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Introducing…clean Water

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Benjamin Latrobe planned much of early Washington, designed roads and canals, built steam engines from scratch, and, far more important, devised and installed the country's first safe, healthy water systems—at the cost, ultimately, of his life

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Stagnant water plus mosquitoes equals yellow fever. A century after this connection was established, the equation is common knowledge. But 200 years ago in the new United States, long before the concept of germs became widespread, the immigrant engineer Benjamin Henry Latrobe struggled to bring fresh water to American cities largely because he and others believed it would combat epidemic disease.

Latrobe was among the earliest professional engineers and architects to emigrate to the United States, settling in Virginia in 1796. He had been born in Britain in 1764 to leaders of the Moravian faith. In an era before today's emphasis on specialization, he received a broad education in British and German schools, with training in engineering and architecture as well as science, literature, and fine arts. When the Napoleonic Wars caused a falloff in architectural commissions, he crossed the Atlantic in search of greater opportunities, armed with letters of introduction and a winning manner.

Tall, well spoken, and always fashionably dressed, he moved easily among the merchant and governing classes in the United States. What made Latrobe more than a drawing-room conversationalist was the way he grasped the needs and potential of a rapidly growing land. He was just as skilled at a hands-on task like establishing his own foundry as he was at dreaming up schemes for the nation's development (he was a major contributor to Albert Gallatin's landmark internal-improvements program of 1808). Although his European suavity and wide-ranging talents set him apart from most of the young nation's rough-and-ready inhabitants, he still spent much of his time in America riding down muddy roads, supervising labor gangs, and prowling smoky mills and workshops.

Everyone agreed that putrid drinking water was, in some way, a major contributor to the problem of yellow fever.

For all his talent, Latrobe had a streak of pride that too often put off other technologists. Several of his most important projects ended in squabbles with his partners or patrons. For years on end he pursued angry disputes with the steam engineer Oliver Evans, the architect William Thornton, and the steamboat inventor Robert Fulton, trading intemperate broadsides with them in the press and ridiculing their ideas. Although well served by his own creative genius, he found it hard to

understand others with similar ability whose thinking broke precedents.

Latrobe's most visible legacy can be seen in the surviving examples of his architectural genius: the U.S. Capitol's statuary hall, the old Senate chamber, the old Supreme Court chamber, and the Baltimore Cathedral. Equally enduring is his greatest engineering accomplishment: his demonstration in two very different cities that waterworks are an indispensable element of urban life.

Yellow fever was the most dreaded epidemic disease in the early United States. Although historically it is most associated with tropical regions, in the late 1700s and early 1800s the disease struck sporadically throughout the Gulf and Atlantic Coasts. Philadelphia was particularly hard hit in the 1790s. With a population of 40,000, it was the United States's largest city, an international hub of commerce, and the seat of the new national government. In the summer of 1793 an outbreak of yellow fever there seemed like a biblical plague. At least a tenth of the city's population died and many more suffered from the disease's symptoms, which were unmistakable: a disabling high fever, changes in skin color (although only a few became dramatically yellow), and a black vomit. Those who died usually succumbed within a week of the disease's onset.

Medical opinion was divided on the cause of the fever. Some said it came from breathing bad air, especially the "miasmas" from swamps, sewers, and filthy streets. Others thought it was a contagious disease, probably brought by immigrants from the Caribbean. Still others believed it was simply a matter of poor diet and hygiene among the lower classes. But almost everyone seemed to agree that putrid drinking water was in some way a major contributor to the problem.

Whatever the cause, yellow fever became an expected part of summer, and anyone with the means to escape fled the city until cool weather returned. Major outbreaks in 1797 and 1798 (killing 3,500 residents in the latter year) left Philadelphia desperate for solutions. The city government formed a "watering committee" to receive proposals. The soundest one called for bringing water into the city by reviving a project to dig a four-mile navigable canal across the northern suburbs. It seemed like a good idea until someone pointed out that Philadelphia was sited on an almost level plain, so a canal would have little slope and thus little flow.

Latrobe first visited Philadelphia in the spring of 1798 and analyzed the water problem with an engineer's eye. He identified pollution of the city's front-yard wells as the cause of "the contagion which appears now to be an annual disease of Philadelphia." Drawing on a civil engineer's practical knowledge of geology, he analyzed the strata of clay, gravel, and sand underlying the city and decided that "noxious matter" from the city's ever-increasing number of privies was percolating into the subsurface water that the wells drew on. Drinking and cooking with this water was, he concluded, the primary cause of yellow fever.

His view was part of a babel of opinions and strategies, none of them clearly ascendant. By the fall of 1798 the city council still had no plan, but the best-educated engineer in the nation was about to return and crystallize opinion.

Latrobe's visit to Philadelphia in the spring had been a trial run. He hoped for better commissions there than he had been able to find in more rural Virginia. When his design for a new building for the Bank of Pennsylvania was accepted, he lost little time in removing to the banks of the Delaware River, arriving early in December 1798.

The chairman of the building committee for the bank happened to be the chairman of the

watering committee as well. Within a month he had sized up Latrobe and asked him to join a group that was examining some freshwater springs north of the city as a possible source of piped-in water. Latrobe rejected the idea of drawing on the springs and proposed a system based on steam engines pumping water from the Schuylkill River, on Philadelphia's western boundary, into the center of the city. Drawing elements of the design from his knowledge of London's steam-powered waterworks of 1783, he confidently predicted that the system could be in operation by July 1799, the beginning of the next summer's yellow fever season.

Latrobe's proposal was published by the city council as View of the Practicability and Means of Supplying the City of Philadelphia With Wholesome Water . The pamphlet immediately made Latrobe the front-runner for solving the water problem. By March the city was negotiating with him to build the waterworks.

To execute this plan, Latrobe and the city council had to overcome a major hurdle: obtaining steam engines. A few had been imported over the previous 40 years, but keeping them in operating condition had proved impossible in a nation with few machinists and virtually no machine-tool industry. Only one foundry in the United States claimed to be able to make engines: the Soho Works (optimistically named after Boulton and Watt's famous works in England) in what is now Belleville, New Jersey, just north of Newark. It had been established to make engines for the steamboat experiments of Nicholas Roosevelt and Robert R. Livingston. (Roosevelt would marry Latrobe's daughter Lydia in 1808.) Latrobe went to Newark, found that some British emigrants with engine-building experience were employed at the works, and reported back to the watering committee that the engines could be constructed there. The city ordered two of them: one to draw water out of the river and one in the center of the city to pump it into an elevated reservoir. Gravity flow through a system of pipes under the streets would provide water pressure for fire hydrants and public pumps, as well as private homes and businesses whose owners paid a fee.

By the spring of 1799 everything seemed to be in order. Although the goal of having the system in operation by July seemed unlikely, enthusiasm ran high. While awaiting the arrival of the steam engines, Latrobe busied himself with hiring skilled assistants and craftsmen. John Davis, an English immigrant with some architectural and engineering training, became his chief clerk. Frederick Graff, the son of a prominent Philadelphia bricklayer (in whose house Thomas Jefferson had written the Declaration of Independence), took on the role of assistant draftsman. Latrobe found an outstanding mason, Thomas Vickers, who knew how to make and use hydraulic cement, which remains hard in contact with water. Other hires were skilled at brickmaking, excavation, and timberwork. With this team Latrobe went about constructing a settling basin in which silt could settle out of the water and be removed; working out the fittings for street hydrants: designing and erecting engine-houses at the river and in the center of the city; supervising the creation of a 2,000-foot-long brick conduit to connect them; and boring thousands of white pine logs for use as distribution pipes.

Each of these was a major undertaking, but perhaps the most remarkable was the construction of the settling basin. To build this masonry-walled rectangle, 150 feet wide and projecting about 250 feet into the Schuylkill River from its east bank, Latrobe was faced with the task of setting the walls directly on bedrock. Nothing of the kind had been done before in Philadelphia (its only bridge over the Schuylkill rested on pontoons), and Latrobe had to design and erect a cofferdam to seal off the river bottom so that Vickers could fix his cement and initial course of cut stone directly on the underlying granite. Latrobe made a set of detailed watercolor drawings of the cofferdam and the basin that testify to his careful planning of the basin's construction. But its

novelty was frightening. At the first flood of the Schuylkill after the basin had been completed, one member of the watering committee wrote in his diary that he had gone “post-haste to the spot” and been greatly relieved “to find that no damage had been done.”

Architecturally, the crown jewel of the system was a templelike building that Latrobe designed for Centre Square, the park at the intersection of Broad and High (now Market) Streets that William Penn had designated in his 1681 plan of the city (and that is now the site of Philadelphia’s City Hall). The other enginehouse, by the river, was a utilitarian structure that contained an iron rolling mill in addition to the pumping engine. For the house that would sit in the middle of Philadelphia, however, Latrobe had called for a building that would be “an ornament to the city.” He came up with a striking design that, along with his new Bank of Pennsylvania, introduced Greek Revival architecture to the United States.

The functional aspects of the building—the containment of a steam engine in its ground floor and elevated reservoirs in its dome—were less than successful: The interior was cramped and dark, making it difficult to carry out repairs on the engine, and there was no space to store coal for the boilers, so temporary sheds had to be built outside. Still, the Centre Square building provided grand evidence of Philadelphia’s pride in its waterworks.

Centre Square helped to establish Latrobe as the leading architect in the United States, a position he held for two decades. A cascade of imaginative designs of mansions, public buildings, and monuments tumbled from his drawing board. His early work in Philadelphia, then the cultural center of America, had vast influence, and his boast that he had “changed the taste of the city” applied just as well to the whole nation.

The opening date of the waterworks came much later than Latrobe had predicted. The summer and fall of 1799 and all of 1800 slipped by, mainly because the steam engines took far longer to build than expected. There was nothing especially challenging about their design; they were of the same condensing type that had been manufactured by Boulton and Watt for a quarter-century. But the Newark foundry was poorly equipped. Boulton and Watt had been boring their cylinders with steam power, achieving both speed and precision. The Newark foundry used waterpower.

A visitor at the Newark foundry in the summer of 1800 described the tedium of smoothing the interior of the 6½-foot-long, 40-inch-diameter cast-iron cylinder for one of the engines, a process that required removing only three-quarters of an inch of iron. “Two men attend the operation,” he observed. “One of them is employed in adjusting the [steel] cutters and almost lives in the cylinder. The other attends the frame [a movable support for the boring head]. These two are relieved by another two at night, so that the business goes on day and night. One other hand is constantly employed in the day time in grinding [sharpening] the cutters.”

When Philadelphia’s water system began operation, in 1801, it was the first in the nation meant to supply an entire city.

Delayed by this primitive manufacturing process, the two engines did not arrive in Philadelphia until well into the fall of 1800. After that the installation moved ahead without difficulty because the rest of the infrastructure was already in place. Philadelphia’s water system began operation in February 1801, the first one in the nation intended to supply an entire city. Pure water could be had for free from streetside pumps, and for a fee one could have a private line directly into a home or business. The pipe network was at first confined to the core of the city but was

continuously extended into new neighborhoods.

Latrobe's accomplishment had unexpected consequences. His design had carried an estimated cost of about $150,000, but the additional time for completion and unanticipated expenses drove it up over $220,000. The city fathers resorted to borrowing money, a painful step for the Quaker merchants who ran Philadelphia. And the expected profits from operation did not materialize. It took time for people to appreciate the benefits of indoor plumbing, just as decades later urbanités needed time to adopt in-home gas and electricity.

The waterworks involved Latrobe in the longest-lasting controversy of his career. In 1803 he reported to the American Philosophical Society on the state of steam engineering in the United States. Proud of the success of his waterworks, he dwelt at length on some minor improvements he had helped make in its two low-pressure condensing engines. Only in passing did he mention other Americans who were active in steam. One was his fellow Philadelphian Oliver Evans, who was already being acclaimed as a genius for his development of the automatic flour mill. Two years before, Evans had constructed a high-pressure noncondensing steam engine to power a plaster-grinding works. He took Eatrobe's brief remarks on this major accomplishment as a slight. A decade later the prickly Evans still described the incident, with considerable exaggeration, as a public attack on "the absurdity of my principles."

Still, Eatrobe did tend to dismiss the importance of Evans's work, and there was a reason: He had heard many reports of high-pressure engines of the Evans type suffering operational problems. It was just common sense that greater steam pressure was more likely to lead to catastrophic failure. On the other hand, high-pressure engines needed less fuel and water and had a greater range of power. Because of these advantages, Evans's engine began to be adopted for steamboating, especially in the West. The growing popularity of high-pressure engines resulted in a series of steamboat explosions, and in 1838 the federal government began to establish standards for boiler construction—the first interstate regulation of technology.

Latrobe never dropped his enmity toward Evans. He petitioned Congress in 1814 not to extend Evans's steamengine patents and carried out an angry newspaper war of words in which he denied that Evans had done anything original or useful. It was a stinging insult to Latrobe when, after fifteen years of service, the Philadelphia waterworks' two worn-out engines were replaced by a single one of Evans's design. Evans had asserted all along that Latrobe's elegant system was inadequate for the needs of a growing city, and the ultimate adoption of his technology seemed to bear him out.

The Evans controversy, though bitter, was only a sideshow to the accomplishments of Latrobe's waterworks. Yellow fever never again struck Philadelphia with the same severity as in the 179Os, partly because as the city expanded, the adjacent swamps and sluggish creeks were filled in and covered over, but also because as piped-in water became more widely used, those excellent mosquito-breeding places, the wells and cisterns, were slowly phased out.

Philadelphia's waterworks became a model for other cities grappling with water problems. Baltimore hired Latrobe's assistant John Davis to build one, and other cities sent delegations to inspect the system. Frederick Graff, who was appointed head of the Philadelphia system, was for many years the leading consultant on urban waterworks in the nation. Until New York City completed its great Croton system in 1842, Philadelphia was the mecca for American water engineers.

When a Philadelphia shop quoted too high a price for a steam engine for New Orleans Latrobe decided to build it himself.

Construction of the waterworks also made Philadelphia the birthplace of the steam revolution in the United States. Several men from the Newark foundry moved to Philadelphia to operate, maintain, and repair the two engines, and one of them, James Smallman, went into the steam-engine business for himself. Immigrant engine makers were drawn to Philadelphia, and Oliver Evans also established a successful engine foundry in the city. The great Philadelphia mechanical engineering tradition, later embodied in such shops as the Baldwin Locomotive Works, sprang from these roots.

Latrobe tried to take advantage of this emerging tradition a few years after completing the Philadelphia job, when he lobbied for the contract to build a waterworks for New Orleans from his new base in Washington. In 1803 President Thomas Jefferson had offered him the position of architect of the Capitol, which was already under construction to rough plans drawn up by William Thornton but desperately needed an experienced designer and superintendent. Jefferson, an amateur architect, kept pestering Latrobe with impractical suggestions but was otherwise one of his most valuable patrons and supported him in his inevitable clashes with Thornton. For the next decade Latrobe helped shape the interiors of the Capitol into some of the young republic's most impressive public spaces.

In addition to his architectural work, Latrobe won further commissions with his technological skills. He worked on a number of canal and river-improvement projects, returning to the area of his earliest engineering jobs after landing in America. As chief engineer of the Navy Department, he contracted with James Smallman for an engine to power the metal and woodworking shops at the Washington Navy Yard. In 1807 he was given a federal assignment to design the customhouse for New Orleans, the prime commercial base of the recently acquired Louisiana Territory. Through that work Latrobe became acquainted with the booming growth of the city, and although he had never been there, he began scheming to apply his skills to its needs.

New Orleans sits on waterlogged soil next to the Mississippi River. At some seasons of the year the city is actually below the level of the river's crest. If not for the levee that by 1807 had been in existence for nearly a century, the city would have been flooded annually. This topography made the supply of fresh water a problem. Shallow wells provided plenty of water, but its taste made it unpalatable for drinking and cooking. Street vendors sold water taken directly from the Mississippi, but it was costly, as much as $150 per year for a household. Neither source could supply enough water for fire fighting in the largely wooden city or for street cleaning in an era when garbage was routinely dumped in the streets. In a rapidly growing city (the census of 1810 found 17,000 residents), the lack of a water system was clearly a threat to public safety.

In 1806, only three years after the territory had been acquired from France in the Louisiana Purchase, various parties in New Orleans began to solicit proposals to build a water system. In 1809, after seeing Latrobe's successful design of the customhouse, the territorial governor, W. C. C. Claiborne, wrote to Latrobe to see if he was interested in applying his water-supply expertise. Latrobe responded with enthusiasm.

In the proposal he sent to Louisiana's legislature, Latrobe drew heavily on his Philadelphia experience but modified it to suit New Orleans's topography. He recommended using a steam engine connected to a suction pipe laid into the channel of the Mississippi to draw water from the river. The water would then be pumped into wooden reservoirs in the enginehouse and

distributed through the city in wooden pipes. Hydrants attached to the pipes would provide water for fire fighting and street flushing. Latrobe saw no reason why he could not get such a system erected in two years.

Although the plan was simple and perfectly adequate, political and economic difficulties dragged out its execution for a decade. In 1810 the territorial legislature turned down Latrobe's request for a charter. He blamed the rejection on his failure to engage a lobbyist to shepherd his project through the political process. He then changed his strategy and sought a waterworks franchise from the New Orleans city council, sending his oldest son, 18-yearold Henry S. B. Latrobe, to represent him. This strategy worked, and a two-year franchise was granted in 1811. The younger Latrobe then designed and erected a sturdy enginehouse on a lot near the river designated by the city.

Meanwhile the elder Latrobe was seeking a source for the most important element of the project—a steam engine. His difficulties illustrate how every engineer had to be a jack-of-all-trades in the early nineteenth century, before America had developed a community of specialists and subcontractors to split up large projects. Neither New Orleans nor any city within a thousand miles could manufacture steam engines. Latrobe's best candidate was Smallman of Philadelphia, whose shop had made the Washington Navy Yard's engine. Smallman gave Latrobe an expensive quote for the job, perhaps based on the generous price the federal government had just paid. Latrobe decided to build the engine himself.

He contracted with four iron manufacturers in Pennsylvania and Maryland to make the boiler, flywheel, and steam cylinder for a low-pressure engine of the Boulton and Watt style. He planned to ship it to New Orleans by a coastal vessel. Unfortunately, the United States declared war on Britain in June of 1812, a war that led to a massive blockade of American ports. After a year's work Latrobe had to abandon any hope of carrying out his initial plan.

Next he tried building the engine in Pittsburgh, which was just becoming an important industrial center. At the time, through a complicated series of arrangements with Robert Fulton, Latrobe became an agent to construct a boat that would extend Fulton's steamboat empire to the Ohio and Mississippi Rivers. Terminating his relationship with the federal government, Latrobe moved to Pittsburgh in 1813 and established a shipyard and machine shop, where he began to build two steamboats as well as the parts for a waterworks engine.

Having invested all his efforts and personal income in the steamboat scheme, Latrobe was financially ruined by the economic chaos created by the war. By mid-1814 he could not get equipment from his suppliers, it was almost impossible to hire the skilled craftsmen he needed, and inflation had made a shambles of his finances. Fulton, exasperated by the situation, ended their relationship. Local creditors tied up Latrobe's assets, and he sank to selling his household furnishings to provide for his family. Writing to his son Henry on New Year's Eve 1814, he painfully described his problems and blamed them on his unrestrained commitment to his profession: "Would to God that I had been early taught that … the enthusiasm of the arts … [cannot] keep the enthusiast out of debt."

Latrobe was relieved from this morass only by the intervention of the President of the United States. In March 1815, shortly after the war's end, James Madison called Latrobe back to Washington (at the secret urging of Latrobe's wife, Mary) to rebuild the wardamaged Capitol. The assignment was a tremendous professional challenge and one that he carried out brilliantly, but it meant that Latrobe would return east without making any further progress in providing an engine

for New Orleans.

In the meantime his son Henry had become well established in the Crescent City and had served as one of Andrew Jackson's engineers in the Battle of New Orleans in January 1815. After the war, with the restoration of regular commerce, Henry negotiated an extension of the waterworks franchise, but in September 1817 he died of yellow fever.

Ironically, yellow fever had not been a major impetus for the establishment of a water system, though it broke out regularly at New Orleans. As the medical historian John Duffy notes, "one attack of yellow fever confers life-long immunity," and virtually all adults of French and Spanish descent (who held political power in the city early in the century) had been bitten by yellow fever-carrying mosquitoes in infancy. Those who survived—more than 90 percent—had nothing to fear. Thus, as Duffy observes, "the successive attacks of the disease took their heaviest toll among the English-speaking section of the population, particularly those who were newly arrived."

Although devastated by his son's death, the elder Latrobe turned his full energies to regaining control of the waterworks project. He solicited and received another extension of the franchise (though the mayor reported that "the city is impatiently awaiting the result of this enterprise"), and throughout 1818 he scoured the Atlantic coast for a steam engine and other equipment. With the financial backing of a Baltimore merchant, he bought a used engine, a mill to bore wooden pipes out of logs, fire bricks for the foundation of the engine's boiler, and castiron pipe. Equally important, he found a steam engineer, Andrew Coulter, who was willing to brave the dangerous climate to erect the engine and superintend its operation.

Latrobe decided to go to New Orleans himself to take charge of the project. He sailed from Baltimore in mid-December 1818 and arrived a month later. Exhilarated by exposure to a new environment (he reported to his wife in February that "all the trees are putting out their leaves, and a most delicious and soft air. I cannot be in better health"), he became a whirlwind of activity. He negotiated an entirely new contract in which the city agreed to purchase shares in the waterworks company, giving Latrobe a critical infusion of capital. He erected the steam engine with Coulter's assistance and put it to work driving the boring mill, which turned out cypress-log pipes that by July were being laid down the main street. He planned to lay mains under the seven broad streets paralleling the river with service lines to branch off under the more numerous cross streets.

In large part beacause of Latrobe, good water became a standard amenity that city governments were expected to provide.

But yellow fever again interrupted Latrobe's scheme. He had 32 men at work early in July, several of them craftsmen he had brought from Philadelphia, Baltimore, and Washington. Ten died from disease, 6 became ill, and another 11 quit or took other jobs. In August Latrobe took to his bed with a severe illness (not yellow fever) that gave him a serious skin infection. It was mid-September before he could again take charge of the project. On September 17, 1819, with yellow fever still raging in the city, he told the mayor and council that he believed little could be done in the remainder of the year and he was returning to the East to gather up his family and belongings in order to move permanently to New Orleans. In July he had purchased a house about a mile south of the city.

His family had been living in Baltimore, where two of Latrobe's architectural commissions—the Baltimore Cathedral and the Baltimore Exchange—were nearing completion. He arrived there in

mid-October and spent the next three months tidying up his professional and personal affairs. He sent his elder surviving son, John H. B. Latrobe, to his second year at West Point, shipped the family furnishings by coastal vessel to New Orleans, and with his wife and children, Julia and Benjamin Jr., set off by carriage to the Ohio River. At Cumberland, Maryland, they took the National Road (now U.S. 40), which interested Latrobe greatly because the federal government had sought his advice during the early phases of its construction. At Wheeling in late February Latrobe and his family took passage on one of the steamboats that, in the five years since they had been in Pittsburgh, had become a common sight on the Ohio. On April 3, 1820, they arrived in New Orleans.

Latrobe was determined to complete the waterworks by the end of the summer. He finished the basic network of 5,000 feet of pipes by late July, and in August he began laying the iron suction pipe from the enginehouse into the river. He had to excavate a cut through the levee and found it very difficult to keep the earth and muck from sliding in. Late in the month he asked for a loan of the city's slave chain gang to supplement his own crew. On August 30 he reported that the work was done.

He never got the chance to experience his triumph. That evening he returned home exhausted by the laying of the pipe and complained that he felt sick from the stench of the excavation. His wife called a physician, who followed the medical wisdom of the time by drawing a quantity of blood from a vein and then blistering his skin, both procedures intended to stimulate the body's healing properties. In addition, Latrobe was given calomel, a preparation of mercury, to purge his intestinal system. In spite of these ministrations, which may in fact have fatally weakened him, Latrobe died on September 3, 1820—of yellow fever.

Latrobe's family returned to Baltimore in a few months, and several succeeding generations remained there. His surviving sons, both with engineering training, became leaders of the Baltimore & Ohio Railroad, and a grandson served as mayor of the city. The New Orleans waterworks lay unused for two years because its accounts were frozen by Latrobe's creditors. The city finally took full control of the property, put the steam engine in working order, and started water flowing through the system. Latrobe's waterworks supplied New Orleans with water until the growth of the city outstripped its capacity and a new system was constructed in 1840.

In both New Orleans and Philadelphia, Latrobe had brought a vision of public water supply to cities that badly needed one. He designed, and persuaded the city fathers to install, comprehensive systems that changed fresh water from a privilege of those who could afford it to a right for all citizens. In large part because of Latrobe, copious supplies of good water became recognized as a standard urban amenity that city governments were expected to provide.

It is not too much to say that Benjamin Henry Latrobe, America's first civil engineer, gave his life to create the ready supply of fresh water that is critical to modern city and suburban life.

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