Two Tales of Infrastructure and Architecture in Philadelphia

GRAY READ
Florida International University

Below the streets of Philadelphia and normally invisible to those above lies a maze of utility lines, trolley tracks, sewers, privies and buried foundation walls unseparated by archaeological strata. In its working depths, Philadelphia's underground realm, like all cities, collects past and present in a simultaneous history that recalls Sigmund Freud's city of the psyche, a compressed Rome in which memory and myth are impossibly merged. Architects and engineers charged with designing the city's infrastructure and novelists who explored its character have modified the ground underfoot and interpreted it with allusions to classical metaphor and to the body. Their cumulative work persists in the mix of conduits, ruins, and collective memory, into which contemporary architects must dig when they build.

Two instances when Philadelphia's underground realm was significantly redefined both physically and metaphorically reveal the narrative potential of infrastructural architecture. In 1799, engineer Benjamin Henry Latrobe built the city's first water system, crafting an heroic classical story in architecture that redefined the source of Philadelphia's drinking water. A hundred and fifty years later, architect and urban designer Edmond Bacon used a similarly ancient metaphor of the city as a body to redefine Philadelphia's underground, building modern transportation viaducts that linked the heart of the city to the suburbs.

Philadelphia's Water Supply

The subterranean environment has always played a paradoxical role in the classical tradition. The earth has long been described as both womb and tomb, the source of life and wealth as well as the underworld of sin and putrefaction. "It is underground that old men scratch for knowledge, gold and death.[1] In Philadelphia, the contradiction of an underground that is at once nurturing and fearful was felt early in the city's history in the uneasy proximity of urban wells and privy pits, two holes dug in the ground, one a vital source and the other a vile dump. An eighteenth-century Philadelphia law governed the depth of both wells and privies to insure that water would be drawn from a deeper strata than waste deposited, the two separated by a fortuitous layer of clay.[2] When the ground proved an imperfect barrier, wells became contaminated and water-bourn disease sickened inhabitants.

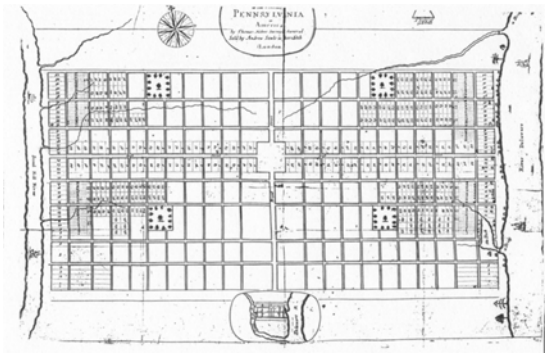

Figure 1 Plan of Philadelphia drawn by surveyor Thomas Holme for William Penn, 1683, showing Center Square and four surrounding urban squares. (Library Company of Philadelphia)

By the 1790s in Philadelphia, urban wells were clearly sources of urban disease. Periodic epidemics of typhoid fever and diphtheria, which had become habitual, were joined by summers of yellow fever. Under a full-blown health crisis, city authorities finally bent to the popular belief that the city could be cured only by abandoning groundwater from wells and piping in abundant pure river water to drink, cleanse the streets, and purify the air with fountains. A Watering Committee appointed by the Common Council of Philadelphia cited the will of Benjamin Franklin, which recommended clean river water be brought into town.[3] The committee was charged with building the city's first infrastructure, which implicitly required a shift in the definition of the urban body. First, the committee had to convince citizens that they could trust public water enough to close cisterns and wells on their own property. Secondly, bringing water from outside renders the city vulnerable, for it must depend on a single supply line that passes outside the city boundary. Social critic Ivan Illich notes that the points where aqueducts entered the ancient city of Rome were considered 'indiscrete' places that broke the urban boundary and required specific protection. The danger and heroism of entry were recognized architecturally by public fountains, each of which celebrated the particular quality of the waters they offered.[4]

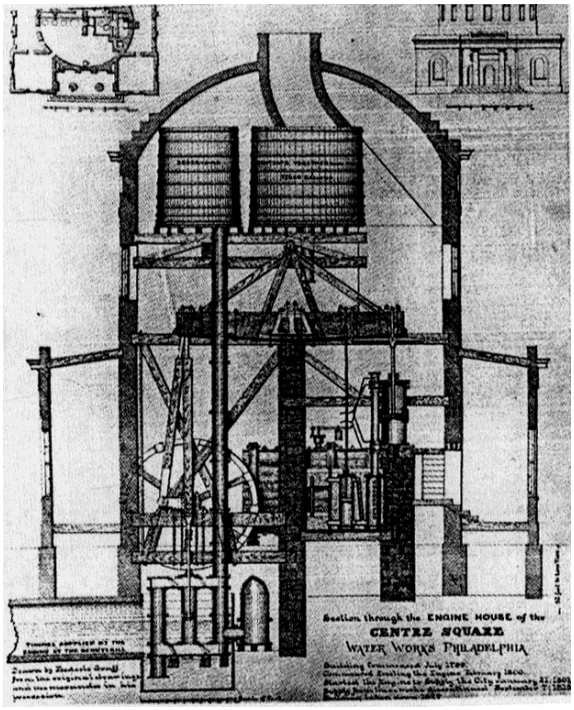

Figure 2: Benjamin Henry Latrobe, section drawing for Pumping Station in Center Square, Philadelphia, c. 1799

In Philadelphia, the press of a particularly severe epidemic in 1798 moved the Watering Committee to enlist engineer Benjamin Henry Latrobe to design and build a water system.[5] Latrobe proposed to deliver water using a series of steam-powered pumps, considered a new and risky technology. He convinced the committee that the system could supply an 'inexhaustible quantity' of clean water for drinking, street cleaning, and fighting fires." promising to assuage both disease and fire, the two potentially devastating threats to urban life.[6]

By 1800, Latrobe had built massive wood-fired steam pumps to lift water from the Schuylkill River to a holding basin from which it flowed through wooden pipes under Chestnut Street to Center Square, the center of the city as laid out by founder William Penn in 1683 (Figure 1 & 2). There, a second pump lifted the water into a small cistern under the dome of a classical building elevated sufficiently that gravity could carry water to hydrants in most of Philadelphia's main streets.[7]

Latrobe's design of the water system engaged the city metaphorically as well as physically to reassure the public and reinforce the promise of health. He summoned the metaphor of the city as a body compounded with the traditionally paradoxical metaphors of the underground to give the system mythic resonance. In design, Latrobe suppressed the place where Schuylkill water entered the city, choosing not to mark it architecturally, thus downplaying the collective risk. Rather, he celebrated the main pumping station in Philadelphia's Center Square, the geographic and symbolic center of the city. Latrobe's design made reference to the tradition of the center as the city's *mundus* or hell's mouth that opened to the underworld, images that would have been familiar to an educated populace. He enclosed the steam engine and cisterns in a small classical temple surrounded by gardens and a fountain graced by a sculpted figure of the nymph of the Schuylkill (figure 3). Within the idiom of the garden

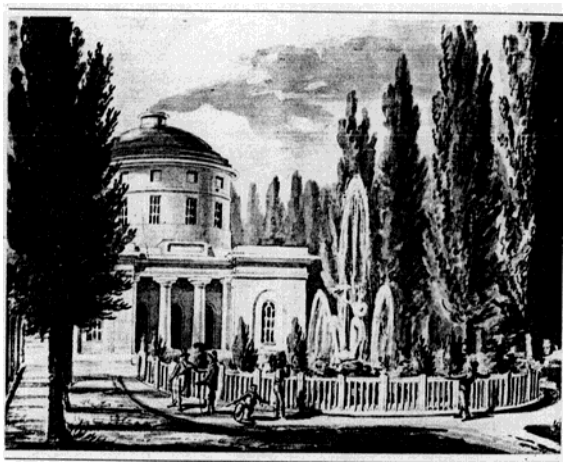

Figure 3: Central Pumping Station, Benjamin Latrobe, 1800

miniature, the temple traced the vertical axis between the bodily underworld and sky by crowning the square base with a circular drum and dome. As if from Hades, smoke rose from the top of the dome into the sky to make clean water surge forth from the navel of the city, offering deliverance from disease and fire.

At the moment when the ground below Philadelphia no longer offered sustenance, Latrobe's heroic machines reified the ancient metaphor of the generative earth while pointedly misrepresenting the real source of the water. The fire-driven, iron pumps were cast as sublime and quasi-natural mechanisms, as if forged by Vulcan, stoking fire to draw water at the city's *mundus*, where tradition located an opening to the underworld. In Penn's plan, Latrobe recognized a symbolic structure descended from Roman foundation rituals that linked the body of the city to the body of the earth, then used it to bless Philadelphia's water supply.[8]

Latrobe's water system performed as promised although the steam engines proved temperamental and expensive. Clean water from the relatively un-populated Schuylkill watershed greatly reduced water-borne disease. Reliable piped water also mitigated yellow fever by reducing the need for rainwater cisterns and shallow wells that had been breeding grounds for mosquitoes. Philadelphia suffered its last major outbreak in 1821. Water hydrants along the streets also made fire-fighting significantly more effective, giving rise to a number of engine companies throughout the city.[9]

However even by 1812, Philadelphia's Watering Committee sought ways to mitigate the costs of fuel and the increasing interruptions caused by engine problems. Engineer Frederick Graff, who had run Latrobe's system since 1805, implemented several changes that modified Philadelphia's waterworks both physically and symbolically.

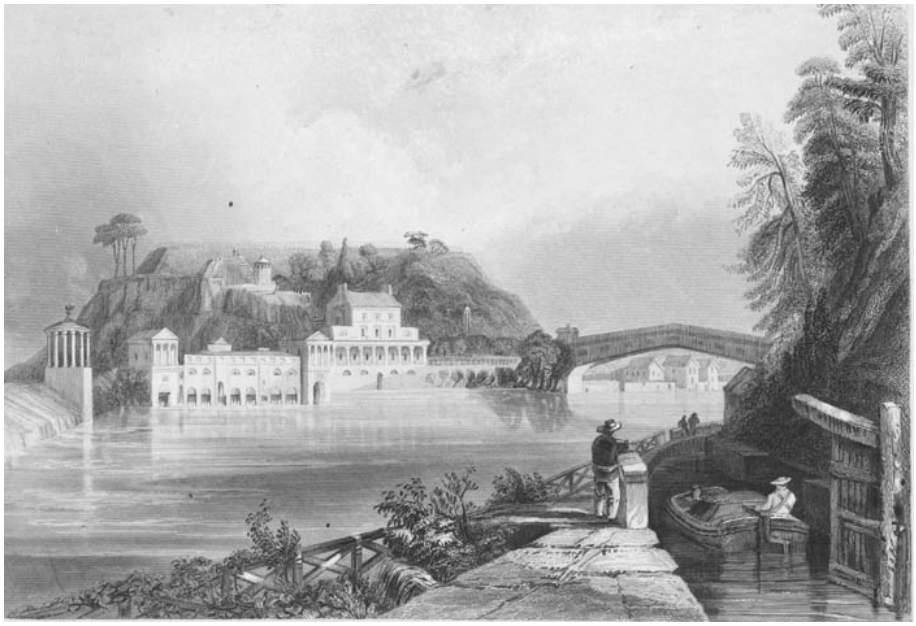

Figure 4. Philadelphia Waterworks 1842 Painting by William Bartlett (Library Company of Philadelphia)

Graff moved the intake a mile upstream to a point above the reach of tides and had a large reservoir dug on top of Morris Hill (currently Fairmount Hill, the site of the Philadelphia Art Museum) from which water flowed down into the city pipes. After an initial attempt to scale wood-fired engines to the task, Graff abandoned steam power in favor of a milldam and waterwheel to drive pumps to lift water. This time, rather than cloak the mechanism, Graff celebrated it architecturally with series of graceful Greek temples, which instantly became one of the most attractive features of the city, an acropolis on the Schuylkill (Fig. 4). Graff's classical buildings cast a new set of allusions that relocated the symbolic source of water definitively away from the city's *mundus* to its edge. Graff no longer summoned the kingdom of Pluto to support his machines or to testify to the purity of the water, rather he cast the waterworks within a picturesque image of temples in a natural garden, or in this case, a verdant riverbank. His acropolis celebrated the threshold, where water was transformed from a wild, natural substance to a vital fluid of the urban body. The allusions remained mythic, but shifted away from the subterranean toward the ethereal. Avoiding any allusion to the earth, Graff recast water in the tradition of pastoral poetry as a sparkling substance of air and light.

Tale #2: An Modern Attempt to Cleanse the Underground

By the twentieth century, the city had grown exponentially and Graff's waterworks had been replaced by an new water supply system, yet the city suffered again from bad water and disease. Both of the city's rivers, the Delaware River bounding the city to the East and the Schuylkill River separating Center City from West Philadelphia, received increasing quantities of sewerage until only industry and the poor inhabited their banks. By the 1930s, the stench from the Delaware River reached several blocks inland, rendering a large area so unpleasant that it deteriorated to slum conditions.

In 1944, an exasperated reporter wrote that standing at Broad and Chestnut Streets, he could smell the rivers.[10] Finally in 1946, armed with federal, state and local funding, and driven by the Federal Clean Streams Act, the city built a series of large interceptor sewers along both riverbanks to collect all of the wastes that had formerly flowed into the rivers and carry them to new treatment plants (Fig. 7).[11] Only by the 1980s could sludge be treated to the point that it could be returned to the land as fertilizer. The city's excreta, which traditionally re-entered the ground through privy pits, is now used to reclaim strip-mined land in central Pennsylvania, returning black earth to the ground (albeit hundreds of miles away) after a century of being dumped into the rivers.

The sewage treatment project of the 1950s coincided with a major planning effort for Center City headed by architect Edmond Bacon, who redefined Philadelphia's underground in a series of transportation viaducts. The spine of Bacon's plan for the redevelopment of Philadelphia was a pedestrian concourse under Market Street and through the same Center Square that once held Latrobe's engine house and now holds Philadelphia's City Hall. The concourse connects the subway system with two commuter rail hubs: Pennsylvania Railroad Suburban Station to the West of City Hall and Reading Terminal to the East and was expanded in the 1980s to allow commuter trains to pass under City Hall and out the other side of the city.[12] (Fig. 5) The concourse was intended to give suburban professionals who worked in Center City offices an integrated path of movement separated from street traffic and linked to the surface by a series of sunken plazas, which he called "an extension of architecture underground."[13] The concourse was celebrated and integrated into a series of new

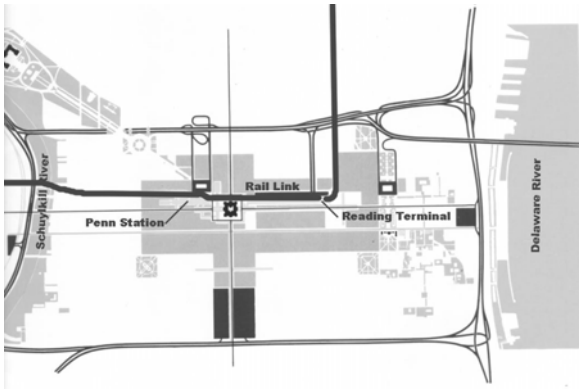

Figure 5. Edmond Bacon's scheme for Rail link between Pennsylvania Railroad Suburban Station and Reading Railroad Commuter lines. (Design of Cities)

buildings along the Market Street corridor to the extent that some of the architects considered access at the street level secondary. Bacon praised a scheme by John Bower, which took pedestrians down two levels to pass under the subway so they could walk from an office tower at 1234 Market Street into the Lits Brothers Department Store without crossing the street.[14]

Much of the architecture associated with redevelopment muted the street level and emphasized the underground spine as an arterial corridor. Bacon wrote that the concourse should clearly orient pedestrians to the cardinal directions, North and South, but should run free of the 'oppressive' presence of the street plane.[15] He located a major underground urban plaza in He equated the underground concourse with an upper level passages over the streets and promoted both as elements of modern, urban circulation.

In this sense, both Bacon's plan and the new sewer system sought to rehabilitate Philadelphia's underground realm by cleansing it and penetrating it with systems linked to the upper world. Bacon wrote that three-dimensional connections between simultaneous movement systems should be celebrated architecturally to make a city exciting and attractive. He described the city and land together as an organism with defined channels of energy that direct future growth in relation to a center so that citizens retain a "sense of orientation to a continually enlarging order."[16] The city as organism refined the urban body metaphor as a circulatory system extending outward from central arteries, so transportation systems underground in the heart of the city extend into a large number of train lines or capillaries on the periphery. People, as corpuscles, move in and out from the heart to the suburbs in a vital flow.

In practice however, Bacon could not cleanse the underground, either of its accumulated associations nor of its gloom. The Penn Center concourse was never lively or loved. Most stores soon closed their architecturally elegant entrances below grade, abandoning the space to subway riders and vagrants. In the 1980s, homeless men and women established a stable community in a concourse below Broad Street that the police and citizenry tolerated for several years. The old positions above and below persisted in spite of modern insistence on geometric balance, order, and cleanliness.

In 1990, novelist John Wideman described Philadelphia's subway system, which also runs under Center Square as alimentary rather than circulatory. He described riding the train as an intestinal journey through the stinking guts of a giant who groans with the passage of the train. In Wideman's narrative, Philadelphia is not a beautiful youthful body but a behemoth, drunk and sprawled on his back, the "rough contours of his body smothering the rolling landscape.[17]

Infrastructural Architecture

Benjamin Latrobe, Frederick Graff and Edmond Bacon engaged Philadelphia's underground systems both physically and metaphorically. Their architecture interpreted the infrastructure using allusions to myths that link the city with its land. Each appealed to a poetic image in order to redefine the city so citizens would accept a new infrastructural system as natural, true and right. Their varying success as urban systems depended as much on the architectural rhetoric as much as it did on engineer

Endnotes

[1] John Le Carré, *The Naive and Sentimental Lover* quoted in Wendy Lesser, Life Below Ground (NY: Faber and Faber, 1987), 13.

[2] The natural clay layer that served to separate privies and wells was an imperfect barrier. By the 1790s, water contamination was a serious problem contributing to disease. See Henry Birkinbine, "History of Water Works, City of Philadelphia and Annual Report of the Chief Engineer of the Water Department," (Philadelphia: City of Philadelphia, 1860), 2.

[3] Report to the Select and Common Councils on the Progress and State of the Waterworks, 1799. P.21 Benjamin Franklin called attention to water problems in the 1780s. His will of 1789 recommends bringing water of the Wissahickon into the city, and making the Schuylkill River navigable. See Birkinbine, "History of Water Works, City of

Philadelphia and Annual Report of the Chief Engineer of the Water Department," 2.

[4] Ivan Illich, H2O and the Waters of Forgetfulness (Berkeley: Heyday Books, 1985), 37.and Roma, la città dell'acqua, (Rome: Ministeri per i beni Cultural, 1994), 83.

[5] Nelson Manfred Blake, Water for the Cities; a History of the Urban Water Supply Problem in the United States (Syracuse, NY: Syracuse University Press, 1956), 30.

[6] Darwin H. Stapleton, ed., The Engineering Drawings of Benjamin Henry Latrobe (New Haven, Conn: Yale University Press, 1980), 29. See also John Reps, The Making of Urban America (Princeton, NJ: Princeton Univ. Press, 1965), 172.

[7] Banjamin Henry Latrobe, View of the Practability and Means of Supplying the City of Philadelphia with Wholesome Water (Philadelphia: 1799).

[8] Joseph Rykwert, The Idea of a Town: the anthropology of urban form in Rome, Italy and the ancient world (Cambridge, Mass: MIT Press, 1988), Page.

[9] Stapleton, ed., The Engineering Drawings of Benjamin Henry Latrobe, 33. Bruce Laurie, "Fire Companies and Gangs in Southwark: The 1840s," in The Peoples of Philadelphia, ed. Allen Davis and Mark Haller (Phila: Temple Univ. Press, 1973), 75.

[10] Quoted “Clean Streams for Philadelphia” Philadelphia Water Department 1983.

[11] W.D. Bush, "Sewage Disposal Project," (Phila.: Department of Public Works, 1932).See also "Annual Report," (Phila.: Philadelphia Water Department, 1957). The work had been delayed since the beginning of the century an experimental sewage treatment plant was designed as early as 1909 and a plan for the whole city developed in 1915. A small Northeast Sewage Treatment works began operations in 1923 to protect the city’s water supply intake on the Delaware.

[12] Edmund N. Bacon, Design of Cities (NY: Viking Press, 1967).

[13] Ibid., 275.

[14]Ibid., 291. See also a critical analysis of Bacon’s plan in Philadelphia, Richard M. Sommer, "Philadelphia - The Urban Design of Philadelphia: Taking the Towne for the City," in Shaping the City: Studies in History, Theory and Urban Design, ed. Edward Robbins and Rodolphe El-Khoury (London: Routledge, 2004).

[15] Bacon, Design of Cities, 291.

[16] Ibid., 301.

[17] John Edgar Wideman, Philadelphia Fire (NY: Vintage, 1990), 20, 23.