

Historical Geographies of Large Infrastructure in the Long Eighteenth Century: a case of water in Britain

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Historical Geography is concerned with geographies of the past as well as with the influence of the past in shaping geographies of the present.¹ As such, the field comprises both the study of eighteenth-century infrastructures through a geographer's lens, and how these infrastructures and their associated practices continue to influence the present. As an interdisciplinary field, historical geographical scholarship is influenced by Science and Technology Studies, Actor-Network Theory, assemblage theory as well as wider relational geographical thinking. These influences mean that infrastructures are considered through their situatedness in place as well as through their entanglements within wider social, financial, and geographical structures. Following Doreen Massey, infrastructures are at the same time locally embedded and made and sustained through wider webs of connections and flows, that today are global in scope, a trend that intensified during the eighteenth century through colonization and the consolidation of global networks.² Geographers are particularly interested in how power operated through these relational infrastructures, and thus which people or places were (dis)connected through either material, managerial, or financial means.

Large infrastructures were, and still are, prominent drivers of the transformation of places and spaces – a key theme within the field. Historical Geography's study of the transformation of

¹ Michael Heffernan, "Historical Geography," in The Dictionary of Human Geography, Fifth edition, eds. Sarah Whatmore, Derek Gregory, Michael Watts, Ron Johnston, and Geraldine Pratt (Oxford: Blackwell, 2009), 332-5.

² Doreen Massey, For Space (London: SAGE, 2005).

the landscape includes, for instance, the development of Britain's eighteenth-century road network as a constant interaction between wider population patterns, agricultural prices, and geographies of industrial development, producing new connections and remaking places.³ Infrastructures, by their nature, often took a long time to build, and once in place the associated institutions and practices created alongside the physical structures could be sustained in their own right. For example, eighteenth-century technology did not allow the early water supply companies in London to measure exactly how much water they supplied to customers. In response, they came up with a mode of charging based on the size of a supplied house and the utilities present, as a proxy for water usage. These water rates proved persistent, with even into the 2020s many households being charged a fixed rate based on the value of their property, although the technology has long caught up. This longevity of both material infrastructure and the institutions that underpin it means that practices rooted in the past continue to influence how people interact with infrastructures into the present.

This contribution examines the historical geographical approach by looking at two case studies of complex water infrastructures in eighteenth-century Britain.⁴ As geographer Alex Loftus has stated, the study of water networks provides “a wonderfully powerful lens through which the workings of different societies might be explored”.⁵ Technological systems of distribution and drainage refracted power relations regarding access to water and

³ Eric Pawson, Transport and economy: the Turnpike roads of eighteenth-century Britain (London: Academic Press, 1977).

⁴ While this contribution focuses on Britain, historical geographers also and increasingly study landscape transformations and (dis)connections within colonial contexts. For an overview of scholarship on water and engineering see: Ruth A. Morgan “Colonial water and hydro-resilience,” in The Sage Handbook of Historical Geography, eds. Mona Domosh, Michael Heffernan and Charles W.J. Withers (London: SAGE, 2020), 738-754.

⁵ Alex Loftus, “Thinking relationally about water: review based on Linton’s *What is water?*” Geographical Journal, 177 (2011), 186-188, 186.

affordability.⁶ Water has both a natural and a social history, and the historical geographical approach focuses on the interactions between the physical and human through which water infrastructures were shaped.⁷ The fluid nature of water is in tension with fixed and embedded infrastructures often constructed to chain and channel water. The first of the two case studies focuses on the private water supply of London, which over the course of the eighteenth century grew to be the largest city in the world. The second case study examines the drainage structures of the Derbyshire lead mines, once the largest lead producers of Europe but in decline during the eighteenth century as the area shifted towards the cotton industry. Both cases, one urban and one industrial, illustrate how infrastructural systems were embedded in place, yet at the same time point towards wider narratives of socio-economic transformation in eighteenth-century Britain.

The history of London's private water supply has been well-studied, from its early modern emergence to the large-scale sanitary interventions of the nineteenth century.⁸ The eighteenth century did not witness such paradigm shifts, but instead was characterized by a gradual expansion of supply networks.⁹ By the end of the century, three quarters of households were supplied by commercial water in London north of the Thames, with the proportion even higher in some neighborhoods.¹⁰ This process meant that in a relatively short time, having a

⁶ Erik Swyngedouw, Liquid power, contested hydro-modernities in twentieth-century Spain (Cambridge: MIT Press, 2015).

⁷ Denis Cosgrove and Geoff Petts, Water, engineering, and landscape. Water control and landscape transformation in the modern period (London: Belhaven Press, 1990).

⁸ See e.g. Mark Jenner, "From conduit community to commercial network? Water in London, 1500-1725," in Londinopolis: essays in the cultural and social history of early modern London, eds. Peter Griffiths and Mark Jenner (Manchester: Manchester Univ. Press, 2000), 250-72; Dale H. Porter, The Thames Embankment: environment, technology, and society in Victorian London (Akron: Univ. of Akron Press, 1998).

⁹ Leslie Tomory, The history of the London Water Industry, 1580-1820 (Baltimore: Johns Hopkins Press, 2017).

¹⁰ Carry van Lieshout, "London's Changing Waterscapes: the management of water in eighteenth-century London" (PhD diss., King's College London, 2013), 195.

private water supply went from being a luxury good to a service that came to be expected, and extended well beyond the higher classes. Records of the creators of the water infrastructure, the various water companies, reveal the complex negotiations involved in the expansion of infrastructure that was, once laid down under the street, literally embedded in earth.¹¹ Economic considerations played an important role, including the number of households likely to become customers and the presence of alternative provisions, but also the city's topography, which spread uphill from the Thames. Due to the latter, technological knowledge played an important role, and water-raising steam technology, and the timing of when a company could invest in it, became a key determinant in a company's success. How a company accessed steam engines points towards the wider networks of technological knowledge and how power operated through eighteenth-century Britain, with for instance the directors of the Chelsea Waterworks Company relying on personal contacts from their investments in West England mines, drawing on drainage technologies and hiring engineers to transform specific sites in London.¹² The timing of their investment was pertinent as well and came at the time of a mid-eighteenth century drought. The analysis of the transformation of London's water supply, and who could access water, thus incorporates the study of rainfall, topography, geographies of knowledge, and neighborhood-level economics of alternative supplies to explain the specific patterns of infrastructural expansion.

Another insight historical geographical analysis offers is a focus on the everyday interactions with infrastructure, and how these shaped the network in ways that could be different from its structural purpose. Much of the eighteenth-century water companies' time was taken up by policing access to the water pipes, as households either chose to share their water or people

¹¹ Carry van Lieshout, "Droughts and dragons: geography, rainfall, and eighteenth-century London's water systems," *Technology and Culture* 57, no. 4 (2016): 780-805, 786.

¹² Van Lieshout "Droughts and dragons", 799.

broke pipes to gain access to the water within.¹³ As mentioned above, customers paid a fixed fee rather than based on usage, and had little incentive to not allow others access to the water when they had more than they required themselves. Water companies had to remind customers to lock their water away – by which they meant to restrict the point of access. Practices that some of those engaging with the infrastructure would consider sharing a common good was considered an illegal appropriation of water by the suppliers. Both the sharing and locking away of water illustrate some of the unintended consequences of how an embedded infrastructure was used in practice, reaching different people than those who constructed it had planned. Such social interactions with water infrastructures also show how power operated through the system: from companies who managed, priced, and directed water, to people who had relatively little consumer power but were able to form their own subversive practices based on a perception of who owned water in the pipes.

The second case study of drainage structures in industrial Derbyshire further explores the tension between an embedded infrastructure and the fluid nature of water. As the lead mines of the Peak District were exploited down to groundwater level, from the seventeenth century onwards it became evident that drainage technology was required to access the deeper-lying veins. Over the following two centuries increasingly longer and deeper soughs – the local term for adits – were driven to drain the mines.¹⁴ The technology of driving soughs was not that different from the technology employed in mining. However, reliance on gravity drainage combined with the complexities of underground mines and the hiddenness of the spaces of operation from those at surface level, caused both legal and financial issues.

¹³ Tomory, *History*, 129-36; Van Lieshout, *Waterscapes*, 159.

¹⁴ Georgina H. Endfield and Carry van Lieshout, “Water and vertical territory: the volatile and hidden historical geographies of Derbyshire’s lead mining soughs, 1650s – 1830s,” *Geopolitics* 25, no. 1 (2020): 65-87.

Legally, local freemining laws only allowed miners right of access and claims of ownership when they were actually uncovering lead, and much of the soughs' courses had to be driven through barren ground rather than through a vein. Financially, due to their length and depth sough construction took a long time, decades for the larger ones, during which time lead production to finance the labor was not possible.

The drainage of the Derbyshire lead mines therefore required new legal and financial institutions. In order to fund the drainage upfront soughs were set up as investment opportunities and financed by their shareholders rather than the small-scale freemining arrangements that previously characterized Derbyshire mining.¹⁵ This shift meant that the labor of sough driving was increasingly performed by previously independent miners as employees of the soughs, with an associated shift to investors who were often based further away from the lead ore.¹⁶ The relation between miners and sough drainage drivers was mediated by complex legal agreements called 'composition', which gave the drainers a claim on the ore unwatered by their sough. Whilst legal and financial arrangements seemed clear on paper, in reality the hiddenness of the sites of the drainage and mining infrastructure created opportunities for subterfuge and confusion. Surface-level owners and investors had to rely on those going underground to state from which part of the mine the ore was mined, and thus how much of it was apportioned to miners or drainers. Subterranean geologies opened up further complexities as to which sough drained what part of a mine, resulting in claim and counterclaim of who benefitted, and who paid.¹⁷ These claims were often accompanied by maps depicting the extent of a mine to illustrate for those at surface level what the

¹⁵ Katrina Honeyman, Origins of enterprise: business leadership in the Industrial Revolution (Manchester: Manchester Univ. Press, 1982).

¹⁶ Andy Wood, The politics of social conflict: the Peak Country, 1520-1770 (Cambridge: Cambridge Univ. Press, 1997).

¹⁷ Endfield and Van Lieshout, "Water and vertical territory".

underground situation looked like, resulting in infrastructural representations that depicted the mine as composed of clean, straight, and horizontal lines, that both flattened and obscured underground realities.

Deploying the analytical lens of the geographical imagination, historical geographers are also interested in such cultural representations of infrastructures. This analytical take includes the study of cartographic representations of large infrastructures as the representation of knowledge and power of states in service of their geopolitical endeavors. But physical structures, too, can be read as everyday expressions of contemporary knowledge and a society's world view that percolate into people's lives through processes of design, construction, and representation.¹⁸ To see the importance of cultural ideas in the physical transformation of water infrastructures we can consider the importance of flow in urban transformations associated with public health. During the eighteenth and nineteenth centuries, urban waste-water infrastructure was increasingly covered and hidden underground, not only to keep the miasmas that were believed to cause disease from circulating in the city, but also to reflect the idea of what a modern city should be, how it should be managed, and what it should look like.¹⁹ Disrupting the flow in the system, causing blockages or floods, had material consequences but also disrupted the faith people had in their systems, as it unsettled the illusion of the modern city in which everything was running smoothly and well-organized.²⁰

¹⁸ K. Maria D. Lane, "Engineering", in *The Sage Handbook of Historical Geography*, eds. Mona Domosh, Michael Heffernan and Charles W.J. Withers (London: SAGE, 2020), 698-719.

¹⁹ See also Miles Ogborn, *Spaces of modernity: London's geographies, 1680-1780* (New York: The Guilford Press, 1998).

²⁰ Maria Kaika and Erik Swyngedouw, "Fetishizing the modern city: the phantasmagoria of urban technological networks," *International Journal of urban and regional research* 24 (2000): 120-138.

What the historical geographical approach illustrates is that large infrastructures often end up doing more than their constructors intended. They refract power and meaning, and can be read through the connections and disconnections they facilitate. The study of urban and industrial water discussed here reflects some of the large socio-economic shifts of eighteenth-century Britain and show how the construction and management of water infrastructure was entangled in the financial revolution, technological breakthroughs, and cultural narratives of channeling water. At the same time however, incorporating into the analysis the materiality of water, as well as that of surface and underground topography, played pivotal roles in the understanding of how and why water infrastructures developed and changed. Geography reminds us to focus both on the material in place and the relational networks that together shape a place and its infrastructure.