility. He also objected to "the color and character of the water which composes this source. Much of the water is derived from the Middlesex Canal, from the leaks and wastes on a large portion of its length. This Canal is fed from Concord River, in Billerica, a large part of whose waters lie every year, nearly motionless, through the dog days, steeping the grass on the Sudbury meadows, for many miles in extent."[59] Baldwin favored the Long Pond aqueduct and suggested that it might be built somewhat more cheaply than the majority of the committee had indicated.

The report of the Commissioners of 1837 sharply defined an issue which had been foreshadowed in the earlier reports of Treadwell, Baldwin, and Eddy. Water politics in Boston during the next eight years were destined to involve not only sharp conflict between the advocates of private enterprise and municipal ownership, but between the Spot Pond and Long Pond factions as well. To complicate the situation still further, proponents of the Charles River and other sources frequently launched campaigns for their own favorite projects.

Mayor Eliot urged immediate action in accordance with the recommendations of the majority report. On January 1, 1838, he discussed the situation in an address to the City Council:

> The expense of the operation is usually regarded as the great objection to it, but I entertain no doubt that the interest of the money invested in the necessary works, and the cost of all repairs, would be repaid to the city by those who use the water. That this opinion is not entirely without foundation would seem probable from the fact, that a private corporation has, for several years, been ready to undertake the work, on their own account, if they could obtain permission. This permission the city has never been willing to give. . . .[60]

On February 12, 1838, the Standing Committee on Water under the chairmanship of Mayor Eliot made a report to the City Council. Once again, the troublesome issue of whether the water works should be built by private or public enterprise was discussed. The majority of the committee favored municipal ownership. "They believe," the report declared, "that it is too important a business to be suffered to be affected by the calculation of private interest, which it is certainly possible might be injurious to the permanent character of a work which ought to be begun with reference to the future wants of a great and growing city."[61] Municipal ownership, moreover, would assure that the citizens would pay lower water rents than those which would be charged by a private corporation. Financial conditions in the country might be cited as a reason for delay, but hard times were a temporary evil. Moreover, the project would alleviate distress by furnishing jobs to the unemployed, while the cost of construction would be less than it would be under more prosperous conditions.[62]

The Board of Aldermen approved the policy recommended by the water committee with little opposition. By a vote of six to two the Board declared that it was "expedient for the City to begin and complete the necessary works for the introduction of a supply of pure water." By a vote of seven to one it resolved that it was expedient to draw the supply from Spot and Mystic Ponds in the manner recommended by the majority of the Commissioners and that the Standing Committee on Water should make immediate application to the Legislature for the necessary powers.[63]

But this policy encountered vigorous opposition from the stockholders in the private water companies. L. M. Sargent, president of the Aqueduct Corporation, addressed a letter of protest to the City Council on February 21, 1838:

> I have patiently listened to much abuse, which has been heaped upon this corporation, in the public journals and elsewhere. It is certainly wholly undeserved. Eight water companies supply the city of London. They are not menaced, from year to year, with an overwhelming municipal interference, in the form of a grand city aqueduct. The Boston Aqueduct Corporation is willing to do the very same thing, upon the very same encouragement.[64]

Sargent warned that the private company would still offer its water for sale, even if the city works were built. The city streets would then be subjected to the nuisance of being dug up by two aqueducts and one gas company, and this "in a city not remarkable for the width or the straightness of its avenues." The proponents of the municipal project were accused of demagogic exaggeration in their allusions to chained pumps and contaminated wells. If the municipal system were built, Sargent asserted, the politicians might vote to make the water free and leave the interest on the water debt to burden the taxpayers.[65]

Proponents of private enterprise argued that the old water company and new ones like the Boston Hydraulic Company might engage in healthy competition. An anonymous author thus stated the case:

> With one aqueduct in successful operation already, which, though it supplies water of the purest quality, scarcely finds one customer in every four dwellings which it passes, and with several millions of dollars invested by our citizens in wells and cisterns,—is it not manifestly the wiser course for Boston to adopt the London plan, rather than that of Philadelphia, where the hydrant was almost coeval with the foundation of the city? Is it not also the juster course, in relation to those, who, having supplied themselves at their own cost, cannot equitably be charged with the burthen of supplying their neighbors? London is supplied by eight private companies. Boston has one. Let us have another and another, as our occasions require. Then every citizen, who wants the water, can have it, on fair terms,—that is, if he will pay for it; and not by throwing a tax upon his fellow-man, who wants it not. We want enough for our present need, not a deluge, at a preposterous expense, that every lady may have a fountain, and every gentleman a hose and squirter. . . . It is well, doubtless, to plan for posterity, but not too extensively.[66]

The Council was besieged with petitions, some favoring and others remonstrating against the idea of enlarging the municipal debt to build water works.[67]

During the Council debates of March, 1838, the faction opposing municipal action appeared to be gaining ground. On March 8 the Common Council concurred in the resolution of the Aldermen declaring it to be expedient for the city to build its own works, but the vote—twenty-three ayes to twenty-two nays—was extremely close.[68] Moreover, the Board of Aldermen itself displayed a new spirit of caution by ordering the Committee on Water to cause the calculations of the Commissioners to be revised to ascertain whether they contained any errors and also ordering the committee to report what measures might be necessary to prevent the water from being made free previous to the liquidation of the debt incurred for its introduction.[69]

This threat of new delays caused the water party to resort to a device similar to that successfully employed in 1836. On April 2, 1838, the citizens of the city were given an opportunity to express their opinion on the important issues involved. To the question: "Is it expedient for the city to procure a supply of soft water at its own expense?" the voters answered "yes" by 2,541 ballots to 1,621. By a similar margin they declared that the work ought to be begun during the current year, if the necessary power could be obtained from the Legislature.[70]

The old Federalist, Harrison Gray Otis, regarded this referendum with disfavor. In a letter of April 9, 1838, to the Mayor and City Council, Otis asked to have his name withdrawn from a memorial that he had earlier signed in favor of supplying the city with water from "extraneous sources." He believed that the water problem was an important one, but that it ought to be dealt with calmly and judiciously "by those whose duty it is to sit upon the matter." "It never occurred to me," Otis asserted, "that popular impulses would be resorted to, in order to stimulate the action of the city authorities. . . . For one, I am not prepared for this rapid movement."[71] The water works, in his opinion, should not be begun until proper provision had been made for paying for them, preferably through the sale of vacant lands belonging to the city.

Even before this protest was received, however, the City Council had passed an order instructing the Committee on Water to make immediate application to the Legislature for the grant of such powers to the city as might be necessary for the introduction of a sufficient supply of water, either from Spot and Mystic Ponds, or from Long Pond.[72] The city's petition to this effect was presented in the House of Representatives on April 7.[73] Four days later, in an obvious counter move, the Boston Aqueduct Corporation submitted a petition of its own, requesting an amendment to its charter to permit an increase in its capital.[74] In a hurry to adjourn, the legislators voted to refer both petitions to the next session of the General Court.[75]

Although decisive moves on the water issue had to wait upon the 1839 session of the Legislature, the opponents of the municipal project attempted one curious gambit in the interval. On October 15, 1838, the City Council ordered the Committee on Water to inquire into the expediency of offering a bonus to any corporation or association which would at its own expense introduce into the city a full supply of water.[76]

On December 24, the Committee on Water made its report on this suggestion. Once again it set forth the contention that the water works should be municipally owned. Particular stress was placed on the need for water to clean the streets, to extinguish fires, and to supply public buildings. These public uses of water were of the highest importance to the city but of none at all to individuals. The bonus that a private company would expect to receive for supplying water for such purposes would be larger than the city ought to pay. As long, therefore, as there was any reason to hope that the city would undertake to build its own water works, the committee believed that it would be inexpedient to offer any bonus to a private corporation. The committee also reported that the Commissioners had revised their estimates of 1837 in accordance with the instructions of the Council. Treadwell and Hale continued to recommend the Spot Pond-Mystic Pond plan, and Baldwin persisted in his preference for Long Pond. The estimates of cost were about the same as in the earlier report.[77]

After the frustrations of fourteen years, the proponents of public water works looked forward hopefully to 1839. This time there was no delay in getting the issue before the Legislature. On January 10, the petition of the city was presented in the House of Representatives and referred to a special committee; on January 17, that committee brought in a bill incorporating the provisions that the city authorities had requested.[78] But these early victories were deceptive. The opponents of the measure were marshalling their forces for a bitter battle. Remonstrances flooded into the Legislature from towns like Malden and Medford where it was believed that a diversion of water to the city might injure local interests and also from numerous individuals both in and out of Boston.[79] The water bill was recommitted to committee, and a protracted series of hearings began.

Agents for the Middlesex Canal appeared to protest that, if the city decided to build the Long Pond aqueduct, the canal would be seriously injured through diversion of its water. Property owners whose land might be taken through condemnation added their remonstrances, as did also a parade of Boston taxpayers objecting to the water project as an unnecessary addition to the municipal debt. The spokesmen for the city presented the familiar evidence of the need for water and detailed the numerous votes by which both the City Council and the voters had approved the building of water works.[80]

The outcome of all this was a bitter disappointment to the water party. The special committee concluded that there was not time enough remaining in the session to decide the issue. Instead, the Legislature hurried through a resolution on April 9, authorizing the Governor on the application of the City of Boston to appoint three Commissioners who should at the expense of the city ascertain and report to the next General Court "all the facts and information which they may deem material, in relation to the several plans proposed by said City for the introduction of Soft Water into Boston, and the bearing of the same upon the interests of all persons and corporations which may be affected thereby."[81]

Mayor Eliot was indignant. In reporting the episode to the City Council he declared:

> It would be difficult to find, on the records of any legislature, a more remarkable result of a three months' investigation of a subject which, for several

years, had occupied the attention of an important portion of the community. . . . The resolve of the legislature authorizes the Executive to appoint Commissioners to do what, so far as regards the City interests, has been the object of the greatest attention of the citizens, and of the most diligent investigation by its various agents, for many years; and so far as regards the interests of other towns and corporations, has been the subject of inquiry during the last session of the legislature, by the very Committee who were instructed to report the resolve.

It is now for the City Council to determine whether they will incur the expense of a new commission to do what has already been done by itself, or ought to be done by the Legislature. . . .[82]

Mayor Eliot, whose son Charles W. Eliot was destined to be one of Harvard's most famous presidents, went on to review the whole water issue. By providing an adequate supply for the city, he believed that the citizens would save $150,000 a year in insurance alone and that an additional $130,000 would be gained by ridding the fire department of its dependence on wells and cisterns.[83] To the argument that times were hard, that the taxpayers were already overburdened, and that the water problem should be postponed for later action, the Mayor responded with impatience:

The present impurity of the water is not enough. We must wait till it becomes an intolerable nuisance, or till it obviously produces disease and death. It is not enough that many instances are known to have already occurred, in which both the rich and the poor have been compelled to pay three or four times as much, for a small quantity of hard water, as the City would require in rent for an abundance of the purest quality, were the cost of the works as high as has ever been imagined by the opponents of the plan. . . . It is not enough that in the more crowded parts of the City, the most violent contests should frequently occur, to obtain enough of a hard, brackish fluid, not for purposes of luxury, nor even of cleanliness, for it is incapable of answering either, but merely to sustain life in those filthy, wretched abodes of squalid poverty, which might at once be rendered comparatively neat and wholesome by an abundant supply of what has never yet been seen there, pure water.[84]

Despite the urgency of the problem, Mayor Eliot advised the Council not to apply to the Governor for the appointment of Commissioners, as provided in the resolution of the Legislature. Instead, he believed that the city should renew its request for a satisfactory law at the next session.[85]

Meanwhile, rival factions continued to argue the respective merits of Long Pond and Spot Pond. The contribution of "Bostonius" to this discussion was the "recitative poem" entitled *A Voice in the City; to Water Drinkers,* one verse of which is quoted at the beginning of this chapter. The bard poured scorn upon the Long Pond aqueduct project:

A duct of stone and mortar—fatal stars!
Which ev'ry quake of earth or thunder jars!

A foolish work, by Nature's vengeance curst!
Pierc'd through the hills, and arch'd across the dales—
Such work of folly soon in ruin fails!
The pressure of the flood, and frosts of air
Such clay-cemented parts unfit to bear![86]

Spot Pond, however, was a far different matter:

But, since enough occasions have been tried,
Spot Pond to show a source of copious tide,
To furnish Boston, by the means of sluice,
Soft waters, beautiful, for present use!
Or if, perchance, the people most desire
Two different founts—one low, the other higher;
This to jet streams, by force of fountain head,
Seven score of feet above the ocean's bed
Appropriate to the mansions of the hill,
Without the aid of reservoir to fill;
And, for the dwelling-places not so high,
Pump from you Mystic suitable supply;
There would be quite enough for every spout,
To endless years, without a single doubt.[87]

Spot Pond continued to be the favored source throughout 1839. Reviewing the situation once more in September, the City Council water committee recommended that the Mayor be instructed to apply to the next session of the Legislature for leave to introduce the water of Spot Pond into the city at the city's expense; and also that he be instructed to open negotiations with the Boston Aqueduct Corporation for the purchase of that property.[88]

In January, 1840, the water party suffered a discouraging setback. Jonathan Chapman, the new Mayor, dismissed the project for municipal works with the following words:

It is an enterprise which, if undertaken by the City, must involve a very considerable outlay, and it cannot but be admitted that some doubts may reasonably be entertained as to its pecuniary results, for at least a considerable period of time. It seems to me, therefore, that no prudent government would enter upon it, unless with the hearty concurrence of a large majority of its own members, and of the citizens generally.

Notwithstanding the view which I have heretofore expressed in another branch of the government, and with less knowledge upon the subject, I now feel satisfied, from subsequent observation, that the public mind is not yet ready to sanction the undertaking by the City Government.[89]

Mayor Chapman's opposition to the water project was consistent with his general policy of strict economy. One reason for this was undoubtedly the economic depression which still gripped the country; another was concern over Boston's municipal debt, which had grown from $100,000 to $1,698,232 over the preceding eighteen years.[90] The City

Council supported Chapman on the issue. Water committees were appointed as usual in 1840 and 1841, but no other action was forthcoming. In 1842, even the gesture of appointing the usual committee was omitted.[91]

The apparent collapse of the movement to establish municipal works naturally encouraged the promoters of private water companies. During the 1839 session of the Legislature, the Boston Aqueduct Corporation obtained the amendment to its charter for which it had applied a year earlier. The company was now empowered to conduct into Jamaica Pond, or into any reservoir adjacent thereto, or into any reservoir within the limits of the towns of Brookline and Brighton and thence into the city of Boston, the water of any streams or ponds which the company might acquire by purchase. The corporation received permission to increase the number of its shares (originally fixed at one hundred) to any number not exceeding five hundred, and the total value of its capital stock (not stipulated in the original charter but carried on the books at $130,000) to any sum not exceeding $500,000.[92]

In 1840, the old company began a modest program of expansion. The leaky wooden pipes that led from Jamaica Pond to the city were replaced by a new iron main at a cost of $70,000. With the increased supply, the company more than doubled the number of its customers. Instead of the fifteen hundred water takers which the Aqueduct had claimed in 1838, there were thirty-five hundred reported in 1845. By this time, the stock of the corporation had become an excellent investment, paying a steady $200 annual dividend, or ten per cent on shares now rated on the books at $2,000 each.[93]

The directors of the Aqueduct Corporation freely admitted that their company could never supply all sections of the city, and their greatest nightmare was that the municipality would build its own water works. Therefore, they eagerly encouraged the efforts of promoters to establish additional companies capable of supplying the higher sections of the city. The Boston Hydraulic Company charter had now lapsed, but projects of a similar character soon developed.

On January 16, 1843, James C. Odiorne, a member of the Odiorne family which had owned Spot Pond for many years, addressed a petition to the Boston City Council asking leave for himself and associates to form a company to bring fresh water into the city from Spot Pond.[94] The committee appointed to consider this proposal recommended that the Council grant its assent, subject to eight specific conditions which related to the right of the city to use the water for fire protection and to purchase the works at some future time, and the right of the Legislature to regulate the water rates.[95]

With this qualified support the Odiorne project succeeded in obtaining the assent of the Legislature. An act of incorporation, passed March 24, 1843, created the Spot Pond Aqueduct Company with a capital stock of $500,000, which might be increased to $1,000,000 if necessary. The Company was to have the exclusive right of using the water of Spot Pond. Both the city of Boston and the town of Charlestown, through which the water would be conveyed, were granted the privilege of using the water free for extinguishing fires. The city of Boston was empowered to purchase up to one third of the stock, or to take over the franchise and property of the corporation at any time on payment of the cost of the aqueduct plus a reasonable profit calculated according to a stipulated formula. The Legislature reserved its right to regulate the price of the water and to incorporate other aqueduct companies. In an unusual provision, the stockholders were made individually liable for the company debts.[96]

The question of whether the city should subscribe for stock in the new company was now considered by a special Council committee, headed by Mayor Martin Brimmer, who had succeeded Jonathan Chapman in January, 1843. The fact that the charter made each stockholder liable for all the debts of the corporation was considered by the committee to be a sufficient reason why the city should not exercise its option, even if there were no other objections. The Council accordingly resolved that it was "inexpedient for the city of Boston to subscribe for any shares in the Spot Pond Aqueduct Corporation."[97]

Despite this rebuff, the promoters of the new company went ahead with their plans. On September 1, 1843, they issued an enthusiastic prospectus. The cost of conveying water from Spot Pond seven miles by an iron main to a reservoir on Beacon Hill and then distributing it through fourteen more miles of pipe was estimated at $500,000. About 5,000 families might be expected to take the water immediately at an average rental of $12 a family. This would provide a gross income of $60,000 and a net revenue of about $50,000 a year. The promoters calculated that 5,000 customers would require only 500,000 gallons a day. Since they estimated the capacity of Spot Pond at 1,750,000 gallons a day, they were sure that there would be an ample reserve for future expansion.[98] Among the stockholders were former mayors like Samuel T. Armstrong, Samuel A. Eliot, and Jonathan Chapman and influential businessmen like Robert G. Shaw, Thomas Wigglesworth, and Cyrus Alger.[99]

But this was not the only group of investors eager to go into the water business. The Middlesex Canal Company, chartered in 1793 to build a waterway from the Merrimac River to Boston Harbor, had fallen on

evil days. Shares that had originally cost over $1,400 were paying dividends of only $10 a year. A pamphlet issued by the Company in 1843 blamed the Legislature for contributing materially to the difficulties of the canal by chartering the Boston and Lowell Railroad. Thus, the pamphlet argued, the Legislature should remedy this injury by incorporating a Middlesex Water Company with the right to use the canal to supply water to the citizens of Boston.[100] Although this maneuver failed, the Middlesex Canal Company continued to be a factor in the water situation, since one of the forlorn hopes of its stockholders lay in the possibility that they might collect large compensation from the city of Boston for diversion of the company's water in case the Long Pond aqueduct proposal were carried into effect.

On February 1, 1844, Charles Crocker and thirteen other individuals petitioned the Legislature to charter a Charles River Aqueduct Corporation. Their somewhat incoherent memorial declared:

> The Undersigned—originally in favor of supply of wholesome water, by a public Aqueduct, owned by the city,—seeing now no prospect of its accomplishment in that way, ask leave . . . by act of incorporation, to supply pure and soft water, from what *they* deem the most available source for an ample and economical supply,—viz: *from* Charles River, *by exclusion of tide waters, by means of a dam, across its mouth;—so that the river will flow down fresh to the new dam;*—having a sufficient lock for navigation . . . —to bring this source of supply so near to a hill in Brighton or BROOKLINE, as to dispense with laying costly iron pipes till the streets are nearly reached, where the extension can pay as it goes; and also create a new tide-mill river power, the *rents* of which may pay for raising this water for domestic uses by steam power, at the hill selected. . . .[101]

During the summer of 1844 all these private water company projects were suddenly threatened by a revival of the demand for municipal water works. A shift in the political winds was indicated on July 22 when the City Council appointed a joint special committee to report upon "what measures, if any, should be adopted to procure an abundant supply of pure, soft water for the use of the City."[102] A week later the Aldermen appointed a small committee to consider the petition of Dr. Walter Channing and others requesting that a general meeting of the citizens be called at Faneuil Hall to discuss the subject of supplying the city with pure water from Long Pond.[103] On August 26, both of these committees brought in reports.[104]

The joint special committee asserted that the time had now arrived when it was both expedient and necessary that pure water should be introduced into the city. There was only one source from which a supply adequate to meet the demands of a rapidly growing community could be taken and that source was Long Pond. "Whatever may be

the interests of private Corporations in relation to other sources, your Committee deem it inexpedient for the City Council to give any other source than Long Pond serious consideration." Notwithstanding the able and voluminous reports of earlier years, important changes had taken place that made it inexpedient for the City Council to take any important step until a commission of competent persons had investigated the present situation. In line with these recommendations, the City Council ordered the appointment of three commissioners to report the best mode and the expense of bringing the water of Long Pond into the city.[105]

The strong preference for Long Pond over Spot Pond which the City Council now exhibited represented a change of policy as significant as that involved in the shift of opinion in New York City from the earlier Bronx project to the Croton plan. In each case, delay and the growth of population made the smaller and less costly plan seem more and more inadequate. In the case of Boston, the situation was undoubtedly complicated by the incorporation of the Spot Pond Aqueduct Company. Private enterprise having pre-empted this water source, proponents of municipal ownership naturally rallied their forces around the Long Pond project.

The Long Pond party was not destined to gain its objective without a bitter struggle. Indeed, on September 2, the City Council backtracked to the extent of passing a resolution to explain that its action in ordering the appointment of commissioners was not intended to commit the city to the use of Long Pond, nor to preclude the examination of other bodies of water later, but only to provide that Long Pond "as one of the prominent sources of supply" should be thoroughly examined at this time in order that the city government might have all the facts.[106]

Meanwhile, the Aldermen had acquiesced in the Channing petition and authorized a general meeting of the citizens at Fanueil Hall on September 3. To the private water company faction, this was history repeating itself with uncomfortable exactness. Council water committees, special water commissioners, public meetings at Faneuil Hall—all these had on earlier occasions preceded formal application to the Legislature for a grant of powers to the city to build water works.

In a long letter to the *Boston Evening Transcript*, "Anti-Humbug" expressed his disgust. With the first return of more prosperous times, he lamented, "some new chimera" must be started to dazzle and bewilder the community and "we are now favored with a revival of the great water project of 1836." Let New York have her aqueduct; if something must be done in Boston for those who didn't pay taxes, why not adapt the scheme a little better to the northern climate? Why not buy

coal to warm the poor people in the wintertime? The rich were fleeing to the suburbs to escape the heavy taxes of the city; the burden of the debt for building water works would fall on the poor themselves.[107]

In a pamphlet dated August 31, 1844, "Selfish Tax Payer" denounced the Long Pond project as originating with certain fine gentlemen who lived on Beacon Hill and other places in Boston where water was scarce. Somewhat inconsistently, the same writer charged that the water movement had obtained most of its support from non-taxpayers. According to his calculation, the aggregate taxes on real estate paid by those petitioning for municipal water works in 1838 had been only $9,045, while the remonstrants had paid $24,000. He was bitter in his condemnation of the propaganda of the water party. "Water, which had been drunken with perfect satisfaction, for many generations, and to a good old age, becomes suddenly offensive to the smell and taste, and old ladies put on their spectacles and look for eels."[108]

But the advocates of the Long Pond project persisted in their campaign. Meetings at Faneuil Hall on September 3 and 4 attracted a respectable attendance. Mayor Brimmer presided, and eloquent speeches in support of the Long Pond project were delivered by Dr. Walter Channing, Henry Williams, and other prominent citizens.[109] At the close of the second evening of speeches and discussion, the meeting was adjourned until October 23.[110] Obviously, the intention was to continue to exert pressure upon the City Council until the report of the Commissioners could be completed and acted upon.

Also effective in winning support for the Long Pond project was Dr. Walter Channing's pamphlet, *A Plea for Pure Water*. This well-known physician, a brother of William Ellery Channing, the famous Unitarian, dealt with the whole water situation. Boston well water, he contended, was heavily impregnated with salts. This rendered it unfit for everyday use. "It hardens the meat you attempt to boil in it. It alters the character of vegetables, often making them unpalatable, hard, and heavy, and so of difficult digestion, and unfavorable to health."[111] Moreover, the well water was contaminated by the sewers of the city. "All the liquid refuse about our houses, and, within a few years, the liquid contents of vaults, and the whole of water-closets, run freely into the sewers. Now is it possible, but that such an amount of foul, most offensive liquid, running freely into the soil . . . must find its way to springs and make them impure?"[112]

Doctor Channing was particularly eloquent in describing the effect of the shortage of water upon the poor.

> The want of water of every kind, except Salt water, is universally felt, and universally declared. . . . Wells and cisterns have rarely, if ever, been so frequently empty as now. Every day increases the inconvenience. . . . It is a remarkable fact, that wells, which have never before failed in this city, but which supplied many families are now so low that their owners are obliged to refuse water to others. . . . Water for daily family use is sold in this city,—so many tickets for a dollar being given out,—notice to this effect being on the pump. A person had lately a cistern in a store cellar, for which he had no use, and was about to have it filled up, in some change he was making in his property. He gave notice that the water in the cistern was at any one's service who would come for it. His premises were crowded with poor people, and it was not without emotion, you saw women and little children going for the water with buckets, and pails, and boxes, and barrels, and the smallest vessels, too, to get a little water, which they so much needed, for which they had paid, it may have been, but a little of which they now might in the general rush and scramble, get without paying for it. . . .[113]

Channing judged the recent attempt of the Boston Aqueduct Corporation to expand its supply to have been a failure. Pipes had been laid in so many streets that the pressure in the whole system had been reduced. The customers were without water much of the time. "The Company had killed the Goose which laid the Golden Eggs."[114]

How should the city's desperate need for water be remedied? Not by the London system of competing private water companies, Channing argued. This system had failed in London itself and everywhere else that it had been attempted. A city should be "the patron of its own great, permanent, universal interests."

> These should be committed to the charge of no other corporation, company, nor individual. The water it drinks, the air it breathes, the light which blesses it, neither of these should be given in charge to any man or body of men. If profit can be made of them, let the city make it. It will go from it, from its government, back to the people again, in new forms of usefulness and blessing; with full interest added, to make its agency more important and more useful.[115]

Two of the Commissioners appointed to report on the Long Pond project had been members of the Commission of 1837. One of these, James F. Baldwin, had favored Long Pond; the other, Nathan Hale, had sided with Daniel Treadwell in recommending Spot Pond. By 1844, Hale had obviously changed his mind, because Baldwin, Hale, and P. T. Jackson, the third Commissioner, were now unanimous in their recommendation that Long Pond, and only Long Pond, would provide an adequate supply for the city.

In their report, dated November 9, the Commissioners stressed the growth of population. Already the city had nearly 110,000 inhabitants; by the time water works could be completed it would probably have close to 125,000. Since the population had more than twice doubled in the preceding fifty years, the Commissioners deemed it reasonable to

base their calculations on providing for the public, domestic, and manufacturing needs of a city of 250,000 inhabitants. At 28½ wine gallons a day per inhabitant, a figure based upon the experience of Philadelphia, Boston would require a daily supply of 7,125,000 gallons a day.[116] After making measurements at Long Pond, the Commissioners concluded that this source might safely be relied upon to produce at least 7,000,000 gallons daily.[117]

This document aroused sharp controversy. In a pamphlet by "Temperance," entitled *Hints to the Honest Tax Payers of the City of Boston*, the Commissioners were accused of having grossly overestimated the needs of the city. The idea that Boston would ever have 250,000 inhabitants was fantastic: the city was located on a peninsula and there was no room for any such growth of population. Boston would never need as large a supply as Philadelphia, where much water was consumed in washing the streets and in supplying public and private baths—luxuries in which "Temperance" obviously did not expect sober Bostonians to indulge. The Long Pond project should really be called the Long Job plan.

> If you can be reconciled to an aqueduct capable of supplying three million gallons daily of the purest water, look to Spot Pond. Two million gallons per day would furnish one hundred gallons daily to every family. This quantity is *certain* that Spot Pond will yield, and this in addition to the supply from Jamaica Pond, will be sufficient for all the wants of the city for very many years to come.
>
> Unite then with a private company to bring in the waters of *Spot Pond*, let the City subscribe for a portion of the stock, and within one year the water may be distributed in Boston.[118]

The Long Pond faction fought back vigorously. Once again Faneuil Hall provided a rallying point. On the night of November 26, after speeches in favor of the Commissioners' plan by Abbott Lawrence, John C. Gray, and other civic leaders, the assemblage adopted resolutions calling for a popular referendum on whether the voters were in favor of procuring a supply of water at the city's expense from Long Pond and whether they wished to instruct the City Council to apply to the Legislature for the necessary powers.[119]

The City Council demonstrated a reluctance to commit itself. On November 27, the Aldermen resolved to submit the water question to the voters, but changed the wording of the referendum to read: "Are you in favor of procuring a supply of water for the inhabitants of the City of Boston, to be brought at the expense of the city, from Long Pond in Natick and Framingham, or from any other sources which may hereafter be decided by the City Council to be best . . .?"[120]

This phraseology was far from satisfactory to the Long Pond faction. At a large Faneuil Hall meeting on December 3, the Aldermen were roundly denounced. Henry Williams argued that the citizens should take affairs into their own hands. A committee should print up ballots containing the original propositions approved at the Faneuil Hall meeting of November 26 and distribute these at the polls. Cooler counsels eventually prevailed, however, and the assemblage voted to appoint a committee to wait on the Mayor and Aldermen, and request them to withdraw the amended propositions and submit the questions approved at Faneuil Hall.[121]

The Aldermen responded to this pressure in very human fashion. A committee, to whom the communication from the Faneuil Hall meeting was referred, defended the earlier action of the Board on the ground that neither branch of the Council had actually committed itself to Long Pond and that it had seemed better to put the question to the voters in such a form as to preserve freedom for the Council to make the final decision upon the source. In an obvious protest against the high tone taken by the Faneuil Hall meeting, the committee asserted that the city charter had vested full power in the City Council and that the Council was in no degree subject to control or direction by the citizens assembled either in general or special meetings. But after the Aldermen had thus salved their pride, they compromised the issue. The citizens were given an opportunity to vote on four questions—the first two phrased to please the Faneuil Hall group, the last two worded in line with the earlier decision of the Aldermen themselves.[122]

The *Boston Evening Transcript* advised its readers to vote "yes" on the first two propositions and "no" on the others. "The remark *'From any other source which may hereafter be decided by the City Council'* as indicated in the third proposition means 'no where,' therefore, good readers, vote *nay* to it, and also to its fellow, number four." Long Pond was the only source that would yield the necessary supply. "The talk about Spot Pond, the pumping up of the water of Mystic Pond, Charles river and *other sources* is mere kite flying, thrown in by the enemies of the project to make confusion and defeat the enterprise."[123]

The water referendum on December 9, 1844, resulted in a sweeping victory for the Long Pond faction. On the key question of whether the citizens favored procuring a supply of water from Long Pond at the expense of the city, there were 6,260 yeas to 2,204 nays. On the second question, whether the citizens would instruct the City Council to apply to the Legislature for the necessary powers, the vote was almost identical. But the third proposition, that the citizens leave the choice of source to the City Council, was defeated by a vote of 1,206 yeas to

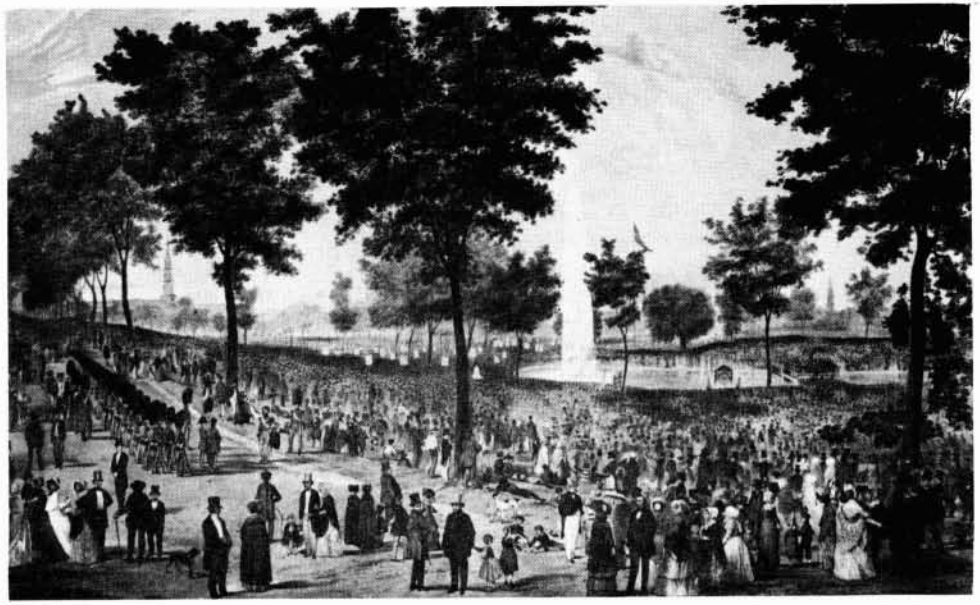
7,081 nays; and the fourth to approve an application to the Legislature for general powers was also decisively rejected.[124]

On December 23, 1844, the City Council accepted the popular mandate and passed resolutions instructing the Mayor to make immediate application to the Legislature for the necessary powers to build the Long Pond aqueduct.[125]

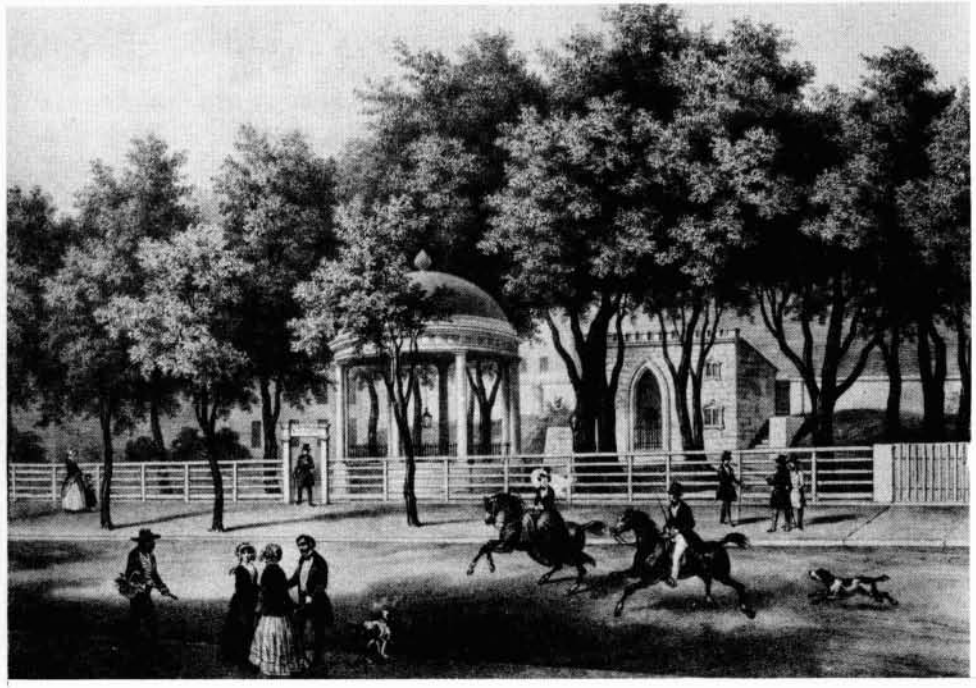
But the opposing faction was by no means ready to surrender. The victors were accused of unfair tactics. The Faneuil Hall meetings were depicted as having been poorly attended and manipulated to prejudice the question and coerce the City Council. Sharp dealing was also evidenced, the defeated party charged, by the fact that the Commissioners' report of 1844 favoring Long Pond was made available to the voters before the election, but a reprint of the Report of 1837 favoring Spot Pond did not appear until after the election. The Long Pond faction was even accused of tampering with the ballots. One critic charged:

> Indeed, I know not how it happened, but, by some strange fatuity, the ballots which had been prepared for those who were willing to leave the whole matter to the City government, seemed, in certain places, to have suddenly disappeared from the rooms in which they had been originally deposited. In my own Ward, I was put to some trouble to find the ballot I wanted; but at last I fortunately stumbled upon some lying in a corner, under a huge pile, smelling strongly of Long Pond.[126]

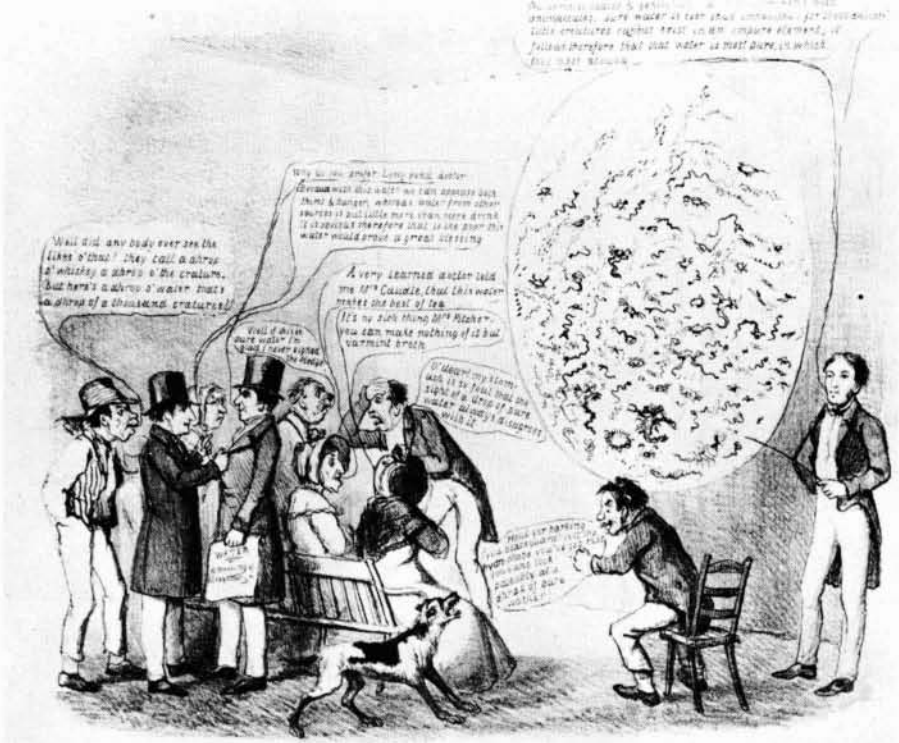
Whether true or not, these accusations provided sufficient adrenalin to revive the combative energies of the anti-Long Pond faction. Defeated in the City Council and at the ballot boxes, they were not yet defeated in the Legislature of Massachusetts.



The water celebration on Boston Common, October 25, 1848. (*New York Public Library*)

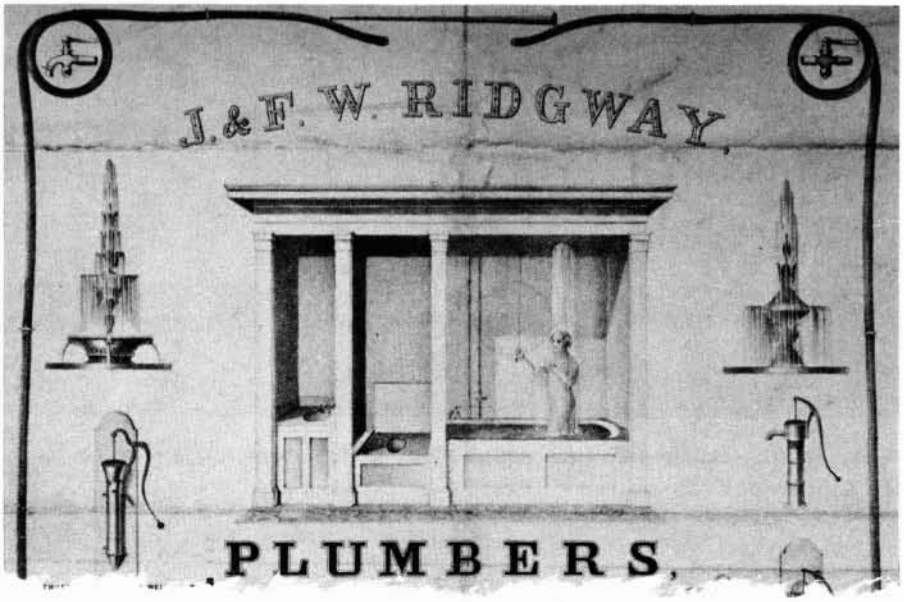


City Spring, Baltimore. Lithographed by Deroy from a drawing by Kollner. (*The Library of Congress*)



A drop of Long pond water magnified by the Solar microscope

A drop of Long Pond water magnified by the solar microscope. From a broadside opposing the Long Pond aqueduct. The cartoonist ridicules the contention that the living organisms to be seen in a drop of water under a microscope are evidence of the water's purity. (*Massachusetts Historical Society*)



Luxuries of running water. Advertisement of a New York plumber

CHAPTER TEN

The Cochituate Aqueduct

My name is Water! I have sped
  Through strange dark ways untried before,
By pure desire of friendship led,
  Cochituate's Ambassador;
He sends four royal gifts by me,
  Long life, health, peace, and purity.

James Russell Lowell, "Ode for the Boston Water Celebration" (1848)

Boston's year of decision in water politics was 1845. From January to December the proponents of the Long Pond aqueduct engaged in a continuous battle with the Spot Pond faction. During these eventful twelve months the Long Pond party experienced a whole cycle of fortunes, passing from victory to defeat and back to victory again.

When the Massachusetts Legislature convened in January, 1845, it was immediately confronted with the petitions of the rival parties. From one side came the petition of the city of Boston requesting authority to introduce a supply of pure water from Long Pond and supporting petitions from many citizens; from the other came remonstrances from dissenting Boston taxpayers and from the outlying towns which might be injured by the diversion of water. When a joint special committee of the Legislature opened hearings on the issue, both sides were represented by eloquent counsel and both paraded an impressive list of witnesses through the committee room.

Attorney Charles H. Warren, arguing on behalf of the city, stressed the need for water and the decisiveness of the vote by which the citizens had approved the Long Pond plan in the recent water referendum. The city authorities came "as beggars for a cup of cold water, and hoped that this slight boon—which they felt to be necessary to their health, comfort and prosperity would not be refused."[1]

Attorney E. H. Derby, appearing for the remonstrants, claimed to represent "a large proportion of the wealth and property of the city, men who anticipated a failure if this great work was commenced, and who if it resulted in the manner a similar work had in New York, would

be obliged to pay the interest on the outlay, which they believed would add 50 per cent to their taxes." This was not a matter in which the popular will was decisive. "The city was not associated together, or clothed with municipal authority, for such a purpose as the building of aqueducts."[2]

> Next year the city might come in there and ask for powers, under a vote of the citizens, to carry out some new project for supplying heat and gas from the interior of the earth; or to borrow money at four per cent. to supply clothing for the poor, that the manufacturers need not charge them thirty per cent.[3]

Where was the minority, in such a case, to find a refuge, if not with the Legislature?

Derby went on to argue that the water needs of the population had been overestimated, that the population was being drawn off to the suburbs, that the city could be supplied from nearer and better sources at one-tenth the cost, and that private corporations were the proper agents for carrying out such projects.

To support these contentions, the remonstrants had mobilized an imposing array of witnesses. Charles W. Cartwright, president of the Manufacturers' Insurance Company, undertook to refute the city's assertion that more water was needed for fire protection and that the building of the Long Pond aqueduct would result in a lowering of insurance premiums.[4] Lemuel Shattuck, who enjoyed a substantial local reputation as a compiler of statistics, argued that the sections of the city adequately supplied by the existing Aqueduct Corporation were growing more rapidly than the sections where the supply was inadequate. He also presented a financial analysis of the Croton Aqueduct, designed to prove that it was paying only about one-quarter of one per cent on the investment.[5] R. H. Eddy argued again for his Spot Pond-Mystic Pond plan, which he calculated to be two million dollars cheaper than the Long Pond project.[6] Two former mayors, Samuel T. Armstrong and Jonathan Chapman, also expressed their preference for Spot Pond.[7]

The proponents of the Long Pond plan put up a vigorous defense. Former Mayor Martin Brimmer told of visiting Spot Pond the preceding September and being convinced that the supply from this source was totally inadequate. He cited evidence that the city's need for water was desperate. When new wells were sunk, the older ones often failed. "There is a constant war going on under ground and many wells have to be deepened from time to time." Large quantities of soft water had been brought into Boston from Charlestown the previous summer and sold at high prices. Particularly serious was the shortage of water for

fighting fires. There were fifty-six public cisterns or reservoirs in the city, each holding from three to four hundred hogsheads of water, but Brimmer believed that they would be inadequate to extinguish a fire of any magnitude. The filthy salt water stored in some of the reservoirs ruined the clothes of the firemen and injured goods almost as much as fire itself.[8]

To rebut the allegation that the wealthiest taxpayers opposed the water project, the spokesmen for the city presented the returns from the water referendum showing a heavy vote in favor of Long Pond in Wards 4 and 7, the richest districts of the community. Letters from leading citizens of New York were read, claiming that fire insurance rates had fallen by forty per cent since the introduction of the Croton water. James A. Coffin, president of the Croton Aqueduct Board, wrote that the citizens of New York would not be without their water works even if their cost were trebled.[9]

On March 6, 7, and 8, the counsel for the remonstrants and for the city made their closing arguments. William J. Hubbard for the remonstrants charged that the course of action on the water issue during the past year had been characterized by "hot haste and a want of due deliberation and thorough investigation, and affords no sufficient evidence that the public necessity or interests require that authority should be granted to carry the proposed plan into execution."[10] The supply of water should be left to private enterprise:

> The remonstrants think there are decided advantages in having the water introduced by a private corporation. They believe it will be done more economically than by the city—the city will incur no risk of loss—those who want water will alone pay for it; and if it proves a profitable undertaking, the city have the power to take it from the company by paying them a reasonable compensation; and if the city should decline taking it, the citizens will be safe against imposition or exaction on the part of the company, by the provision in their charter authorizing the Legislature to regulate the prices of water.[11]

Attorney Richard Fletcher's concluding argument for the city was a refutation of these charges. Once again the need for water and the evidence that the citizens wanted to obtain a supply from Long Pond was reviewed.[12] As for leaving the matter to private companies, Fletcher declared that everywhere this had been done "it had been a source of disappointment and regret." The people should have water "freely and liberally, and without stint."

> A kind Providence had made ample provisions for all; and all should have it in abundance. It should be seen all about us—in fountains before the State House, on the people's Commons, in the public squares, it should be like the air we breathe, everywhere, in doors and out of doors, minis-

tering to the comfort, cleanliness and health of every living thing. If the people, now limited to a scanty supply of impure water, could but once know the blessedness of an abundant supply of pure water,—of the little band who now oppose this measure, there could not a man be found, who would undertake to utter a single word against it,—even by attorney.[13]

On March 13, the joint special committee reported a bill granting the municipality the requested powers. The measure encountered practically no opposition in the Senate, where it passed by a vote of 33 to 2.[14] In the House, however, the anti-Long Pond faction had more success. During the debate a bottle of Long Pond water stood on the Speaker's stand, and some members professed to be shocked by its bright French green color. "Who," asked one legislator, "would drink such water?"[15] Only after a number of amendments had been adopted, did the bill finally pass by a vote of 192 to 30.[16] The Senate concurred with reluctance in the House amendments, and the bill was finally passed and approved by the Governor on March 25, 1845.[17]

The new law provided that the water works should be built under the direction of three Commissioners, to be elected by the Mayor, Aldermen, and Common Council assembled in convention and removed only for cause. The Commissioners were to have authority to issue $2,500,000 in Boston Aqueduct scrip. By one of the amendments added to the original bill the city was not restricted to Long Pond as a source. Authority to take the water of the Charles River was also provided, and the two branches of the City Council were empowered to choose between these alternatives by joint ballot. Finally, the Legislature stipulated that the water act as a whole should not be operative unless it were accepted by the citizens of Boston in a special referendum to be held within sixty days.[18]

Between March 25, when this measure was passed, and May 19, when the issue was submitted to the voters, the water issue was debated all over again in pamphlets, newspaper editorials, and public meetings. Henry B. Rogers, who had been an Alderman during the previous year, denounced the high pressure tactics by which the Long Pond faction had forced its measure through the City Council. He condemned the new water act on the ground that the election of the Water Commissioners by the Aldermen and Common Councilmen sitting in convention threatened to change "the whole character of our municipal affairs."[19] John H. Wilkins, a prominent Whig politician, professed to favor public water works, but to believe that the Charles River would provide purer water than Long Pond and that the city ought to distribute water for domestic purposes free instead of charging water rents.[20]

One of the most active opponents of the Long Pond plan continued to be Lemuel Shattuck, the statistician. He calculated that the present need was only to supply some six to eight thousand water takers, and that a daily supply of from 1,050,000 to 1,400,000 gallons would be adequate. A private corporation could provide this more cheaply and efficiently than the city.[21] Shattuck was probably the author of an anonymous pamphlet of the day entitled *How Shall We Vote on the Water Act?* To this question the answer was unequivocal:

Whether we are rich men, or poor men, or whatever our circumstances may be, it is our duty to vote against this act. The appeal of its friends has been go *for* the act, the whole act, and nothing but the act. We should now make a vigorous attempt to destroy this corporation—this monster, which has been introduced among us—before it becomes a permanent resident; and before it obtains power over the money in our pockets, and the very water we may drink. Our own safety demands that we should kill it. The process is very simple. We have only to go to the ward-room, on the day of election, and *throw "a majority of the votes" to be "given in" against it.* It will then "be void,"—dead. These paper bullets will do the deed. And it will then be remembered only among the things that were; and the only monument over its own grave will be erected by itself, out of its own folly. Let us see to it that we perform this duty faithfully, thoroughly; and try, by all fair means, to persuade our neighbors to do likewise.[22]

Vigorous opposition to the water act was also forthcoming from the promoters of the Spot Pond Aqueduct Company. At the same time that the Legislature had passed the water act it had also quietly liberalized the charter of the Spot Pond enterprise. The stockholders were now relieved of individual responsibility for the debts of the corporation, and the company was given an extension of time for carrying out the purpose of its incorporation.[23] In a broadside addressed "To All Who Want a Supply of Pure Water," the promoters made sweeping promises. If the water act were rejected by the voters, the city would be offered an opportunity either to purchase all the stock of the company, or any lesser portion up to one-half. If the company remained under private management, the Mayor and Aldermen might serve as an unpaid board of commissioners to regulate the water rents and supervise the erection of public hydrants and fountains.

If the result of your votes, fellow citizens, permit the undersigned, and others who may become their associates to proceed under the Spot Pond charter, you will obtain without any cost to yourselves or to the City, beyond an annual charge to those who become consumers of the water—and *for fifty years at least,* as we firmly believe, that most desirable boon, a copious supply of the purest water for domestic uses—street hydrants *to accommodate the poor*—for manufacturing purposes—public baths—ornamental fountains—and the protection of your property from the ravages of fire; and this great result may be effected within one year from the present time.[24]

The Long Pond faction urged acceptance of the water act. In a new pamphlet Dr. Walter Channing gave general approval to the measure, but criticized the provision that had been added to make it possible for the city to take the water of the Charles River. This stream, he charged, was "the common sewer" of Middlesex County.[25] The people should stand fast on their decision of 1844: "Long Pond Water will only answer their purpose; and to Long Pond let them steadily adhere."[26]

Nathan Hale, who had served as Water Commissioner in 1837, 1838, and 1844, explained why he had shifted his support from Spot Pond to Long Pond. Because of the city's increased population and needs, the smaller source was no longer adequate. Hale vigorously denied that Charles River water was purer than that of Long Pond and warned against Wilkins' contention that the city should supply free water. He could not "perceive the reasonableness or propriety of providing such a necessary of life, at the public charge, except to the poor."[27] The Faneuil Hall Committee, which had been so active during the preceding year, issued a pamphlet defending the water act against various criticisms. To the objection that the Water Commissioners had been vested with too much power and were not removable except for cause, the Faneuil Hall Committee answered that this was essential to prevent "private speculation, 'log rolling' and corruption."[28] The voters were urged to waive their objections to "mere 'minutiae.' "

> *It is Water! or no Water!* It is present or speedy action or *interminable delay!* It is manfully and consistently carrying into effect the views and wishes which have been so long labored for and cherished, or weakly abandoning them when the golden prize is palpably within your grasp! We conclude, by averring it as our most confident belief, *that you will vote for the acceptance of the Act!* that you will heroicly sustain and support the high ground which was manifested by your votes on this vitally important subject in December, 1844![29]

The referendum on May 19 resulted in a serious defeat for the Long Pond party. Only 3,670 citizens voted to accept the water act, while 3,999 voted against it.[30] The *Boston Evening Transcript* believed that water would now be a dead issue until some great fire again shocked the citizens into action.[31]

But this predicted lull in the controversy failed to materialize. The promoters of the Spot Pond Aqueduct Company moved quickly to take advantage of the new situation. On the day after the referendum they were reported to be busily engaged in soliciting new subscriptions to their stock.[32] On May 22, the Company submitted a proposition to the City Council, offering to sell all its charter rights and the pond itself to the city for $60,000.[33] In the belief that the Joint Standing Committee on Water was prejudiced in favor of Long Pond, the partisans of the

Company tried to get a new special committee appointed, but they were unsuccessful in this maneuver. On June 9, the Council instructed the Committee on Water to take such measures as in their judgment might be necessary to enable the City Government to decide as to the expediency of accepting the proposition of the proprietors of Spot Pond.[34] Also referred to the same committee were the petitions of former Mayor Armstrong and others, proposing as an alternative that the city should purchase a portion of the Company's stock.[35]

These developments speedily brought the Long Pond faction back into action. The *Boston Evening Transcript* warned investors in the water company that if they persisted in their efforts in the face of widespread opposition "they will have hereafter no pretext for their complaint, if the enjoyment of the expected profits of their enterprise shall be defeated by the execution of a public work worthy of the city and adequate to the supply of all its wants."[36] On the evening of May 26, meetings were held in each of the city wards "for the purpose of organizing and concerting measures in the matter of a supply of water." The call was issued by a committee composed of members drawn from all the major parties of the day—Whig, Democratic, and Native American—with the frankly avowed objective of organizing a "water party," composed of "spirited individuals, who will persevere till the long desired object of water in abundance from some source shall be brought into this city."[37] These meetings resulted in the establishment of so-called Ward Water Unions, which became important factors in the politics of the city for the next several months. One of the first activities of the Water Unions was to circulate petitions requesting the City Council neither to purchase Spot Pond nor to subscribe for stock in the Spot Pond Aqueduct Company.[38]

The struggle between Long Pond and Spot Pond partisans was complicated by the endeavors of the Charles River group to attract attention to their project. On May 24, a letter to the *Transcript* read:

> Mr. Editor: As you do not appear to be sold to any of the various water schemes, perhaps you will allow me to put a single inquiry on this subject. While the city authorities are investigating the capabilities of Long Pond and other sources of supply, would it not be as well for them to look a little closer to Charles River, the water of which, according to the analysis of Dr. Jackson and Mr. Hayes is equal to any other?[39]

The Joint Standing Committee on Water had been charged with the specific responsibility of recommending what course of action should be taken on the Spot Pond proposal. But the Committee at once decided that this decision hinged on much broader issues of policy. On June 12, it resolved to seek authoritative answers to three vital questions: How much water did the city need? What was the daily flow from Spot Pond,

Long Pond, and the Charles River? How much would it cost to introduce water from each of these three sources? By employing two impartial engineers from other cities, the Committee hoped to settle forever these long-debated points.[40]

On June 23, Thomas B. Curtis of the Water Committee conferred on the problem with John B. Jervis, chief engineer of the Croton Aqueduct. In a letter to Jervis he wrote: "In order to satisfy the public mind it is deemed necessary to seek the highest authority. In this view the committee naturally look to you, and would, I presume, be influenced in the selection of another gentleman by your advice."[41] Jervis accepted the proferred commission, and Professor Walter Johnson, a Philadelphia chemist, was appointed to the other post.[42]

Much of the actual field work for the new survey was done by Henry Tracy, one of Jervis' principal lieutenants on the Croton project. Letters from Tracy to his superior show that during August, September, and October meticulous studies of all the suggested sources were in progress.[43] Meanwhile, some of the interested parties were attempting to influence the decision. The eccentric Charles Crocker, who had been proclaiming the advantages of Charles River for many years, demanded that Jervis appoint him to office: "You have authority to appoint a Secretary . . . and I wish to have that employment at once. . . . I must either go on with you or go on without you—It is for you to say if we act together."[44] A day later, Crocker wrote a long letter to Jervis, explaining his Charles River plan and complaining of persecution at the hands of those who had been opposing him:

> What will be my reward for all my labor in water matters is hard to guess—perhaps to dance attendance on the next Legislature at my own cost, after paying a couple of party papers $50 for advertising my petition. One bankrupt runs the Long pond scheme to death and another is ready to take the merit of any body's water labors, with an organized band—the Whigs wish to cheat me and the public by *deferring*—probably, till they have somebody ready to *father* an aqueduct. . . .[45]

Jervis was also favored with a letter from George W. Odiorne, the principal owner of Spot Pond, who confessed to "some delicacy in writing," but who thought that he owed it to his family to call the engineer's attention to certain facts about the amount of water available from this well-known property.[46]

Doubtless fearful that the Jervis-Johnson report would be unfavorable to their interests, the promoters of the Spot Pond Aqueduct Company attempted to get the Council to decide the issue without waiting for the completion of the survey. On August 5, a petition signed by one hundred stockholders was presented to the Council, urging that the

city subscribe for one third of the Company's stock. At the next session of the Legislature the Company promised to seek extensive amendments to its charter to protect the municipal interest. The Mayor and Aldermen would be constituted a board of water commissioners with power to regulate the water rents so that the stockholders would receive not less than six nor more than ten per cent on their investment. The city would pay for the erection of fire hydrants, but the use of the water for extinguishing fire would be made free. Public hydrants would be erected for the supply of the poor with the city paying a rental on the water provided for this purpose. The petitioners had no doubt that a prompt subscription on the part of the city would secure within one year "an ample and sure supply of the purest water at a low scale of charges, and, combining the resources and credit of the City with individual frugality, enterprise and sagacity, will insure promptitude in action, and economy in expenditure, and rapid execution, and avoid all risk of increased taxation from a larger and more uncertain enterprise at the sole risk of the City."[47]

This petition was referred to a special committee of Aldermen, who brought in a favorable report on September 8. The committee noted with approval the distinguished names among the hundred petitioners. These men were the owners and representatives of about eight million dollars worth of property—surely impressive evidence that substantial men of affairs had confidence in the Spot Pond enterprise. The committee recommended that the citizens should have an opportunity to vote on the proposition: "Shall the immediate introduction of pure water be secured by requesting the City Government to subscribe for the remaining third of the capital of the Spot Pond Aqueduct Company, with the liberty to take the whole on the completion of the work, pursuant to the charter?"[48]

As a further step in this campaign to commit the city to the Spot Pond plan, the members of the City Council and other dignitaries were invited to view this body of water for themselves on September 30. But this maneuver miscarried. To the embarrassment of the hosts, the visiting guests found the Pond at its lowest level. The flow at the outlet was trickling through at the rate of about 350,000 gallons a day—about the quantity required for a single ward. The *Transcript* predicted that this fiasco would kill the Spot Pond scheme:

> The *"Amen"* was said over the remains yesterday; and had a vote been taken on the spot we verily believe not a voice would have been raised in its favor, as a source of supply for the present wants of the city.[49]

George W. Odiorne tried desperately to recapture the lost ground. "Some designing persons," he charged, had been deceiving the public

in regard to the quantity of water available from Spot Pond. His employees had explored the channel of the outlet and discovered several large stones obstructing the flow of the stream. With these removed, the flow had steadily risen until it had reached the rate of 1,555,200 gallons a day.[50] But the *Transcript* was not impressed. On October 16, it expressed disbelief in Odiorne's accusations, and two weeks later it published a long public letter condemning these attempts to excite sympathy for Spot Pond. The writer referred to the "eminent Professors" who had been conducting surveys and urged the community to wait for their report.[51] Odiorne continued to protest: "Like the Jews of old, you cry, away with Spot Pond—crucify, crucify—even although Pilate should find no fault with it."[52]

Another development very damaging to the Spot Pond scheme was the rapid growth of the Ward Water Unions. By November, these were reported to have 4,732 members—an impressive total since the negative vote on the water act the previous May had been only 3,999 votes.[53] The *Transcript* hoped that the Water Unions would exert a decisive influence in the fall elections. In order to win, the candidate for mayor would have to be "in favor of a public aqueduct, a well known water man, out and out."[54] The activities of the various Ward Unions were co-ordinated by city-wide Union Water Conventions. One such Convention used the occasion of a serious fire in South Boston to warn the city of the peril in which it was placed by the shortage of water.[55] A second, requested the City Council to submit a new set of questions to the voters at the annual election in December.[56]

"The 'Water Question,' as it is familiarly termed," wrote "A Citizen" to the *Transcript* on November 8, "is growing more interesting as it approaches the crisis." That such a crisis was imminent, the feverish maneuvering of the Spot Pond faction and the Ward Water Unions clearly testified. On November 18, John B. Jervis and Walter R. Johnson presented their report to the Joint Standing Committee on Water, and the gist of their findings soon reached the newspapers. The report constituted, said the *Transcript*, a complete vindication of the course which that paper had been advocating throughout the past year.[57] In short, it was a complete victory for the supporters of Long Pond. Spot Pond could be depended upon for only 1,500,000 gallons a day; the city needed 7,500,000 gallons at once and would soon need 10,000,000 gallons.[58] The engineers found that such a supply could be obtained from Long Pond by works estimated to cost $2,651,643.[59]

> In conclusion, it may be remarked that in view of the whole subject, we have no hesitation in stating, as our opinion, that Long Pond is decidedly the most appropriate source to which the City can resort, to obtain an adequate supply of pure and wholesome water for the present and future use of its inhabitants; and that it will not be a larger provision, in view of the probable growth of the City than is desirable in works of this character and magnitude.[60]

The Jervis-Johnson report virtually annihilated the opposition to Long Pond. On November 24, the Joint Standing Committee recommended the following resolutions:

> That it is inexpedient to accept the proposition of the proprietors of Spot Pond, to sell said pond to the City, for the distribution of its waters therein.
>
> That it is inexpedient to comply with the proposition of Samuel T. Armstrong and others, that the City subscribe to one-third part of the stock of the Spot Pond Corporation.[61]

At a special meeting of the Common Council on November 28, these resolutions were adopted by a vote of 37 to 0. Nor was this all. By the same unanimous vote the Common Council resolved that it was expedient for the city at its own expense to build works for introducing water from Long Pond.[62]

Action by the Aldermen was delayed by the death of Mayor Thomas A. Davis on November 22.[63] The mayor's death had been preceded by a long illness which had left the city government without a head for many weeks. Unusual interest therefore attached to the regular municipal elections scheduled for December 8. The executive committee of the Union Water Convention addressed a letter to each of the mayoralty candidates, pointing out that the citizens of the city had been "repeatedly baffled and disappointed" in their efforts to procure an abundant supply of water. Now, as the result of "an expensive, scientific, and, we believe, accurate survey," Long Pond had been judged "decidedly the best source." Would the candidate, if elected, use his efforts unreservedly to obtain suitable powers from the Legislature and to cause a public aqueduct to be constructed?[64]

Among the men to whom this questionnaire was addressed was Josiah Quincy, Jr., son of the mayor under whom the campaign for public water works had been initiated twenty years before. Quincy, the Whig nominee, gave the Union Water Convention an unconditional pledge that, whether or not he was elected mayor, he would further the construction of the Long Pond aqueduct by every means in his power. Since the Democratic and Native American candidates also gave satisfactory assurances, water was not really an issue in the campaign. Partisan newspapers insisted, however, that a Whig victory was essential to staff the city government with "prudent and judicious men" for the important task ahead.[65] Such counsels were apparently persuasive because Quincy was elected by a large majority, and the Whigs gained secure control of both branches of the City Council. Elected, but running well behind the

rest of the ticket, were two Whig Aldermen, Jonathan Preston and Fredrick Gould, whom the *Transcript* identified as "anti-water men, or what amounts to the same thing, warm partizans of the Spot Pond Corporation."[66]

On December 11, the City Council met in convention to elect a Mayor to fill that vacant office for the balance of the municipal year. Quincy was chosen with little opposition, and accordingly began his term of office several weeks earlier than he would have under normal circumstances. With this question settled, the city government returned to the water project. On December 22, the Aldermen adopted without a dissenting vote the resolutions from the Common Council in favor of building an aqueduct from Long Pond as soon as the requisite powers could be obtained from the Legislature.[67]

Thus it was that in 1846 the Legislature again found the City of Boston a petitioner for authority to build water works. But the situation was much different than it had been the year before. A member of the Boston Water Committee, writing to John B. Jervis, explained that he and his colleagues had attended a legislative hearing on February 9 and "to our astonishment we found no one but the Town of Lowell to oppose us. We shall go on very smoothly."[68] This prediction was substantially borne out. A few other remonstrances—one of them from the old Aqueduct Corporation—were registered, but the opposition was largely perfunctory. On March 30, 1846, a new Water Act was passed, by which the city was empowered to take water from Long Pond and any other stream or pond within a distance of four miles of it. The city might construct aqueducts, dams, and reservoirs, and provision was made for taking land by condemnation if this should be necessary. Supervision of the work was to be in the hands of three Water Commissioners to be appointed by the two branches of the City Council, voting concurrently. The Commissioners were to serve a three-year term, but might be removed by a concurrent vote of two-thirds of each branch of the Council. The city was given authority to borrow up to $3,000,000 and was also empowered to purchase the property of the old Aqueduct Corporation, if it saw fit to do so. The Act would be void unless accepted by a majority of the voters within thirty days.[69]

On April 13, the citizens were for the last time asked to vote on the water issue. The Union Water Convention urged them to register their sentiments decisively:

> No matter of greater importance, in every way it can be viewed, was ever submitted to the inhabitants. . . . The unanimity which appears to prevail on the subject is cause of sincere gratification. It is well worth a year's delay, a year's labor, and a year's expense to have produced such a result.[70]

The outcome of the balloting appeared to justify this assertion. By a vote of 4,637 to 348 the citizens voted to accept the Water Act.[71]

The Water Commissioners, elected by the City Council on May 4, were James F. Baldwin, Nathan Hale, and Thomas B. Curtis—men prominently associated with the Long Pond project during recent years.[72] At their first meeting, the Commissioners decided to invite John B. Jervis to serve as Consulting Engineer. Jervis accepted this invitation and agreed to advise on the plans and execution of the works and to visit the city as often as necessary for an annual salary of $3,000. The Commissioners planned for the work to be organized in two divisions, the first to consist of the aqueduct from Long Pond to a receiving reservoir in Brookline or Brighton; the second to include the line of pipes from that reservoir into the city. Each division was to be under its own Chief Engineer with a salary of $3,000. E. Sylvester Chesbrough, an engineer on the Pawtucket Branch Railroad was engaged to take charge of the first division, and William S. Whitwell was employed to direct the second.[73]

On August 20, 1846, impressive ground-breaking ceremonies were conducted. A party of 230 distinguished guests, including Mayor Quincy, ex-President John Quincy Adams, members of the City Council, and the Water Commissioners, traveled from Boston to Saxonville by special train and marched from there to Long Pond behind a brass band. After appropriate speeches, a steel spade, manufactured for the occasion, was presented to Mayor Quincy, who doffed his coat and took out the first sod amidst loud cheers from the crowd. While the band played "Adams and Liberty," the venerable former president placed the second shovelful of earth into the waiting wheelbarrow, and the third was taken out by the senior Josiah Quincy. After a number of other dignitaries had had their turn, the work was formally delivered into the hands of the contractors, and the distinguished company marched to a pavillion on the other side of the pond, where they sat down to "tables bountifully spread with the wherewithal to comfort the inner man."

After the food had been despatched, Mayor Quincy announced that he had a little business to transact with the Aldermen and Common Council. They had purchased this beautiful sheet of water, he said, and hoped that before long it would be in the houses of the citizens. It was now called Long Pond, but that was like calling a man John Smith—it was no name at all. Deep research on the matter had resulted in the discovery that the original Indian name of the pond was "Cochituate," and, through a remarkable exercise of etymology, the Water Commissioners had decided that this word meant "an ample supply of pure and soft water, of a sufficient elevation to carry into the City of Boston, at a

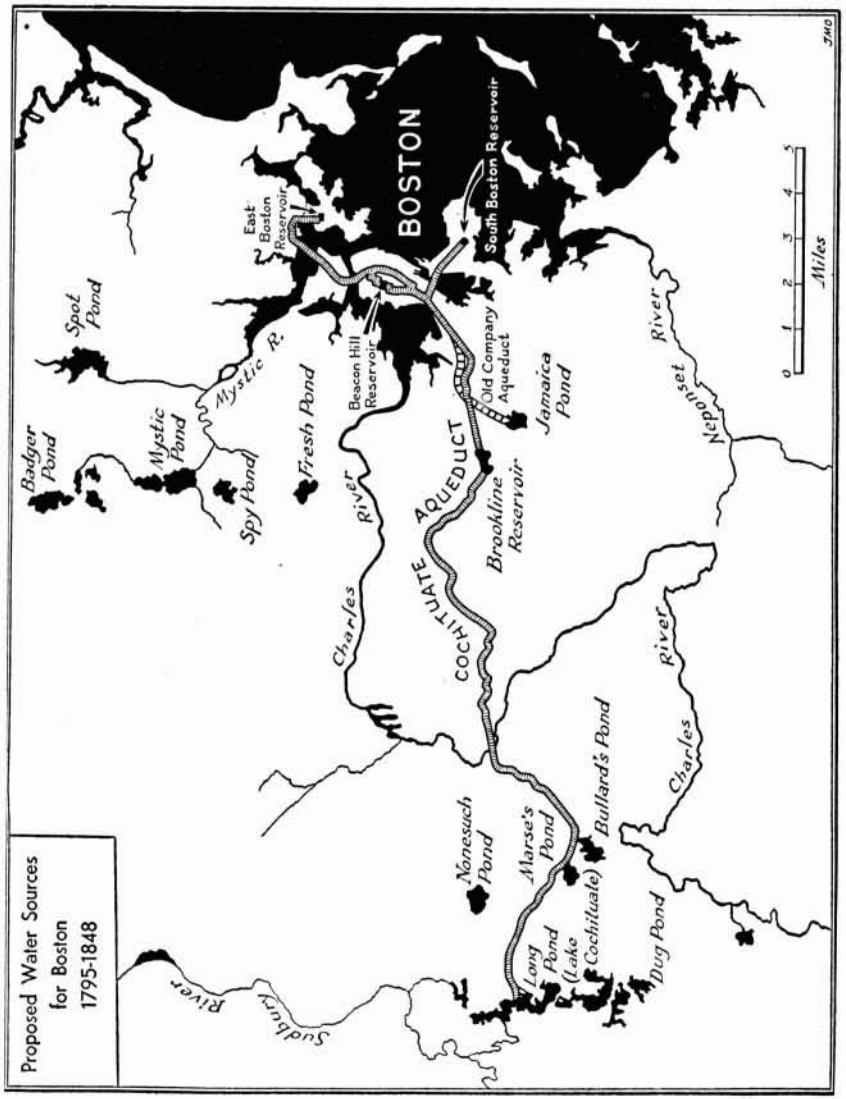
moderate expense." The Mayor's proposal that Long Pond should henceforth be known as Lake Cochituate was enthusiastially adopted. The guests then settled down to a round of eloquent toasts. When ex-President Adams' turn came, he proposed:

> *The waters of Lake Cochituate*—May they prove to the citizens of after ages, as inspiring as ever the water of Halicon to the citizens of ancient Greece.[74]

After this auspicious beginning, the construction of the aqueduct went forward without serious interruption. The city authorities' optimistic belief that European banking houses would eagerly advance the needed money proved ill-founded. Because of the repudiation of American obligations during recent years and the superior attraction of railroad investments, foreign funds were not available on favorable terms. This required some ingenious financial makeshifts—resorts to short-term loans and the like—but no real crises. Most of the money was borrowed from Boston's own citizens at an average interest rate of a little under six per cent. The investors had little reason to worry: not only were the prospective water rents pledged for the payment of the water debt, but in its public lands the city owned assets so valuable that the revenue from this source alone might be counted upon to extinguish the new loans within a period of some twenty years.[75]

The only serious attack upon the administration of the aqueduct project came in December, 1846, when a group of dissatisfied Boston mechanics addressed a petition to the Mayor and City Council. According to this document, the Water Commissioners had appointed citizens of other states engineers at exorbitant salaries and had disregarded the bids of local citizens in order to give the contracts to favored firms from other cities, and this had cast "an imputation of incompetency upon our Boston mechanics." The Joint Standing Committee on Water under the chairmanship of Mayor Quincy brought in a report entirely exonerating the Commissioners.[76] This quieted the complaints for the time being, but in December, 1847, when Mayor Quincy ran for a third term, these charges were revived by a group of dissident Whigs who had nominated their own candidate. Quincy was also accused of having been a Spot Pond partisan until he found it advantageous to change sides after the growth of the Ward Water Unions and of having profited on land transactions with the city. The Mayor's friends defended him vigorously. Thomas B. Curtis, one of the Water Commissioners, explained that full responsibility for the awarding of contracts rested with the Commissioners themselves. Charles Sumner declared in a public meeting:

> Another important consideration is the introduction of pure water. We may well be astonished that the city has been so long without it. The gas



pipes may be likened to the nerves, the sewers to the veins, and the water pipes are the arteries through which the life-giving blood is to be poured into our system. Boston will not be perfected till this is done. It is half done, and shall we not have the benefit of Mr. Quincy's services in finishing it?[77]

The *Daily Evening Traveller* asserted that the real opposition to Quincy's re-election came from the liquor dealers, who were angry with the Mayor because he had provided the casting vote by which a no-license ordinance had been passed.[78] Quincy received an impressive vindication on election day, polling almost three times as many votes as did the next man among the four candidates for the mayoralty.[79]

Although only about half the length of the Croton Aqueduct, the Cochituate Aqueduct was a notable work for its day. Nathan Hale, one of the Water Commissioners, thus described Lake Cochituate itself:

> The source from which the supply is drawn is a Lake, situated in an elevated part of the country, twenty miles distant from the City, remote from the habitations of men, and secluded from the seats of all such occupations as might subject it to causes of impurity. The Lake covers an area of a mile square; it is of great depth; and is supplied by the rains which fall upon a large surrounding country, as well as by springs and streams never liable to be rendered turbid by inundation. . . . The waters of this Lake have flowed for ages through a remote part of the country to the ocean. Their natural outlet is now forever closed; and a new channel has been formed, by the excavation of the intervening barrier of earth and rock, for conducting them by a gentle declivity to the City.[80]

From the gate house at Lake Cochituate to the receiving reservoir at Brookline a masonry aqueduct over fourteen miles in length was constructed. The oval-shaped conduit, built of brick laid in hydraulic cement, was six feet high on the interior. At one point the conduit had to be laid below the bed of a stream in a narrow valley, and this involved engineering problems of a challenging character. Five steam engines had to pump constantly to keep the excavation reasonable dry, while shifts of workers labored day and night to complete this section as quickly as possible.

Two tunnels with an aggregate length of 3,500 feet had also to be dug. These required the sinking of ten shafts from 70 to 75 feet in depth. From the bottom of these shafts the tunnels were dug in both directions by successive parties of miners, working around the clock in eight-hour shifts. Most of the aqueduct ran through deep trenches and was covered with earth, but there were impressive works above ground at Newton, where the water was conveyed across the Charles River through an inverted syphon of iron pipes supported on an arched bridge, and at Needham where another large aqueduct bridge was built over a highway.

At Brookline the masonry aqueduct terminated in a reservoir, some twenty acres in area, with a capacity of 100,000,000 gallons. From this point the water was conveyed by large iron mains to two distributing reservoirs: one, a massive masonry structure on fashionable Beacon Hill with a capacity of 2,600,000 gallons; the second, of more modest construction on historic Telegraph Hill in South Boston with a capacity of 7,500,000 gallons. The total length of iron pipe bringing the water to the city reservoirs and distributing it through the city was estimated at about sixty miles. The cost of the aqueduct was about $4,000,000.[81]

On October 25, 1848, Boston celebrated the introduction of the Cochituate water in a great civic festival that rivaled the New York holiday of 1842. Excited spectators poured into the city from all the outlying towns and villages. Regular trains and special trains on the seven railroads serving the city were crowded, and additional thousands came in by horse-drawn omnibuses and other modes of conveyance. The citizens were awakened by the discharge of one hundred guns and the ringing of church bells—signals that the weather was fair and that the celebration would go forward as planned. The principal streets of the city were profusely decorated with flags, bunting, and a great variety of mottoes and legends. Fourteen of the latter commemorated high points in the long water controversy. The first of these read: "A loud call from the people for pure water! Cry heard by Hon. Josiah Quincy, Mayor, 1825." The last said: "Ground broken at Cochituate Lake by the Hon. Josiah Quincy, Jr., August 20th, 1846."[82]

The parade was all that visiting countrymen could have wished. In the first division marched the city officials from neighboring cities and towns, followed by the officers and student body of Harvard College, and other scientific, historical, and musical societies. In the second division, composed of various associations of mechanics, a great float drawn by four horses carried a complete printing shop, from which "A Song for the Merry-Making on Water Day" was printed and distributed to the spectators. Temperance groups like Father Mathew's Mutual Benevolent Total Abstinence Society, the Boston Temperance Union, the Washington Total Abstinence Society, and the Sons of Temperance marched by with banners flying. Enjoying a place of honor in the procession were such crusading groups as the Citizens' Water Committee of 1844, the Union Water Convention of 1845, and the numerous Ward Water Unions.[83]

The parade terminated at Boston Common, where a crowd estimated at between 50,000 and 100,000 were gathered around a fountain placed in the center of the famous Frog Pond. The spectators heard the school children sing an ode written for the occasion by James Russell Lowell

and listened to speeches by Water Commissioner Nathan Hale and Mayor Josiah Quincy. Cutting short the program, the Mayor then asked the crowd whether it were their pleasure that the water should be introduced. In response to a thunder of "ayes," the valve was opened and water began to rise in the fountain. As the column climbed to a majestic eighty feet, there was a moment of awed silence and then a roar of cheers. A children's choir sang:

> Thanks be to God! He laveth the thirsty land. The waters gather! they rush along; they are lifting their voices. The stormy billows are high, their fury is mighty: But the Lord is above them and almighty.[84]

As the sun sank below the horizon, its last rays gave a touch of color to the soaring water. Bells rang; cannons boomed; and rockets streamed across the sky. The spectators waved their hats, shouted, laughed, and even wept. Contributing to the noisy enthusiasm was Mayor Quincy's announcement: "Boys, there will be no school tomorrow, and the fountain will play all day." The evening brought new delights with an elaborate display of fireworks and a circle of colored Bengal lights to illuminate the lovely fountain.[85]

The water proved equally popular in its more prosaic uses. In August, 1849, only nine months after the aqueduct was open, there were 10,851 private water takers and 750 fire hydrants.[86] By February, 1855, the number of water takers had increased to 17,999; the number of hydrants to 1,210; and the total length of distributing pipes was over 110 miles. By this time the water system had been extended to East Boston. This had required the construction of another reservoir with a capacity of 5,591,000 gallons and the laying of iron mains on wooden piers across the Charles and Mystic Rivers and the channel of the sea which lay between Chelsea and East Boston. Ten public fountains had been built to ornament the city's various parks and squares.[87]

The successful completion of the municipal water works brought an immediate crisis in the affairs of the old Aqueduct Corporation. In a memorial to the City Council in November, 1848, the proprietors reviewed the history of the company and set forth the many benefits which the citizens had derived from its services. The stockholders now asked the city to purchase their rights and property at a price to be fixed either by agreement of the parties or through reference to arbitration. They did not ask redress "as equals, who suffer in competition with equals, but as a few private individuals, who are sacrificed on the altar of public accommodation—whose property is destroyed, for the benefit of the whole remainder."[88]

In response to this overture Mayor Quincy and the Water Committee of the Council entered upon negotiations with a committee representing

the company. The Mayor at first expressed the opinion that $100,000 would be a fair price, but he discovered that payment of so large a sum would be strongly opposed in the Council. Eventually Quincy's committee offered $75,000, and the stockholders reluctantly agreed to accept this amount. The Board of Aldermen passed the necessary order, but the Common Council refused to concur. Benjamin Seaver, president of the latter body, left the chair to lead a bitter opposition.[89]

Seven months later in July, 1849, the issue was re-opened when a resolution was offered in the Common Council to authorize the Mayor to purchase the old water works for $20,000.[90] This provoked an angry reaction from L. M. Sargent, the company president. In a communication to the *Boston Evening Transcript* he asserted:

> It is my humble opinion, very deliberately formed, nevertheless, that the proprietors of the Boston Aqueduct have been treated, by the City Government of Boston, with a measure of injustice, illiberality, and even meanness, which has no parallel here, since Boston was founded in 1630. . . .
>
> Upon whose suggestion Mr. Putnam proposed that $20,000 should be offered for the *property* and *franchise* of the Boston Aqueduct I cannot imagine. . . . Until the time when this property, belonging to a few citizens and taxpayers, was crushed and sacrificed, for the benefit of the whole community, it yielded an income of six per centum, per annum, on more than $350,000, and divided annually, for several years, among the stockholders $20,000, the very sum proposed by Mr. Putnam to be paid *for the whole property and franchise*.[91]

Sargent followed this protest with a series of additional letters to the *Transcript,* subsequently republished as a pamphlet entitled *Boston Aqueduct and the City of Boston.* He accused the politicians of persecuting the company because it had opposed the project for municipal works. "The Boston Aqueduct appears to have been thrown among the overgrown boys of the Council . . . in lieu of a football, just as they were starting for a frolic."[92] In allusion to Benjamin Seaver's career as an auctioneer, Sargent charged that the president of the Common Council had "knocked down the property of his fellow-citizens . . . as summarily as if it were a cask or a bale of damaged merchandise under his professional hammer."[93] He expanded his attack to include Mayor John B. Bigelow, who was depicted as sitting in his chair of office "as upon a fence, utterly disabled from acting with a liberal and independent spirit by a miserable dread of doing the unpopular thing."[94]

After this display of bad temper on both sides, it is not surprising that the city government and the company found no basis for agreement. The private water works continued to supply some four hundred customers who preferred the familiar Jamaica Pond water to the new supply from Lake Cochituate. In January, 1851, however, the Cochituate

Water Board, a new agency entrusted with the administration of the municipal system, renewed negotiations with the company. On April 2, the Board decided to offer $45,000 for the property and franchise, and on April 30, the stockholders signified their acceptance of this proposal.[95]

Hostility to the Aqueduct Corporation still persisted in the City Council. On May 12, the Aldermen concurred in a resolution from the Common Council, instructing the Committee on Water to consider whether the Cochituate Water Board had the authority to make this purchase and whether the purchase was expedient.[96] The Board prepared a report justifying its course. Not only did it claim complete power to act, but it argued that the investment was an excellent one. Buying out the old company would increase the municipal water rents, remove the threat of future competition, and quiet all claims which the company might have for damages against the city.[97] The Committee on Water decided that the Cochituate Water Board possessed the authority to bind the city in the transaction, but rebuked the new agency for not consulting with the City Council on so important a matter of policy.[98]

Thus with the grumbling acquiescence of the City Council the transfer was completed, and the city came into possession of the property and rights of the old water company for $45,000. It was unquestionably a bargain. The immediate increase in water revenues amounted to seven per cent on the outlay. In addition, the city of Boston acquired a right vested by the Legislature in the old corporation to supply the city of Roxbury from Jamaica Pond.[99] This right Boston subsequently sold for $32,000 to a new Jamaica Pond Aqueduct Corporation, chartered in 1857.[100]

Thus did Boston's long controversy over the water problem terminate in a complete victory for the advocates of public control.

CHAPTER ELEVEN

From Private to Public Control in Baltimore

> The Baltimore Water Company has done what a private citizen would have done for himself under similar circumstances, managed its business with an eye single to the interest of the stockholders. It has doubtless dealt as fairly as any corporation in existence, yet public sentiment is not satisfied, nor should it be with its operations. If Baltimore was a "finished city," and was only to survive until its present tenements and warehouses shall have decayed and fallen, the present system of supplying it with water might be tolerated. But her destiny is one of greatness and strength, and those who are now charged with her legislative authority should, before it is too late, confer upon her that benefit which is of inestimable value.
>
> *Report of the Baltimore Water Commissioners,* 1853[1]

In several respects Baltimore's water history ran parallel to that of New York and Boston. In all three cities, private water companies operated for many years. In all of them, the growth of the population outran the facilities provided by private enterprise and resulted in a demand for a municipal system. And in all three, the principle of public control was eventually established. But Baltimore's water company maintained its monopoly for a longer period than those of New York and Boston. Moreover, when the transition to public control did finally take place, liberal compensation was paid to the stockholders of the old corporation. This was in striking contrast to the situation in New York, where the Manhattan Company received nothing when the city system was built, and to that in Boston, where the Aqueduct Corporation's compensation was little more than nominal.

The longer life and happier fate of the Baltimore Water Company may be regarded as a reward for virtue. Although the water supply that it provided was never adequate for the needs of the city, the Baltimore company invested more capital in its works and made greater efforts to extend its services than did its sister institutions in New York and Boston.

Some idea of the extent of the Baltimore Water Company works in 1825 is provided by the report of an engineer whom the new Frederick (Maryland) Water Company sent to Baltimore to gather useful information. The emissary reported that the Baltimore company was supplying 1,640 families with the number increasing daily, and that it was charging ordinary households $10 a year and tanneries, taverns, hatteries, distilleries, and other large users somewhat more. The Frederick Water Company officials were particularly interested to learn what kind of pipe had been found most satisfactory. On this point their engineer reported:

> That the water company of Baltimore in the first instance conducted the water through wooden pipes, but that it was soon ascertained that they were not capable of bearing the necessary pressure, nor durable owing to the beds of sand which every way encompassed them, and it being concluded on fair trial that they would not answer the purpose they were intended for, it was found to be the interest of the company to procure materials of greater strength so that the works might be made permanent. Iron was then procured, and used as the wooden pipes failed and found to be every way suited to the purpose, neither affecting the color nor the quality of the water, either for drinking or washing, nor were the company subject to expense for repairs or decay of the pipes, consequently in their opinions to be preferred to any other material.

Most of the iron pipe had been purchased in England; a little had come from Philadelphia.[2]

Baltimore guide books of the early 1830's contain additional information about the water company. J. H. Latrobe's *Picture of Baltimore,* published in 1832, described the water supply as being conducted from Jones Falls about one-quarter mile by canal to the company's works in Calvert Street, from where the water was pumped by water power into reservoirs of sufficient elevation to distribute it to the various parts of the city through pipes. Fire plugs were placed at convenient distances along the pavements, and most of the private dwellings of the city were furnished with "hydrants."[3] Varle's *Complete View of Baltimore,* published in 1833, added the information that the water system was being enlarged through the construction of a new reservoir at the corner of Calvert and Madison Streets, to be used to supply the lower part of the city.[4]

But many Baltimore citizens obtained their water from other sources. The city continued to dig wells and maintain public pumps. In addition to this familiar urban practice, the Mayor and City Council had adopted a policy of purchasing and securing to the city certain well-known springs. On March 22, 1808, the Council authorized Mayor Edward Johnson to purchase five lots of ground situated on Calvert Street containing several small springs of excellent reputation.[5] On May 4, the Mayor reported that he had been able to make the purchase at the price of $4,000, "being furnished by private subscription from a few individuals who have voluntarily aided me in carrying into effect the intentions of the Council, to secure a supply of pure and wholesome water for the general accommodation of our City, fully impressed with a belief that by so doing the salubrity will be increased."[6] At a cost of $27,000 this so-called City Spring was transformed into one of the show places of the community. John Davis, engineer of the Baltimore Water Company, designed a handsome structure with classical dome and Doric columns to house the water. The surrounding grounds, shaded with pleasant trees, were transformed into a park, where fashionable ladies and gentlemen delighted to stroll.[7]

The success of this venture led the city officials to follow a similar policy with other springs. On February 27, 1817, a Council committee reported that they had paid to this problem the attention that it deserved, "bearing in mind the utility of good and wholesome water, which contributes so largely to the health and comfort of its possessors, and which many parts of this City have not." Unless proper steps were taken to preserve the remaining springs, the rapidly growing population of the city might some day desire this water in vain. Accordingly, the committee recommended that the city acquire two privately owned springs known as Clopper's and Sterrett and Uhler's Springs.[8] In this way the Western Fountain at the intersection of South Charles and Camden Streets, and the Eastern Fountain near the junction of Pratt and Eden Streets had their origin. Following the precedent of City Spring, these new fountains were housed in classical style structures and surrounded with well-kept grounds. Another public fountain was soon added to supply the needs of the Centre Market.[9] Latrobe's guidebook of 1832 commented proudly:

> Among the peculiar ornaments of Baltimore, are its public fountains, in different parts of the city. The site of the town abounded in springs. Many of these have disappeared before the progress of improvement: others again have been carefully preserved, and contribute no small portion to the convenience, health and beauty of their respective districts. In addition to the artificial supply afforded by the water works, the springs in question furnish a sweet and abundant store, of a pleasant temperature, at all seasons of the year.[10]

Unfortunately, however, the public springs were exposed to the same contaminating forces that had spoiled so much of the well water of the city. As early as 1821 the Board of Health reported that there were twenty-three privies in the vicinity of Clopper's Spring (Western

Fountain) and seven near City Spring that required cleaning and repair.[11] In 1826, a health ordinance was enacted, requiring all privies within specified limits around the public springs to be built of brick and cement impervious to water.[12] But even with these safeguards fastidious citizens were suspicious of the springs. Centre Fountain was regarded as purer than the others, because its water originated on the hill to the north of the city known as Howard's Park and was conveyed to the spring house in iron pipes. Latrobe's *Picture of Baltimore* asserted:

> It certainly enjoys the best reputation of all the fountains; inasmuch as springing from the base of a hill, and in a neighborhood in which there are few buildings, it is considered of less equivocal origin, than is occasionally imputed to the other three; and inasmuch as the virtues of the filtering jar are not possessed by the soils of Baltimore,—at least in public estimation,—the centre fountain, which requires no purification by filtration, is the most esteemed by the water drinkers of this day.[13]

The city was growing rapidly. In the census of 1810, taken soon after the Baltimore Water Company works were built, the population was only 35,583. Twenty years later the number of inhabitants had more than doubled, reaching 80,625 in the census of 1830.[14] This created new water needs for the city officials to ponder. On October 22, 1827, the Mayor directed the attention of the City Council to "the increasing scarcity of water and the difficulties and consequent expense attending the deepening of wells and repair of pumps."[15] A few days later a joint committee of the two branches of the Council was appointed to consider this problem and report on "the best mode of supplying the city with good and wholesome water."[16] On January 2, 1828, this committee reported that the Baltimore Water Company was planning to extend its service into the western part of the city and that consequently no action on the part of the municipality was required.[17]

But at the next annual session of the City Council the problem came up again. Mayor Jacob Small described the difficulties that had been experienced in fighting fires in the northeastern section of the city. Either a better supply must be obtained from the Water Company or some other provision must be made. The possibility of boring deep wells was discussed.[18]

During the summer and fall of 1829 while the Council was in recess, a new water committee under the chairmanship of Philip Laurenson conducted an energetic investigation. It visited the Fairmount Water Works at Philadelphia and consulted with Frederick Graff. With the help of Captain Louis Brantz, a local engineer who served without compensation, the committee considered the advantages and disadvantages of each of the three sources that had been suggested on earlier occasions: the Patapsco, Gwynns Falls, and Jones Falls. Owners of mills and other water rights were requested to place a price upon their properties.[19]

Invited to state terms on which the city might acquire the existing water works, Thomas Parker, president of the Baltimore Water Company, replied that there was "a vast interest connected with the right to water in Jones Falls which it does not seem to have been contemplated the Directors should dispose of." Nevertheless, if an equitable value could be agreed upon, the company officers would join with those of the city in applying to the Legislature for power to make the transfer.[20] A committee memorandum shows that the Water Company eventually set a price of $400,000 on its water works and $610,000 on its entire property, which included a grist mill and considerable real estate. The works included some 13¾ miles of pipe; 30,530 feet of this was of iron, and 42,230 feet was of wood.[21]

The result of these inquiries was an extensive report presented to the City Council in January, 1830, the first major document in Baltimore water history. "No City in the United States," the committee asserted, "has been made more sensible of the deterioration of its wells and springs than Baltimore."[22] Nearly all the wells in the older and more populous parts of the city had lost their purity; the same fate was obviously in store for the wells in the newer parts of the city. Only one of the public springs had remained uncontaminated. As for the Baltimore Water Company, the Legislature had made a serious error when it had permitted a private association to obtain "the singular privilege of subjecting to, and making dependent on themselves a population of seventy or eighty thousand people, for the first and most essential necessary of life, *water*." And the committee added:

> Now what is the quality of the water for which the citizens of Baltimore are beholden to the Water Company. It is only necessary by way of answer to this question, to entreat those who receive it, to call to mind, whether during more than one half the past year, its colour and consistence were not such as to render it unfit to be used for any purpose, to say nothing of the number of days during which even that was entirely withheld from them? Moreover, to what proportion of our City is this compound afforded? It is distributed to the centre only. That extensive and rapidly improving part to the North West, can not obtain it; a great portion of that large and important section known by the name of Old Town, and the whole of Fells Point have not been, and cannot be supplied with it, because the works are well known to be inadequate to afford the supply to the latter, or to elevate it to the former.[23]

The committee did not blame the Water Company. It had been principally interested in making money, which after all was the object of

its incorporation. The trouble was with the whole principle of entrusting a vital service like the supply of water to a private corporation. How much wiser the policy of the city of Philadelphia had been!

The committee continued:

> It is then manifest from the foregoing facts that Baltimore is very far from being adequately supplied with pure and wholesome water for her present population, and that the means hitherto resorted to, to furnish that supply have proved inadequate. Now if little more than half of the present city and of the present population is but partially supplied, with this turbid element, which turbid as it generally is, those, who can get it, prefer to the contaminated though clear water of their wells, whence are the future hundreds of thousands, who will be added to the present population, to draw their supply? Are they to borrow it from their neighbours, who, even now, have not enough for themselves, or are they to resort to pumps, which we have found it necessary to abandon, and imbibe disease and putrid water together, or shall they be compelled to relinquish the design of multiplying our houses, our streets and our people, by the want of that, which we can now, at so little expense, place at their command, in any direction, to which it may please them to devote their labour and their enterprise? We trust that we need not enter into further argument, to prove the necessity of providing, if practicable, an ample supply of pure and wholesome water for the preservation of the health and for the promotion of the prosperity of the City.[24]

Of the three sources which the committee had considered, Gwynns Falls seemed the best. It was preferable to Jones Falls, because the water could be taken at a higher elevation and because the water rights could be acquired at less than half what it would cost to buy out the Baltimore Water Company and other valuable properties on Jones Falls. Gwynns Falls was also preferable to the Patapsco, because the water could be conducted by natural flow, whereas to obtain a supply from the latter river expensive pumping works would be required.[25] The committee therefore recommended the issuance of $300,000 in bonds for the immediate purchase of the mill rights on Gwynns Falls:

> We have but to dare and it is done. In aiming at a boon like this, timidity and caution are treason. Heaven is not to be obtained without violence, nor can the best gifts of Heaven, here below, be achieved without courage and perseverance.[26]

Although this proposal constituted a serious threat to the vested interests of the Baltimore Water Company, the Company's reaction was relatively mild. In a long memorial to the City Council, dated January 18, 1830, President Parker reviewed the history of the enterprise, pointing out that the Company had been founded at the invitation of the municipal authorities after the attempts of the city to build its own works had failed. He insisted that the policy of the Company had been "to promote the public convenience in preference to the private interest

of the Stockholders."[27] He then explained the Company's plans for building new reservoirs and expanding its service, promising that a supply would be available for the present population and any future population that the city was likely to contain. However, if the City Council wanted to bring the water supply under municipal control, the Company would transfer to the city its entire property "without asking one cent of profit, and to enable your body to judge the value of this offer, your Memorialists will, to any Committee of your body which may be appointed for that purpose, make a full exhibit of their means."[28] Parker concluded on a sentimental note:

> The proprietors of the Baltimore Water Company have a deep stake in the prosperity of the City of Baltimore, they possess within her limits all those affiliations which bind man to his fellow—they freely expended their money in her youth for her health and comfort, and now when she has approached the bone and marrow of maturity, they are willing to relinquish to the constituted authorities those reins which they have held for so many years with such unceasing solicitude. They are thus passive under the full conviction that the City can entertain no other feelings toward them than those of respect and good faith.[29]

The City Council responded by instructing the Water Committee to ascertain more specifically the terms on which the Water Company would transfer its rights to the city and also the price for which the municipality could obtain the necessary water rights on Gwynns Falls.[30] The Council journals show that the committee reported its findings on March 1, but no further action was taken during the 1830 session.[31]

The Baltimore Water Company managed to dull the edge of hostile criticism and prolong its life more than two decades by initiating steps to enlarge its system. On June 8, 1830, Talbot Jones, the new president, informed Mayor Small that the Company had acquired important water rights at a higher elevation above the city by purchasing the old Salisbury Mills. Now the Company intended "with all possible diligence to construct reservoirs sufficiently spacious to give at all times an abundant supply of pure water to the city." One reservoir was to be built to the west of the newly-acquired mills on ground sufficiently high to supply the most elevated parts of the city; a second was to be built on a level with the mill dam so as to supply the lower parts of the city from the natural flow of the stream.[32]

In 1832, Baltimore was frightened by the great cholera epidemic. On August 6, Mayor William Stewart addressed a letter to the president of the Water Company, requesting permission for the city authorities to use water from the fire plugs to cleanse the gutters. "We would desire to use them thrice a week and for about fifteen minutes each time. Your consent will greatly facilitate the extraordinary exertions that are now

and have been for some time in progress by our fellow Citizens to render our City as clean as it is possible for exertions to make it."[33] The Company granted this request, stipulating only that the water not be unnecessarily wasted, that the fire plugs be opened in different sections of the city on different days, and that, if possible, the gutter cleaning not be done on Saturdays.[34]

Cholera cost the city at least 853 lives in 1832,[35] and this grim experience served to revive concern over the water problem. The possibilities of municipal action were again canvassed in 1833, when a Water Committee of the City Council entered upon new negotiations with the Water Company.

In a letter dated February 21, 1833, to President Talbot Jones, William Gwynn Jones, the chairman of this new committee, explained his position on the issue. Eventually the city would have to undertake the supply of water. Whether it bought out the existing works, or built entirely new ones would depend upon the price which the Company asked for its property. There was much to be said for starting all over again on a more extensive scale, yet if the old works could be acquired on decidedly favorable terms the committee might decide to recommend this as a measure of justice to the Company. The committee was not entirely happy with the price of $500,000 which the Company had now fixed for its works. This seemed too high for a property on which the annual gross receipts totaled only $24,300–$21,500 in water rents and $2,800 in other income. Moreover, the Water Committee was displeased because the Company proposed to reserve its old mill and the lower reservoir from the transfer. Since these would be needed until the new reservoirs and pumping station were completed, the city would still be dependent upon the Water Company. In order to make the transaction fair to the city, the Committee requested that the Company include in its $500,000 price "the City Mill, the reservoir on Center Street, the race to the mill, and all the necessary apparatus to keep it in motion." The letter closed with a gentle warning. The decision was an important one for the Company, since it might one day have in the municipality a formidable competitor.[36]

In replying to the Water Committee, President Talbot Jones protested against the suggestion that the city might build new works in competition with the existing ones. Once again the city authorities were reminded that the Baltimore Water Company had been organized at the invitation of the municipality itself and that many benefits, including free water for extinguishing fires, had resulted to the community.

> It is now twenty-eight years since this Company was organized, and when they look back and see the many difficulties that they had to contend with in procuring suitable pipes and materials, the want of practical experience in erecting such works, and when they consider the great mistakes that were committed in this respect in other places, they deem themselves extremely fortunate that the money they expended had not been a total loss to the stockholders and that the plan originally adopted is still found to answer the purpose for which it was intended.[37]

Jones defended the fairness of the Company's terms and promised that the city would be permitted the free use of the old pumping station and reservoir until the new works were completed. During this period the Company wished to retain its mills and the surplus water power in order to obtain a little additional revenue—necessary from the Company's standpoint because the stated price of $500,000 would not fully repay the stockholders' investment. But Jones promised that the city would be the sole judge of the power needed to pump an adequate supply of water. When the new works were completed, moreover, the Company would surrender all its water rights to the city.

Although the city and the Water Company appeared close to agreement, the Water Committee finally decided against a purchase of the old works. "Believing that the City must at some time undertake the work of supplying our citizens with water and under the impression that no city in the union presents the same facilities as Baltimore for effecting that object," the Committee recommended that plans for building a new system should be formulated.[38]

The water agitation of 1833 eventually terminated like that of 1830 with the city authorities unable to decide either to purchase the old water works or to construct new ones.

Again the postponement of the great decision was followed by an epidemic of cholera. A brief visitation of this disease in November, 1834, resulted in 71 deaths.[39] After referring to this event in his annual message to the Council on January 5, 1835, Mayor Jesse Hunt commented:

> A plentiful supply of pure water is essential to the preservation of the health and cleanliness of our city—and it is also of the first importance in the extinguishment of fires. The want of an abundant supply of water has upon some occasions rendered the invaluable services of our Fire Companies less effectual than they would otherwise have been. To be effective, the supply of water should not only be pure and abundant, but under the entire control of the city authorities. If this object could be attained without adding to the city debt, I would recommend it to your favorable consideration,—but however desirable and important it may be that the city should possess this source of health and safety, I am admonished by the present large stock debt of the corporation not to recommend any expenditure, the necessary consequence of which would be an increase of the taxes

already burthensome to many of our citizens, and especially to the owners of real estate.[40]

Although the Mayor appeared to consider health and safety as luxuries too expensive for the city to indulge in, the City Council once again began to consider the water problem. On February 3, 1835, Columbus O'Donnell, now president of the Baltimore Water Company, offered to sell the Company water works to the city for $550,000. He justified the jump in price over that quoted in 1833 on the grounds that the Company had expended $50,000 during the intervening two years in laying additional pipe and working on the new reservoirs. There were now between seventeen and eighteen miles of distributing pipe, and more than half of this consisted of iron pipe of recent construction. The water rents had increased from $21,000 to $25,500 between 1833 and 1835. In other respects the Company's offer was identical with that of two years earlier.[41]

In reply to this proposal, Joshua Dryden, chairman of the Water Committee, warned O'Donnell that several members of the Council opposed purchase of the old works on any terms because so many of the mains were too small to conduct water "on the extensive scale contemplated by the city in their supply." To meet these objections and to resist the hostility of Council members who favored the building of entirely new works, Dryden requested that the Company reduce its price to $500,000.[42] President O'Donnell replied that he considered the Company's original terms "extremely moderate and much below the intrinsic value of the works." However, as the stockholders were anxious to accommodate the Council, they might be induced to accept Dryden's offer.[43] Further negotiations followed in an attempt to agree on just which of the Water Company's miscellaneous holdings of real estate and mill rights would be transferred to the city. Dryden pushed O'Donnell for further concessions, stating frankly that the committee would need "all the inducements" that it could produce to give it a hope of succeeding with a report recommending purchase of the old water works.[44]

On March 2, 1835, the Water Committee submitted a long report to the Council. Experience had shown, the Committee asserted, that great inconvenience had followed the decision of 1804 to entrust the task of supplying water to a private company:

> . . . it could not be expected that a private corporation would consult the public good when the benefit of the community could only be had by the sacrifice of corporate interests; it could not therefore be expected, that the company would extend their water pipes to parts of the city which offered no hopes for remuneration, and as the supply of water from pumps has from some cause sensibly diminished, such portions of the city are necessarily deprived, not only of a sufficient quantity of wholesome water for family purposes, but also of that equally necessary supply required for cleansing the city, and the extinguishment of fire.[45]

The Committee believed that nine-tenths of the citizens were of the opinion "that the important trust of supplying our large and constantly augmenting population with water ought never to have been committed to a private corporation."[46] But unfortunately, the mistake had been made, and now the question was what should be done to remedy the evil. The water report of 1830 had proposed the construction of entirely new works, but such a project would cost from one to one and a half million dollars—a sum that would unduly burden the city with its already embarrassed finances. To purchase the works of the Baltimore Water Company, however, would require no money. The city could compensate the stockholders with municipal bonds and then pay the interest on the bonds out of the proceeds of the water rents. The necessary expansion of the system would proceed much more rapidly under municipal ownership. Even though water rents were cut from $10 to $5 a house, aggregate water revenue could be greatly increased by imposing a tax on property owners who would enjoy increased fire protection and other benefits from the new hydrants.[47]

In accordance with this analysis of the situation, the Water Committee proposed resolutions under which the Council would declare that it was expedient for the municipality to purchase the water rights of the Baltimore Water Company and the Legislature would be requested to pass enabling legislation.[48]

As the Water Committee expected, its recommendation encountered strong opposition. On March 9, when the First Branch of the Council debated the proposal, one member proposed to substitute resolutions providing for a survey of the various water resources of the vicinity by some competent person—obviously a maneuver intended to promote the idea of an entirely new municipal system. Another member demanded a specific inventory of all the property of the Water Company; and still a third proposed that the whole issue should be submitted to the decision of the voters.[49] On March 20, the First Branch finally approved the Water Committee's recommendations by a vote of 17 to 4.[50]

But other obstacles to the transaction were soon encountered. A memorial from numerous citizens to the Mayor and City Council asserted that such a purchase would not serve the interests of "this great and growing community." The city had already suffered grievously from the Water Company. Baltimore's "unequalled firemen" had often been obliged "with folded arms to witness the devastating element levelling our noble edifices and the property of our fellow citizens to the ground" —mostly because of "the total inadequacy of the Reservoirs, Pipe, &c. of

the Baltimore Water Company." The hope that the problem would be solved by the completion of the new high-level reservoir was ill-founded. Already a large section of the northwestern section of the city was on ground as high as that on which the new reservoir was to be built. Moreover, it would take, according to the petitioners, nine-tenths of the water of Jones Falls to pump the remaining one-tenth into the reservoir. Pumps were liable to get out of order, leaving the city at the mercy of fire.

> New York, in preference to pumping the water of the Hudson into Artificial Reservoirs, is about introducing it through 47 miles of stone aqueduct, at the expense of 5,000,000, and such is the feelings of the People upon this subject, so essential do they conceive it to the well being of their great emporium, they look upon a discussion of the subject of the expense of the project degrading to the character of her People. We believe the present scheme of our Council will prove a sad experiment to Baltimore—that after an expenditure of a million and a half of dollars, the Patapsco or Gwynn's Falls must be resorted to.[51]

When the water question came before the Second Branch, the resolutions providing for municipal purchase of the Company works were voted down. A substitute resolution was passed which named the Mayor and the presidents of the two Branches as a water committee to act during the recess of the Council. This Committee was to have authority to employ a competent engineer for the purpose of ascertaining the capability of the different streams of water in the neighborhood of the city.[52] A brief deadlock between the two Branches ensued, but on April 8 the First Branch finally gave way and accepted the resolution authorizing a survey.[53]

To direct the new investigation John Randel, a local engineer, was appointed. He in turn employed two assistants, George De La Roache and Edward Staveley, to do the actual field work. On April 13, 1836, Randel sent a communication to the Council, explaining that the length and severity of the winter and other circumstances over which he had no control had so retarded the surveys that a final report would be impossible at this session of the Council.

The engineer left no doubt, however, of the direction in which his thought about the problem was moving. He considered that neither Jones Falls nor Gwynns Falls would be dependable sources during a dry season. The Patapsco would provide an adequate supply, but Randel's preference was for the Great Gunpowder Falls some ten miles to the north of the city. This would provide the most abundant supply and cause the least damage to proprietors of mill rights. Randel recommended the following plan for the consideration of the Water Committee:

> A dam is to be built across the valley of the Great Gunpowder Falls, near Tyson's (formerly Jessop's Mills), and another dam across the Western Run, near the York Turnpike Road. These dams are to be connected by an aqueduct, and this aqueduct is to be continued across the valley of the Beaver Dam, to the high ground or hill of the Limestone Rock, lying between a branch of Jones' Falls, south of Timonium and a branch of the Beaver Dam (a tributary to the Great Gunpowder Falls) near Mr. Cockey's, and south west of the residence of Judge Nesbit's. This hill or rock is to be cut down to such a depth as will permit the water to be carried by aqueduct from a point from 10 to 20 feet below the level of the top of this dam, on a descent of about one foot per mile, to and through that deep cut, and thence along the west slope of Jones' Falls Creek to an ample reservoir to be provided in the vicinity of the city of Baltimore.[54]

In order to safeguard this potential aqueduct route, Randel urged the Council to take immediate steps to induce the Baltimore and Susquehanna Railroad to move its projected route out of that part of the Gunpowder valley required for a reservoir.[55]

With this proposal, water politics at Baltimore began to take a form reminiscent of that which had developed in New York and Boston. In the two northern cities the more radical proponents of a municipal supply had demanded relatively distant sources, which promised to afford a large supply but involved major engineering projects, while conservatives opposed these with plans based on the use of nearer and smaller sources. In New York the conflict had been between the Croton faction and the Bronx faction; in Boston, between the Long Pond and the Spot Pond parties. In Baltimore the bolder citizens now began to demand the Great Gunpowder Falls for a supply, while the more cautious clung to the belief that the city could rely upon Jones Falls.

Although the lines of future conflict had thus been traced out as early as 1836, the actual battle was postponed for over fifteen years. A long report on the field work of De la Roache was presented to the municipal authorities on June 6, 1836,[56] but Randel's definitive surveys and estimates appear never to have been submitted. At all events, on March 22, 1837, the Council ordered the Water Committee to report, if practicable, what progress had been made toward the completion of the surveys.[57] Evidently dissatisfied with the results of this inquiry, the Council took the drastic step on April 12 of repealing outright the ordinance of 1835 under which the Randel survey had been authorized.[58] The idea of building independent water works was for the time being abandoned. The victory of the conservatives was probably aided by the Panic of 1837, which caused a reaction against expensive public works throughout the country.

With the City Council unable to decide what it wanted to do about the water problem, the life expectancy of the Baltimore Water Company appeared promising enough to justify major expansion. Over the course of the next fifteen years new reservoirs were built, and the old reservoirs, whose elevation was now too low to serve the city, were abandoned.

The so-called Chase Reservoir, located near the intersection of present-day Chase and North Charles Streets (where the Hotel Sheraton-Belvedere now stands), was completed in 1838. A second reservoir on this tract was subsequently added, and the two had a combined capacity of about 12,000,000 gallons. Along Jones Falls on lower ground to the east of the Chase Reservoirs stood the Salisbury Pump House, which contained two overshot water wheels and four double force pumps, by which the reservoirs were kept constantly supplied. The Pump House also contained a steam engine for use when the water in Jones Falls was too low to work the water wheels.

In 1846, the Company added to its system the Mount Royal Reservoir, constructed to the northeast of Jones Falls near the present site of the Pennsylvania Railroad Station. This reservoir with a capacity of 15,000,000 gallons was supplied by natural flow from a mill dam across Jones Falls some distance above. It served both as a distributing reservoir to supply certain eastern sections of the city, and as a storage reservoir from which water could be taken for the Chase Reservoirs in case of an emergency.[59]

In 1835, the Company had had a total of about 15 miles of pipe; by 1852, this had been extended to 47 miles. In 1835, the annual water rents were about $27,000; by 1852, they amounted to about $80,000. The Company had also acquired several mills, ice houses, dwellings, and other miscellaneous real estate on which it collected rents aggregating $8,700 a year.[60]

During these years of prosperity the Company charged from $6 to $10 a year, according to the frontage of the premises, for water for a private family. Boarding houses were charged from $10 to $50. There were extra charges of $3 a year for each bath room and water closet. Steam engines were charged $10 per horse power; hotels, factories, and other large users arranged special terms with the Company. The Baltimore and Ohio Railroad and the Gas Company each paid the Water Company $1,000 a year.[61]

Although the expansion of the water works quieted much of the criticism of the Water Company that had characterized the early 1830's, an undercurrent of dissatisfaction continued. For one thing, the Company naturally followed the policy of extending its service only so far as it could expect to make a profit on its investment. In 1840, for example,

Columbus O'Donnell, president of the Company, wrote a letter to the chairman of a Council committee, explaining why fire hydrants could not be provided in certain eastern parts of the city.

> The Water Company could not be expected to extend the pipes without some prospect of remuneration. If sufficient encouragement be given by the inhabitants in that part of the city to induce the Company to calculate on receiving an interest on the cost of extending the pipes, it will receive the most favourable consideration. It would be well to state that the part of the City referred to . . . is higher than the head of water in the Calvert Street Reservoir and would require a distinct and separate main from the Chase Reservoir, which would cost at least $20,000, and as the Water rents East of the Falls do not now pay six per cent on the cost of the pipes, I do not think it could be possible to obtain one per cent on the most of making the extension.[62]

In its dealings with the city the Water Company stood on the letter of its charter. It provided free water for the extinguishment of fires. For water to wash the streets and for other civic purposes the municipality was expected to pay. Disturbed by a bill from the Company in 1840, the City Council requested the City Counsellor to investigate the legal issues involved. The Counsellor reported that the company had "the right to claim from the City compensation for the privilege to use water furnished by them for any other purpose than in the case of fire, as fully as they have the right to claim from an individual under similar circumstances. . . ."[63]

More than anything else, it was the continued growth of the city that revived a demand for municipal water works. Between 1830 and 1850, Baltimore's population once more doubled, increasing from 80,625 to 169,064.[64] Even though the Water Company had greatly extended its service during the same period, the city was still inadequately supplied. Dr. James Wynne, reporting on public health to the newly-founded American Medical Association in 1849, asserted that pipes were laid in about one-half the populated parts of the city. Dr. Wynne continued:

> About five thousand houses are supplied with hydrants, and the use of the water is unlimited. The daily consumption in summer varies from five hundred thousand to one million gallons, but is considerably diminished in winter. For the prevention of fires, there are one hundred and fifty fire plugs, and a full head of water is kept on in all the mains, so that it can be obtained as soon as the hose is attached. The city provides no free hydrants for the poor.[65]

Dr. Wynne was complacent about the situation. He described the water of Jones Falls as pure and soft and reported that the Company was confident of its ability to supply "an entire city, twice as large as Baltimore, with an unlimited quantity of water."[66] But Dr. William Travis Howard, a later authority on the city's public health, concluded,

on the basis of Wynne's own data, that the community was very inadequately supplied. Dr. Howard estimated that "certainly not over one-third and probably not over one-fourth of the inhabitants" were served by the Water Company. The needs of the rest of the population were met by public and private wells, and by the public springs. All these water sources, including Jones Falls itself, were more and more threatened with contamination through the growth of the city and the building of new mills and factories.[67]

In 1849, Baltimore experienced another cholera scare. A serious epidemic broke out in the Alms House about July 1. During the next six weeks 155 of the 669 inmates of that institution contracted the disease, and 86 of them died. The municipal authorities took vigorous measures to combat the spread of the malady into the rest of the city. The streets were cleaned and sprinkled with lime, and nuisances were removed. Either because of this clean-up campaign or through good fortune, the epidemic was almost completely confined to the Alms House. Only three clearly-defined cases and a few doubtful ones occurred elsewhere in the city.[68] The episode, however, was sufficiently dramatic to focus attention on the general problem of public health and the particular subject of the water supply.

Two years later Dr. Thomas H. Buckler, one of the city's leading physicians, published a provocative pamphlet on the cholera problem. In line with the medical theories of the day, he asserted that the direct cause of the outbreak in the Alms House had been poisonous and deadly exhalations from a neglected cesspool, an overflowing privy, and putrefying dead animals on the premises.[69] But, in discussing measures through which the community might better protect itself against future epidemics, Buckler laid major emphasis on a pure and abundant water supply:

> It is very probable that much of the sickness which occurs in the city, during the Summer and Autumn months, may depend on the quality of the water, which is consumed by much the larger portion of the community. The use of impure water tends to depress the nervous system and acts as one of the strongest predisposing causes of disease.[70]

Jones Falls water during summer and autumn months was patently impure, in the doctor's judgment. Much of the water pumped into the reservoirs was composed of "mere surface washings which occur after rains, and not the water which had undergone the most perfect filtration, by having soaked through the earth and then issued into the numerous springs, which combined, form the ordinary limpid current of Jones' Falls."[71] Such water was unhealthy, for one reason, because it formed soluble salts of lead when it passed through lead pipes unless the latter had been previously treated with a solution of some sulphate like alum. The water was also contaminated by other causes.

> On both banks of the falls, within four miles of the city, are several factories and from two to three thousand inhabitants, to say nothing of pigs and horses, a large quantity of the waste matters from all of which are washed by heavy rains into the bed of this stream.[72]

Buckler suggested various expedients by which the Water Company might improve its supply by diverting water from Gwynns Falls or from the Great Gunpowder into the bed of Jones Falls and by building new storage reservoirs farther away from the city. Such measures, however, would be only makeshifts. What the city really needed was to abandon its use of Jones Falls and take its entire supply from the Gunpowder. Since this would be opposed to the interest of the Water Company and beyond its means, the project would have to be undertaken by the municipality.

> If the present Council will see that this project is carried out, they will do more for the cause of temperance, for the personal comfort, health, longevity and morals of their fellow citizens than can be accomplished by all other modes in half a century. With a well regulated Health Department and an abundant supply of pure water, Baltimore would be, without doubt, the healthiest city in the Union.[73]

Even before Dr. Buckler's pamphlet appeared, the City Council had begun to debate the water problem again. In April, 1850, the Second Branch had considered a proposed resolution directing the city surveyor to inquire into the practicability of bringing water into the city from either the Patapsco or the Gunpowder, and to ascertain how the rates charged by the municipal systems in Philadelphia, New York, and Boston compared with those of the Baltimore Water Company.[74] The Joint Committee on Water reported against the resolution on the grounds that most of this information had been ascertained in the Randel survey of 1835-1836.[75] Some of the estimates which had been made on that occasion could not be located in the city records, but Randel wrote a reassuring letter to the City Register:

> It affords me great pleasure . . . to inform the City Council through you that I can, from the original notes and maps now in my possession, together with passing over the ground to refresh my memory, again furnish them with those estimates, as well as with all other information, relating to supplying the City of Baltimore with water from each of those streams, and thus save the City the time and expense of a re-survey.[76]

This revival of interest in Randel's Gunpowder project was short lived, and no important action on the water problem was forthcoming until the City Council convened for its annual session in 1852. In that year the First Branch considered a proposed ordinance under which the

citizens would be asked to vote on the question: "Shall the City Councils at their next session, introduce into said city and furnish our citizens with a pure and wholesome supply of water, the said works not to be influenced or affected by any private company or corporation?"[77] A petition with 271 signatures requesting such a water referendum was submitted to the Council.[78] After several weeks of intermittent debate the Council finally decided unanimously upon a substitute ordinance, which received the mayor's signature on May 11, 1852. Whereas the city of Baltimore required a copious supply of pure water "at a moderate price for the purification of its streets, the health and comfort of its citizens, the protection of property from conflagration and the success of many industrial occupations," Joshua Vansant, Ross Winans, and four other prominent citizens were appointed commissioners to inquire into the existing method of supplying the city, and its expense as compared with that of other cities, the quantity and quality of this supply, the propriety and practicability of obtaining it from some other source, the expediency and economy of introducing a full supply at the expense of the city, the probable expense and the most feasible plan. The Commissioners were also directed to ascertain whether a supply from Jones Falls would be sufficient to supply a future population of 500,000, allowing 30 gallons a day for each inhabitant, and to enter into negotiations with the Baltimore Water Company to ascertain on what terms the latter would sell its works to the city.[79]

The Water Commissioners attacked their Herculean assignment with energy. Captain Thomas P. Chiffelle, the City Surveyor, and James Slade, a civil engineer, were appointed to make the numerous surveys and estimates that the Council had called for. Professor David Stewart and Dr. Riggin Buckler undertook the task of analyzing samples of water from various sources. The Commissioners themselves collected information about the water works of other cities and carried on negotiations with the Water Company.[80]

In a letter dated December 1, 1852, Columbus O'Donnell, president of the Company, detailed the improvements in the water works that had been made since 1835 when the system had been offered to the city for $500,000. The price had now gone up to $1,250,000. To purchase the works at this figure would be an excellent investment, O'Donnell argued. Already the Company had 8,000 customers and annual water rents of $80,000 as well as other revenues of $8,750 a year. A steady increase in revenues of at least $5,000 a year could be anticipated, which would soon yield "an immense revenue to the city."[81]

Even before the Water Commissioners had completed their work, the Maryland Legislature cleared the way for the city of Baltimore to take

over control of the water supply. By an act passed May 27, 1853, the Mayor and City Council were authorized to issue "Baltimore water stock" to an amount not exceeding $2,000,000, to contract for land and water rights and to take these by condemnation proceedings when necessary, and to purchase the property of any chartered company authorized to introduce water. Apparently anticipating that the supply would be taken from the Gunpowder, the statute specified the manner in which that stream might be dammed.[82]

On August 31, 1853, the Water Commissioners presented to the Council a voluminous document that included the offer of the Baltimore Water Company, the findings of the engineers and physicians, and majority and minority reports from the Commissioners themselves. Four different water sources—Jones Falls, Gwynns Falls, the Patapsco, and the Gunpowder—were compared as to capacity, purity, and availability. Thirteen different plans for using these sources, either alone or in various combinations, were suggested. Three of the plans were based upon delivering the water by natural flow; the other ten would require machinery for pumping.

The cheapest project was one for using Gwynns Falls by natural flow at a cost of $2,618,000, but this promised a daily supply of less than 14,000,000 gallons. The most ambitious plan was one combining a supply from the Patapsco and Jones Falls which would provide a daily supply of 65,000,000 gallons at a cost of $4,767,000. Intermediate between these extremes were the two plans which commanded the most attention—a plan for pumping water from the Gunpowder by water power that would cost an estimated $3,361,000 and provide a daily supply of 41,000,000 gallons and a plan for taking the water of Jones Falls on high ground to the north and conducting it to the city by natural flow that would cost $2,990,000 and provide a daily supply of 19,000,000 gallons.[83] The report by the physicians who had analyzed samples from the various sources was cautious, but tended toward a high rating for the water of the Gunpowder and a low one for that of Jones Falls with intermediate ratings for the other two streams.

The majority report, signed by five of the six Commissioners, refrained from endorsing any one plan, but argued strongly for building the water works on a scale large enough to provide for the future needs of the city. It pointed out that water consumption in New York and Boston was running far ahead of expectations. The experience of these cities proved that a daily supply of 30 gallons per inhabitant was inadequate; 60 gallons per inhabitant was none too much. The Commissioners estimated that in 1860 Baltimore would have 279,000 inhabitants and would require 16,740,000 gallons of water a day; in 1870 it would

have a population of 461,000 and a daily water need of 27,660,000 gallons.[84] The inference was clear that only the Gunpowder or the Patapsco would provide sufficient water for these future needs.

The Commissioners also left no doubt of their belief that the works of the Baltimore Water Company were hopelessly inadequate, since they provided a daily supply of only 2,500,000 gallons—less than 14 gallons per inhabitant. Moreover, Baltimore was provided with only 227 fire hydrants, as compared with New York's 1,859, Boston's 1,137, and Philadelphia's 1,015.[85]

The sixth Commissioner, Ross Winans, wrote a vigorous dissenting report. Winans, who was locally famous as an inventor of railroad equipment, argued that the comparative figures in the majority report were wrongly calculated. He contended that the true cost on the Gunpowder project would be $5,500,000 instead of the $3,361,000 estimated by the other Commissioners. If the city adopted the less ambitious Jones Falls project, its initial expense would be only $2,990,000, and by supplementing the system by adjacent sources and new reservoirs at a cost of only $924,000 the daily supply could be expanded to 28,000,000 gallons when this much was needed. Winans' argument that the Gunpowder project was unnecessarily ambitious was strengthened by the fact that he based his calculations on a daily supply of 30 gallons per inhabitant instead of the 60 gallons allowed by the other Commissioners.[86]

Both the majority and minority reports were referred to a special joint committee of the two branches of the City Council. In a long report, presented September 8, 1853, this group rejected Winans' arguments and gave its strong support to the recommendations of the other Commissioners. It was imperative, the joint committee asserted, that the supply should be adequate to meet the expanding needs of the city over the next twenty years. Captain M. C. Meigs, an army engineer, then engaged in building water works for the city of Washington, was quoted as saying that the water supply of a city could not be too large. Even when water was wasted, it served a useful purpose in running through the sewers and gutters and carrying off the filth of the city. No "bloated monopoly," Meigs had said, should be allowed to sell "the first necessary of life and health." Water should be "as free as air, and should always be supplied by the government."[87]

The report of the joint committee, like that of the Water Commissioners, came to no final conclusion, but the trend of its discussion strongly favored the Gunpowder project and was sharply critical of Jones Falls. The only specific step that the committee recommended was that the citizens should be asked to vote in the October election on the question: "Shall the City of Baltimore, through the next Council,

proceed to introduce a supply of pure water?" Thus the residents would be given an opportunity to take "the last and most glorious step . . . viz: a rescue from their most intolerable position with regard to this greatest necessity of life."[88]

In accordance with this recommendation the City Council ordered that a popular referendum on the water question should be held on October 11. "We all realize," commented the Baltimore *Sun*, "the importance and necessity of an abundant supply of water for the present and for the future generations; therefore, an affirmative vote upon this subject can scarcely be doubted."[89] The results of the referendum were indeed decisive. There were 9,727 ballots cast in favor of a municipal water supply and only 304 ballots in opposition.[90]

But the most vexatious question had not yet been answered. From what source should the supply be taken? Ross Winans continued to criticize Captain Chiffelle's estimates of the cost of using the Gunpowder. He proposed that the whole subject be submitted to the investigation of J. F. Baldwin, an eminent civil engineer who had served for many years as one of the Boston Water Commissioners. If Baldwin's findings did not prove Winans to be correct, the latter promised to pay the costs of the investigation.[91]

Unfortunately for their case, the advocates of the Gunpowder project had to concede that they had made mistakes in their report. Not only did they revise their figures, but they made major alterations in their plan for conveying the water. Captain Chiffelle now advocated a more direct line which would require a tunnel 3¼ miles long. Winans made the most of these confessions of error. In a strongly worded pamphlet he argued:

> . . . a new survey and estimate of the Gunpowder work is now unavoidable, before the City Council can determine between the relative advantages of the several streams, as there is now *no reliable* official report of any *plan* and *estimates* for the Gunpowder work. The Engineer and Commissioners, who made an official report upon it, having over their signatures made such acknowledgments of error in the plan, estimates, and other things, relating to the work, as to make it quite impossible for the City Council to use it at all, in determining upon the relative merits of the several streams; and as the City Council cannot recognize or adopt as a basis of action upon the *second* report of the Commissioners and Engineer, their official authority having expired before it was made, they are without reliable information on the subject of the Gunpowder work.[92]

Such criticisms shook the confidence of the community in the adequacy of the data gathered in 1853. On March 17, 1854, the City Council authorized a joint select committee to employ a competent engineer to make such further examinations, surveys, and estimates as

might be deemed expedient.[93] For this purpose the committee appointed Theophilus E. Sickels, an engineer who had worked on the Croton Aqueduct as a protégé of Myndert Van Schaick and had later been employed on the Cochituate Aqueduct and the Erie Canal.[94]

While Sickels and his corps were engaged in these new surveys, the long-discussed purchase of the Baltimore Water Company works was finally consummated. Between December, 1852, when the Company had offered to sell its property for $1,250,000, and February, 1854, when negotiations were renewed, a substantial investment had been made in new pipes and annual water rents had increased by over $9,000. Accordingly the Company raised its price to $1,350,000.[95] The Joint Standing Committee on Water, reporting to the Council on June 14, 1854, recommended acceptance of these terms. For the city to ignore the Company and build its own competing water works would be impracticable since it would involve the laying of pipes through the streets and alleys below the pipes already laid by the Water Company and the Gas Company. Hopeless confusion and endless litigation would result.[96]

In keeping with this report, the Council passed an ordinance signed by Mayor J. Smith Hollins on July 29, 1854, authorizing the Commissioners of Finance to issue $1,350,000 in Baltimore Water Stock, bearing interest at six per cent and redeemable at the pleasure of the city on and after May 1, 1875, to be delivered to the Baltimore Water Company on condition that the Company deed all its property to the city.[97]

On September 21, 1854, the report of the Sickels survey was laid before the Council. Sickels agreed with the Commissioners of 1853 in urging that the city make its plans on a large scale. He calculated that the community would need 13,000,000 gallons a day immediately and 41,000,000 gallons by 1880. Since his gaugings indicated that Jones Falls was wholly inadequate, he did not even present a plan for its use. Instead, he confined his considerations to the Patapsco and the Gunpowder. From the former, Sickels believed that a supply of 16,000,000 gallons a day could be taken by water-power pumps at a cost of $2,393,700. From the Gunpowder a supply of 16,000,000 gallons could be obtained by pumping at a cost of $1,914,139, or a supply of 70,000,000 gallons by natural flow for $1,958,850. The last of these plans was the boldest and most original of Sickels' suggestions, since it proposed to conduct the water for 6¾ miles through "an air-line tunnel," cut through rock from 50 to 270 feet below the surface of the ground.[98]

In its haste to settle the water question before the adjournment of the annual session, the Council did not stop for long deliberation. On September 29, 1854, a resolution was passed adopting the Sickels air-line tunnel plan and providing for the establishment of a board of ten water

commissioners to be elected by the two branches of the City Council sitting in convention.[99] Mayor Hollins refused to sign this ordinance, and it never became operative. The Mayor based his action both upon a belief that Sickels had underestimated the costs, and upon disapproval of the provisions for organizing the water department.[100]

In October a new Mayor and City Council were chosen in an election that resulted in a victory for the Native American or "Know Nothing" Party over the usually dominant Democrats.[101] Mayor Samuel Hinks, now the executive, promptly called the Council into extra session to unravel the snarled water situation. Either the bill that the previous Mayor had rejected must be repassed, or a new measure must be framed. Hinks strongly recommended the latter course of action. Instead of the unwieldly board of water commissioners provided by the last Council, he recommended a small salaried commission, to be appointed as other municipal officers were: that is, by the Mayor with the consent of the two branches of the Council. On the question of a source of supply, the new Mayor took his stand with the conservatives:

> After careful investigation, and due reflection, I give it as my deliberate opinion, that if all the water from Jones' Falls be properly applied, and the city has an indubitable right to use it all, we shall have an abundant supply for all purposes, and in every quarter, for the ensuing ten or twenty years.[102]

The Council gave its first consideration to the problem of organizing the water department, a matter of urgency since the actual transfer of the Baltimore Water Company works to the city could not be consummated until an agency had been created to administer them. Obviously jealous of surrendering patronage to the Mayor, a number of the councilmen made a determined fight to have the water commissioners elected either by the Council itself or by the voters. But in the end the Mayor had his way. By an ordinance approved December 29, 1854, the administration of the municipal water works was vested in a board of three commissioners, to be appointed by the Mayor with the consent of the Council "without regard to party or personal favor, and on account of their qualification and reputation only." The president of the board was to receive an annual salary of $1,500; the two assistant commissioners were to receive $1,200 each.[103]

On the question of where and how an adequate supply for the city was to be obtained, the community was still sharply divided. In addition to the Gunpowder and Jones Falls factions, there was a third group loudly proclaiming the advantages of the Patapsco. One proposal for using this last source had been presented to the Council in April, 1854, when the Elkridge Manufacturing and Milling Company on the lower Patapsco had offered for an annual rent to pump 40,000,000 gallons of

water daily into suitable reservoirs, the city to make the distribution and derive the whole revenue.[104]

A second plan was offered by George Y. Worthington, who was engaged in the milling business and had important water rights to sell. Worthington suggested taking the water from the Patapsco at the Union Dam much higher up the stream. In this way very little pumping would be required. He argued that the Sickels plan for using the Gunpowder would cost almost five and a half million dollars, while his own would require only a little more than two million.[105]

Still another proposal was contained in a pamphlet prepared by Alfred Duvall, a local engineer. He favored the Gunpowder for the ultimate source; indeed, he claimed credit for having first suggested the air-line tunnel. However, he urged certain modifications in the Sickels plan and also proposed that the immediate needs of the city should be met by taking a supply from Herring Run. Since this stream lay along the route to the Gunpowder, the works that were built at this time could be incorporated later in the larger system.[106]

All these suggestions were referred to the Joint Standing Committee on Water, which began an intensive re-examination of the whole problem in January, 1855. Numerous hearings were held, in which engineers, physicians, and other leading citizens testified.[107] Columbus O'Donnell, the former president of the Water Company, recommended a continued reliance on Jones Falls, which contained enough water, properly applied, to supply a population three times as large as Baltimore's. James Slade, one of the engineers employed in the surveys of 1853, also favored Jones Falls. George Y. Worthington presented his Patapsco plan, and Alfred Duvall again urged Herring Run for a temporary source and the Gunpowder for a permanent supply. Most of the other testimony favored the Gunpowder. Sickels defended his estimates of the cost, and Dr. Buckler, the author of the cholera pamphlet, gave his opinion that, despite the large expenditure which would be required, the Gunpowder project would be the best answer to the city's needs. Captain Meigs, the engineer of the Washington Water Works, urged his favorite doctrine, that cities should make their plans on a scale adequate to meet the needs of future decades:

> An aqueduct well constructed is the most durable of the works of man. Aqueducts built before the Christian era still continue to supply the city of Rome with water.[108]

The Committee also solicited by mail the opinion of water works officials in New York, Philadelphia, and Boston. From every direction the advice was the same: that Baltimore should draw its supply from the largest available source.

The Water Committee made its report on September 3, 1855. To provide an adequate supply from Jones Falls would require a large storage reservoir, and the Committee believed that recent experience in Boston and Albany had proved that water stored in artificial lakes tended to deteriorate in taste and odor. Only the Patapsco and the Gunpower contained enough water to supply the city from their daily flow. Of these the Gunpowder was the more dependable in time of drought. The Committee recommended a modification of Sickels' plan for using the latter stream. The dam would be built farther up stream at Opossum Hollow. This would make a lower and less expensive dam possible, but the length of the air-line tunnel would be extended to almost eight miles. Although the project would cost an estimated $4,427,155, the Committee argued that it would be a good investment. In addition to water rents which would probably amount to $250,000 a year, the city could derive an excellent revenue by selling surplus water as a source of power to run industrial motors.[109]

These recommendations were at once subjected to blistering attack. An anonymous pamphlet asserted:

> The citizens of Baltimore are indignant at this wild project, that is started in a new shape suddenly upon them, to cost by their own showing, Four and a half Million Dollars, but which most every one believes would be doubled. Did your constituents give you a carte blanch in electing you to the City Council to oppress *them* with taxation? Resolutions . . . of meetings of influential citizens of the 15th and 16th Wards are accessible to us all, and should admonish us of the general public indignation at the recommendation by the Committee of the "Gunpowder Plot."[110]

In proposing an eight-mile long tunnel the Committee had "run *stark mad.*"[111] Proponents of the "Gunpowder Plot" were accused of having offered to trade appointments to the board of water commissioners for votes in support of their scheme.

The conservatives continued to insist that the city could satisfy its requirements by a better use of Jones Falls. Soon after the Water Committee recommended the Gunpowder, the opposing faction countered with a new plan of its own. In a report dated September 4, 1855, Gilbert H. Bryson, a civil engineer, estimated that by building a dam across Jones Falls near the site of the Woodberry Factory mill dam, a reservoir with a capacity of 55,000,000 gallons could be created. The water would be at a level of 168 feet above sea level—high enough to supply most of the city by natural flow. Two lower reservoirs would be built in the valley of Stony Run. The whole cost of this enlargement of the existing water works was estimated at only $730,368.[112]

Mayor Hinks was strongly opposed to the Gunpowder project. In his annual message to the Council of January 21, 1856, he asserted:

> By actual measurement, it has been shown that at present, we are consuming but about 3,000,000 of gallons of water per day. It is ascertained, from reliable sources, that at least one-half of our citizens are using the hydrant water and are fully supplied; therefore, if this be true, (and I challenge refutation) then to supply the whole city with pure and wholesome water, we need provide but from six to seven millions of gallons per day of twenty-four hours. We have certainly eighteen to twenty millions of gallons in that stream; a sufficiency to supply three times the number of inhabitants we have at this time. Where then is the necessity of looking further? Who will say when the number of our citizens will be trebled, whether in twenty, thirty, or fifty years? I am inclined to believe that the youngest male child of the present day would be an old man, before the city of Baltimore will number 600,000 souls, hence the utter folly of incurring *now*, for our posterity, such a debt as recent projects would entail.[113]

The Mayor finally had his way. On June 30, a Joint Special Committee on Water reported to the Council a plan which it optimistically described as uniting "all the advantages possessed by each of the several schemes presented to their consideration, and at the same time, by its simplicity and comparatively economical cost, will furnish an abundant supply of water by natural flow, and that too without the imposition of any additional burden to tax the energies and industry of our community."[114] The Committee's plan was substantially that suggested by Gilbert Bryson but with an additional reservoir on Stony Run at an elevation of 230 feet—high enough to supply locations in the city that had not been provided for in Bryden's scheme. The cost of the proposed new works was estimated at $793,776.[115]

The decision to base the enlarged system on Jones Falls and Stony Run was made official on July 17, 1856, when Mayor Hinks signed an ordinance authorizing the Water Board to carry into effect the plan recommended by the Joint Special Committee. The Board was empowered to make contracts for building the new works to an aggregate amount not exceeding $800,000.[116]

As carried into effect, the plans for the new water works were considerably modified. In February, 1857, the Council decided to abandon the proposed reservoirs along Stony Run, even though the city had been acquiring water rights in that region. This evidence of fickleness in the Council's decisions was seized upon by Mayor Thomas Swann as evidence that primary responsibility for water policy ought to be vested in some other body. Swann, masterful president of the Baltimore and Ohio Railroad, had been elected Mayor on the Know Nothing ticket in a tumultuous contest in October, 1856.[117]

The following February the new Mayor sent a message to the Council pointing out that except for the interposition of his predecessors the Council would have involved the city in expenditures for water works

that might have run as high as $10,000,000. Moreover, through weakness of administration none of the benefits that were hoped for in taking over the works of the Baltimore Water Company had yet been achieved. The salaries provided for the present Water Commissioners were too small to attract men of large ideas. What was needed, according to Mayor Swann, was to create a new board of seven directors "to be selected from the most prominent citizens in the community, whose

standing may at once inspire confidence in any line of policy they may recommend, and whose skill and science would enable them to act for the best interests of the city." The Mayor was confident that men could be found who would "cheerfully lend their aid without compensation."[118]

Although many politicians naturally opposed a measure that threatened to reduce the powers of the Council, Swann was successful in getting an ordinance substantially in line with his wishes. This provided that the Mayor should appoint, with the consent of both branches of the Council, a board of six commissioners who, with the Mayor, should be styled the Water Board of the City of Baltimore. The Board should meet under the chairmanship of the Mayor once a month or more often if required. It should decide upon all plans, both in regard to the general policy and management of the existing system and to the procurement of an increased supply from Jones Falls, but all of these plans should be submitted to the Council for approval. The Board should appoint a water engineer to serve a term of two years, but removable at pleasure, at a salary of $1,800 a year.[119]

One of the first results of the reorganization of the water department was the abandonment of the Bryden plan for using Jones Falls in favor of a different scheme for using the same stream. A project originally suggested by James Slade in 1853 was now brought up to date at the request of Mayor Swann. The Slade plan involved damming Jones Falls near the Relay Station on the Northern Central Railroad at a higher elevation than Bryson had proposed. Slade had originally suggested reservoirs along Stony Run, but the Council's precipitate action in abandoning that property made it necessary to locate the reservoirs farther to the west.[120]

The Council approved these latest plans in June, 1857,[121] and the construction of the enlarged water works began at long last. James Slade served as engineer of the project until 1859, when he was replaced by Charles P. Manning.[122] The new dam at the Relay Station impounded the water of Jones Falls in a reservoir called Lake Roland, with an elevation of 220 feet above mean tide and an available capacity of 400,000,000 gallons. From Lake Roland the water was conducted four miles through a tunnel to two reservoirs, the Hampden Reservoir with a storage capacity of 50,000,000 gallons, and the new Mount Royal Reservoir with a capacity of 30,000,000 gallons.[123]

Meanwhile, the city was vigorously extending the distributing system. In 1854, when the municipality had acquired the Baltimore Water Company works, the length of pipes laid through the city streets had been estimated at 50 miles; by 1860 it had been extended to 127 miles.

During the same period the number of water takers had grown from 8,750 to 16,300.[124] The total cost of the enlargement through 1862, when the new reservoirs were put into use, was $3,526,177,[125] but additional expenses for new reservoirs were soon necessary.

At first the conservatives who had argued for the adequacy of Jones Falls appeared to be vindicated. The city's daily consumption did not exceed 8,000,000 gallons, and the daily flow of that stream provided more than 20,000,000 gallons. But the citizens who had contended for a larger source had the last word.

In 1874, twelve years after the new reservoirs were put into use, Dr. Thomas H. Buckler, author of the famous cholera pamphlet of 1851, wrote another stinging commentary entitled *Past Follies and Present Needs*. "The introduction of Jones' Falls," according to the physician, had served "not to water the City, but to whitewash the Know Nothing party."[126] Instead of costing $1,500,000 as Slade had estimated, it had resulted in the squandering of nearly $7,000,000. During a recent summer the water works had been "almost as dry as a powder-horn."[127] If a serious fire had taken place, the city would have been destroyed. Not only was the Jones Falls supply inadequate, it was impure:

> The ordinary limpid current of the Falls, derived from Green Spring and other natural fountains in the Cave's Valley, gives such an inadequate supply, that unclean water, like that from a dirty roof, but still insufficient in the summer time to fill the reservoirs, is furnished from manured and impure water-sheds, and the organic matters thus derived, undergoing decomposition, breed myriads of vegetable and animal germs, or infusoria, which drying, and in their turn decomposing, give rise to the putrescent odor and tastes so noticeable in hydrant water during the first weeks of the heated term. Baltimore will never be adequately and properly watered, until Jones Falls is abandoned entirely, and the whole supply drawn from the Gunpowder River, as should have been done originally.[128]

Even while Buckler wrote these words, the city was building works to draw an emergency supply from the Gunpowder, and after 1881 this stream became the main reliance of the water system.[129]

Apparently, the victory of Mayors Hinks and Swann over the Gunpowder faction had been a victory for false, rather than true, economy.

CHAPTER TWELVE

Pure Water and Public Health

> Pure water . . . is the best drink for persons of all ages and temperaments. By its fluidity and mildness it promotes a free and equable circulation of the blood and humours through all the vessels of the body, upon which the due performance of every animal function depends; and hence water-drinkers are not only the most active and nimble, but also the most chearful and springtly of all people. . . . But to delicate or cold constitutions, and to persons unaccustomed to it, water without wine is a very improper drink.
>
> *Philadelphia Monthly Magazine* (1798) [1]

It was not enough that the cities should provide themselves with an abundant quantity of water. It was even more important that the water should be kept pure. Unless adequate safeguards were taken, the germs of disease might be carried into every house of the city. Water from a polluted source supplied to the entire population was obviously much more dangerous to public health than a contaminated well or spring serving a single neighborhood.

The need for protecting the purity of the water had been in some degree recognized from the beginning. When he wrote his famous will in 1789, Benjamin Franklin had stressed the danger that as the cities grew, the well water would "gradually grow worse" and in time be "unfit to drink." In each of the municipalities where Council committees and engineers had been appointed to study the water problem, the instructions had always been that provision should be made for an abundant supply of *pure* water. But just what made water pure or impure and just *how* contaminated water might cause disease were difficult questions. Not until the end of the nineteenth century did the science of bacteriology provide really satisfactory answers. But before this time, practical men dealing with the problem of municipal water supply had been moving—largely by intuition—in the right direction.

Of course the earliest tests to be applied were those of taste and smell. By these primitive standards--even today not irrelevant—New York well water was already notoriously bad in the eighteenth century, and Philadelphia's was becoming so. To these elementary ways

of judging purity, amateur scientists soon added a few simple experiments. In 1798, Dr. Joseph Browne of New York asserted that the only two tests necessary to ascertain what was good water were to boil leguminous vegetables in it and to mix it with soap; "for water that contains any of the faults with an earthy base, such as nitrate of lime and magnesia, muriate of lime and magnesia, sulphate of lime, or carbonate of lime and magnesia will not do well for either of the above purposes." In summary, he declared, water "that is clear and from a running source, that boils leguminous vegetables tender, in which soap readily dissolves, and has no bad flavour, may be pronounced good water."[2]

French scientists, meanwhile, were attempting somewhat more sophisticated experiments. A study of Boston well water, made about 1789, by J. Feron, a French surgeon, was thus reported:

> Pump water is more or less charged with heterogeneous parts in proportion to its proximity to the ocean. That in low situations is less pure than the water in more elevated grounds; it generally contains the same principles, except such as have a superabundance of calcarious earth. Among such as he examined, the water of Beacon hill, Charter-street, and some in New Boston, appeared most free from impurities. The weight was generally from fifteen to forty grains above that of distilled water. . . . These waters have a brackish taste to strangers, and the inhabitants themselves are sensible of it on drinking the purer element, which seems soft and insipid; they are hard, and do not dissolve soap. From various experiments he concluded the water of Boston contains a sea salt with a basis of mineral alkali in small quantity, a greater quantity of sea salt with an earthy basis, a certain quantity of oil, perhaps a little of *sal catharticus amarus*. There are besides some which contain farther a superabundance of earth, suspended by means of an undue proportion of air.[3]

By the 1830's chemistry had sufficiently advanced for scientists to venture quantitative analyses of water samples. In 1831, for example, George Chilton reported that a pint of water from a New York well yielded 10 grains of solid matter, which he identified as follows:[4]

Muriate of Magnesia	3.50
Muriate of Sodium	4.
Sulphate of Lime	.25
Carbonate of Lime and Magnesia	1.25
Carbonate of Potassium and Extractive	.75
Loss	.25
	10.

What did such an analysis mean in terms of health? The doctors of the day were not sure. Hard water like this was obviously bad for washing clothes. But was it also bad for the human system? The members

of the New York Lyceum of Natural History struggled with this problem in their report to the New York City Council in 1831. Attributing the high mineral content of New York well water to contamination from graveyards and privies, these men of science added the not very comforting suggestion that it was only the absorption of large quantities of urine that prevented the water from being even worse.

> This liquid, when *stale or putrid,* has the remarkable property of precipitating the earthy salts from their solution, or in other words, it makes hard waters soft. Although the fastidious may revolt from the use of water thus sweetened to our palate, it is perhaps fortunate that this mixture is daily taking place, for otherwise the water of this city would become, in a much shorter space of time than it actually does, utterly unfit for domestic purposes.[5]

The Lyceum committee observed that many New Yorkers had become so accustomed to the local water that they found pure spring water unappetizing. "The popular expression . . . is, 'This water is like wind—there is nothing substantial in it, nothing to bite upon.' " The committee attributed the prevalent dyspepsia and the often fatal bowel complaints of children to the daily use of excessively hard water.[6]

During a debate in the New York City Council, Dr. Peter Townsend charged that the large amount of lime in New York well water, which he dramatized by emptying out a thickly incrusted teakettle, caused stone in the bladder. But the idea was immediately challenged by Assistant Fyler Dibblee who asserted that this ailment was less common in New York than in many other cities. Challenging the whole theory on which the Lyceum had based its case, Dibblee declared:

> The criterion which these gentlemen have laid down, by which to judge of the fitness or unfitness of water for drinking, viz. whether it be soft, or whether it be hard, is proven to me by experience, to be fallacious, and therefore, with me, goes for but little.[7]

This skepticism concerning the unhealthfulness of hard water was in a sense justified. Hard water is not today regarded as of itself dangerous to health. However, the high mineral content of the New York well waters may have indicated contamination of a different kind. A modern expert has written: "Where the normal chloride content of the water is known, the determination of chlorides is of value in judging the sanitary quality of water. Since chlorine is a constituent of urine, the occurrence of chlorides in excess of the usual or normal content of a water may be considered to be an indication of contamination by sewage."[8] In line with this, the United States Public Health Service requires that drinking water provided by interstate carriers must contain no more than 250 parts per million of chlorides and no more than 1,000 parts per million of total solids.[9]

By these standards New York well water was clearly open to suspicion. An analysis by George Chilton of the water being supplied by the Manhattan Company in 1831 revealed that it contained 125.8 grains of solid matter per gallon, composed as follows:[10]

Muriate of Soda	45.2
Muriate of Magnesia	40.
Sulphate of Magnesia	6.
Carbonate of Lime with a little Carb. of Magnesia	12.8
Sulphate of Lime	4.
Extractive matter with combined water	17.8
	125.8

If this analysis was accurate, the water was very poor by present standards. When grains per gallons are converted to parts per million, it appears that the Manhattan water had about 770 parts per million of muriate of soda (sodium chloride) and 680 parts per million of muriate of magnesia (magnesium chloride). Some of this high chloride content is to be explained by New York's proximity to the sea, but nevertheless there is a strong probability—just as the Lyceum of Natural History suspected—that this water had been contaminated by sewage. Likewise unsatisfactory by modern standards was the total solid content of the Manhattan water—about 2,137 parts per million, or over twice that permitted under today's United States Public Health Service standard.

In Boston discussion of the purity of the well water followed a similar course. The water was obviously very hard, but doctors disagreed on whether it was injurious to health. In 1834, Mayor Lyman solicited the opinion of local physicians and received a variety of opinions. Dr. Warren blamed the local well water for disorders of the stomach and digestive organs, and added: "As many fevers are generated by derangements beginning in the digestive organs, I have been led to believe that this impure water is not an unfrequent cause of fever. . . ."[11] Dr. Shurtleff thought that the well water predisposed Bostonians to "calculous" and "bilious" disorders. Dr. Hayward made the shrewd observation that none of the salts or minerals which had been detected by analysis were of themselves injurious to health, but that danger might arise out of certain "foreign bodies" that were mixed with the water. Dr. Randall agreed that the minerals in the local water were probably harmless to the regular inhabitants of the city, but that newcomers were likely to suffer digestive upsets.

> In addition to the above, it is probably true that there are at all times in our City many individuals, who either from a peculiarity of habit, or

from a peculiar condition of the digestive organs, experience much inconvenience from our saline water and who would be much benefited by one of a purer nature.[12]

In the course of the legislative hearings of 1845, opponents of public water works found opportunity to ridicule the contention that the health of the inhabitants was being endangered by the well water. E. H. Derby asserted:

> The impurities in the water now used in the city were only a little lime and a little salt. Were these very injurious? Could the human body live without salt? and lime might be really beneficial. The chemists told us that the bones of the body were made up of phosphate of lime, and if we got a little with our water, it could not be very deleterious. He understood that no case of the disease of stone or gravel, which was that supposed to arise from these mineral substances in water, had originated here for a series of years.[13]

The great Boston water debate took an interesting turn when the disputants began to argue about the significance of minute organisms in the water. Some of these were visible to the naked eye; others could be detected only under the microscope. These "animalcules," as they were called, were alleged to abound in Long Pond. One of the Spot Pond faction undertook to warn his fellow-citizens against water "in which fishes are poisoned by the impurity—in whose current, as it flows to the sea, men's wounds fester when it touches them—and whose animalculi, now obvious to the naked eye, expanding, as they advance to the city, in a sluggish current, falling three inches to the mile, must be nearly ready, on their arrival, to swell into gallinippers or dragon flies."[14]

John H. Wilkins used the animalcule argument to urge that Boston draw its water supply from the Charles River. "*Animalcules,*" he asserted, "are *much less likely to be found in running, or river water, than in pond water;* and when found, *are less numerous and less formidable* (if I may use the word) *in the former than in the latter.*" He explained that he was speaking only of the creatures that were visible to the naked eye "for it is to such only that any one can attach much importance."[15]

Nathan Hale protested that there were as many animalcules in the water of the Charles River as in that of Long Pond. He advised Bostonians to close their eyes to these organisms unless they became too conspicuous.

> It is . . . quite useless to expect to obtain water from a source which will be free from these repulsive living beings. The only remedy against them is, to avoid too curious a search by microscopic eyes, and in case they appear, as they will occasionally, of a size to be discernible by the naked eye, to adopt such methods as shall be found practicable, of removing them.[16]

Some of the experts of the day expressed the opinion that the presence of animalcules in the water was evidence of the water's purity, since these delicate creatures could not be expected to live in water that contained poisonous substances. But this contention was subjected to heavy ridicule by the anti-Long Pond faction. In a cartoon broadside of the day, a drop of water magnified by microscope was depicted as teeming with ferocious animalcules. A spectator was represented as inquiring: "Why do you prefer Long Pond, doctor?" To which the physician replied: "Because with this water we can appease both thirst and hunger, whereas water from other sources is but little more than mere drink. It is obvious therefore that to the poor this water would prove a great blessing."[17]

To appease public anxiety about animalcules, John B. Jervis and Walter Johnson, the Commissioners of 1845, sought the opinion of Professors Benjamin Silliman, Jr., of Yale and J. W. Bailey of West Point. These experts reported that "infusorial insects" were to be found in all waters, including those of the Charles River, the Schuylkill, and the Croton,—indeed, "in this last mentioned celebrated excellent and beautiful river water more animalcules were found than in any other sample."[18] Fortified by this report, Jervis and Johnson went on to declare:

> We hence regard all sensitiveness on this subject as misapplied, and all attempts to discredit a water, merely from the fact of it containing a few animalcules, as wholly unreasonable and unjust. Lakes and rivers alike contain them; reservoirs and wells will frequently produce them; and in summer, few water sources are without these delicate tenants, unless impregnated with the juices of stagnant marshes, or poisoned by mineral compounds noxious to their frail and perishable natures. It is not intended to assert that a source *may not,* from its shallowness, stagnancy, high temperature, and other causes become offensive on account of its excessive productiveness of animalcules. But none of the samples of water which we obtained from the points where it has been proposed to take out conduits or aqueducts for the city, had any thing objectionable in this respect. Of the samples from the three principal sources . . . Long Pond had the fewest animalcules; Spot Pond had more, and Charles River the greatest number.[19]

Relieved of their fear of the animalcules, the Bostonians next began to worry over the danger of lead poisoning. The customary usage of the day was to distribute water through the streets in iron mains, but to employ lead pipe—highly malleable and easily jointed—to convey water into the houses. Lead pipe had been thus used in the water systems of ancient Rome and of modern London, Philadelphia, and New York. Yet, for centuries some authorities had been of the opinion that the practice was dangerous. Vitruvius had warned against it in the first

century before Christ; English and American physicians had sounded the alarm again in the nineteenth century.

The evidence on the subject was curiously mixed. Many indubitable cases of lead poisoning had been traced to the use of lead pipe, particularly with well water. On the other hand, lead service pipes had been used for years in many cities without any apparent bad results.[20] It seemed clear that in some water lead would dissolve in dangerous quantities, and that in other water it would not. Which kind was contained in Lake Cochituate? This was the question that Bostonians were anxiously asking themselves in the fall of 1847, as the aqueduct approached completion.

To settle the issue, the Boston City Council commissioned Professor E. N. Horsford of Harvard to make exhaustive tests. The purpose was to discover whether Lake Cochituate water was any *more* liable to dissolve lead than the water supplied to Philadelphia and New York. If it were not, the question of whether there was serious danger of lead poisoning could be decided on the basis of medical testimony from these cities.[21]

Horsford's research appeared to prove that Lake Cochituate water was neither more nor less likely to dissolve lead than water from the Schuylkill River or Croton Reservoir. In each case when bright bars of lead were first immersed a perceptible trace of lead could be found in the water. But this action appeared to stop after a few days, leading the investigator to conclude that an insoluble oxide soon formed over the surface.[22]

Despite some difference of opinion the preponderant judgment of authorities in Philadelphia and New York was that no injury had followed from the use of lead pipe in those cities. John B. Jervis admitted that he had been very suspicious of the practice, having known personally of cases of poisoning resulting from the use of lead pipe with well water. But he had concluded that there was no real danger with lake or river water. "My experience has led to the conclusion that with the precaution of running off the water that has stood through the night, or for any considerable time in the pipe, no practical effect of an injurious nature will be experienced from the use of lead."[23]

The Boston Water Commissioners decided to use lead service pipes, except where the water takers specifically requested cast iron.[24]

In the fall of 1854, the citizens of Boston were much distressed by a sudden deterioration in the quality of the Cochituate water. To some disgusted householders the water tasted and smelled like fish; to others, like cucumbers. The chief engineer of the water works ordered the flushing out of all the mains and service pipes, but to no avail. No fish,

dead or alive, were discovered, and the bad taste in the water still persisted. Once again the city authorities appealed to local scientists.

Professor Horsford of Harvard and Dr. Charles T. Jackson, well known local chemist, visited Lake Cochituate, where they took numerous samples of the water. The water taken from the surface appeared to be free from unpleasant taste, but that drawn from a depth of twenty-five to thirty feet had the offensive characteristics that Bostonians were complaining about. "We all agreed in opinion that the taste resembled that of water in which cucumbers had been soaked."[25] The investigators were not sure of the cause. The lake appeared to contain neither more nor less than its usual population of fish, and, so far as could be ascertained, the fish were in good health. Dr. Jackson summarized his conclusions thus:

> I regret as much as any one that we have not been able to settle all the interesting questions that have arisen as to the origin of the impurity complained of. This much we have done. We have proved that the peculiar taste of the water does not originate within the pipes, but exists at the fountain head, and that it is not the result of animal putrefaction, but of vegetable fermentation, and that there is nothing deleterious in the water. . . .[26]

In more technical language Professor Horsford explained that he attributed the bad taste to "extracts more or less volatile from the decaying minute aquatic organisms, for the most part vegetable, which, during the late prolonged drought, have been produced in extraordinary quantity upon the low meadows, marshes, bog and peat lands which supply the surface drainage to Cochituate Lake."[27]

Fortunately, the reservoir purged itself, and by February the citizens could drink the water without distaste or fear that it might harm them. In 1859, New York had a similar experience with the Croton water.[28]

Scientists might puzzle over whether minerals in the water, or animalcules, or vegetable fermentation were injurious to health, but, fortunately, from the earliest days a saving instinct of fastidiousness or perhaps elementary common sense warned men of the danger of drinking water from grossly contaminated sources. As early as 1803, the Philadelphia City Council passed an ordinance which declared that, whereas, it was necessary that the water admitted from the river Schuylkill into the basin and canal for the supply of the city should be kept "as pure as possible," every person who should "wantonly or wilfully" throw into the basin or canal any kind of filth, or should go into the water to wash or bathe, or should cause any dog or other animal to go into the water, should be fined five dollars plus costs—one half to go to the City Treasury and one half to the informer.[29]

After the Fairmount Water Works were built, the Pennsylvania Legislature passed acts in 1828 and 1832 designed to protect the purity of the supply.[30] In the second of these laws it was provided that "if any person or persons shall hereafter wilfully take, lead, conduct, carry off, or throw, or shall cause to be taken, led, conducted, carried off, or thrown into that part of the river Schuylkill which is between the dam at Flat Rock and the dam at Fair Mount, near the city of Philadelphia, any carrion or carcase of any dead horse, or other animal, or any excrement or filth from any slaughter house, vault, well, sink, culvert, privy or necessary, or any offal or putrid or noxious matter from any dye house, still house, tan yard or manufactory, or any matter or liquid calculated to render the water of said river impure," every said person, for each and every offense, should be fined not less than five nor more than fifty dollars.

In other cities similar provisions were made to protect the purity of the water. The Maryland act of 1808 incorporating the Baltimore Water Company specified a twenty-dollar fine for any person convicted of polluting the water.[31] In 1817 and subsequent years, the Baltimore City Council passed ordinances intended to protect springs and wells from contamination by nearby privies and cesspools.[32] In 1842, the New York City Council specified a fine of not more than fifty dollars for bathing or throwing stones or dirt into the Croton reservoirs or the aqueduct.[33]

The citizens of Philadelphia had particular reason to worry about the quality of their water. The city and the neighboring districts were entirely dependent upon the Schuylkill and Delaware Rivers, and the danger of pollution steadily increased with the growth of population and industry within these watersheds. In November, 1843, the Philadelphia College of Physicians passed a series of resolutions earnestly recommending to the City Council "the adoption of such measures as will perpetuate the purity of the water derived from the basin of the Fairmount Dam."[34]

Among other measures suggested was that the city should purchase the Lemon Hill Estate on the east bank of the Schuylkill just above the Fairmount Water Works. This proposal was also urged upon the Councils in twenty-seven petitions bearing the signatures of 2,443 citizens. Behind this mobilization of public opinion certain motives other than disinterested benevolence were at work. The Lemon Hill Estate had been one of the assets of the bankrupt Bank of the United States, and the assignees were eager to find a customer for this famous property. Nevertheless, the argument that the purity of the Fairmount water would be endangered if houses, stores, and factories were built in the vicinity of the dam was a sound one, fully justifying the city's purchase of the tract for $75,000.[35]

For some years the municipality did nothing with this acquisition, but in 1854 the Councils decided to develop it as a public park. A number of physicians and leading citizens presented a petition, commending this policy and urging that the city also purchase land to the north and south of Lemon Hill. At stake was not only the proper protection of the Fairmount Water Works, but also that of the Spring Garden Water Works, which had recently become a part of the Philadelphia system through the consolidation of the city. The project would be expensive, admitted the petitioners:

> But when we reflect that the measure we propose will not only be the means of protecting our drinking water from impurities, but furnish the citizens with a large, elegant central public Park, abounding in natural beauties, with extended lawns, groves, and water scenery, easy of access from all parts of our extended city, we are led to believe the purchase now recommended, and the dedication of the whole connected tract from Fairmount to the northern limits of the grounds of the Spring Garden Water Works, to the public use forever, will be hailed with heartfelt pleasure by all classes of our citizens.[36]

In keeping with these suggestions, Fairmount Park was dedicated in 1855 and greatly extended and improved over the next several years.

Although these developments were steps in the right direction, the purity of the drinking water was still far from assured. The Kensington Water Works on the Delaware, which also became a part of the city system through the consolidation of 1854, were notoriously suspect. When a sample from this source was submitted to James C. Booth, a local chemist in 1856, his report was brief and caustic:

> The water from the Kensington Water Works, abounding with scum and sediment is so foul from putrifying organic matter, apparently of animal origin, that a chemical examination of it would be useless. I would not be willing personally to use the water from which the sample was drawn, nor even water which had a remote connection with it, believing it to be injurious to health.[37]

The immediate cause of this pollution was found in a neighboring dock where fish were cleaned and the entrails thrown in the water. Even after this nuisance was eliminated, the Delaware water was not above suspicion, because sewers and drains continued to discharge into streams tributary to the river.[38]

One reason why the municipal authorities were not more alarmed by such conditions was an over-optimistic reliance upon the ability of running water to purify itself and of water in storage to cleanse itself through sedimentation. In discussing measures necessary to protect the water supply in 1861, the Philadelphia Chief Engineer admitted that the city had more power under the law than it had attempted to exercise.

"But how far it would be wise to interfere with the large manufacturing interests which add so greatly to our permanent prosperity" he left for the Councils to decide.

> Much can be done, however, without putting manufacturers to large expense or great inconvenience. They might be prohibited from making the river a common sewer to carry off all refuse, and especially the discharge of privies, as is the practice in most of the factories. Indeed, if nothing but what could not be otherwise disposed of, was drained into the river, it might be allowed, at least for the present. But from that part of the river south of Columbus Avenue, immediate steps should be taken to remove all accumulation of detrius, and prevent all encroachments, and the drainage into it of any objectionable matter; and the whole shore should be guarded with the most jealous care.[39]

Apparently, it was only in the immediate vicinity of the water works that any really serious danger of pollution was felt to exist.

The British traveler, John Melish, writing in 1812, had praised Philadelphia's Centre Square Works, but had added the comment that filtration of the water would be a great improvement. This could be easily done, he said, by the application of a plan devised by "a very ingenious mechanic in Scotland."[40] This was perhaps a reference to the filter in Paisley, Scotland, built by John Gibb in 1804, which a modern authority has described as the "first known filter to supply an entire city with water."[41] The Paisley experiment was followed during the next quarter century with the erection of more famous filters at Glasgow and Greenock in Scotland. One of the London water companies began to filter the water of the Thames in 1829.[42]

Periodically through the nineteenth century the filtration of the Philadelphia water supply was suggested. It is probable that some Philadelphian households took the precaution of filtering their own drinking water in filter jars. This would seem to be the implication in a sharp comment on the Philadelphia situation by Assistant Alderman Fyler Dibblee of New York in 1831:

> The citizens of Philadelphia are a contented people; they have the Schuylkill by their side; and, from necessity, they improve it to the best advantage: but that water is not fit to drink without undergoing the process of filtration. I am informed, from indisputable authority, that insects may sometimes be seen in it one fourth of an inch in length.[43]

In 1846, an engineer named Frederick Erdmann asserted that the Fairmount water held in suspension "a large amount of impure matter, arising from many causes presented along the shores of the Schuylkill and tributaries, particularly, during the time of freshets, when it is so fully charged with foreign matter as to be entirely unfit for use." Erdmann alluded to the progress recently made in constructing filters in Scotland and elsewhere and recommended similar works for Philadelphia.[44]

Old Frederick Graff, who had built the Fairmount Works and was still in charge of them, advised against the innovation. For one thing, the amount of water which Erdmann proposed to filter would be inadequate for the city. Beyond this, however, Graff opposed "constructions of any kind being placed in the reservoirs that cannot be controlled at all seasons of the year, and which would, under the most favourable circumstances, so much endanger the continuance of a supply of water such as the City has been blessed with without interruption for the last thirty years."[45]

In 1849 and again in 1853, the Councils ordered the Watering Committee to inquire into the possibilities of erecting filters, but no action resulted.[46] Professors Booth and Garrett, employed to analyze the Schuylkill water in 1854, made a singularly complacent report. The local water contained only 6.1 grains of solid matter per gallon, according to their findings, as compared with Cochituate's 3.37 and Croton's 10.94 grains per gallon.

> In conclusion, we infer that the Schuylkill water has deteriorated, in no important respects, from its former excellent quality; that from the nature of its small contents of mineral matter, and its unusual freedom from organic matter, it is superior to most waters for domestic and manufacturing purposes; that from the nature and quantity of its mineral contents, it is unnecessary to adopt a system of filtration to improve its quality; and lastly, a comparison of the past and present, leads to the inference, that no plan of improving the water will be required for many years to come.[47]

Frederick Graff, Jr., now Chief Engineer, was as strongly opposed to filtration as his father had been, and the Watering Committee expressed itself as "perfectly satisfied with the extraordinary purity of the Schuylkill water."[48]

The Philadelphia authorities continued to congratulate themselves on the signal purity of their water supply. A report on the situation in 1860 admitted that the upper Schuylkill was so polluted with mine water that it had destroyed all the fish in the river above Reading. But the creeks which emptied into the stream near that city were largely impregnated with lime. This, mixed with the mine water, formed a precipitate "and after flowing a few miles the water is pure and limpid. To this chemical action may be attributed in a great measure the remarkable purity of the water of this river."[49]

Philadelphia was not alone in its belief that filtration would be an expensive and unnecessary nuisance. The Croton Aqueduct Board decided against constructing a trial filter in 1849,[50] and most other Ameri-

can cities refused to consider the idea despite its wide acceptance in Europe. In 1832, Albert Stein, a German-American engineer, constructed the first American filter at Richmond, Virginia, but the device was too small to clarify the highly turbid water of the James River and had to be abandoned. In 1855, a small filter was installed at Elizabeth, New Jersey.[51]

It was not until after the Civil War that American engineers began serious study of the techniques of filtration developed abroad. In 1869, James P. Kirkwood published a *Report on the Filtration of River Waters, for the Supply of Cities, as Practiced in Europe.* The city of St. Louis, which had commissioned this investigation, decided not to attempt the filtration of the muddy water of the Mississippi, but the city of Poughkeepsie, New York, had more courage. In 1872, Kirkwood was employed to construct a slow sand filter that would permit the highly suspect water of the Hudson River to be used as a municipal supply. Although the Poughkeepsie system was cumbersome, it was sufficiently successful to encourage similar ventures elsewhere.[52]

Leadership in the serious study of the relationship between pure water supply and public health was now assumed by the state of Massachusetts. In 1869, the Massachusetts State Board of Health had been established, and in 1878 this agency sent Professor William Ripley Nichols to Europe to study techniques of water purification. In 1887, the State Board of Health established an experiment station at Lawrence, where investigations of great significance were carried out. Five years later a sand filter for the public water supply of Lawrence was built.[53]

More than anything else, the growing fear of typhoid fever convinced municipal authorities that pure water was a matter of life and death. It would be interesting to know the extent to which this disease prevailed in the days when the larger American cities still depended on neighborhood wells for their water supply, but such statistics do not exist. Indeed, final proof that typhoid fever was a separate disease and not merely a variety of typhus was not forthcoming until about 1850. The Boston Board of Health began to list typhoid fever as a cause of death in 1856, but in most other cities reliable statistics were not compiled until the 1870's or 1880's. In 1880, one of the first years for which the comparison can be made, the death rate from typhoid fever was about 31.9 per 100,000 population for New York, 57.6 for Philadelphia, 42.4 for Boston, and 59.0 for Baltimore—all shockingly high by present-day standards.[54]

One of the landmarks of the infant science of bacteriology was the discovery of the typhoid bacillus by the German investigator, Karl

Eberth, in 1880.[55] Even before this event, however, the close relationship between polluted drinking water and typhoid fever was strongly suspected. In a useful work on the practical aspects of water supply engineering, published in 1877, Colonel John T. Fanning listed diarrhea, dysentery, and typhoid as ailments which were carried by impure water.[56] In a pamphlet, entitled *The Dangers from the Domestic Use of Polluted Water,* published in 1883, Dr. Morton Prince of Boston asserted:

> The diseases which may be conveyed by water are many. The most common are typhoid fever, cholera, diarrhoea, and numerous smaller ailments. The most typical of this class is typhoid fever. This is probably, and especially in small towns, conveyed more frequently by poisoned water than in any other way.[57]

To support this contention, he cited numerous examples from English medical history of the 1870's. Typhoid fever, he concluded, was a filth disease. The "poison" which gave rise to it was bred in filth, especially in sewage from houses. "No water supply should be contaminated with the slightest amount of sewage or polluted with organic matter of any kind. The neglect of these precautions means disease."[58]

Shocking proof that whole cities might be endangered from sources of pollution miles away was soon forthcoming. In the spring of 1885, for example, typhoid fever struck the town of Plymouth, Pennsylvania, in a ferocious assault. Out of a total population of some 8,000, over 1,100 persons contracted the disease and 114 died. In the words of a contemporary report:

> The origin of all this sorrow and desolation occurred miles away on the mountain side, far removed from the populous town, and in a solitary house situated upon the banks of a swift-running stream. The attending physician did not know that this stream supplied the reservoirs with drinking-water. Here, if at any place, it might seem excusable to take less than ordinary precautions. . . .[59]

The lessons from such an episode were obvious. Doctors and nurses must exercise the most scrupulous care in disinfecting and disposing of the body wastes from every typhoid fever patient; sanitary authorities must vigilantly protect the entire watershed from which municipal supplies were drawn; if watersheds could not be adequately safeguarded, filtration and other forms of water treatment must be introduced.

Municipal authorities could no longer blandly assume that anything too small to be visible to the naked eye was too small to be injurious to the human body. Through ingenious techniques drinking water was now examined to determine how many bacteria and other microorganisms it contained. The chances of isolating the elusive typhoid

fever bacillus in any particular water sample were small, but a high count of the colon bacillus was presumptive evidence that the water was polluted with sewage and potentially dangerous.[60]

Between 1890 and 1910, American cities made remarkable progress in safeguarding their water supplies. The danger of using untreated water from the rivers which ran conveniently through so many great centers of population was at last realized. Newark, Jersey City, and Paterson had all been drawing their supply from the badly polluted Passaic River. In 1890, Newark had a typhoid death rate of over 100 per 100,000 population; Jersey City's rate was just under 100; and Paterson's was about 30. Within the next fifteen years all three cities took important steps of reform. After Newark abandoned the Passaic in favor of purer upland supplies in 1892, its annual typhoid death rate dropped to about 20. Jersey City took the same step with similar results in 1896. Paterson continued to use the Passaic, but introduced filtration in 1902, thereby reducing the typhoid death rate to about 15.[61]

The Merrimac River, which ran through another famous industrial district, also played the part of villain in this drama of public health. From 1887 to 1893, Lawrence, Massachusetts, was unmercifully scourged by typhoid fever. For seven years the death rate from this cause never fell below 80 and in 1890 it soared to 134. After building filters in 1893, the annual rate fell to between 20 and 30. Lowell was equally plagued so long as it drew its supply from the Merrimac. In 1887, its typhoid death rate was over 120 and in 1890, over 160. After 1893, the city began to draw more and more of its water supply from driven wells, finally abandoning the river completely in 1896.[62]

The cities along the Great Lakes had their own problems. To use those huge bodies of water both for the disposal of their sewage and the supply of their drinking water was temptingly easy—and shockingly dangerous. In 1891, Chicago had almost 2,000 deaths from typhoid fever, and the death rate from this cause was over 173. The city sought to protect itself by building the Chicago Drainage Canal to reverse the flow of the Chicago River and allow most of the wastes of the community to pass down the Des Plaines and Illinois Rivers into the Mississippi instead of into Lake Michigan. This was an act of doubtful neighborliness to cities along these other streams, but Chicago's own typhoid death rate fell to an annual average of about 20 after the Drainage Canal was opened in 1900. In Cleveland, where the situation was similar but not as serious, the typhoid menace was measurably reduced in 1904 by extending the intake tunnel four miles out into Lake Erie.[63]

The city of Philadelphia, once so proud of her leadership in matters of water supply, procrastinated dangerously in adopting adequate safeguards. During the twenty years between 1881 and 1900 the annual typhoid death rate never fell below 35 per 100,000 population and was often above 70. At long last the authorities decided to build filtration plants, and the first of these was put in operation in 1902. But a large part of the city still used unfiltered water, and the incidence of typhoid fever continued to be shockingly high. In 1906, there were 1,063 deaths from this cause, representing a typhoid death rate of over 80. Not until 1911 was the project so far completed that filtered water could be supplied to the whole city.[64]

Technical progress in the treatment of water supplies had now become rapid. In addition to the earlier methods of slow sand filtration, new rapid filters were developed, particularly useful in clarifying highly turbid waters like those of the Ohio and the Mississippi. Disinfection by the use of liquid chlorine was another protective technique developed about 1910, with Philadelphia one of the first large cities to use it. Many communities undertook to improve the odor and taste of their water by aeration. When bad taste and odor resulted from algae and other organisms in the reservoirs, it proved possible to attack the nuisance by treating the water with copper sulphate.[65]

Water supply engineering became a highly specialized field, with each local situation calling for its own policies. Cities like New York and Boston which took their supply from relatively safe upland sources were fortunate. Filtration was not necessary, and other measures of treatment could be held to a minimum. But such cities found it all the more important to guard carefully the watersheds from which their supplies were drawn. Many water authorities agreed that despite all the wonderful progress that had been made in filtration and other methods of water purification, the greatest protection that a city could have was to keep its water supply free from contamination in the first place.

This was the point made in 1952 by the New York Department of Water Supply, Gas, and Electricity in opposing suggestions that the city should look for a future supply to the filtered water of the upper Hudson. Typhoid, the dysenteries, and cholera, the Department observed, had been established for many years as water-borne diseases, but newer knowledge pointed to the possible existence of many others, heretofore not suspected of being associated with water supplies. The subject of the viruses was especially important, since these agents of disease were not removed by filtration and it was not known whether they were vulnerable to other methods of water treatment. The safest procedure was to protect water supplies from all contact with sewage.[66]

The conquest of typhoid fever was one of the most impressive triumphs of modern medicine. During the decade 1880-1889 the average

typhoid death rate for 47 American cities was 58 per 100,000. In 1910, after the first great effort to purify public water supplies, the rate for 78 cities was 20.54. In 1938, after another generation of progress in public health, the rate was only 0.67. By no means should all of this improvement be attributed to purer water supply. The pasteurization of milk, the more adequate treatment of sewage, more screens to keep out flies, and greater personal cleanliness were all contributing factors in the victory over typhoid. But without the safeguarding of water supply, none of these other safeguards would have been adequate.[67]

CHAPTER THIRTEEN

The Race for New Supplies

> The domestic use of water is universally classified as the most important beneficial use of that resource. Water is essential to life—the life of a city as well as the life of a human being. Without water, a man dies. Without water, a community faces the same fate.
>
> Leonard A. Scheele, Surgeon General,
> United States Health Service (1952) [1]

The municipal statesmen who secured the building of waterworks and aqueducts always congratulated themselves on having provided for the needs of their fellow-citizens for generations to come. But almost invariably they had underestimated future consumption. The cities which had built the pioneer water works were soon confronted with new water crises, almost as alarming as the ones that had led to the original construction. And while the older systems had to be again and again enlarged, more and more American cities grew to such a size that they had to take the first steps in providing themselves with a supply.

Most American cities of substantial size had taken some action on their water problem by 1860. The Cincinnati Water Company was organized in 1820 to provide a supply for that bustling community. Water was pumped from the Ohio River, first by horse power and later by steam engine, and distributed through wooden mains. The system was purchased by the city in 1839.[2] About 1826, the city of Pittsburgh built works for pumping a supply from the Allegheny River. The city fathers gave a set of locally-manufactured glassware to Philadelphia's Frederick Graff in gratitude for his advice on their problems.[3] In 1830, the city of Richmond built water-power works to provide a supply from the James River. The following year St. Louis built a seven-mile aqueduct to conduct the water of the Mississippi to the city.[4]

New Orleans' need for water works had been recognized soon after the consummation of the Louisiana purchase. As early as 1809 the governor of the territory had been in communication with Benjamin Latrobe, builder of Philadelphia's famous Centre Square Works. In 1811, the New Orleans City Council granted to Latrobe and certain associates

the exclusive privilege of supplying the city by steam engine. The engineer sent out his son, Henry, to supervise construction, but many frustrations and delays were encountered. In 1817, the younger Latrobe died of yellow fever, and two years later Benjamin himself moved to New Orleans to take over direction of the project. Once again tragedy intervened. On September 3, 1820, yellow fever—the disease whose history in America had been so fatefully intertwined with the water problem—carried off the great engineer.

After Latrobe's death the city took over the water works project and finally completed it in 1822. But the system soon proved inadequate to meet the needs of the rapidly growing community. In 1833, the Legislature chartered a private water company, which began to supply the city four years later. The new works, which like the earlier ones depended on pumping a supply from the turbid Mississippi, were constructed under the direction of Albert Stein, an able engineer who had built water works for Cincinnati, Richmond, Lynchburg, and Nashville.[5]

Chicago obtained its first supply from the Chicago Hydraulic Company, which was chartered in 1836 but did not begin to serve customers until 1842. The supply, pumped by steam engine from Lake Michigan, was suspect both in taste and odor, and public opinion demanded municipal action. In 1854, the city contracted to purchase the franchise of the company, but the actual transfer did not occur for several years. Eventually, the quality of the water was much improved by extending the intake tunnel two miles into the lake.[6]

During the 1850's notable progress occurred in the building of water works. Frightened by serious fires, Congress commissioned Lieutenant M. C. Meigs of the Army Engineers to survey possible sources of water supply for the city of Washington. Meigs' plan for a 12-mile aqueduct to convey water from the Great Falls of the Potomac was approved by Congress in March, 1853, and construction was formally inaugurated by President Franklin Pierce the following November. The aqueduct was not finally completed until ten years later, but a temporary supply was provided in 1859. The most impressive feature of the Washington aqueduct was the Cabin John Bridge, a stone arch 220 feet in width and 105 feet high—for many years the largest stone arch in the world.[7]

Across the East River from Manhattan lay Brooklyn, a separate municipality until its merger in greater New York City in 1898. In the early nineteenth century, Brooklyn was a small town without the acute growing pains of its great neighbor. But between 1840 and 1850 the situation changed dramatically, as Brooklyn's population jumped from 36,233 to 96,838.[8] Now the seventh largest city in the nation, Brooklyn could no

longer rely upon local wells and springs. The Nassau Water Company, chartered in 1855, formulated ambitious plans, but before its works could be commenced the city decided to buy up the stock of the company and build the system itself.

The works, completed in 1859, utilized no single river or lake. Instead, the waters from some six small streams to the east of the city were impounded in separate reservoirs, and then conducted through twelve miles of masonry conduit to a pumping station that raised the supply into the Ridgewood Reservoir on the eastern outskirts of the city. Most of Brooklyn could be supplied by gravity from this point, but to provide service for the most elevated section, the Mount Prospect pumping station and reservoir were built.[9] The whole system, ingeniously contrived to fit the peculiar local situation, was of great interest to engineers. A later authority asserted that the careful analysis required to build the Brooklyn works resulted in a more decided advance in water-works engineering than had hitherto been made, the results of which were to be seen in improvements in pipe manufacture, in engine building, in reservoir construction, and in maintenance works.[10]

Other cities were coming to grips with their water problems. In 1852, a private company began to supply Buffalo from the Niagara River. The city of Cleveland, which had waited twenty years for a private water company to fulfill the conditions of its charter, finally decided in 1854 to build its own works to pump a supply from Lake Erie. In Louisville, Kentucky, a private company was organized to supply the city, but stock subscriptions lagged and eventually the municipality itself purchased all but two of the $100 shares. The works for pumping a supply from the Ohio River were completed in 1860. Across the continent the boom port of San Francisco was supplied by two private companies, founded in 1856 and 1857 to convey water from Pilarcitos Creek and other mountain streams about 15 miles from the city.[11]

By 1860, the sixteen largest cities of the nation, each having 50,000 or more inhabitants, were all served with water works of some kind. Many smaller towns were also provided for. Of the 136 American water works of that year 79, or 58 per cent, were owned by private individuals or companies.[12] But the privately-owned water works were much more characteristic of the small communities than of the large. In the sixteen largest cities all but four—New Orleans, Buffalo, San Francisco, and Providence—now had municipally-owned systems.

In 1849 the Committee on Public Health of the American Medical Association asked Professor Walter R. Johnson of Philadelphia, who had recently studied the Boston water problem, to express his opinion

on whether "the supply of water and gas to cities, as well as their drainage, should be under the direction of, and conducted by chartered companies, or the city authorities."[13] Johnson's reply was an unequivocal endorsement of the principle of municipal management of all these services. Particularly in the case of water works did he feel that private ownership was likely to provide a supply that was deficient in quantity and high in price, that private ownership usually resulted in inadequate provision for public uses like fire-fighting and street-washing, and that public control was more likely to serve "the greatest good of the greatest number."[14] The Committee on Public Health accepted Johnson's reasoning and incorporated the following statement among its findings:

> The introduction of an abundant supply of water is so intimately connected with the health of a city, that the municipal authorities should rank this among the most important of their public duties. In connection with this matter, the committee are deeply impressed with the importance of confining the execution and management of such great public works, as a supply of water, gas, and drainage to the city authorities. The public welfare is too deeply interested in their faithful performance, safely to permit them to pass into the hands of incorporated companies, who, however high-minded they may be, look to them as sources of revenue, and not as objects of public good.[15]

Fortunately, the doctors were able to consider the issue on its merits without the inhibiting fears of "creeping socialism" that would beset a later age.

The period of complacency during which cities like Philadelphia, New York, Boston, and Baltimore could congratulate themselves on having finally solved their water problems was relatively brief. In all these places water consumption increased with such extraordinary rapidity that the city authorities were soon worrying about the adequacy of the supply. A visitor to New York in June, 1854, when the Croton system had been in operation only twelve years, noted that none of the public fountains were playing and drew the inference that the authorities feared a water shortage.[16]

The case of Boston is particularly interesting. For many years the opponents of Long Pond had argued that to plan for a daily consumption of 7,500,000 gallons was visionary; yet the Cochituate Aqueduct was not five years old before this figure was exceeded. By 1853, the average daily consumption was 8,542,000 gallons.[17] The problem was not that more citizens took the water than had been expected, but that the water-taking families used so much more per person than had been predicted on the basis of Philadelphia experience.

The Cochituate Water Board complained that two-thirds of the water was wasted. Livery stables and other establishments used hand hoses

day and night, and the water ran continuously in primitive water closets and urinals. Especially wasteful was the Boston habit of allowing faucets to run wide open all night long when it was feared that the pipes might freeze. So widespread was this practice that the citizens almost drew the reservoirs dry during a spell of bad weather in January, 1854. Consumption rose to 14,000,000 gallons a day, many houses in the higher parts of the city had no water, and civic officials made gloomy predictions of what would happen if a serious fire should break out. Two inspectors were appointed to patrol the streets at night, listening for the sound of running water in the houses. Persons found guilty of unnecessary waste were fined and warned that their supply would be cut off in case of further offenses.[18]

But in a day when household water meters were practically unknown, the trend toward an ever more liberal use of water could not be checked. Average daily consumption in Boston continued to rise: by 1860, it exceeded 17,000,000 gallons. This, asserted the exasperated authorities, represented a daily consumption of 97 gallons for each inhabitant—"an amount believed to be without parallel in the civilized world."[19]

Undoubtedly much of the supply was wasted. When running water was a novelty, the temptation was strong simply to turn it on and watch it flow. Two years after the Croton Aqueduct began to supply New York City, the Water Commissioners complained that those who had planned the works had never contemplated that fountains would be erected in all the public and private parks of the city, or that fire hydrants would be so constructed that they could be turned on at the whim of mischievous boys or curious adults.[20]

But, in the long run, the increasing urban consumption of water reflected not so much willful waste as higher standards of living. As late as 1849, when Philadelphia had had a municipal water supply for almost half a century, public health advocates were deploring the unpopularity of bathing. Out of 15,000 houses with running water only about 3,500 were equipped with private baths—"a fact which would seem to indicate that the practice of bathing was confined to a comparatively small number."[21] The free hydrants which still stood in the streets benefited the poor by supplying drinking water, but were much less effective than running water in each house would have been in encouraging cleanliness. Some reformers hoped that public bath houses would be provided. The benefits to be expected were thus described:

> A benevolent institution, recently established in the district of Moyamensing, for the purpose of furnishing employment to the poor, have connected within their building a range of baths, supplied with hot and cold water, to which access is had by tickets, furnished at the rate of three cents each, or by

its equivalent in labour. Such an arrangement is highly commendable, and has, probably, been the means, in this instance, of furnishing baths to many poor creatures in this section of Philadelphia, who have never before enjoyed that luxury; and who, from their filthy condition, are peculiarly in want of it. The multiplication of such establishments, especially in parts of the city inhabited chiefly by the poorer classes and open at a mere nominal cost, would be an excellent practical measure of benevolence; and would, we believe, diminish the liabilities to disease amongst a large class, who are now much exposed.[22]

At first it was assumed that bath tubs would remain the luxuries of the rich and that the poor could best be served by the erection of public bath houses. From New York it was reported that the Mayor had recommended the establishment of public baths on land to the rear of City Hall. One large common bath would be provided for males, and a second for females. The price of admission would be three cents. On the second floor there would be small rooms with separate bath tubs. To enjoy the privacy of these accommodations the patron would pay six cents.[23]

In Boston the *Evening Transcript* advocated the construction of public baths; if these could not be had, the next best thing would be the establishment of private bath houses. "It is with satisfaction that we learn that an extensive bathing establishment is in process of construction in the basement story of the pianoforte warehouse of Mr. Lemuel Gilbert, Washington street, opposite the Boylston Market. . . . A well kept bath house of this kind is very much needed in this section of the city, and we have no doubt it will be well sustained by all our citizens who glory in the Cochituate."[24]

In the long run, however, it was not the public bath house but the private bath room that was destined to become a great American institution—one firmly established long before Sinclair Lewis provided its classical description in the opening chapter of *Babbitt*. And in the bath room the place of honor was really occupied not by the bath tub but by the toilet seat.

The water closet—to give this convenient device its homely original name—had its own interesting history. Ingenious earlier civilizations like the Minoan and the Roman developed superior privies in which human wastes were carried away by running water, but Christian Europe was content for many centuries with more primitive provisions. A prophet before his time was the English gentleman, Sir John Harrington, whose *Metamorphosis of Ajax*, published in 1596, contained—so we are told—"a complete plan of the *first modern valve water closet.*"[25] But the device was ridiculed and apparently little used. Not until 1775 was the first English patent on a water closet issued to one Alexander

Cummings. A second such patent was granted to Joseph Burmah in 1778, and a number of others followed during subsequent decades.[26]

In the late eighteenth century, the water closet began to gain some popularity in English homes that could afford such a luxury. A few Americans took up the idea. It is not surprising that a bold rationalist like Thomas Jefferson should have been one of them. Soon after he moved into the White House, Jefferson commissioned Benjamin Latrobe to install a water closet to be fed by a cistern.[27] But interest in the new convenience was not confined to political liberals. The staunch Federalist Noah Webster must have had the water closet in mind when he praised the Philadelphia water works in these words:

If pleasure may be considered separately from usefulness, no scheme can be more fertile of pleasure than this. A trivial expense will supply every court yard with a reservoir, and every chamber with a bath; personal impurities of every kind may be hourly washed away. All that is troublesome and noxious, all that is hostile to delicacy, decorum and health, may be instantly swept from sight.[28]

Despite this evidence of early interest, no water closet patents were issued in the United States until 1833 and 1835.[29] It was the introduction of running water and the construction of sewers that eventually led to the wide acceptance of the water closet during the 1840's and 1850's.

Bath tubs, shower baths, and water closets contributed mightily to the rapid increase in water consumption. Fashionable hotels which offered all these modern conveniences were voracious water users. In 1860, an investigation in Boston revealed that the Tremont House was using over 25,000 gallons of water a day and the Parker House over 20,000. Over the bitter protests of the managers meters were installed, and the hotels were compelled to pay water rents commensurate with their actual consumption—about four times the sum they had been assessed under the earlier flat rates.[30]

In a score of ways the use of water continued to exceed the expectation of the municipal planners. Livery stables and industrial shops were large water takers in the early days, while in the twentieth century enormous quantities of water were required not only for manufacturing but for such new uses as washing machines, automatic dishwashers, garbage disposal units, lawn sprinklers, air conditioning, and refrigerating. The rate at which American cities consumed water had no parallel in foreign countries. Before World War II the average per capita use in ten European cities, including London, Paris, and Berlin, was only 39 gallons per day; while in ten American cities, including New York, Philadelphia, Baltimore, Chicago, and Detroit, the rate was

155 gallons per day.[31] Thus it was that each generation of municipal statesmen found itself confronted with a new water supply problem.

Boston did better than most other cities in anticipating its water needs and developing a long range policy. As early as 1869 the obvious inadequacy of the Cochituate Water Works prompted the city to make arrangements for obtaining a supplementary supply from the Mystic Lake Water Board which served the adjoining city of Charlestown. A more important new source was added in 1880 when the Sudbury Aqueduct was completed—a 17-mile conduit to convey water to the city from new reservoirs built on the Sudbury River in Framingham.

Like most other large cities, Boston added to its water perplexities by annexing several of its suburbs. Roxbury was joined to the city in 1868; Charlestown, Dorchester, Brighton, and West Roxbury, in 1874. Still under their own local governments, but deeply involved in the general water problem of the area, were such Boston suburbs as Somerville, Malden, and Watertown. After two years of intensive study of the situation under the direction of Chief Engineer Frederic P. Stearns, the Massachusetts State Board of Health issued an excellent report in 1895, recommending the creation of a Metropolitan Water District to serve Boston and its neighbors with water taken from the South Branch of the Nashua River, some 33 miles to the west.

In conformity with this program the Metropolitan Water District was organized in 1895. By 1920, this included Boston and eighteen suburbs with a total population of one and one-quarter million. By building a great dam across the South Branch of the Nashua River at Clinton, the Wachusett Reservoir, 8½ miles long and 2 miles wide, was created in 1906. The Wachusett Aqueduct, 12 miles long, connected the new reservoir with the Sudbury watershed.

In 1922, the Metropolitan Water District and the State Department of Health recommended that the system be still further enlarged by taking water from the Ware and Swift Rivers, about fifty and sixty miles respectively west of Boston.[32] This proposal was opposed by the state of Connecticut, since the Ware and Swift Rivers were part of the Connecticut River watershed. But the Supreme Court ruled that Massachusetts was entitled to an equitable portion of the water.[33] This permitted the new project to go forward, and by 1931 enough of the new Quabbin Aqueduct was completed to permit the spring floods of the Ware River to be diverted into the Wachusett Reservoir. In 1934, the Swift River was similarly tapped.

But all these steps were preliminary to the construction of the great Quabbin Reservoir, designed to impound the entire flow from a watershed of 186 square miles. The reservoir was of unprecedented size

among such works devoted entirely to domestic water supply. It covered 74,886 acres in twelve different towns and three counties. Both the quick and the dead had to make room for the water. Thirty-five cemeteries were abolished, and 7,606 bodies were moved to new resting places. The new works increased the safe yield of the Metropolitan Water District from 133 million gallons a day to 330 million.[34]

Meanwhile, the old had been forced to give way to the new. In 1931 Boston retired historic Lake Cochituate from duty, because increasing population in the watershed had made its water suspect.[35]

Baltimore was more laggard in water matters. The inadequacy of the Jones Falls supply was made painfully plain in 1869 and 1872, when severe droughts so reduced the reservoirs that a serious fire might have wiped out the city. To obtain a temporary supply, works were built by which ten million gallons a day could be taken from the Gunpowder Falls and pumped over the divide into the valley of Jones Falls. In 1874, the Water Board recommended that permanent works be constructed, and this decision was ratified by the voters in a special referendum. In 1881, the new system, consisting of a dam across the Gunpowder, a seven-mile long tunnel from the dam to the city, and two new distributing reservoirs, was completed, and Baltimore citizens prided themselves on having the finest water works in the United States. The Baltimore supply now totalled 150 million gallons a day, at a time when New York's supply was only 100 million and Philadelphia's was 50 million. When the city was threatened with disaster by the great fire of 1904, the water system proved adequate for the emergency.[36]

By 1910, however, Baltimore had grown to the point where a larger and safer supply was required. In accordance with engineering recommendations made that year, a new dam was built at Loch Raven on the Gunpowder and a filter plant was added to the municipal system. This made possible the final abandonment of Jones Falls—a water source that public health authorities had mistrusted for decades. The new works were placed in operation in 1915, but three years later the entire picture was changed when Baltimore annexed fifty-six square miles of adjoining suburbs, thereby enlarging the area of the city by more than 150 per cent. Further enlargement of the water system was now imperative. During the 1920's the Loch Raven Dam was raised in height, and the filter plant was expanded. Between 1930 and 1933 the new Pretty Boy Dam was built across the Gunpowder, twenty-five miles upstream from the Lock Raven Dam.

These steps did not satisfy the city's needs. Once again it was a severe drought, beginning in 1929 and lasting several years, that warned the Baltimore authorities of the seriousness of the situation. In 1934, an

engineering firm recommended the immediate construction of a new tunnel from the Loch Raven Dam to the filtration plant and the erection of a new and larger dam on the Gunpowder farther downstream. When World War II broke out, the tunnel had been constructed, but the new dam had not. The great industrial expansion of Baltimore during the 1940's affected the water situation in two ways. For one thing, the demands upon existing facilities were greatly increased; for another, property values along the lower Gunpowder went up so much as to make it doubtful whether the new works should be built in this area.

Once again engineers were employed to survey all the possible sources from which the city might enlarge its supply. In 1942 these experts recommended the development of the North Branch of the Patapsco. The project hit a snag when the voters refused to authorize a bond issue of $32,000,000 for this and other purposes. But in May, 1943, a more modest proposal to borrow $12,500,000 to build part of the recommended works was approved. Stage One of the Patapsco development consisted of boring a tunnel from the North Branch to the Montabello Filtration Works in the city. This would add 50 million gallons a day to the existing 148 million gallon supply from the Gunpowder. Stage Two would involve the building of a dam on the North Branch of the Patapsco, thus increasing the city's safe supply to 243 gallons a day.[37]

The Philadelphia authorities, proud of the city's history in water supply, were reluctant to concede that the old Fairmount works would not supply the city forever. By 1850, however, it was apparent that the situation was becoming serious. Consumption had risen to 7,000,000 gallons a day, and the Fairmount reservoirs had a capacity of only 26,000,000 gallons or about 3½ days supply.[38] This was a dangerously small reserve for a water system subject to periodic interruptions by flood and drought. To provide more storage the Councils authorized the building of a new reservoir with 20,000,000 gallons capacity. But this was only a partial answer to the problem. "It is well known," reported Frederick Graff, Jr., in 1851, "that we now have our mill house filled with machinery to its utmost capacity, and moreover, that we cannot do much more than keep pace with the demand for water at present."[39] In order to utilize the water power more efficiently the authorities began substituting turbines for the older water wheels.[40]

In 1854, the Philadelphia water situation was fundamentally altered by the act of consolidation that merged the old city and all the neighboring districts. Through this measure the works built to supply Spring Garden, Kensington, and West Philadelphia became part of the Philadelphia system. But if the pumping and storage resources were thereby enlarged, so too was the area to which water had to be supplied. Even

in perfect running order—which was seldom the case—the various pumping stations could deliver only about 36,000,000 gallons a day, and consumption ran dangerously close to this figure, even exceeding it during the hot summer months.[41]

In 1858, Henry P. Birkinbine, the Chief Engineer, reported that citizen complaints concerning a scarcity of water were well founded and called for immediate action. Since the danger of pollution from nearby sources was so great, Birkinbine suggested that it might be possible to impound the water of upland streams some twenty-five or thirty miles away and conduct this to the city by aqueduct.[42] The engineer recommended a specific plan of this character in 1866, but the city authorities continued to rely on the Schuylkill and the Delaware, confident that the problem of pollution could be controlled by better sanitary provisions.[43]

In conformity with this decision the Philadelphia water works were enlarged during the 1870's with the construction of two new steam pumping stations on the Schuylkill and one on the Delaware, together with four new reservoirs. Severe droughts in 1874 and 1882 warned that the supply was still inadequate. Rudolph Hering, a well-known expert on water supply, was commissioned to head an investigation of the problem. This engineer reported in 1886, as Birkinbine had twenty years earlier, that the local sources were dangerously polluted, and that the city should turn to more distant ones. Once again this advice was ignored, and the city authorities enlarged the water supply by building still another pumping station on the Schuylkill.[44]

The municipal government reviewed the water problem again during the years after 1898. By this time annual epidemics of typhoid fever gave grim warning to the citizens that to continue to drink their untreated local water was to invite death. Still the city was unwilling to abandon the sources which lay so conveniently near. Instead, it authorized the construction of the great filters described in an earlier chapter.[45] By filtration and chlorination the Philadelphia water at last became tolerably safe, but its unpleasant taste and odor gave the city an unhappy notoriety.

During the 1920's and the 1930's official commissions and citizen groups continued to study the problem, but no important decisions were reached until 1940. In that year the municipal government initiated an ambitious program for rehabilitating the water system. The nation's involvement in World War II delayed the work and at the same time added to the urgency of the situation. The pollution of the rivers was increased by the wartime growth of population and the construction of new industries.[46]

For many years Philadelphia had met its water needs on a hand-to-mouth basis. What was imperatively needed was a long-range policy to insure a safe and adequate supply for a half century to come. Such a policy was apparently provided in the plans, recommended by a board of consulting engineers and adopted by the city government in 1945 and 1946. Three stages of future action were proposed. The first, to be undertaken immediately, was devoted to rehabilitating the existing system. The objective would be to increase the supply and to eliminate as much as possible of the offensive taste and odor through use of activated carbon, ozone, and other modern methods of treatment. The second stage, to follow when the first was completed, provided for reorganizing the water system to take a larger portion of the supply from the Delaware River, perhaps abandoning the Schuylkill except as a reserve. The third stage would be to abandon both of the familiar local sources and take a supply from the upper Delaware. As outlined by a Philadelphia engineer:

> The Delaware River Project at Wallpack Bend provides for an average supply of 500 mgd. and involves the construction of a dam on the upper Delaware near Bushkill, a regulating reservoir in the vicinity of Warrington, Pa., and approximately 80 miles of pressure conduits to deliver water by gravity to the site of the present Queen Lane filter plant, for purification purposes. The estimated cost of this project is approximately $285,000,000.[47]

Philadelphia was not alone in looking to the upper Delaware for its future supply. New York City, struggling with its own great water problem, had its eye upon the same source.

The municipal statesmen and engineers who had built the Croton Aqueduct believed that they had anticipated the needs of the city for many decades to come. The masonry conduit had a potential capacity of over 90 million gallons daily but the effective capacity of the original works was only 42 million gallons because of the small dimension of the iron pipes by which the water was conveyed across the Harlem River and the Manhattan Valley.[48] Jervis had been sure that the works would provide enough water for a city of 800,000 persons and he had not expecetd New York to have as large a population as this for thirty years.[49] In 1840, the Whig Water Commissioners had criticized their predecessors' plans as providing local storage facilities which would not be needed "for a century to come, if ever required." They had accordingly economized by not excavating the rock from one of the reservoirs and by reducing the number of pipes between the Yorkville and Murray Hill reservoirs from three to two.[50]

As early as 1845 the municipal authorities had begun to mistrust the wisdom of these economies. Even with the relatively low rate of consumption of those early years, the local reservoirs contained only a twenty-day reserve—hardly adequate in case of accident to the aqueduct.[51] By 1848, the works would no longer deliver a dependable supply to the highest sections of the city, and ways and means of remedying the situation were under consideration.[52] An additional main from the Yorkville Reservoir eliminated one bottleneck. A more ambitious project involved the construction of a large new reservoir in Central Park. Once again the project seemed impressively bold. The new reservoir, completed in 1862, covered over 100 acres and had a capacity of more than one billion gallons—five times that of the original city reservoirs. To complete the enlargement of the works, a giant pipe was laid across High Bridge so that the full capacity of the aqueduct could be utilized.[53]

In less than twenty years, however, the city was in the midst of a new water crisis. Although the aqueduct—filled so full that it leaked at the top—was made to deliver 95 million gallons a day, 20 million more than Jervis had considered its safe capacity, the city was still desperately thirsty. During the hot summer months water would not rise above the first stories of the steaming tenement houses. Once again the city was prodded into what seemed heroic measures. In 1885, a conduit from the Bronx and Bryam Rivers added about 28 million gallons to the daily supply, but this was all needed for newly-acquired territory in the Bronx.

Meanwhile, the construction of a second Croton Aqueduct had been started. Completed in 1893, the New Aqueduct differed from the old in being laid for most of its 31-mile distance through a tunnel. More than three times as large as its famous predecessor, the New Aqueduct could deliver 300 million gallons a day. Since the total available daily supply was now 425 million gallons and average consumption was only 183 million, a safe margin seemed to have been at last provided. The Croton system was further enlarged by building several storage reservoirs in the Croton watershed and constructing the New Croton Dam, three and one half miles below the old one. This work, completed in 1906, was 1,600 feet long and 240 feet high—the largest masonry dam in the world at this time.[54]

But the fierce race between supply and consumption still continued. In 1898, the boundaries of the city of New York were thrown out to encompass Brooklyn, Queens, Richmond, and more of the Bronx. This consolidation doubled the population, confronting the municipal authorities with the water needs of almost 3½ million persons with an average daily consumption of nearly 372 million gallons. Brooklyn had already outgrown its Ridgewood system, while Queens and Richmond were inadequately supplied by small private companies.[55] The net result of consolidation was to add a new sense of urgency to the water problem.

These were years of large immigration, and the population of the city increased by over 1¼ million between 1900 and 1910. The water resources of the Croton and Bronx watersheds and of western Long Island had been forced to yield their full tribute to the thirsty metropolis. To what new source could the city turn?

On August 16, 1899, New York's Commissioner of Water Supply William Dalton recommended to the Board of Public Improvements that the city enter upon a contract with the Ramapo Water Company, under which this private corporation would sell to the city 200 million gallons a day to be taken from the Catskill watershed to the west of the Hudson River. The water would be delivered at the city line and distributed through the regular municipal system. The city was to pay $70 per million gallons, and the contract was to run for forty years.[56]

Behind this extraordinary proposal to return to private enterprise lay a curious story. The Ramapo Water Company had been organized in 1887 under the general corporation laws of the state. In 1895, the Legislature had passed a special act, ostensibly to "limit and define the powers" of the Ramapo Company, actually to enlarge them significantly. The corporation was granted full power to contract to supply water to any municipality or corporation, public or private. It was also given broad powers of condemnation and authorized to choose its own route for conveying its water.

Not only did the Legislature grant this corporation powers greater than that of other water companies and municipalities in the state, but in subsequent legislation it largely emasculated New York City's own rights to obtain water. The Suffolk County Act of 1896 prevented the taking of a supply from that Long Island county, while the Greater New York Charter Act of 1897 prohibited the city from taking a supply from any watershed from which any other city, town, or village was taking its supply—a barrier so formidable that it would be difficult for New York to develop any new source. These laws seemed to have been deliberately planned to bind the city in a strait-jacket, from which it could only escape by coming to terms with the Ramapo Company.[57]

Commissioner Dalton's recommendation caught the community by surprise. The Tammany majority on the Board of Public Improvements tried to rush the Ramapo contract through without discussion, but the City Comptroller, Bird S. Coler, finally obtained a two-week delay. After hurried investigation the Comptroller decided that the plan was a most disadvantageous one for the city and prepared a vigorous protest. He declared:

> . . . the proposed contract with the Ramapo Water Company would result in the City paying an excessive price for water, and . . . at the end of forty years the City would have nothing to show for an expenditure of about $200,000,000, and would gradually become more and more dependent on the mercy of private interests, grown enormously powerful by the aid of the municipal treasury.[58]

On August 30, 1899, writs of injunction were served in several taxpayers' suits, thus prohibiting action by the Board of Public Improvements for the time being.[59]

In his fight against the Ramapo contract Comptroller Coler soon recruited powerful allies. The newspapers condemned the proposal as an outrage perpetrated through an unholy alliance of Boss Platt's Republican machine which controlled the Legislature and Boss Croker's Tammany Democrats who ruled the city. As public indignation mounted, unwary businessmen who had signed petitions favoring the contract hastily withdrew their support.[60]

The fight had its ironic aspects. While municipal office holders were attempting to turn the water supply problem over to private enterprise, the leading role in defending the principle of municipal ownership was assumed by the Merchants' Association of New York, a highly respectable organization of businessmen. At the insistence of this group the city authorities agreed to postpone a decision upon the Ramapo contract, while the Association undertook to make an independent investigation of the whole situation. Governor Theodore Roosevelt gave his blessing to this study in a letter condemning the Ramapo contract as "grossly improper" and the conduct of the city officials as verging on "actual criminality."[61]

The report of the Committee on Water Supply appointed by the Merchants' Association proved that on financial grounds alone the Ramapo contract was an extraordinarily bad bargain for the city. Water under the contract would cost about $80 per million gallons—$70 to the company and $10 for distribution. Since the city collected only $50.29 per million gallons in revenue, it would lose almost $30 per million. In contrast with this, water from the municipal system cost only $29 per million in 1898, leaving the city with a profit of over $21 per million gallons.[62] "The City's water works," declared one of the sub-committees, "are not a burden, but a source of profit."[63] On principle, as well as on grounds of expediency, the Committee on Water Supply upheld the policy of municipal ownership.

> . . . the experience of other municipalities in the United States, as well as in other countries, shows an almost continuous tendency to substitute publicly owned water systems for private, a tendency so persistent and so universal, and of such constantly increasing force, that the wisdom, in the public interest of the policy of municipal ownership and control of water supply, would seem established by abundant experience.[64]

Public opinion against the Ramapo contract was successfully mobilized. The municipal authorities were deterred from completing the

transaction, and in 1901 the Legislature repealed the Act of 1895 under which the Company had been vested with such excessive powers. The next step was to obtain legislation that would grant the necessary authority to a municipal agency. This encountered the opposition of the rural areas whose tranquility might be disturbed by a major aqueduct project, and bills introduced in the 1901 and 1902 sessions failed to pass. By this time, however, the need for action was being publicized by such powerful civic organizations as the Manufacturers' Association of Brooklyn, the Merchants' Association of New York, the Chamber of Commerce of the State of New York, the City Club, and the New York Board of Fire Underwriters. Mayor George B. McClellan gave the movement strong support. Finally, in 1905 the Legislature passed a measure creating a new Board of Water Supply with broad powers to plan and build new reservoirs and aqueducts.[65]

The Catskill Aqueduct, which resulted from these events, was begun in 1907 and completed ten years later amidst civic festivities reminiscent of the Croton celebration of 1842. There was abundant reason for pride. "The great Catskill waterway," wrote former Mayor McClellan, "is in itself certainly the greatest piece of water supply engineering, if not the greatest engineering achievement of any kind, in the world. I think that Gen. Goethals will agree with me that the Panama canal, while more spectacular in character, did not offer the engineering problems which had to be met and overcome in bringing an underground river all the way from the Catskills to . . . New York City."[66] Originating in the great Ashokan Reservoir, the new aqueduct extended 120 miles to its southern terminal on Staten Island. Picturesque arched bridges across rivers and valleys were now a thing of the past. Instead, the aqueduct was carried through pressure tunnels bored deep in the solid rock. Thus was the water conveyed under the Hudson River near Storm King Mountain by the Roundout Siphon, 1,114 feet below sea level. The main artery of the city distributing system was a pressure tunnel from 200 to 750 feet below the street level.[67]

In 1927, the Catskill water system was enlarged by the completion of the Schoharie Reservoir. This permitted the new aqueduct to deliver its full capacity of 555 million gallons a day. But as so often in the history of the water problem, by the time that one great project had been completed, the continued rise of water consumption had made it necessary to start worrying where the next source was to be found. As early as 1921 the Board of Water Supply had decided to construct still another aqueduct to tap the waters of the Neversink River and of the East Branch of the Delaware. Before this project could be commenced, serious obstacles had to be surmounted. The Delaware River was an interstate waterway,

and New Jersey and Pennsylvania refused to give their consent to a diversion of its waters. When the Board of Water Supply recommended that the work should be undertaken without the assent of the other states, the New Jersey authorities appealed to the United States Supreme Court for an injunction to prohibit this.[68]

Not until 1931, after long litigation, did the Court render its decision. Venerable Justice Holmes delivered an opinion spiced with characteristic aphorisms. "A river is more than an amenity," he wrote, "it is a treasure. It offers a necessity of life that must be rationed among those who have power over it." The Court ruled that the city of New York might take up to 440 million gallons of water a day from the Delaware and its tributaries, subject to various safeguards.[69]

Despite this legal victory, work on the new Delaware Aqueduct did not begin for several years. The depression was now in its worst phase, and it was not until 1937 that resulting financial problems were solved and construction could begin. The work was still in its early stages, when World War II halted construction.

The result of these delays was one of the most serious water crises in New York's crisis-studded history. In 1946, the city's average daily water consumption passed the level of 1,055 million gallons a day, considered to be the dependable supply of the municipal system. Fortunately, more than normal rainfall prevailed for the next three years, keeping the reservoirs at a level adequate for the city's needs. But such good fortune could not last. In June, 1949, the amount of rainfall began to fall below average, and in the various reservoirs the water level sank in alarming fashion. On December 12, the combined storage of the Catskill and Croton Reservoirs was only 33.4 per cent of capacity. Although the citizens had paid scant heed to Mayor O'Dwyer's earlier appeals to conserve water, the December situation was serious enough to scare them into action. Restaurants served water to their patrons only upon request; automobile owners were forbidden to wash their cars; the use of water in swimming pools and skating rinks was sharply restricted; new regulations regarding refrigerating and air conditioning installations were laid down; the city authorities instituted a house-to-house inspection to discover leaky fixtures. Friday, December 16, was proclaimed Dry Friday when consumers were asked to reduce water consumption to a minimum and men were requested to forego shaving. So successful was this experiment that Dry Thursdays were observed for the next six months. By such measures the city water consumption was actually reduced.

But rain was still desperately needed to fill the reservoirs. In February the city employed a professional rainmaker, Dr. Wallace E. Howell, to conduct a six-month attempt to increase precipitation by seeding clouds

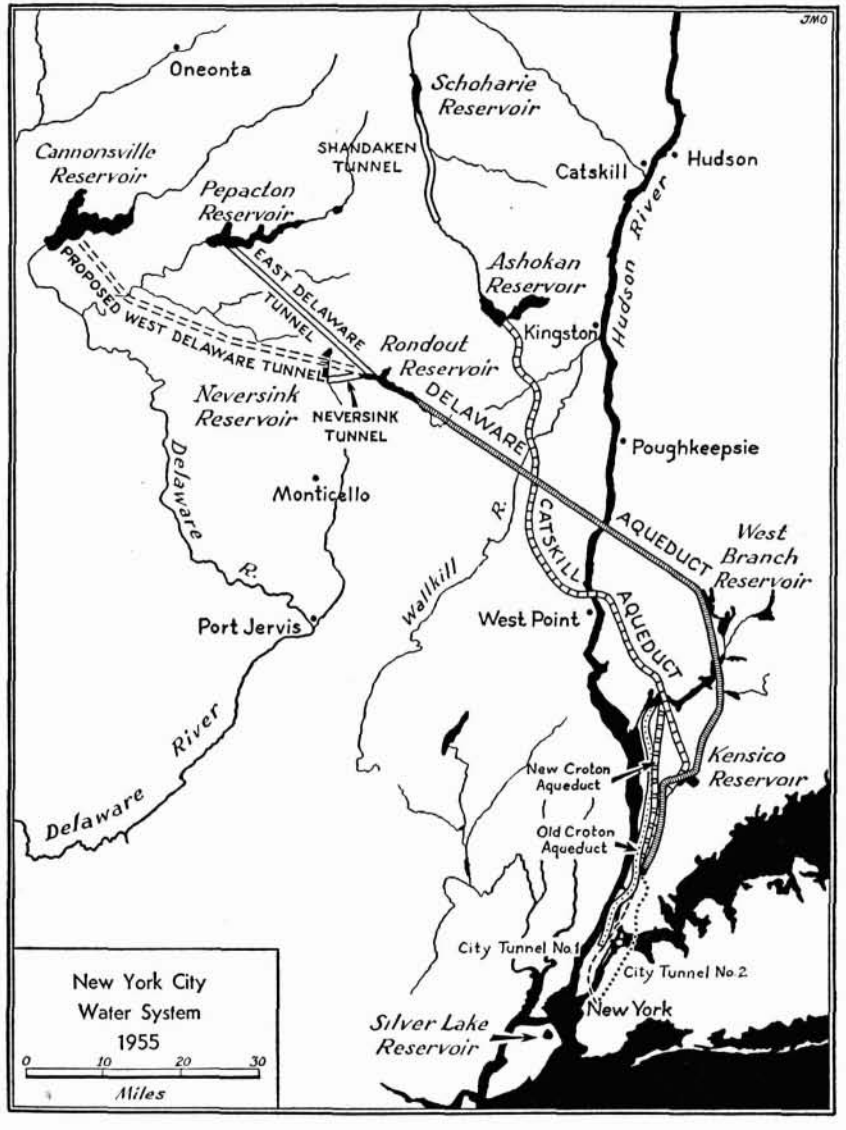
with dry ice sprayed from airplanes and sending up silver iodide smoke from the ground.[70] Dr. Howell claimed that these measures increased the rainfall by about 14 per cent,[71] and residents in the Catskills took the rainmaking campaign seriously enough to sue the city for one and one-half million dollars for water damages caused by "violent and torrential precipitation of rain."[72] Whether by act of God or man, enough rain fell during 1950 to restore the reservoirs to a safe level, and the water crisis finally eased.[73]

The escape from serious trouble had been a close thing, however, and the city was compelled to give anxious consideration to its future needs. As necessary insurance while the Delaware Aqueduct was being completed, a pumping station was constructed on the Hudson River between Beacon and Poughkeepsie capable of providing a supplementary supply of 100 million gallons a day in case of a major water emergency.[74] Meanwhile the new permanent works were being pushed toward completion. These were characteristically bold. The Delaware Aqueduct was 85 miles long and ran from 300 to 1,000 feet below the general level of the ground. At one point it passed 2,500 feet under the crest of a mountain ridge.[75] The various reservoirs were completed in stages, thus adding gradually to the city's supplies. When finally finished in 1955, the new works were calculated to increase the safe yield of the municipal system to about 1,500 million gallons a day.[76]

But even this labor of Hercules would not long satisfy the city and the rapidly growing suburbs. "By 1965," warned the Board of Water Supply, "we should have an additional supply ready, if the City is to avoid a possibility of being behind again."[77] The Board recommended that new works, capable of providing some 360 million gallons, should be built at Cannonsville, New York, on the West Branch of the Delaware. Some local critics opposed this proposal on the grounds of expense and claimed that the city could obtain a safe supply by filtering the water of the Hudson. But the water authorities argued that the policy of relying upon pure upland sources, a policy laid down when New York first decided to go to the Croton, should be firmly maintained.[78] By the end of 1952 Mayor Impellitteri had definitely committed the city to the Cannonsville project.[79]

Serious obstacles stood in the way, however. To increase its diversion of the Delaware water from 440 million gallons a day to 800 million, the state of New York would have to get the Supreme Court to amend its 1931 decree. But what would the authorities of New Jersey, Pennsylvania, and Delaware have to say about this?

Perhaps fearful lest in quarreling among themselves they might invite Federal intervention and the establishment of a northeastern TVA, the



four states concerned had agreed in 1936 to establish an Interstate Commission on the Delaware River Basin. This commission, popularly known as "Incodel," had merely advisory powers. It was to study problems like stream pollution, soil and forest conservation, recreational development, and water supply, and make its recommendations to the various state governments for necessary legislation and administrative action.[80]

Depression and war delayed the initiation of any major Incodel projects, but after 1945 the need for regional planning became urgent. Not only were Philadelphia and New York City setting up conflicting claims to the water of the Delaware, but many other places were concerned in the problem. In northern New Jersey there was a cluster of cities, including Newark, Jersey City, Passaic, Paterson, and others, with an aggregate water consumption exceeding that of Philadelphia. Consumption was already running ahead of dependable supply in this area, and once again the Delaware River seemed to offer the most inviting source for additional stores. Elsewhere in the state, Trenton and Camden were using increasing quantities of water for new industries and also needed to plan for the future.[81]

In 1949, the legislatures of New York, New Jersey, and Pennsylvania directed Incodel to have surveys and studies made and to report on the feasibility of an integrated water supply project. The engineers employed for this purpose made a preliminary report in January, 1950, recommending a bold plan of action. The Delaware, it was believed, could be made to deliver enough water to satisfy all the many claims upon it. The key to the problem was to regulate the river's flow so that surplus water was not allowed to pour out to sea during the spring months, leaving an inadequate flow later in the year. To store the spring flood water, the Cannonsville reservoir should be built on the West Branch of the upper Delaware and a second reservoir should be provided below the junction of the West and East Branches at Barryville, New York. Still a third storage reservoir, the Godeffroy, should be built on the Neversink River, one of the tributaries of the upper Delaware. A diversion tunnel would connect the Barryville and Godeffroy Reservoirs, and a 65-mile pressure tunnel would deliver from 400 to 500 million gallons a day to augment the water supplies of both New York City and the cities of northern New Jersey. Notwithstanding jealous fears to the contrary, these works on the upper Delaware would not rob water from Philadelphia, Trenton, and Camden. On the contrary, by releasing water during the late summer and fall the storage reservoirs would serve to maintain a better flow in the river and bring many benefits.

In addition to the works described above, known as Stage One, the Incodel plan included a Stage Two, which had as its objectives the provision of water supplies for Philadelphia and the cities of southern New Jersey and also more water for New York City and the northern New Jersey cities. Once again three reservoirs were proposed. One would be a large storage reservoir at Fishs Eddy on the East Branch of the Delaware; the second would be the Wallpack Bend Reservoir proposed by the Philadelphia water commission in 1946; the third would be a reservoir

on Flat Brook, a tributary entering the Delaware below Wallpack Bend, to regulate still further the flow of the lower Delaware.[82] The engineers promised that completion of these two stages of development would "provide for all the foreseeable water supply needs of New York, the north and south metropolitan districts of New Jersey, and Philadelphia into the twenty-first century."[83]

The subsequent progress of the Incodel project was slow. The plan was formally presented to the four state governments concerned in January, 1951.[84] The New Jersey and Delaware legislatures promptly passed legislation approving the project in principle and authorizing participation in a permanent interstate commission to make detailed studies and carry out the plan if it appeared sound. But Governor Fine and the legislature of Pennsylvania gave a cold reception to the proposal. By appointing a special committee to investigate the matter, the Pennsylvania government postponed action for two years.[85]

The New York State government pursued two lines of action. It gave its general approval to the Incodel plan and provided for participation in the proposed interstate commission.[86] At the same time, however, it argued that New York City's needs were so urgent that it could not wait for Pennsylvania to make up its mind about the Incodel plan. The state Attorney-General initiated proceedings to obtain Supreme Court permission for immediate further diversion of the water of the upper Delaware.[87] The New Jersey government agreed not to contest the case, and legislation was passed to permit the state of New York to withdraw 800 million gallons a day from the Delaware, on condition that the latter promise to maintain a daily flow in the river of 1,150 million gallons.[88]

Pennsylvania continued to make difficulties. In 1953, the special committee appointed to investigate the Incodel plan returned an adverse report. The benefits to accrue to Philadelphia and other Pennsylvania communities were held to be too doubtful to justify the heavy expenditures that would be involved.[89] In the city of Philadelphia much opposition to the Incodel plan had developed on the grounds that diversion of the water on the upper Delaware would lower the river at Philadelphia and cause higher tides with injurious effects on the piers.[90] In June, 1954, the United States Supreme Court handed down a ruling, supporting New York's right to divert 800 million gallons a day after the completion of the Cannonsville Reservoir, but providing various safeguards to protect the interests of New Jersey and Pennsylvania.[91]

Across the continent another metropolitan area had been growing with phenomenal rapidity. Los Angeles, a city of only 102,000 inhabitants in 1900, had rocketed up to 1,970,000 by 1950. For such a municipality to maintain an adequate water supply in arid southern Cali-

fornia demanded bold action. In 1900, the community was still supplied from the Los Angeles River and various nearby wells and underground galleries. In 1904, a reconnaissance for new sources located a large supply in the Owens River on the eastern slopes of the Sierra Nevadas. The great Los Angeles Aqueduct, 233 miles long, began to supply the city with Owens water in 1913. At first the supply was so abundant that much of the water could be used for irrigation in the fertile San Fernando Valley.

This water surplus provided the principal impetus in Los Angeles' phenomenal expansion between 1915 and 1927 when over 250 square miles of adjoining territory were annexed. For many small suburbs the easiest way to meet local water needs was to accept union with the metropolis. Other cities in the area, however, resented what they regarded as the imperialism of their booming neighbor and undertook to preserve their independence by developing their own water sources, largely in the form of driven wells.

In the early 1920's all southern California was threatened by a water crisis. The combined needs of irrigation and domestic supply were draining local sources at an alarming rate, which could be measured by the rapidly falling underground water level. Several years of drought served to accentuate the shortage. Although the situation was more serious in the surrounding district than in Los Angeles itself, that city was also faced by serious perplexities. The attempt to divert more water from the Owens River was being opposed even to the point of violence by residents of the watershed.[92]

It was this situation, together with the need for irrigation and hydroelectric power throughout the Southwest, that led to the great Hoover Dam project. This massive structure, completed in 1936, brought the wild Colorado River under control, storing its flood waters, clearing them of silt, and generating vast quantities of electricity. About 150 miles to the south of Hoover Dam, a second barrier, the Parker Dam, was thrown across the Colorado to create Lake Havasu. From this reservoir the 242-mile main line of the Colorado River Aqueduct was built to convey water to Lake Mathews, a distributing reservoir on the coastal plain. This aqueduct, completed in 1941, was a masterful piece of engineering, which spanned the deserts and pierced the intervening mountains. Electricity from Hoover Dam was employed to pump the water over elevations more than 1,300 feet higher than the intake of the aqueduct.

To administer this new water supply the Metropolitan Water District of Southern California was organized in 1928. By 1950, this had grown to include Los Angeles, San Diego, Long Beach, Pasadena, and a score of

smaller places. The total population of the district was about 4,000,000 and the area was 1,600 square miles—one and one-half times the area of Rhode Island. Distribution lines from Lake Mathews to these various communities increased the total length of the Colorado River Aqueduct to 392 miles, making it the largest single system in the world. Meanwhile, the city of Los Angeles had tapped still additional sources by extending its earlier water works to the Mono Basin, over 100 miles north of the Owens River. The Los Angeles Aqueduct now stretched a distance of 350 miles.[93]

Impressive though they were, these mighty public works did not guarantee enough water to meet all future needs for this rapidly-growing area. Water politics in the West were more fiercely contested than in the East. Rival factions argued the relative priority of water for irrigation and water for domestic use. One district in California competed with another, while Arizona, eager to make the desert bloom, loudly asserted its claim to more Colorado River water. Engineers surveyed distant mountain streams for new sources, and water experts gravely debated the feasibility of desalting sea water, or reclaiming sewage, or milking rain from the clouds.[94]

The situation in the West gives dramatic emphasis to a fact that developments in the East have been demonstrating in a less sensational way. Water is one of the most previous natural resources—more valuable than gold or uranium because life itself depends upon it. And the water resources of the nation are running dangerously low. Paul Baumann, a Los Angeles engineer, told the American Chemical Society in 1953:

> In 1950 consumption of potable water in the United States reached an estimated level of 170 billion gallons a day, or some fifty-eight cubic miles per year. During the same period the usable volume of water produced by rainfall was only about fifty cubic miles.
>
> This means that the water consumed in 1950 was 116 per cent of the water produced, and this means our national water resources account was overdrawn. . . .[95]

No one with faith in the problem-solving genius of modern science doubts that a solution will be found—perhaps through drawing upon the great storage reservoirs provided in the oceans, perhaps by some other marvel of engineering. But the history of the urban water supply problem suggests that something else will be necessary. Science can solve the technical problems, but will municipal statesmanship show itself capable of intelligent planning? And will citizens, harassed by threats of foreign war and domestic conspiracy, retain enough time and patience to consider problems more prosaic, perhaps, but no less vital to their future welfare?

NOTES

CHAPTER ONE. PERILS OF THE CITY

1. Charles Brockden Brown, *Arthur Mervyn; or Memoirs of the Year 1793* (Philadelphia: David McKay, 1887), I, 154.

2. Noah Webster, Jr., comp., *A Collection of Papers on the Subject of Bilious Fevers* (New York: Hopkins, Webb & Co., 1796), p. 208.

3. Philadelphia City Council Minutes, 1789-1793, Mss. in Historical Society of Pennsylvania, p. 236.

4. *The Writings of Benjamin Franklin,* collected and edited with a Life and Introduction by Albert Henry Smyth (New York: Macmillan Co., 1907), X, 506.

5. *Return of the Whole Number of Persons within the Several Districts of the United States* (Philadelphia: Childe & Swaine, 1791), pp. 23, 37, 47, 90. The figures for Charleston, not given in the above, are taken from *The Seventh Census of the United States: 1850* (Washington: Robert Armstrong, 1853), p. lii.

6. Carl Bridenbaugh, *Cities in the Wilderness: The First Century of Urban Life in America, 1625-1742* (New York: Ronald Press, 1938), p. 210; O. T. Barck, Jr., *New York During the War for Independence* (New York: Columbia University Press, 1931), pp. 79-81; J. Thomas Scharf and Thompson Westcott, *History of Philadelphia, 1609-1884* (Philadelphia: L. H. Everts & Co., 1884), I, 467.

7. J. H. Powell, *Bring Out Your Dead: The Great Plague of Yellow Fever in Philadelphia in 1793* (Philadelphia: University of Pennsylvania Press, 1949) gives a vivid description. Important contemporary accounts are Mathew Carey, *A Short Account of the Malignant Fever, Lately Prevalent in Philadelphia* (4th ed., Philadelphia: Mathew Carey, 1794) and Benjamin Rush, *An Account of the Bilious Remitting Fever, As It Appeared in the City of Philadelphia, in the Year 1793* (Philadelphia: Thomas Dobson, 1794).

8. William Currie, *A Sketch of the Rise and Progress of the Yellow Fever, and of the Proceedings of the Board of Health in Philadelphia, in the Year 1799* (Philadelphia: Budd & Burtram, 1800), p. 55.

9. Powell, *Bring Out Your Dead,* pp. 76-84.

10. Thomas Condie and Richard Folwell, *History of the Pestilence, Commonly Called Yellow Fever, Which Almost Desolated Philadelphia, in . . . 1798* (Philadelphia: R. Folwell, n. d.), pp. 27-28.

11. Academy of Medicine of Philadelphia, *Proofs of the Origin of Yellow Fever in Philadelphia & Kensington, in the Year 1797, from Domestic Exhalation* (Philadelphia: Thomas & Samuel F. Bradford, 1798), p. 5.

12. Brown, *Arthur Mervyn,* I, 161.

13. Condie and Folwell, *History of the Pestilence,* p. 27. Professor Richard Shryock has pointed out that this controversy reflects the revival of the classical thesis that epidemics could be largely ascribed to local conditions ("airs and waters") as opposed to the medieval belief that epidemics were caused by contagion.

14. College of Physicians of Philadelphia, *Facts and Observations Relative to the Nature and Origin of the Pestilent Fever, Which Prevailed in This City, in 1793, 1797, and 1798* (Philadelphia: Thomas Dobson, 1798), pp. 24-26.

15. Academy of Medicine, *Proofs of the Origin of Yellow Fever,* pp. 10-11.

16. Howard A. Kelly, *Walter Reed and Yellow Fever* (3rd ed., Baltimore: Norman, Reddington Co., 1923), pp. 179-180.

17. Webster, *Collection of Papers on Bilious Fever,* p. 76.

18. *Ibid.,* p. 38n.

19. Condie and Folwell, *History of the Pestilence,* p. 28.

20. *Ibid.,* p. 7.

21. Richard Folwell, *Short History of the Yellow Fever, That Broke Out in the City of Philadelphia, in July, 1797* (2nd ed., Philadelphia: R. Folwell, 1798), pp. 15-16.

22. *Claypoole's American Daily Advertiser,* Aug. 10, 1798.

23. Currie, *Sketch of the Rise and Progress of the Yellow Fever,* p. 77.

24. Webster, *Collection of Papers on Bilious Fever,* p. iv.

25. Powell, *Bring Out Your Dead,* p. 22.

26. *Report of a Committee of the Select Council of Philadelphia, Read November 10th, 1796* (Philadelphia: Zachariah Poulson, Jr., 1796), pp. 8-9.

27. William Currie, *Memoirs of the Yellow Fever, Which Prevailed in Philadelphia, and Other Parts of the United States of America . . . in 1798* (Philadelphia: John Bioren, 1798), p. 3.

28. *Ibid.,* pp. 18, 35.

29. Webster, *Collection of Papers on Bilious Fever,* p. 29.

30. Joseph Browne, "Memoir of the Utility and Means of Furnishing the City with Water from the River Bronx" (1798), in *Report of the Committee on Fire and Water Relative to Introducing Water into the City of New-York,* Documents of the Board of Aldermen and Board of Assistants, No. 61 (1831), p. 266.

31. *Ibid.,* p. 267.

32. Sevier to Rush, June 26, 1800, Mss. Correspondence of Dr. Benjamin Rush, in Library Company of Philadelphia, Ridgway Branch.

33. See, for example, B. Henry Latrobe, *View of the Practicability and Means of Supplying the City of Philadelphia with Wholesome Water* (Philadelphia: Zachariah Poulson, Jr., 1799), p. 18.

34. Currie, *Memoirs of the Yellow Fever,* p. 108.

35. *Claypoole's American Daily Advertiser,* Jan. 8, 1799.

36. Benjamin Henry Latrobe, *The Journal of Latrobe: Being the Notes and Sketches of an Architect, Naturalist and Traveler in the United States from 1796 to 1820* (New York: D. Appleton & Co., 1905), pp. 93-98.

37. *Aurora,* May 3, 1799.

38. William T. Howard, *Public Health Administration and the Natural History of Disease in Baltimore, Maryland, 1797-1920* (Washington: Carnegie Institution of Washington, 1924), p. 124.

39. *Pennsylvania Gazette,* Aug. 1, 1787.

40. Edward Wegmann, *The Water Supply of the City of New York, 1658-1895* (New York: John Wiley & Sons, 1896), p. 3.

41. Nathaniel B. Shurtleff, *A Topographical and Historical Description of Boston* (Boston: City Council, 1871), p. 396.

42. *Records of the City of Baltimore (Special Commissioners) 1782 to 1797,* issued by Wilbur F. Coyle, City Librarian (Baltimore, 1909), p. 99.

43. *Report of Committee of Select Council, November 10, 1796,* pp. 9-10.

44. Peter Kalm, *Travels in North America,* revised and edited by Adolph B. Benson, (New York: Wilson-Erickson, 1937), I, 26.

45. *Moreau de St. Méry's American Journey 1793-1798,* revised and edited by Kenneth Roberts and Anna M. Roberts (Garden City, N. Y.: Doubleday & Co., 1947), pp. 262-3, 343.

46. *Minutes of the Common Council of the City of New York, 1784-1831* (New York, 1917), V, 433.

47. Kalm, *Travels,* I, 133.

48. "New York," in Jedidiah Morse, comp., *The American Gazeteer* (Boston: S. Hall and Thomas & Andrews, 1797).

49. *Moreau de St. Méry's American Journey,* p. 147.

50. Sidney I. Pomerantz, *New York: An American City 1783-1803: A Study of Urban Life* (New York: Columbia University Press, 1938), p. 278.

51. So estimated by Clemens Herschel, an engineer, in his translation of *The Two Books on the Water Supply of the City of Rome of Sextus Frontinus* (Boston: Dana Estes & Co., 1899), pp. 239-240. Much larger estimates—some as high as 400,000,000 gallons daily—have been made by other, less qualified, students of the Roman aqueducts.

52. Loammi Baldwin, *Report on Introducing Pure Water Into the City of Boston* (2nd ed., Boston: Hilliard, Gray & Co., 1835), pp. 15-16.

53. Shurtleff, *Topographical and Historical Description of Boston,* pp. 399-403.

54. M. N. Baker, ed., *The Manual of American Water-Works* (New York: Engineering News, 1889), p. 171.

55. Isaac Weld, Jr., *Travels through the States of North America, and the Provinces of Upper and Lower Canada, during the Years, 1795, 1796, and 1797* (London: John Stockdale, 1800), II, 363.

56. Elkanah Watson, *Men and Times of the Revolution; or the Memoirs of Elkanah Watson* . . . (New York: Dana and Company, 1857), p. 294.

57. Baker, *Manual of American Water-Works,* p. 74.

58. I. N. Phelps Stokes, *The Iconography of Manhattan Island, 1498-1909* (New York: Robert H. Dodd, 1915-1928), IV, 860; Pomerantz, *New York: An American City 1783-1803,* pp. 279-280.

59. Isaac Bangs, "New York in 1776," *Historical Magazine,* XIV (Dec., 1886), 305-6.

60. Pomerantz, p. 280.

CHAPTER TWO. THE INGENUITY OF BENJAMIN LATROBE

1. *Poulson's American Daily Advertiser,* Jan. 29, 1801.

2. *An Historical Account of the Rise, Progress and Present State of the Canal Navigation in Pennsylvania* . . . (Philadelphia: Zachariah Poulson, Jr., 1795), p. 64.

3. *Dunlap's Daily Advertiser,* April 21, 1792.

4. *Ibid.,* May 26, 1792.

5. *Claypoole's American Daily Advertiser,* Dec. 29, 1798; *Report of the President & Managers of the Union Canal Company of Pennsylvania* (Philadelphia: John Bioren, 1818), p. 6.

6. Duke de la Rochefoucault-Liancourt, *Travels through the United States of America, the Country of the Iroquois, and Upper Canada, in the Years 1795, 1796, and 1797* (2nd ed., London: R. Phillips, 1800), I, 28-30.

7. *Historical Account of the Rise, Progress and Present State of the Canal Navigation,* p. 79.

8. *Claypoole's American Daily Advertiser,* Dec. 29, 1798.

9. *Aurora,* Dec. 11, 1797.

10. Thompson Westcott, "History of Philadelphia, 1609-1829," as printed in the *Sunday Dispatch.* Extra illustrated and extended to thirty-two volumes by David McNeeley Stauffer and presented by him to The Historical Society of Pennsylvania, 1913 (hereafter cited as Stauffer Collection), vol. III, chap. cccxxxii.

11. *Report of the Joint Committee of the Select and Common Councils, on the Subject of Bringing Water to the City, January 31st, 1798* (Philadelphia: Zachariah Poulson, Jr., 1798), pp. 9-10.

12. *Ibid.,* p. 4.

13. *Ibid.,* pp. 3-7; *Report of the Register-General of the State of the Finances for the Year 1797* (Philadelphia: Zachariah Poulson, Jr., 1798), p. 7.

14. *Journal of the Senate of the Commonwealth of Pennsylvania,* VIII, 216 (March 22, 1798).

15. *Report to the Select and Common Councils on the Progress and State of the Water Works, on the 24th of November, 1799* (Philadelphia: Zachariah Poulson, Jr., 1799), p. 6; *Claypoole's American Daily Advertiser,* Dec. 5, 1798.

16. *Claypoole's American Daily Advertiser,* Dec. 1, 1798.

17. *Ibid.,* Dec. 18, 1798.

18. *Ibid.,* Dec. 25, 1798.

19. *Ibid.,* Dec. 8, 1798.

20. *Aurora,* Dec. 13, 1798.

21. *Journal of the First Session of the Ninth House of Representatives of the Commonwealth of Pennsylvania* (Philadelphia: Hall & Sellers, 1799), 44 (Dec. 15, 1798). *Journal of the Senate,* IX, 23, 26, 36 (Dec. 11, 12, 18, 1798).

22. *Ibid.,* IX, 41 (Dec. 21, 1798); *Journal of the House of Representatives,* 1798/9, 63 (Dec. 22, 1798).

23. *Claypoole's American Daily Advertiser,* Dec. 29, 1798.

24. *Ibid.,* Jan. 11, 1799.

25. Fiske Kimball, "Benjamin Henry Latrobe," *Dictionary of American Biography* (New York: Scribner's, 1928-37), XI, 20-25.

26. B. Henry Latrobe, *View of the Practicability and Means of Supplying the City of Philadelphia with Wholesome Water in a Letter to John Miller, Esquire, December 29th, 1798* (Philadelphia: Zachariah Poulson, Jr., 1799), p. 4.

27. *Ibid.,* p. 5.

28. *Ibid.,* p. 15.

29. *Idem.*

30. *Ibid.,* p. 18.

31. *Ibid.,* p. 19.

32. *Report to the Select and Common Councils on the Progress and State of the Water Works, on the 24th of November, 1799* (Philadelphia: Zachariah Poulson, Jr., 1799), pp. 6-7.

33. Benjamin H. Latrobe, Journal, Mss. in Maryland Historical Society, XVI, 35 (Sept. 17, 1799).

34. *Address of the Committee of the Delaware and Schuylkill Canal Company, to the Committees of the Senate and House of Representatives on the Memorial of Said Company* (Philadelphia: John Ormrod, 1799), p. 28.

35. B. Henry Latrobe, *Remarks on the Address of the Committee of the Delaware and Schuylkill Canal Company to the Committee of the Senate and House of Representatives* (Philadelphia: Z. Poulson, 1799), *passim.*

36. *Remarks on a Second Publication of B. Henry Latrobe, Engineer Said to be Printed by Order of the Committee of the Council; and Distributed among the Members of the Legislature,* p. 2.

37. Horace Wemyss Smith, *Life and Correspondence of Rev. William Smith, D.D.* (Philadelphia: Ferguson Bros. & Co., 1880), II, 410.

38. Latrobe, Journal, XVI, 48 (March 1, 1800).

39. H. S. Starr, "William Smith," *Dictionary of American Biography,* XVIII, 353-357.

40. *Journal of the Senate,* IX, 68-69 (Jan. 12, 1799).

41. *Aurora,* Feb. 12, 1799.

42. *Idem.*

43. *Ibid.,* Feb. 9 & 12, 1799.

44. *Ibid.,* Feb. 12, 1799.

45. John C. Lowber, comp., *Ordinances of the Corporation of the City of Philadelphia* (Philadelphia: Moses Thomas, 1812), pp. 160-163.

46. *Claypoole's American Daily Advertiser,* Feb. 11, 1799.

47. *Aurora,* March 6, 1799; *Report on the Progress and State of the Water Works on the 24th of November, 1799,* p. 9.

48. Benjamin H. Latrobe, *An Answer to the Joint Committee of the Select and Common Councils of Philadelphia on the Subject of a Plan for Supplying the City with Water,* March 2, 1799, p. 4.

49. *Ibid.,* p. 7.

50. *Report on the Progress and State of the Water Works on the 24th of November, 1799,* pp. 9-10.

51. *Journal of the Senate,* IX, 136.

52. *Ibid.,* IX, 151 (Feb. 20, 1799).

53. *Ibid.,* IX, 185, 187-188, 190.

54. *Ibid.,* IX, 219.

55. *Ibid.,* IX, 318.

56. *Report of the Committee Appointed by the Common Council to Enquire into the State of the Water Works* (Philadelphia: William Duane, 1802), pp. 36-44.

57. *Ibid.,* pp. 21-36.

58. Scharf and Westcott, *History of Philadelphia,* I, 500-501; *Report on the Progress and State of the Water Works on the 24th of November, 1799,* pp. 16, 32.

59. *Report on the Progress and State of the Water Works,* pp. 16-17.

60. *Ibid.,* pp. 17-18.

61. *Ibid.,* pp. 18-21.

62. Lowber, *Ordinances,* pp. 164-5; *Claypoole's American Daily Advertiser,* Aug. 9, 1799.

63. *Report on Progress and State of the Water Works,* p. 23.

64. *Ibid.,* p. 22.

65. Latrobe, Journal, XVI, 36 (Sept. 17, 1799).

66. Latrobe to Rev. Wm. Dubourg, Nov. 12, 1809, Latrobe Letter Books in possession of Mrs. F. C. Latrobe II, Baltimore, Md.

67. H. Drinker, Jr. to T. P. Cope, Dec. 20, 1799, Thomas P. Cope Papers, 1775-1867, Historical Society of Pennsylvania.

68. *Report of the Committee for the Introduction of Wholesome Water into the City of Philadelphia* (Philadelphia: Zachariah Poulson, Jr., 1801), pp. 13-15.

69. *Poulson's American Daily Advertiser,* Jan. 29, 1801.

70. "History of the Water Supply of Philadelphia," in Department for Supplying the City with Water, *Annual Report of the Chief Engineer of the Water Department of Philadelphia for the Year 1875* (Philadelphia: E. C. Markley & Son, 1876), pp. 14-15.

71. *Ibid.,* p. 15.

72. Oliver W. Larkin, *Art and Life in America* (New York: Rinehart & Co., 1949), pp. 93, 102.

73. *Report of the Committee Appointed by the Common Council, to Enquire into the State of the Water Works,* p. 13.

74. *Report of the Joint Committee, Appointed by the Select and Common Council for the Purpose of Superintending and Directing the Water Works* (Philadelphia: Robert Cochran, 1802), p. 23.

75. Stauffer Collection, vol. IV, chap. ccccxxvii.

76. Joseph Parker Norris to Charles Thomson, Jan. 7, 1801, Autograph Collection of Simon Gratz, Historical Society of Pennsylvania.

77. John F. Watson, *Annals of Philadelphia and Pennsylvania, in the Olden Time* . . . (Philadelphia: Carey and Hart, 1845), II, 457.

78. Lowber, *Ordinances,* pp. 160-163.

79. J. Vaughan to Committee of Distribution, Dec. 21, 1804; Matthew Carey to Watering Committee, Aug. 7, 1805; John S. Robins to W. Ker, Dec. 16, 1808. All in the mss. collection of The Library Company of Philadelphia, Ridgway Branch.

80. *Report of the Watering Committee to the Select & Common Councils, November 7, 1811* (Philadelphia: Jane Aitken, 1811), p. 14.

81. *Ibid.,* p. 5.

82. *Report of the Joint Committee, appointed for the Purpose of Superintending and Directing the Water Works,* pp. 76-81; Stauffer Collection, vol. IV, chap. ccccxxviii.

83. *Report of the Watering Committee to the Select and Common Councils, November 1, 1804* (Philadelphia: Robert Cochran, 1804), p. 44.

84. Stauffer Collection, vol. IV, chap. ccccxxvii.

85. Frederick Graff, *Notes of Steam Engines in the United States about Year 1801, and a Description of Those in Use at the Water Works of the City of Philadelphia* (Philadelphia, 1876), pp. 3-5.

86. F. Graff to his wife, March 6, 1807, Mrs. Charles Graff Collection, Historical Society of Pennsylvania.

87. *Ibid.,* Feb. 25, 1807.

88. *Report of the Watering Committee to the Select & Common Councils, November 13th, 1806* (Philadelphia: Jane Aiken, 1806), p. 3.

89. *Report of the Watering Committee to the Select & Common Councils, October 7th, 1805* (Philadelphia: William M'Corkle, 1805), p. 19.

90. B. H. Latrobe to Sam'l H. Smith, Sept. 22, 1809, Latrobe Letter Books.

91. B. H. Latrobe to Richard Peters, Feb. 14, 1807, *ibid.*

92. B. H. Latrobe to Thomas Jefferson, Oct. 2, 1803, *ibid.*

93. B. H. Latrobe to Rev. Wm. Dubourg, Nov. 12, 1809, *ibid.*

94. *Report of the Joint Committee, to Whom Was Referred the Memorial and Remonstrance of Nicholas J. Roosevelt* [Philadelphia? 1805?] pp. 1-3.

95. B. H. Latrobe to N. I. Roosevelt, Aug. 13, 1804, Latrobe Letter Books.

96. *Aurora,* Sept. 24, 1805.

97. B. H. Latrobe to N. I. Roosevelt, Sept. 24, 1805, Latrobe Letter Books.

98. *United States Gazette,* Sept. 27, 1805; *Aurora,* Sept. 28, 1805.

99. B. H. Latrobe to N. I. Roosevelt, Aug. 21, 1805, Latrobe Letter Books.

100. *Report of the Watering Committee, Nov. 13, 1806,* pp. 3, 6.

101. *Annual Report of the Chief Engineer of the Water Department of Philadelphia for 1875,* p. 18.

102. "Autobiography of John Davis, 1770-1864," *Maryland Historical Magazine,* XXX (March, 1935), 11-39.

103. B. H. Latrobe to Wm. L. Smith, March 21, 1804, Latrobe Letter Books.

104. *Maryland Hist. Mag.,* XXX, 17-18.

105. Lowber, *Ordinances,* pp. 225-227 (April 1, 1809).

106. *Report of the Watering Committee, Nov. 13, 1806,* p. 5.

107. *Report of the Watering Committee to the Select & Common Councils, November 13, 1807* (Philadelphia: Jane Aitken, 1807), p. 5.

108. Lowber, *Ordinances,* pp. 225-7.

109. Charles William Janson, *The Stranger in America* (London: James Cundee, 1807), p. 187.

110. *Report of the Watering Committee to the Select & Common Councils, November 1, 1803* (Philadelphia: William Duane, 1803), p. 4.

111. Lowber, *Ordinances,* pp. 196-197 (March 15, 1806).

112. Clipping dated 1809 in collections of Historical Society of Pennsylvania.

113. James Melish, *Travels in the United States of America in the Years 1806 & 1807, and 1809, 1810 & 1811* . . . (Philadelphia: Thomas & George Palmer, 1812), I, 157-8.

CHAPTER THREE.

THE STRANGE BIRTH OF THE MANHATTAN COMPANY

1. *Minutes of the Common Council of the City of New York, 1784-1831* (New York, 1917), I, 129.

2. *Ibid.,* 194.

3. *Ibid.,* 198.

4. *Ibid.,* 213-4.

5. *Ibid.,* 354.

6. *Ibid.,* I, 426.

7. *Ibid.,* II, 63, 135, 137.

8. *Ibid.,* II, 212, 225, 307, 314.

9. *Ibid.,* II, 347.

10. Stokes, *Iconography of Manhattan Island,* V, 1356.

11. *Ibid.,* V, 1798.

12. *Idem.*

13. Quoted in *Claypoole's American Daily Advertiser, Dec. 20, 1798*

14. Browne, "Memoir . . ." in *Report of the Committee on Fire and Water Relative to Introducing Water into the City of New York, December 28, 1831,* Document No. 61, p. 271.

15. *Ibid.,* pp. 265-280.

16. *Minutes of Common Council, 1784-1831,* II, 486.
17. Stokes, *Iconography,* V, 1361 (Jan. 16, 18, 1799).
18. *Min. Com. Coun.,* II, 497-8.
19. Stokes, *Iconography,* V, 1361.
20. *Min. Com. Coun.,* II, 509-10.
21. *Ibid.,* II, 527; *Report of William Weston, Esquire, on the Practicability of Introducing the Water of the River Bronx into the City of New York* (New York: John Furman, 1799), *passim.*
22. *Min. Com. Coun.,* II, 514.
23. *Ibid.,* II, 517.
24. *Ibid.,* II, 518-9.
25. *Ibid.,* II, 520.
26. *Journal of the Assembly of the State of New York,* 22 Sess., pp. 261-3.
27. *Journal of the Senate,* 22 Sess., pp. 109, 118.
28. *Laws of the State of New York,* 22 Sess., chap. lxxxiv, pp. 810-7.
29. *Ibid.,* p. 816.
30. Matthew L. Davis, *Memoirs of Aaron Burr* (New York: Harper & Bros., 1837), pp. 415-6.
31. *The Spectator,* May 1, 1799.
32. *New York Commercial Advertiser,* May 4, 1799.
33. Davis, *Memoirs of Aaron Burr,* p. 411-7.
34. *New York Commercial Advertiser,* May 1, 1799.
35. Troup to King, April 19, 1799, Rufus King Papers, New York Historical Society.
36. Troup to King, June 5, 1799, *ibid.*
37. *New York Commercial Advertiser,* April 23, 1797.
38. *Min. Com. Coun.,* II, 535 (April 22, 1799).
39. *Spectator,* May 4, 1799.
40. *New York Commercial Advertiser,* May 22, 23, 1799.
41. *Ibid.,* June 8, 1799.
42. *Ibid.,* May 22, 1799.
43. *Idem.*
44. *Background for Tomorrow: An Historical Sketch of the Bank of the Manhattan Company* (New York [n. d.]), p. 12.
45. *New York Commercial Advertiser,* April 19, 1799.
46. *Report of Committee Directed to Report to the Corporation of the Manhattan Company the Best Mode of Procuring a Supply of Water . . .* [New York, 1799], p. 37.
47. *Ibid.,* p. 28.
48. *Ibid.,* p. 12.
49. *Ibid.,* pp. 12-17.
50. *Ibid.,* p. 20.
51. *Ibid.,* pp. 3-10.

52. *New York Commercial Advertiser,* May 22, 1799.
53. *Min. Com. Coun.,* II, 543.
54. Quoted in Stokes, *Iconography,* V, 1370.
55. *A Short Account of the Manhattan Company's Early Operations in Water Supply,* reprinted from the remarks of J. Stewart Baker, Chairman, at Directors' Dinner, June 5, 1951, pp. 2-5.
56. *Greenleaf's New York Journal,* Nov. 16, 1799, quoted in Stokes, *Iconography,* V, 1371.
57. Stokes, V, 1373.
58. *Ibid.,* V, 1378.
59. *Short Account of the Manhattan Company's Early Operations in Water Supply,* p. 4.
60. *Ibid.,* pp. 5-7.
61. Stokes, *Iconography,* V, 1411.
62. *Min. Com. Coun.,* II, 586, 610, 641.
63. *Ibid.,* III, 6.
64. *Ibid.,* III, 400.
65. *Ibid.,* III, 591; *New York Evening Post,* June 17, 1830.
66. *Ibid.,* III, 107.
67. *Ibid.,* III, 583.
68. John Melish, *Travels in the United States of America. In the Years 1806 & 1807, and 1809, 1810, & 1811 . . .* (Philadelphia: Thomas & George Palmer, 1812), I, 61.
69. *Short Account of the Manhattan Company's Early Operations in Water Supply,* pp. 7-8.
70. *Min. Com. Coun.,* IV, 614.
71. *Ibid.,* III, 583.
72. *Ibid.,* III, 606, 622, 626.

CHAPTER FOUR. RISE OF THE PRIVATE WATER COMPANIES

1. Joseph S. Davis, *Essays in the Earlier History of American Corporations* (Cambridge: Harvard University Press, 1917), II, 24, 250.
2. Journal of the House of Representatives, Mss. in Massachusetts State Library, XV, 105.
3. Davis, *Earlier History of American Corporations,* II, 250-1; Samuel G. Griffin, *A History of the Town of Keene* (Keene, N. H., 1904), pp. 285, 297, 658; Thomas C. Amory, *Life of James Sullivan: With Selections from His Writings* (Boston: Phillips, Sampson & Co., 1859), I, 374.
4. Francis S. Drake, *The Town of Roxbury* (Roxbury: Francis S. Drake, 1878), pp. 404-5; Amory, *Sullivan,* I, 373-4.
5. Amory, *Sullivan,* I, 374; Registry Department of the City of Boston, *Boston Town Records, 1784-1796* (Boston: Municipal Printing Office, 1903), p. 382.

6. *Private and Special Statutes of the Commonwealth of Massachusetts* (Boston: Manning & Loring, 1805), II, 19-21.

7. *Idem.*

8. *Ibid.*, II, 76.

9. *E.g. Columbian Centinel,* May 11, 1796, April 8, 1797, Sept. 13, 1797.

10. Nathan Bond to Loammi Baldwin, July 23, 1795, Miscellaneous Mss., Massachusetts Historical Society; Davis, *Earlier History of American Corporations,* II, 251.

11. Griffin, *History of Keene,* p. 302.

12. *Columbian Centinel,* Nov. 25, 1795.

13. *Ibid.*, Feb. 13, 1796.

14. *Ibid.*, July 2, 1796.

15. *Ibid.*, Oct. 15, 1796.

16. *Ibid.*, Aug. 1, 1796.

17. *Ibid.*, Dec. 21, 1799.

18. *Private and Special Statutes,* III, 226-7.

19. L. M. Sargent, *Boston Aqueduct and the City of Boston* [Boston, 1849], p. 7; Jamaica Pond Aqueduct Corporation, Stock Assignment and Transfer Book, 1798-1844, Mss. in Boston Public Library, *passim.*

20. Edward A. Kendall, *Travels through the Northern Parts of the United States, in the Years 1807 and 1808* (New York: I. Riley, 1809), II, 259.

21. Charles Shaw, *A Topographical and Historical Description of Boston* (Boston: Oliver Spear, 1817), pp. 300-1.

22. *Report of the Committee on Water on Purchase of Jamaica Pond Aqueduct by the City,* Dec. 14, 1848, Boston City Document No. 44, p. 5.

23. *Private and Special Statutes,* II, 13-15 (Feb. 25, 1795).

24. In 1796: Greenfield, Richmond, Stockbridge, Williamstown; in 1797: Hallowell, Lancaster, Plymouth, Northfield, Salem and Danvers, Wilbraham; in 1798: Wrentham, Springfield, Amesbury Ferry, Hopkinton, *Private and Special Statutes,* II, *passim.*

25. *Laws of the Commonwealth of Massachusetts* (Boston: Manning & Loring, 1801), II, 843-7.

26. *Private and Special Statutes,* II, 86, 221.

27. *Return of the Whole Number of Persons within the Several Districts of the United States . . .* (Philadelphia: *Childs and Swaine,* 1791), pp. 23-32.

28. Davis, *Earlier History of American Corporations,* II, 254.

29. *Ibid.*, II, 252; M. W. Baker, ed., *The Manual of American Water-Works,* 1st Annual Issue 1888 (New York: Engineering News, 1889), p. 54.

30. *Claypoole's American Daily Advertiser,* Dec. 26, 1798

31. Davis, II, 253. The Morris Aqueduct Company had a particularly long history. Reorganized in 1868, the company continued to supply Morristown, until its properties were finally sold to the town in 1923. Memorandum prepared for the author by Nelson S. Butera, Superintendent of Water, Morristown, N. J.

32. Memorandum prepared for author by Warren A. Gentner, Deputy Manager and Chief Engineer, Water Bureau, Hartford, Conn.

33. Davis, II, 343.

34. *General Index to the Laws of the State of New York, 1777-1901* (Albany: J. B. Lyon Co., 1902), I, 284-5.

35. *Laws of Maryland,* 1792, chap. 11, Transcripts in possession of Mr. K. H. Schamberger, Senior Associate Engineer, Bureau of Water Supply, Baltimore, Maryland—cited hereafter as S. T. (Schamberger Transcripts).

36. *Ordinances of the Corporation of the City of Baltimore* (Baltimore, Warner & Hanna, 1801), pp. 75-76.

37. S. T.

38. *Idem.*

39. *Federal Gazette,* Feb. 14, 1799 (S. T.).

40. *Ordinances of Baltimore* (1801), pp. 223-6.

41. *Ibid.*, p. 219. A sum of $4,381.70 was raised through this device.

42. Message of Mayor James Calhoun, June 10, 1799, Mss. in Baltimore Museum (S. T.).

43. Baltimore Mss., 1799-213 (S. T.).

44. *Ordinances of Baltimore* (1801), p. 247.

45. *Laws of Maryland,* 1800, chap. 77 (S. T.).

46. Journal of 2nd Branch, Feb. 9, 1801, Mss. in Baltimore City Hall (S. T.).

47. Journal of 1st Branch, Feb. 14, 1803 (S. T.).

48. *Ordinances of the Corporation of the City of Baltimore, Passed at Their February Session, 1803* (Baltimore: Warner & Hanna, 1803), pp. 132-4.

49. Commissioners' Report, Baltimore Archives, 1804-132 (S. T.).

50. Journal of 1st Branch, Feb. 23, 1804 (S. T.).

51. *Federal Gazette,* April 27, 1804.

52. *Ibid.*, May 3, 1804.

53. *Ibid.*, May 5, 1804.

54. *Ibid.*, May 7-10, 1804.

55. *Ibid,* May 9, 1804.

56. *Ibid.*, May 24, 1804.

57. *Memorial of the Water Company, to the City Council of Baltimore, January 18, 1830* [Baltimore, 1830], pp. 3-4.

58. "Autobiography of John Davis," *Maryland Historical Magazine,* XXX (1935), 15-16; William T. Howard, *Public Health Administration and the Natural History of Disease in Baltimore, Maryland 1797-1920* (Washington: Carnegie Institution of Washington, 1924), p. 126.

59. *Moreau de St. Méry's American Journey,* p. 79.

60. *Laws of Maryland, November Session, 1801,* chap. 86.

61. Baltimore Archives, 1805-290 (S. T.).

62. *Ibid.*, 1805-291 (S. T.).

63. *Ordinances of Baltimore,* 1806, pp. 276-7.

64. *Laws of Maryland, November Session, 1805,* chap. 44.

65. *Laws of Maryland, November Session, 1808,* chap. 79.

66. *Federal Gazette,* Jan. 13, 1807, April 9, 1807. (S. T.).

67. *Annual Report of the Water Department of the City of Baltimore . . . January 1, 1863* (Baltimore: James Young, 1863), p. 17.

68. *Memorial of the Water Company . . . January 18, 1830,* p. 6.

69. *Baltimore Archives,* 1809-512 (S. T.).

70. City Register Records, Bureau of Archives (S. T.).

71. Journal of 1st Branch, Feb. 11, 1811 (S. T.).

CHAPTER FIVE. IMPROVEMENTS AT PHILADELPHIA

1. Etting Collection, Historical Society of Pennsylvania.

2. "Autobiography of John Davis, 1770-1864," *Maryland Historical Magazine,* XXX (1935), 21.

3. *Report of the Watering Committee to the Select & Common Councils, November 5th, 1812* (Philadelphia: Jane Aitkin, 1812), pp. 1-2.

4. *Ibid.,* pp. 7-19.

5. *Ibid.,* p. 3.

6. *Ibid.,* p. 4.

7. *Annual Report of the Watering Committee, for the Year 1852* (Philadelphia, 1853), p. 27.

8. *Aurora,* Aug. 13, 1812.

9. *Ibid.,* Nov. 5, 1812.

10. Graff, *Notes of Steam Engines,* pp. 5-6.

11. *Report of the Watering Committee to the Select & Common Councils. Read January 25, 1816* (Philadelphia: William Fry, 1816), p. 3.

12. *Ibid.,* p. 4.

13. Graff, *Notes of Steam Engines,* p. 6.

14. *Annual Report of the Watering Committee for 1852,* p. 45; *Annual Report of the Chief Engineer for 1875,* p. 20.

15. Graff, *Notes of Steam Engines,* p. 6.

16. *Report of the Watering Committee, Read in Select Council, November 12, 1818* (Philadelphia: William Fry, 1822), pp. 3-5.

17. *Ibid.,* pp. 6-7.

18. *Ibid.,* pp. 4-5.

19. *Report of the Watering Committee to the Select & Common Councils. Read February 10, 1820* (Philadelphia: Lydia R. Bailey, 1820), pp. 3-4.

20. Scharf and Westcott, *History of Philadelphia,* I, 597.

21. *Report of the Watering Committee to the Select & Common Councils. Read January 18, 1821* (Philadelphia: Lydia R. Bailey, 1821), p. 3.

22. *Annual Report of the Watering Committee for 1852,* p. 45.

23. *Annual Report of the Watering Committee for the Year 1848* (Philadelphia, 1849), p. 6.

24. Charles G. Paleske, *Observations on the Application for a Law to Incorporate "The Union Canal Company"* (Philadelphia: Duane, Printer, 1808), p. 9.

25. *Acts of the General Assembly of the Commonwealth of Pennsylvania,* 1810/11 Session, chap. cxxxvi.

26. *Report of the President & Managers of the Union Canal Company of Pennsylvania* (Philadelphia: John Bioren, 1818), p. 6; *Register of Pennsylvania,* I (June, 1828), 411.

27. *Laws of Pennsylvania,* 1814/15 Session, chap. lxii.

28. *Philadelphia Gazette,* Jan. 8, 1830.

29. *Report of the Watering Committee of the Agreements with the Schuylkill Navigation Company and White and Gillingham Relating to the Water Power of the River Schuylkill* (Philadelphia: W. Fry, 1819), pp. 7-14.

30. *Ibid.,* pp. 19-20.

31. *An Additional Report on Water Power by the Watering Committee* (Philadelphia: William Fry, 1819), p. 5. See also *Report of the Watering Committee on the Subject of Obtaining Water Power from the River Schuylkill* (Philadelphia: Lydia R. Bailey, 1820). pp. 5-7.

32. *The Union,* April 12, 1819.

33. *Philadelphia Gazette,* Jan. 8, 1830.

34. *Report of the Watering Committee on the Propriety of Raising the Dam at Fairmount* (Philadelphia: Lydia R. Bailey, 1820), pp. 3-6.

35. *Report of the Watering Committee to the Select and Common Councils. Read January 24, 1822* (Philadelphia: Lydia R. Bailey, 1822), pp. 3-4.

36. *Report of the Watering Committee . . . January 9, 1823* (Philadelphia: Lydia R. Bailey, 1823), pp. 1-6. The water-works buildings now house the Philadelphia Aquarium.

37. *Ibid.,* pp. 5-7.

38. *Report of the Watering Committee . . . January 8, 1824* (Philadelphia: Lydia A. Bailey, 1824), p. 8.

39. *Ibid.,* pp. 9-10.

40. Scharf and Westcott, *History of Philadelphia,* I, 617.

41. *Ibid.,* pp. 614, 617.

42. *Report of the Watering Committee . . . January 23, 1834* (Philadelphia: Lydia R. Bailey, 1834), p. 5.

43. *Annual Report of the Watering Committee to the Commissioners of the District of Spring Garden, January 22, 1827* (Philadelphia: Jacob Frick & Co., 1827), *passim.*

44. *Report of the Watering Committee . . . January 12, 1832* (Philadelphia: Lydia R. Bailey, 1832), p. 3.

45. *Annual Report of the Watering Committee for the Year 1836 . . . to Which are Prefixed, the Report for the Year 1822, and an Extract from the Report for 1823* (Philadelphia: L. R. Bailey, 1837), p. 19.

46. *Ibid.,* p. 37.

47. *Ibid.,* pp. 41, 47.

48. *Ibid.*, p. 20.

49. J. S. Lewis, Observations upon Stoning in Front of the Dam, Read before Watering Committee, Aug. 6, 1823, Etting Collection Historical Society of Pennsylvania.

50. *Report of the Watering Committee . . . Relative to the Dam at Fair Mount, Read and Adopted September 25, 1828* (Philadelphia: Lydia R. Bailey, 1828), pp. 3-7.

51. *Philadelphia Gazette*, Sept. 25, 1828.

52. *Report of the President and Managers of the Schuylkill Navigation Company, to the Stockholders, January 2, 1826* (Philadelphia: Lydia R. Bailey, 1826).

53. *Communication of Joseph S. Lewis, Chairman of the Watering Committee to the Select and Common Councils, April 7, 1824*, p. 2.

54. *The Water Works, The Misconduct of the Present City Councils in Relation to the Fairmount Water Works . . .* (Philadelphia, September, 1833), p. 4.

55. *Ibid.*, p. 5.

56. *Idem.*

57. *Opinion of Counsel, on the Right of the Schuylkill Navigation Company to Make Another Lock and Canal for the Use of the Navigation at the Fair Mount Dam* (Philadelphia: James Kay, Jun. & Co., 1833), pp. 3-19.

58. *Correspondence of the Watering Committee with the Schuylkill Navigation Company, in Relation to the Fair Mount Water Works* (Philadelphia: Lydia R. Bailey, 1833), pp. 41-42.

59. *Ibid.*, pp. 44-45.

60. *The Water Works*, p. 7.

61. *Correspondence of the Watering Committee with the Schuylkill Navigation Company*, p. 45.

62. *Ibid.*, p. 47.

63. *Ibid.*, p. 39.

64. *The Water Works*, p. 7.

65. *Report of the Watering Committee . . . January 23, 1834* (Philadelphia: Lydia R. Bailey, 1834), p. 6.

66. *Annual Report of the Watering Committee . . . January 20, 1842* (Philadelphia: L. R. Bailey, 1842), p. 7.

67. *Journal of the House of Representatives*, 1828/29 Session, p. 44.

68. Frederick Graff to his wife, Feb. 1, 1829, Mrs. Charles Graff Collection.

69. Graff to his wife, Feb. 3, 1829, *ibid.*

70. *Laws of Pennsylvania*, 1828/29 Session, no. 33.

71. *Ibid.*, no. 172.

72. *Report of the Watering Committee to the Select and Common Councils of Philadelphia, Relative to the Termination of the Columbia and Philadelphia Rail Road* (Philadelphia: Lydia R. Bailey, 1830), pp. 15-16.

73. *Ibid.*, p. 13.

74. *Ibid.*, p. 14.

75. H. S. Sprachman to F. Graff, Jan. 22, 1835; Sprachman to Graff, Feb. 24, 1838, Autograph Collection of Simon Gratz; *Journal of House of Representatives*, 1837/38 Session, I, 341, 495.

76. *Journals of the Select & Common Councils of the City of Philadelphia, 1835-1854* (Philadelphia, 1836-1854), *Journal of Select Council*, 1842/3, p. 58; *Journal of Common Council*, 1842/3, p. 66.

77. *Reports of the Watering Committee, Made June 22, 1843* (Philadelphia: J. Crissey, 1843), p. 8.

78. *Ibid.*, p. 9.

79. *Opinions of Messrs. Meredith & Binney As to the Right of the Corporation of the City of Philadelphia to the Use of the Water and Water Power of the River Schuylkill at Fair Mount Dam, March, 1843* (Philadelphia: J. Crissey, 1843), p. 6.

80. *Ibid.*, p. 7.

81. *Laws of Pennsylvania*, 1843 Session, no. 147.

82. *Reports of the Watering Committee, Made June 22, 1843*, p. 4.

83. *Ibid.*, pp. 4-5.

84. *Journal of Select Council*, 1842/3, pp. 135-136.

85. *Journal of Common Council*, 1842/3, pp. 21-22.

86. *Ibid.*, 1843/4, Appendix, pp. 28-30.

87. *Journal of Select Council*, 1843/4, p. 58.

88. *Journal of Common Council*, 1843/4, Appendix, p. 56.

89. *Report of the Water Commissioners to the Boards of Commissioners of the Districts of Northern Liberties & Spring Garden, December 14, 1843*, pp. 3-12.

90. *Report of the Joint Watering Committee of Northern Liberties & Spring Garden Water Works* (Philadelphia: Barrett & Jones, 1846), pp. 4-5.

91. *Journal of Select Council*, 1843/4, Appendix, p. 131.

92. *Ibid.*, 1844/5, Appendix, pp. 110-117.

93. *Ibid.*, p. 105.

94. Mayor of Philadelphia v Commissioners of Spring Garden, *Pennsylvania State Reports*, VII, 363.

95. *Ibid.*, p. 364.

96. *Ibid.*, p. 365.

97. Scharf and Westcott, *History of Philadelphia*, I, 689.

98. *Journal of Select Councils*, 1848/9, Appendix, pp. 16-18.

99. *Ibid.*, p. 38.

100. *Compendium of the Enumeration of the Inhabitants . . . from the Sixth Census* (Washington: Thomas Allen, 1841), p. 26; De Bow, *Statistical View of the United States . . . Being a Compendium of the Seventh Census* (Washington: A. O. P. Nicholson, 1854), p. 375.

101. Frederick Graff, *Report to the Watering Committee of the City Councils*, February 20, 1851, p. 2.

102. *Journal of Select Council*, 1851/2, Appendix, pp. 4-5.

103. Frederick Graff, *Report to the Watering Committee of the City Councils,* December 4, 1850, p. 3.

104. Scharf and Westcott, *History of Philadelphia,* I, 685.

CHAPTER SIX. NEW YORK WRESTLES WITH THE WATER PROBLEM

1. *Report of the Committee on Fire and Water Relative to Introducing Water into the City of New-York, December 28, 1831,* Doc. No. 61, pp. 2-3.

2. Nathan Schachner, *Aaron Burr: A Biography* (New York: Frederick A. Stokes Co., 1937), p. 220; Dorothy Bobbé, *De Witt Clinton* (New York: Minton, Balch & Co., 1933), pp. 88-91, 104.

3. *Min. Com. Coun.,* III, 447-8.

4. Stokes, *Iconography,* V, 1428.

5. *Min. Com. Coun.,* III, 648.

6. Undated memorandum in De Witt Clinton Letter Books, Columbia University Library, XVI, 247-8.

7. *Min. Com. Coun.,* III, 594-5.

8. Minutes of a meeting of the directors of the Manhattan Company, December 24, 1804, in Wynant Van Zandt Papers, New York Public Library.

9. *Min. Com. Coun.,* IV, 686.

10. *Ibid.,* IV, 715-6.

11. *New York Evening Post,* Jan. 26, 1808.

12. *Min. Com. Coun.,* IV, 716.

13. *Ibid.,* IV, 732.

14. *Ibid.,* IV, 733.

15. *New York Evening Post,* Jan. 26, 1808.

16. Stokes, *Iconography,* V, 1485.

17. Jabez D. Hammond, *The History of Political Parties in the State of New-York* (Albany: C. Van Benthuysen, 1842), I, 262.

18. *New York Evening Post,* Feb. 17, 1808.

19. *Min. Com. Coun.,* V, 24.

20. De Witt Clinton Letter Books, XVI, 400-1.

21. Memorandum in Henry Remsen Papers, New York Public Library.

22. De Witt Clinton Papers, New York Public Library.

23. *Journal of the Assembly: 1808,* 286-7.

24. Clinton to Remsen, March 21, 1808, De Witt Clinton Papers, New York Public Library.

25. *Laws of the State of New York: 1808,* chap. lxxxviii.

26. Clinton to Remsen, March 21, 1808, De Witt Clinton Papers, New York Public Library.

27. Stokes, *Iconography,* V, 1450.

28. *Ibid.,* V, 1494.

29. *Ibid.,* V, 1505.

30. *Ibid.,* V, 1507.

31. *Ibid.,* V, 1535.

32. *Ibid.,* V, 1543.

33. *Idem.*

34. *Min. Com. Coun.,* VI, 48.

35. *Ibid.,* VI, 60.

36. Gustavus Myers, *The History of Tammany Hall* (New York: Boni & Liveright, 1917), pp. 29-42.

37. *Remarks of Mr. Dibblee in Common Council, on discussing the following Resolution offered by Alderman Stevens . . .* [New York? 1831?], p. 31.

38. Clinton to Remsen, Nov. 22, 1813, De Witt Clinton Letter Books, XVII, 136; Bobbé, *De Witt Clinton,* p. 206.

39. *Min. Com. Coun.,* VII, 653.

40. *Laws of New York: 1817,* chap. xxv.

41. *Min. Com. Coun.,* XVII, 723.

42. *Ibid.,* VIII, 464-5.

43. *Ibid.,* X, 503.

44. *Ibid.,* XI, 15.

45. De Bow, *Statistical View of the United States . . .,* p. 192.

46. Charles Z. Lincoln, ed., *Messages from the Governors . . .* (Albany: J. B. Lyon Co., 1909), II, 1017.

47. "The Memoirs of Stephen Allen (1787-1852)," ed. with Introduction and Notes by John C. Travis, one of his Great-Grandsons, New York, 1927, typescript in New York Public Library, pp. 1-80.

48. *Min. Com. Coun.,* XII, 168-9.

49. *Ibid.,* XII, 309-311.

50. *Ibid.,* XII, 560, "Memoir of Stephen Allen," pp. 98-9.

51. Allen to J. S. Lewis, March 13, 1823, Stephen Allen Letter Books, New-York Historical Society.

52. *Min. Com. Coun.,* XII, 766.

53. *Ibid.,* XII, 771.

54. Allen to Edwards, Feb. 23, 1823, Stephen Allen Letter Books.

55. *Laws of the State of New York: 1823,* chap. cxc.

56. Allen to Alex M. Muir, Feb. 17, 1824, Stephen Allen Letter Books.

57. *Report of the Committee on Fire and Water Relative to Introducing Water in the City of New York, December 28, 1831* [New York, 1831], pp. 50-2.

58. *Ibid.,* pp. 17-40.

59. *Journal of the Assembly: 1824,* p. 730.

60. *Ibid.,* p. 844 (March 22, 1824).

61. *Certificates Relative to Manhattan Water in New York* [New York? 1824?], pp. 1-2.

62. *Messages from the Governors,* II, 87-8.

63. *Journal of the Senate: 1825,* pp. 131, 606.

64. Stokes, *Iconography,* V, 1638.

65. Remsen to Clinton, Feb. 10, 1825, De Witt Clinton Papers, Columbia University Library, XIII, 18.

66. *Idem.*

67. *Idem.*

68. Clinton to Remsen, March 10, 1825, De Witt Clinton Letter Books, XXI, 426.

69. *Remarks on the Remonstrance, Purporting to Be From A Committee of the Directors of the Manhattan Company, Against the Bill Incorporating the New-York Water Works Company* [New York? 1825?], pp. 2-3.

70. *Min. Com. Coun.,* XIV, 288.

71. *Ibid.,* XIV, 326-7.

72. *Ibid.,* XIV, 351.

73. *New York Evening Post,* March 15, 1825.

74. *Ibid.,* April 20, 1825.

75. *Ibid.,* June 20, 1825.

76. *Ibid.,* Nov. 26, 1825.

77. *Ibid.,* Nov. 28, 1825.

78. *Ibid.,* Nov. 29, 1825.

79. *Ibid.,* Dec. 14, 1825.

80. *Ibid.,* Dec. 16, 1825.

81. *Report of the Committee on Fire and Water . . . December 28, 1831,* pp. 53-75.

82. *New York Evening Post,* Jan. 9, 1826.

83. *Journal of the Assembly: 1826,* pp. 744-5.

84. *New York Evening Post,* Jan. 28, 1826.

85. *Ibid.,* Jan. 27, 1826.

86. *Journal of the Senate: 1826,* p. 51.

87. "Report From the Select Committee, on the Petition of the President and Directors of the New-York Water Works Company, February 25, 1826," *Assembly Document No. 146 (1826),* p. 2.

88. *New York Evening Post,* July 15, 1826.

89. *Ibid.,* Aug. 11, 1826; Stokes, *Iconography,* V, 1661.

90. *Laws of New York: 1826,* chap. ccxc.

91. Stokes, *Iconography,* V, 1622.

92. *New York Evening Post,* March 28, 1825.

93. *An Essay on the Art of Boring the Earth for the Obtainment of a Spontaneous Flow of Waters* (New Brunswick: Rutgers Press, 1826), p. 45.

94. *Ibid.,* p. 19.

95. *Min. Com. Coun.,* XVI, 117, 434; Harman C. Westervelt, "Early Struggles for Pure Drinking Water," Mss. in New York Public Library.

96. Stokes, *Iconography,* III, 635.

CHAPTER SEVEN. THE GREAT CROTON PROJECT

1. "Report of the Commissioners appointed, pursuant to a Law passed by the Legislature, on the 2d of May, 1834, in relation to supplying the City of New-York with pure and wholesome water, February 16, 1835," *Board of Aldermen Document No. 44,* p. 331.

2. "Report of the Committee on Fire and Water, to whom was referred the Report of the Water Commissioners . . . March 4, 1835," *Bd. Ald. Doc. No. 45,* p. 527.

3. *New York Commercial Advertiser,* March 25, 26, 27, 1845.

4. "Semi-Annual Report of the Water Commissioners, August 8, 1842," *Bd. Ald. Doc. No. 9,* pp. 86-7.

5. Stephen Allen, "Miscellaneous Papers on Various Subjects, No. 3," Mss. in New-York Historical Society, pp. 2-4.

6. "Report of the Commissioners under an Act of the Legislature Passed February 26th, 1833, relative to supplying the City of New-York with Pure and Wholesome Water, November 12, 1833," *Bd. Ald. Doc. No. 36,* p. 370.

7. Stokes, *Iconography,* V, 1677.

8. *Min. Com. Coun.,* XVII, 521.

9. *Ibid.,* XVII, 539-540.

10. *Ibid.,* XVII, 561.

11. *Ibid.,* XVII, 570.

12. *Ibid.,* XVII, 725.

13. "Semi-Annual Report of the Water Commissioners, August 8, 1842," *Bd. Ald., Doc. No. 9,* pp. 86-7.

14. *New York Evening Post,* April 20, 1830; Stokes, *Iconography,* V, 1691.

15. *Min. Com. Coun.,* XVIII, 375.

16. *Ibid.,* XVIII, 466.

17. *Ibid.,* XVIII, 604.

18. *Journal of the Senate: 1830,* pp. 198, 378.

19. *New York Evening Post,* June 17, 1830.

20. Undated clipping in Stephen Allen Scrap Book, New-York Historical Society.

21. *Idem.*

22. John L. Wendell, comp., *Reports of Cases Argued and Determined in the Supreme Court of Judicature and in the Court for the Correction of Errors of the State of New-York* (Albany, 1829-1842), IX, 352.

23. *Min. Com. Coun.,* XIX, 459.

24. *New York Evening Post,* Feb. 15, 18, 1831.

25. *Communication from the Committee of the Lyceum of Natural History of the City of New-York in Answer to an Enquiry from Mr. Townsend on the Source, Quality and Purity of the Water on this Island, February 22, 1831* [New York, 1831], p. 3.

26. *Ibid.,* p. 9.

27. *Ibid.*, p. 10.

28. *New York Evening Post,* Feb. 18, 1831.

29. *Remarks of Mr. Dibblee in Common Council, on discussing the following resolution offered by Alderman Stevens . . .* [New York, 1831], p. 36.

30. *Ibid.*, p. 51.

31. *Min. Com. Coun.*, XIX, 520-2.

32. *Journal of the Assembly: 1831,* p. 437.

33. Committee on Fire and Water, *Report to the Board of Aldermen, Relative to Introducing into the City of New-York a Supply of Pure and Wholesome Water, December 28, 1831* [New York, 1831], pp. 2-3.

34. *Ibid.*, pp. 12-13.

35. *Proceedings of the Board of Aldermen* (New York, 1835-1899), II, 84; *Proceedings of the Board of Assistants* (New York, 1837-1853), I, 325.

36. *Journal of the Assembly: 1832,* p. 320.

37. *New York Evening Post,* May 19, 1845.

38. *Ibid.,* May 22, 1845.

39. *Ibid.,* Jan. 3, 1832.

40. *Ibid.,* June 15, 1832.

41. *Ibid.,* June 21-22, 1832.

42. *Ibid.,* June 22-23, 1832.

43. *Ibid.,* June 18, 1832.

44. *Ibid.,* July 20, 1832.

45. *Ibid.,* July 5, 1832.

46. J. S. Chambers, *The Conquest of Cholera, America's Greatest Scourge* (New York: Macmillan, 1938), pp. 64-7.

47. *New York Evening Post,* Aug. 6, 1832.

48. *Ibid.,* July 17, 1832.

49. *Ibid.,* July 23, 1832.

50. Chambers, *Conquest of Cholera,* pp. 190-1.

51. *New York Evening Post,* Aug. 9, 1832.

52. Chambers *Conquest of Cholera,* p. 76.

53. *Ibid.,* p. 43.

54. James B. Murray, *The Origin of the Croton Aqueduct in the City of New York* (New York: Chas. W. Baker, 1857), p. 11.

55. *New York Commercial Advertiser,* March 25, 1845.

56. *Proc. Bd. of Ald.,* III, 268.

57. *New York Commercial Advertiser,* March 18, 1945; Murray, *Origin of the Croton Aqueduct,* pp. 12-13.

58. "Report of Colonel De Witt Clinton to Committee on Fire and Water, December 22, 1832," Board of Aldermen *Doc. No. 61,* pp. 191-245.

59. Wendell, *Reports,* IX, 373-394.

60. "Timothy Dewey and William Serrell to Benjamin Wright, Nov. 29, 1832," Board of Aldermen *Doc. No. 61,* pp. 253-8; *Proc. Bd. Assists.,* II, 232.

61. *New York Evening Post,* Dec. 24, 1832.

62. *New York Commercial Advertiser,* March 26, 1845.

63. *Proc. Bd. of Ald.,* IV, 94; *Proc. Bd. Assists.,* II, 282.

64. *Laws of New York: 1833,* chap. xxvi.

65. M. Van Schaick to W. L. Marcy, May 7, 1851, William L. Marcy Papers, Library of Congress.

66. "Report of the Commissioners . . . November 12, 1833," pp. 381-406.

67. *Ibid.,* p. 376.

68. John L. Sullivan, *An Address to the Mayor, the Aldermen, and the Inhabitants of New York . . .* (New York: Clayton & Van Norden, 1833), p. 24.

69. *Communication from J. L. Sullivan to Members of the Common Council, January 7, 1834* [New York, 1834], p. 5.

70. "Report of Colonel De Witt Clinton . . .," Board of Aldermen, *Doc. No. 61,* p. 211.

71. *Proceedings of the Board of Aldermen and Assistant Aldermen and Approved by the Mayor* (New York, 1835-1854), II, 118.

72. *New York Commercial Advertiser,* March 26, 1845.

73. *Laws of New York: 1834,* chap. 256.

74. *Proc. Bd. of Ald.,* VII, 151; *Proc. Bd. Assists.,* IV, 97.

75. "Report of the Commissioners appointed, pursuant to a Law passed by the Legislature, on the 2d of May, 1834, in relation to supplying the City of New-York with pure and wholesome water, February 16, 1835," Board of Aldermen, *Doc. No. 44,* pp. 405-433.

76. *Ibid.,* pp. 475-510.

77. *Ibid.,* pp. 367-8.

78. *Ibid.,* p. 393.

79. *Ibid.,* p. 380.

80. *Ibid.,* p. 401.

81. "Report of the Committee on Fire and Water, to whom was referred the Report of the Water Commissioners . . . March 4, 1835," Board of Aldermen, *Doc. No. 45,* p. 522.

82. *Ibid.,* p. 525.

83. *Proc. Bd. of Ald.,* VIII, 272, 282.

84. *New York Evening Post,* March 17, 1835.

85. J. L. Sullivan, *Exposition of Errors in the Calculation of the Board of Water Commissioners . . .* (New York: George P. Scott & Co., 1835), p. 2.

86. M. Hale, *Spring Water Versus River Water, for Supplying the City of New-York, Containing a Compendious Examination of the Internal Supplies, the Method, and Actual Expense of Obtaining Them . . .* (New York: Marsh & Harrison, 1835), p. 43.

87. Stephen Allen, "New York Water Works-Narrative," mss. in New-York Historical Society, Book 1.

88. *New York Evening Post,* April 23, 1835.

89. *Proc. Bd. Assists.,* V, 228.

90. "Memoir of Stephen Allen," p. 156; *Proc. Bd. Assists.*, V, 240, 245.

91. "Communication from the Water Commissioners to the Common Council, August 1, 1836," Board of Aldermen, *Doc. No. 12*, pp. 63-64.

92. "Memoir of Stephen Allen," p. 156.

93. *The Diary of Philip Hone, 1828-1851*, edited with an introduction by Bayard Tuckerman (New York: Dodd, Mead and Co., 1910), I, 180.

94. *New York Herald*, Dec. 18 and 19, 1835.

95. *Ibid.*, Dec. 17. 1835.

CHAPTER EIGHT. NEW YORK BUILDS ITS AQUEDUCT

1. "Semi-Annual Report of the Water Commissioners, August 8, 1842," Board of Aldermen, *Doc. No. 9*, p. 86. These reports will hereafter be cited as follows, W. C. *Report* with appropriate dates.

2. "Communication from the Manhattan Company," *Documents of Aldermen and Assistants No. 27*, p. 150.

3. *Proceedings of the Boards of Aldermen and Assistant Aldermen and Approved by the Mayor, 1831-1889* (New York, 1835-1890), II, 117-8, 156.

4. Board of Aldermen, *Doc. No. 89* (1836), pp. 465-6.

5. "Report of Special Committee, to whom was referred the annexed Report and Resolution from the Board of Assistants, April 26, 1836," Board of Aldermen, *Doc. No. 120*, pp. 634-6.

6. "Report of Select Committee on the Memorial of Citizens of the City and County of New York, praying for an investigation in relation to the Manhattan Company, April 18, 1836," *Assembly Doc. No. 308*, p. 11.

7. *Proc. Bd. of Ald.*, XI, 387; *Proc. Bd. Assists*, IX, 197, 268; XIV, 354.

8. See *New York Morning Herald*, Feb. 12, 21, March 21, 1840.

9. Wegmann, *Water Supply of the City of New York*, p. 12 n

10. *New York Herald*, Oct. 14, 1836.

11. For Douglass's side of the controversy, see *New York Times & Star*, Oct. 30, 1840; for Allen's rebuttal, see *Morning Courier & New York Enquirer*, Nov. 12, 1840.

12. "John B. Jervis, C. E.," *American Engineer*, Nov. 1880.

13. "Communication from the Water Commissioners to the Common Council . . . January 9, 1837," Board of Assistant Aldermen, *Doc. No. 24*, p. 105.

14. Notice, dated Feb. 28, 1837, in John B. Jervis Papers, Rome (N. Y.) Public Library.

15. *New York Times & Star*, Oct. 30, 1840.

16. *Morning Courier & New York Enquirer*, Nov. 12, 1840.

17. *New York Evening Post*, Nov. 20, 1874.

18. Wegmann, *Water Supply of the City of New York*, pp. 238-240.

19. "Communication from the Water Commissioners to the Common Council, August 1, 1836," Board of Aldermen, *Doc. No. 12*, pp. 65-6.

20. *Westchester Herald*, March 7, 1837.

21. *Ibid.*, March 14, 1837.

22. W. C. *Report*, July 1, 1837, pp. 98-9.

23. Allen, "New York Water Works Narrative," Book 3.

24. W. C. *Report*, July 1, 1837, pp. 99-100.

25. "Communication of the Water Commissioners to the Common Council . . . January 9, 1837," pp. 100-101.

26. W. C. *Report*, Jan. 2, 1838, pp. 355-6.

27. *Ibid.*, July 2, 1838, p. 59.

28. *Ibid.*, pp. 57-9.

29. *New York Morning Herald*, April 13, 15, 1840.

30. Joshua Purdy to Corporation of City of New York, March 21, 1840.

31. Allen, "New York Water Works Narrative," Book 3.

32. "Memoirs of Stephen Allen," p. 155.

33. Jervis to Stephen B. Brophy, May 19, 1837, John B. Jervis Letter Books, Rome (N. Y.) Public Library.

34. W. C. *Report*, July 1, 1837, p. 94.

35. Jervis to H. T. Anthony, March 8, 1839, Jervis Letter Books.

36. Circular to Resident Engineers, July 26, 1839, *ibid.*

37. *Proc. Bd. Assist.*, XV, 366-8.

38. "Memoirs of Stephen Allen," p. 191.

39. *Idem.*

40. W. C. *Report*, July 1, 1837, pp. 95-6.

41. *Ibid.*, Jan. 2, 1838, p. 366.

42. *Ibid.*, pp. 361-2.

43. W. C. *Report*, Dec. 31, 1838, pp. 251-2.

44. *Ibid.*, Jan. 11, 1841, pp. 512-7.

45. *Ibid.*, Jan. 2, 1838, pp. 378-9.

46. Jervis to M. Delano, March 1, 1838, Jervis Letter Books.

47. Allen, "New York Water Works Narrative," Book 2.

48. *New York American*, March 15, 1838.

49. *New York Evening Post*, March 13, 1838.

50. *Ibid.*, March 29, 1838.

51. "Report of the Committee on Grievances, on the memorial of sundry inhabitants of the county of Westchester, in relation to crossing the Harlaem river with the Croton aqueduct, April 5, 1838," *Assembly Document No. 319* (1838).

52. *Laws of New York: 1838*, chap. 311.

53. Undated clipping in John B. Jervis Papers, Rome (N. Y.) Public Library.

54. Memorandum dated April 2, 1838 in Jervis Papers.

55. Committee on Roads and Canals, "Report on Carrying the Aqueduct across the Harlaem River, April 23, 1838," *Bd. Ald. Doc. No. 88*, p. 620.

56. Committee on Roads and Canals, "Minority Report on Carrying the Aqueduct across the Harlaem River, May 7, 1838," *Bd. Ald. Doc. No. 99,* pp. 632-4.

57. "Communication from the Water Commissioners to the Common Council, May 8, 1838," *Bd. Ald. Doc. No. 2,* p. 33.

58. *Proc. Bd. Ald.,* XV, 183-4.

59. *Proc. Bd. Assists.,* XII, 84-5.

60. *New York Evening Post,* Aug. 25, 1838.

61. W. C. *Report,* Dec. 31, 1838, pp. 239-240.

62. *Ibid.,* July 1, 1839, pp. 118-9.

63. *Laws of New York: 1839,* chap. 318.

64. W. C. *Report,* July 1, 1839, pp. 143-158.

65. *Ibid.,* pp. 126-7; W. C. *Report,* Jan. 2, 1840, p. 442.

66. Jervis to Colonel J. J. Abert, Dec. 29, 1838, Jervis Letter Books.

67. R. F. Jervis to J. B. Jervis, Sept. 8, 1837, Jervis Papers.

68. *New York Morning Herald,* Sept. 4, 1839.

69. "Memoirs of Stephen Allen," p. 169.

70. *Ibid.,* p. 170.

71. *New York Morning Herald,* March 31, 1840.

72. "Report of the Water Commissioners of the City of New York, April 4, 1840," *Assembly Doc. No. 289 (1840),* p. 6.

73. W. C. *Report,* Jan. 11, 1841, pp. 518-526.

74. "Supplemental Report of the Late Water Commissioners, March 25, 1840," *Bd. Ald. Doc. No. 65,* p. 645.

75. *Morning Courier and New York Enquirer,* Oct. 28, Nov. 3, 1840.

76. *Ibid.,* Nov. 12, 1840.

77. *New York American,* Nov. 10, 1840.

78. *New York Evening Post,* Nov. 20, 1874.

79. W. C. *Report,* Jan. 2, 1840, p. 462.

80. *Laws of New York: 1840,* chap. 175.

81. "Communication of the Water Commissioners in Relation to Laying Down the Distributing Pipes, May 4, 1840," *Bd. Ald. Doc. No. 72,* pp. 710-711.

82. *Proc. Bd. Assists.,* XVI, 19-20.

83. "Report of the Joint Special Committee on the Croton Aqueduct, June 29, 1840," *Bd. Ald. Doc. No. 8,* pp. 69-74.

84. *An Ordinance to Organize the Croton Aqueduct Department,* pp. 1-4.

85. "Communications of the Comptroller, the Water Commissioners, and the Croton Aqueduct Committee, etc. on the Subject of the Ordinance to Instruct the Water Commissioners," *Bd. Assists. Doc. No. 70* (October 12, 1840), pp. 251-6.

86. *Ibid.,* pp. 253-260.

87. *Ibid.,* pp. 263-8.

88. "Report of the Majority of the Special Committee, on the Subject of the Ordinance Creating the Aqueduct Department . . ., December 14, 1840," *Bd. Assists. Doc. No. 31,* pp. 101-2.

89. Edward C. Mack, *Peter Cooper, Citizen of New York* (New York: Duell, Sloan and Pearce, 1949), pp. 146-7.

90. "Communications of the Comptroller, the Water Commissioners, and the Croton Aqueduct Committee . . .," *Bd. Assists. Doc. No. 70* (1840), p. 259.

91. *Ibid.,* pp. 266-7.

92. *Communication of "S.R., J.R., J.R." to the Editors of the New York Commercial Advertiser* [New York, 1840], pp. 8-9.

93. *Laws of New York: 1841,* chap. 306.

94. W. C. *Report,* Jan. 11, 1841, pp. 533-5, 553-4.

95. *Ibid.,* pp. 535-6.

96. *Ibid.,* Jan. 17, 1842, pp. 366-7.

97. W. C. *Report,* Aug. 8, 1842, p. 82.

98. *Ibid.,* p. 84.

99. *The Diary of Philip Hone, 1828-1851,* ed. with an introduction by Bayard Tuckerman (New York: Dodd, Mead and Company, 1889), II, 137-8.

100. *Ibid.,* II, 150.

101. *Ibid.,* II, 151-2; "Memoirs of Stephen Allen," pp. 200-201.

102. *The Diary of George Templeton Strong,* ed. by Allen Nevins and Milton Halsey (New York: Macmillan, 1952), I, 188-9.

103. *Diary of Philip Hone,* II, 152.

104. *Idem.*

105. Stokes, *Iconography,* V, 1777.

106. "Memoirs of Stephen Allen," pp. 200-201.

107. *New York Plebian,* Oct. 15, 1842.

108. *Diary of George Templeton Strong,* I, 184.

109. *Ibid.,* I, 203.

110. *Ibid.,* I, 210.

111. Moses G. Leonard to J. B. Jervis, Feb. 28, 1842, Jervis Papers.

112. W. C. *Report,* Aug. 18, 1842, pp. 78-9.

113. *Ibid.,* June 30, 1845, pp. 88-93.

114. "Memoirs of Stephen Allen," p. 212.

115. W. C. *Report,* July 13, 1848, p. 101.

116. *Diary of George Templeton Strong,* I, 305.

117. W. C. *Supplemental Report,* Feb. 1, 1848, p. 577.

118. W. C. *Report,* June 20, 1849, p. 81.

119. J. B. Jervis to Philip Hone, June 30, 1849, Jervis Letter Books.

120. The most authoritative description of the Croton works is John B. Jervis, *Description of the Croton Aqueduct* (New York: Slamm & Guion, 1842). See also Charles King, *A Memoir of the Construction, Cost, and Capacity of the Croton Aqueduct . . .* (New York, 1843) and F. B. Tower, *Illustrations of the Croton Aqueduct* (New York: Wiley & Putnam, 1843).

121. T. Addison Richards, "The Croton Aqueduct," *Harper's New Monthly Magazine,* XXII (Dec., 1860), 28.

122. *Idem.*

123. Annual Report and also a Quarterly Report of the Croton Aqueduct Board, September 4, 1848," *Bd. Ald. Doc. No. 11,* pp. 161-4.

124. W. C. *Report,* Jan. 11, 1841, p. 532.

CHAPTER NINE. WATER DEBATES AT BOSTON

1. "Bostonius," *A Voice in the City; to Water Drinkers, Narrative Poem* (Boston, 1839), p. 3.

2. Josiah Quincy, *A Municipal History of Boston, during Two Centuries* (Boston: Charles C. Little and James Brown, 1852), p. 160.

3. Records of the City of Boston: Mayor and Aldermen, Boston Public Library, microfilm copy of mss., III, 116-7.

4. Quincy, *Municipal History,* pp. 160-3; *Boston News-Letter and City Record,* I (Dec. 31, 1825), 23.

5. Quincy to Lewis, April 20, 1825, Etting Collection, Historical Society of Pennsylvania.

6. Lewis to Quincy, May 20, 1825, *ibid.*

7. Records of Boston, III, 172.

8. Quincy to Lewis [n. d.], Etting Collection.

9. Lewis to Quincy, May 28, 1825, *ibid.*

10. Quincy to Lewis, June 6, 1825, *ibid.*

11. Records of Boston, III, 203-4.

12. Daniel Treadwell, *Report Made to the City of Boston, on the Subject of Supplying the Inhabitants of That City with Water* (Boston: True & Greene, 1825), *passim.*

13. Quincy to Lewis, Nov. 28, 1825, Etting Collection.

14. Graff to Lewis, Dec. 9, 1825, *ibid.*

15. Lewis to Quincy, Dec. 21, 1825, *ibid.*

16. Quincy, *Municipal History,* p. 395.

17. Warren to Quincy, Nov. 25, 1825, J. C. Warren Papers, Massachusetts Historical Society.

18. Quincy, *Municipal History,* pp. 198-9.

19. Records of Boston, V, 41.

20. *Ibid.,* V, 326.

21. Nath. J. Bradlee, *History of the Introduction of Pure Water into the City of Boston, with a Description of Its Cochituate Water Works* (Boston: Alfred Mudge & Son, 1868), p. 8.

22. Quincy, *Municipal History,* pp. 303-4.

23. Records of Boston, X, 8.

24. *Ibid.,* XI, 9.

25. *Ibid.,* XI, 54, Bradlee, *History,* p. 9.

26. Lyman to Lewis, Dec. 28, 1833, Etting Collection.

27. Lewis to Lyman, Jan. 1, 1834, *ibid.*

28. *Communication to the City Council, on the Subject of Introducing Water into the City, January 29, 1834* (Boston: J. H. Eastburn, 1834), p. 6.

29. *Ibid.,* p. 7.

30. *Ibid.,* pp. 9-12.

31. *Ibid.,* p. 21.

32. *Ibid.,* p. 28.

33. Lyman to Lewis, Feb. 28, 1834, Etting Collection.

34. Lewis to Lyman, March 8, 1834, *ibid.*

35. Records of Boston, XII, 111-112.

36. Loammi Baldwin, *Report on Introducing Pure Water into the City of Boston* (2nd ed. with additions, Boston: Hilliard, Gray & Co., 1835), p. 48.

37. *Ibid.,* p. 77.

38. *Idem.*

39. *Ibid.,* p. 49.

40. *Ibid.,* p. 58.

41. Records of Boston, XII, 314-6.

42. *Ibid.,* XIV, 4-5.

43. R. H. Eddy, *Report on the Introduction of Soft Water into the City of Boston* (Boston: John H. Eastburn, 1836), p. 4.

44. *Ibid.,* p. 9.

45. *Ibid.,* pp. 36-40.

46. "Report of the Committee Appointed to Consider and Report, upon the Subject of Introducing a Full Supply of Water . . . June 30, 1836," *Documents, Common Council, No. 7—1836,* p. 5.

47. Records of Boston, XIV, 174-5.

48. *Boston Evening Transcript,* Aug. 17, 1836.

49. *Ibid.,* Aug. 18, 1836.

50. Loammi Baldwin, *Second Report Made to a Committee of the Boston Aqueduct Corporation, January 19, 1835* (Boston: Eastburn's Press, 1835), pp. 3-12.

51. Bradlee, *History,* p. 18.

52. *Boston Evening Transcript,* Aug. 23, 1836.

53. Records of Boston, XIV, 316-9.

54. *Ibid.,* XV, 13-14.

55. *Ibid.,* XV, 22, 72-3, 91-2.

56. "Report of Committee who were appointed 'to consider and report what measures, if any, ought to be adopted to provide funds for meeting the expenditures to be incurred by the introduction of pure water . . .' May 18, 1837," *Documents, Common Council, No. 9—1837,* p. 11,

57. *Report of the Commissioners Appointed under an Order of the City Council, of March 16, 1837, to Devise a Plan for Supplying the City of Boston with Pure Water* (Boston: John H. Eastburn, 1837), p. 5.

58. *Ibid.*, pp. 30-35.

59. *Ibid.*, pp. 50-51.

60. Samuel A. Eliot, *Address of the Mayor to the City Council of Boston, January 1, 1838* (Boston: John H. Eastburn, 1838), p. 5.

61. Records of Boston, XVI, 43.

62. *Ibid.*, XVI, 49.

63. *Ibid.*, XVI, 50-51.

64. *Mr. Sargent's Communication, Feb. 21, 1838* (Printed for use of Council, March 1, 1838), p. 4.

65. *Ibid.*, pp. 7-10.

66. "A Selfish Taxpayer," *Thoughts about Water* (Boston, 1844), p. ii.

67. *Petitions and Remonstrances, For and Against Introduction of Pure and Soft Water into the City* (Printed for use of the Council, March 1, 1838), *passim.*

68. *Boston Evening Transcript,* March 9, 1838.

69. Records of Boston, XVI, 89-90.

70. *Boston Evening Transcript,* April 3, 1838.

71. H. G. Otis to Mayor, Aldermen & Common Council, April 9, 1838, Harrison Gray Otis Papers, Massachusetts Historical Society.

72. Records of Boston, XVI, 121.

73. Journal of the House of Representatives, Mss. in Massachusetts State Library, LX, 447.

74. *Ibid.*, LX, 465.

75. *Ibid.*, LX, 479, 513.

76. Records of Boston, XVI, 343-4.

77. *Ibid.*, XVI, 412-4.

78. Journal of the House of Representatives, LXI, 35, 44, 83.

79. *Ibid.*, LXI, 88.

80. *Statement of Evidence Before the Committee of the Legislature, at the Session of 1839, on the Petition of the City of Boston, for the Introduction of Pure Soft Water* (Boston: John H. Eastburn, 1839), *passim.*

81. "Report from the Standing Committee on Water . . . May 2, 1839," *City Document No. 19—1839,* p. 6.

82. *Ibid.*, pp. 6-7.

83. *Ibid.*, p. 15.

84. *Ibid.*, p. 18.

85. *Ibid.*, p. 19.

86. "Bostonius," *A Voice in the City,* pp. 17-18.

87. *Ibid.*, p. 24.

88. "Soft Water: Report of the Committee on the Introduction of Soft Water into the City, September 1839," *City Document No. 25—1839,* p. 16.

89. Bradlee, *History,* p. 41.

90. Justin Winsor, ed., *The Memorial History of Boston, Including Suffolk County Massachusetts, 1630-1880,* III, 247.

91. Bradlee, *History,* p. 41.

92. *Private and Special Statutes of Massachusetts,* VIII, 121, chap. 108 (April 6, 1839).

93. [L. M. Sargent], *Boston Aqueduct and the City of Boston* [Boston, 1849?], p. 7.

94. Records of Boston, XXI, 8.

95. "Pure Water: Report of the Committee on the Petition of James C. Odiorne and others, to convey Water into the City, February 6, 1843," *City Document No. 6—1843,* pp. 7-8.

96. *Private and Special Statutes of Massachusetts,* chap. 76 (1843), VIII, 297-300.

97. Records of Boston, XXI, 206-7.

98. *Circular inviting stock subscriptions in Spot Pond Aqueduct Co., Sept. 1, 1843, passim.*

99. *Idem.;* see also list of signers to "Petition of Spot Pond Aqueduct Company, August 5, 1845," *City Document No. 27—1845,* pp. 6-8.

100. *Historical Sketch of the Middlesex Canal, with Remarks for the Consideration of the Proprietors* (Boston: Samuel N. Dickinson, 1843), pp. 18-19.

101. *Petition for a Charter for a Charles River Aqueduct Company, February 1, 1844* [Boston, 1845?], p. 1.

102. Records of Boston, XXII, 288.

103. *Ibid.*, XXII, 297.

104. *Ibid.*, XXII, 327-9.

105. *Ibid.*, XXII, 329.

106. *Ibid.*, XXII, 344.

107. *Boston Evening Transcript,* Sept. 3, 1844.

108. "A Selfish Tax Payer," *Thoughts About Water, August 31, 1844,* p. 14.

109. *Boston Evening Transcript,* Sept. 4, 1844.

110. *Ibid.*, Sept. 5, 1844.

111. Walter Channing, *A Plea for Pure Water: Being A Letter to Henry Williams, Esq. by Walter Channing . . ., Oct. 1, 1844* [Boston, 1844], p. 4.

112. *Ibid.*, p. 5.

113. *Ibid.*, p. 7.

114. *Ibid.*, p. 9.

115. *Ibid.*, p. 24.

116. "Report of the Commissioners appointed under the Order of the City Council, August 26, 1844 to Report the Best Mode and Expense of Bringing the Water of Long Pond into the City of Boston," *City Document No. 24—1844* (Boston: John H. Eastburn, City Printer, 1844), pp. 3-5.

117. *Ibid.*, p. 14.

118. "Temperance," *Hints to the Honest Tax Payers of the City of Boston* [Boston, 1844], pp. 7-8.

119. *Boston Evening Transcript*, Nov. 27, 1844.

120. Records of Boston, XXII, 493-5.

121. *Boston Evening Transcript*, Dec. 4, 1844.

122. Records of Boston, XXII, 460-7.

123. *Boston Evening Transcript*, Dec. 7, 1844.

124. *Proceedings before a Joint Special Committee of the Massachusetts Legislature upon the Petition of the City of Boston . . .* (Boston: John H. Eastburn, 1845), pp. 125-6.

125. Records of Boston, XXII, 493-5.

126. Henry B. Rogers, *Remarks on the Present Project of the City Government for supplying the Inhabitants of Boston with Pure Soft Water* (Boston: I. N. Dickinson, 1845), p. 11.

CHAPTER TEN. THE COCHITUATE AQUEDUCT

1. *Proceedings before a Joint Special Committee of the Massachusetts Legislature upon the Petition of the City of Boston . . . February and March, 1845* (Boston: John H. Eastburn, 1845), p. 4.

2. *Ibid.*, p. 12.

3. *Ibid.*, p. 13.

4. *Ibid.*, p. 21.

5. *Ibid.*, pp. 32-3.

6. *Ibid.*, pp. 50-3.

7. *Ibid.*, pp. 38-9, 44.

8. *Ibid.*, pp. 63-6.

9. *Ibid.*, p. 67.

10. William J. Hubbard, *Argument on Behalf of Joseph Tilden and Others, Remonstrants on the Hearing of the Petition of the Mayor of the City of Boston* (Boston: T. R. Marvin, 1845), p. 52.

11. *Ibid.*, p. 57.

12. *Proceedings before Joint Committee*, p. 114.

13. *Ibid.*, p. 110.

14. Journal of the Senate, Mss. in Massachusetts State Library, LVI, 416, 453.

15. Walter Channing, *Parliamentary Sketches and Water Statistics* (Boston: Benjamin H. Greene, 1845), p. 10.

16. Journal of the House of Representatives, LXVII, Appendix, p. 14.

17. Journal of the Senate, LVI, 498, 502, 517.

18. *Proceedings before Joint Committee*, pp. 132-140.

19. Rogers, *Remarks on the Present Project of the City Government*, p. 39.

20. John H. Wilkins, *Remarks on Supplying the City of Boston with Pure Water* (Boston: Little and Brown, 1845), pp. 3-4.

21. *Letter from Lemuel Shattuck, in answer to Interrogatories of J. Preston, in Relation to the Introduction of Water into the City of Boston, March 8, 1845* (Boston: Samuel N. Dickinson, 1845), pp. 27-30.

22. *How Shall We Vote on the Water Act?* [Boston, 1845], p. 24. A note on a copy of this pamphlet in the Massachusetts Historical Society attributes authorship to "L. Shattuck."

23. *Private and Special Statutes of Massachusetts*, VIII, 500, chap. 219 (March 25, 1845).

24. *To All Who Want A Supply of Pure Water* [1845] Broadside in collections of Massachusetts Historical Society.

25. Channing, *Parliamentary Sketches and Water Statistics*, p. 14.

26. *Ibid.*, p. 28.

27. Nathan Hale, *Inquiry into the Best Mode of Supplying the City of Boston with Water for Domestic Purposes* (Boston: Eastburn's Press, 1845), p. 5.

28. *Address of the Faneuil Hall Committee, on the Project of a Supply of Pure Water for the City of Boston, May 5, 1845* [Boston, 1845], p. 18.

29. *Ibid.*, p. 32.

30. Records of Boston, XXIII, 195.

31. *Boston Evening Transcript*, May 20, 1845.

32. *Ibid.*, May 21, 1845.

33. *Ibid.*, May 23, 1845.

34. *Ibid.*, June 10, 1845.

35. Records of Boston, XXIII, 224.

36. *Boston Evening Transcript*, May 21, 1845.

37. *Ibid.*, May 26, 1845.

38. *Ibid.*, May 30, 1845.

39. *Ibid.*, May 24, 1845.

40. "Report of the Joint Standing Committee on Water, to whom was referred a communication from James C. Odiorne, George Odiorne, and Thomas Odiorne, proprietors of Spot Pond . . .," *City Documents No. 40—1845*, pp. 2-3.

41. Thomas B. Curtis to J. B. Jervis, June 23, 1845, Jervis Papers.

42. *City Document, No. 40—1845*, p. 3.

43. Henry B. Tracy to J. B. Jervis, Aug. 5, Sept. 3, Oct. 2, 1845, Jervis Papers.

44. Ch. Crocker to Jervis, Oct. 18, 1845, *ibid.*

45. Crocker to Jervis, Oct. 19, 1845, *ibid.*

46. Geo. Odiorne to Jervis, Oct. 23, 1845, *ibid.*

47. "Petition of Spot Pond Aqueduct Company, August 5, 1845," *City Document, No. 27—1845*, p. 5.

48. "Report of Special Committee to whom was referred the petition of Robert G. Shaw and ninety-nine others . . . September 8, 1845," *City Document, No. 29—1845*, p. 7.

49. *Boston Evening Transcript*, Oct. 1, 1845.

50. *Ibid.*, Oct. 15, 1845.

51. *Ibid.*, Oct. 16, Nov. 4, 1845.

52. *Ibid.*, Nov. 8, 1845.

53. *Ibid.*, Nov. 13, 1845.

54. *Ibid.*, Nov. 24, 1845.

55. *Proceedings of the Union Water Convention Concerning the Conflagration at South Boston . . .* (Boston: Eastburn's Press, 1845), pp. 3-7.

56. Records of Boston, XXIII, 462.

57. *Boston Evening Transcript,* Dec. 1, 1845.

58. *Report of the Commissioners Appointed by Authority of the City Council, to Examine the Sources from Which a Supply of Pure Water May Be Obtained for the City of Boston* (Boston: J. H. Eastburn, 1845), pp. 17, 128.

59. *Ibid.*, p. 127.

60. *Ibid.*, p. 60.

61. City Document, No. 40—1845, p. 6.

62. *Boston Evening Transcript,* Nov. 29, 1845.

63. *Boston Daily Atlas,* Nov. 24, 1845.

64. *Ibid.*, Dec. 6, 1845.

65. *Idem; Boston Advertiser and Patriot,* Dec. 8, 1845.

66. *Boston Evening Transcript,* Dec. 4, 9, 1845.

67. Records of Boston, XXIII, 532.

68. Norcross to Jervis, Feb. 10, 1846, Jervis Papers.

69. *Private and Special Statutes of Massachusetts,* VIII, 620-6, chap. 166 (March 30, 1846).

70. *Boston Daily Atlas,* April 13, 1846.

71. Records of Boston, XXIV, 188.

72. *Ibid.*, XXIV, 230.

73. "Water Commissioners' First Monthly Report, June 6, 1846," *City Document, No. 20—1846.*

74. *Boston Daily Atlas,* Aug. 21, 1846.

75. *Daily Evening Traveller,* Dec. 10, 1847; *Celebration of the Introduction of the Water of Lake Cochituate into the City of Boston, October 25, 1848* (Boston: J. H. Eastburn, 1848), pp. 39-41.

76. "Report of the Joint Standing Committee on Water on the Petition of Silas P. Barnes and Others," *City Document, No. 8—1847,* pp. 2-5.

77. *Boston Daily Atlas,* Dec. 13, 1847.

78. *Daily Evening Traveller,* Dec. 10, 1847.

79. *Ibid.*, Dec. 14, 1847.

80. *Celebration of the Introduction of the Water,* p. 24.

81. *Ibid.*, pp. 32-9.

82. *Ibid.*, pp. 4-6.

83. *Ibid.*, pp. 6-17.

84. *Ibid.*, p. 44.

85. *Ibid.*, p. 45.

86. "Report of the Water Commissioners, August 6, 1849," *City Document, No. 38—1849,* p. 5.

87. *Report of the Cochituate Water Board, to the City Council of Boston, January 15, 1852* (Boston: J. H. Eastburn, 1852), pp. 27-30; *Report of the Cochituate Water Board . . . February 1, 1855* (Boston: J. H. Eastburn, 1855), pp. 4-5.

88. [L. M. Sargent] *Boston Aqueduct and the City of Boston* [Boston, 1849], p. 12.

89. *Ibid.*, pp. 12-15.

90. *Boston Evening Transcript,* July 13, 1849.

91. *Boston Aqueduct and the City of Boston,* pp. 5-6.

92. *Ibid.*, p. 27.

93. *Ibid.*, p. 14.

94. *Ibid.*, pp. 27-8.

95. Bradlee, *History of the Introduction of Pure Water,* p. 138.

96. Records of Boston, XXIX, 220.

97. "Communication from the Water Board respecting the purchase of the Boston Aqueduct, May 15, 1851," *City Document, No. 38—1851,* pp. 3-7.

98. "Report concerning the power of the Water Board to purchase the franchise of the Jamaica Pond Aqueduct Company . . .," *City Document, No. 40—1851,* pp. 3-4.

99. "Report from the Cochituate Water Board . . . June 12, 1851," *City Document, No. 46—1851,* pp. 2-4.

100. Bradlee, *History,* p. 176; *Opening Argument of Arthur W. Austin, Esq. on Behalf of the Jamaica Pond Aqueduct Corporation* (Boston: Wright & Potter, 1867), p. 6.

CHAPTER ELEVEN.

FROM PRIVATE TO PUBLIC CONTROL IN BALTIMORE

1. Th. H. Buckler, *A History of Epidemic Cholera, As It Appeared at the Baltimore City and County Alms-House, in the Summer of 1849 . . .* (Baltimore: James Lucas, 1851), p. 44.

2. Minutes of the Frederick (Md.) Water Co., April 6, 1825. Transcript in possession of Mr. K. H. Schamberger, Senior Associate Engineer, Bureau of Water Supply, Baltimore, Md. Mr. Schamberger's transcripts will hereafter be identified by the initials S. T.

3. [John Hazlehurst Latrobe] *Picture of Baltimore, Containing a Description of All Objects of Interest in the City; and Embellished with Views of the Principal Public Buildings* (Baltimore: F. Lucas, Jr., 1832), pp. 71-2.

4. Charles Varle, *A Complete View of Baltimore, with a Statistical Sketch* (Baltimore: Samuel Young, 1833), p. 40.

5. Journal of the Proceedings of the First Branch of the City Council of Baltimore, Mss. in Baltimore City Hall, pp. 178, 180. (S. T.)

6. *Ibid.*, p. 190 (S. T.).

7. J. Thomas Scharf, *History of Baltimore City and County from the Earliest Period to the Present Day* (Philadelphia: Louis H. Everts, 1881), p. 213.

8. Proceedings of First Branch, p. 147 (S. T.).

9. Varle, *Complete View of Baltimore*, pp. 39-40.

10. Latrobe, *Picture of Baltimore*, p. 72.

11. Baltimore Archives, 1821-49 (S.T.).

12. *Ordinances of the Corporation of the City of Baltimore from 1823 to 1827, Inclusive* (Baltimore: John Cox, 1876), p. 211.

13. Latrobe, *Picture of Baltimore*, p. 75.

14. DeBow, *Statistical View of the United States*, p. 192.

15. Proceedings of Second Branch, p. 145 (S. T.).

16. *Ibid.*, p. 150, 152 (S. T.).

17. Baltimore Archives, 1828-844 (S. T.).

18. *Journal of the Proceedings of the First Branch of the City Council of Baltimore*, January Session 1829, p. 5.

19. *Report of the Water Committee to the City of Baltimore* [Baltimore, 1830], pp. 8-9.

20. Parker to Laurenson, Aug. 12, 1829, Baltimore Archives, 1829-1165 (S. T.).

21. Baltimore Archives, 1829-1174 (S. T.).

22. *Report of the Water Committee*, p. 6.

23. *Ibid.*, p. 7.

24. *Ibid.*, p. 8.

25. *Ibid.*, pp. 9-11.

26. *Ibid.*, p. 15.

27. *Memorial of the Water Company to the City Council of Baltimore, January 18, 1830*, p. 6.

28. *Ibid.*, p. 8.

29. *Idem.*

30. *Journal of First Branch*, Jan. Sess. 1830, pp. 38, 41.

31. *Journal of Second Branch*, Jan. Sess. 1830, p. 84.

32. Jones to Mayor Small, June 8, 1830, Baltimore Archives, 1830-507. (S. T.).

33. Baltimore Archives 1832-1032 (S. T.).

34. *Ibid.*, 1832-1033. (S. T.).

35. William Travis Howard, *Public Health Administration and the Natural History of Disease in Baltimore, Maryland, 1797-1920* (Washington: Carnegie Institution of Washington, 1924), p. 251.

36. Baltimore Archives, 1833-712. (S. T.).

37. *Ibid.*, 1833-712 (S. T.).

38. *Ibid.*, 1833-1181 (S. T.).

39. Howard, *Public Health Administration*, p. 253.

40. *Journal of First Branch*, Jan. Sess. 1835, pp. 7-8.

41. Baltimore Archives, 1835-731 (S. T.).

42. *Ibid.*, 1835-793 (S. T.).

43. *Ibid.*, 1835-794 (S. T.).

44. *Ibid.*, 1835-785 (S. T.).

45. *Journal of First Branch*, Jan. Sess. 1835, p. 180.

46. *Idem.*

47. *Ibid.*, p. 184.

48. *Idem.*

49. *Journal of First Branch*, Jan. Sess. 1835, pp. 200-202.

50. *Ibid.*, pp. 278-9.

51. Baltimore Archives, 1835-720 (S. T.).

52. *Journal of Second Branch*, Jan. Sess. 1835, p. 179.

53. *Journal of First Branch*, Jan. Sess. 1835, p. 350.

54. *Ibid.*, Jan. Sess. 1836, p. 437.

55. *Ibid.*, p. 438.

56. George F. De la Roche to John Randel, June 6, 1836, Mss. in Legislative Reference Library, Baltimore City Hall.

57. *Ordinances of the Mayor and City Council of Baltimore*, Jan. Sess. 1837, p. 54. (No. 47).

58. *Ibid.*, p. 68, (No. 86).

59. Howard, *Public Health Administration*, p. 126; Baltimore *Sun*, Dec. 5, 1846.

60. *Journal of First Branch*, Jan. Sess. 1854, pp. 500-501.

61. *Report of the Joint Standing Committee on Water . . . on the subject of a proposed purchase of certain rights, privileges and franchises . . . of the Baltimore Water Company . . .* (Baltimore: James Lucas, 1854), p. 17.

62. O'Donnell to Charles M. Keyser, Jan. 21, 1840, Baltimore Archives, 1840-368 (S. T.).

63. Baltimore Archives, 1840-367 (S. T.).

64. DeBow, *Statistical View of the United States*, p. 192.

65. *First Report of the Committee on Public Hygiene of the American Medical Association* (Philadelphia: T. K. & P. G. Collins, 1849), p. 562.

66. *Ibid.*, pp. 561-2.

67. Howard, *Public Health Administration*, pp. 127-8.

68. Thomas H. Buckler, *A History of the Epidemic Cholera, as It Appeared at the Baltimore City and Country Almshouse in the Summer of 1849 . . .* (Baltimore: James Lucas, 1851), pp. 17-35.

69. *Ibid.*, p. 17.

70. *Ibid.*, p. 41.

71. *Ibid.*, p. 42.

72. *Idem.*

73. *Ibid.*, p. 45.

74. *Journal of Second Branch,* Jan. Sess. 1850, pp. 269-270.

75. *Ibid.,* pp. 280-283.

76. Baltimore Archives, 1850-716 (S. T.).

77. *Journal of First Branch,* Jan. Sess. 1852, p. 57.

78. *Ibid.,* p. 386.

79. *Ordinances of Baltimore,* Jan. Sess. 1852, p. 117 (No. 97).

80. *Report upon a Supply of Water for the City of Baltimore, by the Commissioners Appointed under Resolutions of the City Council* (Baltimore: James Lucas, 1854), pp. 5-21. Hereafter cited, *Commissioners' Report: 1853.*

81. *Journal of First Branch,* Jan. Sess. 1854, pp. 499-501.

82. *Acts of the Maryland Assembly, Jan. Sess. 1852,* chap. 376.

83. *Commissioners' Report: 1853,* p. 37.

84. *Ibid.,* p. 10.

85. *Ibid.,* pp. 10-11.

86. *Ibid.,* pp. 45-53.

87. *Journal of First Branch,* Jan. Sess. 1853, p. 840.

88. *Ibid.,* p. 848.

89. Baltimore *Sun,* Oct. 11, 1853.

90. *Ibid.,* Oct. 13, 1853.

91. *Minority Report of Mr. Ross Winans, one of the Water Commissioners . . . and a Supplement Thereto* (Baltimore: "American Times Office," 1853), pp. 29-30.

92. *Supplement to the Minority Report of Mr. Ross Winans, one of the Water Commissioners . . .* (Baltimore: "American Times Office," 1853), p. 8.

93. *Journal of Second Branch,* Jan. Sess. 1854, p. 381.

94. Van Schaick to Jervis, March 8, 1839, Jervis Papers; *Proceedings of the Joint Standing Committee on Water . . .* (Baltimore: Joseph Robinson, 1855), p. 49.

95. *Report of the Joint Standing Committee on Water on the subject of a proposed purchase of certain rights . . . of the Baltimore Water Company,* pp. 17-18.

96. *Ibid.,* pp. 21-22.

97. *The Ordinances of the Mayor and City Council of Baltimore . . .* (Baltimore: George W. Brown & Co., 1858), pp. 320-5.

98. T. E. Sickels, *Report upon a Supply of Water for the City of Baltimore* (Baltimore: Jas. Lucas & Son, 1854), pp. 3-27.

99. *Journal of First Branch,* Jan. Sess. 1854, p. 1018.

100. *Ibid.,* Extra Sess. 1854, pp. 14-15.

101. Baltimore *Sun,* Oct. 12, 1854.

102. *Journal of First Branch,* Extra Sess. 1854, p. 15.

103. *Ordinances of Baltimore,* Extra Sess. 1854, pp. 5-9 (No. 1).

104. *Journal of First Branch,* Jan. Sess. 1854, p. 457.

105. George V. Worthington, *A Plan for Obtaining an Abundant Supply of Water . . .* [Baltimore, 1854], pp. 1-13.

106. Alfred Duvall, *Communication in Relation to a Supply of Water to the City of Baltimore* (Baltimore: John D. Toy, 1854), pp. 1-20.

107. *Proceedings of the Joint Standing Committee on Water,* pp. 5-56.

108. *Ibid.,* p. 32.

109. *Report of the Joint Standing Committee on Water, together with an Appendix, made to the City Council of Baltimore, September 3d, 1855* (Baltimore: Joseph Robinson, 1855), pp. 3-13.

110. *Speech on the "Water Question," Delivered in Council Chamber on September 12, 1855. By the Member from 21st Ward . . .* (Baltimore, 1855), p. 5.

111. *Ibid.,* p. 7.

112. Gilbert H. Bryson, *Report upon a Supply of Water to the City of Baltimore, from Jones Falls, by Natural Flow from Woodberry Dam* (Baltimore: Mills & Cox), pp. 3-10.

113. *Proceedings of First Branch,* Jan. Sess. 1856, pp. 18-19.

114. *Ibid.,* p. 719.

115. *Ibid.,* p. 720.

116. *Ordinances of Baltimore,* Jan. Sess. 1856, pp. 48-51 (No. 40).

117. Scharf, *Chronicles of Baltimore,* p. 549.

118. *Proceedings of First Branch,* Jan. Sess. 1857, p. 342.

119. *Ordinances of Baltimore,* Annual Sess. 1857, pp. 60-4.

120. Slade to Mayor Swann, June 8, 1857, Mss. in Enoch Pratt Free Library; *Annual Report of the Water Department of the City of Baltimore . . . January 1, 1863* (Baltimore: James Young, 1863), p. 5.

121. *Journal of First Branch,* Annual Sess. 1857, p. 852.

122. *Annual Report of Water Department . . . January 1, 1863,* p. 5.

123. Howard, *Public Health Administration,* p. 128.

124. *Annual Report of the Water Department . . . December 31, 1860* (Baltimore: Wm. M. Innes, 1861), pp. 3-5.

125. *Annual Report of Water Department . . . January 1, 1863,* p. 8.

126. T. H. B. [Buckler], *Past Follies and Present Needs* [Baltimore, 1874], p. 6.

127. *Ibid.,* p. 10.

128. *Ibid.,* p. 6.

129. Howard, *Public Health Administration,* p. 129.

CHAPTER TWELVE. PURE WATER AND PUBLIC HEALTH

1. "On the Means of Preserving Health," *Philadelphia Monthly Magazine,* II (August, 1798), 83.

2. *Report of the Committee on Fire and Water Relative to Introducing Water into the City of New-York, December 28, 1831,* Doc. No. 61, pp. 271-2.

3. Shaw, *Topological and Historical Description of Boston,* p. 104.

4. *Communication from the Committee of the Lyceum of Natural History,* p. 7.

5. *Ibid.,* p. 9.

6. *Ibid.,* p. 10.

7. *Remarks of Mr. Dibblee in Common Council,* p. 52.

8. W. A. Hardenbergh, *Water Supply and Purification* (Scranton, Pa.: International Textbook Co., 1938), p. 284.

9. American Water Works Association, *Manual of Water Quality and Treatment* (New York: American Water Works Association, 1940), p. 25.

10. *Report of the Committee on Fire and Water . . . December 28, 1831,* Doc. No. 61, p. 62.

11. Lyman, *Communication to the City Council . . . January 29, 1834,* p. 9.

12. *Ibid.,* p. 12.

13. *Proceedings before a Joint Special Committee . . . February and March, 1845,* p. 16.

14. *Boston Daily Argus,* Sept. 30, 1845.

15. John H. Wilkins, *Further Remarks on Supplying the City with Pure Water* (Boston: Charles H. Little & James Brown, 1845), p. 13.

16. Hale, *Inquiry into the Best Mode of Supplying the City,* p. 48.

17. Broadside in the Massachusetts Historical Society.

18. *Report of the Commissioners* (1845), p. 92.

19. *Ibid.,* p. 94.

20. E. N. Horsford, *Service-Pipes for Water: An Investigation Made at the Suggestion of the Board of Consulting Physicians of Boston* (Cambridge: Metcalf & Co., 1849), pp. 3-6.

21. *Ibid.,* pp. 6-7.

22. *Ibid.,* pp. 46-8.

23. *Report of the Consulting Physicians of the City of Boston in Relation to the Action of Cochituate Water upon Mineral Substances* (Boston: Eastburn's Press, 1848), pp. 37-8.

24. *Report of the Water Commissioners on the Material Best Adapted for Distribution Water Pipes* (Boston: J. H. Eastburn, 1848), pp. 20-1.

25. *Report of the Cochituate Water Board, to the City Council of Boston for the Year 1854* (Boston: J. H. Eastburn, 1855), p. 48.

26. *Ibid.,* p. 58.

27. *Ibid.,* p. 41.

28. Richards, "Croton Aqueduct," *Harper's Magazine* XXII (Dec., 1860), 29.

29. Lowber, *Ordinances of Philadelphia (1812),* p. 183.

30. *Laws of Pennsylvania,* Session of 1827/28, No. 138; *ibid.,* Session of 1831/32, No. 38.

31. *Laws of Maryland,* Nov. Session, 1808, chap. 79.

32. Howard, *Public Health Administration,* p. 104.

33. *Proceedings of the Board of Aldermen and Assistant Aldermen and Approved by the Mayor,* X, 45.

34. *Sketch of Fairmount, Lemon Hill, and the Adjoining Grounds, as a Public Park* (Philadelphia, 1855), p. 28.

35. Scharf and Westcott, *History of Philadelphia,* I, 675-6.

36. *Sketch of Fairmount,* p. 9.

37. *Annual Report of the Chief Engineer of the Water Works of the City of Philadelphia . . . January 22, 1857* (Philadelphia, 1857), p. 13.

38. *Ibid.,* pp. 13-14.

39. *Annual Report of the Chief Engineer . . . February 21, 1861* (Philadelphia: Wm. F. Geddes, 1861), p. 18.

40. Melish, *Travels,* I, 160.

41. M. N. Baker, *The Quest for Pure Water* (New York: American Water Works Association, 1949), p. 78.

42. *Ibid.,* pp. 81-112.

43. *Remarks of Mr. Dibblee in Common Council,* p. 16.

44. *Journal of Select Council,* 1845/46, Appendix, pp. 106-108.

45. *Ibid.,* p. 108.

46. *Ibid.,* 1848/49, pp. 186-7; *Report of the Watering Committee . . . on Filtration . . .* (Philadelphia: Crissy & Markley, 1854), p. 5.

47. *Ibid.,* pp. 7-8.

48. *Ibid.,* p. 15.

49. *History of the Works and Annual Report of the Chief Engineer of the Water Department of Philadelphia . . . Feb. 9, 1860* (Philadelphia: C. E. Chichester, 1860), p. 45.

50. *Minutes of the Croton Aqueduct Board of the City of New York, July 18, 1849 to April 9, 1870* (New York: Mail & Express Co., 1903), p. 10.

51. Baker, *Quest for Pure Water,* pp. 125-131.

52. *Ibid.,* pp. 133-6, 148-155.

53. George C. Whipple, "Fifty Years of Water Purification," in *A Half-Century of Public Health,* ed. by M. P. Ravenel (New York: American Public Health Association, 1921), pp. 161-4.

54. George C. Whipple, *Typhoid Fever: Its Causation, Transmission and Prevention* (New York: John Wiley & Sons, 1908), pp. 389, 397-8.

55. *Ibid.,* p. 8.

56. Baker, *Quest for Pure Water,* p. 137.

57. Morton Prince, *The Dangers from the Domestic Use of Polluted Water* (Boston: Rockwell and Churchill, 1883), p. 1.

58. *Ibid.,* p. 8.

59. Whipple, *Typhoid Fever,* p. 139.

60. *Manual of Water Quality and Treatment,* p. 9.

61. Whipple, *Typhoid Fever,* pp. 232-4, 242-3.

62. *Ibid.,* pp. 149-153, 234, 237.

63. *Ibid.,* pp. 161-171.

64. *Ibid.*, pp. 246-7; Memorandum supplied to author by Samuel S. Baxter, Commissioner of Philadelphia Water Department, Sept. 23, 1952.

65. *A Half Century of Public Health*, pp. 166-173.

66. Department of Water Supply, Gas and Electricity, *Analysis of "Report of Engineering Panel on Water Supply," May 12, 1952* [New York, 1952], p. 20.

67. *Manual of Water Quality and Treatment*, pp. 17-18.

CHAPTER THIRTEEN. THE RACE FOR NEW SUPPLIES

1. U. S. Congress, House Committee on Interior and Insular Affairs, *The Physical Basis of Water Supply and Its Principal Uses* (Washington, 1952), p. 42.

2. Baldwin, *Report on Introducing Pure Water into the City of Boston*, pp. 42-3; M. N. Baker, ed., *Manual of American Water Works, 1897* (New York: Engineering News Publishing Co., 1897), p. 294.

3. Baker, *Manual* p. 207; Select and Common Council of Pittsburgh to F. Graff, Dec. 24, 1827, Miscellaneous Mss. Collection, Historical Society of Pennsylvania.

4. Baker, *Manual*, pp. 240, 503.

5. Benjamin H. Latrobe, *Impressions Respecting New Orleans*, ed. by Samuel Wilson, Jr. (New York: Columbia University Press, 1951), pp. xiv-xxiii.

6. Bessie L. Pierce, *A History of Chicago* (New York: Alfred A. Knopf, 1937-40), I, 352-3; II, 332.

7. Wilhelmus B. Bryan, *A History of the National Capital from Its Foundation through the Period of the Adoption of the Organic Act* (New York: Macmillan Co., 1916), II, 306; H. P. Caemmerer, *Washington, the National Capital* (Washington: U. S. Government Printing Office, 1932), p. 302.

8. *U. S. Seventh Census: 1850*, p. 101.

9. Baker, *Manual*, p. 91.

10. O. Chanute, "History and Progress of American Water Works," *Scientific American*, XLIII (Aug. 14, 1880), 105.

11. Baker, *Manual*, pp. 93, 285, 296, 570.

12. *Engineering News*, XXVII (Jan. 23, 1892), 84.

13. *First Report of the Committee on Public Hygiene of the American Medical Association* (Philadelphia: T. K. & P. G. Collins, 1849), p. 645.

14. *Ibid.*, pp. 645-9.

15. *Ibid.*, p. 437.

16. *Proceedings of the Joint Special Committee on Water* (Baltimore, 1855), p. 19.

17. *Report of Cochituate Water Board for 1860*, Appendix, p. 8.

18. *Report of the Cochituate Water Board for 1854*, pp. 7-9.

19. *Report of the Cochituate Water Board for 1860*, p. 7.

20. W. C. *Report*, Jan. 3, 1844, pp. 612-3.

21. *First Report of the Committee on Public Hygiene*, p. 478.

22. *Ibid.*, pp. 479-480.

23. *Boston Evening Transcript*, July 26, 1844.

24. *Ibid.*, July 12, 1849.

25. Reginald Reynolds, *Cleanliness and Godliness* (Garden City: Doubleday & Co., 1946), p. 81.

26. *Ibid.*, p. 89.

27. Referred to in Latrobe's letter to Jefferson, Oct. 2, 1803, Latrobe Letter Books.

28. *The Spectator*, June 8, 1799.

29. Glenn Brown, *Water Closets: A Historical, Mechanical and Sanitary Treatise* (New York: Industrial Publication Co., 1884), pp. 26-7.

30. *Report of Cochituate Water Board for 1860*, Appendix, p. 28; *Report of Cochituate W. B. for 1861*, pp. 12-13.

31. Committee on Interior and Insular Affairs, *The Physical Basis of Water Supply*, p. 42.

32. James J. Matera, "One Hundred Years of Public Water Supply for Boston," *Journal of the New England Water Works Association*, LXIII (June 1949), 156-161.

33. 282 U. S. 660-674.

34. Karl R. Kennison, "Boston System Modernized," *Water Works Engineering*, C (July 9, 1947), 790-2.

35. Matera, *Journal of the New England Water Works Association*, LXIII, 163.

36. Scharf, *History of Baltimore City and County* p. 222; Schuyler Blackburn, "Enlargement of the Baltimore Water Supply System," *Journal American Water Works Association*, XXXIX (Feb. 1947), 119-120.

37. *Ibid.*, 120-2.

38. Frederick Graff, *Report to the Watering Committee of the City Councils, December 4, 1850* [Philadelphia, 1850], pp. 1-6.

39. Graff, *Report to the Watering Committee, February 20, 1851*, p. 2.

40. *Annual Report of the Watering Committee . . . January 1, 1852*, pp. 7-8.

41. *Report of the Chief Engineer for Supplying the City with Water . . . April 19, 1855* (Philadelphia: Crissy & Markley, 1855), p. 27.

42. *Annual Report of the Chief Engineer . . .* (Philadelphia: Collins, 1859), pp. 39-40.

43. Nathan B. Jacobs, "The Water Supply of the City of Philadelphia and the Proposed Supply from Upland Sources," *Journal of the Boston Society of Civil Engineers*, XXXIV (Jan. 1947), 33.

44. *Ibid.*, p. 34; Memorandum of S. S. Baxter, Commissioner of Philadelphia Water Department, Sept. 23, 1952.

45. Jacobs, *Journ. of Boston Society of Civil Engineers*, XXIV, 36.

46. Myron G. Mansfield, "Philadelphia Improvement Program," *Journal American Waterworks Association*, XLII (July, 1950), 646.

47. *Ibid.*, p. 647.

48. Wegmann, *Water Supply of New York*, pp. 64-5.

49. W. C. *Report,* Jan. 5, 1846, pp. 456-7.

50. See above p. 159.

51. W. C. *Report,* Jan. 5, 1846, p. 449.

52. "Quarterly Report from the Croton Aqueduct Board, November 2, 1848," Board of Aldermen, *Doc. No. 18* (1848), pp. 358-360.

53. *Annual Report of the Croton Aqueduct Department . . . for the Year 1860* (New York: Edmund Jones & Co., 1861), pp. 15-18; Stokes, *Iconography of Manhattan Island,* V, 1875.

54. Wegmann, *Water Supply of New York,* p. iii; Edward H. Hall, *The Catskill Aqueduct and Earlier Water Supplies of the City of New York* (New York: Mayor's Catskill Aqueduct Celebration Committee, 1917), pp. 66-8.

55. Merchants' Association of New York, *An Inquiry into the Conditions Relating to the Water-Supply of the City of New York* (New York, 1900), pp. 11-12.

56. *Ibid.,* pp. 487-502.

57. *Ibid.,* pp. 597-604.

58. *Ibid.,* p. 504.

59. *Ibid.,* p. xxiv.

60. *Ibid.,* p. xxv; *New York Tribune,* Aug. 18, 1899.

61. Merchants' Association, *Inquiry,* p. xxxvi.

62. *Ibid.,* p. 531.

63. *Ibid.,* p. 533.

64. *Ibid.,* p. 20.

65. Hall, *Catskill Aqueduct,* pp. 77-84.

66. *Ibid.,* p. 6.

67. *Ibid.,* pp. 89-110.

68. Board of Water Supply, *The Delaware Water Supply for the City of New York* [New York, 1942], p. 2.

69. 283 U. S. 336-348.

70. Edward J. Clark, "The New York City Water Shortage," *Municipal Engineers Journal,* XXXVI (1950), 96-104.

71. *New York Times,* March 17, 1951.

72. *Ibid.,* Dec. 22, 1951; June 18, 1952.

73. *Ibid.,* Feb. 9, 1951.

74. George R. Rich, "The Hudson River Emergency Pumping Plant of the City of New York," *Journal of the Boston Society of Civil Engineers,* XXXVIII (Jan. 1951), 165-6.

75. Board of Water Supply, *Delaware Water Supply,* pp. 1-2.

76. Department of Water Supply, Gas and Electricity, *Analysis of "Report of Engineering Panel on Water Supply," May 12, 1952* [New York, 1952], p. 3.

77. *Forty-sixth Annual Report of the Board of Water Supply of the City of New York* [New York, 1952], p. 2.

78. *Ibid.,* pp. 2-3; Department of Water Supply, Gas and Electricity, *Analysis of Report of Engineering Panel . . .,* pp. 14-24.

79. *New York Times,* Nov. 10, 1952.

80. James H. Allen, Malcolm Pirnie, and Francis S. Friel, "Development Plans for the Delaware Basin," *Journal American Water Works Association,* XLII (July, 1950), 615-6.

81. *Ibid.,* pp. 617-9.

82. *Ibid.,* pp. 620-9.

83. *Ibid.,* p. 624.

84. *New York Times,* Jan. 16, 1951.

85. *Ibid.,* May 11, 1951.

86. *Ibid.,* April 16, 1952.

87. *Ibid.,* Oct. 30, 1951.

88. *Ibid.,* Dec. 20, 31, 1953.

89. *Ibid.,* Feb. 13, 1953.

90. *Ibid.,* Aug. 22, 1952.

91. 347 U. S. 995.

92. Vincent Ostrom, *Water Supply: Metropolitan Los Angeles, Study in Integration* (Los Angeles: Haynes Foundation, 1953), pp. 12-17.

93. *Ibid.,* pp. 19-23; Don J. Kinsey, "Colorado River Aqueduct Goes to Work," *Water Works Engineering,* XCIV (June 18, 1941), 705.

94. Ostrom, *Water Supply,* pp. 23-30.

95. *New York Times,* March 17, 1953.

INDEX