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"…[T]he movement of a celestial system than a human invention:" Abram Blanding and bringing water to Columbia

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Abstract
Abram [sometimes referred to as Abraham] Blanding (1776–1839) constructed a waterworks that captivated the citizens of the planned city of Columbia, South Carolina, bringing a wondrous scene of mechanistic intervention in nature. He was able to integrate the steam engine with original innovations regarding piping to transport fresh water into the new frontier city. The establishment of the waterworks also fulfilled Columbia's political desires to bring water to its citizens. Columbia became a more progressive city based on the standards of the nineteenth century. But while building the waterworks in Columbia would become an asset to the city, it would also be an eventual irritation to Blanding. Overall, this paper is a case study in how ambitious engineers, like Abram Blanding, used technology to provide a reliable source of drinking water at the turn of the nineteenth century

Keywords Waterworks · Steam-engine · Planned city · Water history · Nineteenth century US engineering · History of southern engineering

Providing running water to its citizens defined the planning of Columbia, South Carolina. Planners selected the land where the Broad and Saluda rivers meet to form the Congaree River to provide water to its citizens (Moore 1993; Edgar 1998; Henning 1936). The test of the early city's planning and propagation depended on how running water would be managed and utilized. In the eighteenth century, planners and residents were worried about what being near water meant for the prosperity of the former fort area that would become Columbia.

These individuals were especially worried about putrid smells and stagnant water that brought disease. As the new nation's second planned city, Columbia's leaders had to know how to protect and utilize Columbia's fresh water supply to advance the city into moderni-

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ty.[1] The challenge that lay before the planning committee was essentially how to transform water from a natural resource into a safe resource for the citizens of Columbia.

Engineers and governmental officials in the South attempted to manipulate the flow of water to ensure Columbia's prosperity as an urban center. Ryan A. Quintana frames the improvements that men like Robert Mills and Abram Blanding made as a move to increase state power. *In Making a Slave State*, Quintana contextualizes the actions of Mills and Blanding: "These were not men, at least on the surface, who simply wanted to aggrandize power, add to their own wealth through the manipulation of improvements, or make a name for themselves. They were uniformly men who were invested in the practice and promise of public works, who desired the legitimization of state power, and who wished to see South Carolina move forward with reforms…." (Quintana 2018, p. 159).

Establishing Columbia meant a break from the rice-planting mentality that defined the Charleston area, that of adapting to and being in relationship with the land. However, this change was not easy or instantaneous. Planting elites who fought against the move of the newly established state's capital to essentially a frontier outpost had worries about the new urban space (Brownell and Goldfield 1997; Mohl 1998; Reps 1965; Schultz 1989; Bender 1975; Goldfield 1982). Charleston was different; planters went to the city to escape mosquitoes and stagnant water and could quickly retreat away from the city when the climate changed during planting season. Charleston had amusements and a temporal seat of government. Columbia would be a city of government with no current amusements and modern amenities.

The historian Peter McCandless writes of both the immense wealth of South Carolina, especially its low-country region, and its "unhealthy" nature (McCandless 2011). He writes that, "Many diseases contributed to the high mortality and morbidity rates of the lowcountry." (p. 6) Disease included, according to McCandless, "…malaria, yellow fever, smallpox, dysentery, respiratory disorders, numerous helminthic (worm infestations, and tetanus." (p. 6–7) He also included yaws and syphilis. Other historians linked disease specifically to the climate and the land. In the article, "Dying in Paradise: Malaria, Mortality, and the Perceptual Environment in South Carolina," H. Roy Merrens and George D. Terry claim that early South Carolina settlers thought that they were living in paradise, but white inhabitants often died before they were forty (McCandless p. 6–7; Merrens and Terry 1984, p. 533–550.)

Morris Piece, the historian of waterworks, provides useful comparative work in his project *Documentary History of American Waterworks*.[2] He specifically notes that in regards to the Columbia waterworks. In comparison to other major United States cities with waterworks in the nineteenth century, Columbia was the fourth behind New York, Philadelphia, and Natchez, Mississippi to incorporate such a utility into its planning. Columbia had a waterworks prior to that in New Orleans. Columbia was also the fourth city, behind Philadelphia, Baltimore, and Albany, New York, to use cast iron pipes in its waterworks. He also

[1] This point has been reflected by historians such as Hammond and Kohn. Columbia was defined and planned before the establishment of Washington D.C. However, one could argue that New York, Boston, or Williamsburg could predate the planning of Columbia.

[2] The general website is located at: http://www.waterworkshistory.us/index.htm. Also see the entries for Columbia, South Carolina: http://www.waterworkshistory.us/SC/Columbia/, New York, New York: http://www.waterworkshistory.us/NY/New_York_City/, Philadelphia, Pennsylvania: http://www.waterworkshistory.us/PA/Philadelphia/, Saint Louis, Missouri: http://www.waterworkshistory.us/MO/Saint_Louis/, New Orleans: http://www.waterworkshistory.us/LA/New_Orleans/, and Albany, New York: http://www.waterworkshistory.us/NY/Albany/.

notes that 120 waterworks had been built by the 1820s. By the time the town owned Columbia's waterworks in 1836, the city of St. Louis had also purchased a waterworks, resulting in city governments owning 30 of about 233 systems in the United States.

In the nineteenth century, leaders in Columbia wanted to improve the lives of its citizens through building a planned city. Leaders attempted to avoid the problems that came with urbanization, such as disease. Blanding's job as head of the Board of Public works was essentially to change the land to suit the city of Columbia's needs. Columbia's planners thought that the building of a waterworks was the answer to curbing diseases that arose out of nature. A clear group (rather than class) of urban planners and engineers emerged with the planning of Columbia. They would make their wealth mechanizing and reforming new public spaces of commerce and government.

This group of urban planners and engineers would make their wealth from design, civil service, and engineering: Abram Blanding of such a historical trend. A northern outsider, Blanding was able to participate in civil government to earn a contract that would enable him to earn a comfortable living. Columbians were enticed by the capital investment Blanding arranged to get such onerous projects off the ground. However, it is no surprise that the General Assembly assigned the project to a man of unknown engineering ability, as they were likely more captivated by Abram Blanding's large amount of political capital.

Blanding's work needs contextualization in the larger history of urban studies and water history. Previous studies of waterworks focused on the cities of New York and New Orleans, London, and Washington, D. C. (Kapsh 2018; Hamlin 1990; Soll 2018; Faletti 2017; Hamlin 2000); Baker 2020). Other scholars of water history have argued that services in cities like garbage disposal and fresh water changed the nature of cities, making them healthier for its citizens (Melosi 2000; 1981).

These civil works projects were also scenes of wonder for all people in the city of Columbia. When Abram Blanding first unveiled his steam engine pump that delivered running water to the city, onlookers were awestruck. In a sense, Blanding realized a vision of Columbia for both bureaucrats and citizens. Blanding impressed not only his constituents, but also fellow engineers such as Robert Mills. Newspapers conveyed the new and exciting mechanistic interventions with the land (Larson 2001). However, when the city needed to repay Blanding the capital for these wonders, the council baulked.

In this essay, I argue that Blanding not only brought running water to the city and captivated the citizenry but also eased worries about disease associated with stagnating water and a lack of fresh drinking water. Establishing the waterworks also fulfilled Columbia politicians' vision of nature. Columbia in a sense became a healthier and more progressive city in nineteenth-century eyes. While the building of waterworks in Columbia would become an asset to the city, they would also become a source of consternation for Blanding.

The need for a waterworks

When Blanding attempted to build a similar waterworks system in Charleston five years after the completion of the waterworks in Columbia, he said that it would improve the health of its citizens. He argued that:

> It is most probable, that were the streets at stated periods well cleansed by washing them into the subterraneous drains which have been constructed under most of them,

> and that these drains were regularly ventilated and washed clean, the *yellow fever* might be greatly mitigated, if not expelled from the city. It is very certain that the comfort and general health of the place might be improved by these means (Kohn 1938a, p. 383–386).

Blanding also argued that foreigners feared for their health in the city. A clean water system would alleviate the fears of foreigners and make Charleston a more comfortable city.

Blanding's contemporary, the architect and engineer Robert Mills also noted the danger of the swamps in the low country and Midlands; they caused fever and ill health. He also noted that the Midlands and Upcountry seemed to shelter settlers from yellow fever because of the lack of swamp land. He noted that in the low country, those unimproved are dangerous, "The low country has suffered where the cultivation of swamps has been but partial, afterwards deserted and left to return to a state of nature, which in the mean time produce evils of greater magnitude than they possibly could in their original state." (Mills 1826, p. 140) Both Blanding and Mills were worried about yellow fever. Blanding believed that yellow fever was spread by the winds picking up, "…deleterious qualities of those vast swamps, which lie in the direction from the city (p. 144)." This is precisely why Blanding noted that the winds brought disease to Charleston and why the streets needed to be continually cleaned (p. 143–144).

Mills, like Blanding, concluded that "wholesome water" was the key to health. He argued that the availability of fresh water was one of "…the principle sources of health as well as comfort in such a climate as ours, and no expense should be spared to accomplish so desirable an object." (p. 146) City dwellers needed "an abundant supply of good water" in order to wash cities, cook, cool the streets, and fill baths and fountains." (p. 146).

Water was both the source of and the cure for what Mills noted as epidemics. (p. 145–146) In the period of the establishment of Columbia, physicians and experimental philosophers thought of disease as not contagious from person to person, but from lands and swamps to people. The prevailing idea of disease was the theory of miasma, which dated from antiquity and held that foul-smelling air produced disease. This meant that swamps and other seemingly "putrefied" areas were dangerous. During the eighteenth and nineteenth century, physicians and governmental leaders advocated for the draining and removal of such areas to provide good health to citizens. South Carolina was historically a dangerous place in the eyes of new settlers. Ever since arrival in the low country, settlers from Barbados, England, France, and Scotland believed that South Carolina was very dangerous for their health (Chaplin 1993).

Planning capital cities and improvement

The City Planners decided in 1785, because of large amounts of political strife and backlash against the frontier, that the capital of the state be moved from Charleston to Columbia. State senator Arnoldus Vanderhorts, stated that the frontier town be named "Town of Refuge," because it seemed open to harboring criminals and debtors, while additionally lacking the refinement and legal control of a capital like Charleston (Copper 1838, p. 751–752; Lockhart 2003, p. 176–197; Zagarri 1988, p. 1239–1256). However, not all government officials saw the loss of Charleston as a capital as a negative. Columbia would be a planned city. The establishment of the new "frontier" capital would include governmental buildings

and the establishment of a state college to educate the future leaders of the state. (Copper T 1838) However, in terms of the perceptions of good health, the city would have a long way to go to break from its dangerous backcountry legacy. The Carolina backcountry generally referred to the areas in the rural north of Columbia and beyond, while the low country referred to the tidal areas of South Carolina and greater Charleston.

State capitals in most of the original thirteen colonies relocated into more healthy, centralized, or profitable areas. This change in venue of the government gave planners an exciting chance to plan a city a city they considered modern (Copper T 1838; Chaplin 1993; Kupperman 2009). Being the nation's second planned city, Columbia had to transcend governmental planners' worries about nature (Lockhart 2003; Galehouse 2019, p. 1–7). The city had to be built to protect people from the dangers of the countryside. Though this might seem at odds with the idea of the healthful country life, by the late eighteenth century, the idea of seasoning (or the early modern thought of getting the body used to a new climate) was changing. Physicians argued that too much time in the countryside was making people sick, especially children (Chaplin 1993, p. 92–108; Waring 1964). Therefore, cities became a good alternative to individuals who had been spending all their time in the fever–ridden countryside.

The representatives in the State House of Charleston believed that they would make the wilderness into the ideal capital (Copper T 1838). In the first Act that appointed commissioners for purchasing land and the planning of the "seat of government," legislators were very specific about what type of land they wanted and the land's purpose and planned for the distribution of the land:

> …to lay off a tract of land of two miles square, near Friday's ferry, on the Congaree rive, including the plain of the hill whereon Thomas and James Taylor, Esquires, now reside, into lots of half an acre each, and the streets shall be of such dimensions, not less than sixty feet wide, as they shall think convenient and necessary, with two principal streets, running through the centre of the town at right angles, or one hundred and fifty feet wide; which said land shall be, and the same is hereby declared to be, vested in the said commissioners, and their lawful successors, for the use of the State. (Copper T 1838)

On March 22, 1786, the government in Charleston signed its vision of the new capital into law (Copper T 1838).

Understanding Columbia's wells and methods of collecting drinking water

Columbia, like many southern cities, including Charleston, depended on wells for drinking water (Tolbert 1999). Well levels in Columbia seemed to trouble citizens. In the first volume of the newly established *American Journal of Science and the Arts*, the chemist Edward Darrell Smith wrote a response to a query from the journal's publisher, Benjamin Silliman, also a chemist, at Yale (Smith 1818, p. 93–95; Driggers 2020). Silliman wanted to know how the New Madrid earthquakes of 1811 through 1812 affected the wells of Columbia (Penick Jr. 1981). Silliman was attempting to establish a scientific community throughout America, emulating his European peers. Smith and many other natural and experimental

philosophers were interested in the earthquake as a natural phenomenon (Grant 2007). They were interested in recording data and describing the events of the New Madrid earthquakes so that they could eventually make larger theoretical and more abstract epistemic claims about earthquakes and nature's course (Valencius 2013).

South Carolina had a black majority population since 1708 and a slave colony legally since 1669; (Wood 1975). By the 1780 s, white South Carolinians and enslaved black South Carolinians had a close and anxious relationship. White planters used slave labour in the new urban landscape. Obtaining water was a crucial part of everyday life in Columbia. White masters sent enslaved persons to collect water for their daily needs at public sources of water, such as aquifers (such as the one that Blanding would use for the source of running water), rivers, streams, and public and private wells. Many whites drank water out of "drinking gourds" manufactured by slaves. The gourds themselves had even been brought to South Carolina by slaves as seeds, almost a century before the founding of Columbia (Samford 1996, p. 87–114). Possibly because of their dependence on slave labor, anxious masters were constantly worried about the threat of their water being poisoned (Savage 2007, p. 635–662). African slaves developed unique ways of collecting water for their own personal use. There is evidence that slaves used giant cisterns to collect rain water to use for drinking and for watering their personal gardens (Savitt 2002 p. 60–63).

The observations about the changes in the wells were from Smith's visit to Columbia in 1812. While Smith was visiting Columbia, he learned that historically the drinking wells had been deep and abundantly full of water. In 1812, the wells continued to serve the needs of the community. The well of the College was especially perfect for the needs of the students and faculty; it contained twelve feet of water, which usually satisfied the needs of two hundred persons.

However, shortly after Smith arrived, the wells of the city began to dry up. Smith notes that the state of the wells became progressively worse each year. Three years after the earthquake, most of the wells were either dried up or contained only two to three feet of water, "Shortly after this time, many of the wells in the town began to fail in their usual supply of water, although they were frequently cleaned out and occasionally deepened. Their state became worse every year, until, at length, about three years since, some of them proved to be entirely dry, and most of the others had their water turbid, and diminished to the depth of only two or three feet." (pg. 93) Of these wells that contained some water, the water was turbid.

Smith then called on data about rain fall. Since the establishment of plantations in the American South, plantation owners, gentlemen, and scientists alike kept track of the rain (Golinski 2007; Burris et al. 2018; Druckenbrod 2003). Before the dry stretch of years after the earthquake, Smith observed that Columbia had very little rain fall until the previous spring. After the spring, Columbia received a large amount of rainfall. Smith noted that the topography of Columbia might be affecting the reception of rainfall into its wells.

The importance of the location of the town is highlighted in Smith's article. Columbia is "thickly built up" approximately a mile from the Congaree River. Smith estimates the town was one hundred feet above the normal height of the river. The hill that the town is situated near is made up of porous, sandy soil. Smith doubts that there was little hard rock underneath the foundation of the town closest to the river. Some individuals in town had proposed that the earthquakes caused the lack of well water from the texture of the soils loosening, and "the views of water which used to supply the wells, had sunk beneath the

level of these reservoirs…." (Smith 1818, p. 94) However, Smith noted, "…that that there was no remarkable failure of water for one or two years after these changes were supposed to have been effected." (p. 94) Other counter arguments proposed that the failure of well water was linked to the "dearth" of rainfall, which affected the level of the river that feeds the water wells of Columbia.

Smith noted that these arguments would be proved correct if the deepening of wells or the increase of rainfall affected the amount of drinking water in the wells. In fact, some Columbians decided to deepen the wells from their previous depth of two feet to a depth of eight or even ten feet, but this measure proved ineffective. Taking the increased rainfall of the previous year into account, although some of the well levels had risen, Smith wrote that "…there is not the half as much [well water] as existed before the earthquakes." (p. 94).

Though Smith did not know the cause of the phenomenon, he noted that the effects on the drinking water supply were very "inconvenient." (p. 95) Smith believed that the lack of drinking water would be permanent, and noted many people in the town were beginning to look to alternative methods of collecting water, such as building cisterns to "…accumulate artificial reservoirs of water." (p. 95) Columbians, like Smith, likely wanted a more secure and steady supply of water that was not dependent on unpredictable natural phenomena.

Planning nature: Bring wholesome water to the new capital

The town of Columbia would be located near fresh water. The first section of the act laid out specifically that the capital be on a two-mile tract between Friday's Ferry and the Congaree River (Copper 1838). Placing the city between two rivers was one of the most important points of design as the rivers could provide a highway for trade and transport, as well as drinking water. The City Planners would lay out the streets and lots accordingly. The lots for sale would be half an acre each and the streets would be at least sixty feet wide. The town would be designated into private lots with eight acres reserved for municipal use. This municipal use included plans to build a state house where the General Assembly would meet, courts of justice, and offices for other municipal workers (Copper 1838). Eventually, there would be provisions for a permanent residence for the governor. The capital would have ornamental land use with the remaining lots that were not used by the government or sold (Copper 1838).

Ten years after the planning of Columbia, the General Assembly came together to attempt to improve the health of the city. The preamble of an 1818 act called for the establishment and the construction of a waterworks. The preamble notes the benefit of a system of running water to the health of the people of Columbia, saying "…it would conduce much to the health and convenience of the inhabitants of the town of Columbia if they could be supplied with good water…." (McCord 1939) However, changing the landscape for the health of the people required money and the town taking on debt.

The act that enabled Columbia to construct a waterworks system has as much to do with enabling the town's wardens to borrow money as to the actual details on the construction of the waterworks. According to the General Assembly, it seemed their role in the construction of the waterworks was not the planning of the system but the planning of how to fund a large debt. Most of the preamble of the act notes that "…the intendent and wardens of said town have by their petition, represented that if they were empowered to borrow a sufficient

sum of money, this desirable end may be easily accomplished." (McCord 1939) Most of the act describes and stipulates how much money the wardens of the town could borrow. The Act empowers the new city in regards that, "…the intendant and municipal wardens of the town of Columbia shall be, and they are hereby, empowered to borrow of any corporation or individual or individuals, a sum of money not exceeding twenty-five thousand dollars, at such interest and payable at such times and in such manner as shall be deemed prudent by them." (McCord 1939) The Corporation would be called the Columbia Watering Company (McCord 1939).

However, the General Assembly also mapped out how the town would pay off the debt over the long run. In the second section of the act, the General Assembly established a taxing scheme to pay for the waterworks:

> …That it shall be the duty of the said intendant and wardens to levy, by tax on the taxable property of the town of Columbia, a sum sufficient to pay the interest on the said loan from year to year, and to discharge the principle of the said loan when the same shall become due, and to constitute a sinking fund from the redemption thereof. (McCord 1939)

Therefore, the General Assembly's role in the establishment of the waterworks only extended to financial planning. It was, according to the act, an established corporation that would complete the task of planning and building the waterworks.

This corporation would have special privileges and responsibilities. One of these was that the corporation had the power to change the natural surroundings. For instance, according to the Act,

> … the said cooperation shall be, and they are hereby, authorized and empowered to divert from its usual channel any stream or streams of water in or adjacent to the said town, making to the person or persons injured thereby adequate compensation for the same, which compensation shall be ascertained by five commissioners to be appointed by the court of equity or common pleas, on application by petition for that purpose by the said corporation or person injured. (McCord 1939)

The corporation also had the power to use any private property deemed necessary to the enterprise. This power included using private property to access reservoirs of water, laying down pipes/aqueducts, and any other means to distribute water through the town. The planning of the city, through a public and private partnership, focused on developing a water system to provide consistent water to the city.

Engineering water: Political capital, innovation and government planning

Abram Blanding came to Columbia in 1797, after graduating from Rhode Island College (now Brown University). He came to South Carolina based on the recommendation of Jonathan Maxcy, who would later become the first president of South Carolina College Maxcy likely remarked to Blanding that there would be excellent financial opportunities in South Carolina for an educated man (Kohn et al. 1938a, b; Kirkland and Kennedy 1968; O'Neal 1859; Scott 1884).

Blanding's first role in Columbia was as the principal of Columbia Male Academy (Kohn et al. 1938a, b; Kirkland and Kennedy 1968; O'Neal 1859; Scott 1884). While leading this new center, which sought to educate the influx of new citizens, Blanding also began to educate himself in the law (Kohn et al. 1938a, b; Kirkland and Kennedy 1968; O'Neal 1859; Scott 1884). He gained admittance to the bar in 1802 (Kohn et al. 1938a, b; Kirkland and Kennedy 1968; O'Neal 1859; Scott 1884). Lawyers carried out much of the municipal planning of Columbia early on (Kohn et al. 1938a, b; Kirkland and Kennedy 1968; O'Neal 1859; Scott 1884). Blanding seemed to have the right connections; he married the daughter of the President of South Carolina College in 1815. Prior to this marriage, Blanding earned election to the South Carolina Legislature, holding the position of representative of Kershaw from 1805 to 1812 (O'Neal 1859, p. 236–238).

Blanding won the right to build the waterworks from the General Assembly in 1819. He won this right because of his success with previous public acts of community improvement and his seniority in the General Assembly. Blanding had the right connections, both in family and government, and in April of 1820, he was appointed the Superintendent of Public Works. Blanding was friends with a leading architect in South Carolina, Robert Mills. In addition to work in architecture, Mills also wrote about water systems.[3]

The story of establishing running water in Columbia was no different than any growing city of the time, especially Charleston. When one reads Abram Blanding's reports as chairman of the Board of Public Works, the rationale for building the waterworks in Charleston shows similar pressing issues during the drive to build a waterworks in Columbia. Blanding's 1825 Report on the Edisto Canal and other Public Works projects discusses the problems of drinking water in Charleston.

In his first sentence in the section describing the "Watering of the City of Charleston," Blanding states that, "the well water of Charleston is not good. It is unpleasant to the taste, and too hard for washing." (Kohn ed. 1938a, 383–386) Blanding also notes that, "To furnish the city with an abundant supply of pure fresh water for every domestic use, is certainly very doable." The Columbia Canal was one of the first large projects that Blanding and the Board of Public Works were charged with completing.

The Canal was completed in March of 1825, after the completion of the waterworks. The Board of Public Works attempted to use the reservoirs of the Canal for other purposes. These uses included running pipes to harness the power of the running water coming into the Canal to power machinery used to manufacture bricks in a local factory. More importantly, the Superintendent of Public Works was given the power to decide who could use water coming from into the canal. Essentially, Blanding was given the power to decide who could use a natural resource and protect the town against any improper use of water. Therefore, Blanding received a power to define the use of nature, and the type of nuisances that the state protected the public from was loosely defined. The water coming from the Congaree River was a resource that Columbia could not provide to its citizens. (Kohn ed. 1938a, 383–386)

He estimated that the project would be relatively cheap for the citizens of Charleston to have such a healthy system of protection against yellow fever. He noted that it would only cost the citizens $10.00 per year, paying 10% of the project's debt per year, which he noted is half the price of annual water service for the citizens in Columbia.

[3] After building and profiting from tax revenue from the waterworks, Blanding edited the *Carolina Law Journal* with D.J. McCord in 1831, "Abram Blanding" in Kohn et al., *Internal Improvements in South Carolina*.

> The expenses of service pipes is not included in this estimate, as families will supply them at their own expense, which will not exceed $[sic]20 to each family…It is supposed that two thousand families at least would be supplied in the city, and that $[sic] per annum would be a moderate charge for each family. This is mone half the rate in Columbia—this would give a gross amount of $20,000 or ten per cent on the expenditure. The uses made of the water by the city, independent of domestic purposes, out to be sufficient to pay the current expenses of the establishment. (pg. 384)

He noted that the project could potentially provide water for a thousand people's domestic homes from the waterworks. Blanding also comment on the cleanliness of the water:

> It is most probable, that were the streets at state periods well cleaned by washing them into the subterraneous drains which have been constructed under most of them, and that these drains were regularly ventilated and washed clean, the *yellow fever* might be greatly might be greatly mitigated, if not expelled from the city. It is very certain that the comfort and general health of the place might be improved by these means. (384–385)

Blanding also argued that the availability of water could provide other sources of utility and comfort for the city: "It is still more desirable that the supply should be so abundant, that it may be used not only for extinguishing fires, but watering the streets in dry weather, and at all times for cleansing the gutters and the subterraneous drains of the city." (Kohn ed. 1938a, 383).

He situated the location of the waterworks near a canal constructed previously by the Board of Public Works. He noted that the water must be "elevated and purified" to a high location, where the water will be pumped by machines. Critical to pumping the water would be establishing a basin where water could collect for six days. Then Blanding argued that engineers could use excess power from the canal to pump the water into the city. The City made similar plans concerning the utility of the Columbia Canal.

He estimated the cost of the city's waterworks based on the existing waterworks of Columbia. Blanding used $75,000 of his own fortune to build the waterworks in Columbia. In his report, he bases his estimation on the construction of a basin ($66,000) and pipes ($17,000). The estimate omitted the cost of the pump, which would likely come from Britain.

The rise of the steam engine arguably changed the way that labor and the environment interacted. A steam engine based on the designs of James Watt and Mathew Boulton replaced the pump. It is unclear what powered the water pump prior to the replacement with the Watt and Boulton pump. The efficiencies of this machine allowed for a greater amount of water to be supplied at a greater distance than the pump, and allowed the user to diversify the work of the machine to not only pump water but operate mills and heat public baths.

Newspapers & wonder

The Charleston Courier heralded the establishment of mechanistic wonders in the town of Columbia. On December 20, 1820, both the General Assembly and the general public of Columbia were interested to see how their newly appointed Commissioner of Public Works was spending the community's money (Charleston Courier, 12/20/1820). On Wednesday

December 20, 1820, Abram Blanding attempted a demonstration of the new technology that would essentially allow him to bring good health to the town. There was also a certain novelty to seeing fresh water being pumped from a reservoir to the town. The *Courier* reported with great interest:

> On Wednesday morning last, the Steam engine, put up by Col. Blanding for the purpose of supplying the town of Columbia with water, was set in operation before a large number of the citizens and members of the Legislature. The pipe to the lower basin was not complete, and of course the water would not be propelled from the machine to the upper basin. But as far as could be judged from the operation of the machine alone it gave universal approbation. A cleaner working piece of machinery perhaps is not in the United States. It appeared more like the movement of a celestial system than a human invention, to see the complicated machinery in active motion, with a balance-wheel of sixty hundred eight, without the least noise or jar (*Charleston Courier*, 12/20/1820 and Roll, 1968).

Other newspapers around the Columbia area promoted the excitement of the waterworks and its construction. In 1821, the *Camden Gazette* proudly covered the construction of the waterworks:

> *Columbia Water Works.*---We had the pleasure on Friday last of seeing these works put into full operation. Every part of the machinery worked in the most perfect manner; and the purse spring water of the valley with great apparent ease and regularity flowed into the reservoir, which has a perpendicular evaluation above the lower basin of 116 feet and above the common level of the town of 35 feet. The distance on an inclined plane from the basin where the water is collected, to the summit of the discharge is 900 feet, and is laid down with iron pipes of eight inches interior diameter. The forcing pumps make 54 strokes in a minute when the steam engine is at original speed, and discharge 10,000 gallons of water into the town in one hour. The beauty of the machinery and the permanent construction of the work is believed not to be excelled by any similar establishment in the United States (Documentary History of American Waterworks: http://www.waterworkshistory.us/SC/Columbia/1821Apr12.pdf).

The article praised the mechanics and ingenuity of Blanding. The article glowed about the fact that much of the machinery came from Manchester, England:

> The greatest credit is due to the manufacturers, Messrs. Galloway and Bowman of Manchester, England, and to Mr. Johnson the engineer, whose ingenuity and attention to the erection of this beautiful establishment cannot be too highly extolled. Col. Blanding could not have put this into more faithful hands. The whole of Richardson Street, from the state house to Upper-Boundary street, has been laid down with cast iron pipes (Documentary History of American Waterworks: http://www.waterworkshistory.us/SC/Columbia/1821Apr12.pdf).

About one and one quarter of a mile worth of pipes brought the water to Columbia. The article said that half of the population of the city received water. The article also stated that the writer expected all the city to have water. The state promoted the taste of the water, saying that though there are iron pipes, "…it is understood, never gives an unpleasant taste or del-

eterious quality to the water." (http://www.waterworkshistory.us/SC/Columbia/1821Apr12.pdf).

The springs in close proximity to Columbia could support a town three times the size of Columbia, which would provide plenty of consistent water for the city. The article ends by further cementing the utility of water to the importance of the success of Columbia. "Whether we regard the health and comfort of our citizens, or the security of the town from fire, this establishment cannot but be considered as of the utmost importance to Columbia." (http://www.waterworkshistory.us/SC/Columbia/1821Apr12.pdf).

About sixty years before Blanding's importing of the technology, engineers had first used steam power to pump water into an urban space in England, after its success pumping water out of coal mines. Boulton and Watt were devoted to capturing the "waterworks" market between the years 1775 and 1785, the first ten years of their partnership. They focused on refining their pump engine to be as efficient as possible (Roll 1968). The 1785 engine that Watt devised was remarkable for how efficiently it used coal. This appealed to Blanding, who needed a reliable and efficient source of power to pump water from a low elevation to a high elevation (Roll 1968).

The construction of the Columbia waterworks caught the attention of other architects and engineers. Robert Mills, who served on the Board of Public Works and was a practicing engineer and architect in South Carolina, wrote a history of the state that highlighted the modernity of the city and its wondrous technological interventions intended to utilize nature. Mills's 1826 *Statistics of South Carolina, Including a View of the Natural, Civil, and Military History, General and Particular* includes a description of the waterworks as a wonder of the city of Columbia (p. 706).

As a member of Blanding's Board of Public Works, Mills likely intended to promote the wondrous engineering projects taking place in Columbia. Mills described Columbia as "… amply supplied with spring water…" from the work of "…our enterprising citizen, Col. Abram Blanding." (p. 706) Mills also praised the establishment of the canal system.

As an engineer and tinkerer, Mills wanted to show how Blanding was able to bring water into a planned city. He described the waterworks in great detail. The water, he stated, came from an underground spring, and its contents moved one hundred and twenty feet by steam power. Then the cast-iron pipes moved the water through the city, distributing it to individual households by "leaden pipes." (p. 706).

Specifically, Mills highlighted the steam-powered mechanism that moved the water. James Watt and Mathew Balton developed plans for Columbia's steam engine. The English company of "Messers Galloway, and Bowman" also constructed the steam engine (p. 706). The steam engine was imported from Manchester, United Kingdom, "This is the work of our enterprising citizen, Col. Abraham Blanding. The steam engine is on Watt and Balton's plan and was constructed by Messrs. Galloway and Bowman, of Manchester, England. It is of beautiful construction, and works with great ease and effect. The surplus power is applied to the grinding of wheat and Indian corn." (p. 706 and waterworkshistory.us/SC/Columbia) Excitedly, Mills also noted that the surplus energy from the steam engine could provide power for other projects. For instance, people used Blanding's steam machine's surplus energy to grind wheat and "Indian corn."(p. 706) Additionally, they also used the heat from the machine for public baths adjacent to the waterworks (p. 706).

The steam pump ran on the burning of timber. Mills cautioned the reader that they had to be mindful of their wood supply because Columbia had no coal resources. His warning

was: "It behooves us to be careful of our wood lands, for we have no coal to substitute for fuel when the timber is gone." (p. 383 and http://www.waterworkshistory.us/SC/Columbia/) Mills cautions that parts of South Carolina have been completely depleted of their natural resources because of the need for fuel. Mills cautions that, "Some parts of the district are beginning already to experience a want of timber, even for common purposes. If we cut off the wood and exhaust the soil, by repeated culture, without nauring, a long period must elapse before another growth of timber occupies the same ground." (p. 383) Mills even proposed that plantations needed to focus on regenerating timber. Mills encouraged plantation owners to have a plan for timber: "Every plantation ought to serve at least one fourth of its extent of acres in wood; and, when clearing land, the planer should walys leave a sufficient depth of wood land, next to the river or swamp, standing, as a proftection to the health of the inhabitants residing on the high land contiguous." (383) Mills wants to secure a steady and consistent fuel source for agriculture and the powering of other projects, like those of steam engines.

Steam was the literal driving force of the waterworks. *The City Gazette*, based out of Charleston, reported on the waterworks of Columbia in 1828 (http://www.waterworkshistory.us/SC/Columbia/1828May2.pdf) The paper recounts how inspiring the waterworks were, but also how they functioned. The article stated that:

> The Water Works of Columbia were begun in 1818, and finished in 1821. The water is collected from pure springs in a valley within the limits of the town, which is about ninety feet lower than the platform on which that beautiful place is built; these springs are conducted under ground to a reservoir in the centre of the valley; which is walled with granite and covered with a wooden roof; its capacity is 60,000 gallons. The springs now turned into it, fill it twice in twenty four hours, and should the town require it, the supply may have doubled from other springs in the same valley, which are not now used. (http://www.waterworkshistory.us/SC/Columbia/1828May2.pdf).

The article's author also historicized the successes of the waterworks, reporting that the waterworks had been thriving for the last seven years and the operation of the waterworks had been very efficient.

> The plans and execution of his work have been so perfect, that in seven years, during which time it has been in operation, the town has never been a day without water, and the repairs of the whole establishment have lost less than one hundred dollars a year. This work has been constructed by the funds of a single individual and has a cost about $ 55,000.

(http://www.waterworkshistory.us/SC/Columbia/1828May2.pdf) By 1850, a survey included the site of the waterworks (http://www.waterworkshistory.us/SC/Columbia/ and https://www.loc.gov/item/77696235/). The waterworks was located on the newly named "Blanding Street."[4] A new waterworks was constructed by 1855. The waterworks is part of the planned and gridded plan for Columbia. (http://www.waterworkshistory.us/SC/Columbia/).

The incorporation of waterworks into the planning of cities would continue in the nineteenth century and Mills continued to promote the value of water works for cities. Robert

[4] Water historian Dr. Morris Pierce notes in his history of waterworks that the town expanded the reservoir and also owned the engineering house (http://www.waterworkshistory.us/SC/Columbia/)

Mills always promoted the healthful benefits and aspects of modernity that water systems brought to Americans. In 1849, Mills promoted a plan for the waterworks of Washington, D.C. (Mills 1853) In his promotional pamphlet, Mills writes that, "In a physical sense, water is the great solvent of matter and promoter of health." (Mills 1853, p. 6) In his history of the engineering of water for consumption, he marvelledat the greatness of Rome for their achievements in drinking water:

> From what has been said we may judge of the rapid progress made by this remarkable people, the Romans, in the facilities of procuring and distributing water through their cities, and science exhibited in the construction of the works connected with the same. (p. 9)

Before proposing his own plan for the construction of a waterworks in Washington, he equated water availability to citizens with liberty:

> In almost every European Government the same liberal policy was manifest, and under our free Government, instituted for the welfare and happiness of the people, we should not lag behind those Governments (arbitrary as many of them were) to enter on the great work of causing the life-preserving waters to flow through the people's city free as air, not only for the refreshment of its citizens and the Representatives of the people assembled here half the year on an average, but for the security of the public records. (p. 30)

Mills pointed out that having access to water would prevent fire. He also asserted that having flowing water would completely end all disease. He proclaimed that "we may venture to say that no city, possessing the treasure of the abundance of waters, would suffer from a diseased or contaminated atmosphere." (p. 30) Mills believed that water purifies and should be primary "…in the scale of personal comforts." (p. 30) He even channelled religion, writing that Christ stated that, "'Ho every one that is thirsty let him come to me and drink.'" (p. 30).

Blanding and the town council

Historians estimate Blanding's investment in the waterworks at $75,000 (Freeman 1886, p. 102–104).[5] It seems that Blanding constantly had to petition the Town of Columbia for reimbursement for his work for the town. For example, Blanding wrote to the State Legislature, noting that he had turned on the required State buildings to his water system. He notes that it cost him $170.25 to put pipes into the State House. In another petition, Blanding asked the town to allow the College, Asylum, and the Arsenal Hill Academy to be watered by the canal, though there were other types of water sources to access. It seems that toward the end of Blanding's tenure managing the water system of Columbia, too many buildings and a growing population seemed too costly for Blanding to continue managing the waterworks privately.[6]

[5] Other historians such as Lynn Sims Salsi estimate that Blanding sold his share for $25,000. See Columbia: the Story of a Southern Capital (Charleston: Arcadia Publishing 2003), 36. However, the case description from "Blanding v. Columbia" notes $24,000.

[6] "[Abram Blanding] Petition Asking Compensation for Putting Down Service Pipe and Conducting Water to the State House and Goal [Jail]" Series S165015, No Date, Item 017131, and "[Town of Columbia] Peti-

Blanding died in 1839, and his widow Mary Blanding brought suit against the corporation of Columbia in 1857, with the case being published in 1858 (Richardson 1859, p.573). In the historical summary in the description of the court case, the attorneys frame the issues with the City Council of Columbia. Mary was requesting to redeem the stock from the waterworks venture that Abram Blanding took in exchange for the sale of the Columbia works to the city:

> It is ordered and decreed that the corporation of the city of Columbia, S C., do pay to the plaintiff, Mary C. Blanding, the sum of fifteenth thousand five hundred dollars, ($ 15, 500) being the principal of the certificates of stock still belonging to the estate of Abram Blanding, with interest on the said sum from the eleventh (11th) day of July, A. D., (1855,) eighteen hundred and fifty-five, at the rate of seven per cent per annum; any payments which have been made on account of interest, be allowed as credits *pro tanto* thereon. (575–577)

This case cites a previous agreement made on June 13, 1835 (p. 573). The brief recounts that, "…the corporation of Columbia entered into articles of agreement with Abram Blanding, to purchase from him the waterworks he had erected in the said town, to supply the inhabitants with water, at the expense to him of seventy thousand dollars." (p. 573–574) The brief then states that the contract that Blanding entered into stipulated that he would receive twenty-four thousand dollars in stock in the town. This stock would yield 5% interest per year, and that interest payment would be paid per quarter. This means that Blanding was collecting twelve hundred dollars per year or four hundred dollars per quarter. The important part of the brief is the notation that, "The said stock shall be redeemable at the pleasure of the corporation, after the 10th July, 1855." (p. 574) Blanding accepted these conditions and received twenty-four thousand dollars' worth of stock.

Mary Blanding had sold some of the stock and had fifteen thousand five-hundred dollars' worth remaining. She wanted the corporation to pay her for the remainder of the stock that she continued to hold. The brief stated that on "About the 10th of July, 1855, she [Mary Blanding] demanded of the corporation to redeem the stock, or to issue new stock bearing legal interest, and payable at a reasonable time, suggesting ten years as such limit." (p. 575) The Corporation did not honor her request as they said they were not "bound" to give her the value of her stock, as it was "their privilege" because of the contract originally signed with Blanding. According to the Corporation, they only had to pay the 5% interest payment every quarter.

Mary Blanding's attorneys argued that the statement that said that the Corporation would pay at their pleasure after 1855 gave her the right to collect the cash balance. Ultimately the Court decided that Mary Blanding would not only receive the remaining debt but the Corporation would pay her a full 7%. Again, this decision included the payment rate from 1855 to 1858 to include the 7% interest on the principle.

Columbia eventually appealed the case because they said the contract stipulated that they pay at their pleasure, and were therefore, not obligated to pay any interest. The Equity Court

tion Asking for Aid to Expand the Town Waterworks to Meet the Needs of the Lunatic Asylum, the College, School Students and the General Increase of Population" Series S165015, No Date, Item 05680, and "[City Council of Columbia] Petition Giving A History of the Water Supply to Public Buildings and Asking for An Additional Appropriation Equal to the Increased Demand from New Buildings" Series S165015, No Date, Item 05840. All documents listed above came from the South Carolina Department of Archives and History, viewed on Microfilm.

of Appeals, where the decision was rendered that the interest be paid, heard the case, but the Corporation could redeem the stock at its pleasure (p. 577–581). This likely hurt the family of Abram Blanding, considering the large amount of capital that was invested in the water works and the lack of interest that would be paid to the family. There is no data that I came across that indicated how the family fared after the court's judgement, but with such a public display of the city's appeal against paying out to Blanding's widow, future investors should have been cautioned in investing in the city's infrastructure.

Conclusion

In the 1830s, Blanding wished to remove himself from the day-to-day operations of the waterworks. The population of Columbia had grown from a few hundred prior to the start of the nineteenth century to almost four thousand people by 1835 (Freeman 1886, p. 102–104). Per his contract, Blanding was obliged to eventually bring water to every part of the town. Blanding simply might have been tired of providing exploratory capital to construct a larger waterworks to supply the town. Additionally, the contract that Blanding signed to construct the waterworks only allowed him at maximum 14% total profit from Blanding's original investment on water usage. This fee might have been difficult to collect or simply not enough to cover Blanding's expenses. (Waterworkshistory.us/SC/Columbia and Moore)

Blanding might have also been too busy to expand the coverage of the waterworks; his responsibilities as leader of the Board of Public Works also expanded during this time. Blanding would go on to construct and manage large railroads across the state and a road from Columbia to Charleston, and would chair a private bank before his death in 1839 (Kohn 1938a, 47–48 and 599).[7] Blanding was able to retire to Sullivan's Island, South Carolina, after his service to the city of Columbia and his private enterprises (p. 599). Perhaps Blanding's career trajectory demonstrated the difficulty of investors and innovators in the South during the early nineteenth century.

In the nineteenth century, the South Carolina State Legislature thought that they could improve urban life with access to water. "Wholesome water" as Robert Mills described, was a way to transcend the fever-ridden swamps of the midlands and low country of South Carolina (Mills 1826). Therefore, planners of Columbia desired to have a running water system to ensure the good health of the citizenry and encourage investors to come to the state to bolster its prominence.

Blanding did not necessarily have engineering credentials, but the General Assembly trusted that he could complete the water works. When constructing the waterworks, Blanding used the latest pump technology from Watt & Boulton. Blanding's bureaucratic and leadership techniques served him well in directing the construction of the waterworks. However, it seemed that Blanding had a strained relationship with the leadership of the Town of Columbia.

The waterworks brought Columbia a wondrous scene of mechanistic intervention in nature. The waterworks also allowed Columbia to escape some of the worries associated with well water. Blanding bringing water to the city allowed for state buildings and some wealthier homes to have constant access to water. However, lower class and more rural

[7] Also see biography on page 599.

homes still had to gather water through municipal wells, slave labor, or private wells. Water seemed to divide the citizenry based on their access to this luxury.

Columbia's waterworks served as inspiration for other cities, such as Charleston. Blanding did not profit from fees from the customers of the water works, he never received his complete investment back. Water works in the nineteenth century gave cities like Columbia the modern features that planners desired, but ultimately Columbia did not support entrepreneurs like Blanding, as the water works expanded and more citizens desired access to the innovative water system.

References

Baker J (2020) Building America: The Life of Benjamin Henry Latrobe. Oxford University Press, New York

Bender T (1975) Toward an Urban Vision: Ideas and Institutions in the Nineteenth Century America. University Press of Kentucky. Lexington

Blanding A (No Date) [Abram Blanding] Petition Asking Compensation for Putting Down Service Pipe and Conducting Water to the State House and Goal [Jail]" Series S165015, No Date, Item 017131. South Carolina Department of Archives and History, viewed on Microfilm

Blanding A "[Town of Columbia] Petition Asking for Aid to Expand the Town Waterworks to Meet the Needs of the Lunatic Asylum, the College, School Students and the General Increase of Population" Series S165015, No Date, Item 05680. South Carolina Department of Archives and History, viewed on Microfilm

Blanding A "[City Council of Columbia] Petition Giving A History of the Water Supply to Public Buildings and Asking for An Additional Appropriation Equal to the Increased Demand from New Buildings" Series S165015, No Date, Item 05840. South Carolina Department of Archives and History, viewed on Microfilm

Brownwell B, Goldfield D (eds) (1997) The City in Southern History: The Growth of Urban Civilization in the South. Kennikat Press, Port Washington

Burris G, Elsner J, Joel R (2018) Plantation Records as a Source of Historical Weather and Agricultural Data. Southeast Geogr 58:348–364

Chaplin J (1993) An Anxious Pursuit: Agricultural Innovation and Modernity in the Lower South, 1730–1815. University of North Carolina Press, Chapel Hill

Charleston Courier (1820) December 20. University of South Carolina. South Caroliniana Library Viewed on microfilm

Copper T (1838) "An Act to Appoint Commissioners to Purchase land for the Purpose of Building a Town, and for Removing the Seat of Government Thereto, No. 1333 A.D. 1786". The Statutes at Large of South Carolina: Edited Under Authority of the Legislature, by Thomas Copper, vol 4. A.S. Johnston. Columbia

Driggers E (2020) "A Clue in a Labyrinth:" The Medico-Chemistry of the Stone in the Life of Edward Darrell Smith. J Med Biogr 28:232–245

Druckenbrod D et al (2003) Late-Eighteenth Century Precipitation Reconstruction from James Madison's Montpelier Plantation. Bulletin of the American Meteorological Society 84 (2003) 57–72

Edgar W (1998) South Carolina: A History. University of South Carolina Press, Columbia

Faletti R (2017) Industrial Ornament, Modern Symbol: New Orleans' First Waterworks on the Mississippi River. Open Rivers 8:29–52

Freeman A (ed) (1886) "Blanding v. Columbia" in The American Decisions Containing the Cases of General Value and Authority Decided in the Courts of the Several States From the Earliest Issue of the State Reports to the Year 1869, vol 73. Bancroft-Whitney Company, San Francisco, pp 102–104

Galehouse R (2019) The Power of the Plan: Building a University in Historic Columbia, South Carolina. University of South Carolina Press, Columbia

Goldfield D (1982) Cotton Fields and Skyscrapers: Southern City and Religion, 1607–1980. Louisiana State University Press, Baton Rouge

Grant E (2007) A History of Natural Philosophy: From the Ancient World to the Nineteenth Century. Cambridge University Press, New York

Golinski J (2007) British Weather and the Climate of Enlightenment. The University of Chicago Press, Chicago

Hamlin C (1990) A Science of Impurity: Water Analysis in Nineteenth Century Britain. University of California Press, Berkley
Hamlin C (2000) "Waters' or Water?"—Master Narratives in Water History and their Implications for Contemporary Policy. Water Policy 2:313–325
Henning H (1936) Columbia, Capital City of South Carolina, 1786–1936. R. L. Bryan Co., Columbia
Kapsh R (2018) Building Washington: Engineering and Construction of the New Federal City. Johns Hopkins University Press, Baltimore, pp 1790–1840
Kirkland J, Kennedy M (1968) Historic Camden.Kershaw County Historical Society. Camden
Kohn D (ed) (1938a) "Watering the City of Charleston" Abram Blanding, in Internal Improvements in South Carolina. Private Printing. Washington D. C
Kohn D (ed) (1938b) [Report No. 4] Report to the Acting Commissioner, for the Department of Roads, Rivers and Canals on the State Road," in Internal Improvements in South Carolina
Kupperman K (2009) The Jamestown Project. Harvard University Press, Cambridge
Larson J (2001) Internal Improvement: National Public Works and the Promises of Popular Government in the Early United States. University of North Carolina Press, Chapel Hill
Lockhart M (2003) Under the Wings of Columbia: John Lewis Gervais As Architect of South Carolina's 1786 Capital Relocation Legislation. S C Hist Mag 104:176–197
O'Neal J (1859) Biographical Sketches of the Bench and Bar of South Carolina. S. G. Courtenay & Co. Charleston
McCandless P (2011) Slavery, Disease, and Suffering in the Southern Lowcountry. Cambridge University Press, Cambridge
McCord D (ed) (1939) An Act to Enable the Intendant and Wardens of the Town of Columbia to Borrow Money for the Purpose of Supplying the Said Town with Water; And For Other Purposes Therein Mentioned, No. 2204, A.D. 1818 in The Statutes at Large of South Carolina, Edited Under the Authority of the Legislature
Merrens H, Terry G (1984) Dying in Paradise: Malaria, Mortality, and the Perceptual Environment in Colonial South Carolina. J South Hist 50:533–550
Melosi M (1981) Garbage in the Cities: Refuse, Reform and the Environment, 1880–1980. Texas A & M. College Station
Melosi M (2000) The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present. Johns Hopkins University Press, Baltimore
Mills R (1826) Statistics of South Carolina: Including a View of Its Natural, Civil, and Military History, General and Particular. Hurlbut and Lloyd. Charleston
Mills R (1853) Water-works for the Metropolitan City of Washington. L. Towers. Washington. Found in http://www.waterworkshistory.us/DC/Washington/1853Mills.pdf
Mohl R (ed) (1998) The Making of Urban America. Scholarly Resources
Moore J (1993) Columbia and Richland Country: A South Carolina Community, 1740–1990. University of South Carolina. Columbia
Penick J Jr (1981) The New Madrid Earthquake. The University of Missouri Press, Columbia
Pierce M (2021) http://www.waterworkshistory.us/index.htm. Also see the entries for Albany, New York: http://www.waterworkshistory.us/NY/Albany/. Charleston, South Carolina: http://www.waterworkshistory.us/SC/Charleston/. Columbia, South Carolina: http://www.waterworkshistory.us/SC/Columbia/. New Orleans: http://www.waterworkshistory.us/LA/New_Orleans/. New York, New York: http://www.waterworkshistory.us/NY/New_York_City/. Philadelphia, Pennsylvania: http://www.waterworkshistory.us/PA/Philadelphia/. Saint Louis, Missouri: http://www.waterworkshistory.us/MO/Saint_Louis/. Washington, D.C.: http://www.waterworkshistory.us/DC/Washington/
Quintana R (2018) Making a Slave State: Political Developments in Early South Carolina. University of North Carolina Press
Reps J (1965) The Making of Urban America: A History of City Planning in the United States. Princeton University Press, Princeton
Richardson J (1859) Reports of Cases in Equity, Argued and Determined in the Court of Appeals and Court of Errors, of South Carolina Vol, vol X. McCarter & Co. Charleston, p 573
Roll E (1968) An Early Experiment in Industrial Organization: Being a History of the Firm of Boulton & Watt. Cass, London, pp 1775–1805
Samford P (1996) The Archaeology of African-American Slavery and Material Culture. William Mary Q 53:87–114
Salsi L (2003) The Story of a Southern Capital. Arcadia Publishing. Charleston
Savage J (2007) "Black Magic" and White Terror: Slave Poisoning and Colonial Society in the Early 19th Century Martinque. J Soc Hist 635–662
Savitt T (2002) Medicine and Slavery: The Diseases and Health Care of Blacks in Antebellum Virginia. University of Illinois Press, Champaign

Schultz S (1989) Constructing Urban Culture: American Cities and City Planning, 1800–1920. Temple University Press, Philadelphia
Scott E (1884) Random Recollections of a Long Life: 1806–1876. Charles A Calvo Jr. Columbia
Smith E (1818) On the Changes which have taken place in the Wells of Water situated in Columbia, South-Carolina, since the Earthquakes of 1811–1812.American Journal of Science and Arts 1
Soll D (2018) An Environmental and Political History of the New Work City Water Supply. Cornell University Press, Ithaca
Tolbert L (1999) Constructing Townscapes: Space and Society in Antebellum Tennessee. University of North Carolina Press, Chapel Hill
Valencius C (2013) The Lost History of the New Madrid Earthquakes. University of Chicago Press, Chicago
Waring J (1964) A History of Medicine in South Carolina, 1670–1825. South Carolina Medical Association. Columbia
Wood P (1975) Black Majority: Negroes in Colonial South Carolina From 1670 Through the Stono Rebellion. Norton, New York
Zagarri R (1988) Representation and the Removal of State Capitals, 1776–1812. J Am Hist 74:1239–1256

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