Local government responses to urban river pollution in late medieval England

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> We command that no man, himself or his servants, cast dung of his stables or other filth into the common river, upon the pain to pay half a mark at the first trespass, 1 mark at the second, and 20s. at the third.[1] Also that no man is permitted to make an obstruction or stopping with trees, stones, or other filth in the aforesaid river, upon the pain aforesaid. … Also that the river and the brooks that come to and run through this city, and also the Red Ditch, should be enlarged to their rightful breadth in order to have the right course. The water has been stopped of its course by encroachment of dwellers on both sides, by being straightened and narrowed, and by filth, dung, and stones. Every man must clean his property up to the water, and dig out and clean the river's old course, so that waters in flood time may pass easily, eschewing diverse perils of the past from flooding because of stopping and straightening of the same rivers and ditches. This must be done before Midsummer's Day, upon the pain of 20s. for every man found in default.
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> – Coventry Mayor's Proclamation 1421[2]

Urban river pollution is typically understood as a problem of the modern age. Scholars have investigated two main aspects of river pollution: how industrial by-products and agricultural run-off contaminated waterways, prompting legislative responses (e.g. Oosthoek 2002; Massard-Guilbaud 2004; Barles and Lestel 2007; Closmann 2007); and how domestic wastewater disposal created hygiene concerns and difficulties with providing clean drinking water (e.g. essays in Bernhardt 2004; essays in Schott et al 2005; Tarr and Josie 2006). In these analyses, the focus is on nineteenth and twentieth century legislative attempts to control pollutant sources and the creation of large-scale infrastructure systems to divert or clean wastewater and supply fresh water to urban inhabitants. Physical interventions in urban rivers such as dredging and channelling have not been treated within the context of pollution response, although work on London's Thames Embankment project (Porter 1998) is

[1] Fines are given in the original monetary units of £1 (pound) = 20s. (shillings); 1s. = 12d. (pence); 1 mark = £2/3 = 13s. 4d. For an idea of the value of the fines, the York council listed the permissible daily wages for skilled building workers in 1563: in the summer months, they received 8d. per day or 4d. per day plus meat; in the winter they got 1d. less per day; other urban laborers received 5d. per day or 2d. per day plus meat. (Raine 1942–50, 6: 58-60)

[2] Author's modern English translation of the Middle English original (Harris 1907–13, 1: 29-31)

an exception. The scholarship in general follows in the footsteps of foundational urban environmental history work by Tarr (1996) and Melosi (2000), which established legislation and infrastructure systems as key areas of investigation. These studies often present the development of bacteriology, or 'the bacteriological revolution' (Melosi 2000), as critical for creating the impetus to clean up urban waters.

Scholarship on medieval rivers has followed a similar trajectory. Historians have typically seen rivers in the medieval world as resources – for fish, drinking water, transportation and waterpower – and have focused their efforts on understanding how early societies came to harness rivers as a resource (e.g. Guillerme 1988; Hoffmann 1996; Magnusson 2001). Although there has been some investigation into urban rivers during medieval times (e.g. Sabine 1933, 1934, 1937; Zupko and Laures 1996; Leguay 1999, 2002; Kucher 2005a, 2005b; Magnusson 2006; Ruhland 2007), the studies have focused on either legislative attempts at pollution[3] control –which are generally categorized as futile because of the lack of modern technologies and failure to control public actions – or drinking water infrastructures, mirroring their modern counterparts.

None of these historians have treated pollution regulations and regular river upkeep activities such as scouring and dredging as part of the same toolbox for responding to urban river pollution. Yet these two seemingly separate activities were indeed connected during the medieval period. As the opening quotation from the Coventry Mayor's Proclamation of 1421 shows, both legislative action (i.e. ordering people not to do certain activities) and scouring projects were responses to filth and dung accumulation in urban waterways. By overlooking the connection between pollution legislation and river cleansing, historians have underappreciated the extent of involvement by local town governments in controlling and responding to pollution in the riverine landscape.

Three interwoven concerns dominated medieval concepts of river pollution: obstructions, disease and proper moral behavior. Obstructions in waterways, as well as roads, had a direct effect on commerce. Riverine obstruction came in all forms from construction rubble and logs to dung and butchery entrails. It was one of the

[3] I use the word 'pollution' in the modern sense as an undesirable state of the natural environment because contamination by harmful substances, rather than the spiritual and ritual meaning of the word, which would have been its contemporary meaning in the Middle Ages. The environmental sense of the word 'pollution' originates in the nineteenth century.

primary types of ‘nuisance’ violation, something harmful or offensive to the public or an individual under medieval legal English law (Chew and Kellaway 1973). Disease was another motivating factor. The miasmic theory of disease, which was leading belief at the time, stated that corruption of the air lead to disease (Cipolla 1992). Vapors, fogs, and even unseen strong smells could cause infection. For example, Sabine (1933) tied complaints against disposal of butchery waste to outbreaks of the plague in London. Corruption was extended to water as well: in 1579, the Norwich assembly responded to a recent plague outbreak by ordering the clean-up of leaky latrines and outlawing the practice of washing fabrics in the river because they caused ‘greate infeccion’ of the river (Hudson and Tingey 1906–10, 2: 335–37). Finally, civic pride and proper moral behavior motivated pollution concerns (e.g. Kucher 2005b). The idea of cleanliness as part of the public good (Jørgensen 2010) was clearly intertwined with concerns about obstructions to commerce and urban disease. If the river became filled with dirt, waste, and other pollutants raising one or more of these concerns, the medieval town governments could not stand idly by.

There is little distinction in the medieval sources between natural silting, weed growth, and accumulation of waste such as dung in rivers. The modern reader might not consider weeds a pollutant, but in the medieval sources it was treated as one: weeds and ‘ffylthe’ both caused rivers to ‘decaye’ and needed removal at the same time (Hudson and Tingey 1906–10, 2: 115). The configuration of medieval drainage systems physically connected streets, which could be a source of wastes, with rivers (Jørgensen 2008), so weeds and filth in the rivers often stemmed from the same problems. It was common practice to pile up waste on the street in front of one’s house, shop, or stable to await final offsite disposal. When it rained, the waste would wash away down to the river along with the rainwater. As the water velocity slowed down in the riverbed, the waste would settle out in the river. Over time, the accumulation of waste and dirt would decrease the river’s carrying capacity and encourage weed growth. People in the medieval towns recognized this connection; for example, Norwich’s assembly bemoaned the fact that waste was set in the street or on vacant land and then rain would come and wash it into the gutters and ditches, and eventually into the river where it caused ‘great annoyance’ (Hudson and Tingey 1906–10, 2: 141). Because the medieval actors considered all types of materials as equivalent river pollutants, this article treats them in the same manner. Pollutants in

this sense were any 'matter out of place' (Douglas 1969). Thus actions to remove weeds or accumulated silt were fundamentally the same as carting away dung.

This article examines the local responses to medieval urban river pollution in three leading English towns—Coventry, Norwich, and York—during the late fourteenth through sixteenth centuries. All three were in the upper echelon of English urban centers, ranking in the top seven towns behind London in 1524-25 with populations of 6,000 to 9,000 (Slack 2000). Each town had local council consisting of a mayor and aldermen who represented various wards within the town.[4] The survival of relatively complete town government records from the late fourteenth through sixteenth centuries make it possible to reconstruct some of the relationship between the urban governments and their rivers.[5] Although the King of England had nominal jurisdiction over all rivers used for commerce, the actions and funding for river management came from the local governments in the late medieval period. The King could and did issue writs and proclamations based on requests brought to him, but the local government was responsible for implementing the requests (Doig 1998). By focusing on the local urban governments, we can see how pollution concerns were dealt with on the ground. The case studies of these three towns reveal the extent to which local governments became involved in river upkeep. Interventions by the town governments were two-fold: (1) preventative actions in the form of regulations and regulatory enforcement and (2) responsive actions to physically remove materials that had already accumulated in the rivers.

York: Managing a multiple use river

In the later fourteenth century, York ranked second in size behind only London. The population captured in the poll tax returns of 1377 was approximately 11,000 (Tillott 1961), although population thereafter began a gradual decline, so that the population in 1524-25 was approximately 8,000, moving York down to the third or fourth spot (Slack 2000). It was the major trading center the in northern section of the country.

[4] For simplicity, I have chosen to call various governmental forms 'councils' since they were structurally similar to the modern town council, even though each town government had a unique structure.

[5] These late medieval council records have for the most part been transcribed from the original medieval manuscripts and published. Citations to these published primary sources are given with editor's name, the volume (if appropriate) and the page number in the printed version of the text.

York had a Court of the Mayor and Alderman, which issued civic ordinances and administered the law through fines and arrests. There were several concentric circles of government around the mayor who stood at the center: a council of 12 aldermen, a council of 24 men, and a communitas of 48 men representing the community at large (Tillott 1961). York's government issued laws that made throwing manure, household sweepings, or other filth into the river illegal (Sellers 1912, 1: 164; Raine 1942–50, 3: 95-96), but more significantly York faced considerable problems craft waste disposal in the Ouse river, and the records show that the government attempted to restrict leatherworking and butchery to avoid contamination of the waterway.

The River Ouse (Figure 1) passed through the heart of the town and the River Foss wound its way through the eastern side. The Ouse was the main commercial boating thoroughfare, connecting York to the Humber River and the North Sea, whereas the Foss created swampy conditions and several large pools. The Ouse was also important commercially as a source of water for use in water-demanding trades such as tanning and dyeing. As we will see, multiple uses of the river came into conflict, prompting the local government to act as arbitrator.

Fig. 1 Map of York indicating the watercourses, key places mentioned in the text, and centers of activity for water-polluting crafts. The river flows from left to right in the map. The base map is Map of Yorke from John Speed, The Theatre of the Empire of Great Britaine, I. Sudbury and G. Humble, London, 1611

Leather, the preserved hides of animals, was one of the primary materials for medieval clothing, animal harnesses, and military equipment. In order to make animal hides durable, leather creation included numerous chemical and biological processes, most of which generate noxious by-products (Cherry 1991). Tanners acquired hides with the horns and hooves attached from butchers. The first step was to clean the hides of blood, dung, and salt left over from the butchering process. The tanner then allowed the hairs on the skin to rot, sometimes assisted by sprinkling the hair side with urine or soaking the skins in lime in order to loosen the hairs for removal. After the hairs were removed, the tanner treated the skins to make them flexible. This was done either through alkaline bating, which involved immersion in bird guano or dog dung, or acidic drenching, which required treatment in fermenting barley or rye. After

all this preparatory work, the hides could actually be tanned in tanning liquor typically made from oak bark. Hides often stayed in the tanning liquor for a year before removal and final washing. The tawyer followed a similar process of preparing hides except that instead of using oak bark, the tawyer treated the skins with a paste of alum and oil. As this description reveals, tanning and tawying were extremely foul-smelling processes that required hazardous strong acidic or basic liquors. The fluids included ingredients such as lime, dung, urine, and one-year-old soaked oak bark.

The tanning process required significant amounts of water and generated highly noxious effluent. For this reason, most tanneries were located on a river or stream, although some may have used well water. York's tanners located their shops upstream of the town centre on the Ouse River near its entrance into the town (Figure 1). The placement of the tanners in this part of town is also attested by the name of the street Tanners Row and the fact that the tanners' guild leased a large piece of land in the area (Attreed 1991, 1:31–33). Washing skins directly in the river from these locations was convenient for tanners, and wastewater vats contaminated with blood, flesh pieces, lime, and tannins could easily be emptied into the river. The medieval residents could sense the physical contamination – the water stank, it tasted strange, and discarded flesh and fat floated on top of the water. These pollutants needed to be controlled because of downstream uses of the water, particularly if the water was to be consumed.

The York council appears to have been concerned about tanning liquids contaminating river water which was used for food preparation. The York council barred the washing of skins between the Friars Minor's (Franscicans) property and the King's staith, as well as any place on either side of the Ouse where water was drawn for brewing or baking (Sellers 1912–15, 1: 15). As shown in Figure 1, the Franscican friary was located downstream of the Ouse Bridge after the third lane leading down to the river on the city side. The King's staith, which was a primary ship cargo unloading area, took up most of the river shoreline between the friary and the Ouse Bridge. This area was also known as the Pudding Holes because the butchers washed the entrails of beasts used to make black pudding there. Since the area was used to prepare food, it was important to keep water at Pudding Holes clean (Raine 1955).[6]

[6] York's council also required fish cleaning to take place downstream of Pudding Holes rather than above it in 1580 and forbade the disposal of dung and filth at the location. Coventry had a quite

York's council stated that tanners were not to lie, cast, or wash limed skins or leather in the water above Pudding Holes because of 'corruption of the water of Ouse' (Sellers 1912–15, 2: 247). These restrictions clearly demonstrate that the York council recognized that washing leather contaminated the water, making it unfit for use in food or drink prepartion. The council sought to render the water safe for consumption through its control of the leather-working crafts.

Although the tannery regulations were intended to keep the water clean for use by butchers preparing puddings, butchery also appears as a source of river pollution in York. Butchery was messy business, leaving behind blood and offal, which was not fit for consumption. An extended sequence of events in York tells us that the urban leadership clearly recognized the sanitation problems at hand and issued regulations accordingly, but butchers were not always willingly compliant with these orders.

In 1371, the York council prohibited butchers from casting refuse or offal from slaughtered beasts between the Ouse Bridge and the wharf near the Friars Minor. The butchers' guild was ordered to make a pier upon the small wharf downstream of the Friars for washing their entrails (Sellers 1912–15, 1: 15) – this is the area that became known as Pudding Holes. It appears that the council's action came in response to complaints from the Friars Minor, because when the 1371 command failed to deter the butchers' waste disposal practices, the friars appealed to the king.

Although the friars' original letter does not survive, King Edward III sent a letter to the mayor and bailiffs of the town on 10 May 1372 in response to the friars' complaint (United Kingdom 1911, 46 Edward III). The King's letter indicates that the friars claimed that the butchers had recently started throwing waste near their walls and gates as well as into the River Ouse near the monastery. According to the letter, there were dire physical consequences of the waste disposal practices: 'the air in their church is poisoned by the stench there generated as well around the altars where the Lord's body is daily ministered as in other their houses, and flies and other vermin are thereby bred and enter their church and houses'. The result was that the good people of the city and country who used to go to the friars' church to hear mass and pray 'are

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different problem with washing entrails for pudding. In that case, butchers had been washing entrails in the conduit water reserved for drinking. The council outlawed the practice and set a 40d. fine for violators (Harris 1907-13, 1: 208).

withdrawing themselves because of the stench and the horrible sights'. The friars' also feared that 'sickness and manifold other harm' would arise if the king did not order a change in the practices. In response, the king commanded the town officials to issue a order to the butchers that they should only dispose of offal, blood, dung, and ordure 'in the places where they used to be laid and cast of old time' or the council should appoint a new disposal place where the waste could be 'covered up'. The king set a fine of 100s. on any butcher laying waste within 200 feet of the Friars' monastery. The Friars had appealed to the king as the ultimate authority in England for relief and the king took it as his Christian duty to respond. Yet, the letter placed the burden of ordering the butchers to follow the rules on the mayor and city bailiffs, which indicates that the king saw sanitation as the local government's responsibility.

The town authorities had to respond to the king's request. The records do not include an immediate proclamation in response, but five years later, in 1377, we know that the mayor and council passed a law saying that if any butcher or his servant threw offal or refuse on the Ouse Bridge, into the River Ouse, into the streets of the town or elsewhere except 'in the place assigned to them by the mayor of the said city', the butcher would be fined 6d. and forfeit the vessel in which the perpetrator had carried the waste (Sellers 1912–15, 1: 17–18).

Apparently, the butchers did not abide by this ruling because in 1380, the Friars Minors again complained about the situation to the king (United Kingdom 1895, 4 Richard II Part I). The king issued a grant in favor of the Friars stating that it was illegal for butchers to throw offal or filth into the river or lanes near the convent. The king mandated that the butchers take their waste to a distant place according to the previous order of York's mayor and bailiffs. With this order, the king himself ordered the butchers to obey the council's rules.

The orders from the king and town government had specified that butchers were not to throw waste in the river and near the Friars' monastery and required disposal in approved distant places. But even if the butchers stopped throwing waste in the river and near the monastery, did they consistently take it to the approved location? The evidence suggests that the butchers simply relocated their urban waste disposal to another area of town. In 1409 Thomas Haxey, Canon-residentiary, heard complaints from parishioners of St. John Baptist Hungate (see Figure 1) that the butchers of the Shambles were dumping offal near the southern churchyard wall. The parishioners were disgusted by the waste as well as the unclean birds and dogs that

flocked to the spot causing 'such a vile smell that only with difficulty did the priest manage to get through the service'. Bones were scatted about the churchyard, and the roof of the church had been damaged. In 1411 the residents again complained to the canon-residentiary about the offal heap, but the complaint was never reported to the king or the town council as far as we know (Raine 1955).

St. John Hungate was located in an area known as 'The Marsh' in swampy terrain near the River Foss. This site is even closer to the Shambles than the River Ouse, so it would have made a convenient waste dump after disposal in the Ouse was forbidden. The land was also fairly vacant in the Middle Ages because of its waterlogged nature; the lack of nearby residents would have made it a highly attractive landfill site to the butchers. The butchers' actions clearly adversely affected the church parishioners, but no action by the York council to stop disposal in the Hungate area is recorded. In fact, in 1524, the council indentified Hungate as the appropriate disposal location for all residents of Walmegate ward (Raine 1942–50, 3: 96).

York obviously faced an ongoing problem with butchery waste disposal, because in 1421, when the council approved a 90-year lease of a property on the bank of the Ouse to the ironmonger John Preston, the lease contained the restriction that Preston was not to sublease the land to any butcher for the disposal of entrails and was to keep the property free from filth causing foul smells or he would face expulsion (Percy 1973, 58). Seven years later, the council told butchers to take their entrails to a particular spot on the Ouse River where men of the local villages could come with their boats to pick up the 'dung, filthy nuisances, fluids and intestines to cultivate and prepare their land' (Sellers 1912–15, 2: 70).

York's dealings with the urban butchers reveals the difficulty of controlling waste disposal in river. Although York had made early attempts to restrict disposal of butchery waste in the Ouse, it continued to be a problem. The council was forced to establish waste disposal practices that included mandatory reuse of butchery wastes as fertilizer.[7] This was a way of providing a practical solution to the ever-present problem of urban waste disposal.

[7] York's ban on river disposal is quite different from the disposal requirements in London where butchers were instructed to take entrails to the Thames at ebb tide for disposal (Sabine 1933). It appears that Winchester butchers also practiced legal river disposal (Keene 1983).

The mechanism for enforcement of these restrictions is not clear until the 1540s when the council created a special water bailiff position to conduct river inspections on the Ouse. The water bailiff turned in individuals who had thrown any construction materials, sweepings of houses or gardens, dung or anything else into the Ouse and received half of the individual's fine as payment (Raine 1942–50, 4: 57–58).

Toward the end of the study period, there appears to be shift from a legislative approach to a physical one to ensure clear passage of commercially vital river. The council organized several river cleansing operations that were targeted at removing waste and accumulated materials from the Ouse. In 1546, York's council ordered every merchant, the wealthiest of the town's residents, to send one capable laborer to help clean the Ouse during a workday to be supervised by the wardens (Raine 1942–50, 4: 147). Because workers from each of the four wards only worked one day, they were not able to completely scour the river. The following year, the council mandated another workday in which the laborers would 'begyn in that warde where as they left the last tyme'; 'every person of abilitie' who did not supply a laborer for the cleaning operation would be charged for the cost of hiring one by the town (Raine 1942–50, 4: 157). In 1567, the York council once again organized a common river workday to clear debris and stones from the Ouse beginning in the ward where they last left off; this was repeated the following year (Raine 1942–50, 6: 128, 139).

The government was clearly concerned about the passage of ships on the Ouse and sponsored several dredging projects. In 1557, the council hired a Master Matthew Hirst to oversee an operation to cleanse a part of the Ouse specifically to aid the passage of ships to and from the town, and in 1571, they accepted an offer from the shipwright James Cronyssh to dredge the Ouse to a depth of 7 feet at low tide in exchange for £10 per year for life and citizenship for him and his sons (Raine 1942–50, 5: 162, 7: 20–21). The River Ouse dredging projects should be seen within the context of previous legislation and government-sponsored workdays to ensure passage on the Ouse, which was the merchants' lifeline.

The reasoning behind the shift from legislation to physical cleaning is not spelled out in the documents, but it might be that although little waste was being intentionally dumped in the Ouse (thus ordinances against it were not necessary), general runoff from the streets continued to fill the river with accumulated waste and silt. The council ordered householders to be diligent about street cleaning several

times in the mid-1500s (Raine 1942–50, 5: 82, 6: 83-84) at the same time as this shift. Since medieval paved streets and gutter systems were interconnected with town's ditches and rivers, and waste was commonly stored in the street to await pick-up, waste-laden silt would have surely made its way into the urban river (Jørgensen 2008). This interpretation links together legislative attempts to regulate pollutants and physical river cleansing efforts. Both can be seen as addressing the same problem of unwanted river pollutants.

In the case of York, we see that the local government took an active interest in maintaining a pollutant-free river. Tanning liquids and butchery offal were targeted as noxious wastes that needed to be kept out of the river. The council attempted to control the craft by-products, but because waste production was in fact inevitable, the problem was often simply relocated. In addition to regulation, the York council also took concrete actions to remove waste that had accumulated in the river, hosting several cleaning days in the mid-1500s. Both types of actions aimed to keep the Ouse, a vital commercial thoroughfare and source of water for food preparation, free of contaminants.

Coventry: A river stopped of its course

Coventry lies within a shallow basin at a bend in the River Sherbourne (Figure 2), creating many low-lying areas and marshes. Medieval deeds include frequent references to land called *mora*, indicating that marshy land was a common feature (Stephens 1969). Coventry was an exception to urban economic-dependence on water transport: the River Sherbourne, a non-navigable river meandering through the medieval town, was primarily a drainage way. As a market center and home to approximately 6,000 in the 1500s, Coventry depended on roadways, not waterways, for import and export of goods.

Fig. 2 Map of Coventry showing the River Sherbourne and key places mentioned in the text. The river flows from left to right in the map. The base map is Map of Coventree from John Speed, The Theatre of the Empire of Great Britaine, I. Sudbury and G. Humble, London, 1611

The river's drainage function meant that any waste accumulation in the river could cause a decrease in water-carrying capacity, which would in turn cause

flooding. The town council recognized this threat and in 1421 commented that the River Sherbourne had been 'stoppyd of his course' by 'filthe, dong, and stonys' causing 'dyuers perels…by floodys'; such encroachments in the river needed to be removed so that 'the waters in flod tyme may the lyghtlyer passe' (Harris 1907–13, 1: 31). The prior of the monastery also complained in 1480 that dung, filth, and household sweepings were stopping up the monastery's floodgates and channels of their mill (Harris 1907–13, 2: 445).

In Coventry, the governmental structure was dominated by the court leet. The leet usually met twice a year to both execute justice and pass legislation. The mayor and a council of twenty-four reviewed submitted petitions before the day of the leet and controlled their inclusion or exclusion from the proceedings. It appears that the court was not popularly elected by citizens, but rather selected by the mayor, perhaps with advice from other members. Coventry was divided into four wards with aldermen responsible for town order in each ward (Harris 1907–13, 4: xi–xxvii). To address the problem of river blockage, this local government managed the River Sherbourne through both legal means—instituting legal restrictions against waste dumping in the river and assigning inspectors to look for violators of these laws—and physical ones by organizing river cleanup efforts.

Legal restrictions against waste disposal in the river are found throughout the period. A Coventry Mayor's Proclamation in 1421 forbade the casting of dung from stables and other filth into the river. It set up fines that increased with each successive violation: half a mark due for the first violation, one mark for the second, and one and a half for the third (Harris 1907–13, 1: 29). In 1424, the fee structure was changed to the one and a half mark penalty for every offense; the prohibition was soon reiterated in 1426 and 1429 (Harris 1907–13, 1: 91, 107-8, 119). Similar prohibitions against river disposal continue to be reiterated by the council every decade or so. In an entry from 1475, the council specified that no inhabitant of Well Street, Bishop Street, Cook Street, or Catesby Lane was to put dung or other filth into the river running from the mill in the south part of Well Street to the hospital of Saint John the Baptist (Harris 1907–13, 2: 417). Obviously, there had been waste disposal occurring in those areas and thus the council named them specifically

Just as York's urban government had faced the issue of river disposal of butchery wastes, Coventry dealt with the same problem. Some persons lodging at the Coventry priory complained to the king in 1380 that 'certain evildoers' had thrown

animal wastes into the River Sherbourne repeatedly, thus corrupting the water that flowed into the priory mill and 'infecting the air'. The king responded by issuing a commission of inquiry into the complaint (United Kingdom 1895, 4 Richard II Part I). The results of the inquiry are not known. The list of wastes—bones, hides, and offal of oxen, swine, and sheep—in the complaint indicates that the likely perpetrators were butchers and tanners. We know that the disposal of butchery waste appears twice in later records. In 1452, Coventry mandated that butchers only deposit entrails in the 'assigned' place; in 1474, the driver of the butcher's cart was ordered to throw the entrails and other waste into the middle of the pit at Poddycroft and not on the sides. The council even banned butchers from taking hogs to the pit to consume the slaughter leftovers, presumably for health reasons (Harris 1907–13, 2: 271-72, 389). The Coventry council thus took steps to designate alternate waste disposal locations in order to minimize river dumping, indicating that they not only recognized the potential pollution but also that alternative disposal had to be provided.

In order to enforce the local restrictions, river inspections took place to identify and fine violators. In 1424, the council ordered the common sergeant to perform weekly searches of the Sherbourne to identify those who had thrown household sweepings or other filth into it (Harris 1907–13, 1: 91). In 1426 the sergeant's duties included ensuring that no waste was dumped into the river, any houses or stables extending over the water were removed, and any drains running from the houses directly to the river were stopped up. The sergeant was assisted by river overseers who were assigned to four different sections of the River Sherbourne (Harris 1907–13, 1: 107-8). The council specifically charged the mayor with inspection of the river in 1429, 1430, 1439, and 1446 to find out where the river was 'narrowed, mysruled, or stopped, or encroached' (Harris 1907–13, 1: 118, 119, 130, 190, 227). He was asked not only to identify the violators, but also to fix any issues. In 1469 the council ordered the mayor to perform inspections of the river at least twice a year. The ordinance stipulated that the oath of the mayor was to be changed to include a river semi-annual inspection (Harris 1907–13, 2: 347-48). By 1517, the oath for the aldermen in each ward included the responsibility for ensuring that the river was cleaned and the streets were swept (Harris 1907–13, 3: 652-53); aldermen in turn elected and appointed men within their wards as overseers of the rivers and streets (Harris 1907–13, 3: 723). The delegation of responsibility for enforcement, which Jørgensen (2010) argues is a sign of increased governmental specialization, indicates

that the government responded to river pollution with practical methods to identify urban pollution.

Inspections certainly would have identified waste accumulation in the rivers, but then something had to be done to remove it. Orders for cleaning the River Sherbourne tend to appear about once every ten years in the early fifteenth century. The earliest recorded order was in 1421 when the council ordered the scouring of the River Sherbourne and all ditches within the town to remove filth, dung, and stones which were blocking the waterways before Midsummer's Day. The *Leet Book* entry makes it clear that the waste removal efforts were necessary to increase the channels' carrying capacities in times of flooding (Harris 1907–13, 1: 31).

Coventry depended on citizen involvement to clean the Sherbourne, just as York had enrolled citizens to clean the Ouse. In 1425, every man with property abutting the river was ordered to clean it within a week (Harris 1907–13, 1: 100). In 1434, the council ordained that the Sherbourne should be enlarged under the mayor's oversight and that every man with a tenement adjacent to the river had to clean it or else pay a fine of 20d. for noncompliance (Harris 1907–13, 1: 170). The council ordered another cleansing of the river in 1444 in which each person was responsible with cleaning the river along their land, beginning at Crow mill and continuing as far as the Priory before Whitsunday. The fine for not cleaning was to be split one-third to the mayor and two-thirds to the wardens who were responsible for presenting violators (Harris 1907–13, 1: 208). Even if the river was cleaned on that occasion, it appears that waste accumulation was a continual problem; only two years later, the council restated that everyone having lands or tenements adjacent to the river from Crow mill to Gosfordgate had to clean the river before Whitsunday (Harris 1907–13, 1: 227). This time, the cleaning operation must have been relatively successful because another cleanup was not issued until 1469 (Harris 1907–13, 2: 347-48). Almost another 30 years passed before the council told those with tenements adjacent to the river that they must clean their section of it (Harris 1907–13, 3: 586-87). Additional orders to clean the river followed in 1534 and 1551 (Harris 1907–13, 3: 719, 800). The spacing of these orders indicates that although waste was occasionally disposed of in the river, the problem was only serious enough to require special scouring and cleaning operations every ten to thirty years. In the intervening period, waste accumulation may have been gradual and/or the tenement holders regularly cleaned the section of the river which abutted their properties.

In the Coventry, the town government clearly had a vested interest in maintaining the Sherbourne because of looming flooding threats and thus actively attempted to remove pollutants from it. Unlike York which started scouring activities only in the mid-1500s, Coventry's local government took both legislative action and practical steps to remove accumulated waste and dirt from the river banks and bed throughout the period. The danger of flooding because of filth, stones and dung in the river appears at the beginning of the leet's existent records[8], and served as a primary motivator for the government to both issue legislation and order cleaning activities. Inspectors confirmed the presence of unwanted materials, and the residents were directly involved in river maintenance, as each householder was made responsible for cleaning their land adjacent to the river. The frequency of both legislation and river cleansing activities indicates that the local government considered water pollution control a vital part of their civic duty because of potential hazards to the urban inhabitants.

Norwich: A constant struggle against weeds and filth

Norwich ranked as the fifth largest town in England with nearly 4,000 taxpayers in the 1377 poll tax (Dyer 2000), and by 1524–25, boasted a population of about 9,000, making it second only to London (Slack 2000). Norwich's government was similar to York. Norwich received a royal charter in 1404 permitting the annual election of a mayor. A ruling elite of 24 aldermen and an outer circle of common councilors joined the mayor in the leading city positions. The body of common councilors had to approve of all actions of the mayor and aldermen for them to be valid (Frost 2004).

Norwich's River Wensum (Figure 3) took a winding course through town and, based on the frequency of complaint about sandbars and weed overgrowth stopping up the river, was relatively shallow. In 1467, Norwich councilmen complained that their river was 'greatly filled with dirt, so that at divers times of the year, dry ground is observed in certain places…and the flow of water is prevented' (Hudson and Tingey 1906–10, 2: 96). In spite of being shallow, the Wensum was the major transportation route, connecting Norwich with Great Yarmouth and the North Sea to the east and its hinterland to the west. There were five bridges crossing the Wensum

[8] The records begin in 1420 and flooding of the River Sherbourne is first mentioned in 1421.

within the town's bounds, including four that connected the northern ward of Over the Water with the rest of the town. The government of Norwich recognized that the River Wensum served 'the common utility', 'a thing very useful to the city' (Hudson and Tingey 1906–10, 2: 85, 96).

Fig. 3 Map of Norwich indicating the River Wensum and key places mentioned in the text. The river flows from left to right in the map. The base map is Map of Norwich from John Speed, The Theatre of the Empire of Great Britaine, I. Sudbury and G. Humble, London, 1611

Weed overgrowth of the river was a habitual problem in Norwich, and waste entering the river was seen as a leading cause; weeds and filth are consistently mentioned together as river annoyances (Hudson and Tingey 1906–10, 2: 96-98, 115, 121, 318-319). While today we may not think of weeds as pollutants, the residents of medieval Norwich believed the Wensum's weed growth was related to urban waste entering the river and thus weeds were seen as pollutants. When the river was filled with dirt and weeds such that the flow of water was prevented, the council was obliged to step in.

Norwich's local government issued little legislation touching on river pollution: we have only one ban on carrying 'muck and other vile filth' to the Wensum from the city's charter of 1462. The court records of the Norwich Leet, however, indicate that individuals received fines when they blocked the river or disposed of waste there, meaning that such activities were illegal. For example, in 1390-91, two dyers were fined for throwing cinders, paste, and other craft wastes into the river and another man was fined for obstructing the river with old building materials (Hudson 1892, 70, 73). The government also regulated carrying muck—likely horse manure—to and on the Wensum, going so far as to specify in 1453 that only one man had permission to transport muck by boat and he was not permitted to throw any muck into the river within the town's jurisdiction which was marked with a chain (Hudson and Tingey 1906–10, 2: 91, 391–92).

Although legislation banning polluting activities was not frequent, the Norwich's town government continually cleaned the overgrown Wensum and dug out accumulated muck and silt using city funds. The city paid river cleaning supervisors as early as 1367 (Hudson and Tingey 1906–10, 1: 267). In 1398, the city paid for a

man from a nearby town to ‘examine the defects’ of the Wensum (Hudson and Tingey 1906–10, 2: 52). Beginning in 1401, soon after the inspection, the Treasurer’s accounts for the town show expenditures for workmen and equipment cleaning the river (Hudson and Tingey 1906–10, 2: 54).

Most of the records are not clear about the methods used for scouring or cleaning rivers in the medieval period. We do however have an instance in 1543 when Norwich’s town elites debated how to best scour the river. According to court records, they discussed many devices and settled on using boards and posts to divert the flow from half of the riverbed. After water was drained from the section, gravel and other accumulated material would be hauled off to make the shallow areas deeper (Hudson and Tingey 1906–10, 2: 171). Unfortunately, the success or failure of this intrusive scouring operation is not recorded. We also have an illustrated manuscript image (Figure 4) dated to between 1350 and 1375, which may have originated in Norwich, showing two men clearing a watercourse. They are using a shovel and pan to lift accumulated waste and dirt out of the riverbed. They are standing in the water, but it is relatively shallow; wooden boards, perhaps water diversion boards, are shown on the edge of the water in front of the muck pile. This may well be an accurate representation of typical late medieval scouring activities.

Fig. 4 Manuscript illustration from the third quarter of the fourteenth century showing two men scouring a riverbed. One is using a shovel and the other a pan for lifting out the muck. The origin of the manuscript is believed to be either Norwich or Durham, which may mean that this image accurately pictures techniques used in an early attempt to scour the Wensum. British Library, Egerton Gospel Picture Book, Egerton 1894, fo. 14r

The Norwich city assembly required that individuals dwelling in particular wards participate in scouring activities like those shown in Figure 4. This was similar to Coventry’s approach of requiring individual householders to clean the river adjacent to their properties. In 1422, the assembly ordered a river workday with some detailed plans (Hudson and Tingey 1906–10, 1: 277–78). Individuals could choose whether they wanted to personally labor in the river cleaning operation or pay the cost to hire a laborer to work on their behalf. The residents were split into two groups, with the Over the Water ward responsible from the mills downstream to Bishop gate

and the remaining residents responsible for the rest. The constable of each ward ensured that individuals reported for work or paid for their replacement. The city paid for all of the tools and boats. Such weed-cutting projects appear to have been regular features of Norwich's approach to the river problem: in 1478 the elected river overseers contracted laborers to cut rushes growing in the river and in 1479 citizens were required to cut growing on the riverbank adjacent to their properties (Hudson and Tingey 1906–10, 2: 102).

From the beginning, the Norwich government had paid for some of the river cleaning expenses out of the town's funds; therefore, it is not surprising that they needed to gather additional monies for this purpose. In 1452, it appears that they requested a commission from the King that allowed the mayor and sheriffs to collect taxes for river projects (Hudson and Tingey 1906–10, 2: 318-319). They implemented a dedicated tax in 1517 to collect a total of £40 to be used for river cleaning, a community dung collection cart, and the wages for a permanent street cleaner (Hudson and Tingey 1906–10, 2: 109–10).

Because waste often entered the river via the street gutter system rather than direct dumping, in 1467 Norwich implemented a program to rework the street system in order to provide 'remedies of the injuries of the river', which included reduced river flow and dry ground within the river's course (Hudson and Tingey 1906–10, 2: 96–98). In May that year, each individual, whether an owner or occupant, was required to sweep up and remove all of the waste in front of his home or shop. Churches and convents were also responsible for the street in front of their properties. After the cleaning, the responsible party had to level the street with sand or stone paving by June. The leveling was supposed to take into account the 'ancient water drain' which would funnel runoff to the large ditches (called cockeys) or directly to the river. Work supervisors were appointed by the aldermen of the wards to oversee the work. The council established fines for anyone not complying with the street leveling program. The Mayor was held personally responsible for the whole program, with a fine of 100s. if he failed to implement it.

Maintenance of the Wensum was a continual task. In June 1532, the city assembly noted that the river was 'soore in decaye' and its condition would likely worsen since the weeds growing in the river had not been cut back and removed annually and filth continued to enter the river via the cockeys and street gutters (Hudson and Tingey 1906–10, 2: 115–16). They issued a new river management plan,

which combined all of the river management elements found in earlier efforts. Individual owners with property adjacent to the river were still responsible for cutting weeds in the river, but this time the assembly noted that the weeds had to be removed all the way to the middle of the river. In addition, the town organized an annual scouring effort. The Mayor and two Justices of the Peace were instructed to hire surveyors to determine where work was needed and certify that day labourers were able-bodied. The Justices of the Peace, aldermen of the wards, and brothers of the leading guild had to find labourers for river cleansing for a set number of days per year; other inhabitants could be charged annually for river cleaning at the discretion of the Mayor and Justices of the Peace. In addition, the Norwich assembly declared that the crafts that they thought were particularly troublesome to the river should be charged more than the average resident for river cleaning: 'Provided that barkers, dyers, calaundrers, parchementmakers, tewers, sadelers, brewers, wasshers of shepe, and all suche great noyers of the same rever tobe ffurder charged than other persons shalbe…'. Norwich's list of polluters is quite comprehensive: textile manufacturers (launderers, washers of sheep skins, dyers), leather workers (barkers, tawyers, saddlers, tanners, glovers, and parchment-makers), and brewers. These particular trades consumed significant quantities of water and often generated noxious wastes that contaminated water sources, as we noted earlier in the case of York's tanners and butchers. Norwich councilmen therefore felt justified in levying higher environmental taxes on these craft workers than average citizens.

Twenty years after the comprehensive river management plan of 1532 had been enacted, the city assembly bemoaned its failures: 'the side river decayethe and fyllethe moore and moore, what for want of dewe execution of the seide former actes, and for wante of money...' (Hudson and Tingey 1906–10, 2: 127–30). A new 12-person commission called 'The Surveyours of the Ryver and Streates' was charged with conducting a survey of the river and streets, developing a budget for the next year for cleaning and scouring operations, enforcing all previous ordinances, and collecting fines from violators that would be used for river and street maintenance. In order to bolster the river management finances, the new plan included several fund raising elements. First, it allowed the commission, in consultation with the Mayor and two Aldermen, to levy a river and street tax on all of the inhabitants of the town and the suburbs. Second, it established a sliding-scale tax on the leading citizens, with Justices of the Peace, Aldermen, and livery members paying set amounts. Third, it

required that the city mills contribute £14 annually to the fund. Fourth, the plan allowed the commission to levy special taxes on noisome crafts, including dyers, tanners, glovers, parchment makers, and brewers, and the miller. Fifth, the commission was allowed to receive funds bequeathed to the city for river maintenance.[9] The assembly was clearly attempting to set up a well-funded and planned commission, and it appears they were successful. Four years after being established, the Surveyors created account books separate from the general city accounts, and the commission, which became known as the River and Street Committee, existed for the next three hundred years.

The Norwich case reveals intensive activity by a late medieval town government in addressing river pollution. Silting and weed growth, which was related to waste entering the river via street gutters and ditches, posed major challenges to keeping the Wensum navigable. Major river cleaning operations appear to have been conducted, at least nominally, on an annual basis with town funds. The Norwich government expended considerable time and money on developing solutions to their river management issues, and they finally succeeded—at least if longevity of an institution is a success indicator—in 1552 with the establishment of the Surveyors of the Rivers and Streets which survived into the 1800s.

Conclusion

The cleanliness of urban waterways occupied a prominent place in the cityscapes of the late Middle Ages. Each of the towns presented here has a different story: York with its struggle with craft wastes disposed of in the Ouse; Coventry with the shallow, food-prone Sherbourne; Norwich with its major shipping route often choked by weeds and filth. Yet the town governments shared a common goal of maintaining clean rivers and often employed the same tactics.

The 'bacterial revolution' was not a prerequisite for town governments to recognize and address urban waterway pollution. Pollution in the medieval era was not narrowly defined as specific kinds of organic or inorganic chemical contamination as it might be today – it was much more broadly construed as things which threatened the river's use, truly 'matter out of place'. Within this context, the local governments

[9] The text says two gifts from previous Alderman had already been received for river and street cleansing and notes that the commission was authorized to receive future gifts. This kind of gift was not new: another leading citizen had bequeathed £10 toward river cleansing in 1456.

viewed both waste products (including tannery liquids, butchery offal, and horse dung) and accumulated weeds and silt in the urban river as pollutants.

Legislation aimed at preventing river pollution was one of the responses to these pollutants, as previous scholarship has discussed, but it was not the only one. The actions of the urban governments were in fact wide-reaching: they prohibited individuals and particular craftspeople from disposing of waste into the water bodies; they fined violators; they required individuals to both physically participate in river cleaning operations and support such operations with tax money; they organized significant river scouring and dredging projects on a regular basis. By opening up the study of responses to pollution to include physical river maintenance alongside legislation, this study shows that these three town governments were quite active in managing urban river pollution as early as the late fourteenth century.

The ongoing effort required to keep an urban river clean cannot be underestimated. As these cases show, the town governments reissued legislation banning river dumping and ordered citywide river workdays many times over the course of 200 years. The repeated nature of the medieval town's activities should not surprise us – nor should we interpret it to mean that the measures were ineffective. Just as modern officials find street and river maintenance to be a continual chore, so too our medieval counterparts faced constant challenges keeping their rivers free from waste and weeds. The recorded actions of the town governments of York, Coventry, and Norwich reveal that they met the challenges of urban river pollution with vigor and determination.

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