THE CONSTRUCTION OF RAINWATER CISTERNS IN EARLY MODERN DEVENTER

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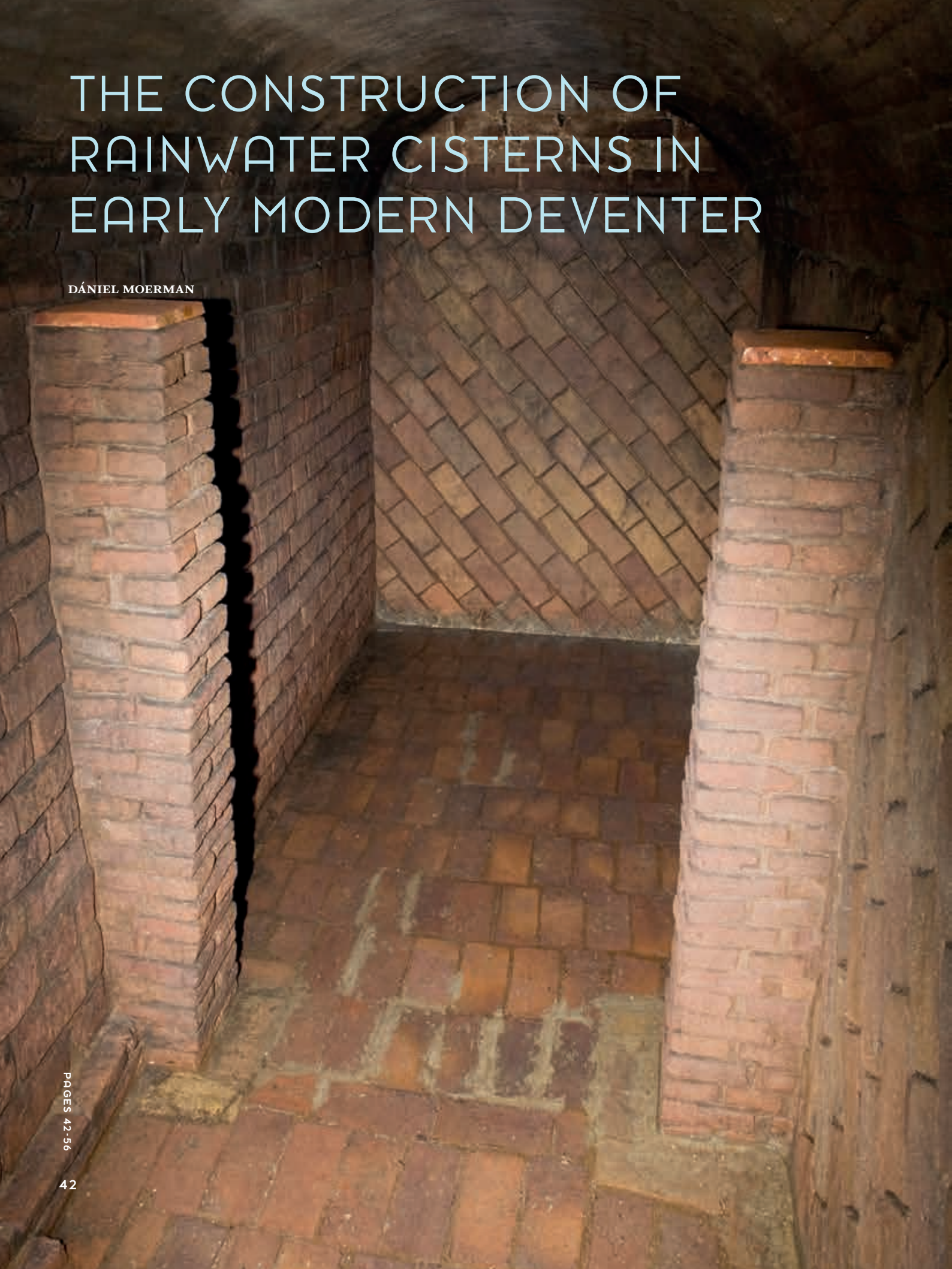


◄ 1. Interior of a cistern beneath Singel 299 in Amsterdam, with brick walls and vaulted ceiling. Probably built in the late eighteenth, early nineteenth century (Rijksdienst voor het Cultureel Erfgoed)

▲ 2. H.P. Schouten, painting of Bloemstraat in Amsterdam looking towards the Prinsengracht. In the foreground left a rainwater cistern with lid and opening, 1778 (Stadsarchief Amsterdam)

Recent years have seen the discovery of several rainwater cisterns in cities like Amsterdam, Alkmaar, Dordrecht, Katwijk, Leiden and Utrecht (figs. 1, 2 and 3). Most of these cisterns, an age-old contrivance for storing rainwater drained from roofs, date from the seventeenth, eighteenth and nineteenth centuries.[1] Despite growing archaeological interest in rainwater cisterns,

3. Remains of rainwater cisterns discovered during roadworks along the Stromarkt in Amsterdam, looking towards the Kattegat (photo Han van Gool, Stadsarchief Amsterdam)

the historical literature is confined to their distribution and to their use by, for example, households and breweries.[2] Next to nothing is known about the building history of rainwater cisterns, due in large part to a lack of research and perhaps also to the dearth of written sources. Only a few brief archaeological reports, such as those describing the many rainwater cisterns in Amsterdam or recently discovered cisterns in Leiden, provide a general impression of the building methods and the materials used.[3] In consequence, there is a sizeable gap in our knowledge regarding the building history of this phenomenon.[4] One exception is the rainwater cistern below the Portuguese synagogue in Amsterdam for which we have a late seventeenth-century building report in the form of a series of notarial deeds relating to the materials used and the work carried out by various workmen.[5]

Much less is known about the existence of rainwater cisterns in the east of the Netherlands, certainly in comparison with the western part of the country. What we do know is that rainwater cisterns existed in a few cities like Deventer, Groningen and Zutphen in around 1600. In Deventer, for example, cisterns were constructed near the houses of the former chapter of the Lebuinus Church. After Deventer became part of the Dutch Republic in 1591, these houses, like all other ecclesiastical property, devolved to the town council.[6] The existence of these rainwater cisterns can be inferred from the accounts drawn up by the administrators of the various ecclesiastical properties, which were subsequently converted to new uses. These financial accounts, like those of the Portuguese synagogue in Amsterdam, contain detailed records relating to the construction of the rainwater cisterns: the cost of materials and the workmen involved, as well as ongoing maintenance.

To date there has been little research into these accounts, even though, given their age, they provide a unique insight into the construction of rainwater cisterns in a part of the Netherlands where this phenomenon has received scant attention. A systematic study of these reports could help broaden our understanding of the construction of rainwater cisterns in East Netherlands. It would also complement earlier archaeological studies and research into architectural treatises so that it would allow the construction process of rainwater cisterns to be placed in a wider historical context. This in turn could support archaeological conclusions regarding the use of a standard design for rainwater cisterns, the hiring of specialized craftsmen and the use of specific materials.[7]

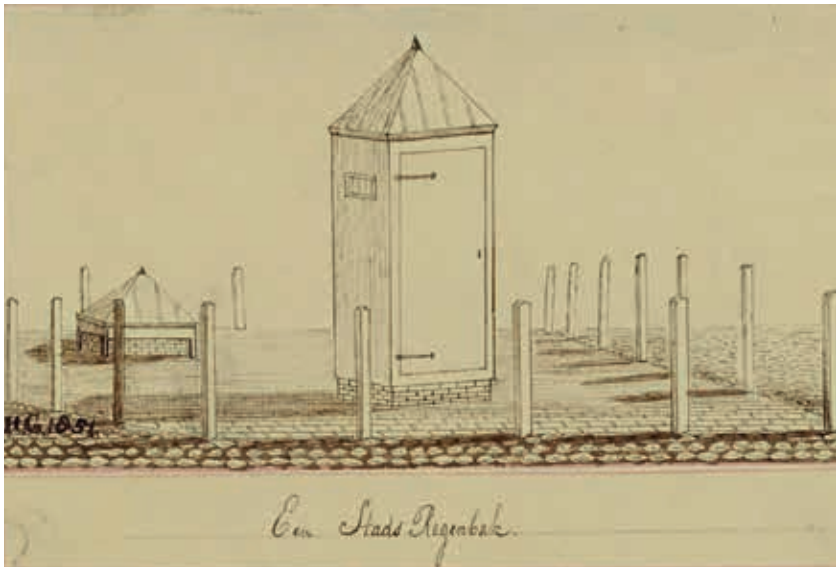
Below, a short historiographical sketch of the construction of rainwater cisterns in the early modern Netherlands is followed by a discussion of the detailed information contained in the Deventer accounts for the period from the city's accession to the Republic in 1591 to the middle of the seventeenth century. Attention will also be paid to specific aspects, such as the role of roof structures in the construction of rainwater cisterns and similarities with a specimen recently excavated in Deventer.

A BRIEF HISTORIOGRAPHY

Until the arrival of a piped water supply at the end of the nineteenth century, various areas in the Netherlands were dependent on specific sources of water. According to a study carried out in 1956 by Izak Vogelzang, parts of Friesland, North Holland and Zeeland were especially dependent on rainwater (fig. 4). This was chiefly due to the fact that the somewhat brackish groundwater in these regions was unfit for drinking.[8] Moreover, from the late Middle Ages the surface water in towns in the Province of Holland was heavily polluted due to emerging industries, especially the tanning and textile industries, but also due to citizens dumping their rubbish in the canals. Remarkedly, in Amsterdam and other cities in Holland the surface water was already so polluted during the Middle Ages that it was no longer deemed suitable for brewing, cooking or drinking. From the sixteenth century onwards, in addition to shipping water in with water barges', residents resorted to rainwater cisterns. In seventeenth-century Amsterdam most houses had at least one rainwater cistern, and in 1761 the city council started to install municipal rainwater cisterns in the vicinity of churches and other public buildings (fig. 5).[9]

The importance of rainwater collection and its quality becomes apparent from a study of historical sources and technical treatises. One such is *Materiae politicae*

4. J. ter Gouw, drawing of a municipal rainwater cistern in Amsterdam, c. 1851. In the foreground a lockable pump house and in the background (left) a covered manhole (Stadsarchief Amsterdam)



by the engineer and mathematician Simon Stevin, published posthumously in 1649. According to Stevin rainwater dependence was greatest in places where the groundwater could not be used for washing clothes and cooking food.[10] This was underscored in the *Algemeen huishoudelijk, natuur, zedekundig en konstwoordboek* (1778), a Dutch translation of the celebrated *Dictionnaire Oeconomique* (aka The Family Dictionary) by Noël Chomel, a French cleric and agriculturalist. Chomel stated categorically that the purest water was rainwater, and he regarded its collection as 'an extremely useful practice'.[11] However, the eighteenth-century Bergen op Zoom brewer, Wouter van Lis, pointed out that rainwater quality was subject to seasonal variation. While the rainwater collected in winter was fairly pure, in summer it was often of inferior quality and contaminated by tiny insects washed down from roofs, while spring and autumn rains were only deemed suitable for malting grain.[12]

The earliest rainwater cisterns, in Holland at any

5. House on Schouwen-Duiveland. In the foreground an aboveground rainwater cistern sealed with a lid designed for withdrawing water (photo G.J. Drukker, Rijksdienst voor het Cultureel Erfgoed)

6. Drinking water supply in the Netherlands from 1850-1950, based on the map by I. Vogelzang (1956) (Roos van Oosten and the cartographic department of the University of Amsterdam)

rate, have been dated to the end of the fifteenth and middle of the sixteenth century. Recent excavations in Alkmaar uncovered four internal 'water cellars' dated between 1475 and 1550. Since they were probably fed via an inlet from the roof, they can be regarded as rainwater cisterns.[13] In Leiden the oldest cisterns can be dated at the end of the sixteenth century; the oldest reference dates from 1592.[14] These discoveries confirm the impression that rainwater cisterns were a late medieval phenomenon and that their numbers increased from the second half of the sixteenth century.[15]

Much less is known about the construction of rainwater cisterns and the use of rainwater in the East Netherlands. According to Vogelzang, the south-eastern provinces relied primarily on ground and surface water, which was relatively clean compared with that in the west of the country thanks to the geohydrological structure (fig. 6).[16] This might seem to suggest that

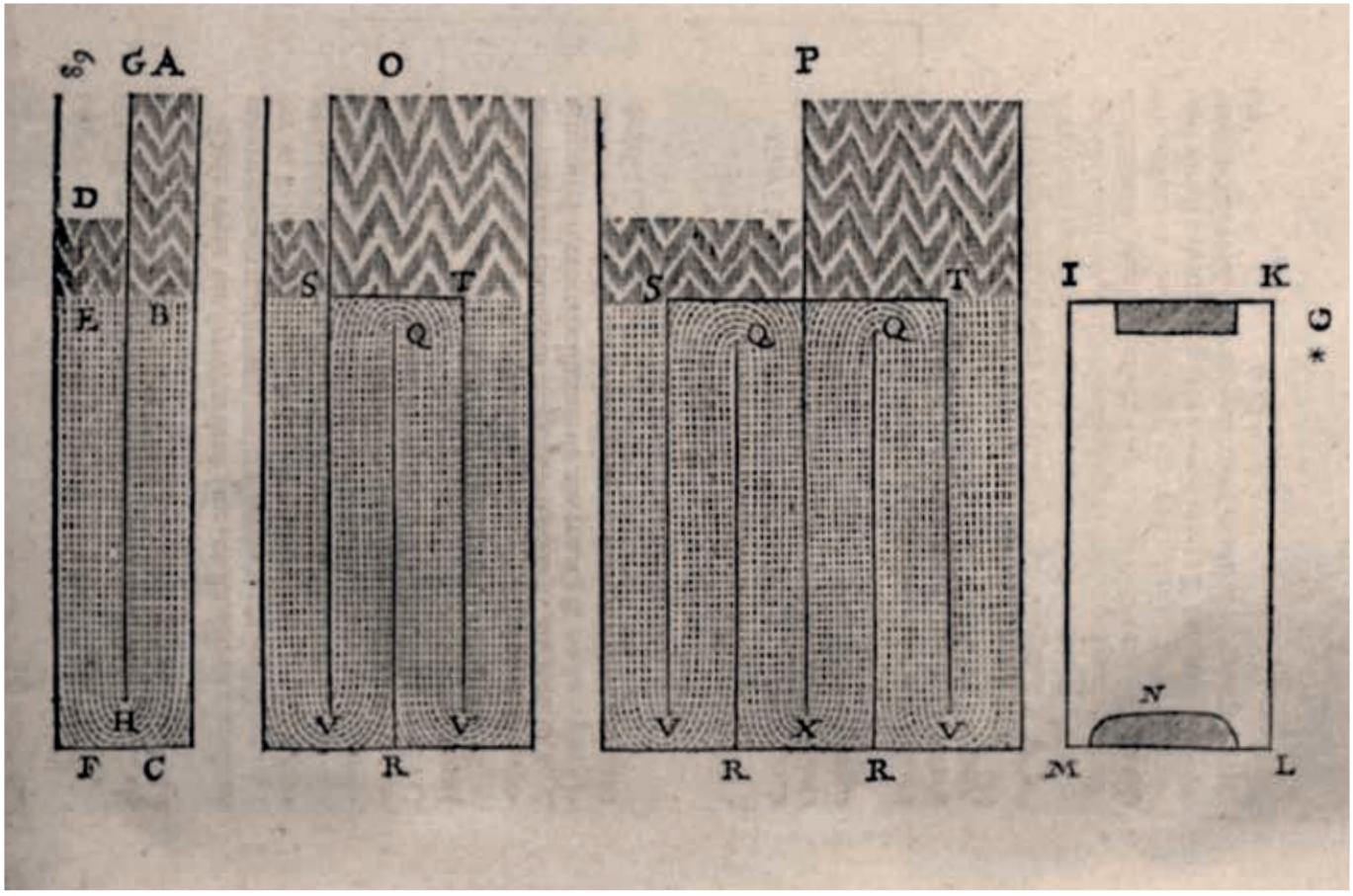
there was less need to collect rainwater in the eastern provinces, but rainwater cisterns were built here, too, in the sixteenth and seventeenth centuries, albeit probably on a smaller scale than in the west. We know that in Groningen at the end of the Middle Ages rainwater cisterns were built in several prominent houses, including the Hinckaertshuis (Oude Kijk-in-'t-Jatstraat 6) and a house on the Ossenmarkt.[17] The eighteenth-century Overcingel estate in Assen also boasted several rainwater cisterns, which continued to function into the twentieth century.[18] The historical land register of Zutphen also contains references to rainwater cisterns from the eighteenth and nineteenth centuries. One of these cisterns is known to have been built beneath the front pavement where it served as a readily accessible water supply for one or possibly more households.[19]

In all these cases we know little or nothing about the building history. Recent archaeological excavations have mostly provided interesting yet limited insights into the location, materials and dimensions of the rainwater cisterns.[20] But we learn very little about their construction and use. Contemporary sources are confined to a few short treatises and descriptions, and municipal regulations, mainly from the seventeenth and eighteenth centuries.

EARLY MODERN TREATISES AND REGULATIONS

Simon Stevin's *Materiae politicae* is one of the few early modern Dutch sources to describe the ideal type of rainwater cistern. Stevin stressed that rainwater cisterns needed to be sealed and regularly cleaned to prevent the water becoming polluted. To keep the water as pure as possible he suggested building a second cistern next to the rainwater cistern 'as a reservoir, with a wall of porous bricks, so that water seeps out of the reservoir and is thereby cleaned.'[21] Stevin believed that porous brick could be used to purify water coming from the roof making it 'better and more healthy to drink'.[22] Apart from porous bricks, Stevin also recommended sand filtration as a good way of removing contaminants from rainwater (fig. 7). A similar practice was also described by Chomel who regarded the use of 'percolation bricks' or 'thin bricks' as one of the best methods for purifying water, referring to 'drip cellars' or 'underground cavities … where rainwater penetrates the brick courses that make up the arched ceiling of the cavity, drop by drop', leaving behind only

7. Sections through rainwater cisterns with sand-based purification plant. The zigzag pattern represents water, the dotted lines sand. The example on the left has two compartments separated by a trass wall (H to G). The water sinks from B and returns in a filtered state at E. The other examples are of cisterns with multiple compartments (S. Stevin 1649, 89)



clear water.[23] Stevin noted that the outer wall should be a 'laid with trass'.[24] The use of trass mortar was intended to render the wall watertight. Rainwater cisterns were usually built underground, but according to Stevin some were also built aboveground.[25] The advantage of aboveground rainwater cisterns was that the water could be easily drawn using buckets, whereas underground cisterns often required the addition of a pump to bring the water up.

A 1681 treatise by the Zeeland writer and publisher Wilhelmus Goeree provided a similar account of rainwater cistern specifications, but also referred to regulations and practical applications. For example, Goeree wrote that townspeople could not build a rainwater cistern wherever they liked, but first had to have their plans approved by the clerk of works. Like Stevin, he endorsed the use of trass cement, not only because it prevented loss of water through seepage, but also as a means of preventing the ingress of dirty water. The risk of the latter was the reason why rainwater cisterns could not be built in the vicinity of privies or cesspits, and why they had to be properly cleaned and covered, preferably with a heavy copper lid. The latter served not just to prevent contamination, but also 'to prevent children from being able to open them easily and so fall into them and drown'.[26] Interestingly, Goeree wrote that these lids should furnished with small holes in order 'to aerate the water', which was evidently supposed to contribute to the quality of the stored water.[27]

We also have legal documents in which city councils formulated the rules and conditions governing the construction of rainwater cisterns. A good example is Zutphen, where clear guidelines for rainwater cisterns were included in the updated municipal by-laws of 1742. For instance, anyone wanting to build a rainwater cistern to harvest water from a shared roof was required, at their own expense, to install a separate downpipe to channel the water into the cistern. Moreover, rainwater cisterns, like cellars and privies, had to be built in such a way as to cause no damage to party walls. The operative rule here was that an additional wall, one-and-a-half bricks thick, had to be built and plastered with trass 'so that no moisture seeped through into the neighbouring property'.[28] The emergence of this type of legislation during the eighteenth century was probably due to the construction of substandard rainwater cisterns with all the risks that entailed. In 1756 a resident of Deventer was permitted to retain his rainwater cistern on condition that it be rebuilt in accordance with the advice of the city's master mason by 'building a brick wall in front of the base of the Lebuinus church, such that the church should suffer no damage whatsoever'.[29]

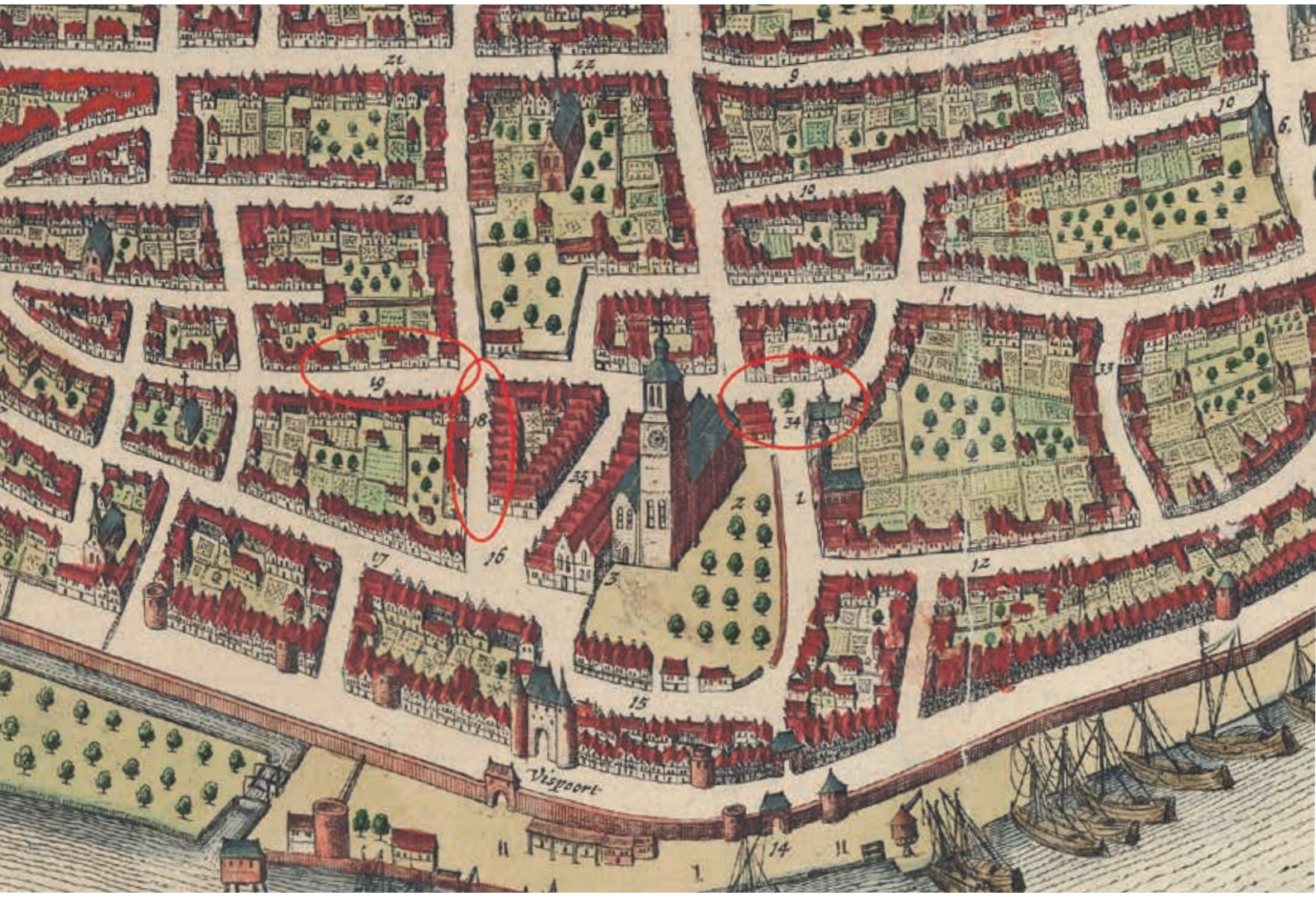
Although these texts provide some insight into the construction and operation of rainwater cisterns, they are ultimately not much more than normative and theoretical expositions with the occasional practical example. As such, they must be seen primarily as ideal-typical descriptions of how a rainwater cistern should be built. The information gleaned from the accounts of the former ecclesiastical properties can serve as an important complement to practice, as well as the question of how widely these innovations were implemented. On this point, the accounts of the former eccesiastical properties offer a solution.

ECCLESIASTICAL PROPERTIES AFTER 1591

Until Deventer acceded to the Dutch Republic following its siege and capture in 1591, the Catholic Church, and the Lebuinus chapter in particular, played a key role in the city as the centre of religious life and education.[30] From the twelfth and thirteenth centuries onwards various religious houses associated with the chapter were built, principally round the Stromarkt and Papenstraat, north-west of the Lebuinus Church (fig. 8).[31] After the city's capture in June 1591, the new Protestant city council seized the chapter houses and other ecclesiastical properties, most of which were empty and in a ruinous condition. In 1594, with a view to improving their wretched state, a steward was appointed: Dirck Heynk (a cousin of the mayor, Johan Heynk), was tasked with managing the finances and works relating to the former ecclesiastical buildings. Under his stewardship the chapter houses were restored and converted into residences for (Protestant) clergymen. This was financed by the revenue from the sale of former chapter properties; this, too, was overseen by Dirck Heynk. Although there were few alterations to the structure of the buildings, Heynk did not skimp on the restoration work. Floors and roofs were replaced, and some of the houses were even fitted with new stained-glass windows. It is fortunate that Heynk's meticulous accounts for these works have survived for they provide insight into the construction work and the occupational history of the former chapter houses.[32]

THE CONSTRUCTION OF RAINWATER CISTERNS

The main chapter houses known to have been provided with rainwater cisterns around 1600 are the Doirshuis (Papenstraat 17-19), the Weme (Papenstraat 6-8-10) and the Vrijenhuis (Kleine Poot 18-20) (fig. 9).[33] The first in the series was the Doirshuis, where work began on the construction of a rainwater cistern 'at the discretion of aldermen and council' in October 1594. The assistance of the city mason, Master Engbert, was enlisted for this work, along with several labourers and helpers. Before construction could begin, first a hole had to be dug. A digger was hired who removed



8. Detail of the 1649 street map of Deventer by J. Blaeu. In the middle the Lebuinus church (2), and to its left the Onze-Lieve-Vrouwe church, dissolved in 1591 (3), encircled by buildings belonging to the former Catholic chapter on the Poot (34), the Stromarkt (18) and Papenstraat (19) (HCO Stadsarchief Deventer)

'6 carts of clay and 6 carts of sand'. However, these were not the only groundworks carried out at the Doirshuis. At the same time the courtyard was raised and enclosed by a wall 'half the height of a man'.[34] That suggests that this particular cistern was not built directly under the house but beneath the courtyard, possibly against the external wall of the house, which was a fairly common practice.[35] Once the hole had been dug, Master Egbert together with two masons and an overseer, set to work building the rainwater cistern.

The Doirshuis cistern was built using 'clinckaerts' and an unspecified mortar.[36] The latter is highly likely to have been 'trass', a cement made from finely ground tuff (a light, porous rock formed by consolidated volcanic ash). Since the Middle Ages Deventer had been an important staple market for tuff, which was widely used, including in churches.[37] The term 'clinckaerts' refers to a particular type of paving brick, also known as 'klinkaert', 'klinker' or 'tichelsteen', which had been used in the Netherlands since the Middle Ages.[38] In this instance nothing is known about the dimensions of the bricks. In his book on house building (*De Huysbou*), Stevin refers to the use of bricks and trass mortar as one of the methods for building good, watertight cellars, which suggests that this combination would have been an obvious choice for the construction of underground rainwater cisterns.[39] This is also corroborated by archaeological research in Amsterdam which concluded that klinkers and trass cement were invariably used in the construction of seventeenth-century rainwater cisterns.[40] All in all, ten tuns of trass were ground, which equates to a volume of 118.7 to 121.4 litres per tun according to the standard volume of a Dordrecht 'trass tun', which was also used elsewhere.[41] The rainwater cistern beneath the Doirshuis had the typical domed ceiling encountered in recently

excavated rainwater cisterns.[42] In addition to the work on the cistern, a new 'watergang' or ditch was dug. Whether this fed into the cistern is not clear, however. The two masons worked for a total of twelve and a half days on the rainwater cistern, the apprentice ten. They received twelve and nine 'stivers' a day respectively and five tankards of beer, which is reasonably consistent with the average summer daily wage for craftsmen in the East Netherlands in the late sixteenth century, namely ten and a half stivers.[43]

In July 1595 work began on the rainwater cistern at the Weme house, then occupied by the pastor Franciscus Schurckmannus. Once again, as in subsequent years, the assistance of the master mason Engbert and his workmen was enlisted. From the description of this cistern it seems that use was made of recycled components, such as tiles from a rainwater cistern in the medieval Proosdij (deanery).[44] Archaeological research has shown that several rainwater cisterns were built beneath the ground floor rooms of the Proosdij.[45] However, all we know about these cisterns is that they were connected via lead pipes to a pump in the basement of the neighbouring building (Stromarkt 19).[46] Archaeological excavations beneath this building have revealed that in the seventeenth or eighteenth century a rainwater cistern was built using second-hand bricks, five metres from the rear elevation.[47] The fact that the cistern found at Stromarkt 19 was built

9. Gable of the Weme chapter house after the nineteenth-century renovation, 1959 (photo G.T. Delemarre, Rijksdienst voor het Cultureel Erfgoed)

from recycled bricks supports the hypothesis that the cistern beneath the Weme house was made up of bricks from an older cistern beneath the Proosdij. Given that the accounts mention that the Proosdij cistern was to be removed (with the consent of aldermen and council), it is reasonable to assume that the bricks would have been reused for the cistern below Schurckmannus's house. The same accounts refer to two more of Engbert's workmen, who were hired to renew the tiled roof.[48] The fact that this occurred around the same time might have nothing to do with construction of the rainwater cistern, but later works indicate that it may have been intended to improve rainwater collection.

Two years later, work on the rainwater cistern at the Weme house was still not finished, to the annoyance of Pastor Schurckmannus. An entry dated 3 June 1597 notes that Schurckmannus 'was quite insistent regarding the construction of a rainwater cistern under the ground'.[49] It was also noted that five tuns of tuff had been taken from the Mariakerk to be ground into trass for the construction of the brick cistern. The Mariakerk (or Onze-Lieve-Vrouwekerk) was one of the churches that was closed down after Deventer's accession to the Republic after which it served a new purpose as a source of building materials for the restoration of the chapter houses. A month later, on 9 July, the son of Master Engbert, together with a mason, overseer and a boy were hired for respectively nine and four and a half days to prepare the cement and build the rainwater cistern. An external labourer was also hired to dig a hole which, taken together with the remark about building 'under the ground', suggests a cistern underneath the courtyard or the garden. When the carters came to carry away excavation spoil, Schurkmannus's servants seized the opportunity to gather up 'dreck and rubbish' from the house and throw it on the cart. On 10 July 2200 klinkers were purchased for the wall of the cistern. On the same day an amount of thirty stivers was entered for a cartload of slaked lime from the Rijke Fraerhuis, as well as a small cartload of sand for the construction of the Weme rainwater cistern.[50] The lime and the sand were most probably intended as ingredients for the trass mortar.[51]

In July 1601 work began on the rainwater cistern at the Vrijenhuis. Ten tuns of tuff were ground to produce sixteen tuns of trass.[52] Oddly enough, there is no mention of the building of the cistern wall. It was another month before Master Engbert, together with a mason and a boy started to build the cistern, which took eleven and a half days. The accounts entry 'excavation works' indicates that it was an underground cistern, probably below a courtyard, as in the earlier examples.[53] Four years later Master Engbert and his workmen were called in again, this time to carry out repairs to the top part of the cistern.[54]

The accounts of Heynk's successor, Joost Hagedoorn, provide little information about rainwater cisterns. Perhaps this was because the major restoration works had been largely completed under Heynk's stewardship. The only detail of interest to emerge from Hagedoorn's accounts is that in September 1638 workmen started to dig a hole for the repair of the cistern under the Weme house, at that point occupied by the well-known German pastor, Caspar Sibelius.[55] As much as 52 cartloads of earth were carried away, which suggests a fairly significant and costly operation.[56] In January 1639 the slater, Master Hendrik, was paid for making a new drainpipe that was to end in the rainwater cistern. In April of that same year a pump was installed on the cistern and the slate roof relaid for the not inconsiderable sum of 89 guilders.[57]

Harvested rainwater cannot have been the only source of water for the chapter houses and other households. Most financial accounts from the end of the sixteenth century onwards mention works relating to wells and even pumps.[58] The rainwater cisterns built at that time probably functioned as a secondary water supply that was particularly advantageous for residents during periods of scarcity, for example during a prolonged drought or siege.[59]

OTHER RAINWATER CISTERNS

Heynk and his successors were stewards not only of the chapter properties but also of real estate belonging to other former ecclesiastical institutions. The last of these under Heynk's stewardship was the fifteenth-century priory at what is now Bergkerkplein 12.[60] Work on this rainwater cistern started in May 1596 with the installation of two pumps that could be connected to the cistern. The construction of the cistern itself began in July, when a bargee was paid to transport 3000 klinker bricks from Amsterdam. Why they needed to be brought in from Amsterdam is unclear. It is possible that they were IJssel bricks, a small yellow brick produced along the Hollandse IJssel river from the fifteenth century onwards, which have also turned up in rainwater cisterns elsewhere.[61] For the barrels of lime needed for the cement a sum of 2 daalders and 27.5 stivers were paid. This indicates that lime rather than trass mortar must have been used for this cistern, because there is no mention in the accounts of ground tuff or trass. Master Engbert and his son both worked thirteen and a half days that month 'in the Priory to brick the cistern under the earth'. So this was another underground cistern. The overseer, who was also involved in the work, received one and a half stivers for preparing the cement and thoroughly cleaning the cistern so that it could be handed over in a spick-and-

span condition.[62] In May of that year work also started on laying a new tiled roof in the course of which the roof was shaped so that it was better able to collect water as '2 ends matching one another, and sloping downwards, so the water is channelled into the cistern'.[63]

In the accounts relating to the priory rainwater cistern it is stated explicitly – and this is rare – that the roof works were carried out in order to improve the collection of rainwater. Although the literature suggests that the construction of rainwater cisterns at the end of the Middle Ages went hand-in-hand with the replacement of soft roof materials, in particular reed and straw, with hard roofs with gutters, more historical and archaeological research is needed to confirm this link.[64] The existence of a connection between the roofing material and the shape of the roof was highlighted by Vogelzang, who stated that the effective collection and use of rainwater depended on a number of factors, including the quality, dimensions and orientation of the roof, as well as the gutters and pipes that channel the water into the cistern. Of all these factors, the roofing material was one of the most decisive. Reed and straw roofs have a high absorption capacity, meaning that a lot of water is lost and only a small amount is collected. People were also well aware that rainwater from reed and straw roofs was prone to contamination with dirt, especially bird droppings, as well as particles of reed and straw. Hard, tiled roofs were consequently preferable because more water could be collected, and that water was generally cleaner. Slate roofs were considered less suitable because the water had a milky and greasy appearance compared with water from tiled roofs.[65] The orientation of the roof planes was seen as another important factor since the wind plays a big role in determining how much rain falls on a roof surface. Consequently, as the abovementioned accounts demonstrate, the modification of the roof covering could help to improve rainwater collection.

THE EXCAVATIONS AROUND LAMME VAN DIESEPLEIN

The last rainwater cistern to appear in Hagedoorn's accounts is that of the Rijke Fraterhuis, a complex of buildings constructed in 1441 by the pietist Brothers and Sisters of the Common Life.[66] The description is brief, noting only that in November 1641 a lead pump was installed in the rainwater cistern in the courtyard, at a cost of ten guilders and four stivers.[67] This cistern may have been from an earlier period since Heynk's accounts for 1601 stated that 'the dilapidated rainwater cistern' in the Fraterhuis needed to be repaired, requiring the entire cistern to be broken open.[68]

During archaeological excavations a few years ago around the site where the Rijke Fraterhuis once stood (now Lamme van Dieseplein), an almost complete rainwater cistern was discovered (figs. 10 and 11). Given the characteristics and location of the cistern it is reasonable to assume that this is the cistern mentioned in the accounts: it was found beneath the courtyard, against a building. Its rectangular structure and domed ceiling, constructed largely of red bricks on the outside and IJssel bricks with lime mortar on the inside, accords with the details in the aforementioned accounts. The rainwater cistern was three metres long by 1.75 metres wide and 2.1 metres high.[69] Compared with the dimensions of previously discovered rainwater cisterns in Amsterdam, this indicates a medium-sized cistern with a capacity of around 5000 litres.[70] Repairs to the vaulted ceiling using Portland cement, a nineteenth-century invention, suggest that this rainwater cistern was in service until at least the nineteenth century, and would naturally have required various repairs over the years.[71]

Because the rainwater cistern at Lamme van Dieseplein is one of the few complete cisterns to have been found it can be compared with the details recorded in the accounts. This has not been possible for the cisterns in chapter houses because no large-scale excavations have taken place there.[72] In the absence of excavation data, the historical information gleaned from the accounts is crucial to our understanding of the rainwater cisterns in Deventer.

CONCLUSION

Recent years have seen more and more information come to light about the history of rainwater cisterns in the Netherlands, in both historical and archaeological studies. Since the sixteenth century these cisterns have played an important role in the supply of drinking water, especially in western coastal provinces. It now transpires that rainwater cisterns were also built in the eastern regions, where it had been assumed that people relied mainly on wells for drinking water. There is scant historical information about the construction of these early modern rainwater cisterns. In Deventer, however, rainwater cisterns were built near chapter houses and data relating to their construction was meticulously recorded by the stewards of these buildings. Records of holes being dug point to the construction of underground cisterns, which in this instance must have been located in a courtyard or garden rather than beneath the actual house. The cisterns were rectangular with a domed ceiling and were all built by the same master mason and his team. This corroborates the surmise stemming from archaeological research that rainwater cisterns were constructed according to a standard design: usually rectangular with a vaulted ceiling, and moreover built using the same materials, such as klinkers and trass cement, and by a group of

10. Excavated rainwater cistern on Lamme van Dieseplein, the site of the former Rijke Fraterhuis (M. van der Wal 2015, 15)

11. Structure of the interior of the excavated rainwater cistern on Lamme van Dieseplein (M. van der Wal 2015, 15)

specialist workmen. Another detail that came to light and which certainly warrants more historical research relates to the modification of roofs to improve the collection of rainwater, which might explain the alterations to roofs carried out concurrently with the construction of rainwater cisterns.

The dearth of relevant excavations has meant that there was very little archaeological data available for the current study. The excavations at Lamme van Dieseplein, near the former site of the Rijke Fraterhuis, provided the only opportunity to compare historical data from the accounts with an actual cistern. Inevitably therefore, this article, in which the main focus is on the under-researched eastern provinces, is only a modest contribution to the very limited building history literature on rainwater cisterns in the Netherlands. A synthesis of historical sources and archaeological data is required in order to provide a more complete picture of the history of rainwater cisterns in the Netherlands.

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NOTEN

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THE CONSTRUCTION OF RAINWATER CISTERNS IN EARLY MODERN DEVENTER

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In recent years, many old cisterns for the collection of rainwater have been discovered in Dutch cities, in particular in Amsterdam. Such rainwater cisterns were for centuries an important source of fresh water. Most date from the second half of the sixteenth century onwards. They were especially prevalent in the western provinces, where the ground and surface water were mostly unpotable due to salinization and pollution. However, rainwater cisterns are also known to have existed in the eastern parts of the country. Yet very little is known about the architectural history of these cisterns in the Netherlands, especially for the period prior to the seventeenth century. While there are archaeological reports detailing specific aspects of their construction, the historical literature focuses on the use of rainwater cisterns by households and industry. There is a general lack of written sources describing the construction of cisterns prior to the seventeenth century.

This article highlights one specific historical source that has not been fully studied, namely the accounts left by the stewards of the former ecclesiastical houses in the city of Deventer. After the city became part of the Dutch Republic in 1591, the ecclesiastical houses were confiscated by the city and extensively refurbished. This included the construction of rainwater cisterns in around 1600. The accounts of these works contain valuable notes regarding the construction process and maintenance of cisterns, the use of specific materials and the hiring of specialist workmen.

The findings from these notes, as presented in this article, can be used to complement recent archaeological findings and contemporary architectural descriptions, thus providing insights for further research. The notes confirm, for example, that these rainwater cisterns were constructed underground by the same specialist, according to a specific design, using similar materials, such as bricks known as 'klinkaerts', and trass to create waterproof mortar. The construction of rainwater cisterns was sometimes accompanied by roof renovations designed to enhance the rainwater collection, as illustrated by an example. Ultimately, the article aims to show the relevance of such historical sources to furthering our knowledge of the construction history of rainwater cisterns in the Netherlands, in particular in the rather underexamined eastern parts of the country. Future research could aim to synthesize such historical sources with archaeological findings in order to arrive at a more comprehensive view of rainwater cisterns and their history in both the eastern and western Netherlands.