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13 Medieval and Post-Medieval Urban Water Supply and Sanitation

Archaeological Evidence from Göttingen and North German Towns

Abstract: Accessibility to clean water is a fundamental need of medieval towns. It was a necessary supply in private households, in craft and industry, for mills and for livestock husbandry. To assure this, natural streams and rivers were used, forming dividing, as well as connecting elements in the townscape. In north German towns, with Göttingen as an example, water supply was provided by private wells and by public infrastructure, such as water pipes. Archaeological evidence for both exists and examples are given. Some towns needed a *Wasserkunst* (water-works) to lift the water in the pipes with sufficient pressure. Most plots of land also had a cesspit for the disposal of faeces. The vicinity of the fresh water supply and sanitation have often been cited as an example of poor hygienic standards. Evidence for this statement – often repeated unchallenged – is discussed in this paper. Water quality was monitored and attended to, which is shown not least in the praise of fresh, clear water in texts, and in costly fountains in market-places.

Introduction

The region of the northwest German lowlands forms an old cultural landscape that contains a series of high and late medieval towns. Many of these north German towns participated in the Hanseatic League, the famous network of merchants that, for centuries, was responsible for successful trade and constantly growing wealth. The regional, but mainly long distance, trade in the North Sea and in the Baltic reached as far as London and Bruges in the west and as far as Novgorod in Russia in the east. It connected the metal-mines of the Harz Region and the salt-works of Lüneburg with the fishing grounds of Sweden and Norway, and connected the markets with the inland trade. The high and late medieval towns, many of them founded during the 12th century, can be characterized as communities of burgesses and council, containing churches and seats of nobility, surrounded by fortifications of wall, moat and rampart. Unlike in rural areas of the time, the burgesses were comparatively free, with their own urban self-government and legislation. Even with differing natural conditions, the towns therefore can be regarded as comparable. Inside the towns, the accessibility to clean water was a fundamental need. It was a necessary supply in private households, in craft and industry, for mills and for livestock husbandry. The text below tries to give a rough overview of private and public water management infrastructure, quoting examples from different towns, with the main focus on Göttingen in Lower Saxony. It also discusses connected problems of waste water and waste disposal in the towns with their high housing density.

Natural waters

Ditches, creeks and rivers in medieval towns had a dividing and a connecting impact at the same time. The location of the proto-urban settlement of Gutingi in the 7th century and the

Note: This article will try to describe and reference examples of urban water supply of towns in north-western Germany, but will focus mainly on Göttingen, where the author has been responsible for archaeology for more than 25 years.

Fig. 1: Map of the old town of Göttingen with surrounding rampart (dark grey), water-filled moat and the inner stone wall (black line). 1: the artificially diverted Gote; 2: the lined Leinekanal forming a part of the inner fortification; 3: natural side arms of the Leine (e. g. 'Cow-Leine') in the west, used by several industries.



foundation of a town beneath it in about 1180 is said to be connected to a ford on the nearby river Leine. Even when the river was only small, it formed an obstacle for carts and walkers, which could increase in seasons of heavy rainfalls when the water level could suddenly rise enormously, so the facility to cross it was essential for the use of the old trading routes.

The proto-urban settlement of Gutingi was set beneath the Hellweg, a trading route dating back to the time of Charlemagne or before. A nearby stream coming down from the eastern hills would naturally have taken a northern route, following the topography, as hydrological studies have shown.¹ However, the people in the village of Gutingi redirected the stream to make it flow through the area of their settlement (Fig. 1, 1), which was set on a small ridge. Evidence for this was found in several transects in the excavation of the village in 2003.² They showed the stream of the small river and a broad flooding zone, which is the result of flooding in several seasonal heavy rain events. The flooding zone could be seen in areas of different sizes of grains of soil, which indicate different velocities of the water flow. Somewhere in the west, this new stream was connected again with a side arm of the Leine.

The redirection of the stream must have been an enormous effort for the community – and it shows the importance of, and need for, fresh water, which has been vital for every settlement

¹ Keller 1980.

² Arndt – Ströbl 2005, 29–35; Arndt 2004a, 119.

since prehistoric times. This redirected creek was called Gote, and was eponymous to the settlement. Following the Etymologists who have tried to trace the (unusual) name of the settlement,³ the Saxon word *Gutingi* means something like ‘settlement on a gutter’. Here ‘gutter’ seems to be used in the middle low German meaning for canal, which would underline the artificiality of the stream – and which is confirmed by the results of the excavations that showed that the stream was redirected.

Presumably, around 1180 the medieval town was founded directly beneath this old settlement and was fortified with a wall, leaving the proto-urban settlement outside. The name passed on to the town, while the older village was now called *dat olde dorp* (the old village).⁴ It was only integrated into the town when a second fortification with a rampart and broad ditch was erected from 1363 onwards. Water surrounded the town in the moat, which was ponded in several steps because of the sloping terrain.⁵

The Towns

Inside the towns, fresh water was crucial for the life of humans and livestock. It was needed for several purposes in every household: not only for drinking, cooking and washing, but also – very important – for brewing. The small side streams flowing through the western part of the town of Göttingen were therefore used as a natural water supply (Figs. 1, 2). One of the side streams, called Small Leine or Cow-Leine, which no longer exists, could be identified in excavations in Groner-Tor-Straße 14.⁶ Greyish-blueish layers of clay show that this small stream had cut into the underlying glacial pebbles. The small stream was lined by a row of small wooden posts, possibly an attempt to control the flow of water and keep it in a bed. An accumulation of posts on the bank suggests a construction to make the water more easily accessible.

In some north German towns, a stream flowed in an open bed directly through the market street – like the Gose in Goslar⁷ or the Brehme in Duderstadt in Lower Saxony, with a breadth of about 1 m.⁸ Historical evidence gives a first date for the Brehme of 1276. Only as late as in the 18th century was this open water lined with stones. It not only served as a fresh water supply, but could also be used to flush away dirt and rubbish. In an attempt to keep the water clean, several rules were passed, including the interdiction of washing pigs in the Brehme.⁹ An old, still repeated rhyme¹⁰ indicates that an official announcement was made on the day before beer brewing started, asking to refrain from urinating in the Brehme at this time (though it remains unclear if there is evidence for a legal rule in historical sources).

Crafts and workshops in need of water

In addition to the ‘private’ need for water, several crafts had an intensive need for water and rely on a constant water supply. The workshops were therefore often placed next to the moat or a river. In Göttingen, for instance, there were dyers, as the textile industry was important

³ Lehmborg 1999, 59.

⁴ Arndt 2016, 131.

⁵ Arndt 2010, 226 f.

⁶ FStNr. 48/07 (FStNr is the Find Site Number and is the reference number for the excavation in the archive of Stadtarchäologie Göttingen. This number is also referred to in the regular reports on Göttingen excavations in ‘Göttinger Jahrbuch’ – see Bibliography); Arndt 2007, 269–271; Arndt 2008, 103–106.

⁷ Griep 1998, 20.

⁸ Porath 1998, 60 f.

⁹ Porath 1998, 60.

¹⁰ The German rhyme says: *Hiermit wird bekannt gemacht, dass niemand in die Brehme macht, denn morgen wird gebraut.*



Fig. 2: Göttingen, Angerstraße 4, a row of wooden boxes for watering and soaking hides in the tanning process.

economically to the town. An excavation of a dyer's workshop in 2005 in Angerstraße 14 showed the foundation of the dyer's oven, which once carried a big tub for heating the dye lot.¹¹

Tanners nearly always had their workshops directly next to rivers, as they were in need of running water. A Göttingen workshop found in Angerstraße 4¹² was situated directly next to the Leine canal. In a rescue excavation, remains of a large wooden tub were found, possibly for watering the hides in an alkaline mixture of water and ash to dissolve hair and any remaining flesh. A row of rectangular wooden basins was used in the process of soaking the leather with tanbark (Fig. 2), but some of these also seem to have contained ash. Between the different steps of flushing and soaking, the hides were presumably rinsed directly in the canal. Small strips and offcuts of leather could be found in thick layers on the plot.

The adjacent Leinekanal formed, for more than a century, an important part of the fortification of the town (Fig. 1, 3). The canal was stabilised by a wooden reinforcement. Horizontal wooden beams of oak, up to 7 m long, could be seen in a rescue excavation in 1994,¹³ they were held by pointed vertical posts, but unfortunately no decent documentation was possible. They prove that the canal was lined with wood, before it was later stone lined with the local limestone. The wood, however, delivered dendrochronological dates of 1285 (–6/+8) and several dates between 1413 and 1491, which likely show repeated renovations of the construction.

It is often stated that water-polluting industries were placed at the outflowing end of rivers and canals; this cannot be proved, at least for Göttingen. Efforts to sustain the good quality of water, however, can possibly be seen in the regulations for craftsmen.

Mills

The (wooden) lining of the canal was not only necessary to keep the water in a given bed and keep it from meandering, but also to control (the amount of) the water flow, which was impor-

¹¹ FStNr. 48/06; Arndt 2007, 274–276.

¹² FStNr. 35/03; Arndt 1996b, 252f.

¹³ Arndt 1996b, 253.



Fig. 3: Göttingen, the Lohmühle (Tanbark Mill, left) and the Odilienmühle or small mill with reconstructed wooden wheel (used for polishing metals, right) at the influx of the Leinekanal. View from rampart.

tant for managing the mills. Until the steam engine was invented, water and wind mills were important to provide energy for several early industrial processes.¹⁴ The mills served not only for grinding grain for bread, but also for chipping malt for brewing, for producing oil or for fulling cloth in the textile production process, for grinding lime and plaster for building, for sawing wood, and for whetting and polishing metal objects (*Odilienmühle*). In 1305, Göttingen already had five mills,¹⁵ all of which were water mills situated on the Leinekanal. Their large wooden wheels were operated by the natural flow of the water. Only one windmill is known, presumably of minor importance, which was erected on a former tower of the old town wall (14th century).¹⁶ The *Große Mühle* (the big mill) had as many as nine millworks. Some mills also served to stamp oak bark that was needed for tanning. The purpose can often be found in their names, such as in *Lohmühle* (tanbark mill) (Fig. 3), and in some cases the guilds were responsible for their maintenance.

The north German town of Stade also had a major water mill, first mentioned in 1297, which was operated by the alternating tidal stream of the river Schwinge.¹⁷ In the town of Einbeck, the ‘technical mills’ were placed outside the medieval town, while the flour mills for grain were situated inside the fortifications.¹⁸ All three were water mills. The grinding of grain for flour and of malt for the famous beer of Einbeck, which was exported in large quantities, was kept as a monopoly of the council. In most medieval towns, the tax for grinding was an important source of income and grinding at home was forbidden.¹⁹ As water mills often interfere with water management on a broader scale, permission of the sovereign would have been necessary in many cases, at least in the rural areas. Inside the late medieval towns, however, the mills could be operated under communal control.²⁰ The water mills not only interfered with the natural flow

¹⁴ Prange 1989, 512–514.

¹⁵ Fahlbusch 1952, 105.

¹⁶ Fahlbusch 1952, 109; Göbel 1993, 23 n. 22.

¹⁷ Lüdecke 2004, 207.

¹⁸ Heege 2002, 108.

¹⁹ Göbel 1993, 111 f.

²⁰ Petersen – Reitemeier 2017, 279 f. I am grateful to Prof. C. Rohr (Bern) for the hint to this reference; Göbel 1993, 57 f.

of water, as it was necessary to dam up the water, they could also cause trouble for fish (and fishermen) and for navigation. The town of Lüneburg, for instance, retained the right to dismantle three water mills on the Ilmenau River should they cause problems for shipping the salt of the profitable Lüneburg salt-works or the necessary supply of raw material to this end; they also exercised this right.²¹

Wells

For a long while, the responsibility for fresh water lay with the individual household.²² In Göttingen, citizens built wells in the yards behind their houses.²³ The archaeological investigations have shown different types of wells. The oldest known ones of the 12th century are also the smallest in diameter. An example from Rote Straße 34²⁴ was only 80 cm in diameter. It was built of broken limestone of different and irregular sizes, forming a polygonal cylinder, and dates to 1260 or shortly after. It was placed behind the house in the yard. In 1414, the well was closed and covered by an extension of the building and thus needed to be replaced. The new well was placed again in the yard behind the house, but was larger, with an inner diameter of 1.10 m. All examples of the 15th century are about this width. This well was dug with a large tapered building pit. Most wells had to be dug up to 8.50 m deep to reach the ground water flow.

All wells in Göttingen lay behind the houses, with a distance to the street of 11.50 m to 14.30 m. If this reflects a building regulation, as H. Plath already found in 1950 for Hanover,²⁵ would be a subject for further investigation. In Hanover, all wells were placed 60 (medieval) feet²⁶ away from the street.

Some examples were built in an exact round circular form, for which the stones had been chiselled concave on the inside, as is the case of an early post-medieval example from Rote Straße 30²⁷ (Fig. 4). Some long stones reach out far to the outside to function as guides (in a

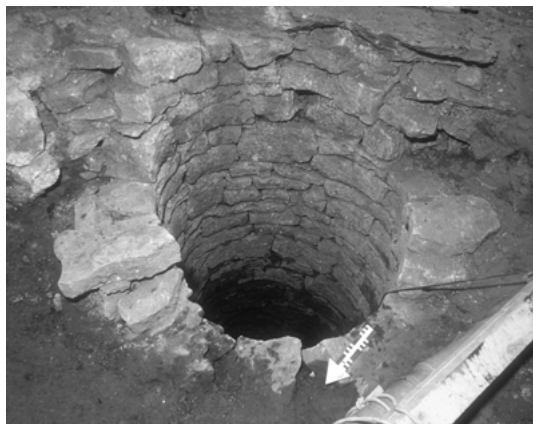


Fig. 4: Göttingen, a well of local limestone behind the building in Rote Straße 30. The well is built over a wooden frame.

²¹ Petersen – Reitemeier 2017, 287.

²² Dirlmeier 1981, 151. 154.

²³ An overview is given in Arndt 2004b.

²⁴ FStNr. 02/08 and 02/10; Arndt 1997, 226 f.

²⁵ Plath 1978, 16.

²⁶ Plath 1978 gives 32.50 cm for the medieval foot measure, which means the wells in Hanover were built with a distance of 19.50 m from building line.

²⁷ FStNr. 02/06; Arndt 2004b, 138.



Fig. 5: Göttingen, the Klotzbrunnen in Hetjershausen shows a well with stone enclosure and a long wooden lever to lift the bucket with water.

system of runner and guides). It was constructed on a wooden frame of 1.13 m edge length. The well exists today and still reaches the ground water at 6.30 m under the surface.

Other wells were constructed above round frames, for which out-of-use wheels could be re-used sometimes (e. g. Groner Tor Straße 14²⁸). The largest excavated well in Göttingen showed a diameter of 1.60 m (Prinzenstraße 8²⁹). The stones again were chiselled round on the inside and it was infilled in the 17th century, as finds indicate. In Papendiek street, a ground water well had an inlet of a water pipeline in the upper part of the lining. A historical etching of 1765 shows a public well at this place.³⁰

In Göttingen, in more than 30 years of archaeological investigation, no example of a wooden well has been found, so it seems likely there is none. Limestone was the main building material for everything and could be found easily in the surroundings. Wood, which was needed for the wooden, timber-framed houses, was potentially too expensive.

What did the wells look like? Unfortunately, the upper part, the part of the wells above ground, is always missing. The *Sachsenspiegel*, a medieval book of laws, requires wells to be built knee-high above the ground, in order to prevent people falling in. If somebody died (because he fell in), a penalty is due. The illustrated edition of the *Oldenburger Sachsenspiegel* from 1336 shows a well with a beam next to it to lift the buckets with water.³¹ In the village of Hetjershausen, now part of the town of Göttingen, an example of this type of wooden construction still exists (Fig. 5).

Another possible construction is a draw well with a windlass, where the buckets could be pulled upwards with a chain or a rope. A decorated fragment of a plate of 'Werraware' in the collections of the *Stadtarchäologie* shows one of these, with a pitched roof above it³² (Fig. 6).

²⁸ FStNr. 48/07; Arndt 2007, 269–271.

²⁹ FStNr. 17/08; Arndt 1998b, 198.

³⁰ Papendiek 14, FStNr. no. 49/06; Arndt 2004c, 155–157.

³¹ *Sachsenspiegel* digital: urn:nbn:de:gbv:45:1–3571; <<https://digital.lb-oldenburg.de/ihd/content/pageview/192532>> (29. 07. 2019).

³² Göttingen, Weender Straße 11, FStNr. no. 17/02, Inv. no. 2908 (late 16th/early 17th century).



Fig. 6: Göttingen, fragment of decorated earthenware (Werrakeramik, late 16th/early 17th century): woman standing at a well (water-colour with graphical completion).

Since at least the 15th century, the council took more responsibility for the water supply, to which end public wells were installed in the streets, in addition to the private wells behind the houses. A Göttingen chronicle of 1734 lists 42 public ground water wells and 10 wells supplied by water pipes.³³ Archaeological evidence for such a street well was found in 1996 in the Rote Straße during the renovation of the sewage system (Fig. 7). A wooden water pipe entered a rectangular box of large sandstone slabs with a stone pavement. On the opposite side, another pipe leads the water out again. We have no remains of the upper construction, but it is likely this was the underground structure of a running fountain in the street, which is also marked on the 18th century plan.³⁴

Water pipes have been in use in Göttingen at least since 1429. They were supplied by natural streams, which was possible through the natural incline of the surface. The water coming downhill from east of the town first supplied the council fish pond inside the ramparts, before the water was fed into the wooden pipes running down to a central fountain at the market place. A written source says the Göttingen fishmaster shall let water flow when the inhabitants of Rote

³³ Zeit- und Geschichtsbeschreibung 1734, book II, Chapter VII, 63–65.

³⁴ Arndt 1998a, 83; Arndt 2004a, 124.



Fig. 7: Göttingen, Rote Straße, large stone box as substructure of a public well in the street, fed by an underground wooden water pipe.



Fig. 8 Einbeck, wooden water pipe near Benser Tor. The two segments are connected by a metal sleeve.

Straße want to brew beer.³⁵ Provision with water from outside the towns could generally be vulnerable in belligerent times (because of the necessary urban autarchy) and thus was often only additional to the private wells.

The pipes found in Göttingen were all post-medieval, but were all of the same type. A beam of oak was sawn so as to create an octagonal section. With a long metal drill, a spoon auger, the inner opening was produced. The separate parts were linked together with an iron sleeve that was punched in the wood.³⁶ Similar types of wooden water pipes have also been excavated in Einbeck, the oldest dating to 1440 dendrochronologically. The connecting pieces were here made of copper or copper alloy (Fig. 8). In Lübeck, apart from round pipes, long wooden boxes, rectangular in section with a flat cover, were also in use.³⁷ Here, the sleeves could also be made of lead. Lüneburg had to save surplus water in a pond before it could be led inside the town through wooden pipes,³⁸ a system known of since the late 14th century.

Wasserkünste

In addition to sampling points, wells, and an open canal, the Neustadt of Einbeck had a *Wasserkunst* since the 15th century.³⁹ It was necessary to lift the water into the pipes, as the flow of the surrounding streams seems not to have been strong enough. The charming German word *Wasserkunst* (literally: ‘art of water’, meaning waterworks) describes a technical device to lift water which is then fed into pipes. *Wasserkünste* existed in several late medieval towns, apart

³⁵ von der Ropp 1907, 320 no. 225.

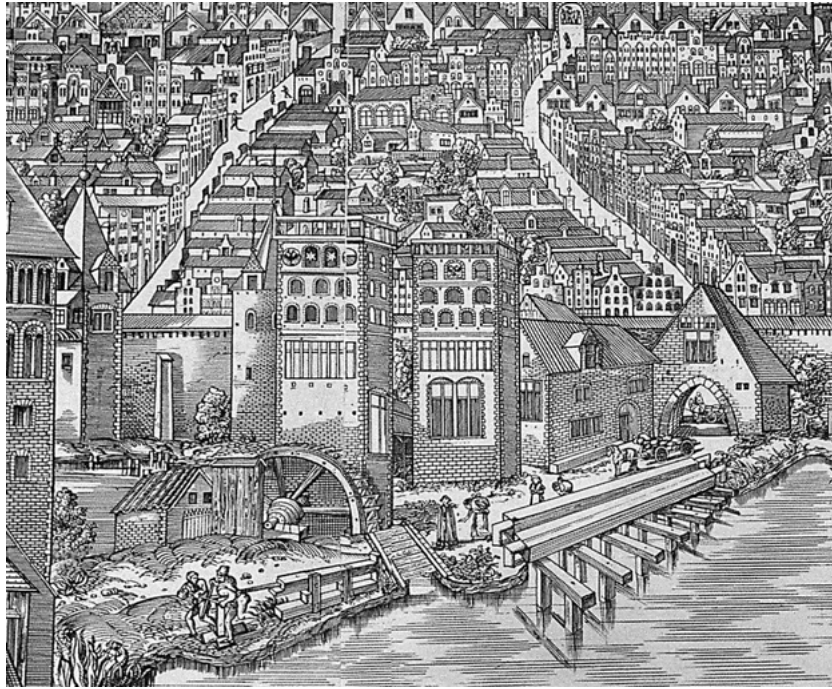
³⁶ Arndt 2018, 295.

³⁷ Grabowski 1994, 33 f.

³⁸ Ring 2004, 237.

³⁹ Heege 2002, 128.

Fig. 9: View of Lübeck from Elias Diebel (1552), the two towers of the waterworks of the brewers (*Brauwasserkunst*, left) and of the merchants (*Kaufleutewasserkunst*, right) at Huxterdamm. In the foreground wooden water pipes are being drilled.



from Einbeck, for instance, in Hildesheim, in Braunschweig, in Lüneburg, in Stade, and in Lübeck, to name just the best known.

The Huxtertor Wasserkunst of Lübeck on the river Wakenitz is shown in a woodcut by Elias Diebel of 1552 (Fig. 9): it lifted the (previously held-back) water with a large wheel, and the water could then flow into the town through the wooden pipes with sufficient pressure. The image shows two high tower-like buildings: the Wasserkunst of the brewers on the left (*Brauerwasserkunst* of 1294) and next to it the Wasserkunst of the merchants (*Kaufleutewasserkunst* of 1533), as well as a bucket wheel that is driven by the natural flow of the river; in the foreground two men can be seen drilling the wooden pipes. In Lübeck about 1302, more than 1800 households were supplied by six *Wasserkünste*, a system that remained in use until 1867.⁴⁰ Some of the wooden pipes in Lübeck led directly into the houses, which is something we have not found in other north German towns.

Public wells, canals in the streets and water pipe systems show, that from the 15th century at the latest, the water supply became more and more a communal affair. From Einbeck we know that the neighbourhood had the common responsibility to maintain the wells and the system of pipes.⁴¹

Sufficient water supply was also necessary for fire protection.⁴² Regulations for fire protection were important, as a fire could cause major damage in a short time, as could be seen in Einbeck, where a town fire burnt down nearly the entire old town in only four hours, killing about 400 inhabitants, in 1540.⁴³ In Göttingen, leather buckets for extinguishing fires were kept in the town hall; furthermore, a subsidy was paid for people to change their (dangerous) thatched roofs to tiled ones.⁴⁴ Göttingen, fortunately, remained untroubled by larger fire events.

⁴⁰ Gläser 2004, 187–190; Grabowski 1994, 27–46.

⁴¹ Heege 2002, 125.

⁴² Brinkmann 1987, 292 f.

⁴³ Heege 2002, 52.

⁴⁴ Ehrhardt 1997, 43.

Rubbish and garbage

When the wells fell out of use, they were filled in, often with rubbish. Archaeological evidence from these fillings indicate that, in most cases, household rubbish was used, but not excreta or human faeces. In an example in the Weender Straße 48, it seems the whole household inventory was disposed of in an empty well (that had been in use since the second half of the 13th century), resulting in an enormous quantity of ceramic material and nearly no soil infilling between the pieces.⁴⁵ More than 240 complete ceramic vessels could be reconstructed, including pieces of a Meissen porcelain tea service, plus pieces of cutlery, glass bottles and vessels and the singular find of a French Dijon mustard pot, which altogether show an upper-class household of about 1760 with a well-off lifestyle. No wooden material was found, however, and no noble metal. It is clear that only selected material was thrown into the former well. The criteria of this selection process, however, are to a great extent, unknown to us.⁴⁶

A smaller part of the household garbage was disposed of also in cesspits. Originally, these were built for use as toilets, to get rid of human excreta and faeces in the narrowness of the towns. In Göttingen, most of these cesspits are stone lined and square or rectangular, sometimes vaulted. In the poorer areas, old barrels without a bottom and cover were also used for this purpose.⁴⁷ For Göttingen we can say that the number of wells on private plots is significantly lower than the number of cesspits, as far as can be seen in the archaeological evidence. It is also clear that far from *all* rubbish was thrown into cesspits or unused wells. Here again, the selection process that decided which object was to end up in a cesspit (and which was dumped somewhere else) is basically unknown to us. Maybe wet and unhygienic things like pots with rotten food were disposed of here, as well as broken sherds that could potentially cause harm.⁴⁸

The problem of dirt and rubbish lying around in the streets was addressed by the town council in most towns, and several regulations and penalties concerning this problem existed.⁴⁹ In Göttingen, the *dreckwagen* – the rubbish cart – came and took the rubbish outside the town. Everybody was supposed to help with it, as the statutes of 1468 make clear:⁵⁰ *When the rubbish cart (dreckwagen) comes to the door in times when the rubbish is driven out, everybody shall help to put the rubbish in front of his door in heaps and load it on (the wagon).* Violation was fined with a penalty of 6 penninge (pennies).

From 1458 on, a streetmaster overlooked the cleanliness of the streets. Rubbish was also classified into different categories. Everybody had to clean up the dirt in front of his house and was not allowed to put it in front of other houses, but had to bring it outside the town wall. Dung was not allowed to lie longer than two days; when a roof was renewed, the thatch might not lie longer than three days (surely also to prevent fires). Wood was not allowed to lie in the streets at all. Slaughtering in the streets was forbidden, tanning only allowed in one's own yard.⁵¹

To see all these regulations as a sign of ignorance about dirt and generally unhygienic conditions in medieval towns, as is often and repeatedly stated, is clearly wrong and is seeing things in too simple a way. Surely, any ban on swine and cattle inside towns, for example, could not be enforced for several reasons, so the problem of dung existed and had to be managed. Rules were imposed and the streetmaster was installed to make sure they were observed.

⁴⁵ FStNr. 22/08; Arndt – Gößner 2007, 22–24.

⁴⁶ Arndt – Gößner 2007, 22; Arndt 1999a, 54 f.

⁴⁷ Arndt 2004b, 138 f.

⁴⁸ Arndt 1999b, 105 f.

⁴⁹ Thoughts on the spread of rubbish and its cycle in medieval towns were expressed early by Keene 1982; more recent thoughts on rubbish, health and environmental impact can be found in Evans 2010. For Göttingen: Arndt 1999a.

⁵⁰ von der Ropp 1907, 117, 7 (1420); 298 IV, 51 (1468).

⁵¹ Arndt 1999a, 58–61.

The existence of expensive cesspits shows that human faeces were seen as unwanted, if not as hazardous, too. The closeness of ground water wells and cesspits in medieval towns is also often described as an expression of ignorance that will have resulted in very unhealthy conditions. However, the contamination of ground water by chemical or bacterial pollution from human excreta through the earth is limited, and also dependent on the direction of the ground water flow (and any possible contamination is never upstream from its source). A study by the World Health Organization found that the bacterial pollution grows for about five metres' distance, but will decline again in the next six metres, while the chemical pollution can scatter into a much wider area.⁵² It seems that the pores in the soil lock up after some time. The pollution of the surroundings by a cesspit is therefore limited in time and space. Apparently, this can be observed in excavations, when a 'ring' of differently coloured earth around a cesspit is clearly visible. In some cases, cesspits were deliberately sealed with clay impervious to water.⁵³ Vermicular eggs, often found in cesspits, will not migrate through the earth into a nearby well at all and are not taken in with drinking water. An infection with endoparasites is nearly always connected with poor hygiene in food intake, which means quite simply not enough hand washing or eating uncleaned fruit or vegetables which were treated with dung, or by eating raw or undercooked meat or fish. Even when it is still not advisable to have a cesspit and a well at a small distance from each other, the danger might be overestimated and falsely generalized from our modern hygienic point of view.⁵⁴ In addition, the threat of bacterial (and chemical) pollution, for instance, was unknown in medieval times, whereas bad smells were regarded as harmful and were therefore a topic of legislation and controversy of neighbours. It could only be seen as ignorance on this topic, when the danger of water pollution through industrial or household garbage or through faeces would have been fully known and understood.

In some towns, rules existed for the location of cesspits in the yard – demanding a minimum distance to the neighbouring plot. These rules are based on the *Sachsenspiegel* and can also be found in local legislation. In Göttingen, latrines in the ground had to be three feet away from the neighbour's boundary, latrines over ground seven feet.⁵⁵ The cesspits were often placed at the far end of the yards behind the houses, but could also be found under rear buildings.

We also know that water quality was monitored. This might be the reason why some wells were finally filled in with garbage and closed. Clear and sweet water was praised in reports of visitors and contemporaries.⁵⁶ Information on cleaning, maintenance, repairs and technical improvements of wells and water supplies is also known from many towns.

Not least, many towns had a large central fountain, which was an adornment for the whole town. One of the oldest of its kind in Germany is the Romanesque market fountain in Goslar (Fig. 10): two large basins entirely cast of bronze⁵⁷ (of the 12th century or around 1300, respectively) with a decoration of fabulous creatures carry a gilded, crowned imperial eagle. In the early 14th century, this fountain will not only have been of enormous value, but the fact that it is highly decorated and that it stands on the market place shows the importance of clean and free fresh water – it was something the burghers were proud of.

In 2013, the foundation of Göttingen's famous Gänseliesel Fountain in front of the historical Rathaus (built in 1270) was excavated. The fountain, only built in 1902 and still a landmark of the townscape, was moved from the centre to the margin of the marketplace in 1968, leaving the old foundation in the ground.⁵⁸ On this occasion, the remains of a round sandstone basin of the first market well from 1568 were also found, as the oldest of three successive market

⁵² Wagner – Lanoix 1958, 28 f.; Arndt 1996a, 13; Arndt 2004b, 142 fig. 9.

⁵³ Arndt 2004a, 126; Arndt 2004b, 138.

⁵⁴ On water conditions and assessing health hazards in medieval towns: Röber 2016, 32.

⁵⁵ von der Ropp 1907, 13. 53.

⁵⁶ Zeit- und Geschichtsbeschreibung 1734, book II, Chapter VII, 65–67. 132–135.

⁵⁷ Goslar on the Harz was head of the famous Rammelsberg mining region (now world heritage site).

⁵⁸ Arndt 2014, 318–323.



Fig. 10: Goslar, the Romanesque Market fountain. The two basins are cast of bronze and decorated with sculptures.

wells. At least from the 17th century on, a ‘pipemaster’ (*Röhrmeister*) was paid to take care of the well and the pipes leading to it. The large basin also served as a reservoir for firefighting water.⁵⁹ A chronicle describes a stone lion in the middle and water that poured down from it through small pipes. Its water is portrayed as *light and clear and with a lot of little bubbles*.⁶⁰

Altogether, it may be said in conclusion that water has been an important feature in towns from medieval times on up to the present age. The inhabitants were not at all ignorant as to the quality of water; on the contrary, water has always been monitored and attended to in several ways, and became more and more a matter of communal responsibility, as a service of general interest.

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⁵⁹ Ehrhardt 1997, 60 f.

⁶⁰ Zeit- und Geschichtsbeschreibung 1734, book II, Chapter VII, 66.

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