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The cover image is of Delta of the Yellow River, China (top) and Delta of the Zambezi River, Mozambique (bottom). Landsat imagery courtesy of NASA Goddard Space Flight Center and U.S. Geological Survey.

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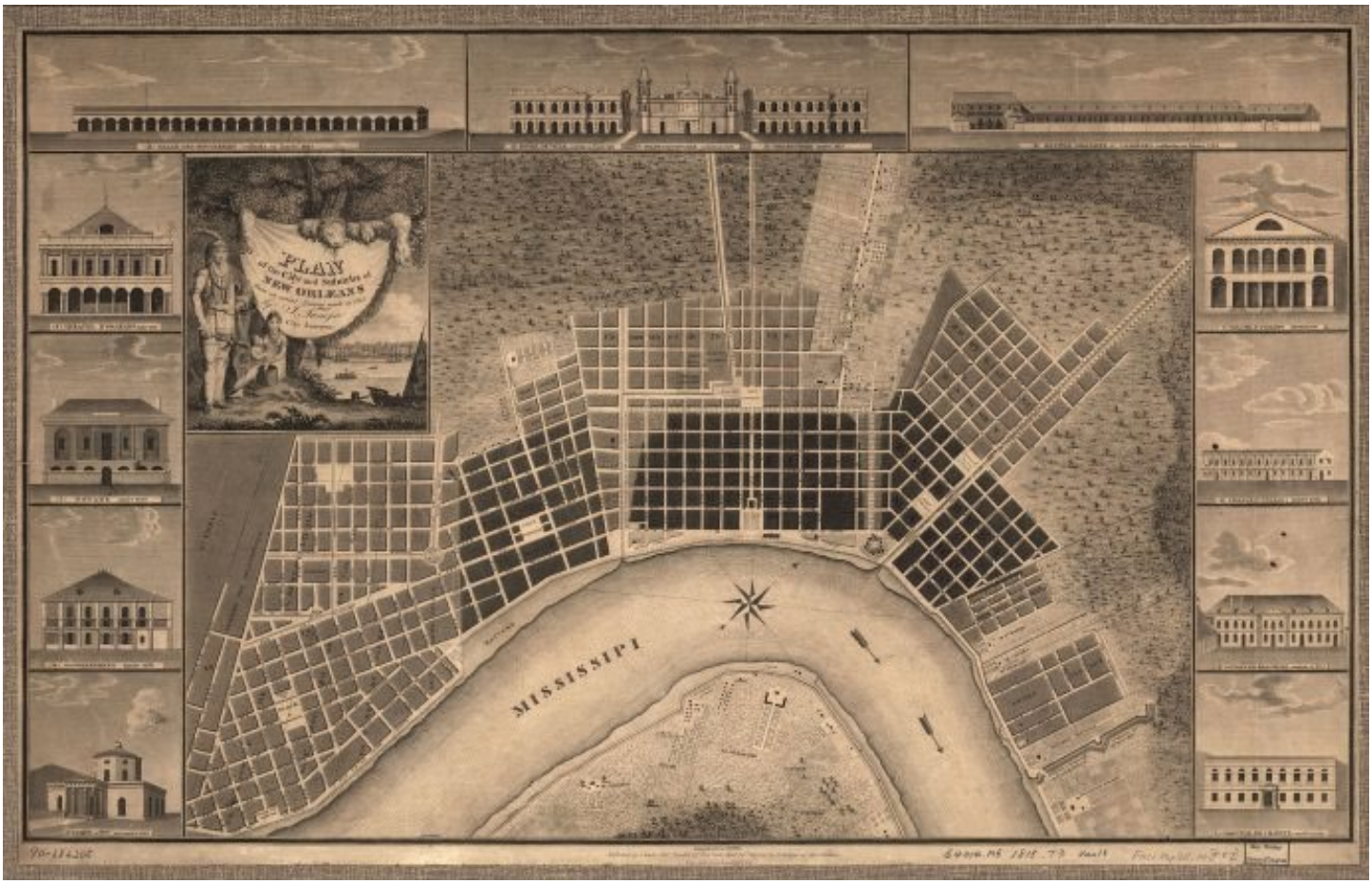
FEATURE (PEER REVIEW)

INDUSTRIAL ORNAMENT, MODERN SYMBOL: NEW ORLEANS' FIRST WATERWORKS ON THE MISSISSIPPI RIVER

By Rina Faletti

Editors' note: This feature article has been peer reviewed.

The second city in U.S. history to debut a modern industrial urban waterworks system was New Orleans[1] (figure 1). Designed and



I. Tanesse's 1815 survey map of New Orleans. Note lower left inset image depicting Benjamin Latrobe's New Orleans waterworks, featured as one of the city's dozen most noteworthy buildings. Credit: 'Plan of the City and Suburbs of New Orleans' by I. Tanesse, William Rollinson, Charles Del Vecchio and P. Maspero (1815), Library of Congress, https://www.loc.gov/resource/g4014n.ct000684/.

Figure 1: New Orleans Water Works design, 1812. Designer: Benjamin Latrobe. Construction Supervisor: Henry Latrobe. Credit: Detail from 'Plan of the City and Suburbs of New Orleans' by I. Tanesse, William Rollinson, Charles Del Vecchio and P. Maspero (1815), Library of Congress, Geography and Map Division.

built between 1811 and 1820, the New Orleans Waterworks displayed the most advanced innovations of its day, both in hydraulic engineering technology and in aesthetic architectural design. Its cutting-edge steam-powered pumps lifted water from the Mississippi River, fed it into a neoclassical-style waterworks pumping station, and then conveyed the water supply through a downtown distribution network of bored-log pipes. In addition to pioneering industrial machinery capable of pumping river water continuously under pressure and against gravity, the New Orleans system featured a vanguard architectural design. The neoclassical temple to water technology displayed a bold aesthetic form designed by the nation's leading engineer-architect and Architect of the U.S. Capitol, Benjamin Latrobe. Latrobe's temple form worked symbolically to brand the port city of New Orleans as a modern, industrious, and prestigious gateway to

Figure 2: Philadelphia Centre Square Water Works, 1799-1801. Designer: Benjamin Latrobe. Credit: 'The Water Works in Centre Square' by William Birch (1800), from 'Birch's Views of Philadelphia in 1800', the Independence Hall Association, http://www.ushistory.org/birch/plates/plate28.htm.

the new American West, and it advanced a vision of technological and aesthetic innovation for the United States.

It may be hard for readers today to realize that when the new steam-powered waterworks appeared, "the very notion of 'technology' as an agent of change scarcely existed."[2] Mid-twentieth-century historian of the American West, Leo Marx, revealed that, from the Revolutionary War until deeply into the nineteenth century, industrial technology was deemed relatively trivial in comparison with agriculture: "Although many features of what we now call industrialism already were visible, neither the word nor the concept…was available."[3] Today, by contrast, our views of history and society are deeply defined by an integration of technology, not only as an agent of change, but as an omnipresent feature of daily life. Technology plays a major role in our senses of time, place, change, and well-being now, but two hundred years ago, just after the 1810 Census, the state of industrial technology was very different: the

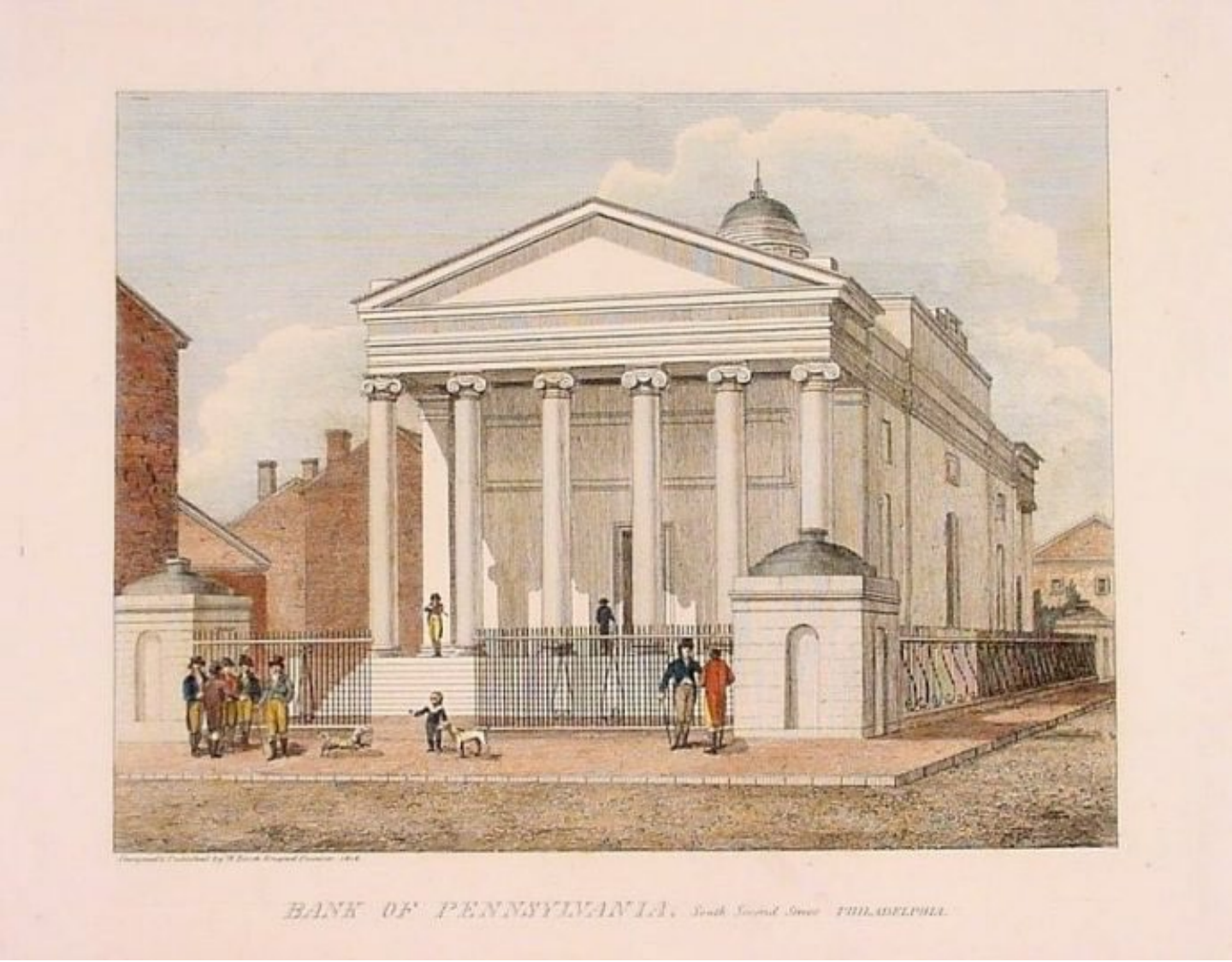


Figure 3: Bank of Pennsylvania, Philadelphia, 1798. Design: Benjamin Latrobe. Credit: "Bank of Pennsylvania," engraving by William Birch, Wikipedia, https://en.wikipedia.org/wiki/Bank_of_Pennsylvania.

United States numbered 17 states, with Kentucky and Tennessee the farthest to the west, and only five American cities had populations over 20,000. A concept of "urban places" was developing, and cities were just beginning to grapple with the need to increase water supplies through industrial technology.

One aspect of that problem, added to the task of inventive hydraulic engineering design, was to determine the physical form an industrial hydraulic works structure should take. Latrobe's design solution for New Orleans built upon neoclassical traditions, but broke ground with an unconventional drum-and-dome temple form featuring a portico of Greek columns. An octagonal drum rose from an office base featuring a pedimented colonnade; arched windows punctuated the office block; a clerestory of a dozen small windows ringed the drum; and an oculus centered on the dome was the mouth of a hidden smokestack.[4] Latrobe had introduced this Greek-inspired design a few years earlier, initiating in Philadelphia the nation's very first modern neoclassical waterworks[5] (figure 2, see also figure 7). The engineer-architect applied these formal innovations to all his structures, from public works like waterworks and lighthouses, museums and banks, churches and residential mansions, city halls and the U.S. Capitol (figure 3, see also figures 11–12). At this time, waterworks stood as an aesthetic and cultural equal with all major urban buildings.

The exemplary neoclassical building for the waterworks was more than simply an infrastructure warehouse limned with a decorative facade. It was a carefully studied design, inside and out. The arrangement of machinery within the open octagonal drum served as the core of a fully fitted engine house[6] (figure 4). Steam engine, boilers, and flywheel worked together within the compact cylindrical space to pull water up from the river, move it along a dock to the waterworks, and lift it up into its storage tanks, where gravity flow then conveyed water through 5,000 feet of wooden distribution pipes.[7] These "invaluable machines" carefully packed into the open cylinder of the waterworks temple drum showcased Latrobe's penchant for modern invention as he matched the groundbreaking machinery's utility with inventive architectural form.[8] With the formal design problems solved, "waterworks were not only the latest in steam technology, they were aesthetically pleasing as well."[9] Waterworks design began to play a leading role in creating an architectural signature for American cities.

The New Orleans Waterworks gave the Mississippi River a prominent monument, one very different from the city's architectural norm at the time. In New Orleans, French Creole was the local vernacular style. When Latrobe first visited the city, he admired its French identity, and lamented that "American" culture was rapidly overtaking the Old World French architectural styles in the city, "a replacement of good taste by bad." Latrobe observed that most recent buildings "exhibit[ed] the flat, dull, dingy character of Market Street in Philadelphia…instead of the motley and picturesque effect of the stuccoed French buildings of the city."[10] The unique Waterworks temple Latrobe then designed, sited prominently on the Mississippi River off Decatur Street (today the site of Latrobe Waterworks Park), stood out from among both the traditional French Creole architecture and the uninteresting warehouses near the growing market in the original town grid, now called the French Quarter or Vieux Carré (figure 5). In a city map of 1815, a drawing of the Waterworks highlighted it among a handful of the city's most prominent buildings[11] (figure 6). New Orleans was already an established city, and indeed a former French territory – the French Creole is a hybrid style that developed from its French, Spanish, and Caribbean stylistic historical influences—but the engineer-architect's introduction of a new look in European neoclassical architecture added a modern structural form to the more lyrical vernacular skyline.[12]

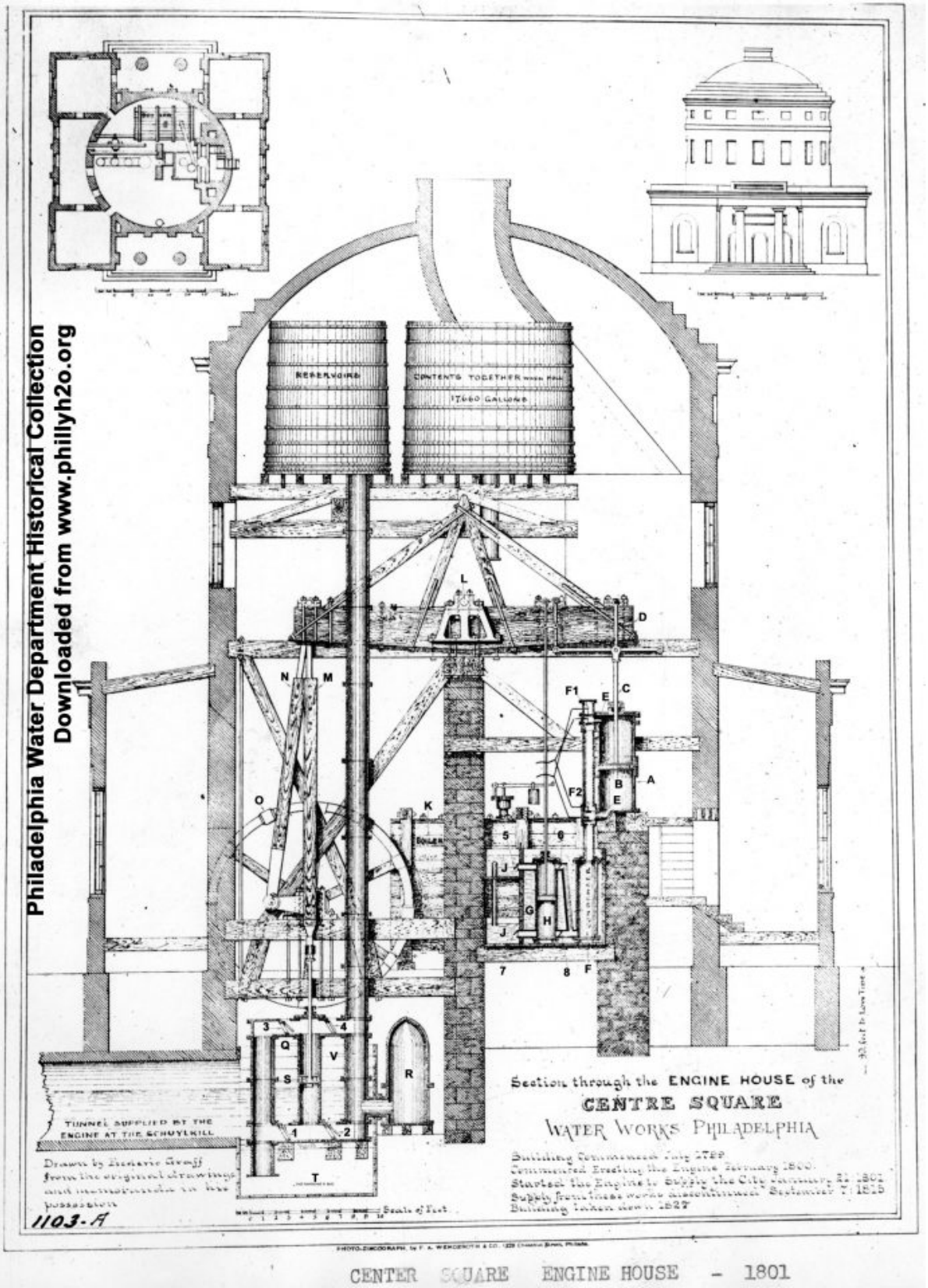


Figure 4: Benjamin Latrobe's Centre Square Water Works in Philadelphia, 1799-1801. Credit: Adam Levine, 'PhillyH20: The History of Philadelphia's Watersheds and Sewers', http://www.phillyh2o.org/backpages/figures/Fig07_20040570221042_withnos.jpg.

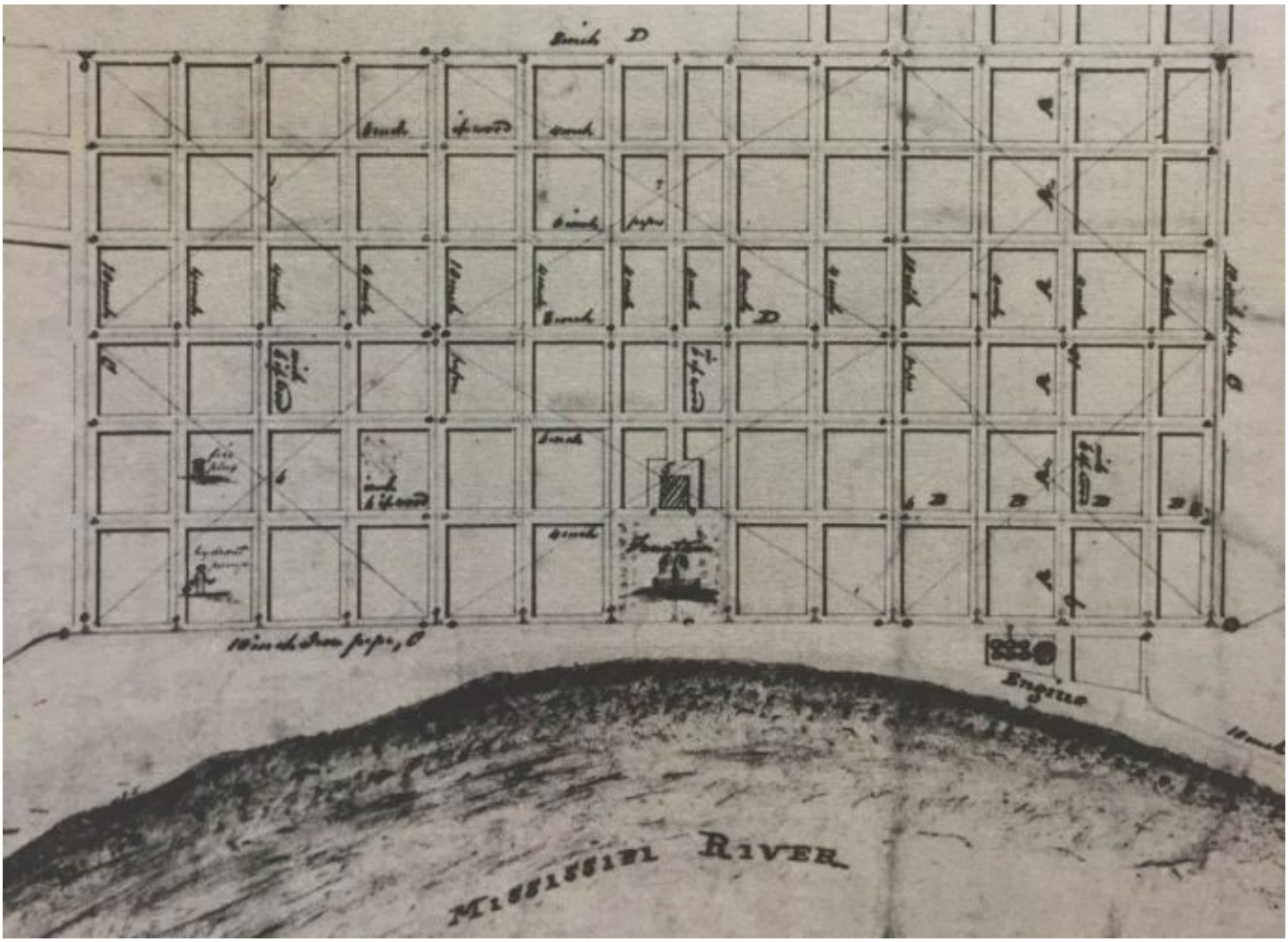


Figure 5: New Orleans grid map (1811) showing the location (but not the final design) for the waterworks engine house. Note the planned waterfront fountain, never built.
Credit: Image courtesy of Louisiana Division/City Archives, New Orleans Public Library.

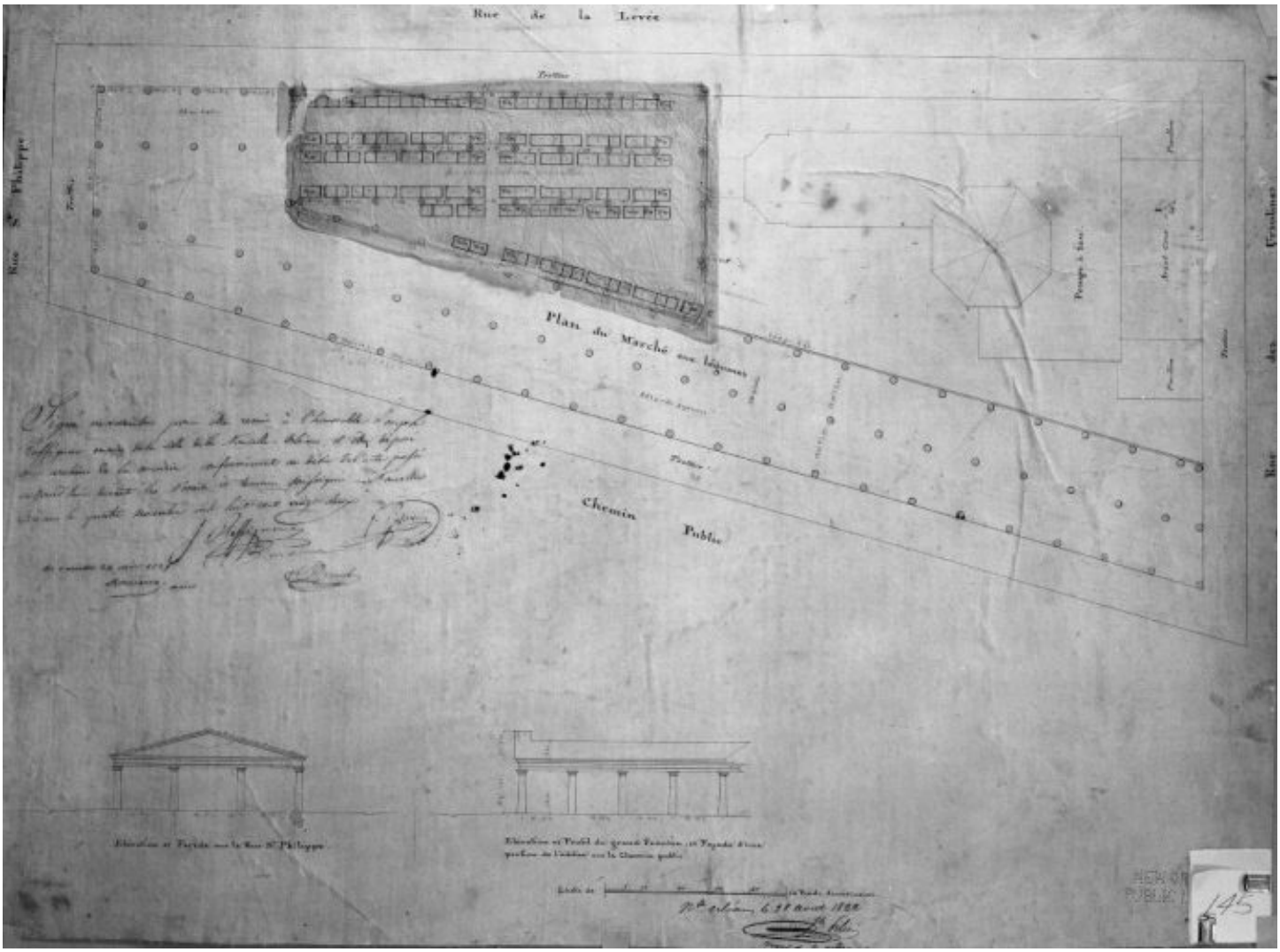


Figure 6: 1822 plan drawing for the new vegetable market, showing the final waterworks location and design plan at the corner of Ursulines and Rue de la Levee (now Dacatur). Credit: Image courtesy of Louisiana Division/City Archives, New Orleans Public Library.

The Precedent for New Orleans: Philadelphia's Center Square Water Works

The New Orleans Waterworks was the second modern waterworks for both Latrobe and for the nation. The first had been at Philadelphia, the Center Square Water Works of 1801 (figure 7, see also figure 2). Pinpointed upon the central public square of William Penn's 1682 city grid plan, the round temple with its colonnaded porticoes was the city's centerpiece (figure 8). The architect's signature style—the domed neoclassical structure with a portico of Greek columns—came to be revered as the American Greek Revival style, and it established the engineer-architect's immediate fame and eventual moniker, "The Father of American Architecture." His first successful buildings, with their domes, rotundas, and colonnaded porches, had caught President Thomas Jefferson's eye, and, in anticipation of the Louisiana Purchase Treaty of 1803, Jefferson

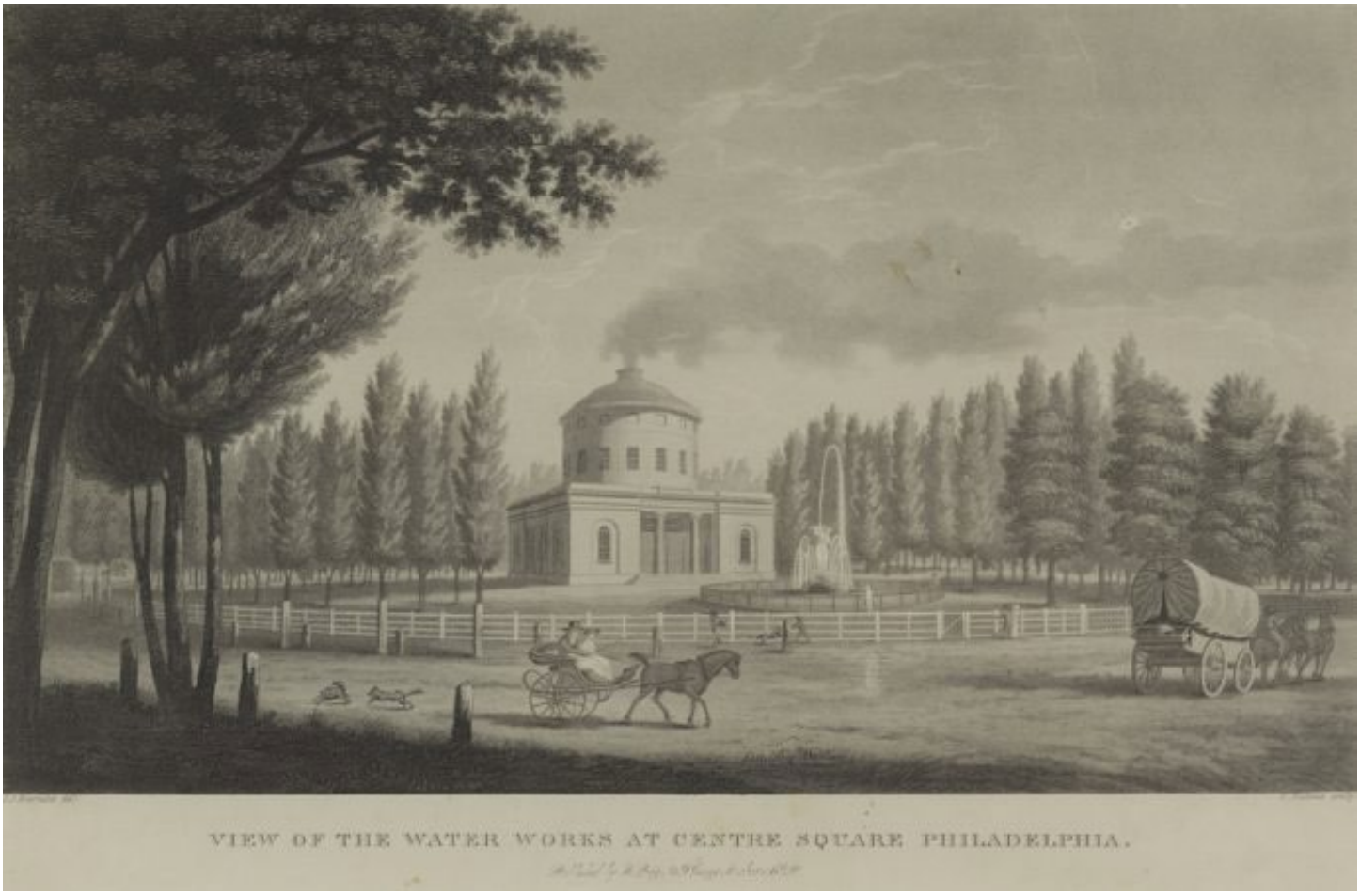


Figure 7: Period Image of Centre Square Works, ca.1810. Image courtesy of Adam Levine, Philadelphia. Water Department Historical Collection, http://www.phillyh20.org

brought Latrobe to Washington, D.C. as the Surveyor of Public Buildings and Architect of the Capitol. As the national architect, Latrobe supervised design and construction of all federal buildings and public works, with a special focus on the design for the future U.S. Capitol dome as an architectural symbol that associated Greek and Roman legacies with American civic ideals. From his position in Washington, he set his sights on New Orleans for the nation's second waterworks.

In 1803, New Orleans was slated to become the most prominent port in the United States. For many decades, most Americans were unable to imagine the full extent of the Western Territories' land mass, but infrastructure modernization as a foundation for future growth was emerging among planners as a new urban reality. Before the 1803 Louisiana Purchase, the 1800 U.S. Census listed 33 "Urban Places," whose populations ranged from the largest (New York City at 60,000, and Philadelphia at 41,000), to the smallest, which included Washington, D.C., with populations of less than 10,000. It might seem inconceivable today that even Manhattan, the most populated U.S. city since the Census began in 1790, did not have a modern water supply until 1842. More than four decades earlier, the waterworks Latrobe had built for Philadelphia (with its 1801 population of 41,000) and New Orleans (with 17,000 inhabitants in 1810) were indeed keystones of American urban modernization, and they were seen as such in their time.

It is difficult to imagine the extent of the city and its water supply in retrospect, but it might

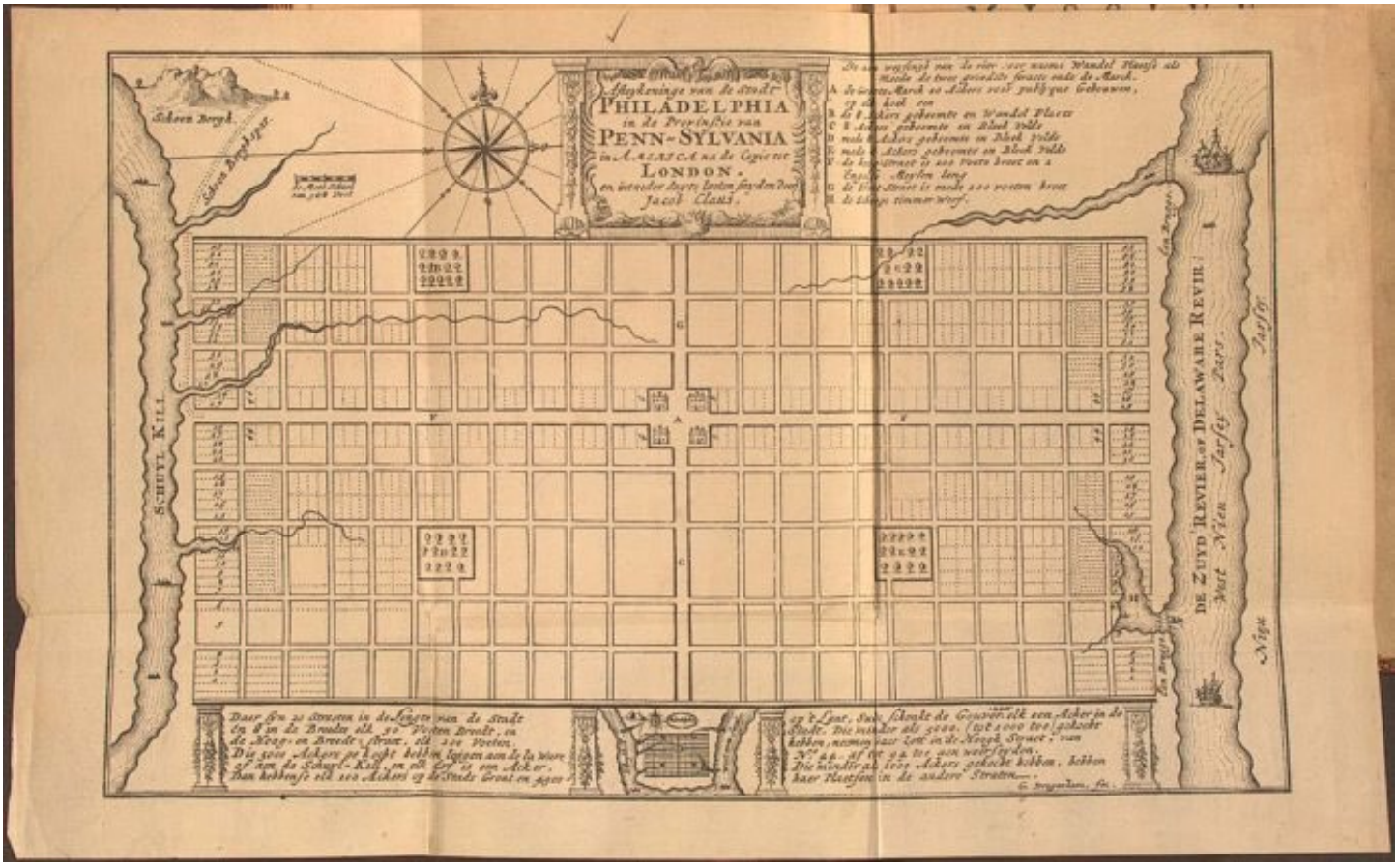


Figure 8: William Penn's Plan of Philadelphia, 1682. Benjamin Latrobe's 1801 Centre Square Water Works occupied the Centre Square, at the centerpiece of the city grid, currently the location of Philadelphia City Hall.
Credit: Library of Congress, https://www.loc.gov/exhibits/religion/images/vc006400.jpg.

be helpful to compare current-day population equivalencies in Louisiana, taken from the 2010 Census, with numbers from the 1810 Census, the first after the Louisiana Purchase. The 1810 Census saw New Orleans immediately enter the top rank of American cities as the seventh largest of 46 "Urban Places," with 17,000 inhabitants, on a scale of today's Opelousas or Natchitoches. [13] To round out the comparison, New York City was about the population of Lake Charles; Philadelphia numbered between that of Houma City and Alexandria City; and Washington, D.C. ranged in population between the cities of Ponchatula and Plaquemine. In 1803, these numbers would have been even smaller. 5,000 feet of bored-log pipelines distributed water to the central city grid but the water system did not reach every neighborhood in New Orleans.[14] The history of communities who did not receive access to the modern water supply is one of urban social inequality that has yet to be fully explored.

Urban Spectacles: Steam Power and Hydraulic Technology

How might we grasp the engineering novelty of waterworks at the turn of the nineteenth century and the effects it had on people at the time? Current-day readers must make a conscious effort to "forget" our blind twenty-first-century reliance on hydraulic technology. For us, it just works. In the first decade of the nineteenth century, by contrast, New Orleans' and Philadelphia's hydraulic works were unique, modern innovations. First and foremost, they were steam-powered. To push large quantities of water against gravity over a distance of a mile or more was an advanced achievement that required breakthrough developments in industrial steam and mechanical technology. Well into the nineteenth century, water for the nation's busiest cities came primarily from common public hand pumps placed at intervals through the city center, or from barrels carted through the streets. Indoor plumbing was rare, even for the wealthy. Water for mills (the primary form of machine production) was lifted from local rivers by traditional waterwheels, a bucket at a time, and then conveyed short distances in gravity-fed ditches.

Before Latrobe designed aesthetic works at Philadelphia and New Orleans, large-scale hydraulic mill works were the norm for machine production, and the structures were purely utilitarian in both function and form. Water-powered mills were simple wood or stone buildings in no way distinguished by architectural design, although they were the smaller-scale hydraulic technology marvels of their day. By contrast, Latrobe's waterworks forms functioned as visually provocative signs for the advanced technology inside them, the water it moved, and the modernization their city sites represented.

The Mississippi River was the water source for the developed portions of the city center, but the river was also central to new advancements in transportation. This meant developing river infrastructure on a brand-new scale, to ensure sufficient water supplies and to sustain increased navigation. The resulting development vision for the Mississippi port city required rethinking water as both supply and transport. To meet the requirements of the federal governance and improvement plan for the Louisiana Purchase, President Jefferson ordered a national lighthouse for the delta river mouth beyond New Orleans, at Frank's Island.[15] Latrobe, "one of only a few Americans who realized the potential of river

transportation for America," proposed several lighthouse designs between 1805 and 1817, eventually refining a unified neoclassical structure[16] (figures 9a & b). In 1810, he hired his 18-year-old son, Henry Latrobe, to supervise his work in New Orleans—over the years, the Latrobes had several commissions in New Orleans, to include a house of commons, churches, and a bank. Henry had trained in his father's architectural offices and had supervised engineering and construction of the National Road in the east, and the younger Latrobe's mastery of French was critical in New Orleans, where French was the official language. He supervised the lighthouse work, and in 1811 presented his father's plan for the New Orleans Waterworks, working on both projects until his sudden death from yellow fever in 1817. Two years later, in 1819, Benjamin went to New Orleans, but within a year he, too, had died, also of yellow fever, unaware that the mosquito was "the carrier of the disease he was attempting to arrest by supplying clear water to New Orleans."[17] He completed the waterworks distribution system just before his death.

Before Latrobe's 1796 emigration to Virginia, he had worked in England with noted architect and engineer John Smeaton. With Smeaton, Latrobe practiced both hydraulic engineering and neoclassical architecture. His exposure to historical and modern neoclassical styles throughout the Grand Tour cities of Europe tutored him in both

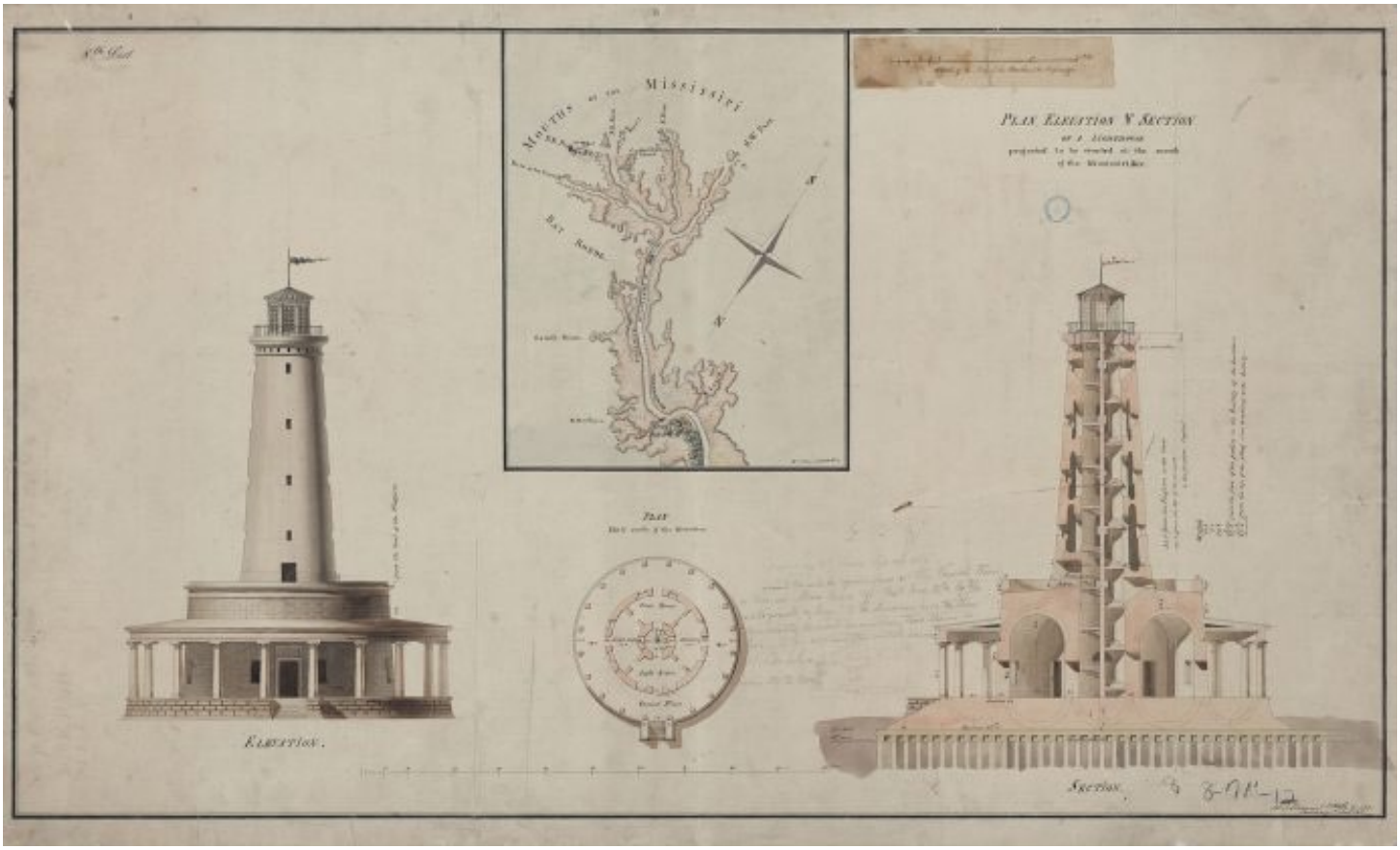


Figure 9: Frank's Island Lighthouse, New Orleans coast. Design: Benjamin Latrobe, 1816. Credit: "Plan Elevation ½ Section of a Lighthouse to be Erected at the Mouth of the Mississippi River," 1816, Records of the Bureau of Lighthouses and its Predecessors 1785-1951, Records of the United States Coast Guard, Record Group 26, U.S. National Archives. Image courtesy of Jay Riedl, Frank's Island Lighthouse, http://franksislandlight.blogspot.com/.

Figure 9b: Detail from Frank's Island Lighthouse, New Orleans coast. Design: Benjamin Latrobe, 1816. Credit: "Plan Elevation ½ Section of a Lighthouse to be Erected at the Mouth of the Mississippi River," 1816, Records of the Bureau of Lighthouses and its Predecessors 1785-1951, Records of the United States Coast Guard, Record Group 26, U.S. National Archives. Image courtesy of Jay Riedl, Frank's Island Lighthouse, http://franksislandlight.blogspot.com/.

ancient and modern European architecture and engineering. When he emigrated to the United States in 1796, he brought hydraulic engineering practices and architectural design ideas with him, and these ideas fed his statements in waterworks designs that proclaimed his vision for a new architectural identity for modern American cities. His Philadelphia and New Orleans waterworks buildings displayed innovations on neoclassical architectural designs that recalled historical and cultural precedents, but with a new-world flair. These stylistic innovations quickly became ingrained as modern symbols for expanding American ideals and values. With a river-fed waterworks system in the city and a lighthouse at the mouth of the Mississippi, New Orleans was poised to fulfill its new destiny as the key port city for an expanding American West.

New Orleans as the New Center of the American West

In 1803, when the Louisiana Purchase was complete, Americans knew nearly nothing of the territories west of the Mississippi River. Perceptions of geography, topography, climate, land extent, and distance were completely misunderstood, regardless of the official government exploration surveys that began in 1804. The Louisiana Territories Treaty had doubled the geographical expanse of the United States. This confounded cultural concepts of "West" by making the Mississippi River and New Orleans a center line within this vast new territory, in sharp contrast to its previous situation, when the Mississippi River and its delta city had marked a far-west outland border, the last falling-off place beyond the country's terminal limit.

Also unbeknownst to Americans were the realities of water west of the Mississippi. Water posed an extreme exception within traditional Euro-American conceptions of the western landscape. The material fact of an unknown, expansive, and arid West was hard to imagine, much less accept and adapt to, in light of long-held landscape ideas. New problems for grappling with types of topography, weather, and water never before imagined rendered traditional conceptions of a western landscape contradictory and meaningless.[18]

It is easy to forget that these perceptions of land, water, and fertility developed east of the Mississippi, where, in 1803, the "continent" comprised 17 states and the Northwest Territory of the Ohio River watershed. The total area ranged from the Atlantic seaboard to the Mississippi River and from the southern shores of the largely unexplored Great Lakes to the Georgia territory in the south. Long-held cultural conceptions of a fertile cultivated landscape could not possibly apply to the "virgin land" of the territory west of the Mississippi River, but no one knew that yet.

Machine and Garden

To define the historical importance of urban water delivery in 1800 is complicated by another history: that of water's relation to ideas of nature, landscapes, and gardens. When these are interpreted as cultural ideas that determine the way people view nature's place in human

culture, landscape is "a cultural image, a pictorial way of representing, structuring or symbolizing surroundings."[19] This is historically central to cultural identity in Euro-American culture. Further, since internal cultural images figure their way into cultural products like architecture and parks, we can interpret cultural aspects of architecture built into a landscape. Artistic and literary works of the age, for example, were replete with representations of the glories of a lost golden age, represented by ancient ruins in pastoral and agrarian scenes, versions of Edenic gardens, and awe-inspiring grand Romantic landscapes. This was the pastoral landscape ideal in pictures and in print; built environments, too, like gardens and parks, were also cultural products whose form and iconography signified landscape ideas of the age. Given that hydraulic works were set in gardenscapes and parks, as I have described, landscape ideas are helpful for interpreting industrial waterworks designs.

European ideas of westward imperial movement across unknown oceans and lands that could only be imagined originated with European Renaissance explorations, and ideas of "West" have historically grounded ideas of land, landscape, and garden for western cultural history. Behind patent territorial aims, European exploration sought a paradise on earth that transcended the sublime terror of the unknown. By the eighteenth century, the American interior beyond the Atlantic coast was imagined by Europeans, and by the new Euro-Americans, as an enchanting region of inexpressible beauty and fertility. As settlement focused on individual private lands supported by agriculture, the dream became embedded as a "garden of the world."[20] The idea persisted, and traveled continuously westward, that an individualistic yeoman working an agrarian West thrived on a fertile landscape blessed with endless water from ample local rivers fed by reliable rainfall during the growing season.

As industrial machinery began to force itself onto the pastoral landscape ideal of the Romantic age, a complex contradiction in American values emerged. Leo Marx was one of the first historians to note that only artists initially were able to address this contradiction, in representations that depicted "machine technology [as] a proper part of the landscape."[21] Representations of the West first circulated in print after the Lewis and Clark expeditions of 1804, ordered by President Jefferson as a way to explore the nation's new territory with the aim of finding a Missouri River outlet at the Pacific Ocean, presumable connected with the Columbia River. American landscape painters and photographers joined expeditions, producing landscape representations that embellished published reports and popular descriptions.[22] Prominent artists such as George Catlin, and later Albert Bierstadt, Thomas Moran, and Sanford Gifford, built on early eighteenth- and nineteenth-century European landscape painting traditions, eventually founding grand-scale American Romantic painting traditions grounded in the vastness and sublimity of the American Western landscape. These cultural images, as well as travel brochures enticing westward emigration, suspended the idea of "West" behind a veil, serving to obscure the real nature of land and water in the Far West region.[23] These exaggerated artistic views reinforced imagined narrative impressions rather than describing real experiences of overland migration. The scientific reports went largely ignored.[24] This may seem strange in retrospect, but it reveals a cultural conflict of the age:

> From the time of Franklin down to the end of the frontier period almost a century and a half later, the West had been a constant reminder of the importance of agriculture in American society. It had nourished an agrarian philosophy and an agrarian myth that purported to set forth the character and destinies of the nation. The philosophy and the myth affirmed an admirable set of values, but they ceased very early to be

> useful in interpreting American society as a whole because they offered no intellectual apparatus for taking account of the industrial revolution.[25]

As a kind of bridge between myth and reality, new-style industrial waterworks stood prominently on open squares centrally located within a town grid or on a waterfront, conveying the idea that nature was best shaped by human ingenuity (see figure 10). Waterworks temples placed in park-like garden settings offered a kind of engineering artistry that carried cultural currency. This style of waterworks architecture eased the tension that machine technology's screech levied against the perceived calm of agrarian traditions and pastoral ideals. In allying the unfamiliar with the familiar, Benjamin Latrobe's comforting neoclassical aesthetic brought into balance the foreign "throbbing, industrial function" the architectural form enclosed.[26]

It may seem to some that the waterworks temple form was incongruent with the utilitarian industrial function of the building, and that neoclassical style for waterworks was a meaningless skin that costumed the works. This interpretation makes the building a caricature that served promotional purposes alone, meant to glorify patrons and disguise capitalist aims. Such an interpretation certainly raises valid issues: architecture has worked throughout human history

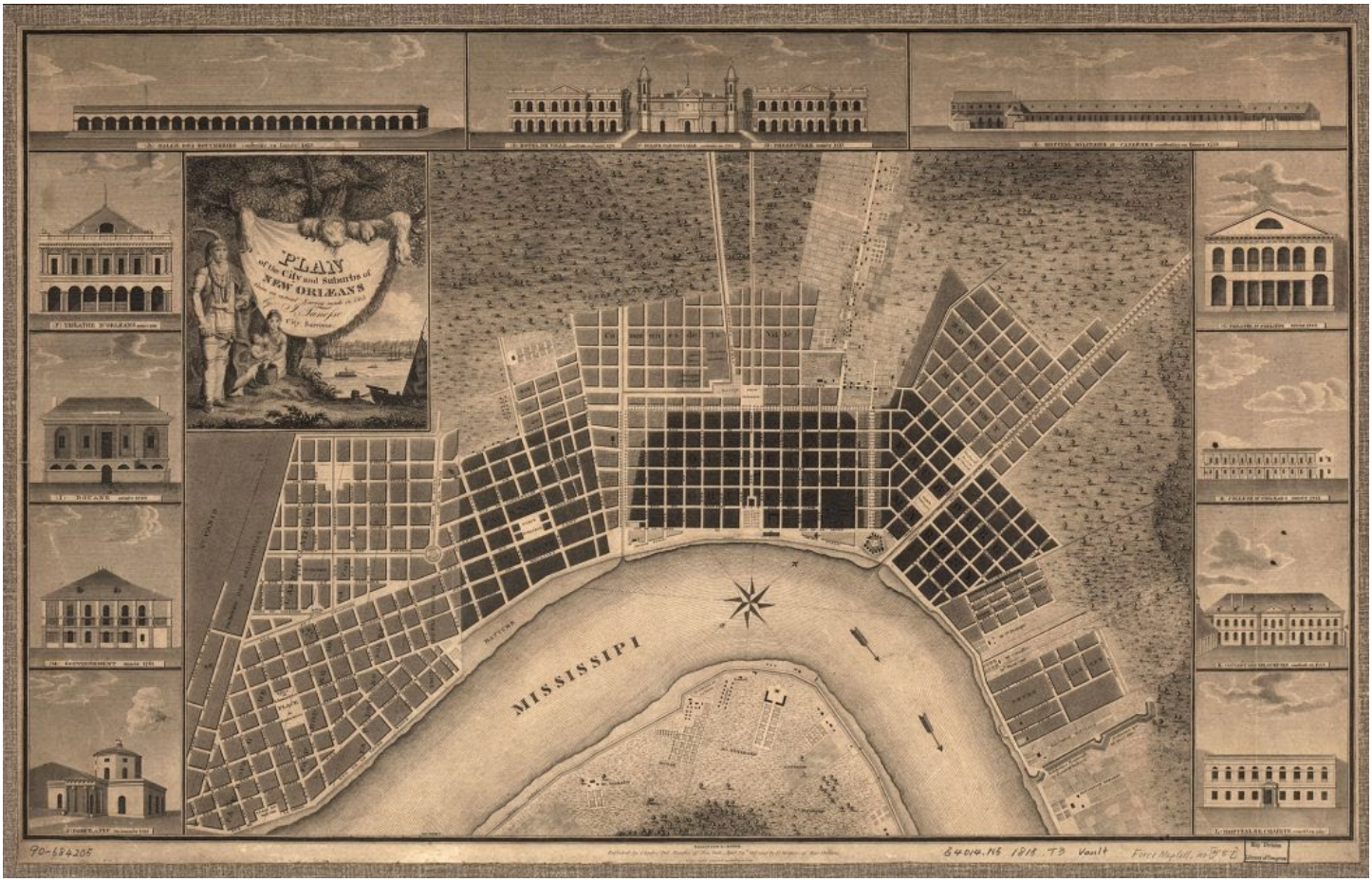


Figure 10: I. Tanesse's 1815 survey map of New Orleans. Note lower left inset image depicting Benjamin Latrobe's New Orleans waterworks, featured as one of the city's dozen most noteworthy buildings. Credit: 'Plan of the City and Suburbs of New Orleans' by I. Tanesse, William Rollinson, Charles Del Vecchio and P. Maspero (1815), Library of Congress, https://www.loc.gov/resource/g4014n.ct000684/.

in part to promote building patrons and their investments. Any business or institution that has commissioned a high-status building design and constructed it upon a visually, culturally, or politically prominent site has certainly advanced programs of architectural symbolism to legitimize the business it houses. Indeed, in addition to the waterworks I examine in this article, comparable examples arose in architectural designs for capitol and government buildings, banks and lighthouses, churches, museums and universities, for precisely this reason (see figures 11 & 12).

Yet, I encourage deeper analysis. The situation goes beyond simple promotion. All conscious and sophisticated building design draws attention to underlying cultural values in addition to indexing business or ideological interests. At best, any close study of aesthetic form examines cultural ideas that underlie design choices, specifically in order to avert a summary dismissal of architectural design as boosterism alone.

In fact, the architecture of early nineteenth-century waterworks drew full attention to the industrial contents, making no effort to hide them. Contrary to what we might believe today, the visual form of these buildings heightened the experience of the physical workings within. The building design and its workings called

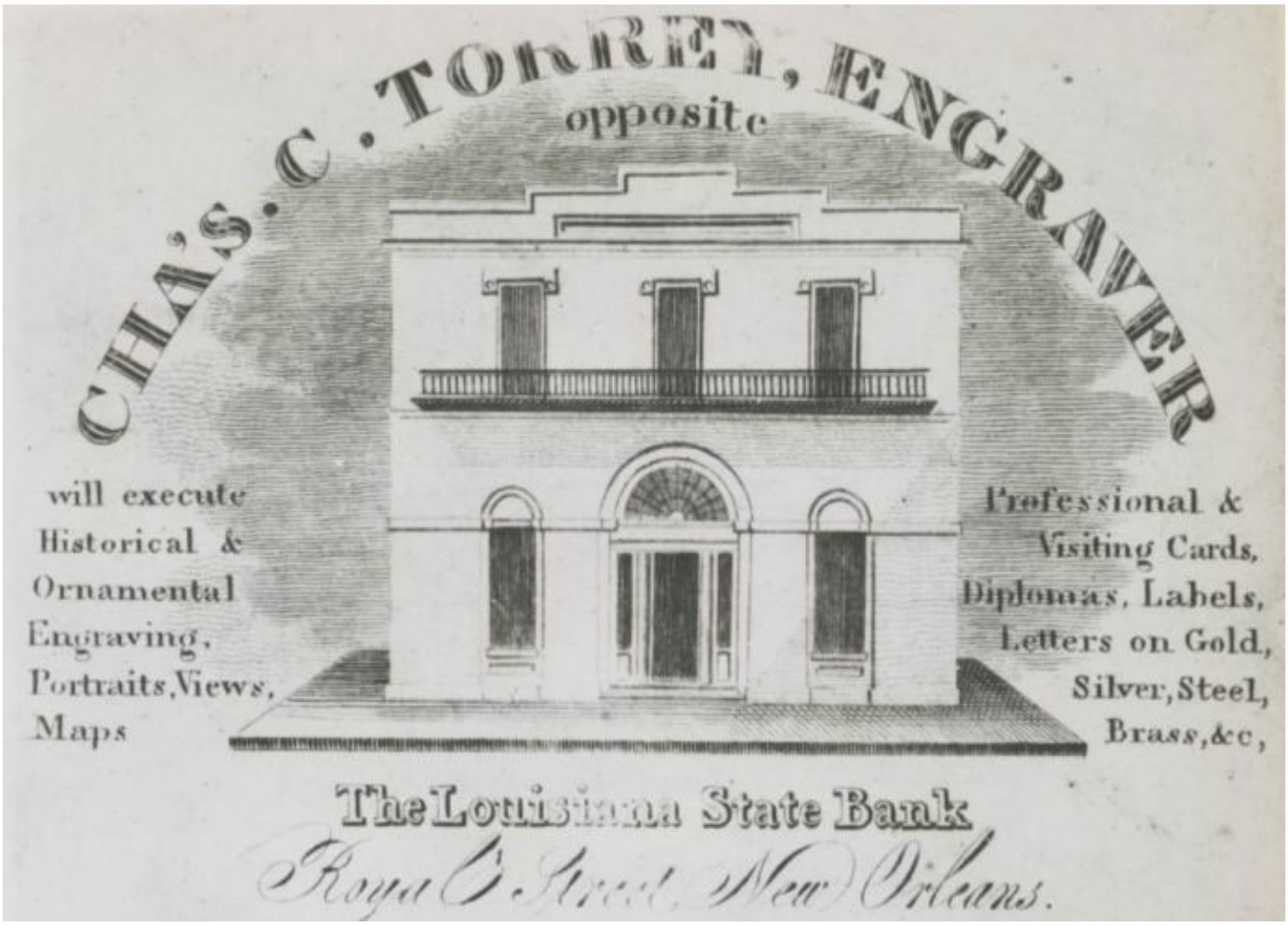


Figure 11: Benjamin Latrobe's probable Louisiana State Bank exterior design, from an 1822 engraving. Credit: Collins C. Diboll Vieux Carre Digital Survey, Historic New Orleans Collection, https://www.hnoc.org/vcs/property_info.php?lot=11271.

public attention. It drew spectators toward it. The machinery inside was loud. It clanked and boomed. It smelled. Period prints illustrate visitors gathered around the Center Square temple in its parklike setting as plumes of black smoke streamed from the oculus of the dome (see figure 2). The aesthetic of a neoclassical temple in a garden setting provided a recognizable visual context for framing the "beauty" of the new technology, while still allowing the transparency of the industrial processes within to speak for themselves.

The waterworks building embodied a cultural function as much as it advanced a utilitarian one. In form, temple contained machine. It housed, displayed, and celebrated—eventually venerated—not only a water supply larger than ever before imagined, along with the machinery that moved it, but also the engineering and aesthetic lineages from antiquity forward. This resulted

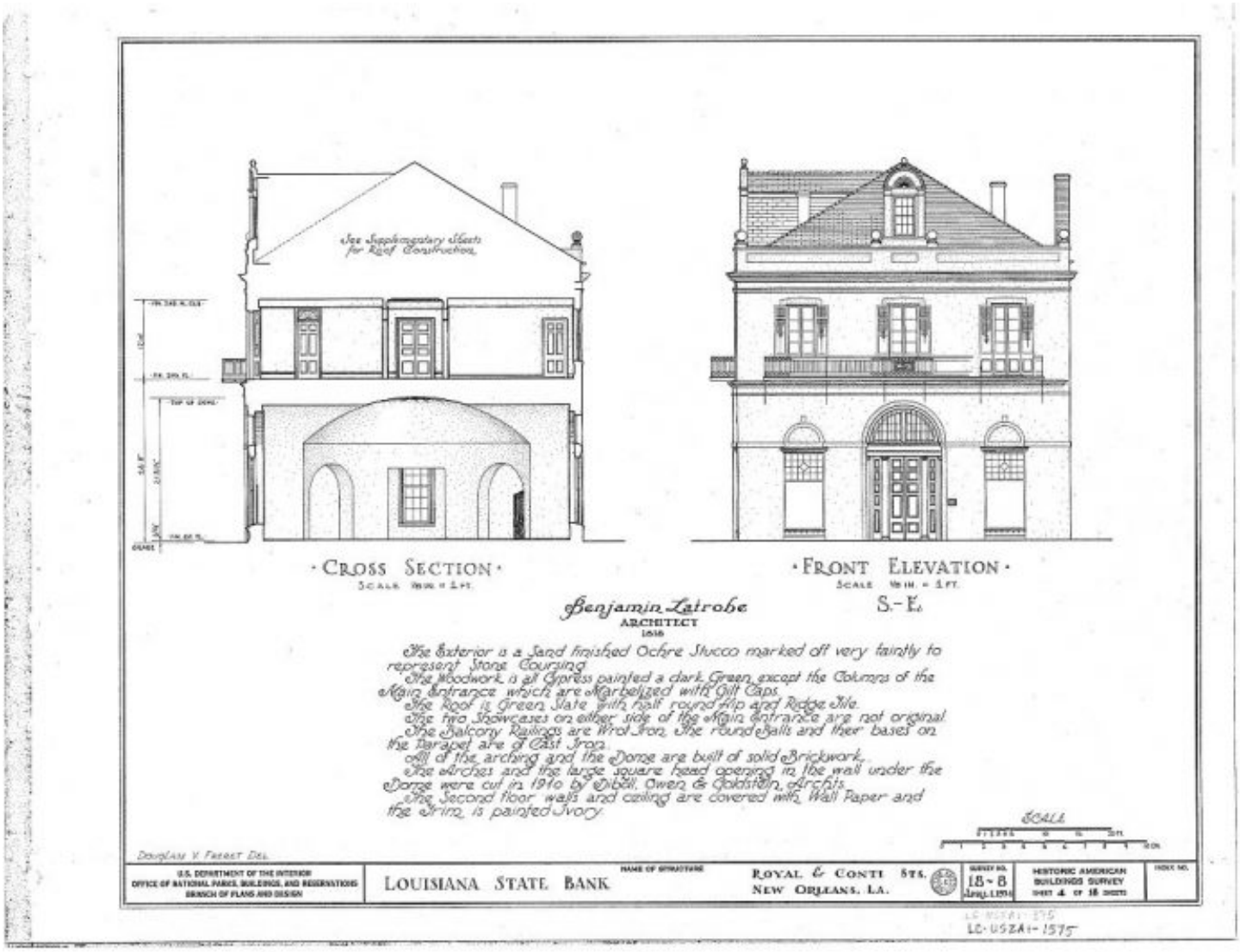


Figure 12: Louisiana State Bank (1820), Benjamin Latrobe. HABS front elevation and cross section drawings. Credit: Library of Congress, http://www.loc.gov/pictures/item/la0010.sheet.00004a/resource/.

in a mix of forms. The water temple, a sacred cultural type often associated with religious connotations of water, was a symbolic container for the industrial works that moved water. Yet, this form also signaled a deep ambivalence between two apparently conflicting cultural values. On the one hand, society valued a reliance on nature and agriculture, represented by long-held western European pastoral ideals such as Old Testament images of the Garden of Eden. On the other hand, changed circumstances created a prospective reliance on industrial machinery as a fabricator of a new urbanism, a symbol of a modernity that worked to better nature through human ingenuity.

The image of a steam-powered waterworks held inside a temple within a pastoral garden presented society with a technological form that conflated the garden with the machine. This provided a context for machines to take an updated but still familiar form; yet, an underlying ambivalence, the tension between agriculture and industry, still managed "to mask the real problems of an industrial society," problems the nation had not yet defined.[27] Ultimately, nineteenth-century agrarian pastoralism was "powerless to confront issues arising from the advance of technology."[28]

This conflict was subtle, but not new. It had plagued Thomas Jefferson, who had expressed deep ambivalence toward the relationship between the workings of industrial technology and the ideals of landscape and agrarian values. Jefferson was fraught with indecision regarding the role manufacturing should play as American society moved toward economic independence from Europe. He struggled to align what appeared to be irreconcilable values. Placing "the manufacturer by the side of the agriculturalist," Jefferson saw an either-or dilemma: "He…who is now against domestic manufacture, must be for reducing us either to dependence on that foreign nation, or to be clothed in skins, and to live like wild beasts in dens and caverns.'"[29] Leo Marx suggested that the inconsistencies and conflicts that arise within deep cultural ambiguities die hard: "They stem from a profound ambivalence—a complex response to the conflicting demands of the self and society… decisive contradictions in our culture and in ourselves."[30] The symbol of America as a garden became a less and less accurate description of a society transformed by commerce and industry, but the image of an agricultural paradise in the West remained a prominent image throughout the nineteenth century.

In this way, waterworks buildings inter-identified modern with ancient, present with past, machine with garden. The two contradictory ideas melded. Industrial waterworks structures in their landscape contexts became an impetus for larger and larger public parks, with water technology as a cultural center point. In New Orleans, as in Philadelphia, the new waterworks watered a public garden. An 1811 Latrobe drawing shows a fountain proposed for Jackson Square, facing the Mississippi River (see figure 5). One of the nation's first waterworks-fed fountain designs after that of Philadelphia, the architectural form embodied a cultural symbolism that signified a combination of water, technology, and landscape as a center for urban life. Earlier, Philadelphia's Center Square of 1801 (see figure 8) had been the first park featuring a waterworks, but by 1812, the city had outgrown the Center Square works, and an expansive Greek Revival building complex rose in stages on the Schuylkill River, about a mile downstream from the first works. The new Fairmount Waterworks expanded between 1812 and 1822—the same time period in which the New Orleans Waterworks were in planning and building stages—and the wooded hillside grew into Fairmount Park, the first large city park sited on an urban waterworks site. There, the works themselves were a spectacle as much as the surrounding garden. Fairmount Park predated by many decades the formal development of New York's Central Park or San Francisco's Golden Gate Park, but these too, as well as many

other nineteenth-century urban leisure gardens, were waterworks sites before they were full-blown, large-scale central city parks. Hydraulic architecture became signature, symbol, and spectacle of modernity in American cities.[31] The commission of an industrial waterworks in the form of a neoclassical domed temple became a city's statement showcasing its leadership in innovative urban growth. Prominent engineers and architects after Latrobe eventually designed waterworks buildings in similar neoclassical forms for every major city in the nation, into the twentieth century.

CONCLUSION

Benjamin Latrobe's waterworks aesthetic stood as a cultural equal to every major building type that contributed to the modernization of early nineteenth-century American cities. When urban modernization was in its beginnings, water systems were in their infancy, but so were government, banking, business and social organizational developments. Period modernization involved defining new cultural criteria for urban prosperity and progress, and cornerstone architectural symbols established the image of the early nineteenth-century American city.

Latrobe's neoclassical models inspired an original American architecture that would serve posterity.[32] As cutting-edge hydraulic engineer and contemporary architect, Latrobe's artistic aim for public works development was to marshal a balanced dialogue between form and function, enabling a waterworks building's form to heighten the modern relationship between its technological functions and its broader cultural and historical contexts.[33] When Latrobe recorded his impressions of three prominent buildings on the New Orleans skyline, for example, he drew a clear distinction between two views. First, he described the visual effect of each individual building. Second, he wrote about the visual impression a group of buildings projected when seen together from a distance—an early identification of what we today call a city skyline. He wrote: "In detail [they] are as bad as they can be," even as their symmetry, proportions, strong relief, and solid mass produced "an admirable effect when seen from the river or the Levee."[34] Latrobe's ability to see, value, and produce architectural nuance—more specifically in individual building design and more broadly toward a complete urban vision—filed his leading edge as an inventive creator, during a time when the nation needed a symbolic urban image. His fusion of aesthetic architecture and industrial technology made the New Orleans waterworks temple on the Mississippi River a symbol for the important roles water played in the formation of an American city identity in the early nineteenth century.

Editor's note: This feature article has been peer reviewed.

Footnotes

[1] See also Rina Faletti, "Undercurrents of Urban Modernism: Water, Architecture and Landscape in California and the American West" (PhD diss., University of Texas at Austin, 2015), 74–85, https://repositories.lib.utexas.edu/handle/2152/30482.

[2] See Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964), 150–69, esp. 154–55, and 376 n. 4–8.

[3] See Marx, *Machine in the Garden*, 150–69, esp. 154–55, and 376 n. 4–8.

[4] See the following for images: Stapleton, *Engineering Drawing*,174–78, esp. 178, fig. 41; Leland M. Roth, *American Architecture: A History* (Boulder, CO: University of Colorado Press, 2001), 125–26 (a print image of the Center Square Water Works appears in Roth, 125); Harold Donaldson Eberlein, "The Fairmount Waterworks, Philadelphia," *The Architectural Record* 62 (July 1927), 57, 64; Jane Mork Gibson and Robert Wolterstorff, "The Fairmount Waterworks," *Philadelphia Museum of Art Bulletin* 84, no. 360/361 (Summer 1988), 1–46; Donald C. Jackson, "'The Fairmount Water Works, 1812–1911,' at the Philadelphia Museum of Art," *Technology and Culture* 30, no. 3 (July 1989), 635–39; and Talbot Hamlin, *Benjamin Henry Latrobe* (New York: Oxford University Press, 1955).

[5] See Gary A. Donaldson, "Bringing Water to the Crescent City: Benjamin Latrobe and the New Orleans Waterworks System," in *Water-Supply and Public Health Engineering, vol. 5 in Studies in the History of Civil Engineering*, ed. Denis Fischbacher-Smith (Aldershoot, Great Britain: Ashgate, 1999), 195-210. See also Darwin H. Stapleton, ed., *The Engineering Drawings of Benjamin Henry Latrobe* (New Haven: Yale University Press for the Maryland Historical Society, 1980), 198–204 and figs. 55–57.

[6] See Stapleton, *Engineering Drawings*, 199–205, esp. 199, fig. 55.

[7] Donaldson, "Bringing Water," 209. During May 2017 in Philadelphia, bored log conduit was discovered beneath city streets during a water main replacement project. See http://www.phillywatersheds.org/resident-helps-spot%E2%80%94and-preserve%E2%80%94some-philly%E2%80%99s-oldest-water-infrastructure#more.

[8]Marx, *Machine in the Garden*, 150–69, esp. 154–55, and 376 n. 4–8. Marcus Whiffen and Frederick Koeper, *American Architecture*, vol.1: 1607–1860, (Cambridge, MA: MIT Press, 1981), 130. See also Roth, *American Architecture*, 125–26.

[9] Eleanor A. Maass, "A Public Watchdog: Thomas Pym Cope and the Philadelphia Waterworks," *Proceedings of the American Philosophical Society* 125, no. 2 (Apr. 30, 1981): 134–54, esp. 136.

[10] Donaldson, "Bringing Water," 198, 205.

[11] I. Tanesse, William Rollinson, Charles Del Vecchio, and P. Maspero, "Plan of the City and Suburbs of New Orleans, from an actual Survey made in 1815" (New York: Charles Del Vecchio; New Orleans: P. Maspero, 1815). Accessed March 25, 2017, https://www.loc.gov/item/90684205/.

[12] Michael W. Fazio, "Benjamin Latrobe's Design for a Lighthouse at the Mouth of the Mississippi River," *The Journal of the Society of Architectural Historians* 48, no. 3 (September 1989):238–39.

[13] Campbell Gibson, "Population of the 100 Largest Cities and Other Urban Places in the United States: 1790 to 1990," Population Division Working Paper No. 27, U.S. Bureau of the Census, Washington, D.C., June 1998. Accessed Sept. 3, 2017, https://www.census.gov/population/www/documentation/twps0027/twps0027.html.

[14] Henry Latrobe's 1811 drawing of the New Orleans city grid shows a water distribution service area of 13 x 7 blocks. Stapleton, *Engineering Drawings,* Fig. 55.

[15] Fazio, "Benjamin Latrobe's Design," 232–47; Lee W. Formwalt, "Benjamin Henry Latrobe and the Revival of the Gallatin Plan of 1808," *Pennsylvania History* 48, no. 2 (April 1981): 99–128.

[16] Donaldson, "Bringing Water," 208.

[17] Donaldson, "Bringing Water," 206.

[18] Roland Van Zandt, *The Metaphysical Foundations of American History* (Gravenhage: Mouton & Co., 1959) 17–19, quoted in F.S.C. Northrop, *The Logic of the Sciences and the Humanities* (New York: Macmillan Co., 1947), 16.

[19] Denis E. Cosgrove, *Social Formation and Symbolic Landscape* (Madison, WI: University of Wisconsin Press, 1998), 1, 98–101, 135–41.

[20] Henry Nash Smith, *Virgin Land: The American West as Symbol and Myth* (1950; repr., Cambridge, MA: Harvard University Press, 2009), 11; Cosgrove, *Social Formation*, 1, 98–101, 135–41. Cosgrove's work related to hydraulic engineering and waterworks projects, from a global point of view. See also Denis E. Cosgrove and Geoffrey E. Petts, eds., *Water, Engineering, and Landscape: Water Control and Landscape Transformation in the Modern Period* (New York: Belhaven Press, 1990), esp. 1–11, 188–208; and Denis E. Cosgrove, et al., "Landscape and Identity at Ladybower Reservoir and Rutland Water," *Transactions of the Institute of British Geographers*, New Series 21, no. 3 (1996): 534–51.

[21] Marx, *Machine in the Garden*, 226.

[22] Wallace Stegner, *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West* (1953, repr., New York: Penguin Books, 1992), 174–91, and section of images with captions inserted between 92–93.

[23] G. Malcolm Lewis, "Rhetoric of the Western Interior: Modes of Environmental Description in American Promotional Literature of the 19th century," in *The Iconography of Landscape*, eds. Denis E. Cosgrove and Stephen Daniels (Cambridge: Cambridge University Press, 2008), 179–93.

[24] Catrin Gersdorf, "History, Technology, Ecology: Conceptualizing the Cultural Function of Landscape," *Icon*, v. 10 (2004): 34–52.

[25] Smith, *Virgin Land*, 259.

[26] Gerard T. Koeppel, *Water for Gotham: A History* (Princeton, NJ: Princeton University Press, 2000), 105.

[27] Marx, *Machine in the Garden*, 6–8. On Eden, Marx quotes José Ortega y Gasset, *The Revolt of the Masses: Authorized Translation from the Spanish* (New York: W.W. Norton & Co., 1932), 1030; Smith, *Virgin Land*, 128.

[28] Smith, *Virgin Land*, 259.

[29] Thomas Jefferson to Benjamin Austin, Jan. 9, 1816, in *The Writings of Thomas Jefferson*, XIV, ed. Andrew A. Lipscomb (Washington, D.C.: Thomas Jefferson Memorial Association of the United

States, 1903), 387–93, quoted in Marx, Machine in the Garden, 139, 375 n. 47.

[30] Marx, *Machine in the Garden*, 136–37, 141; Richard Hofstadter, *The American Political Tradition and the Men Who Made It* (New York: A.A. Knopf, 1948), 24–25; Merrill D. Peterson, *The Jefferson Image in the American Mind* (New York: Oxford University Press, 1960), 443–46.

[31] Donaldson, "Bringing Water," 198; Stapleton, *Engineering Drawings*, fig. 55.

[32] Fazio, "Benjamin Latrobe's Design," 238–39.

[33] Fazio, "Benjamin Latrobe's Design," 239.

[34] Donaldson, "Bringing Water," 390. See also Richard W. Longstreth, "Academic Eclecticism in American Architecture," *Winterthur Portfolio* 17, no. 1 (Spring 1982): 55–82.

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