CHAPTER 6

Storage and Supply in the City

The Imperial Portico is not to be seen, though the Cistern remains. Through the inhabitants' carelessness and contempt for everything that is curious it was never discovered except by me, who was a stranger among them, after a long and diligent search for it. The whole area was built over, which made it less suspected that there was a cistern there. The people had not the least suspicion of it, although they daily drew their water out of the wells that were sunk into it.[1]

INTRODUCTION

The opening quotation from Gilles' account of his rediscovery of the Basilica cistern — now one of Istanbul's most popular tourist attractions, the Yerebatan Sarayı — reveals not only the difficulties facing any study of the Byzantine city, but also the particular significance of the very large number of cisterns for an understanding of water storage and distribution. Furthermore the surviving remains of the known Byzantine cisterns are also key components for the understanding of the topographic framework of the Byzantine city, with wider significance for the identification of the street layout.[2]

Storage facilities may be divided into reservoirs (lined pits) and cisterns (covered, underground chambers). About 150 Byzantine cisterns and reservoirs of various sizes have been recorded in the accounts of travellers and by archaeologists and these are catalogued in the concordance of cisterns, see below and Maps 12–15. Many of the cisterns and reservoirs were purpose-built, the majority in Late Antiquity, others in the Middle Byzantine period and later. Through time others became established in buildings that had formerly been put to quite different uses. Thus, beside the Hippodrome, a rotunda and adjacent dining-hall belonging to the fifth and sixth centuries were both later converted into cisterns (F7/8 and F7/9). A similar fifth-century palatial rotunda near the Philadelphion was also transformed into a cistern by the addition of columns and vaults, forming the platform on which Romanus Lecapenus built his palace (D7/2). Whilst such conversions may be viewed as indicative of the decay of the monuments of the late antique city, they also confirm the continuing need for water storage in the early medieval and middle Byzantine city.

Many cisterns and reservoirs survive to this day, others have been destroyed to make way for roads and buildings, and the state of preservation of others cannot be ascertained. Most of the cisterns are dry today, although groundwater accumulates in the Yerebatan Sarayı (G7/9) and the 'Theodosius Cistern' (F7/3), and in 1911 was present to a depth of about 0.45 m in the Binbirdirek (F7/5).[3] Over the centuries, sediment and rubbish have accumulated in the cisterns, often to a considerable depth. This may be appreciated, for example, by observing many of the section drawings that appear in Forchheimer and Strzygowski's account published in 1893. As a result, many of the cisterns are now much reduced in capacity or difficult even to enter. In 1911, an excavation was undertaken in the Binbirdirek cistern, which established that the ground-level had risen by 3.06 m.[4] It was not possible during our project to make excavations in, or take cores of earth from the cisterns of Istanbul, although such work could yield material of value in determining the history of their use and abandonment. Such work might still be undertaken in a number of the city's cisterns, including the Binbirdirek cistern, where the marble paving laid down during the recent restoration sits upon the

[1] Gilles (1561a), 2.20; see the full text in Appendix 1.

[2] For recent studies of the topography of the city which make extensive use of the physical location and orientation of the cisterns to help reconstruct the road system, see Berger (1997a) and Bardill (1997), 79–80, n. 55.

[3] On the Binbirdirek, see Wulzinger (1913a), 384 fig. 9.

[4] Wulzinger (1913a), 384 with fig. 9.

Fig. 6.1 Cistern near the Forum Tauri (E7/5).

accumulated earth, which was fortunately not completely cleared from the cistern.

Already in the early fifteenth century, Buondelmonti indicated that certain cisterns were being used to grow vines, and in the late sixteenth century Gerlach saw a cistern south of the Kariye Camii in which Jews were spinning silk (C3/7). Later illustrations show silk-spinning being undertaken in the Binbirdirek, as was the case at many others.[5] Today many of the cisterns still retain a working function in the daily life of the city as private abattoirs, or in the case of the cistern close to St John of Stoudios, as a small plastic-bottle factory until a disastrous fire about thirty years ago. Of the surviving cisterns, some are used today for storing goods (at the time of writing F6/5 is used to store bottled drinks), and others have been cleaned out, restored, illuminated, and put to other uses. The suburban Fildamı reservoir, for instance, houses an athletics track, the reservoir of Aetius (C3/1) contains a football stadium, and the reservoir of Aspar (D4/6) hosts a children's school and park. Amongst the covered cisterns, the restored Yerebatan Sarayı (G7/9) is a major tourist attraction, the 'Theodosius Cistern' (F7/3) is a lesser known curiosity, the Binbirdirek (F7/5) is a cultural centre, the Bodrum Camii (D7/2) is a failed market, a cistern near the Forum Tauri (E7/5) is a nightclub (Fig. 6.1), a small cistern to the north-west of Haghia Sophia has been converted into a restaurant (G7/15), a small adjacent cistern with just two columns serves as the bar of a hotel (G7/16), the cistern flanking the Hippodrome on Nakilbent Sok. (F8/1) is an art gallery, and the remains of a cistern in the Boukoleon Palace (F8/6) are preserved in the foyer of a plush hotel.

HISTORICAL TOPOGRAPHY AND WATER STORAGE

A good number of cisterns are referred to in our Byzantine texts, but in only a few cases can we link the texts with the archaeology and firmly identify the cistern described. This is usually because our sources are not specific about the location of a cistern, or because no cistern has been discovered in the area to which a text refers. The major cisterns and reservoirs attested in our historical sources, some of which have already been mentioned in Chapter 2, may be considered again here.[6] The texts referring to them appear in Appendix 1.

CISTERNS AND RESERVOIRS

The need for water storage within the new city of Constantinople was recognized before the water channels of the aqueduct of Valens reached the city in 373. The City Prefect Modestus had already made

[5] Andréossy (1828), 446–7.

[6] See the discussion in Forchheimer and Strzygowski (1893), 147–88.

provision for water storage by ordering the construction of a reservoir between 363 or 369. The *Notitia urbis* of *c.* 425 indicates that this cistern was in Region XI; it was apparently in the northern sector of that region, since the *Patria* places it near the Church of the Holy Apostles. A cistern (D5/4) was indeed noted between the Bozdoğan Kemeri and Sehzadebaşı Caddesi by Gilles in the Saraçhane (Saddlers' Market).[7] Forchheimer and Strzygowski discerned some parts of the cistern's exterior walls and were able to establish that it measured 154 m from north to south by 90 m from east to west.[8] Stolpe's 1:15,000 map of 1880 shows a block of these dimensions in the street system and labels it 'Sairadsch hane Cisterne Modestiana'. It is not entirely certain, however, that these remains related to the cistern of Modestus rather than to another of the cisterns known to have been located in this area (such as the Arcadiaca, also in Region XI).[9] The surface area of the cistern (14,000 m²) is much greater than that of our largest covered cistern, the sixth-century Basilica Cistern (9,000 m²), but much smaller than that of the open reservoirs of Mokios (24,900 m²), Aspar (23,100 m²), and Aetius (20,700 m²), although the Fildamı reservoir outside the walls is smaller (9,600 m²).

Clearchus was City Prefect of Constantinople in 373, the year that Jerome's *Chronicle* records that the waters reached the city. We are also told by Socrates that, as City Prefect, Clearchus built a *hydreion megiston* near the site where Theodosius I would later build his forum. Cedrenus and Zonaras used instead the term *nymphaion*. The great nymphaeum was, according to the *Notitia*, in Region X of the city, so must have been located at the south-eastern limit of that region if it was near the Forum of Theodosius. Clearchus is known to have been City Prefect in 372–3 and 382–4; since the nymphaeum is likely to have been built to receive the new water supply, it was presumably built during his first tenure of the office.[10]

The aqueduct of Valens ensured the supply of the cistern of Modestus, the nymphaeum, the Constantianae baths, and the Anastasianae and Carosianae baths, which Valens built and named after his daughters. These baths probably came into service before the Constantianae, since the gymnasium of the Carosianae was dedicated in 375, shortly after Valens' line came into operation. The *Notitia* of *c.* 425 locates the Anastasianae in Region IX of the city, and the Carosianae in Region VII. The Carosianae were therefore on the Third Hill at an altitude of 50–60 m above sea level, and certainly could not have been supplied by the Hadrianic line if, as we have argued, that line entered the city at an altitude only sufficient to supply the Roman city of Byzantium.

Four nymphaea are attested in the *Notitia urbis*, one each in Regions IV and V,[11] the Great Nymphaeum in Region X, and another outside the city in Region XIV, possibly at Rhegion.[12] It should be noted that remains excavated in Beyazıt immediately east of the arch in the Forum Tauri have been identified by Bauer with the nymphaeum in Region X (372–3) supplied by the aqueduct of Valens. Berger, by contrast, has suggested that the remains may be the foundations of the external walls of the Forum Tauri itself.[13] There is no way of knowing who is correct on the basis of the available information, but Bauer adduces in support of his identification the fact that vaulted conduits were discovered entering the structure from the north.[14]

[7] Gilles (1561a), 4.2; Mango (1998), 88, n. 13, identifies this cistern with the cistern of St Michael, named in the later list of the wonders of the city; see also note in Appendix 1.

[8] Forchheimer and Strzygowski (1893), 52.

[9] Mango 1998, 88, n. 10.

[10] For the Great Nymphaeum constructed near the Forum of Theodosius, see Socrates, *Church History* 4.8: 'For when that aqueduct was completed, Clearchus the prefect of the city built a stately bath (*hydreion megiston* = large nymphaeum), to which the name of "the Plentiful Water" was given, in that which is now called the Forum of Theodosius: on which account the people celebrated a festival with great rejoicings'. The translation of *hydreion megiston* as large nymphaeum seems likely, since *hydreion* as well as meaning a bucket, can also have the meaning of a place where water is drawn and distributed, Liddell and Scott, *Lexicon*, s.v. *hydreion*; although it cannot be ruled out that it could also have the meaning of reservoir, perhaps in the same way that the *Piscina Mirabilis* at Misenum was a great covered cistern.

[11] The nymphaeum in Region V may be that attested in the Forum of Constantine (which burned under Leo I; see Appendix 1). Bassett (2004), 29, 70, following Bauer (1996), 171, fig. 59, suggests that there was a nymphaeum at the south end of the Forum of Constantine where statues could be displayed. This is, however, unlikely to have been completed before the high-level water supply in 373; see also Berger (1997a), 379–80.

[12] Mango (2004), 78.

[13] Bauer (1996), 193–7, figs 62, 63; see also Mango (2004), 77. The hemicycle north-east of the Beyazıt Hamamı shown on Bauer (1996), fig. 62 is more than twice the diameter of the Great Nymphaeum at Lepcis Magna (Ward-Perkins (1993), 79–87), which would lend support to Berger's argument that this is part of the forum's precinct wall.

[14] Bauer (1996), 195, n. 365.

No excavations have yet been made beneath Constantine's forum, so the cistern attested there has not yet been located. The Theodosian cistern mentioned in the *Notitia* is perhaps to be identified with an open reservoir to the north-east of the Forum of Constantine on Bab-ı Ali Caddesi (F7/7), and may also be the same as the Cistern of Philoxenus attested elsewhere.[15] This open cistern and the Saraçhane (possibly that of Modestus) show how open reservoirs were a feature of the city within the Constantinian walls, as well as the three better-documented examples located outside. The Arcadian Cistern has not been identified. The reservoirs of Aetius, Aspar and Mokios all survive and are identifiable today as deep pits (C3/1, D4/6, B6/1). The sphendone of the Hippodrome still stands today, and its internal chambers attest to its conversion into the Cold Cistern of Anastasius (F8/5). The Basilica Cistern is to be identified with the Yerebatan Sarayı (G7/9). The cistern at *ta Armatiou* has not been located. The location of the Bronze Tetrapylon is known, but the only cistern yet discovered in its vicinity (F7/1) appears to date from the sixth century, not from the time of Phocas.[16] The cistern of Bonus is not certainly known, although it was a covered cistern close to the Church of the Holy Apostles.

Major cisterns known from literary sources with dates and the codes of those still extant

Modestiaca cistern (= Cistern of Archangel?)	D5/4?	363–369
Nymphaeum near the Forum of Theodosius		372–73
Underground cistern near Constantine's Column		406/7
Reservoir of Aetius (= Cistern of Pulcheria)	C3/1	12 February 421
Theodosian Cistern (=Cistern of Philoxenus?)	F7/7	before 425
Arcadiaca Cistern	D5/4?	before 425
Reservoir of Aspar	D4/6	459
Reservoir of Mokios	B6/1	built under Anastasius (491–518) ?
Cold Cistern at Sphendone	F8/5	built under Anastasius (491–518) ?
Basilica Cistern	G7/9	526/7
Palace Cistern		after 532
Cistern at *ta Armatiou*		built under Maurice (582–602)
Cistern near the Bronze Tetrapylon		609
Cistern of Bonus		built before 627

THE RESERVOIRS (OPEN CISTERNS)

General observations

The reservoir of Aetius, built in 421, may be considered in conjunction with those of Aspar (459) and Mokios (probably built under Anastasius), since all three of these huge reservoirs survive, all are located outside the Constantinian walls, but within the later Theodosian Land Walls, and can be identified with certainty.[17] The Aetius and the Aspar reservoirs are both situated on the Fifth Hill towards the north-west corner of the city. As we have seen, the Valens supply-line passed very close to them. The cistern of Mokios is situated on one of the highest points of the Seventh Hill, and the issue of its water supply is more problematic. The dimensions of the reservoirs are as follows:[18]

Aetius: 244 x 85 x 13–15 m (= 269,620–311,100 m^3)

Aspar: 152 x 152 x 10–11 m (= 231,040–254,144 m^3)

Mokios: 170 x 147 x 12 m (= 299,880 m^3)

If filled to capacity, the Aetius, Aspar and Mokios reservoirs could collectively have stored up to 865,124 m^3 of water, although it is perhaps unlikely that they ever reached such capacity. Çeçen, it may be noted, estimated that, for reasons of water pressure, the reservoir of Aspar could have withstood being

[15] See Bardill (1997), fig. 2.

[16] Bardill (2004), 128–30.

[17] Janin (1943). The identification of the Aspar reservoir is confirmed by Heron of Byzantium: see Appendix 1, and the comments of Mango (1995), 17 n. 41; Mango (1997), 50 n. 34; Sullivan (2000), 138–41, 265–7, fig. 41.

[18] See Cistern Concordance for references.

filled at most to a depth of 7.5 m, and the other cisterns to 9.5 m.[19] Working on that basis, the maximum total capacity of the three reservoirs would have been 607,715 m^3.

The open nature of such cisterns would have meant that the water stored in them would have been much less clean than that stored in closed cisterns. The water from the reservoirs is unlikely, therefore, to have been intended for the public fountains and industrial and agricultural purposes are often suggested. Indeed, the very location of the Aetius, Aspar and Mokios reservoirs suggests an agricultural connection, since much of the area between the old Constantinian walls and the Theodosian Land Walls was devoted to growing vegetables,[20] although such an interpretation does not take into account the two large open reservoirs within the Constantinian walls: at Saraçhane (D5/4) and on Bab-ı Ali Caddesi (F7/7) north-east of the Forum of Constantine. After the sixth century, it became more important to be able to grow some crops within the city's fortifications in case of siege, and the open cisterns will have been an important source for the irrigation of market gardens. Non-industrial societies have often shown clear preferences for differing sources of water, based entirely on empirical criteria of taste and clarity. This is clearly demonstrated in the writings of Frontinus and Vitruvius[21] on the appropriate water sources and their distribution, and this concern is maintained today in many Mediterranean communities. Following a lecture we gave in Istanbul in 2002 on the Byzantine water supply, Professor Halet Çambel, Turkey's senior prehistorian and herself a native of the city, observed that in her youth (seventy plus years ago) people would be able to identify a specific spring source from amongst the waters sold by the *sucular* (waterboys) in the city. Although the perceptions of water purity and quality are a cultural construct, it is clear that there were similar concerns in the ancient and modern Mediterranean worlds which might explain the two parallel channels found within the Bozdoğan Kemeri: one possibility is that one channel carried water from the Thracian springs, whereas the other was sourced from open reservoirs, the latter perhaps intended for a variety of uses ranging from irrigation to possibly the baths and other industrial functions, depending on the volume of flow from the main channels.[22]

Aetius reservoir (C3/1) and Aspar reservoir (D4/6)

The Aetius reservoir, now the Karagümrük football stadium, is situated on a narrow ridge between the Fifth and Sixth Hills, and the Aspar, the çukurbostan below Sultan Selim Camii, lies at the north-eastern edge of the Fifth Hill on a shelf-like promontory. As we have seen, there is a clear relationship between the projected course of the Thracian channel and the location of these two reservoirs. The Aetius cistern was located to the north of a concave curve of the channel, so that the channel (at 63 m above sea level) proceeds along the long, south-west flank of the Aetius cistern and then may have turned abruptly to the north-east, thus framing the site of this reservoir. The long rectangular shape of the cistern was presumably dictated by the fact that the slope of the ground down to the Golden Horn precluded a greater width, whereas the flat ridge and the course of the channel allowed a greater length. The Aspar cistern is located north of a convex curve in the path of the channel and was located in a less steeply-sloping area. It was square in plan.

Both reservoirs display a similar construction technique. Forchheimer and Strzygowski recorded that the reservoir walls were built of alternating bands of brick and stone-faced mortared rubble. At the Aetius reservoir, the brick bands were 0.35 m high, and the stone bands 1.8 m high. The north wall was 5.2 m thick.[23] At the Aspar reservoir, the brick bands were 0.5 m high, and the stone bands 1.2 m high (Fig. 6.2). The walls were of about the same

[19] Çeçen (1996a), 37.

[20] Koder (1995); see the account of Nikolaos Mesarites who describes the orchards and gardens surrounding the Church of the Holy Apostles, Downey (1957), 3.6. p. 863.

[21] See especially Vitruvius, Book 8; see the commentary and translation by Rowland and Howe (1999), 275, fig. 108.

[22] There remains the question of how water was extracted from the lower reservoirs, especially as their levels fell in the dry season. Procopius' comments on the Basilica Cistern (see Appendix 1) reveal the importance of the cisterns, both covered and open, for ensuring the sustainability of the Byzantine hydraulic water system. There is still concern in modern Istanbul about the purity and taste of the public water with the result that huge quantities of bottled water (often in large carboys) are sold within the city. Concepts of purity were clearly of concern to the Romans as Tacitus shows when telling of the opprobrium Nero received for bathing in the sources of the Aqua Marcia, whereby he 'polluted the sacred water and the sanctity of the spot', Tacitus, *Ann.* 14.22. See also the inscription of Honorius and Arcadius relating to the repair of the pools of the Aqua Marcia, Ashby (1935), 92–3,

[23] Forchheimer and Strzygowski (1893), 48–9.

FIG. 6.2 Aspar reservoir, showing later stone repairs on the right-hand wall.

thickness as those in the Aetius reservoir.[24] The south-west wall of the Aspar reservoir displayed a series of brick arches consisting of two courses of radially-laid bricks about 0.8 m high. Forchheimer and Strzygowski stated that these were the remains of niches or something similar, and accordingly introduced a series of buttressing niches into their ground plan.[25] It seems doubtful, however, that such niches existed, and the brick arches may simply have served as structural reinforcement. Stamped bricks have been found in both reservoirs. Those from the cistern of Aspar carry a tenth indiction year, which suggests that they were manufactured in 456/7, given that the *Chronicon Paschale* dates the building of the cistern to 459.[26] Those from the cistern of Aetius carry a third indiction year, which suggests that they were manufactured in 419/20, given that the cistern is said to have been built in 420/1.[27]

It is unclear precisely how water entered and exited these vast enclosures. None of the three intramural reservoirs today shows signs of either inflow or outflow points in the primary (fifth-century) phase of construction. Forchheimer and Strzygowski noted a channel broken through the north-west wall of the reservoir of Aetius near its west corner.[28] This measured 1.20 m high by 0.67 m wide, and was an inlet for a stream that was traced outside the reservoir. This may not be an original inlet channel, but nevertheless it is significant that the base of the channel was only about 6 m above the floor of the reservoir, suggesting the maximum capacity at later periods if not in the fifth century. It is conceivable, however, that originally the channel was a high-level outlet, such as is found at the Fildamı reservoir. The same scholars noted a channel running east from the middle of the south-west flank of the reservoir of Aspar.[29] This was presumably part of the channel from Thrace. We may assume that there was some way of diverting into the reservoir a proportion of the water flowing down the main channel bringing water from Thrace. No evidence for this is visible today. Water would certainly have entered a reservoir at a level higher than the highest intended capacity, so it is possible that evidence for inflow channels has been lost with the ruin and destruction of the uppermost parts of the reservoir walls.

In order to be able to drain a cistern to the bottom, outflows would have been required at the lowest levels. To withstand the huge pressures of water from above, these outflows and their sluice-gates must have been robustly constructed. Unfortunately the lower portions of the walls of the reservoirs, where such evidence would be located, are no longer visible, since debris has accumulated within the reservoirs and today ground-level all around the reservoirs rises to the height of the surrounding walls.

[24] Forchheimer and Strzygowski (1893), 46–7.

[25] Forchheimer and Strzygowski (1893), 47 with 46 figs 1 and 4. Similar relieving arches are a common feature of fortification walls in the fifth and sixth century, see the walls of Selymbria (Silivri) and Thessalonike; Crow (2001).

[26] Bardill (2004), 61, 109; see Bardill (2004), 50–1, table 2 for a discussion of indiction dating.

[27] Bardill (2004), 110.

[28] Forchheimer and Strzygowski (1893), 49 with figs 1–2.

[29] Forchheimer and Strzygowski (1893), 47.

How the pressure of water flowing out was controlled in the early period of the existence of these reservoirs is not certain, but it was presumably controlled by sluice-gates, although their location is not known. It may be significant that both the Aetius and the Aspar reservoirs are flanked by smaller closed cisterns (C3/2, D4/1). Although Forchheimer denied any connection between the reservoirs and their satellite cisterns,[30] it remains possible that these were somehow involved in the regulation of flow from the reservoirs.

In a later period, modifications were made to the Aspar reservoir. In particular, a cylindrical tower capped by a semi-dome was built in the north corner of the reservoir (Fig. 6.3).[31] The structure was built of alternating bands of brick and stone, which were not of similar heights to the bands in the walls of the reservoir itself, suggesting that it was an added structure. The stone bands contained occasional vertical bricks, a technique that suggests a Middle Byzantine date, probably after the late tenth century.[32] Putlog (scaffold) holes are visible in the surviving wall of the cylinder, and wooden cribwork has clearly rotted away within the structure.

At the Aspar reservoir, much of the tower has been destroyed, but clues as to the function of this structure come from a similar, better preserved, tower at the open Fildamı reservoir near Bakırköy. The Fildamı tower clearly served to reduce the pressure of water exiting the reservoir, and the tower at the Aspar reservoir presumably served a similar function.[33] At the Aspar reservoir, however, we have no indication of the existence of an internal cylindrical chamber, such as survives at the Fildamı. Excavations made to a depth of 5.5 m below present ground-level revealed no channels.[34] Furthermore, there is no trace in the walls that do survive of a spiral staircase in the outer chamber, as known at the Fildamı. It is not clear, therefore, how the pressure of the water was reduced in the earlier outflow systems in the Aspar and Aetius reservoirs. At the Fildamı, in the period before the tower was built, this appears to have been achieved by having outlets at various heights in the external walls, so that they could be opened as the water-level gradually declined. But we have no clear evidence that a similar system had originally been in place at the Aspar and Aetius reservoirs.

Fig. 6.3 Cylindrical tower in north corner of the reservoir of Aspar.

Bearing in mind the historical evidence, it seems likely that the reservoirs of Aetius, Aspar and Mokios, along with all the other cisterns along the Thracian line, fell out of use between 626 and 765 when that line was cut and subsequently repaired. The addition of the pressure tower to the reservoir of Aspar most probably took place after 766. The tower was built beside the north-west wall, close to the north corner of the reservoir, and if the location is significant, it is possible that the water was used to supply the north-west of the city, that is, the area around the Blachernai Palace. Mango points to an illustration in the tenth-century manuscript of Hero of Byzantium's *Geodesia*, which shows the reservoir

[30] Forchheimer and Strzygowski (1893), 47, 49.

[31] Photographs in Çeçen (1996a), 31, 33–7, 212.

[32] Çeçen (1996a), 35 wrongly compares the structural technique of the tower with that of the fifth-century Land Walls, and mistakenly suggests a date contemporary with that of the reservoir.

[33] See below for fuller discussion; see also the comments by Çeçen (1996a), 32–4, 35–7, 222.

[34] Çeçen (1996a), 34 with photos of the excavated tower on p. 35.

of Aspar filled with water.[35] This may be merely a convention, or it may be evidence that the cistern continued to be used at a late date. Repairs in the recessed brick technique at the south corner suggest attention in the tenth century, although it is not certain whether this indicates that the cistern was still in use for the storage of water, or whether the repairs were undertaken to prevent the walls of the reservoir collapsing onto an area put to a new purpose, such as market gardens.

The Mokios reservoir (B6/1)

The Seventh Hill of the city, which forms a triangle bounded by the Sea of Marmara, the valley of the Lycus, and the Theodosian Walls, was named the Xerolophos (the Dry Hill), possibly with good reason, since the main lines of the aqueducts of Hadrian and Valens were far away in the north of the city. A water channel is mentioned in this part of the city in the tenth-century *Book of Ceremonies*[36] and this almost certainly fed the reservoir of Mokios. It is likely, as noted before, that this channel was a branch off the main Valens line. The demand for water in this region may have been limited since, in addition to the main reservoir, we know of only three Byzantine cisterns in this area (B7/1, B9/1, C7/1). However, in area this is the largest reservoir either inside or outside the city, with a potential storage of nearly 300,000 m^3.

According to the *Patria*, the reservoir of Mokios was constructed in the early sixth century by the emperor Anastasius.[37] This testimony in such a late and often unreliable source has rightly been called into question.[38] Indeed, a brickstamp recorded by Forchheimer and Strzygowski *in situ* in the north wall of the reservoir is of typical fifth-century style.[39] However, this may have been old stock, given the discovery elsewhere in the structure of stamped bricks bearing a name-abbreviation of the late fifth or early sixth century. These stamps carried an eighth indiction and may therefore date to 499/500 or 514/15, thereby providing some support for the *Patria*'s assertion.[40] Structurally, the Mokios reservoir is somewhat different from the other two, a fact which may reflect a difference in the date of construction. As noted above, the walls of the Aetius and Aspar reservoirs display an alternation of bands of brick with bands of mortared rubble that are faced with neatly-squared limestone blocks[41] — a technique typical of the early fifth-century buildings in the city.[42] In the reservoir of Mokios, the structure is broadly similar, except for the fact that the brick bonding courses are themselves faced with stone — not with the small blocks that are used to face the mortared rubble, but with much longer, higher and deeper blocks.[43] The technique is therefore distinct from both the typical fifth- and sixth-century construction styles, but can be paralleled with the Anastasian construction of the Long Walls of Thrace, where similar stone bonding courses are apparent in the northern sector of the wall.[44]

The Fildamı reservoir

This reservoir is located outside the city in Bakırköy (the ancient Hebdomon), and is not attested in our texts.[45] Internally, it measures 127 by 76 m, and the walls are visible to a height of about 10 m (Fig. 6.4). In total area it is somewhat smaller than the other open reservoirs within the Land Walls and is only *c.* 1,000 m^2 larger in area than the Yerebatan Sarayı. It stands on the west side of a valley running northwards from the Sea of Marmara. Its west wall is buried within the valley side, and it was necessary to buttress the wall internally against the weight of the hillside (Fig. 6.5). This buttressing was achieved, as is not uncommon in Roman and Byzantine cisterns and retaining walls, by building it on a scalloped plan with nineteen niches, creating a series of projecting buttresses, bringing the thickness of the wall to 7.0 m.[46] The downhill, east wall, which is of the same

[35] Mango (1995), 17; Sullivan (2000), 138–41, 265–7, fig. 41.
[36] See Appendix 1.
[37] See Appendix 1.
[38] Mango (1995), 16.
[39] Bardill (2004), 175.1c, with 32 n. 80. This stamp was relocated by us at the foot of the wall.
[40] Bardill (2004), 32 with n. 80.
[41] Forchheimer and Strzygowski (1893), 46–9.
[42] Bardill (2004), 52–3.
[43] Forchheimer and Strzygowski (1893), 44–5.
[44] Crow and Ricci (1997), 245, n. 60.
[45] See Forchheimer and Strzygowski (1893), 50–1; Ergil (1974) for previous studies. See also Crow (2007a).
[46] As noted by Ergil (1974), 47.

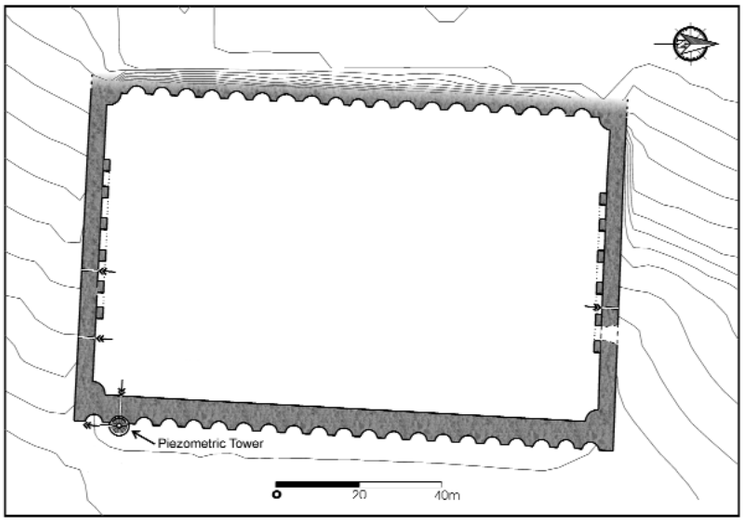

FIG. 6.4 Plan of the Fildamı reservoir.

FIG. 6.5 View of the interior of the Fildamı reservoir, with the scalloped buttress wall on the west side.

thickness, is, by contrast, free-standing,[47] but required twenty-one external niches forming intervening buttresses to retain the internal water pressure. The north and south walls (each of which has a double staircase on the interior) are narrower, at 4.10 m thick, and unbuttressed. The internal corners of the cistern are convex in plan, so as to further strengthen the structure from the internal water pressure. Such buttresses are not to be found in the other reservoirs in the city which were sunken into

[47] Ergil (1974), 42 states that the east wall was cleared of earth in 1968. This earth was perhaps post-construction accumulation, in which case the east wall was originally exposed, as is the east wall of cistern E5/2 on Atatürk Bulvarı, see Müller-Wiener (1977), figs 237, 244; the cross-section in Forchheimer and Strzygowski (1893), 50, fig. 4.2 indicates that there was soil build-up against both the west and east walls.

the existing ground surface, such as those of Aetius, Apsar and Mokios. Although it is not unusual to find bevelled corners in the covered cisterns of the city (such as the Yerebatan Sarayı), a convex corner is otherwise only known in the north-west corner of the large Unkapanı Cistern (E5/2). In addition, this cistern, like the Fildamı, has niches on its two long walls.

We do not know how the Fildamı was supplied. It is situated at a relatively low elevation and a number of springs further up the valley might have provided sufficient discharge. Alternatively, a channel might have been built, branching from the long-distance supply line or another source coming from Thrace. The reservoir is likely to have served the troops and animals that mustered before and after campaigns on the nearby *kampos* (the equivalent of Rome's Campus Martius).[48] Some of the water may have been piped to the nearby imperial palace at the Hebdomon,[49] and a channel was reported leading south of the structure.

Retaining walls

Two aspects of the planning and construction of the reservoir deserve further attention. In her study of the Fildamı,[50] Ergil noted examples of similar retaining walls from Constantinople, including the inner face of the south-west wall of the cistern of Aspar (D4/6), although, as explained above, this reconstruction seems doubtful; the interior of the west wall and the exterior of the east wall of cistern E5/2 in Unkapanı on Atatürk Bulvarı[51] (see Fig. 5.1); a small cistern at Baltalimanı on the Bosphorus; a retaining wall in Caferiye Sokağı (west of Haghia Sophia); and a similar wall east of Basilica B in Beyazıt.[52] It is possible that we should consider a roughly similar date for these cisterns.[53] The niches of the Unkapanı cistern are topped by semidomes, and the same is true of the southernmost niche in the east wall of the Fildamı (see Fig. 6.7). The other niches in the east and west walls of the cistern rose to a greater height than this particular niche, and are not topped by semidomes. Ergil suggested that they had once carried semidomes, but that these have all collapsed.[54] This seems an unlikely possibility, since, unless the loss was due to deliberate demolition rather than collapse, we would have expected to see some indication that the masonry had once risen to a higher level. The Fildamı cistern is built using an alternation of bands of brick and bands of mortared rubble faced with small stone blocks. In each band there are either five courses of brick or two to five courses of stone. The consistently small size of the bricks in this reservoir (about 330 mm square) could suggest a post-Justinianic date, and the apparent absence of brickstamps in the structure suggests a date after the end of the sixth century.[55] However the scalloped form of external and internal buttressing was an established form of Roman construction and was recommended by Vitruvius,[56] and is thus unlikely to be a significant chronological guide.

Water outlets

The builders needed to address the issue of extracting the water from the reservoir. It would be impossible to have a single outlet at a low level, since the pressure of the water would be so great that it would be difficult to control the rate of the outflow. One possible solution would have been to extract water close to the surface. That would have required outlets at regular heights, so that successively lower sluices could be opened as the water-level declined. On the inside of the reservoir, on both the north and south side, was a pair of staircases built against the wall (Fig. 6.6). The staircases in each pair descended from the wall-top in opposite directions (to the east and west), and were supported by an arcade of five blind arches of differing heights built against the wall of

[48] A suggestion also made by Demangel (1945), 50 n. 1 and Ergil (1974), 47. On the probable location of the *kampos*, to the south of the Fildamı, see Demangel (1945), 5–6 with fig. 1.

[49] On the palace, Demangel (1945); on the date of the destruction of this palace, see McCormick (1986), 155 n. 87.

[50] Ergil (1974), 47.

[51] Müller-Wiener (1977), figs 237, 244.

[52] Bardill (2004), 66 with fig. 6; fig. 17.

[53] Another possible indication that these two cisterns may be of broadly similar date is the brick-lengths, which in both cases are significantly less than material belonging to the fifth and early sixth centuries. At the Unkapanı cistern, the bricks measure 340–350 by 38–40 mm, Forchheimer and Strzygowski (1893), 71; those from the Fildamı are 320–330 mm square, Ergil (1974), 46; Bardill (2004), 39. For average dimensions of the fifth and sixth centuries, see Bardill (2004), 102–6.

[54] Ergil (1974), 45.

[55] On the masonry, see Forchheimer and Strzygowski (1893), 51 and Ergil (1974), 46. On the date, see Bardill (2004), 39; Ergil (1974), 47 is mistaken in asserting that the banded masonry style indicates that the cistern belongs in the same period as the reservoirs of Aspar and Aetios.

[56] Vitruvius 6.8.6–7; Rowland and Howe (1999), fig. 99, showing a dam from Mérida with similar arcuate, external buttressing; see the discussion of Roman cisterns in Chapter 9.

FIG. 6.6 Remains of the staircase against the north wall of the Fildamı reservoir.

the reservoir. These staircases were no doubt part of the original structure. Their function is uncertain, but it may be suggested that they served to give access to sluice-gates set at various heights in the north and south walls of the reservoir. However, if this were the case we would expect to have found a whole series of outlets at regular intervals down the stairs. In fact, only two outlets were noted in the south wall above the eastern staircase, and one in the north wall above the eastern staircase.[57] In the south wall, the floor of the eastern of the two outlets was 1.5 m above ground-level, and the more westerly outlet was at 4.35 m. Clearly, ground-level in the cistern has risen by about 1.7 m since Forchheimer and Strzygowski studied the cistern and produced an elevation of the interior of the south wall at its east end.[58] The lower outlet measured (on the interior) 0.65 m wide by 1.10 m high to the top of the arch. The opening was recessed into the wall and where the angles of the recess had not suffered, they measured 16 cm wide by 15 cm deep. They no doubt served to house a wooden sluice-gate. A channel 4.0 m long and plastered on the interior passed right through the thickness of the reservoir wall. The higher outlet at 4.35 m (or 6 m in Forchheimer and Strzygowski's day) was also recessed for a sluice-gate. On the exterior, where (because of the higher external ground level) the other end of the channel passing through the wall could be easily examined, the opening measured 0.65 m wide by 0.85 m high to the top of the arch. In the north wall, the arched opening was at the same level as the higher of the two channels noted in the south wall, and measured 0.65 m wide by 1.35 m high to the top of the arch; again, it was recessed. Neither we nor Ergil saw evidence for a second, more easterly and lower channel in the north wall, as shown in the elevation of Forchheimer and Strzygowski,[59] although such a channel would have corresponded with the position of the lower of the two channels in the south wall.

The pressure tower

At the southern end of the east wall of the cistern, within the penultimate curved recess, stands a cylindrical tower (Figs 6.7; 6.8). This was clearly a later addition to the structure: it is not bonded to the reservoir, it is built without the brick bands typical of the reservoir, and its coursed rubble stonework is less carefully dressed than in the walls of the reservoir.[60] Unlike that at the cistern of Aspar, this tower was built on the exterior of the reservoir. No doubt an external location was not adopted at the cistern of Aspar because that cistern is entirely buried, which means that deep excavations would have been necessary to construct an external tower. Presumably it was simpler to drain the reservoir than to conduct such excavations.[61]

It was possible to enter the tower at the Fildamı cistern, where some of the internal structures still survive; these were recorded by our colleague Paolo Bono in 2000. Entrance to the tower was achieved

[57] The positions of these three channels are also indicated in the plans and elevations of Forchheimer and Strzygowski (1893), 50 figs 1–3, and on the plan of Ergil (1974), 45.

[58] Forchheimer and Strzygowski (1893), 50 fig. 3.

[59] Forchheimer and Strzygowski (1893), 50 fig. 2, but unreported by Ergil (1974), 47.

[60] Although possible, it is not necessary to deduce, with Ergil (1974), 45, that the rough finish of the tower suggests that it was never intended to be visible.

[61] Çeçen (1996a), 37 states that there is extremely impervious clay soil in the area of the Aspar reservoir.

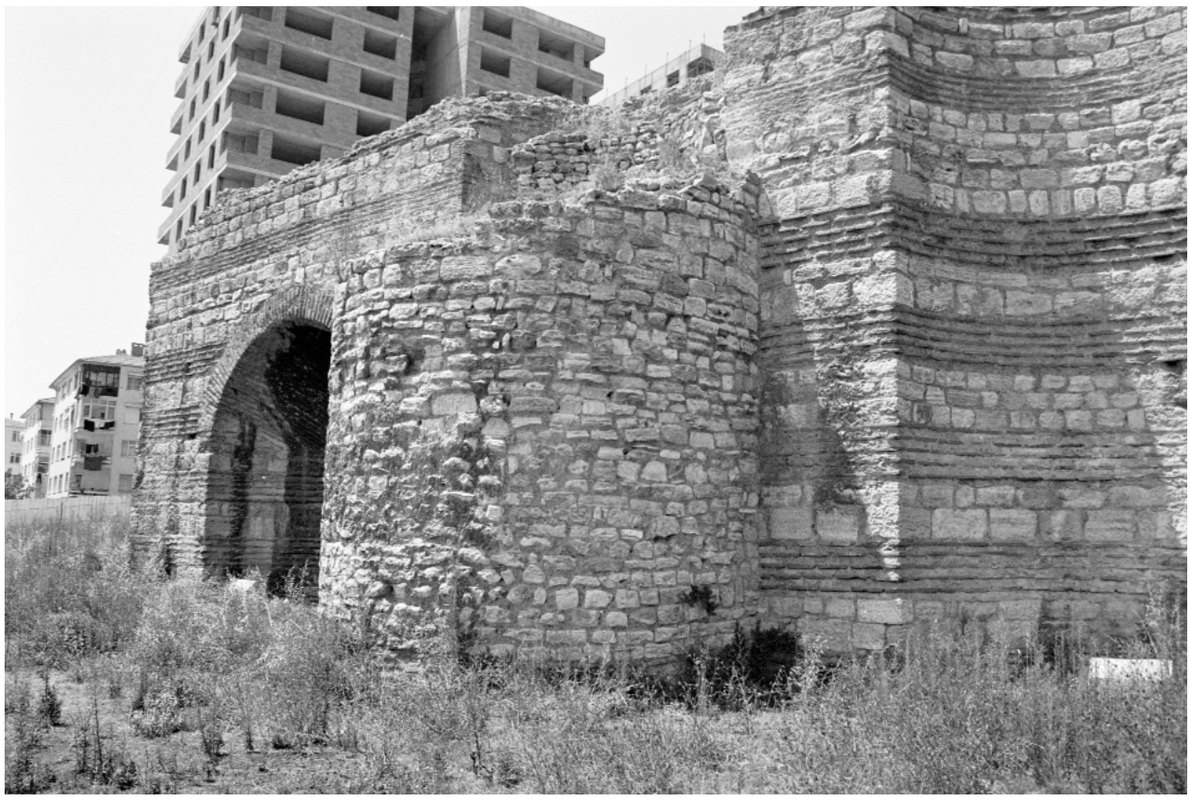

FIG. 6.7 (above) Water tower in the Fildamı reservoir.

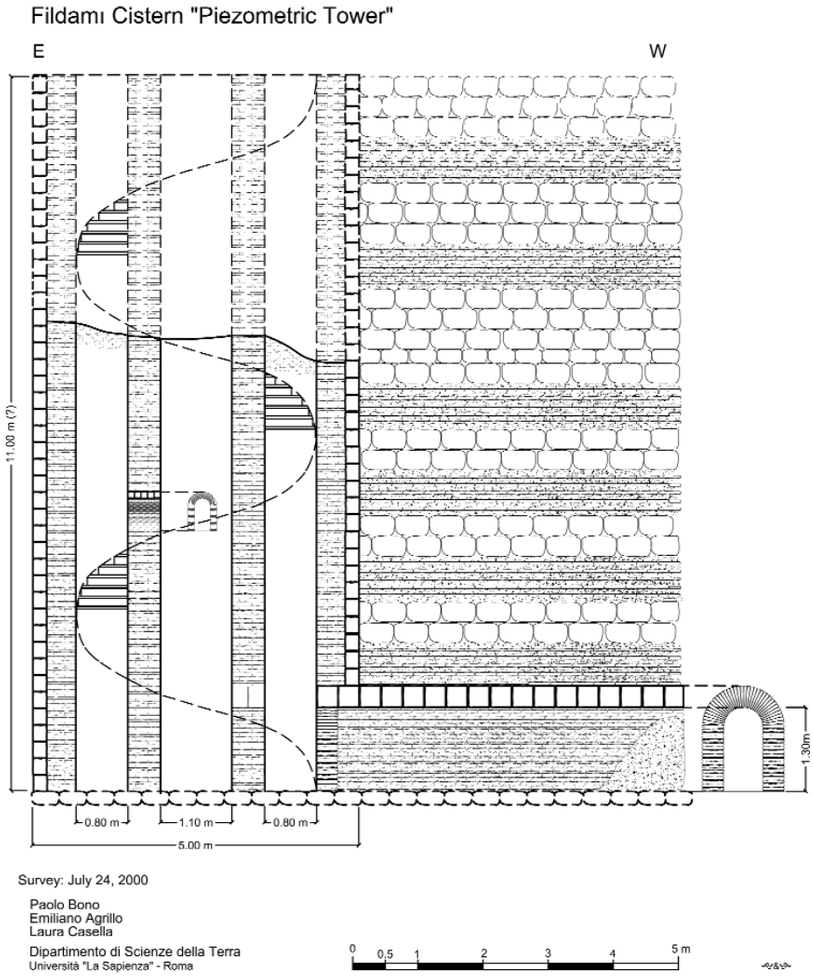

FIG. 6.8 (right) Sectioned elevation of water tower at the Fildamı reservoir. (By Paulo Bono)

from the interior of the reservoir through an arched opening 1.0 m wide at the foot of the east wall. From within, it was possible to observe that the tower consisted of concentric chambers, with a central shaft, 1.10 m in diameter, enclosed by an internal spiral staircase 0.80 m wide. The channel from the main reservoir led into the outer chamber with the staircase. At a high level in the wall of the central shaft were two small arched openings, 0.60 m high. The lower was 3.0 m from the floor of the tower, opening into the inner chamber, and a second was 4.0 m from the floor of the tower and opened in the west wall of the inner chamber. These openings were positioned so as to be accessible from the spiral staircase in the outer chamber, and we may assume that there were further openings at regular intervals allowing the water, which would have been at the same level as the surface of the reservoir, to spill over into the central shaft and exit it under a lower pressure along outflow channels leading away from the reservoir in different directions.

It is clear from the evidence discovered at the Fildamı that this tower was a pressure tower intended to allow for the distribution of water from the reservoir at a reduced pressure. Water flowed from the bottom of the reservoir through the 1.0 m-wide opening into the outer chamber and rose up the staircase to the same level as the water in the reservoir. The *hydrophylax*[62] of the cistern would descend the staircase within the outer chamber of the tower to the level of the water. He could then wade into the water to open the sluice just below the surface. The sluices were apparently placed at intervals of 1.0 m, so it would never be necessary to submerge oneself to open the sluice. The water would begin to pour slowly, and at low pressure, through the sluice and fall to the bottom of the inner chamber. From there it would flow out through a 0.90 m-wide tunnel. This form of pressure tower is not otherwise known in Roman cisterns or dams.

THE COVERED CISTERNS

Characteristics of construction

The covered cisterns of Byzantine Constantinople were predominantly brick-built, although there are a handful of exceptions where coursed rubble was employed alternately with brick bonding courses. The interiors of the cisterns were divided into bays with supports spaced generally 2–4 m apart. The roof supports were almost always columns. An exception is cistern D5/1 west of Zeyrek Camii (the Pantocrator Monastery), where the cistern roof was supported by two columns and ten stone-built piers with impost blocks in a six by two configuration. These piers seem to be a primary feature, not a later Ottoman addition, such as we find in the Nakilbent (F8/1). Brick arches spanned the gap between adjacent columns, and each of the square bays thus formed supported a brick dome between the arches.

The cisterns were clearly designed to contain a fairly large capacity of water. Most were largely subterranean, so that the surrounding earth contained the outward forces exerted by the water within. If, however, a cistern was built on a hillside, and so only partially embedded in earth, the exposed downward-facing walls were buttressed (as in the case of E5/2 in Unkapanı and D4/2 on Müftü Hamamı Sok.). Most were reinforced at the corners, which were typically angled or curved. The use of convex reinforcement (as at E5/2) may be a diagnostic feature of some of the later cisterns. The remains of sockets above the capitals in the cisterns attest to the use of wooden tie-beams between the supports, possibly to ensure that the structure would move uniformly in an earthquake.

It was important to keep the water aerated. If the exterior walls projected above the ground surface, windows would be inserted, invariably above the level of the column capitals. Such openings would also have provided a suitable overflow, should it have been required. The walls were plastered to just above the height of the openings. It is possible that many of the subterranean cisterns served as the substructures of buildings. This was certainly the case with the cistern established in the rotunda beside the Bodrum Camii, which served to support the palace of Romanus I (D7/2),[63] and it is also true of some of the cisterns whose plans clearly indicate that a now lost church once stood above them (D4/4a, D5/9, G6/16).[64] Very few covered cisterns within the city have been dated with any degree of certainty. Potential dating methods involve examination of masonry styles, of the style of the column capitals, and of brickstamps. Masonry style and brick dimensions

[62] The term used in *Cod. Iust.* 11.42.9; see Appendix 1.

[63] See also the comments of Betsch (1977), 41 (although note that the Yerebatan Sarayı was built later than the colonnaded Basilica above it).

[64] Berger (1997b); Ousterhout (1999), 165–9.

can provide some clues as to date, but must be used cautiously; brickstamps can give much more reliable indications where they have been discovered and recorded.[65]

Capitals are less reliable as dating evidence, since in most cases it cannot be firmly demonstrated that they were manufactured at the same time as the construction of the cistern. They may often have been reused or stockpiled and they can at best provide us with a *terminus post quem* for the date of construction. Betsch explains that spolia capitals can often be recognized by their condition. They may display blackened surfaces, suggesting that they were recovered from a burned building. They might also show physical surface-damage of varying degrees, such as weathering or breakages of projecting elements as a result of the collapse or careless dismantling of a building. Sometimes, however, they can appear to be in perfect condition or unfinished in the state in which they emerged from the quarries.[66]

By far the majority of capitals used or reused in cisterns belong to the fourth, fifth, and sixth centuries. This is the period during which the Proconnesian marble quarries were in operation. In cisterns built during this period, it was rarely necessary to reuse capitals because new material was readily available. Thus in the Binbirdirek cistern, for instance, all 224 columns were topped with a simple, deep, rounded impost; all are assumed to have been of recent manufacture (Fig. 6.9). In fact, the only certain occurrence of reused capitals in a cistern of late antique date is in the Justinianic Basilica Cistern.[67] Although most of the columns were topped by plain basket capitals, 98 carried acanthus capitals; whereas Betsch believes these also to be contemporary with the cistern, Mango claims that they were old stock that had been in storage since the fifth century.[68] Three Corinthian capitals were certainly reused, one dating to *c.* 200, another possibly to the time of Constantine.[69] In addition to capitals, other architectural sculpture was re-employed in the cistern, including a fourth-century column shaft with a lopped branch design[70] and inverted Medusa heads (probably of Severan date), which were used as column bases.[71]

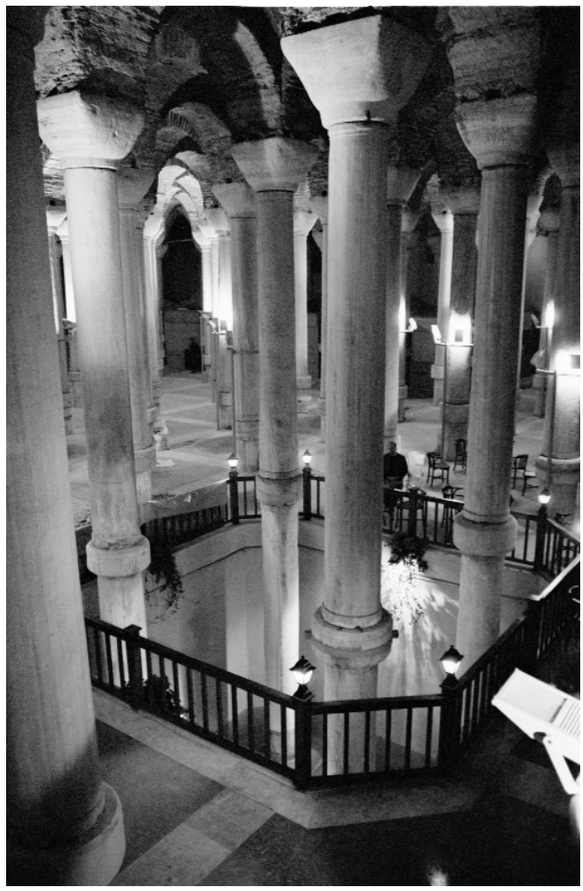

FIG. 6.9 Binbirdirek cistern.

Around 600, it seems that the Proconnesian quarries closed; as a result, builders had to rely on stockpiled materials or materials salvaged from ruinous or demolished structures.[72] Many spolia are likely to have been obtained from structures damaged in fires or earthquakes, in particular the colonnaded streets of the city.[73] Buildings other than cisterns that were constructed in this period display

[65] See now Bardill (2004), especially 52–3 (masonry style); 48, 102–6 (brick dimensions). Bardill (2004), 39–42 has argued that dated brickstamps ceased to be produced after the end of the sixth century and in many cases may be reused.

[66] Betsch (1977), 35–6.

[67] Betsch (1977), 251.

[68] Betsch (1977), 134, 233–4; Mango (1978), 123.

[69] Betsch (1977), 183–4, 251, 357.

[70] Mamboury and Wiegand (1934), 57; Mango (1978), 123.

[71] Mango (2004), 75.

[72] The phenomenon of reuse in this period has also been observed in the case of bricks, see Bardill (2004), 39–42.

[73] Betsch (1977), 42–9.

about the same number of new capitals as reused capitals of the late antique period. In the cisterns, however, the spolia capitals are in the vast majority, demonstrating the extent of the destruction of the buildings of the late antique city and the small scale of production in the middle and late Byzantine periods.[74] The figures compiled by Betsch for the capitals in the cisterns of Constantinople reveal just sixty capitals manufactured between 550 and 1453, as opposed to more than 1,150 capitals of the late antique period.[75]

From the point of view of dating the construction of the cisterns, it would be helpful to determine those which contain only late antique material (manufactured before 550), and which may therefore have been built in that period, and those which contain later material. Betsch identifies the following cisterns as containing one or more capitals manufactured after 550:[76] the cistern beside Bodrum Camii (D7/2), the İpek Bodrum (C3/2), the cistern east of Fethiye Camii (D3/2), the cistern west of Zeyrek Camii (D5/1), the cistern north of Nişanca Camii (C4/1), and the cistern in the American Bible House (F6/4). It may be instructive to summarize Betsch's observations in a number of these late cisterns.

The earliest surviving cistern dating after the closure of the quarries belongs to the early tenth century and was constructed within the fifth-century rotunda beside the Bodrum Camii (Myrelaion) (D7/2).[77] It was established by Romanus I Lecapenus (920–944), who built a palace on top of it. The capitals in the cistern are heterogeneous spolia of widely differing dates, ranging from the second half of the sixth century to the ninth century.[78] In the medium-sized İpek Bodrum cistern (C3/2) next to the reservoir of Aetius, stockpiled capitals were used as bases or as impost blocks, so as to increase the height of column shafts. Amongst the various styles of capital were Ionic imposts, Corinthian capitals (including the lyre-type), and double capitals. Two double capitals of the impost form published by Kautzsch are the latest capitals in the cistern, and therefore provide a *terminus post quem* for its construction in the eleventh or twelfth century.[79]

Another late cistern incorporating spolia is D5/1, west of Zeyrek Camii, which if it supplied the adjacent Pantokrator monastery is unlikely to have been built earlier than 1118. The twelve impost blocks upon the ashlar piers cannot be dated, although nine have a cross on opposite sides. Of the two capitals in the cistern, the double capital is believed to be of Justinianic date, on the basis of its shape and carving, and the other capital seems to be a copy of a Justinianic composite capital, made perhaps in the seventh century.[80]

Cistern F6/4 is very small, with only four columns. There is one plain Ionic impost block; two Ionic impost capitals with identical decoration, deeply undercut, and datable to the Justinianic period on the basis of similar firmly dated examples; and a third Ionic impost capital whose decoration appears to be an imitation of the Justinianic capitals in low relief by a sculptor who did not understand the late antique forms well enough to reproduce them. The imitation perhaps dates to the second half of the sixth century, but it is uncertain how much later than 550–600 the cistern was built.[81]

The known cisterns containing capitals that have been dated after 550 are relatively few in number, and the vast majority (so far as we know at present) would seem to contain only capitals dating before 550. That need not mean, however, that the cisterns themselves mainly belong to the early period, since capitals of early manufacture may well have been reused at much later dates, when, as we have seen, the quantities of new capitals being made had reduced dramatically.

Inflow and outflow channels

Despite the detailed nature of the studies undertaken on the city's Byzantine cisterns, very little evidence has emerged for the methods of supplying water to, and extracting water from the cisterns. At the small Bible House cistern above Sirkeci (F6/4), a single terracotta inflow pipe entered through one of the vaults, clearly an original feature. By contrast, water entered the large Unkapanı cistern (E5/2) through an

[74] Betsch (1977), 253.
[75] Betsch (1977), 254–5, 357–61.
[76] Betsch (1977), 357–61.
[77] Betsch (1977), 251–2.
[78] Betsch (1977), 108–17.
[79] Betsch (1977), 99–108.
[80] Betsch (1977), 80–92.
[81] Betsch (1977), 92–9.

elevated channel which surrounds the main chamber at gallery level, and probably connected at the south-west side.[82] The substantial and deep cistern which lies to the north-west of the Fatih Camii (D5/5) has three openings high in the walls: two of these, in the north-east corner and in the north wall, were described as later openings by Forchheimer and Strzygowski.[83] Only the narrow opening in the west wall was interpreted by them as an original feature. Since this faces in the direction of the projected channel route, we can suppose that this represents an inflow channel; unfortunately no dimensions were given. Andréossy notes that at the cistern by the Stoudios monastery (B9/1), it was possible to see the channel exiting the cistern 'à trois pieds audessus du sol' (presumably the contemporary ground surface) and entering at the level of the springing of the vaults.[84]

As for outflows, within the Nakilbent cistern (F8/1) there remains a (now blocked) low rectangular opening, topped by a stone lintel, at the south end of the east wall of the structure. In the small cistern with two columns that serves as the bar of the Konuk Evi Oteli (G7/16), we noted a brick-vaulted outflow channel in the south-west wall, measuring 0.49 m wide and 0.57 m high to the top of the vault. As Gilles noted in his discussion of the Yerebatan Sarayı quoted at the opening of this chapter, a common way to draw water was from a shaft, using the cistern like a well. Examples are well documented in earlier contexts from Delos, Pompeii, and Herculaneum from household cisterns.[85] Examples of vertical shafts through the vaults of the cisterns are known from Constantinople; although the majority are likely to represent later alterations to the structure,[86] at some churches, like the *Chora*, they are clearly contemporary.[87] Open access was, however, an important feature of many of the surviving Constantinopolitan cisterns, both covered and open, as illustrated by the stairs in the Fildamı, Yerebatan Sarayı (G7/9), Unkapanı cistern (E5/2) and others; but notably at D4/1, east of the Aspar, and C3/2, the İpek Bodrum, the steps stop 2.5 m short of the cistern floor, suggesting that drawing water was a more important function than access for maintenance.

The contribution of groundwater and rainwater

So far, an assumption has been made that the city's water supply was provided entirely from external sources. In the light of the large number of cisterns in the city and the substantial proportion that were associated with standing structures, it is necessary to assess the potential contribution of rainwater-harvesting from rooftop run-off for the city's water provision. Examples of cisterns from elsewhere in the ancient world would indicate that rainwater had an important role in the filling of cisterns, especially those directly associated with domestic households.[88] Recent studies from Pompeii have shown how far the city was reliant on wells and cisterns for domestic water and that the provision of piped water from the Aqua Augusta was to a large extent intended to fulfil the needs of water used in gardens for display rather than domestic consumption.[89] On Delos, for example, the majority of the main town-houses incorporated a large cistern below the peristyle court, clearly a major source on an island of few wells or springs, and the potential catchment of the cavea of the theatre was channelled into a larger vaulted cistern. Significantly, on the neighbouring island of Syros many of the town-houses of nineteenth-century Hermoupolis continued to rely on deep cisterns built within the foundations. Another factor is the direct association of cisterns with churches, clearly shown in Constantinople, where examples of the Middle Byzantine period include cisterns below the parekklesion of the Kariye Camii (C3/6), the naos of the Eski İmaret Camii (D4/5), and the lost anonymous churches recognized from the plans of the surviving cisterns beneath them

[82] Similarly, two blocked openings can be seen high in the south-east wall of a cistern lying 100 m to the north of the Basilica Cistern (G7/15).

[83] Forchheimer and Strzygowski (1893), 74–5, (D5/5).

[84] Andréossy (1828), 452–3; see also the recent study of the middle Byzantine church and cistern at Küçük Yalı by Alessandra Ricci, where there is clear evidence for the pipes leading into the cistern (2003).

[85] See Jansen (1991).

[86] e.g. C4/1.

[87] Ousterhout (1999), 167, fig. 129.

[88] The specific question of cisterns in Rome is discussed further in the final chapter.

[89] For cisterns in Pompeii, see Eschebach (1979); for domestic use, see Sear (2004), 165–6; Jones and Robinson (2005); for Carthage, see Wilson (1998), especially 71–7.

[90] Forchheimer and Strzygowski (1893), 106–7; 80–1; Berger (1997b); Ousterhout (1999), 165–9; see also Dagron's comments on cisterns associated with churches and other monuments in his discussion of the alleged cistern below Haghia Sophia (1984b), 283, n. 80, the sources for which (including Covel's important seventeenth-century account) are collected in Appendix 1.

(D4/4a, D5/9, G6/16).[90] An especially interesting example may be seen at the so-called 'Palace of Theophilus' at Küçükyalı in the Asiatic suburbs of the city. Recent survey and excavations have led Alessandra Ricci to argue that what had formerly been interpreted as an audience hall influenced by Abbassid palace architecture, was in fact the remains of a large cistern located beneath the atrium of a prominent church dating from the ninth century.[91]

In the case of Küçükyalı rainfall is likely to have made a significant contribution; indeed Ousterhout has argued that in many of the cases where cisterns underlie middle Byzantine and later churches there is clear evidence for collection of water from roofs, which he interprets as a response to the demise of the 'the public system of works' so that 'private institutions included their own systems for the collection and storage of water'.[92] However these cisterns are quite modest in comparison with the great cisterns in the city and it is worth attempting some calculations to model the potential discharge of rooftops of major buildings within the city. A suitable test case is a reasonably substantial L-shaped cistern (G7/5), possibly associated with the Hospice of Samson, situated between Haghia Sophia and Haghia Eirene on the southern edge of the First Hill. The relationship of this cistern to the projected lines of the water channels of Valens and Hadrian is significant, since it is of higher elevation than the Belgrade Forest line and is separated from the long-distance line by the saddle between the Second and First Hills. A possible solution as to how this cistern and those behind the Archaeological Museum might have been supplied has already been discussed in Chapter 5. The alternative possibility that it was supplied by rainwater will be considered here.

In order to provide a rough estimate of the potential yield of the rooftops, a simple calculation (with a significant number of assumptions) can be made. The mean annual precipitation in Istanbul over the last forty years is 640 mm.[93] The combined surface area of the roofs of the churches of Haghia Sophia and Haghia Eirene can be estimated from the area of the ground plans as approximately 5500 m².[94] This results in an optimum yield of 3520 m³ per year. It is, however, unlikely that more than 70 per cent of the maximum yield could have been collected, taking into account evaporation and inefficiencies in collection systems (the latter particularly after flash storms). A more realistic estimate for the yield is, therefore, approximately 2500 m³ per year. The cistern between the two churches, which has a surface area of approximately 2000 m² could therefore have been filled to a maximum depth of 1.25 m in a year, assuming it relied for its supply wholly on the neighbouring rooftops of two of the largest buildings in the city. Assuming that there has not been a dramatic climate change since antiquity, this evidence is sufficient to effectively rule out the significance of rainwater run-off from anything other than the humblest of cisterns in private residences.[95]

Despite these reservations, it remains significant that many cisterns are associated with churches, although the scale of such cisterns may reflect more the needs of the church and the Christian community that it served than the potential run-off from the roof and paved areas such as atria.

Storage capacity

Two principal factors affect our ability to accurately calculate the storage capacity of Byzantine Constantinople's cisterns and reservoirs. First, we cannot accurately assess the number of cisterns functioning in the city at any one time. There are undoubtedly a number of substantial and very many minor cisterns that either no longer exist or remain to be discovered. Some of these are known through historical sources, but many others are unmentioned in our texts. Second, we can only propose the *maximum* capacity for any given cistern, whereas we cannot determine how far and how frequently this was achieved. The principal indicator for the maximum capacity of a cistern is provided by the height of surviving hydraulic mortar. The cisterns of Constantinople were plastered to about the springing of the vaults. This corresponds with the height of ventilation openings in many cisterns which would dictate the maximum fill level. One interesting case that may be cited is the cistern lying beneath a terrace east of the apse of the Fethiye Camii (D3/2). When Forchheimer and

[91] Ousterhout (1999), 167.

[92] Ousterhout (1999), 167, figs 126, 127, 130.

[93] Data from www.weatherbase.com (06/8/02).

[94] Haghia Eirene *c.* 1700 m², Haghia Sophia *c.* 3800 m².

[95] The same conclusion was reached by Andréossy (1828), 442: 'On ne pense pas que les eaux que les citernes tenaient en réserve fussent simplement des eaux de pluie; la quantité qui en tombe annuellement à Constantinople, est trop peu considérable pour qu'elle eût été en état de les remplir.'

Strzygowski recorded this cistern, they noted the absence of any windows but also observed that the columns and even the capitals were covered with sinter.[96] Unfortunately it was not possible to measure the full depth of this cistern as a result of the accumulation of debris inside. Therefore, while the height of the hydraulic mortar indicates the maximum water level of the cistern, the presence of sinter reveals the actual height reached by the water, at least during its latest periods of usage. Gilles, too, refers to the Yerebatan Sarayı becoming filled with water in the winter 'up to the middle of the capitals'.[97]

SUPPLYING WATER

Over 150 lead fistulae, many with stamps, survive from ancient Rome, evidence for the widespread distribution and supply from public reservoirs to private households and baths.[98] By contrast, only one stamped fistula is known at Constantinople — intended to supply a water fountain close to or inside the Serpent Column in the Hippodrome.[99] Ancient texts, especially up to the seventh century, give some information about the pipes that distributed water from the cisterns to the residences, baths, fountains, churches, monasteries, and hospices around the city. A law addressed to the city prefect Clearchus in 382 attempted to clarify the hierarchy of water privileges to individual properties. The quantity of water permitted was expressed in terms of the diameter of the supply pipe and was determined according to the status of the inhabitant, the scale of his residence, and the existence and extravagance of the associated bathing facilities. Thus a house with an elegant private bath could be supplied by a 2-inch pipe, although if the owner was of sufficiently high rank this could be increased to a 3-inch pipe. Lower-status properties with bathing facilities were allowed a pipe of 1½-inch diameter, whilst those without baths were allowed a pipe of just ½ inch.[100] A law of Justinian granted 'three ounces of water per day' to the nunnery of Olympias. Mango is probably correct in suggesting that this pertains to the provision of a 3-inch pipe; in this case the nunnery would have received the same quantity as a high-status private residence with a luxury bath.[101]

A law issued by Theodosius I and Valentinian refers to the lead pipes supplying the hot baths of Achilles. These baths were no doubt supplied by the Hadrianic line, since an earlier section of the law concerns that supply line, and since the Baths of Achilles were in the Strategion, which the Hadrianic line would certainly have supplied. These pipes are clearly of different dimensions to the *megiste holkos* of lead recorded by Zonaras from the time of Justinian; as noted before, this is more likely to be from a siphon than a private supply.[102]

Manuel Chrysoloras's account of the old and the new Rome describes 'the public water-pipes (*dēmosioi hyponomoi*), of which a great many also exist there (in Constantinople)', although there is little well-documented archaeological evidence for the channels within the city.[103] Perhaps the most significant finds are the marble pipes found in 1964 during the construction of a pedestrian underpass below Yeniçeriler Caddesi near Kara Mustafa Paşa Medrese in 1964.[104] The pipes were located below the ancient Mese about half-way between the Forum Tauri and the Forum of Constantine.[105] Two parallel conduits were discovered. The sections of pipe were cut from marble blocks, some from old column shafts and capitals, and then cemented together with white mortar. Each section was inscribed with a name in large letters. Since their upper sides showed wear, the pipes would have been buried only down to the level of the surface of the road. Fıratlı reports that in one section of pipe there were holes closed tightly with stones. He believed that these were in order to clean the pipelines or to connect a secondary line. Given that some of the holes were plugged with stones, however, it is possible that they in fact functioned as adjustable vents to the atmosphere to help maximize flow rates.

[96] Forchheimer and Strzygowski (1893), 74–5. This cistern was inaccessible in 2001, although it probably still survives intact.
[97] Gilles (1561a), 2.20; see Appendix 1.
[98] See the recent survey of the evidence in de Kleijn (2001); see also Ortloff and Crouch (2001) for Ephesos.
[99] Madden (1992), 117 and Bassett (2004), 224–7; see Appendix 1; *PLRE* 1, 1009.
[100] *Codex Theodosianus* 15.2.3 (22 June 382); see Appendix 1; note the difference from Frontinus' Rome where a pipe's discharge was measured in *quinaria*, although he notes how inches were still used to measure the diameter of pipes in Apulia, 24.1–2.
[101] Mango (1995), 37, 17.
[102] Zonaras, *Hist.* 3.157; see Appendix 1.
[103] Manuel Chrysoloras, *PG* 156, 44A-B, writing *c.* 1400; see Appendix 1.
[104] Fıratlı (1964), 209–10.
[105] Müller-Wiener (1977), figs 303 and 305.

FIG. 6.10 Pipes at the entrance to the Antik Hotel (E7/5).

Such vents are necessary in order to avoid partial vacuums developing in the pipe where the slope of the conduit alters. Similar vents have been noted, for instance, in pipelines from the Fountain House at Ephesus, where some of the holes were plugged indicating, according to Ortloff, some trial and error in their positioning to achieve the best performance.[106] Some years before 1964, reports Fıratlı, these same stone conduits had been seen further west at the Singer Building, the Beyaz Saray, the foundation of the building beside the Marmara Theatre, and at the corner of Mithat Paşa Sokağı. 'It is understood', he adds, 'that they continue westward near the Beyazıt baths and from there follow to the north in the direction of Bozdoğan Kemeri street. In this district pipelines have been seen before. It can be consented that these pipes are remains of the high pressure water system that distributed water within the city that came from the Valens aqueduct.' If this information is correct, it may provide a reason for thinking that Bozdoğan Kemeri Caddesi followed the course of a Byzantine street.[107] Elsewhere water pipes are found in a number of locations in the city — for instance those displayed in the entrance to the Antik Hotel near the Forum of Theodosius, where the cistern is used as a disco (E7/5) (Fig. 6.10). Outside the city at the Hebdomon, Demangel describes a vaulted passage, 0.88 m wide by 2.15 m high and about 40 m long, taking water from a cistern to a lost edifice on the shores of the Sea of Marmara, on the cape identified as the Magnaura.[108]

The final component of the urbanized water system ensured the completion of the water cycle and carried away the waste waters from the streets and roofs, uncollected in the cisterns, and the waste products of the human population. This was achieved by means of sewers and storm-water drains laid below the surface of the streets. The main literary reference to sewers is in the late text of the *Patria* which, as usual, attributes most of the main elements of the city's infrastructure to Constantine the Great,

> He (Constantine) also brought the aqueducts from Bulgaria, and he built vessels of mortared rubble (*karabos enkhorēgos*) all over the city that are as deep as the porticoes are high in order that there be no stench and no occurrence of many diseases but rather that the stinking substances run through and run down to the sea.[109]

It is likely that examples of the sewers and other drains will continue to be encountered in building

A BIBLIOGRAPHICAL CONCORDANCE OF CISTERNS IN ISTANBUL

By Jonathan Bardill

In the corpus of cisterns published by Forchheimer and Strzygowski in 1893, street names and house numbers are often given to indicate the location of a cistern. Many of the streets retain the same or similar names today, others can be identified on the insurance maps of J. Pervititch made in the 1920s and 1930s.[111] Of particular help when the names and layout of the streets have changed are Forchheimer and Strzygowski's regular references to the numbers on C. Stolpe's map of 1866 (revised 1880), which give

[106] Ortloff and Crouch (2001), 849 with fig. 3.

[107] *contra* Bardill (2004), 131, n. 191.

[108] Demangel (1945), 47, see p. 6, fig. 1 for location and pl. VIII for plan.

[109] *Patria* 1.69–70, ed. Preger II, 149; see Appendix 1. Bardill suggests that the brickstamps associated with these drains along the Mese date between the mid-420s and the end of the 460s: (2004), 77–8, 110–11, table 20.

[110] Müller-Wiener (1977), fig. 288 shows the sewers A A and B B in the cross-section at the Forum of Constantine. Significant waste-water drains have been discovered in the current excavations on the Harbour of Theodosius at Yeni Kapı; we are grateful to Dr İsmail Karamut, director of the Istanbul Archaeological Museum, for this information.

[111] For excellent reproductions of Pervititch's maps, see Ersoy, Anadol *et al.* (2001).

an indication of the location of each cistern they write about.[112]

Stolpe's map formed the basis of the later map accompanying A. M. Schneider's *Byzanz* (1936). That was in turn updated by W. Kleiss (1965a). The most up-to-date topographical maps of the city are those appearing as figures in the text of W. Müller-Wiener's *Bildlexikon zur Topographie Istanbuls* (1977). There, the cisterns are indicated with the prefix 'Zist.' and are designated according to the grid-square in which they fall. The grid-squares themselves are indicated on the 1:10,000 map of the entire city at the end of the volume. It should be noted, however, that the numbering system used to designate monuments (and certain major cisterns) on the 1:10,000 map, which is at first sight similar to that used on the figures in the text, is in fact a completely different referencing system and irrelevant for our purposes.

The purpose of this concordance is to gather together much of the scattered bibliography concerning archaeologically attested cisterns in Istanbul, so as to make it easier to ascertain the various places in which the same cistern has been published. The systematic referencing system established by Müller-Wiener has been adopted, since it can be expanded as required, and the cisterns are plotted on the accompanying maps produced by Richard Bayliss (Maps 12–15).[113]

Cisterns that do not appear on Müller-Wiener's figures (whether discovered more recently or simply omitted) have been given new designations following the principle of Müller-Wiener's scheme. These reference numbers have been used throughout this volume. Since Müller-Wiener's grid does not extend outside the city walls, and omits parts of Galata and the Asiatic suburbs, it has, in the case of a very few cisterns, been impossible to give them reference numbers. An asterisk indicates cisterns whose precise location cannot be mapped.

The corpus cannot pretend to be exhaustive since cisterns continue to be discovered and it has not been possible to incorporate some of the most recent literature. Nevertheless, it may serve as a framework for future study.

CISTERN CONCORDANCE

Extra-mural

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Fildamı reservoir	Ergil 1974 Fıratlı 1969: 192 Forchheimer and Strzygowski 1893: 50–1 no. 4 Janin 1964: 205–6, no. 5 Mamboury 1925: 476–7
	*Cistern at Kasım Paşa	Forchheimer and Strzygowski 1893: 113 1
	Cistern on Sıraselviler Caddesi	Bardill 2004: fig. 14 Mamboury 1951: 430–1
	Cistern at Fenerbahçe	Janin 1964: 206 no. 6
	Cistern at Baltalimanı	Ergil 1974: 47 (mentioned)
	Cistern 600 m south-east of Fildamı	Demangel 1945: fig. 1
	Cistern near Cape Magnaura in the Hebdomon	Demangel 1945: 49 with figs 1, 33–5 and pl. VIII Janin 1964: 215 no. 50

[112] Thanks are due to Nicola Beech of the Map Library in the British Library for providing a copy of the key to Stolpe's map (Stolpe 1867). The importance of the references to Stolpe's map that are given by Forchheimer and Strzygowski (1893) is illustrated by the error in Berger (1997a). Berger claims that the location of Forchheimer and Strzygowski's cistern no. 81 is difficult to ascertain. Yet Forchheimer and Strzygowski's reference to Stolpe (1867), no. 59 clearly indicatesthat this cistern was located near the junction of Haliç Caddesi and Yeşil Sarıklı Sok. (and the position is thus correctly indicated by Schneider (1936) and Kleiss (1965a) no. 86, contrary to the assertion of Berger (1997a), 455, n. 2). Thus it appears that Müller-Wiener (1977), 409 is correct to indicate that this cistern was beside another on Haliç Caddesi (mentioned by Berger (1997a), 460 and Özgümüş (2001), 146). The two adjacent cisterns are here referred to as D4/4a and D4/4b.

[113] For a discussion of the terraces marked on Maps 12–15 see Crow (2007b).

Intra-mural

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
B6	Mokios reservoir (B6/1)	Andréossy 1828: 453 Çeçen 1996a: 28–41 Forchheimer and Strzygowski 1893: 44–5, no. 1 Gilles 1561a: 1.18 Janin 1964: 205 Kleiss 1965a: map Ce Mamboury 1925: 477 Müller-Wiener 1977: endpaper map B6 Stolpe 1867: no. 7b.
B7	Cistern (B7/1) south of Mokios reservoir	Kleiss 1965a: map Be (unnumbered) Müller-Wiener 1977: 363
B9	Cistern (B9/1) south of Stoudios basilica	Andréossy 1828: 452–3 Auzépy and Grélois 2001: 136, fig. 73 Forchheimer and Strzygowski 1893: 66–7 no. 11 Gilles 1561a: 4.9 Janin 1964: 215 no. 49 Kleiss 1965a: no. 93 Mamboury 1925: 486–7 Müller-Wiener 1977: 147, 151 Schneider 1936: 88 plan B9 Stolpe 1867: no. 51 Tonguç 1990: 42–3
C1	Cistern (C1/1) in Anemas Tower	Forchheimer and Strzygowski 1893: 108–9 no. 38 Kleiss 1965a: no. 78
	Cistern (C1/2) near İvaz Efendi Camii	Forchheimer and Strzygowski 1893: 108–10 no. 39
	Cistern (C1/3) west of Atik Mustafa Paşa Camii	Stolpe 1867: no. 2
C3	Aetius reservoir (C3/1)	Andréossy 1828: 454 Çeçen 1996a: 28–41 Forchheimer and Strzygowski 1893: 48–9 no. 3 Gilles 1561a, 4.4 Janin 1964: 203–4, no. 1 Mamboury 1925: 476 Müller-Wiener 1977: 278 Stolpe 1867: no. 7 Tonguç 1990: 45
	Cistern (C3/2) İpek Bodrum	Andréossy 1828: 454 (Djin-Ali-Kiochki) Betsch 1977: no. 10 (pp. 99–108) Forchheimer and Strzygowski 1893: 64–5 no. 10 Janin 1964: 213 no. 26 Kleiss 1965a: no. 82 Mamboury 1925: 481–2 Müller-Wiener 1977: 164, 167, 189, 281 Schneider 1936: 88 plan C3 Stolpe 1867: no. 9
	Cistern (C3/3) beneath Odalar Camii	Forchheimer and Strzygowski 1893: 108–9 no. 36 Kleiss 1965a: no. 81 Müller-Wiener 1977: 167
	Cistern (C3/4) east of Kefeli Mesc.	Forchheimer and Strzygowski 1893: 102–3 no. 31 Kleiss 1965a: no. 80 Müller-Wiener 1977: 167 Schneider 1936: 88 plan C3

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (C3/5) Löküncüler Cad.	Forchheimer and Strzygowski 1893: 102–3 no. 32 Kleiss 1965a: no. 98 Schneider 1936: 90
	Cistern (C3/6) beneath Kariye Camii	Forchheimer and Strzygowski 1893: 106–7 no. 35 Kleiss 1965a: no. 79
	Cistern (C3/7) south of Kariye Camii	Gerlach 1674: 455–6 Ousterhout 1985: 120 with fig. 3
	*Cistern (C3/8) north of Kara Gümrük Camii	Andréossy 1828: 453–4 Forchheimer and Strzygowski 1893: 112 f and g
	*Cistern (C3/9) near Edirne Kapı	Forchheimer and Strzygowski 1893: 114 t
	*Cistern (C3/10) in Kurt Ağa Çeşmesi Caddesi	Forchheimer and Strzygowski 1893: 114 s
C4	Cistern (C4/1) north of Nişanca Camii	Forchheimer and Strzygowski 1893: 84–5 no. 20 Kleiss 1965a: no.83 Schneider 1936: 88 R
	*Cistern (C4/2) south-west of Fethiye Camii	Forchheimer and Strzygowski 1893: 114 r
C6	Cistern (C6/1) under Fenari İsa Camii	Forchheimer and Strzygowski 1893: 114 v
C7	Cistern (C7/1) north of Hekimoğlu Ali Paşa Camii	Andréossy 1828: 453 (wrongly with 6 columns) Forchheimer and Strzygowski 1893: 96–7 no. 27 Kleiss 1965a: no. 92 Schneider 1936: 88 plan B7
D3	Cistern (D3/1) in Köröğlü Sok.	Forchheimer and Strzygowski 1893: 88–9 no. 22 Kleiss 1965a: no. 76 Müller-Wiener 1977: 167 Schneider 1936: 87 K
	Cistern (D3/2) east of Fethiye Camii	Forchheimer and Strzygowski 1893: 74–5 no. 15 Janin 1964: 213 no. 25 Kleiss 1965a: no. 77 Müller-Wiener 1977: 167 Schneider 1936: 88 plan D3
	Cistern (D3/3) west of Fethiye Camii	Forchheimer and Strzygowski 1893: 113 p (possibly) Kleiss 1965a: no. 77 Müller-Wiener 1977: 309 Schneider 1936: 88 plan D3 Wulzinger 1913: 374–6
	Cistern (D3/4) at Sinan Paşa Mescidi	Özgümüş 2001: 149 fig. 15
	*Cistern (D3/5) in Tabak Yunus Sok.	Forchheimer and Strzygowski 1893: 113 o
	Cistern (D3/6) below Fethiye Camii	Hallensleben 1963–1964: 146–56, pls 62–4 Müller-Wiener 1977: 135
D4	Cistern (D4/1) east of Aspar reservoir	Betsch 1977: no. 9 (pp. 59–79) Çeçen 1996a: 28–41 Forchheimer and Strzygowski 1893: 62–3 no. 9 Kleiss 1965a: no. 84 Mamboury 1925: 487–8 Schneider 1936: 88 L Stolpe 1867: no. 11
	Cistern (D4/2) on Müftü Hamamı Sok.	Forchheimer and Strzygowski 1893: 72–3 no. 14 Kleiss 1965a: no. 87 Müller-Wiener 1977: 193 Schneider 1936: 88 M

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (D4/3) in Büyük Otlukçu Yokuşu	Forchheimer and Strzygowski 1893: 68–9 no. 12 Janin 1964: 212 no. 21 Kleiss 1965a: no. 85 Mamboury 1925: 480 Müller-Wiener 1977: 409 Schneider 1936: 90 Tonguç 1990: 42
	Cistern (D4/4a) below church north of Fatih Camii	Berger 1997 (position wrong on fig. 3) Forchheimer and Strzygowski 1893: 80–1 no. 18 Janin 1964: 212–13 no. 23 Kleiss 1965a: no. 86 Müller-Wiener 1977: 409 Schneider 1936: 88 N
	Cistern (D4/4b) at south end of Haliç Caddesi	Berger 1997: 460 with fig. 3 Müller-Wiener 1977: 409 Özgümüş 2001: 146 fig. 6
	Cistern (D4/5) beneath Eski İmaret Camii	Forchheimer and Strzygowski 1893: 106–7 no. 34 Kleiss 1965a: no. 88 Müller-Wiener 1977: 193, 409
	Aspar reservoir (D4/6)	Andréossy 1828: 448, pl. 5 Forchheimer and Strzygowski 1893: 46–7 no. 2 Gilles 1561a: 4.2 Janin 1964: 204–5, no. 2 Mamboury 1925: 476 Müller-Wiener 1977: 279 Stolpe 1867: no. 7a Tonguç 1990: 45
	Cistern (D4/7) on Fodlacı Sok.	Özgümüş 2001: 147 fig. 7
D5	Cistern (D5/1) west of Zeyrek Camii	Betsch 1977: no. 16 (pp. 80–92) Fıratlı and Yücel 1952: no. 6 Forchheimer and Strzygowski 1893: 76–7 no. 16 Janin 1964: 213 no. 27 Kleiss 1965a: no. 89 Mamboury 1925: 482 Müller-Wiener 1977: 210 Schneider 1936: 89 plan D5
	Cistern (D5/2) on Hacı Hasan Sok.	Kleiss 1965a: no. 115 Müller-Wiener 1977: 409
	Cistern (D5/3) x 2 north of Şeyh Süleyman Mescidi	Fıratlı and Yücel 1952: nos 1 (and 8?) Janin 1964: 213 nos. 28–9 Kleiss 1965a: map Ed (unnumbered) Müller-Wiener 1977: 203
	Cistern (D5/4) at Saraçhane	Forchheimer and Strzygowski 1893: 52 A Gilles 1561a: 4.2 Stolpe 1867: no. 25a
	Cistern (D5/5) on north flank of Fatih Camii	Eyice 1979: 10 figs 7–8 Janin 1964: 213 no. 24 Tonguç 1990: 4 Ülgen and Kunter 1939: 16, pls 16, 71, 72

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (D5/6) at Çukur Hamamı	Andréossy 1828: 455 Forchheimer and Strzygowski 1893: 52 B Gilles 1561a: 4.2
	*Cistern (D5/7) south-east of Fatih Camii	Forchheimer and Strzygowski 1893: 112 m
	*Cistern (D5/8) near Çukur hamam	Forchheimer and Strzygowski 1893: 114 z
	Cistern (D5/9) in Mıhçılar Caddesi	Müller-Wiener 1985
D6	Cistern (D6/1) west of Marcian's Column	Forchheimer and Strzygowski 1893: 78–9 no.17 Kleiss 1965a: no. 90 Müller-Wiener 1977: 282, figs 319–20 Özgümüş 2004: 133–4, fig. 1 Schneider 1936: 88 O
	Cistern (D6/2) near Orta Çesme	Forchheimer and Strzygowski 1893: 82–3 no. 19 Kleiss 1965a: no. 91 Müller-Wiener 1977: 427 Schneider 1936: 88 P
	Cistern (D6/3) west of Marcian's Column	Kleiss 1965a: no. 116 Müller-Wiener 1977: 282, fig. 320 Özgümüş 2004: 134, figs 2–3
	Cistern (D6/4) south of Marcian's Column	Kleiss 1965a: no. 117 Müller-Wiener 1977: 427 Özgümüş 2004: 134–5, fig. 4
	Cistern (D6/5) at Alaettin Mescidi	Özgümüş 2004: 135, fig. 5
	*Cistern (D6/6) in Molla Hüsrev Sok.	Forchheimer and Strzygowski 1893: 114 y
D7	Cistern (D7/1) remains on Haseki Cad.	Kleiss 1965a: no. 121
	Cistern (D7/2) in rotunda beside Bodrum Camii (Myrelaion)	Andréossy 1828: 451–2 Betsch 1977: no. 7 (pp. 108–17) Forchheimer and Strzygowski 1893: 58–9 no. 7 Janin 1964: 213 no. 30 Kleiss 1965a: no. 60 Mamboury 1925: 482–3 Müller-Wiener 1977: 106, 242 (fig. 273) Naumann 1966 Stolpe 1867: no. 39 Talbot Rice 1933 Tonguç 1990: 40–1 Wulzinger 1925: 98–110
E4	Cistern (E4/1) by Sea Walls at Cibali Kapı	Janin 1964: 212 Mamboury 1925: 480–1 Müller-Wiener 1977: 309
	Cistern (E4/2) below Kadir Has Üniversitesi	As yet unpublished
E5	Cistern (E5/1) west of Zeyrek Camii Cistern (E5/2) Unkapanı on Atatürk Bulvarı	Fıratlı and Yücel 1952: no. 4 Forchheimer and Strzygowski 1893: 70–1 no. 13 Kleiss 1965a: 74 Müller-Wiener 1977: 210, 215, 275 (giving E5/3 in error) Schneider 1936: 87 G
	Cistern (E5/3) south-west of Zeyrek Camii	Fıratlı and Yücel 1952: no. 5 Müller-Wiener 1977: 210 C

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (E5/4) west of Zeyrek Camii	Fıratlı and Yücel 1952: no. 2 Müller-Wiener 1977: 210 C
	Cistern (E5/5) at Yoğurtcu Oğlu Medr	Müller-Wiener 1977: 275
	Cistern (E5/6) south of Zeyrek Camii	Fıratlı and Yücel 1952: no. 3 Müller-Wiener 1977: 210
	Cistern (E5/7) in Sabunhanesi Sok.	Forchheimer and Strzygowski 1893: 110 no. 40 Kleiss 1965a: no. 75 Schneider 1936: 87 H
	*Cistern (E5/8) near Zeyrek Camii	Forchheimer and Strzygowski 1893: 111–12 d
	*Cistern (E5/9) north of Zeyrek Camii	Andréossy 1828: 447–8 Forchheimer and Strzygowski 1893: 112 e
	Cistern (E5/10) north-east of Zeyrek Camii	Forchheimer and Strzygowski 1893: 113 k Stolpe 1867: no. 17
	*Cistern (E5/11) below Vefa Kilise Camii	Forchheimer and Strzygowski 1893: 113 q
	*Cistern (E5/12) on north side of Third Hill	Forchheimer and Strzygowski 1893: 111 c Gilles 1561a: 3.6
	Cistern (E5/13) north of Hacıkadın hamam	Ataçeri 1965: 73–4
	*Cistern (E5/14) south of Şepsefa Hatun Camii	Ataçeri 1965: 74 (mentioned)
	Cistern (E5/15) south of Kilise Camii	Kleiss 1965a: map Ed unnumbered
	*Cistern (E5/16) open cemetery near Süleymaniye	Mamboury 1951: 444
E6	Cistern (E6/1) north of Beyazıt medrese	Fıratlı 1967: 226, pls 62.1, 62.2 B Kleiss 1965a: no. 122 Müller-Wiener 1977: 258 Tonguç 1990: 39
	Cistern (E6/2) on Vezneciler Cad.	Fıratlı 1967: 226, pl. 62.2 A, pl. 63.1 Kleiss 1965a: no. 122 Müller-Wiener 1977: 258 Tonguç 1990: 39 (photo)
	Cistern (E6/3) in Ağa Yokuşu Sok.	Forchheimer and Strzygowski 1893: 99 no. 28 Kleiss 1965a: no. 94 Müller-Wiener 1977: 254 Schneider 1936: 90
	Cistern (E6/4) in Müh. Emin Paşa Sok.	Bardill 2004: fig.12 Forchheimer and Strzygowski 1893: 108–9 no. 37 Kleiss 1965a: no. 68 Müller-Wiener 1977: 258 Schneider 1936: 87 I
	Cistern (E6/5) at east end of Bozdoğan Kemeri	Forchheimer and Strzygowski 1893: 111a Kleiss 1965a: no. 95 Müller-Wiener 1977: 258 Schneider 1936: 88 S
	Cistern (E6/6) west of Beyazıt Camii (northern cistern)	Duyuran 1958 Kleiss 1965a: no. 34 Müller-Wiener 1977: 260 I (mentioned)

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (E6/7) north of Beyazıt medrese	Ataçeri 1965: 73 c
	Cistern (E6/8) north of Beyazıt hamam	Forchheimer and Strzygowski 1893: 111a Gilles 1561a: 3.6 (possibly) Kleiss 1965a: map Ee (unnumbered)
	*Cisterns (E6/9) x 2 near Beyazıt Camii and Grand Bazaar	Forchheimer and Strzygowski 1893: 111 b Gilles 1561a: 1.10, 3.6
	Cistern (E6/10) on Üniversite Caddesi	Fıratlı 1967: 226, pl. 62.2 C Kleiss 1965a: map Fe (unnumbered) Mamboury 1936a: 256–7
	Cistern (E6/11) in Çadırcılar Caddesi	Kleiss 1965a: map Fe (unnumbered) Stolpe 1867: no. 164
	*Cistern (E6/12) north of Laleli Camii	Forchheimer and Strzygowski 1893: 112 i
	Cistern (E6/13) 5 cisterns at University excavations west of Beyazıt	Bardill 2004: fig. 17 Fıratlı 1951 Kleiss 1965a: no. 55 Mamboury 1951: 437
	Cistern (E6/14) Children's Library	Çeçen 1996: 221–2
E7	Cistern (E7/1) on Forum Tauri	Müller-Wiener 1977: 261
	Cistern (E7/2) south of Beyazıt	Mamboury 1951: 443–4 Müller-Wiener 1977: 261 c
	Cistern (E7/3) in Bodrumhan in Grand Bazaar	Forchheimer and Strzygowski 1893: 114 u
	Cistern (E7/4) west of Beyazıt Camii (southern cistern)	Duyuran 1958 Kleiss 1965a: no. 34 Müller-Wiener 1977: 261 I
	Cistern (E7/5) below Antik Hotel, Beyazıt	As yet unpublished (see figs 6.1 and 6.10)
E8	*Cisterns (E8/1) x 2 in Arapzade Sok., Kumkapı	Forchheimer and Strzygowski 1893: 114 x
F3	Cistern (F3/1) in Yaşmak Sıyıran Sok.	Fıratlı 1969: 191–2
F4	Cistern (F4/1) beneath St Benedict's in Galata	Gilles 1561a: 4.11 Janin 1964: 205 no. 4
F6	Cistern (F6/1) beneath İstanbul Erkek Lisesi	Kleiss 1965a: no. 109 Müller-Wiener 1977: 342
	Cistern (F6/2) on west side of Mengene Çık.	Fıratlı 1967: 227, pl. 63.2 Forchheimer and Strzygowski 1893: 86–7 no. 21 Janin 1964: 214, no. 31 Kleiss 1965a: no. 96 Müller-Wiener 1977: 342, 434 Schneider 1936: 88 Q
	Cistern (F6/3) Baltacı Hanı	Forchheimer and Strzygowski 1893: 92–3 no. 25 Kleiss 1965a: no. 69 Müller-Wiener 1977: 342 Schneider 1936: 86 D
	Cistern (F6/4) in American Bible House	Betsch 1977: no. 30 (pp. 92–9) Forchheimer and Strzygowski 1893: 100–1 no. 30 Kleiss 1965a: no. 67 Müller-Wiener 1977: 342, 377 Schneider 1936: 86 C

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (F6/5) substructures on Cemal Nadir Sok.	Bardill 2004: fig. 8 Forchheimer and Strzygowski 1893: 91 no. 24 Janin 1964: 214, no. 32 Kleiss 1965a: no. 7 Mamboury 1925: 483–4 Müller-Wiener 1977: 41, 342 Paluka 1895a Tonguç 1990: 37 Wulzinger 1913: fig. 4
	Cistern (F6/6) east of Hoca Kasım Köprü Caddesi	Bardill 2004: fig. 8 Kleiss 1965a: map Ge (unnumbered) Wulzinger 1913: fig. 3
	Cistern (F6/7) north-west of İstanbul Erkek Lisesi	Müller-Wiener 1977: 342
	Cistern (F6/8) 2 cisterns in Ferdi Gökçay Sok.	Kleiss 1965a: no. 111
	Cistern (F6/9) in Çatalçeşme Sok.	Kleiss 1965a: no. 114 Kleiss 1965b: fig. 1
	Cistern (F6/10) north of American Bible House	Kleiss 1965a: map Fd (unnumbered)
	Cistern (F6/11) built over buildings at Vilayet	Fıratlı 1969: 193–5 Müller-Wiener 1977: 46
	Cistern (F6/12) in printing house on Mengene Sok.	Fıratlı 1967: 226–7 (a) Kleiss 1965a: no. 122
	*Cistern (F6/13) x 3 in Tarakcı Cafer Sok.	Fıratlı 1967: 227–8 (c), pl. 64
	Cistern (F6/14) below Nurosmaniye Camii	Tonguç 1990: 38 ('second cistern')
F7	Cistern (F7/1) on Divânı Ali Sok. next to Kara Mustafa Paşa Medr.	Bardill 2004: 128–30 Janin 1964: 214 no. 34 Kleiss 1965a: no. 105 Mamboury 1936a: 275 Mamboury 1936b Müller-Wiener 1977: 283
	Cistern (F7/2) on Şeref Efendi Sok.	Forchheimer and Strzygowski 1893: 90–1 no. 23 Kleiss 1965a: no. 70 Mamboury 1925: 483 Müller-Wiener 1977: 342 Schneider 1936: 87 E Tonguç 1990: 38 (photo)
	Cistern (F7/3) beneath Eminönü Belediyesi	Andréossy 1828: 447–51, pl. 3 Betsch 1977: no. 8 (pp. 50–9) Forchheimer and Strzygowski 1893: 60–1 no. 8 Gilles 1561a: 2.25 Janin 1964: 208 (text at n. 3) Kleiss 1965a: no. 73 Müller-Wiener 1977: 280, 283 Schneider 1936: 87 F Tonguç 1990: 28 Wulzinger 1913: 388–90
	Cistern (F7/4) north of Dizdariye Çeşmesi Sok.	Ataçeri 1962 Kleiss 1965a: no. 53 Müller-Wiener 1977: 283

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (F7/5) Binbirdirek	Andréossy 1828: 444–7, pl. 5 Auzépy and Grélois 2001: 131, fig. 67 Forchheimer and Strzygowski 1893: 56–7 no. 6 Gilles 1561a: 2.25 Janin 1964: 207–8, no. 2 Kleiss 1965a: no. 72 Mamboury 1925: 478–80 Müller-Wiener 1977: 280 Stolpe 1867: no. 41 Tonguç 1990: 25–7 Wulzinger 1913: 383–6 Wulzinger 1925: 94–8
	Cistern (F7/6) west of Firuz Ağa Camii	Kleiss 1965a: 49 Müller-Wiener 1977: 283 Naumann 1965
	Cistern (F7/7) on Bab-ı-Ali Caddesi	Bardill 1997: 69–75 Fıratlı 1969: 192–3 Müller-Wiener 1977: 283
	Cistern (F7/8) in rotunda north of hexagon of Antiochus	Kleiss 1965a: no. 49 Naumann 1965
	Cistern (F7/9) in great hall north of hexagon of Antiochus	Kleiss 1965a: no. 49 Naumann 1965
F8	Cistern (F8/1) on Nakilbent Sok.	Casson 1928: 23 with fig. 33 Janin 1964: 211 no. 15 Kleiss 1965a: no. 31 Mamboury 1925: 484 Mamboury and Wiegand 1934: 47–9 Müller-Wiener 1977: 67, 225 Schneider 1936: 89 plan F8
	Cistern (F8/2) in Oğul Sok.	Fıratlı 1950: 61 Kleiss 1965a: no. 63 Mamboury 1951: 447
	Cistern (F8/3) under staircase in Boukoleon Palace	Kleiss 1965a: no. 59 Mamboury 1925: 485 Janin 1964: 211 no. 16 Mamboury and Weigand 1934: 10–13 Müller-Wiener 1977: 226
	Cistern (F8/4) beneath floor of Great Palace peristyle	Bardill 2004: fig. 19 Müller-Wiener 1977: 231 Talbot Rice 1958: 15–17
	Cistern (F8/5) in Sphendone of Hippodrome	Casson 1928: 16–18, figs 19–22 Forchheimer and Strzygowski 1893: 104–5 no. 33 Guilland 1969: I 376, 442 Janin 1964: 211–12 no. 17 Kleiss 1965a: no. 61 on map (duplicated number) Mamboury 1925: 481 Mamboury 1936a: 242–3 Mamboury and Wiegand 1934: 40–2 Schneider 1936: 89 plan F8 Tonguç 1990: 28–9

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (F8/6) in Eresin Crown Hotel foyer	As yet unpublished
	Cistern (F8/7) on south flank of Apsed Hall	Talbot Rice 1958: 44–9
G6	Cistern (G6/1) in Gülhane Park (former aquarium)	Janin 1964: 215 no. 48 Kleiss 1965a: no. 64 Müller-Wiener 1977: 40, 497 Schneider 1936: 89 plan G6 Tezcan 1989: S19 Tonguç 1990: 33–4 (St George Cistern) Wulzinger 1913: 390–5 Wulzinger 1925: 31–5
	Cistern (G6/2) beneath Topkapı Sarayı	Demangel and Mamboury 1939: pl. 1 Janin 1964: 215 no. 46 (but not 12 columns) Kleiss 1965a: no. 107 Müller-Wiener 1977: 497 Tezcan 1989: S22b
	Cistern (G6/3) in Archaeological Museum court	Müller-Wiener 1977: 497 Tezcan 1989: S22a
	Cistern (G6/4) below north wing of Archaeological Museum	Müller-Wiener 1977: 497
	Cistern (G6/5) east of Archaeological Museum	Müller-Wiener 1977: 50 C, 497 (label misplaced) Tezcan 1989: S20
	Cistern (G6/6) west of Mangana Palace	Demangel and Mamboury 1939: 30, fig. 37, pl. 1 Kleiss 1965a: 108 Mamboury 1925: 486 Müller-Wiener 1977: 497 Tezcan 1989: S13
	Cistern (G6/7) north of Haghia Eirene	Müller-Wiener 1977: 50 (unlabelled) Tezcan 1989: S4
	Cistern (G6/8) in Topkapı second court	Müller-Wiener 1977: 75 (unnumbered) Tezcan 1989: S10
	Cistern (G6/9) north of Haghia Eirene	Tezcan 1989: S24
	Cistern (G6/10) in Topkapı second court	Tezcan 1989: S1
	Cistern (G6/11) in Topkapı third court	Tezcan 1989: S8
	Cistern (G6/12) in Topkapı third court	Tezcan 1989: S9
	Cistern (G6/13) below buildings near Goths' column	Tonguç 1990: 34
	Cistern (G6/14) beside Alay Köşkü	Tonguç 1990: 33
	Cistern (G6/15) in Topkapı second court	Tezcan 1989: S2
	Cistern (G6/16) below St George in the Mangana	Demangel and Mamboury 1939: pl. 4 Janin 1964: 214 no. 36 (wrongly named) Mamboury 1925: 486
	Cistern (G6/17) east of St George in the Mangana	Demangel and Mamboury 1939: pls 1, 3, 6, 9 Janin 1964: 215 no. 47 Mamboury 1925: 486
G7	Cistern (G7/1) at Arslanhane Kapısı	Demangel and Mamboury 1939: pl. 1 Janin 1964: 215 no. 45 (but not 7 columns) Kleiss 1965a: no. 104 Müller-Wiener 1977: 43, 497 Tezcan 1989: S14

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
	Cistern (G7/2) Cebehane cistern	Demangel and Mamboury 1939: pl. 1 Janin 1964: 215 no. 44 Kleiss 1965a: no. 103 Mamboury 1925: 485 Müller-Wiener 1977: 43, 497 Tezcan 1989: S18
	Cistern (G7/3) beneath Gülhane Hospital	Demangel and Mamboury 1939: pl. 1 Janin 1964: 215 no. 43 Müller-Wiener 1977: 497 Tezcan 1989: S15 Wulzinger 1913: 372 Wulzinger 1925: 47–8
	Cistern (G7/4) beneath Gülhane Hospital	Kleiss 1965a: no. 101 Mamboury 1925: 486 Müller-Wiener 1977: 497 Tezcan 1989: not recorded
	Cistern (G7/5) south of Haghia Eirene	Casson 1928: 23–4 with fig. 34 Erder 1960 Janin 1964: 214–15 no. 37 Kleiss 1965a: no. 51 Müller-Wiener 1977: 90, 113, 497 Tezcan 1989: S23 Tonguç 1990: 32
	Cistern (G7/6) in first court of Topkapı Sarayı	Bardill 2004: fig. 10 Forchheimer and Strzygowski 1893: 99 no. 29 Janin 1964: 215 no. 38 Kleiss 1965a: no. 65 Müller-Wiener 1977: 497 Schneider 1936: 86 A Tezcan 1989: S11 Wulzinger 1925: 52–63 (faulty)
	Cistern (G7/7) in first court of Topkapı Sarayı	Bardill 2004: fig. 10 Forchheimer and Strzygowski 1893: 94–5 no. 26 Janin 1964: 215 no. 39–41 Kleiss 1965a: no. 65 Mamboury 1925: 485 Müller-Wiener 1977: 497 Schneider 1936: 86 A Tezcan 1989: S16 Wulzinger 1925: 52–63 (faulty)
	Cistern (G7/8) north of Gülhane Hospital	Demangel and Mamboury 1939: pl. 1 Kleiss 1965a: no. 102 Müller-Wiener 1977: 497 Tezcan 1989: S6
	Cistern (G7/9) Yerebatan Sarayı	Andréossy 1828: 443–4 Auzépy and Grélois 2001: 59, fig. 22 Forchheimer and Strzygowski 1893: 54–5 no. 5 Gilles 1561a: 2.20 Janin 1964: 208–9, no. 3 Kleiss 1965a: no. 71 Mamboury 1925: 477–8

Intra-mural (continued)

GRID SQUARE	NUMBER/NAME/LOCATION	REFERENCES
		Mamboury and Wiegand 1934: 54–69 Müller-Wiener 1977: 283–5, figs 321–3 Schneider 1936: 23–6, 86 Stolpe 1867: no. 35 Tonguç 1990: 11–24 Wulzinger 1913: 383
	Cistern (G7/10) north-west of Gülhane Hospital	Forchheimer and Strzygowski 1893: 113 Kleiss 1965a: 66 Mamboury 1925: 485–6 Schneider 1936: 86–7 B Tezcan 1989: S26
	Cistern (G7/11) south-east of Haghia Sophia	Tezcan 1989: S3
	Cistern (G7/12) south of Haghia Eirene	Tezcan 1989: S5
	Cistern (G7/13) east of Haghia Eirene	Tezcan 1989: S21
	Cistern (G7/14) under Palace of Justice	Müller-Wiener 1977: 497 (where wrongly labelled G7/1—a duplicate)
	Cistern (G7/15) on north side of Soğukçeşme Sokağı (restaurant)	Kleiss 1965a: map Ge (unnumbered) Mamboury 1925: 489 Tonguç 1990: 30–1 Karakaya 1994: 27
	Cistern (G7/16) on south side of Soğukçeşme Sokağı (hotel bar)	Mamboury 1925: 489
	Cisterns (G7/17) below Haghia Sophia	Bent 1893: 170 Buondelmonti in van der Vin 1980: 668 Clavijo in van der Vin 1980: 635 Janin 1964: 211 Pero Tafur in van der Vin 1980: 698 Tonguç 1990: 31
	Cistern (G7/18) below Mangana Palace	Demangel and Mamboury 1939: pl. 8 Janin 1964: 214 no. 35 (wrongly named) Mamboury 1925: 484
	*Cistern (G7/19) in front of Gülhane military school	Forchheimer and Strzygowski 1893: 113 n
	*Cistern (G7/20) near Yerebatan Sarayı	Paluka 1895b Schneider 1936: 90
	Cistern (G7/21) south of Haghia Eirene	Müller-Wiener 1977: 113 (unnumbered) Tezcan 1989: S25
G8	Cistern (G8/1) east of Great Palace Apsed Hall	Müller-Wiener 1977: 231 Talbot Rice 1958: 44 and fig. 17
	*Cistern (G8/2) between the 'House of Justinian' and Ahır Kapı	Tonguç 1990: 35