

# *“Cool and tasty waters”: managing Naples’s water supply, c. 1500–c. 1750*

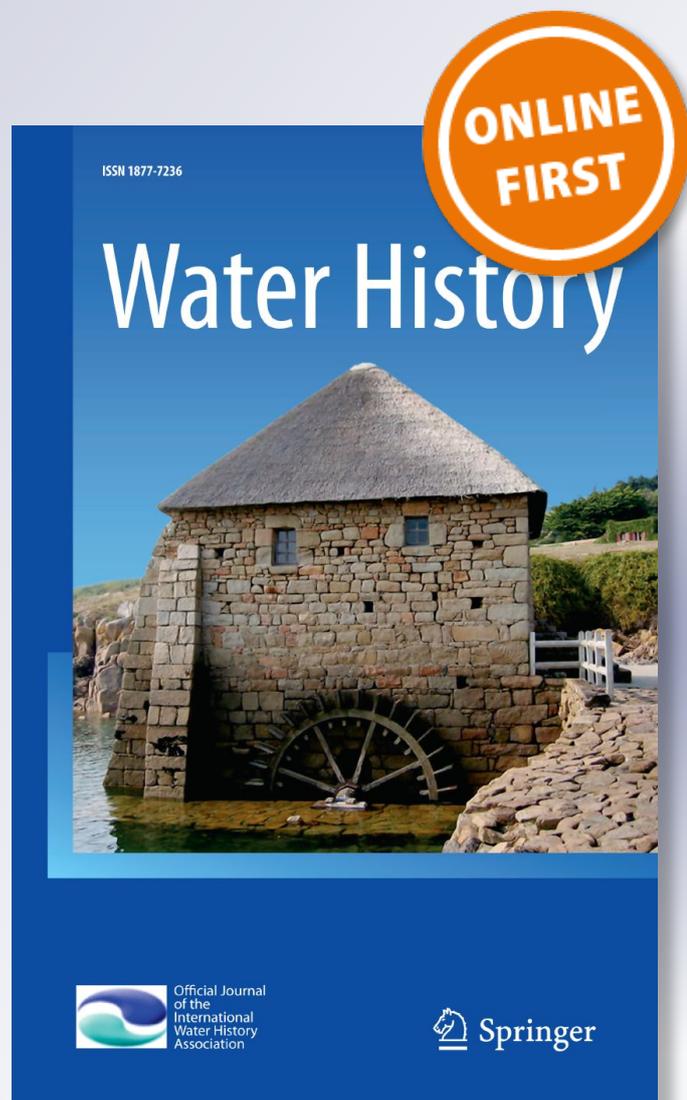
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# “Cool and tasty waters”: managing Naples’s water supply, c. 1500–c. 1750

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## Abstract

Although Naples was one of Europe’s largest cities (after London and Paris), studies of the management of its water supply during the early modern period are sorely lacking, despite growing interest in the subject at both an Italian and European level. Naples was perhaps unique in relying on a vast and tortuous underground network of reservoirs, cisterns, channels and conduits, accessed by well shafts, all fed by an ancient aqueduct. The present study outlines and evaluates the Neapolitan water supply as it existed in the period, analysing the archival records of the municipal tribunal responsible for the city’s infrastructure, the ‘Tribunale della Fortificazione, Acqua e Mattonata’, and its various ‘Appuntamenti’ (proposals), ‘Conclusioni’ (decisions) and edicts. This is interwoven with reference to pertinent printed accounts, from contemporary guide books to medical regimens and health manuals. We examine both water quantity, in terms of availability and accessibility (by looking at the structure and its management, and the technicians responsible for its maintenance) and water quality (by looking at contemporary attitudes and perceptions). In the process we are able to question the widespread view of early modern Naples as chaotic and uncontrolled, governed by a weak public authority, as well as widely held assumptions about the “inertia” of the pre-modern hydro-social system more generally.

**Keywords** Urban hydraulic infrastructure · Early modern Naples · Water quality · Water supply management · Tribunale della Fortificazione · Acqua e Mattonata

## Introduction

In his ten-volume history of Naples, published in the mid-eighteenth century, the abbé Placido Troyli gave water pride of place, “the abundance of waters being the thing most necessary to a city’s fame” (Troyli 1747–54; vol. 4, book 2, p. 60). He sought to demonstrate “how Naples in this matter exceeds all the other cities of Italy”. To do so, Troyli described how, as its waters entered the city, they were divided into different underground “reservoirs and cisterns”, called *formali*, for all the city’s residences.

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These waters were characterised by their accessibility, freshness and abundance (ibid. p. 67). Each building accessed the water directly from an underground reservoir to its kitchen, “something that would be difficult to find in other cities of the world, with each large building having its own reservoir and each apartment the convenience of drawing water both night and day from within”. The coolness of the waters was accompanied by their “healthiness and ineffable taste”. As they flowed from the aqueduct through a series of underground channels and cisterns, they were filtered and purified. The waters then “lay still for years and years at a time” in the underground reservoirs, where they become “cool and tasty”. But their greatest quality was their abundance, supplying not only every palace but the city’s many mills and fountains.

We might dismiss this encomium of Naples’s water supply as mere chauvinism or rhetorical pandering, not surprising perhaps in a work which is dedicated to the city’s seven municipal officials, or *Eletti* (Trombetta 2006, p. 147), and not unknown in guides to Naples and its kingdom, which might boast of the city’s “good fresh water which gurgles in many splendid fountains” (Bacco 1629, p. 7). However, foreign visitors to the city were just as favourable, beginning with those on the Grand Tour (De Seta 2014; Sweet 2012, pp. 164–169). When the widely-travelled French clergyman and polymath Jean-Baptiste Labat visited the city sometime between 1706 and 1716, he praised the “admirable” and healthy quality of its waters (Labat 1730, v. 5, p. 384). He was impressed by the many “people who earn their living selling water to passers-by, whether to quench their thirst or refresh themselves”, despite the “prodigious” number of public fountains throughout the city, supplying “abundant” water (ibid. p. 396). Labat’s judgment is especially valuable because he was never one to take water for granted, commenting knowledgeably on its provision wherever he went, occasionally suggesting technical improvements.

All of this praise may come as some surprise to those who know Naples and its more recent history. The safety of its water supply has been frequently called into question. Not long ago, the Italian news magazine *L’Espresso* published an article entitled “Bevi Napoli e poi muori” (Drink Naples and die), which highlighted an investigation by the US Navy into the presence of dangerous chemicals in the water supply (Di Feo and Pappaianni 2013). Our negative view of the city’s water supply is further conditioned by the city’s tragic experience of Asiatic cholera, which struck Naples in a succession of epidemics—1836, 1855, 1863, 1873, 1884, 1911, and even as late as 1973—and were the occasion for the massive but only partially successful late-nineteenth-century clearing and renewal of parts of the historic centre (Esposito 1973; Forti Messina 1979; Snowden 1995; Luzzi 2004, pp. 93–96). But even before cholera, the doctor and medical historian Salvatore De Renzi furnished a list of “issues”, including lengthy uncovered stretches of the aqueduct which became contaminated with rainwater and debris and the limitations of the city’s domestic architecture. These included the small underground cisterns, dug straight into the tuff and difficult to clean, the proximity of well water to waste water in kitchens, the uncleanness of rainwater cisterns, and contamination by brackish water (De Renzi 1829, pp. 50–54). Earlier still, around Troyli’s time, Giovanni Carafa, lecturer of optics and mathematics at the University of Naples, had highlighted the mismanagement of the city’s water supply (Carafa 1750, pp. 24–28).

But if we are to understand and evaluate the water supply of the sixteenth and seventeenth centuries, how helpful is it simply to project backwards, before what has been called the “conquest of water” (Goubert 1989)? After all, when it came to a limited supply of clean water, to a proximity of clean water and sewage or to problems regarding the disposal of the latter, pre-modern Naples was by no means alone in early modern Europe

(Pardailhé-Galabrun 1988; Skelton 2016). What follows is one historian’s attempt to answer that question.

Studies on the management of the water supply in early modern Naples are sorely lacking, despite growing interest in the subject at both an Italian and European level (Rinne 2010; Prato 2018). Some of the most interesting recent studies have been comparative investigations of the technical advancements in accessing water in early modern Europe (Fournier 2016; Shulman 2017). All of these works challenge widely held assumptions about the “inertia” of the pre-modern hydro-social system (Staddon et al. 2017, p. 84). Indeed this challenge was first made some thirty-five years ago by André Guillerme, who traced evolving civic concern for water management in northern France from the high Middle Ages onwards (Guillerme 1983). On Naples in particular, the architectural historian Giuseppe Fiengo presented a picture of corrupt urban authorities unable or unwilling to provide the city with the water it needed during the sixteenth and seventeenth centuries, resulting in ongoing water shortages (Fiengo 1990, pp. 8–9). Fiengo’s view has been echoed more recently by the chemical engineer and speleologist Clemente Esposito (2018, pp. 40, 105). Research into the municipal tribunal responsible for (amongst other things) water management in the city, the Tribunale della Fortificazione, Acqua e Mattonata, have come to divergent conclusions. On the one hand, the “pessimists” have pointed to the tribunal’s tendency to act only on a “case by case” basis (De Seta 1995, p. 136), without plan or policy (Brancaccio 1996, pp. 51–84), enacting only “fragmentary and occasional initiatives” (Sodano 2013, p. 122). This view is consistent with a broadly shared view of early modern Naples as chaotic and uncontrolled, governed by a weak public authority. By contrast, the “optimists” have pointed to its ongoing administration of public spaces (Marin 2006), the regular maintenance works it undertook (Russo 2014), and the similarities between its activities/limitations and those of other large European cities (Bruno 2018, pp. 715–717).

How can the administration of Naples’s early modern water system inform this debate? How does Naples fare when compared to other European cities during the time of limited water resources? (Roche 1984). It is important to examine the early modern period on its own terms, contextualising Naples within the broader situation in Europe. What I would like to do in this article is outline and evaluate the Neapolitan water supply as it existed in the period when the city, capital of the Kingdom of Naples, was governed by Spanish viceroys (1504–1713). I focus on water availability and accessibility, examining the hydraulic structure and its management (in Sect. 2); the technicians and trades involved in its execution, and in the maintenance and delivery of water (in Sect. 3); and water quality, by analysing contemporary attitudes and perceptions (in Sect. 4).

## Naples’s water supply and its management

Early modern Naples’s main source of water was the Bolla spring, located on the slopes of Mount Vesuvius, rich in springs and streams, and the associated aqueduct, of presumed late Roman origins (De Feo and Napoli 2007; Riccio 2002, p. 115). The Bolla’s waters ran in canals towards a large reservoir, the Casa dell’Acqua (Water House), located near Poggioreale, the sometime summer villa and pleasure gardens of the viceroys, on the eastern outskirts of the city. Here, it split into two. One part joined the river Sebeto, which flowed to the east of the city walls. The other, main part flowed into a series of canals and cisterns, the first of which was the vast reservoir underneath the Porta Capuana, then the main land entrance into the city. From here it went downwards underneath via Tribunali, the middle

*decumanus* (or ancient artery) via San Gregorio Armeno to the lower *decumanus*, and thence to San Giovanni Maggiore and Santa Maria la Nova, before ending in front of the Castel Nuovo (Summonte 1601, bk. 1, pp. 228–259; Celano 1843; Fiengo 1990; Miccio and Potenza 1994; Rasulo 2002; Muto 2013, pp. 51–53; Montuono 2014; Esposito 2018).

Despite differences throughout the network, which was known collectively as the “Formale Reale” (Fig. 1)—some sections were covered or subterranean and others open, some wide and some narrow, some simply bored and others paved, and of varying heights—on a technical level the system was quite functional. Until its complete abandonment in 1885, when it was replaced by a new water supply (Barca 2004, pp. 63–64; Miccio and Potenza 1994, pp. 97–98), the ancient system brought water to various areas of the old, walled city, where most of Naples’s large population was concentrated. Water was carried to underground cisterns and reservoirs, linked by a complex series of channels and secondary branches. There were various distribution points along the way, as well as numerous fountains, both decorative and functional, including drinking fountains, washbasins for laundry and watering places for animals. The water was also accessed by means of *pozzi* (well shafts), *bronzi* (bronze spouts), and conduits which brought water to palaces, religious institutions and workplaces.

If Naples was constrained by its geography—between the mountains and the sea—to build ever more densely, its geology made this possible. Naples was able to build up by tunnelling down. The same tuff quarried to make the vast underground reservoirs and winding channels to provide water was used in constructing its famously tall buildings (Cardone 1990; Liccardo 2000). The city’s underground network was regarded by contemporaries as distinctive. Provided one knew one’s way around, one could descend at one end of the city and then come up again at the other, according to cathedral canon Carlo Celano (1692, v. 1, p. 187). In terms of functionality, it led to the claim that, for much of the ancient city, a source of water was never far away: “there is no house, however small, which is not provided with convenient water by the [underground] reservoirs” (ibid).

Newer areas of the city not served by the Formale Reale, which included the Spanish Quarters, the Riviera di Chiaia (Salvemini 2004, p. 75) and the rapid population expansion up the surrounding hills, depended on several thousand wells (reaching an estimated 9000 by 1817). Finally, rainwater was captured and stored “in private houses and in monasteries” (Summonte 1601, p. 258). The monastery of San Domenico Maggiore had its own rainwater cistern, as did Castel Sant’Elmo, famous for its huge size, and the villa and garden of Luis de Toledo, son of the viceroy, in Pizzofalcone (Tchikine 2014, p. 133); but the full extent of such structures in Naples’s dense network of narrow streets and high, multi-family dwellings has proved impossible to document. Rainwater also served to clean the city’s streets (Labat 1730, v. 5, p. 396) but this was also another way of saying that there were no drains, with the result that torrential rains and flash-floods routinely caused terrible damage (Muto 2013, p. 50).

The earliest survey of the city’s water supply system dates from 1495 (Croce 1990, pp. 321–322), and by at least 1515 it was being overseen by the Deputazione dell’Acqua e Mattonata, which in 1631 became part of the new Tribunale della Fortificazione, Acqua e Mattonata—also responsible for the maintenance of the city’s walls, fortresses and road network (Brancaccio 1996, pp. 51–84; Lomonaco 2008; Russo 2014; Marin and Ventura 2004; Marin 2006; Bruno 2018). It was thus a sort of public works department of the city council. The Tribunal consisted of a noble “regent of the chancellery”, responsible

for settling legal disputes, and six deputies.<sup>1</sup> Its deputies would have been drawn from the city’s elites, noble and mercantile-professional; indeed, the Tribunal was a compromise between noble and “popular” authority of the sort that typified the government of Spanish Naples (Sodano 2013). The deputies were assisted by a secretary, salaried officials (*portieri*), and, when it came to managing the water system in particular, employed the services of a surveyor (*tavolario*), a “water-master” (*maestro d’acqua*) and a large number of *fontanari* and *pozzari* (roughly translatable as fountaineers and well-attendants)—occupations to which we shall return below.

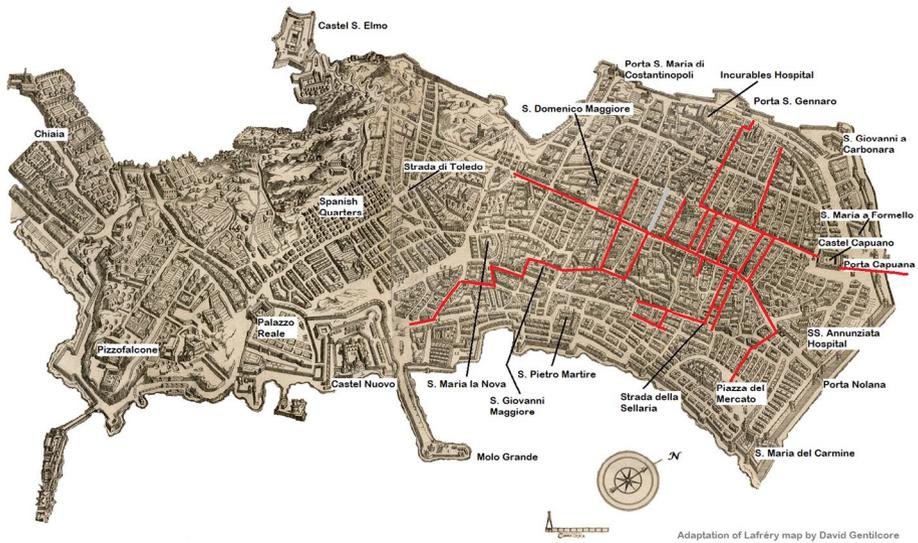
An anonymous description written sometime around 1610 noted that Naples’s water system was “well regulated”, the deputies of the Tribunal normally meeting twice a week, assisted by the trades responsible for maintaining the system, who had to be licensed (Montuono 2014). In terms of the archival records at our disposal to evaluate this claim, already in 1801 there were worries about the dispersal and loss of the Tribunal’s archives (Brancaccio 1996, pp. 79–80). Closer to our own times, a fire in 1946 destroyed some three-quarters of the precious contents of the Neapolitan municipal archives, which had been painstakingly catalogued and organised by Bartolomeo Capasso in the previous century (1876; 1899); and matters are not made any easier by the destruction, in 1943, of the administrative records relating to the Kingdom of Naples as a whole prior to 1560 (Marino 2013a, pp. 17–19). These events have made writing the city’s history particularly challenging. Fortunately, portions of the Tribunal’s holding survived the fire, allowing us to investigate its various proposals (*appuntamenti*), decisions (*conclusioni*), edicts (*banni*) surveys (*relazioni*).

The first surviving edict issued on behalf of the Tribunal on the management of the city’s water supply dates from 1552.<sup>2</sup> At this point the Tribunal’s primary aim when it came to water was the protection and maintenance of the existing supply. The only instructions directed at ensuring the *quality* of the water were the prohibition against the throwing of animals, living or dead, or anything else, into the well shafts connected to the underground reservoirs (*formali*), which would pollute or block them, and the prohibition against the washing of clothes and vegetables in fountains or dirtying them in any way. In an unpublished manuscript compiled in 1598, Giovanni Antonio Nigrone suggested that dogs and cats, poultry or snakes were the least of the deputies’ worries. During his “own times” as *fontanaro*, four stabbed men found there in 1549, a dead boy in 1551, a woman so disfigured she could not be identified in 1553 and a murdered couple in 1556.<sup>3</sup> The 1552 edict’s other items all focused on ensuring the *quantity* of the water supply, by decreeing that uncovered portions of the system should be kept clear of debris, prohibiting unapproved alterations to the underground reservoirs, obliging the owners of private wells to notify the authorities of defects and have them repaired within three months, and prohibiting millers from accessing water without permission.

<sup>1</sup> Anonymous manuscript, c. 1610, Biblioteca Nacional, Madrid, “El servicio de aguas en Nàpoles”, MS9610, fols. 112r–115v. (Full text in Montuono 2014, pp. 1042–1044).

<sup>2</sup> Archivio Storico Municipale, Naples, *Tribunale di fortificazione, acqua e mattonata* (hereafter: ASMN, *Trib. Fort.*), Banni 31, 1552–1700, fols. 1r–4v, 13 June 1552. Summonte refers to an edict issued in 1515 which, however, no longer survives (1601, p. 241).

<sup>3</sup> Biblioteca Nazionale, Naples, “Vari discorsi di Giovanni Antonio Nigrone”, MS XII G 59–60, vol. 2, fol. 370v.



Adaptation of Lafréry map by David Gentilcore

**Fig. 1** The main branches of Naples' "Formale Reale", superimposed on an adaptation of the Antoine Lafréry map of the city (Braun and Hogenberg 1572, vol. I, p. 47). Map by the author

However, even prior to 1552 there had been serious concerns about the quantity of water available to a fast-growing city like Naples.<sup>4</sup> In 1549 the Spanish viceroy Pedro de Toledo had commissioned an investigation by the city's chief surveyor (*tavolario*), Pietroantonio Lettieri, into the viability of restoring the ancient but no longer functional Serino aqueduct (Strazzullo 1968, p. 73; Fiengo 1990, pp. 19–51). Four years earlier, Agostino Steuco had carried out a similar investigation into the ancient Aqua Virgo for Pope Paul III in Rome (Long 2018, pp. 67–67). Mixing the skills of architect, engineer and archaeologist, Lettieri's ambitious survey lasted four years and cost around 4000 ducats. The resulting report, completed in 1560, commented on the increasing shortage of water in the city, both for domestic consumption and powering mills. Lettieri also noted a phenomenon that would plague the city's water supply, the proximity of clean to waste water in the lower parts of the city (Lettieri 1560, p. 398). As a solution to these problems, he recommended restoring the Serino aqueduct and bringing it back into service. Not only would the increased water supply power new grain mills in the city, but the run-off from the city's fountains "would clean the sewers and remove all bad smells, which are the cause of the putrefaction of the air" and protect the foundations of buildings (*ibid.* p. 410). Lettieri hoped this would protect the city from future plague epidemics. And, in an attempt to sell this very costly project to the viceroy, Lettieri wrote of the perpetual glory, fame and praise that would be heaped upon him (*ibid.* p. 404).

The flattery did not work and nothing came of Lettieri's proposal. Projects of this ambitious scale had been proposed and undertaken elsewhere. These included the restoration of Segovia's ancient aqueduct, completed eighty years earlier (Pierce and Steel 2009) and

<sup>4</sup> The city's population grew from an estimated 212,000 in 1547 to over 300,000 in 1630 (making it then Europe's most populous city), before declining (due to the disastrous plague epidemic of 1656) to 186,000 in 1688, and then progressively recovering during the course of the eighteenth century (Muto 2013, p. 43).

the restoration of Rome’s Aqua Virgo, eventually completed in 1570, becoming the Acqua Vergine (Rinne 2010, pp. 38–55; Long 2018, pp. 63–91). The reluctance in Naples was due partly to the great expense and partly because of a change of viceroy: Pedro Afan de Rivera, who had succeeded de Toledo, opted for a less elaborate scheme. But Lettieri’s death in December of 1562 brought even this to a halt (Fiengo 1990, p. 41). Other investigations of the remains of the Serino were carried out under successive viceroys, as water needs increased, but nothing ever came of them (Montuono 2014, pp. 1037–1038).

The only immediate impact of Lettieri’s report seems to have been an increased concern with public health, especially with regard to the threat of epidemics such as plague. For instance, an edict of 1566 begins with the words “For the universal benefit and maintenance of the healthy airs of this magnificent and most faithful city of Naples...” and focuses on the cleanliness of the city’s streets, with the goal of avoiding the accumulation of rubbish and waste which could lead to disease-causing miasmas.<sup>5</sup> That said, the Tribunal’s next general edict did take the renewed urgency into account. Issued in 1610, it is much more verbose than the 1552 edict, opening with a consideration of the necessity and usefulness of water to human survival, comfort and health.<sup>6</sup> The 1610 edict’s concerns were also more pressing: the aqueduct was in a state of disrepair in many places, thefts and frauds had occurred and sewers and waste were often located in too close proximity, with the risk that they could “taint the water”. The edict’s aim is to supply water that is “clean, clear and pure” to the “universal benefit” of the city. It consists of twenty-five items, six more than the 1552 edict. Even where the individual items were much the same as the earlier edict, they provided more detailed instructions on what was to be done (and not done) to avoid water loss. A new instruction was that the conduits which took water from the Formale Reale to mills, public fountains and private houses were to be sealed and registered with the municipal authorities, the seals to be kept under lock and key. It forbade the locating of latrines and burials within 16 *palmi* (or just over four metres) of where the Formale Reale passed, ordering those who had them closer to relocate them. Finally, people and institutions who had been issued with written concessions, granting them water access rights for mills or fountains, were to present these to the authorities within 20 days or face a penalty of 50 *onze* and the loss of their water access.

These concessions remind us that Naples’s water system may have been ancient, but it was not unchanging. It had the advantage of being quite easily expanded and developed underground, even if the actual supply of water remained the same. Thus, from as early as the 1480s secondary branches were lengthened to bring water to public fountains and private palaces, for elaborate water displays and domestic uses (de Devitiis 2015, pp. 200–202). Private concessions increased throughout the early modern period, with the deputies keeping careful lists of these private water subscribers—rights which could be inherited. Individuals or institutions paid for the privilege of either harvesting water run-off from a specific fountain or accessing the system from a certain point underground, and for a specific period. Annual rates varied from a ducat or two for access to a spout (*penna*) of water to twenty-four ducats for enough water to supply a series of ornamental fountains, conceded to the nobleman Rinaldo Miroballo in 1655 (Carbone 1677, p. 20). Monasteries and convents sometimes had to purchase water access. So too did trades, like the important

<sup>5</sup> ASMN, *Trib. Fort.*, Banni 30, 1540–1686, fols. 25r–30v, 7 September 1566.

<sup>6</sup> ASMN, *Trib. Fort.*, Banni 31, fols. 101r–107v, 20 December 1610; also reproduced in de Sarii (1794, vol. 5, pp. 265–268).

wool-makers guild,<sup>7</sup> and the tanners, whose guild paid 12 ducats a year to be able to use the reservoir for the fountain in the Piazza del Mercato for softening their hides (Carbone 1677, p. 23). Water rights were also “conceded” in the currency denominations of *tari*, *tornesi* and *carlini*, indicating the diameter of the spout (*bronzo*) providing access to the supply. Thus, from 1669, Giuseppe and Francesco Troise paid just over one ducat a year for “two water spouts, one of a *carlino* and the other of a *tornese*” (Carbone 1677, p. 20).

In addition to regularly updated lists of subscribers, the deputies commissioned surveys of the system, both to keep up with these changes and to ensure they were paid the monies due: one in 1626 a further two in the late 1660s.<sup>8</sup> In 1667 the “engineer” Antonio Galluccio was tasked with providing a visual survey of all the concessions from the Formale Reale that had been granted to the mills and fountains, to the city itself, private citizens and ecclesiastical institutions. Galluccio was assisted by Lorenzo Ruggiano, Francesco de Martino, “and other *fontanari*”. Although it excluded wells and was limited to water supplied by the Bolla aqueduct, the resulting report consists of thirty-two sketch maps. Each illustrates a section of the network, tracing the underground channels and the names of the places and/or people served by each, giving a birds-eye view (if a somewhat fragmented one) of a large part the city’s water distribution system. These were drawn by Galluccio “as best as was possible according to what was represented to me by the said *fontanari*, given that because they are underground, they cannot be seen”.<sup>9</sup>

Together, these documents suggest a carefully managed if complicated and evolving network of water access. If the Formale Reale system clearly failed to reach every house, as Celano boasted, it did serve a wide variety of religious institutions, private residences, workshops and taverns. Galluccio’s map 14 provides an example of the range of consumers. It illustrates a section in the proximity of the Strada della Sellaria, a busy commercial and craft area, specifically in the Palazzo della Zecca (the Mint), from which different concessions branch out. These served the marquis de la Ripa at Pennino, Innocentio de Piro “at [the church of] San Giovanni a Mare” (at some distance), “the house of the Oratorian Fathers [the Girolamini] where the fruiterer is”, the house of Alessandro di Peppo “near the knife-sharpener’s”, the “lodging houses”, the house of Domenico Farcone the gilder, the Mortella tavern, the house of Francesco Stinca “and the macaroni-maker’s”, Caro the notary’s house, and “the Augustinian friar where the cheese and oil [shop] is”.<sup>10</sup>

Access could get complicated in Naples, as private individuals bought the rights to half the run-off a certain fountain (*acqua perduta*) or the contents of a cistern (*acqua morta*) from a neighbour. Moreover, the Tribunal used the same word, “concessions”, to indicate those areas of public space and small structures it leased to private individuals for their own use, such as shops or storage. Sometimes these two different uses, water and property, coincided. In this way in 1677 Onofrio Campanile was recorded as paying four ducats a

<sup>7</sup> ASMN, *Trib. Fort.*, Acque-Relazioni, 1830, fol. 121v.

<sup>8</sup> Alessandro Ciminelli’s 1626 survey, of which only excerpts survive, is discussed by Fiengo (1990, p. 62, n. 22, pp. 68–72). The 1667 survey is entitled “Relazione dell’Ingegnere D. Antonio Galluccio, colla quale da raguaglio al Tribunale di tutte le concessioni di acque... che prendono l’acqua dal Formale Reale” (AMSN, *Acque. Relazione di concessioni, bronzature et altro 1633–1788*, b. 1830, fols. 35–51). A very similar survey was compiled around the same time as Galluccio’s, with the title “Hydrografica descrizione di Napoli sotterraneo ovvero Concessioni dell’acque di essa” (Biblioteca Nazionale, Naples, MS XI E 25). Although lacking author and date, it can be dated to 1666–1670 (Riccio 2002, pp. 125).

<sup>9</sup> AMSN, *Trib. Fort.*, Acque-Relazioni, 1830, ‘Relazione... Galluccio’, 1667, fol. 34. The same section is map 22 in the “Hydrografica descrizione”, fol. 13v.

<sup>10</sup> AMSN, *Trib. Fort.*, Acque-Relazioni, 1830, “Relazione... Galluccio”, 1667, fol. 41v.

year for the “concession obtained” of a structure adjacent to the convent of Santa Maria a Formello, “where he can build a well at his own expense” (Carbone 1677, p. 8). This was certainly an advantageous arrangement, given the convent’s location at the entry of the Bolla aqueduct into the city.

Such was the constant pressure on the system, however, that private individuals might be tempted to tamper with the water supply. In 1723 the wholesale haberdasher Gennaro Barbato was accused of attempting to alter the water course in order to supply a fountain in his own house, at the expense of a neighbour’s supply. To resolve the dispute, the deputies sent an official to Barbato’s house to investigate, comparing the water course to a detailed survey of the system by the surveyor Alessandro Ciminelli in 1626, which noted the exact quantity of water households were due.<sup>11</sup>

Some attempts were made to increase the overall water supply coming into the city. Two additional culverts were constructed in 1612–15 to bring water from beneath the Bolla plain straight to Naples, to power three watermills. The works were directed by the same Ciminelli just mentioned (also spelt Cimminiello or Ciminello in the records), making use of a water vein he had located (Fiengo 1990, pp. 8, 60–66). For Fiengo, this operation to supply watermills for the production of flour is a clear indication that the municipal authorities privileged the interests of the *Annona*—the city’s bread provisioning office—against the overall health and hygienic concerns of the city (1990, p. 61). But we can look at this decision to prioritize mills another way. The water was a crucial source of power for the city’s mills, given that unlike London or Paris (Heller 1996, pp. 12–15), Naples did not have a major river to rely on, other than the Sebeto, fed entirely by the Bolla aqueduct (such that when the Bolla system was decommissioned, at the end of the nineteenth century, the Sebeto ceased to flow (Barca 2004, p. 65)). In Naples, from the earliest survey of the system in 1495, mills and fountains had had to share resources (Croce 1990, pp. 322–323). Moreover, the Neapolitan *Annona* was no mere provider of food. It maintained social stability in the face of the ever-present risk of bread riots (Sodano 2013, p. 118). Putting the city’s bread supply over its water supply can thus be viewed as a harshly rational choice in the context of vice-regal politics. Only twenty years earlier (1585) a revolt had been triggered when the municipal authorities had increased the price of bread, even whilst wheat was being exported to Spain (Villari 1993). In any case, the deputies were so pleased with Ciminelli’s “many and constant efforts made ... in the service of the new water” that in 1617 they presented him with a gold chain worth 400 ducats (Fiengo 1990, pp. 61–62).

Although it soon became clear that the water supply was insufficient for the purpose (Miccio and Potenza 1994, pp. 40–41), this did not dampen the deputies’ enthusiasm for Ciminelli. They accepted an even more ambitious proposal from him, in a seventeenth-century example of what we would today call a public–private partnership, not at all unusual in European infrastructure projects of the sixteenth and seventeenth centuries. (In the same way, in 1554, the engineer-entrepreneur Adam de Craponne financed, and hoped to profit from, the canal that bears his name in Provence: Soma Bonfillon 2007, pp. 77–80, 96–103, 237–9). Ciminelli, in association with the nobleman Cesare Carmignano, proposed powering the city’s mills with an even more abundant water flow, this time from the River Faenza at Airola, near the town of Sant’Agata dei Goti (35 kilometres northeast of Naples). It would also serve the newer western parts of Naples, unable to access the waters of the Formale Reale.

<sup>11</sup> ASMN, *Trib. Fort.*, Conclusioni 17, fols. 11–16. (see also Bruno 2015–16, p. 37).

The resulting contract was advantageous to Ciminelli and Carmignano, who put up the costs for building the aqueduct and buying the water rights, but between them would receive half the profits generated by a monopoly on milling in the city, in perpetuity. They were not disinterested benefactors, as Troyli and other Neapolitan writers later depicted them (Troyli 1747–54, vol. 4, book 4, p. 452), but shrewd entrepreneurs with technical expertise (in the case of Ciminelli) and money to invest (in the case of Carmignano) (Fiengo 1990, p. 89). Ciminelli and Carmignano agreed to a two-year deadline for completion of the work and specified the exact nature of the work to be undertaken. They committed themselves to channelling any water remaining from powering the watermills to supply parts of the city not then supplied by the *Formale Reale* and to supply the water for three new ornamental fountains—the fountains themselves to be paid for by the royal court and local administration. In exchange for this, Ciminelli and Carmignano received a virtual tax monopoly on milling within the city. Both actively defended their financial interests over the years to come, resorting to the courts when necessary.

The Carmignano project was judged a success—finished on time, delivering the promised water—and for years to come was distinguished by Neapolitans as the “*acqua Nuova*”, as opposed to the “*acqua Vecchia*” to indicate the Bolla system (Celano 1692, vol. 8, pp. 3–4, 19). At the same time, it is also evident that no significant changes were made to the city’s water supply during the next century. Work on the system was limited to maintenance, such as the occasional dredging of the main channels.<sup>12</sup> The *fontanari* and *pozzari* continued to take regular note of the water concessions granted, as well as the number and location of private fountains.<sup>13</sup> But they seem to have been fighting a losing battle against increasing demands on the system, prompting Carafa to complain (in contrast to Troyli) that the water supply was lacking both in quantity and in quality (1750, p. 25). If this lack of capacity development in the system had been less of a problem in the fifty years following the 1656 plague, when the city had a much-reduced population, it would begin to pose a problem from the early decades of the eighteenth century when the population began to reach, and then overtake, pre-plague levels.

## The technicians of water

Ciminelli did not work in isolation, of course. He was at the top of a pyramid of trades involved in the realisation and upkeep of the city’s hydraulic infrastructure. The functioning of Naples’s water system and access to its waters depended on the expertise of a wide range of occupations, arranged hierarchically, from architects like Ciminelli at the top, down to water-carriers, at the bottom. This section focuses on this hierarchy—on the people and occupations behind the process—to demonstrate the complexity of designing, building and maintaining the system.

If Ciminelli was not as disinterested as Troyli made out, the abbé was certainly right to stress the importance of engineering and architectural expertise when it came to the city’s infrastructure (1752, vol. 4, p. 452). Ciminelli is identified elsewhere in the records as a surveyor, mathematician, engineer or architect, indicative of both his wide-ranging talents—he also designed the city’s imposing Santa Lucia fountain in 1606—as well as

<sup>12</sup> ASMN, *Trib. Fort.*, Banni 32, 11/7/1729, f. 61r-v., 7/11/1744, f. 133r-v., 17/9/1753, f. 152.

<sup>13</sup> ASMN, *Trib. Fort.*, Appuntamenti 24, 1704, f. 13 and 1710, f. 22.

the spectrum of activities associated with the occupation of *tavolario*. We have already encountered the services of the *tavolario* Lettieri. In the Kingdom of Naples, the *tavolario* was associated with the preparation of the *apprezzi*, detailed fiscal surveys carried out of feudal estates—which often consisted of entire towns and their associated countryside—prior to their sale (Labrot 1995). The *tavolario* was in fact much more than the combination of land surveyor-cum-notary that the *apprezzi* might imply, bringing together the skills of civil engineer and architect as well. In Naples, the *tavolari* had their own College, enjoying elite status. Part of the Sacro Regio Consiglio (the Sacred Royal Council, a royal tribunal and highest appeal court), but whose members were nominated by the municipal authorities, the function of the *tavolari* was thus both royal and urban at the same time. College members, of whom there were ten, had authority over all of the city’s master builders, carpenters, lime-sellers and stonemasons, effectively exercising control over the whole construction cycle (Strazzullo 1968, pp. 27–47; Brancaccio 1991, pp. 239–253).

From his work on the Carmignano aqueduct, Ciminelli’s abilities and expertise emerge quite clearly. This was at a time when the figures of architect and engineer were not yet that distinct from that of master builder: in Naples as late as 1605 architects and engineers could be admitted into the stonemasons’ guild (Rescigno 2015, p. 245). Nor was there an agreed-upon apparatus of learning and licensing, of the sort we would associate with a modern “profession” (Long 2017). It was a time of occupational flux, as architects, engineers and mathematicians increasingly sought to distinguish themselves professionally both from master builders—as they did in another Spanish dominion, Milan, by establishing their own corporation (Gatti Perer 1965)—and from one another (Maffioli 2013). Architects and engineers took on public roles requiring knowledge of water provision, management and consumption, which relied on technical expertise in hydraulics, transportation and practical mechanics, as well as mathematics. This was linked to a broader understanding of water and health as well as natural history, including the origins of springs, the flow of rivers and the power of earthquakes and volcanoes. They mixed the possession of knowledge with entrepreneurial savoir-faire, occasionally at considerable financial risk. In this regard, Ciminelli’s activities are consistent with those of other hydraulic engineer-entrepreneurs active elsewhere in Europe at around the same time, such as Adam de Craponne in Provence (Soma Bonfillon 2007), Jean Lintlær in Paris, Peter Morris in London and Januelo Turriano in Toledo (Shulman 2017, pp. 290–292). So, too, do his political connections and financial astuteness.

To complete the building works, Ciminelli depended on the expertise of some forty stonemasons to reconstruct or build the channels and source the stone, all of whom were named (Fiengo 1990, pp. 105–106, n. 59). Then came the ranks of *fontanari* and *pozzari*. Whilst architects like Ciminelli were ranked amongst the city’s “respected occupations”, alongside merchants, the *fontanari* (fountainers) and *pozzari* (well attendants) were considered “plebeian occupations” (Riaco 1658; Petraccone 1974). Located in between was the “water-master” (*maestro d’acqua*), who exercised authority over the maintenance of the system as a whole and reported directly to the deputies. In this capacity, in 1627 Santillo d’Urso submitted a written report to the deputies regarding “frauds” being committed within the network. D’Urso’s report was based on “several investigations inside the Formale Reale and its branches” that he had personally carried out.<sup>14</sup> We know from other sources that d’Urso was a master builder (Nappi 1985, p. 179 n. 22); moreover, his report

<sup>14</sup> ASMN, *Trib. Fort.*, Banni 31, fols. 148r-v.

is written and signed in the same elegant handwriting, suggestive of considerable learning (Grendler 1989; Pelizzari 2000).

Below the role of water-master were the two occupations that kept the whole system functioning day-to-day: the *fontanari* and *pozzari*. Their role was fundamental and yet Carafa would later describe them as a law unto themselves. They “dispose of other people’s water without reason, and they bestow and withdraw it according to their skill, having imposed a kind of annual tax on charitable institutions and private houses for the maintenance of those waters, of which they are the masters” (Carafa 1750, pp. 24–25). Moreover, because they were the only ones who knew “the actual course and quantity of the waters”, they had become the “absolute arbiters of this invisible and subterranean, but necessary and most important part of our city” (*ibid.*, pp. 26–27).

Was their bad reputation deserved? After all, Carafa was writing as an eighteenth-century rationalist and reformer, with new expectations, which also coincided with the arrival of a Bourbon king (in 1734) and important new building works (De Seta 1995, pp. 165–208), as well as a new detailed survey of the origins of the water system ordered by the deputies in 1739. The answer is yes and no. On the plus side, the *fontanari* were responsible for ensuring the fountains worked, providing for a constant flow without too much loss of water. This also meant making repairs to the system, both above and below ground, requiring skills in masonry and a sophisticated practical knowledge of water flow and levelling. They were also called upon to ensure a consistent flow of water, which meant a conceptual understanding of how the various fountains in areas of the city where they worked fit into the system as a whole. A “plebeian” occupation it may have been, but considerable theoretical learning and professional expertise went into it. One of their number, Nigrone, mentioned above, referred to himself as a “*fontanaro e ingegniero de acqua*” (fountaneer and water engineer) in his elegant manuscript treatise on fountains and hydraulics (and much else besides).<sup>15</sup> By his own account, Nigrone had worked on the Formale Reale from 1549, in addition to designing numerous fountains and waterworks for noble families, both in Naples and beyond; his son Orazio carried on the profession (Borzelli 1902; Tchikine 2014; Giannetti 1989; Nobile 2014, pp. 364–65) (Fig. 2).

From early on, fountains were a priority for the deputies, as suggested by the 1562 appointment of an architect, Colangelo Tofanisco, with supervisory powers over their use and maintenance.<sup>16</sup> Today, we tend not to think of Naples as a city of fountains, in comparison with (say) Rome; but in the sixteenth century these were highly regarded, both public and private (Starace 2002), so much so that Eleonora di Toledo, daughter of the viceroy, who grew up in the city, took her love of fountains and waterworks with her to Florence as the wife of grand-duke Cosimo I (Ferretti 2016, p. 72; Visone 2016; Edelstein 2004).

In 1678, the deputies of the Tribunale della Fortificazione, Acqua e Mattonata stipulated that each quarter of the city would have two *fontanari* in charge, appointed by the deputies, to ensure the flow of water to public and private fountains “in all its bounty and perfection”. The *fontanari* could hire others to undertake this maintenance, keeping records of their expenses. Two, sometimes three, *fontanari* or *pozzari* were responsible for overseeing the water supply in each quarter of the city.<sup>17</sup> In addition to regular maintenance work, the *fontanari* were called upon for their expertise of the system as a whole; their knowledge

<sup>15</sup> Biblioteca Nazionale, Naples, “Vari discorsi di Giovanni Antonio Nigrone”, MS XII G 59–60.

<sup>16</sup> ASMN, *Trib. Fort.*, Conclusioni 8 (1564–73), fol. 93.

<sup>17</sup> For instance, new appointments were made in late 1704, effective from the start of the following year. ASMN, *Trib. Fort.*, Conclusioni 13, 15 December 1704, fols. 74v–75r.



**Fig. 2** A self-portrait of Giovanni Antonio Nigrone, with the tools of his trade. The verses boast of the high-placed patrons for whom he had designed water features. “Vari discorsi di Giovanni Antonio Nigrone”, Biblioteca Nazionale, Naples, MS XII G 59, fol. 5 Photograph courtesy of the Ministero per i Beni e le Attività Culturali, Rome

was essential to Galluccio's 1667 maps of the network. The maps ensured equitable and sufficient water flow throughout the system and identified possible frauds involving individuals illicitly tapping into the system.

The *pozzari* shared much of the expertise and many of the responsibilities of the *fontanari*, although they focused on the well shafts accessing the system, as their name suggests (from the Italian *pozzo*, well: see Fig. 3). They cleaned and maintained the underground reservoirs, the well shafts and the conduits known as *tufolature* (so-called because they were excavated directly into the tuff, then lined with glazed earthenware pipes and sealed with lead (Esposito 2018, p. 45, n. 30). However, these functions might also extend to the management of the water supply itself. For instance, in 1651, “in case of shortage of water from the Acqua Antica” in the city districts of Palazzo, Pizzofalcone and Mortella, the *pozzaro* Aniello Ciento, responsible for them, was permitted to make up for the deficiency by accessing the “new water” of the Largo di Castello fountain, “taking it at night-time”.<sup>18</sup>

Together, these two occupations were the real experts of the hydraulic system, both above and below ground. When it came to regulating the flow of water—when, for example, in a particular part of the system so much water was being drained off to fountains or private homes that the water mills could not function—it was the *fontanari* and *pozzari* who had to make the necessary adjustments. Moreover, resolving such issues might involve considerable negotiating skills, given the different interests at stake.<sup>19</sup> And yet they were ambivalent occupations. On the negative side, as a result of the widespread demand for water, especially amongst those Neapolitans willing and able to pay for the privilege, and given that the *fontanari* and *pozzari* depended upon such piecemeal work to earn a living, one can see how they might be tempted to use their knowledge to make private arrangements on the sly. Nigrone blamed his fellow technicians for any faults in the Formale Reale: they alone had the keys to the different compartments into which it was divided and so could regulate the flows of water to the highest bidder.<sup>20</sup> And indeed, on one occasion several “*fontanari* and their mates [*loro compagni*]” were denounced for causing fluctuations in the flow of water, as a result of which certain fountains “were seen to flow at half of their water play”.<sup>21</sup>

The deputies recognised this ambivalence, their edicts sending conflicting messages. The general edict of 1610 prohibited *pozzari* from opening new wells or connecting to the Formale without express permission of the Tribunal, suggesting they might be the cause of problems.<sup>22</sup> At the same time, *pozzari* were promptly to report any issues with the Formale to the authorities. All *pozzari* resident in the city were to register before the deputies, “so that no one is admitted to the said occupation other than those recognised in that trade”. (Ironically, this licensing procedure made their occupation more regulated than that of the architect-engineers.) *Pozzari* were only permitted to clean the wells of private individuals after being issued with a licence specifying the location and the problem. According to the edict, this was “to avoid the ongoing frauds that the said *pozzari* commit, such as by cleaning a dirty well shaft and finding a dead rotten cat in it, they throw the same cat in other nearby shafts so that they become infected, and so their owners are obliged to fetch the same *pozzari* to

<sup>18</sup> ASMN, *Trib. Fort.*, Conclusioni 11 (1649–55), 27 June 1651, fol. 109r.

<sup>19</sup> For example, a formal complaint made by the deputies to the president of the Sacro Regio Consiglio, Diego Bernardo Zofia, regarding the *bronzo* of Largo di Castello. ASMN, *Trib. Fort.*, Conclusioni 11 (1649–55), 24 February 1650, fols. 42v–43r.

<sup>20</sup> Biblioteca Nazionale, Naples, “Vari discorsi di Giovanni Antonio Nigrone”, MS XII G 59–60, vol. 2, fol. 371.

<sup>21</sup> ASMN, *Trib. Fort.*, Conclusioni 12 (1676–84), 5 April 1678, fol. 37v.

<sup>22</sup> ASMN, *Trib. Fort.*, Banni 31, fols. 101r–107v, 20 December 1610.



**Fig. 3** A well shaft from the “Vari discorsi di Giovanni Antonio Nigrone”, Biblioteca Nazionale, Naples, MS XII G 59, fol. 294 Photograph courtesy of the Ministero per i Beni e le Attività Culturali, Rome

clean them”. To avoid abuse, the edict also limited the amount *pozzari* could be paid to 5 *carlini* per day, presumably so they did not ask for more. One hundred and sixteen years later, not much had changed: no *pozzaro*, even if licensed, was to go down into

the conduits of the Formale Reale, “to clean them or for other reason” or to tamper with the course of the water.<sup>23</sup>

And yet, their nature as respected and respectable occupations also emerges from the Tribunal’s records. The occupation of *pozzaro ordinario*—well attendants responsible for overseeing the situation quarter by quarter—was passed down from father to son so that there were whole dynasties, such as the d’Adamo family, which I have been able to reconstruct for the eighteenth century (see Fig. 4). Patrick Fournier has done something similar for a dynasty of *fontainiers* in Carpentras, France (1999, pp. 290–292), and Urszula Sowina has studied the well-builders of late-medieval Poland (2016, pp. 246–259).

We first encounter Carmine d’Adamo in August of 1718, when he takes over as *pozzaro* in the Monte Oliveto, Banchi Nuovi and Ramo dei Greci quarter from the aging and ailing Mattio Sica, for whom he had worked for many years as assistant, “it being useful that in this trade new recruits are instructed, who can then fill positions when these become available”.<sup>24</sup> Upon Sica’s death the following month, Carmine was awarded his salary of 10 *carlini* a month, “with all the usual legitimate earnings, salaries and emoluments associated with the said post”.<sup>25</sup> A few years later, Carmine was allowed to appoint his sons, first Pietro and then Gaetano, as his assistants. When Carmine died in 1750, the deputies allowed Pietro and Gaetano to take over, recognising that they had “all the qualities necessary for the said post”.<sup>26</sup> Moreover, the deputies stipulated that the two brothers had to commit themselves to supporting their mother, as well as training their younger brother Domenico to be a *pozzaro*. All of this also suggests that the deputies had a degree of trust in the *pozzari*; sought to ensure an adequate supply of skilled and reputable practitioners; and considered the family line the best way of achieving this.

The two elder d’Adamo brothers must have kept to their side of the deal, because in 1752 their younger brother Domenico was appointed assistant to another *pozzaro*, and then *pozzaro ordinario* in his own right in 1753, upon the death of Domenico’s elder brother Gaetano.<sup>27</sup> When Pietro d’Adamo died in 1759, his twelve-year-old son Carmine was appointed to take over in his place. Given that “at the present time [Carmine] is still a minor and not well instructed in the office of *pozzaro*”, his uncle Domenico agreed to assume responsibility for Carmine, with the additional proviso that Carmine will have to undergo an examination upon reaching the age of 20.<sup>28</sup> Carmine eventually became *pozzaro ordinario* alongside his uncle Domenico; and when the latter died in 1778, it was Carmine’s turn to take responsibility for Domenico’s eldest but still young son, Pietro (Carmine’s cousin).<sup>29</sup> Upon Carmine’s death, his own brother, Gaetano, was nominated *pozzaro ordinario*. When Gaetano also died, the younger Pietro became *pozzaro ordinario* in the same Monteoliveto, Banchi Nuovi and Ramo dei Greci quarter, with Nicola d’Adamo as his assistant. Upon Pietro’s death in 1801, Nicola was duly examined and took his place.<sup>30</sup> Although not all was sweetness and light in the d’Adamo family—two elderly female

<sup>23</sup> ASMN, *Trib. Fort.*, Banni 32, 11 February 1726, fol. 18r.

<sup>24</sup> ASMN, *Trib. Fort.*, Conclusioni 15, 1 August 1718, fol. 86v. Sica had held the post from at least 1704 (ASMN, *Trib. Fort.*, Acque-Relazioni 1830, fols. 128–130v).

<sup>25</sup> ASMN, *Trib. Fort.*, Conclusioni 15, 26 September 1718, fol. 92v.

<sup>26</sup> ASMN, *Trib. Fort.*, Conclusioni 18, 15 May 1750, fol. 164v.

<sup>27</sup> ASMN, *Trib. Fort.*, Conclusioni 18, 20 June 1752, fol. 191v.; ASMN, *Trib. Fort.*, Conclusioni 19, 10 September 1753, fol. 22v.

<sup>28</sup> ASMN, *Trib. Fort.*, Conclusioni 19, 9 June 1759, fol. 144v.

<sup>29</sup> ASMN, *Trib. Fort.*, Conclusioni 20, 18 July 1778, fol. 120v.

<sup>30</sup> ASMN, *Trib. Fort.*, Acque-Concessioni 1832, 23 May 1801 (unnumbered folios).

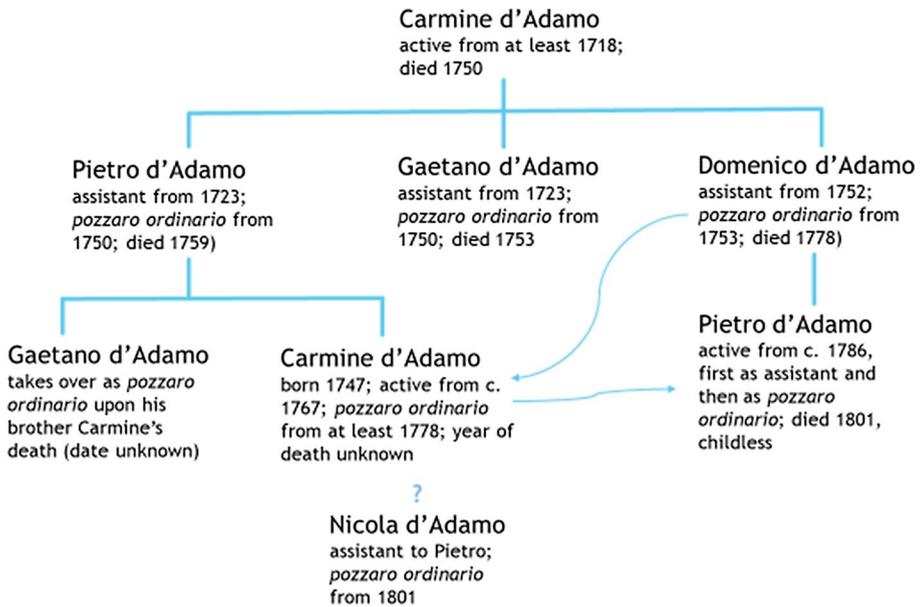


Fig. 4 The d’Adamo family of *pozzari* (well attendants), c. 1718–c. 1801

members of the family having to petition the deputies for financial support from Nicola, which they were awarded—the dynasty continued into the new century.

This discussion of the activities, responsibilities and ambiguities of the *fontanari* and *pozzari* gives the impression that Naples’s water supply was parcelled out haphazardly, without the clear hierarchy of usage evident in other Italian towns, such as Siena. Here, access to fountains and uses of water with greater potential for contamination were kept “downstream” from uses that required fresh water (Kucher 2005). In Rome, the papal city’s increasingly numerous fountains were classified by use and patronage and the water that flowed into and away from them by type (Rinne 2010, p. 156). Summonte did distinguish Naples’s fountains—he mentions thirty-nine—according to function: ornamental, for drinking, for clothes-washing and for watering animals (1601, pp. 241–253). But our knowledge is still incomplete. If a hierarchy of use existed in Naples, the evidence suggests that it privileged water mills, ornamental fountains, elite institutions and households, and certain occupations, like the wool and leather guilds. Washerwomen and vegetable sellers were left very low down on the hierarchy, as the often-reiterated legislation against their use of ornamental fountains for their activities suggests.

The desire on the part of the authorities to keep the ornamental fountains ornamental did battle with a perennial shortage of locations for the washing and drying of laundry. Just occasionally the deputies responded to this need. In 1603 it announced a bidding process for the construction of a new washbasin (*lavatoio*) at the Molo Grande fountain. This was intended principally for sailors and their own washing needs; the fact that the washbasin was intended “for the preservation of the said fountain, so that it remains clean and tidy”, suggests that the sailors were already using the larger fountain for that purpose.<sup>31</sup> Although

<sup>31</sup> ASMN, *Trib. Fort.*, Banni 31, fols. 36r-v., 23 January 1603.

the washing of clothes and linens was an absolutely crucial activity in such a large and densely populated city as Naples, washerwomen's choices were relatively limited in comparison to Rome, where dedicated laundry basins were built as the city's aqueduct system was being developed (Rinne 2001–2), or cities like Florence which could locate such activities along their river banks (Ferretti 2016, p. 30). At Naples's Piazza del Mercato there was "a convenient washbasin for the women who are seen there everyday in large numbers washing clothes" (Summonte 1601, p. 243). Washerwomen also used the fountain located at the seat of the wool guild, behind the Palazzo della Zecca (the Mint), as well as fountains on the "street known as Pistasi", inside the Castel Nuovo and at the Santissima Annunziata hospital. A description of the latter, from around 1588, notes how "morning and afternoon, you would see around the fountain, full of sweet and lovely waters, five hundred maidens who together, sleeves rolled up, are doing the laundry" (del Tufo 2007, p. 358).

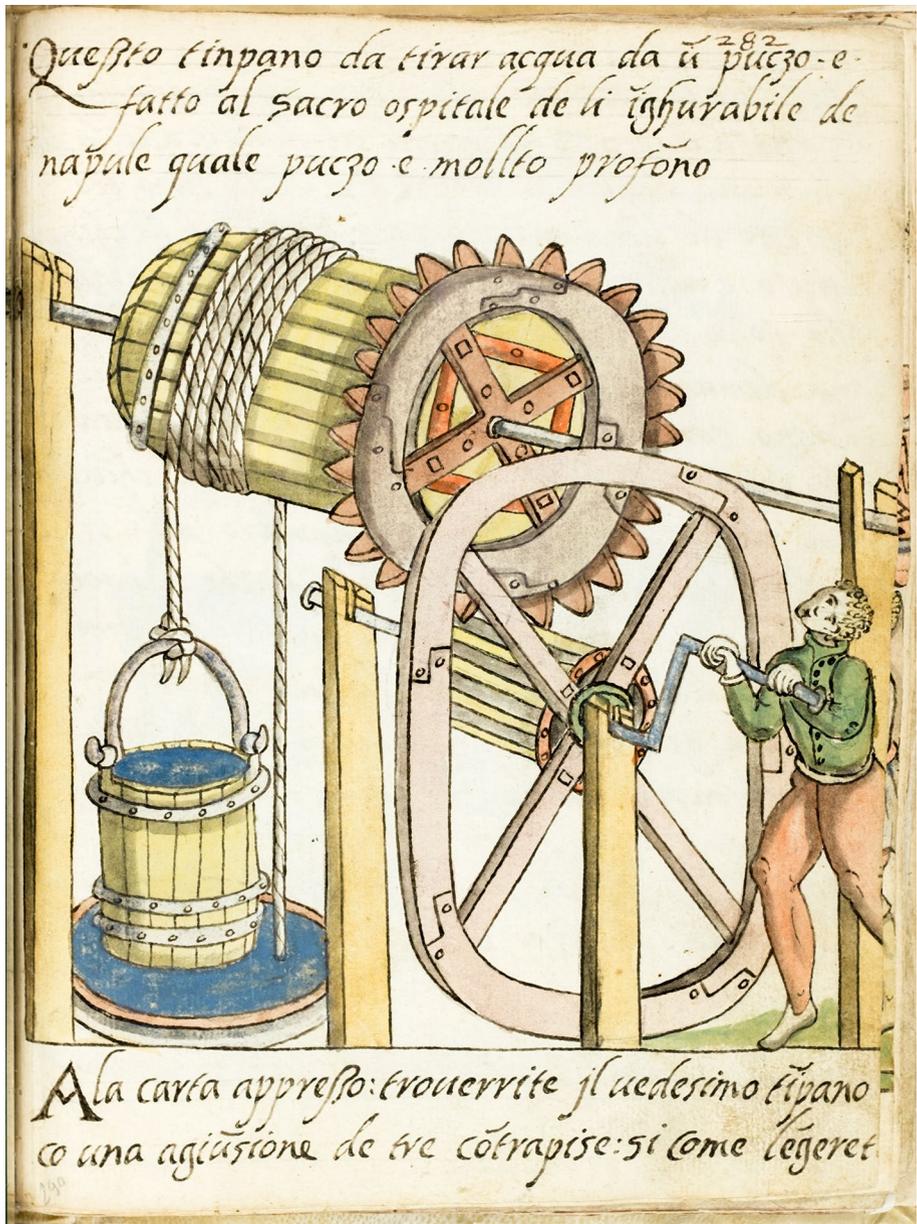
The issue of mixed use often came to a head following the completion of new public works. Just a few years after the authorities had finished moving and embellishing Ciminelli's Santa Lucia fountain "for public recreation and convenience", in 1620, it ordered that no one "string clothes lines or hang up clothes ... or obstruct the iron railings or wash clothes in it". The local guards had the authority to remove the clothes and fine the offenders. The Deputies also took the opportunity to extend the prohibition to two other ornamental fountains.<sup>32</sup> But the demand for the Santa Lucia fountain's water would not go away. In 1742 the Deputies petitioned the king's secretary to have a guard posted permanently at the fountain. They complained how they had "paved almost the entire broad and pleasant street of S. Lucia a Mare", had "had removed all the shacks which despoiled the sea-front side" and had "restored the fountains along the street which, at the hands of excellent sculptors, make it a most beautiful and elegant street"—only for it to be ruined by "the heavy-handedness and indifference of the populace of that Borgo", which, as in the past, used it for the washing of and drying of clothes, "mistreating and dirtying [the fountain's] very beautiful statues".<sup>33</sup>

Water-carriers were the final link between the urban water supply and consumers. They served to supplement the supply of water and so were to be found in every European city (Costantini 1984; Braudel 1981, vol. 1, p. 230; Pardailhé-Galabrun 1988, p. 352; Flaxman and Jackson 2004). They were usually men; women and servants had the tiresome (and tiring) job of fetching water from fountains or wells and carrying it home, often up numerous flights of steps. It has been estimated that, for domestic use, early modern women carried something between 5 and 30 l of water at a go (Sarti 2004, p. 143). In Naples, if many elite religious institutions and households had direct access to the underground reservoirs of the Formale Reale, the well shafts could none the less be quite deep. Such was the case of the Incurables' Hospital, for which Nigrone designed a special mechanism to make bringing up water easier (see Fig. 5). From the seventeenth century, some of city's elite religious institutions, as well as a few private households, were more fortunate in being able to install hydraulic pumps for the purpose (Novi Chavarria 2009, pp. 105–106).

The city's the water-carriers provided three basic services: selling drinking water from a stall at a set location, peddling it through the streets of the city or delivering it by the cartload. As we have seen, Père Labat was struck by the large number of water-sellers in

<sup>32</sup> ASMN, *Trib. Fort.*, Banni 31, fols. 143r-v., 15 May 1625.

<sup>33</sup> Archivio di Stato, Naples, *Segreteria di Stato di Casa Reale*, Diversi, fol. 798, 30 April 1742. My thanks to Diego Carnevale for supplying this reference.



**Fig. 5** Nigrone's hydraulic "tympanum" for the Incurables' Hospital, Naples. "Vari discorsi di Giovanni Antonio Nigrone", Biblioteca Nazionale, Naples, MS XII G 59, fol. 282 Photograph courtesy of the Ministero per i Beni e le Attività Culturali, Rome

Naples, selling water to passers-by from large earthenware jars, full of cold, clean water, to drink or wash their faces and hands with (Labat 1730, vol. 5, p. 396). They were part of Naples's bustling retail sector, characterised by an extensive informal economy (Clemente

2015). Labat makes no mention of them selling their water accompanied with lemon; but this is how stall-holders and pedlars were doing it from at least the 1770 s, to judge by contemporary illustrations and travellers' accounts (Fabris 1773; Goethe 1970, pp. 319–320; Calaresu 2016, pp. 113–114).

Water-sellers were also associated with two local mineral waters. Their therapeutic use was discussed favourably in a treatise by the Neapolitan physician, botanist and literary scholar Bartolomeo Maranta (1559). One of these was the *acqua zurfegna* or sulphur water of Santa Lucia, which “is cold and has a pleasing acidic quality; poured into a glass it produces much bubbling, like common water in a vacuum”, according to the natural philosopher and mathematician Giovanni Maria della Torre (1755, pp. 88–89). Coinciding with increased medical and scientific interest in the chemical properties and therapeutic benefits of diverse mineral waters throughout Europe, the Deputies first took an interest in the city's sulphur water in an edict of 1736. Declaring their longstanding jurisdiction over “all waters, both mineral and simple and natural that originate and flow in this city”, they declared that the sulphur water should be freely available to all and prohibited its distribution without their permission and its sale at any price, however low.<sup>34</sup>

The final activity of the water-carriers, bringing regular deliveries of water, known as an *acquata*, to the palaces of private individuals, overlapped with the carters. Such was the supply of “two cartloads of water a day” to be delivered to the royal palace (not reached by the Formale Reale), recorded in 1650.<sup>35</sup> In this case, it was not just any water, but water from the Dominican monastery of San Pietro Martire, which had its own groundwater well (Summonte 1601, p. 256) the water of which was recognised as the best in the city, “perhaps the most perfect there is in all of Italy”, which never spoiled. Its goodness was such that “when some political figure comes from Spain and is strict in applying the law, it is said: ‘He hasn't yet drunk the water of San Pietro Martire’”. The then viceroy, Iñigo Vélez de Guevara, apparently drank no other water during his tenure in Naples, even taking supplies with him when he went on campaign (Celano 1692, book 4, p. 147). It was still being touted as Naples's best a hundred years later, when the first chemical analyses of the region's waters were undertaken by physician Nicola Andria (1783, pp. 305–307).

## Water quality in early modern Naples

Was this some kind of urban legend? Were Neapolitan consumers simply making a virtue of necessity in praising their own waters? We find the same preferences for local waters in other early modern cities. The Roman physician Andrea Bacci wrote that the popes were so fond of Tiber water that they insisted on bringing it with them when they left the city (Bacci 1576, p. 211). Likewise, Parisian enthusiasm for the water of the Seine went unquestioned until the end of the eighteenth century (Euzen and Haghe 2012), despite it being common knowledge that visitors to the city would invariably fall victim to its bad effects, suffering “fluxes” and worse (Pardailhé-Galabrun 1988, pp. 353–354). To explain this attachment, we need to “re-examine the assumptions we bring to the questions of water quality”, as Christopher Hamlin has suggested (2000, p. 315).

<sup>34</sup> ASMN, *Trib. Fort.*, Banni 32, 28 July 1736, fol. 95r.

<sup>35</sup> ASMN, *Trib. Fort.*, Conclusioni 11 (1649–55), fol. 79.

How can we explain the praise that Troyli, Labat and others lavished on Naples’s water? It is important, as much as possible, to judge this by the standards of the time and in comparison with other large European cities. As I argue elsewhere (Gentilcore [in press](#)), early modern Europeans knew, through long experience, which waters were “best” (as they saw them) and to take certain precautions when it came to their consumption—even if the rationale was necessarily couched in a different medical philosophy and even if their efficacy would often be questionable from the perspective of modern bio-medicine. Before the first chemical analyses were developed in the second half of the eighteenth century, such as those undertaken by Andria in Naples (1783), doctors relied on a mixture of techniques and on their senses to determine the healthiness or otherwise of a particular water, little changed since classical times (Euzen and Haghe 2012; Sansa 2002).

An analysis of the waters in advance of building the new Carmignano aqueduct in the early 1600 s gives an idea of what this entailed. The deputies commissioned two high-ranking university physicians, Latino Tancredi and Mario Zuccaro, as part of a team to investigate and analyse the waters of the proposed source and compare them to those of the existing Formale. Tancredi had written a medical treatise on hunger and thirst and Zuccaro one on poisoning, so they were both well-placed to judge (Tancredi 1607; Zuccaro 1611). The two doctors reported on “all the diligence and observations, experiments and tests necessary to ascertain the goodness and quality of the said waters”. These consisted of “weighing, heating and cooling, distillation, drying on cheesecloth, and quality in terms of flavour, taste, colour and odour” (in Fiengo 1990, pp. 85–86, n. 8). They reported back that the water was “most pleasing to the taste, without any hint of foreign quality, light and clear” and “a bit lighter” in weight than the Bolla water supplying the Formale Reale.

From the times of Aristotle, Hippocrates and Galen, and repeated in early modern printed dietary regimens and health guides as received wisdom, the best waters were clear, light and tasteless, emerging from eastward-flowing springs from mid-summer rain showers (Gentilcore [in press](#)). River water was to be used only out of necessity and then only from large rivers, far from towns and free from mud. The worst were well water and pond waters. Both required a period of storage to allow their “impurities” to settle, in order to make them potable. The quality of cistern-water—of relevance to Naples’s water supply—divided doctors. For the Englishman Tobias Venner it was amongst the worst for “alimentary uses”, because it was “shut up from the air” (1620, p. 10), or, for the Spaniard Francisco Nuñez de Oria, because it was in contact with the earth (1586, pp. 343v.). However, for the Venetian resident Tommaso Rangoni cisterns served to “purge” rain-water, making it “agreeable, without taste and colour, indeed sweet and limpid and light” (1577, p. 7v.). Venetians depended on rainwater cisterns for all their fresh-water needs: every square (*campo*), each with its characteristic well-head, was in fact the top of a giant underground cistern, where rainwater was filtered through sand and clay (Costantini 1984; Giormani 2010). Perhaps it is no coincidence that some of the highest praise of Venice’s water came from a Neapolitan, the natural philosopher and army physician Luca Antonio Porzio, who wrote in 1685 of its “perfectly purify’d” quality (1747, p. 58).<sup>36</sup>

The perceived quality of Naples’s underground water supply was attributed to both its origins and the system’s structure. Being aqueduct water meant all of the perceived advantages of spring water (the source) with few of the disadvantages of river water (such as silt and mud). Summonte praised the Bolla aqueduct which, because of its “tortuous” changes

<sup>36</sup> On Porzio, see Pádraig Lenihan (2008).

in direction and level, allowed the water to filter itself (*purgarsi*), the twists and turns agitating the water, making it “healthier” and its motion making it “cooler” (Summonte 1601, p. 240). Summonte refers to Giovanni Pontano—statesman, scholar and poet—who, a hundred years earlier had explained how the city’s water cleaned itself, because it flowed over gravel through wide but irregular channels (1509, book 6; de Devitiis 2015, p. 197). In addition to this, the water was then allowed to settle for long periods of time in large underground reservoirs or cisterns. For Celano, the city’s water was “so limpid and purified, that one cannot taste better in the world”, because much of it came from a large underground basin located directly underneath the convent of Santa Croce di Lucca, not far from where the Bolla waters entered the city: a reservoir so vast that “no new water had come into it in the previous forty years, and which would probably last another hundred”. Moreover its water was “so cold that it is difficult to believe that snow has not been added to it” (Celano 1692, vol. 2, p. 203).<sup>37</sup>

For Porzio, what sometimes made Naples’s waters “prejudicial, heavy and ill-smell’d”, was when they were “violently agitated” (Porzio 1747, p. 55). Otherwise, the filtering and storage process that attracted such praise to Naples’s water was the inspiration behind several of his water filtration devices, which he recommended for encamped soldiers. These included a floating “machine” whose different compartments, filled with pebbles and sand, would draw off water, filter it and make it safe for use (*ibid.*, pp. 60–66). In designing these devices, “we have imitated the means which nature generally uses to purify water, which by passing frequently thro’ the bowels of the earth, there leaves its impurities, and at last produces fountains whose water are good and salutary” (*ibid.*, pp. 72–73).

There is one final point to consider in understanding early modern preferences for local water. For early modern medicine, the fabric and make-up of one’s body was the product of the local environment. As a result, the consumption of local foods and drinks were best for the maintenance of one’s health; any change in this brought serious health risks (Gentilcore 2016, pp. 76–82). Citing Plato, Porzio noted how “the aliments we use are not everywhere the same, and as waters do not mix with bodies in one uniform manner, their effects must also be different”. It all depended on what one was accustomed to. He recounted how people, greatly favouring the waters “so much used by the Neapolitans”, attributed their illnesses in Rome to drinking too much of Rome’s water. To which Porzio would answer that there were “excellent” waters in Rome, “and that if a person should drink of them as frequently and copiously as the Neapolitans do of the spring by them called *Formale*, they would also produce disorders”. That said, according to Porzio, “the air of Naples is highly pure, whereas that of Rome is thick, moist, and full of vapours”, which also explains ‘why a large quantity of water drank there [in Rome] is more prejudicial than at Naples’ (Porzio 1747, pp. 74–75).

## Concluding remarks

A recent survey history suggests that in the age of ‘hydro-precarity’, urban water politics was shaped by “similar political economic alliances deploying water services technologies to make the cities of their eras more comfortable *for themselves*”. That is to say, a

<sup>37</sup> On Celano’s work, see Joris van Gastel (2014).

corporatist political elite relied on the services of a “technocratic elite of engineers”, even if this was not in the interests of a broader public good, a concept which did not yet exist (Staddon et al. 2017, pp. 84–85). The present study both confirms and contradicts this. In early modern Naples, those two elites, political and professional, certainly exercised control, especially evident in the relations between the deputies and Ciminilli; but their authority was sorely tested by the pressures constantly put on access to the water system, with *fontanari* and *pozzari* tampering with the system due to pressure (and payment) from private individuals. At the same time, the authorities also colluded with this ever-increasing demand on limited resources, by granting “concessions”. These favoured the religious and social elites but were by no means limited to them. This co-existed with a notion of water as a universal good, freely available to all, expressed in the legislation and in material form in the city’s numerous public fountains. A perception of water quality also existed, with legislation to ensure a hierarchy of uses of the fountains and prevent the pollution of the water supply and consumers who were broadly content with the product, when not positively enthusiastic. A system which proved adaptable over time, with its multitude of “branches”, coincided with the reality of a limited supply of water, privileged access for the elites (who were also prepared to pay for it) and milling interests, and the risk of water contamination.

More particularly, what can the management of the city’s water supply over a period of two hundred years tell us about governance in Spanish Naples? It provides ample evidence of the “collision and collusion” (Sodano 2013, p. 127) between the different layers of government in the exercise of authority, from the Spanish monarch’s representative in the city, through to the noble and urban elites serving as deputies, all the way down to the *pozzari* labouring at the coalface. In these “dynamic interactions” (Marino 2013b, p. 26), power was shared out and negotiated. An established hierarchy of official roles and functions was thus dispersed across a multiplicity of agents and sources of expertise and practical knowledge. None of this should come as any surprise to scholars of early modern Europe, in general, and Naples, in particular. What is perhaps more surprising is how the surviving evidence suggests that, far from being ineffectual at best and corrupt at worst, the Neapolitan authorities and their employees largely succeeded in maintaining and providing a functioning and evolving service, even if this was achieved on the basis of ongoing ad hoc interventions rather than as part of rationalised and systematic policy.

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