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Evolution of Water Management in the *Maloutena* Residential Quarter of Nea Paphos The Hellenistic and Early Roman Periods

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Abstract: The paper reconstructs the evolution of water management in the *Maloutena* residential quarter of Hellenistic and early Roman Nea Paphos (Cyprus), drawing on the analysis of water-related installations uncovered there by the Polish Archaeological Mission of the University of Warsaw (1965–2016). Structured into a four-phase periodisation spanning from the late fourth century BC to the mid-second century AD, the study traces successive transformations in local practices of water supply, usage, and disposal, considering them in their historical context with regard to their potential environmental, political, and socio-cultural determinants.

Keywords: water management, *Maloutena*, Nea Paphos, Cyprus, Hellenistic period, early Roman period

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Water, the substance fundamental to all living beings, profoundly permeates human existence, coursing through its biological and cultural dimensions in a multitude of tangible and intangible currents. When carefully traced in the archaeological record, these currents may yield deeper insight into past societies viewed through the lens of their relationship with water. In line with this perspective, the present study takes a closer look at the remains of water infrastructure uncovered between 1965 and 2016 by the Polish Archaeological Mission of the University of Warsaw (hereafter as PAM UW)[1] at the site

[1] The mission inaugurated in 1965 by Kazimierz Michałowski, was subsequently directed by Wiktor A. Daszewski (1967–2007), Henryk Meyza (2008–2019), and – currently – Ewdoksia Papuci-Władyka, under the auspices of the Polish Centre of Mediterranean Archaeology, University of Warsaw (PCMA UW).

of *Maloutena*, within the residential quarter of the capital of Ptolemaic and Roman Cyprus, Nea Paphos.

Water availability and management have been critical concerns in Cyprus since the earliest times. Characterised by an intense Mediterranean climate, the island experiences hot, dry summers and mild, rainy winters, necessitating both the collection of rainwater for the dry season and protective measures against surface runoff during the wetter months.[2] Nea Paphos, located on a small promontory at the south-western coast of the island, atop a marine terrace formed by a karstified carbonate rock basement with calcarenite aquifers confined by impervious marls,[3] also offered access to groundwater, though with the risk of saline intrusion in the areas close to the shoreline, such as *Maloutena*.[4] Additional water sources included seasonal rivers, such as the *Koskinas* to the north and the *Limnaria* to the east, along with smaller streams once flowing through or in the immediate vicinity of the city.[5] While the water from the downstream parts of these watercourses was likely unsuitable for drinking, carrying pollutants from the upper reaches, the nearby *Troodos* mountains, just a few kilometres inland, offered access to good-quality spring water. These complex local hydrological conditions underscored Nea Paphos' need for a carefully considered water management strategy and infrastructure.[6]

Nea Paphos was founded in the late fourth or early third century BC and, under Ptolemaic rule, developed into Cyprus's principal political, military, religious, and economic centre.[7] In the late third century BC, it became the seat of the Ptolemaic governors (*strategoi*), thus supplanting Salamis as the island's capital.[8] It retained this status following the Roman annexation of the island in 58 BC, continuing to flourish despite recurrent devastating earthquakes.[9] Eventually, the destructions by the series of earthquakes in the fourth century AD marked the beginning of its gradual decline and prompted the relocation of the capital back to Salamis (Constantia).

[2] According to data from the Paphos Airport meteorological station for the years 2005–2014, mean annual precipitation in the region of Nea Paphos reached approximately 375mm, with mean maximum temperatures of about 31–32°C in the warmest months, July and August, and mean minimum of about 8–9°C in the coldest months, January and February (values approximated from Sparrow, John 2016: 10, Fig. 1). During the Hellenistic–Roman period, the Levant – and likely Cyprus as well – experienced two notable phases of wetter climate: approximately between 150/100 BC and AD 200/250, and again during several episodes in the fourth and fifth centuries AD (McCormick *et al.* 2012: 180, 183, 187–188, 197). See also Romaniuk 2021: 365, n. 6.

[3] Hadjistavrinou, Afrodisis 1977: 19–20, Fig. 1; Kalicki, Chwałek, Frączek 2020: 489.

[4] Romaniuk 2021: 367, n. 16.

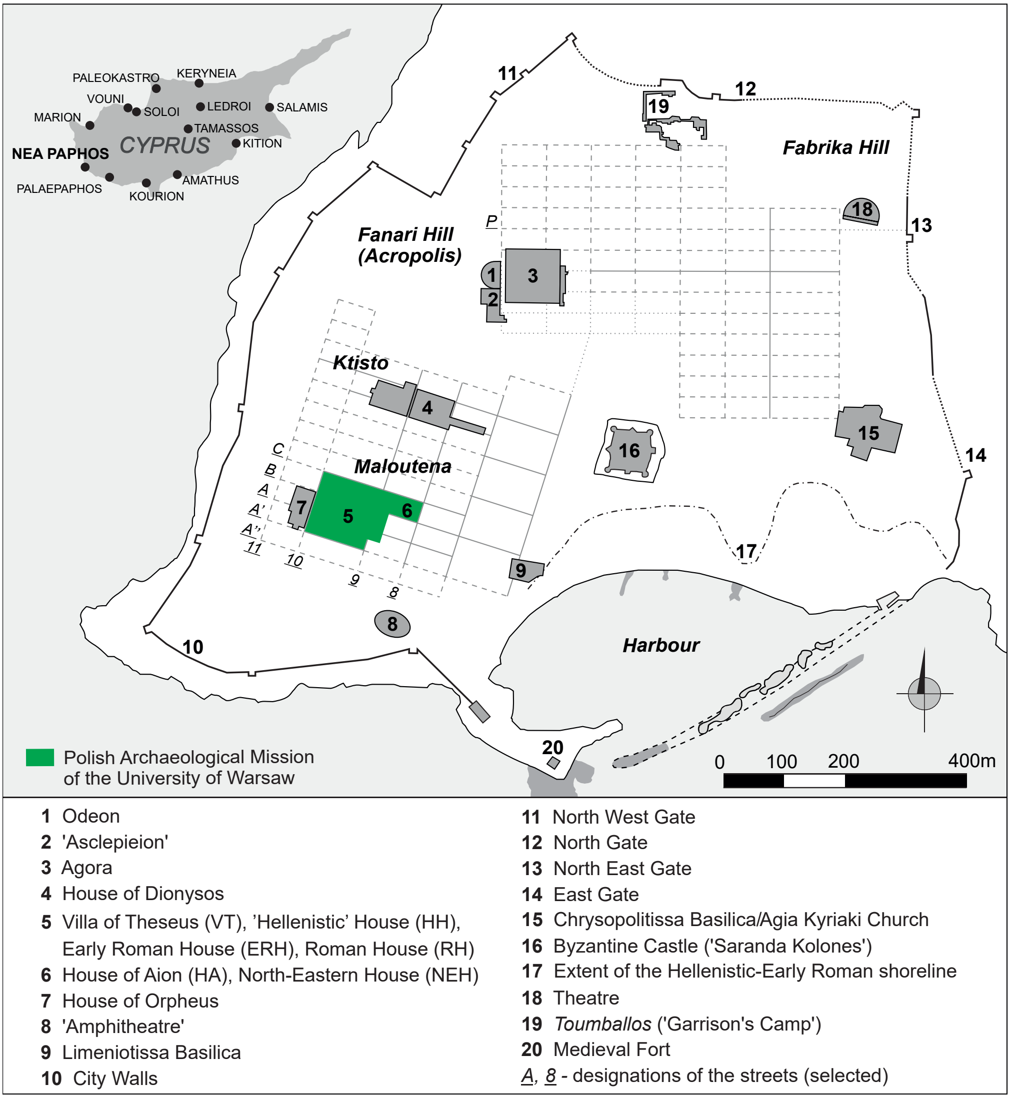
[5] Młynarczyk 1990: 91.

[6] The term 'water management' refers here to all the practices, strategies, and physical features related to the water supply, usage, and disposal.

[7] For the foundation of the city, see Papuci-Władyka 2020: 73, n. 2; for its history, urban development, and history of research, see e.g. Maier, Karageorghis 1984; Młynarczyk 1990; 2016; Papuci-Władyka, Miszk 2020a: 91–109.

[8] Młynarczyk 1990: 121–129.

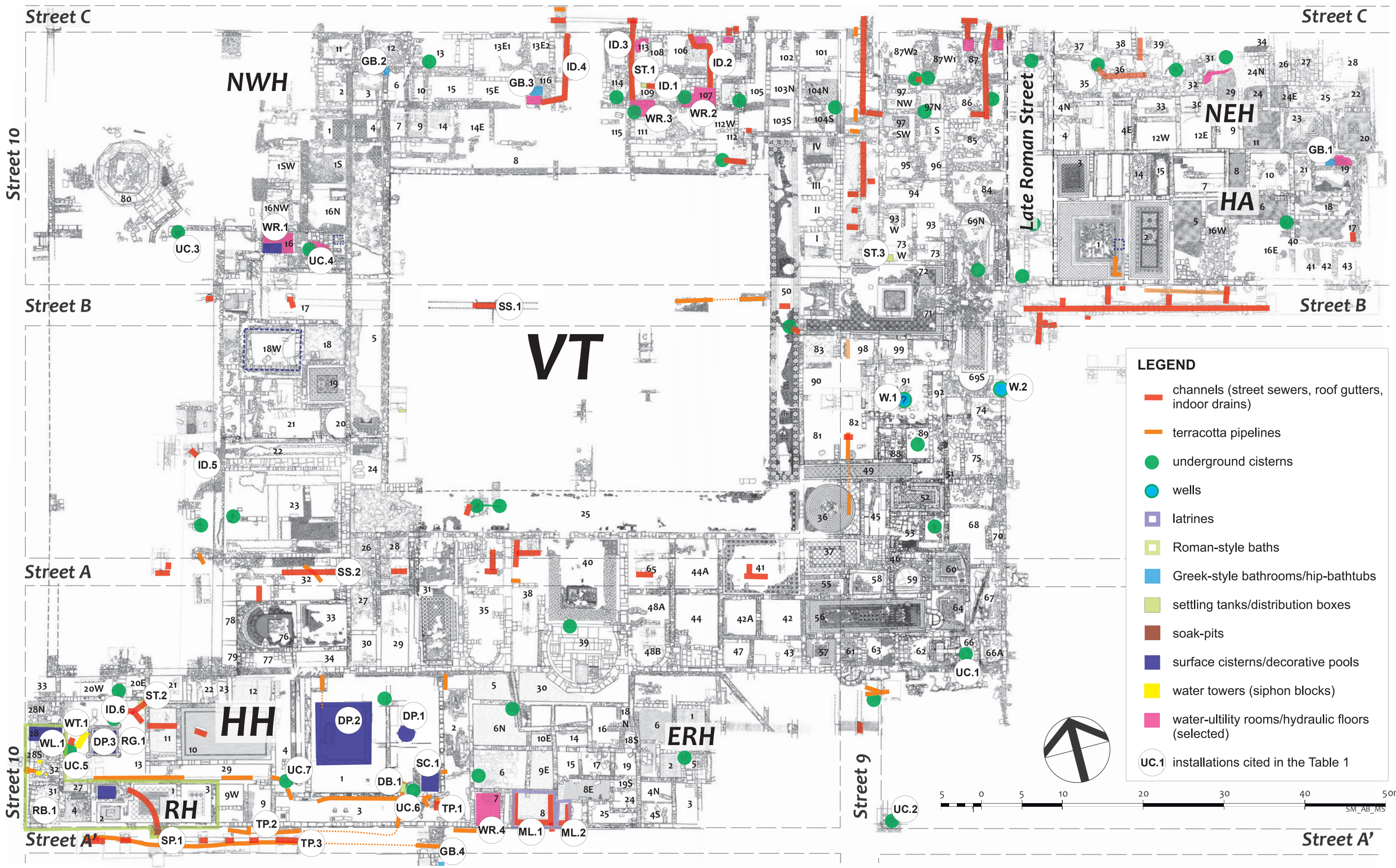
[9] The seismic events most frequently cited as affecting Cyprus and Nea Paphos, according to literary and archaeological sources, occurred around 17/15 BC, AD 76/78, once or more in the first half of the second century (after AD 126) and in the fourth century AD (Młynarczyk 1990: 33–34; Ambraseys 2009: 104, 119, 139, 141–143, 157; see also footnotes 86 and 87 below).



1. Plan of Nea Paphos (Drawing: M.M. Romaniuk; based on: Papuci-Władyka 2020: Pl. 5; Romaniuk 2021: Fig. 1).

The area under discussion, *Maloutena*, lies in the south-western part of the city (see **Figs 1–2**). Excavations carried out by the PAM UW have revealed that this sector was occupied by middle-class houses, wealthy residences, and various workshops, dating from the early Hellenistic to the late Roman period.[10] Initially, these structures – among them

[10] For an overview of the structures unearthed at *Maloutena*, see e.g. Młynarczyk 1990: especially 184–193; 2016: 34–35; Meyza, Zych 2015. For the reconstruction of architectural layout evolution in this area, see: Medeksza 1992: Figs 5–6, 15, 20, 22; 1998: Figs 3–7.



2. Plan of the excavations of the Polish Archaeological Mission of the University of Warsaw in Nea Paphos, 1965–2016, with Hellenistic–early Roman water installations marked; abbreviations on the plan: ERH – Early Roman House, HA – House of Aion, HH – 'Hellenistic' House, NEH – North-Eastern House, NWH – North-Western House, RH – Roman House, VT – Villa of Theseus (Drawing: S. Medeksza, M. Słowińska, A. Brzozowska, A. Kubicka; processing: M.M. Romaniuk).

the ‘Hellenistic’ House (hereafter HH)[11] and the Early Roman House (ERH)[12] – were incorporated into the rectangular *insulae* formed by an orthogonal Hippodamian street grid.[13] This layout was disrupted in the late second century AD by the early-phase construction (the portico building with projecting side bays) of the palatial residence called the Villa of Theseus (VT),[14] possible seat of the Roman provincial governor,[15] which was built over earlier structures and Streets A and 9. In the fourth century AD it had been extended to the north acquiring its final, monumental peristyle form, covering almost the entire investigated area. Alongside its eastern wall the new route called Late Roman Street was laid and the new residences emerged including the House of Aion (HA) and the North-Eastern House (NEH).[16] Shortly thereafter, the area entered a period of decline as a result of the further fourth-century earthquakes, being eventually taken over by squatters around a century century later.[17]

Over 380 elements belonging to the water infrastructure, dated from around the late fourth century BC to the fourth/fifth century AD, have been identified by the author at *Maloutena*. They belonged to categories such as the underground rock-cut (UC)[18] and surface masonry-built cisterns (SC),[19] wells (W), lead and terracotta pipelines (TP), siphon water towers (WT), settling tanks (ST), distribution boxes (DB), soak-pits (SP) and cesspits, channels (street sewers – SS, street gutters, roof gutters with gargoyles – RG, and indoor drains – ID),[20] Greek-style bathrooms with masonry hip-bathtubs (GB), Roman-style heated baths (RB), multi-seat latrines (ML), *nymphaea*, decorative pools (*impluvia* and garden pools – DP), water-related utility rooms (WR), and presumed water-lifting devices (WL). The abundance and diversity of these objects illustrate the sophistication and advancement

[11] Building names are abbreviated, with a numerical suffix indicating an individual room or courtyard within a given structure (e.g. HH1 for Courtyard 1 in the ‘Hellenistic’ House).

[12] For references on HH and ERH, see Brzozowska-Jawornicka 2021. Together they occupied the *insula* delineated by Streets 10, 9, A, and A’; see also Daszewski 2016, who identifies additional unit between them. In the south-western corner of HH another unit, termed the Roman House (RH), was also distinguished, recently reclassified as part of HH (see footnote 85 below).

[13] For discussion on the street layout of Nea Paphos, see e.g.: Młynarczyk 1985; 1990: 160–177; Miszk, Ostrowski, Papuci-Władyka 2020: 527–528; Kubicka-Sowińska *et al.* 2024.

[14] Medeksza 1992; 1998.

[15] Daszewski 1985: 284; for other possible interpretations, see Miszk 2020: 154, n. 69.

[16] Mikocka 2018; Jastrzębowska 2021.

[17] Daszewski 1985: 284; Medeksza 1992: 8, 42–45; 1998: 36.

[18] For the purposes of this article, the installations discussed are designated by symbols indicating their category and identification numbers (e.g. UC.1, SC.1, W.1 etc.). Categories not discussed have not been labelled.

[19] An ‘underground rock-cut cistern’ is defined here as a reservoir to store the water, hewn deep into bedrock, typically consisted of a narrow shaft leading to a bulbous chamber; contrary a ‘surface masonry-built cistern’ has usually angular form, and open or vaulted top, placed near or above ground level. Notably, only a few of the catalogued underground cisterns have been fully, or even partly, explored, and most have therefore been identified solely on the basis of their presumed openings, leaving open the possibility that some may in fact have been wells (see also Romaniuk 2021: 367, n. 16).

[20] The term ‘drain’ is used here both for channels that convey rainwater into cisterns (the water-supply function) and for those that carry it into sewers together with other wastewater (the water-disposal function).

of the water culture of the local community, as well as its capacity to adapt to challenging hydrological conditions.

Despite growing scholarly interest in water management in ancient Nea Paphos,[21] the subject remains underexplored. *Maloutena* is likewise included in this assessment as its water infrastructure has never been examined in a comprehensive manner. To date, it has received only limited attention, mainly in the form of brief overviews and case studies, with primary data scattered across various monographs and numerous excavation reports.[22] This paper seeks to address this gap by reconstructing the evolution of Hellenistic and early Roman water management at *Maloutena* (see **Fig. 2**) covering the period from around the late fourth century BC to the mid-second century AD, that is, from the foundation of the city to the erection of VT. The reconstruction is presented within a four-phase periodisation:

Phase I: late fourth century BC until mid-second century BC
Phase II: mid-second century BC until mid-first century BC
Phase III: mid-first century BC until mid-first century AD
Phase IV: mid-first century AD until mid-second century AD

RESEARCH METHODOLOGY AND LIMITATIONS

The research framework embraced three stages:
1. Investigation and cataloguing of the water installations at *Maloutena* with regard to their form, function, chronology, and closest parallels in Cyprus and beyond, based on archival documentation,[23] on-site observations, and published materials;
2. Classification of the installations by chronology and function for the preliminary identification and periodisation of the water infrastructure transformations;
3. Contextualisation and interpretation of the identified transformations within their historical context, considering their potential environmental and anthropogenic determinants, aimed at the final reconstruction of the local water management evolution.

The fragmentary preservation of investigated installations – particularly those of Hellenistic origin – and substantial post-depositional disturbances in their archaeological contexts hindered the acquisition of a comprehensive dataset, especially concerning chronology,

[21] See recent online workshop 'Aqua Paphia: The Use and Meaning of Water in Hellenistic-Roman Nea Paphos and Beyond', 5–6 July 2024.

[22] For a brief overview see e.g. Meyza, Zych 2015: 'Water in Early Roman Paphos'; for case studies: Romaniuk 2017; 2021; Michalik *et al.* 2024; for monographs: Młynarczyk 1990; Medeksza 1992; for excavation reports and articles see periodicals such as *Bulletin de Correspondance Hellénique*, *Report of the Department of Antiquities*, *Cyprus*, *Polish Archaeology in the Mediterranean*, and *Études et Travaux* numerously cited here. Given the frequent overlap of content across these publications, citations are limited here to the selected primary sources and/or studies offering more comprehensive bibliography.

[23] The archival archaeological documentation examined in this study is held in the repositories of the Institute of Mediterranean and Oriental Cultures of the Polish Academy of Sciences and the Polish Centre of Mediterranean Archaeology of the University of Warsaw.

which could often be determined only in broad terms. Since these limitations precluded detailed reconstructions of the hydraulic system, this study has focused on outlining a more general picture of local water management using a qualitative approach, establishing at least what kind of water-related practices occurred in the area over time, inferred from preserved installations – even if fragmentary, insofar as they are diagnostic. This picture was refined through contextual analysis, seeking the correlations between the shape of local water management and various factors, such as hydrological conditions, political circumstances, socio-cultural water-use habits, technological advancement, or urban development.

The proposed periodisation has been defined primarily with reference to the presumed periods of municipal water supply operation and the introduction of previously unattested categories of installations, such as terracotta pipelines, siphon water towers or Roman-style baths. Since precise chronological determination is not feasible, the boundaries between phases have been set arbitrarily at century midpoints or transitions, with a reasonable tolerance of a quarter of a century.

Each phase is presented below in three thematic sections outlining the water supply, usage, and disposal, illustrated by representative installations,[24] and followed by a commentary assessing the most probable determinants of the observed water management transformations within their historical context. The installations mentioned in the text are listed in **Table 1** (in alphabetical order of their designations), which includes information on their dating and selected references.

PHASE I

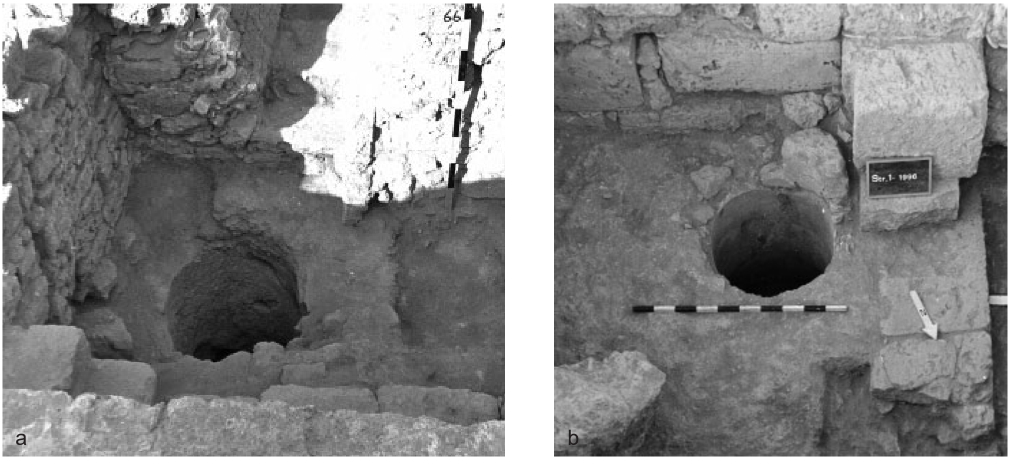
WATER SUPPLY

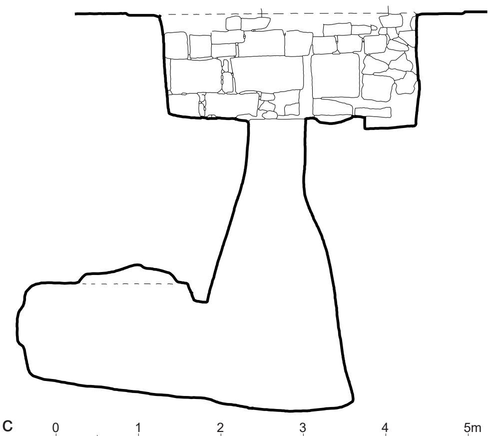
From the city's foundation between the late fourth and the early third century BC, rainfall and groundwater must have constituted one of the primary sources of water at *Maloutena*, as evidenced by such installations as the rock-cut underground cistern UC.1 under VT66 (**Fig. 3a**),[25] the settling tank ST.1 with small drain ID.1 under VT109 (**Fig. 4a**), and a presumed well W.1 under VT91 (**Fig. 5**).[26] Supposedly located in courtyards, these features most likely formed part of rainwater harvesting/drainage systems typical of Greek domestic architecture, in which roof run-off was channelled through gutters, downspouts,

[24] Due to the difficulty of precise dating, the attribution of installations to a given phase denotes only their most probable time of use, while their earlier or later functioning cannot be excluded.

[25] Most of the rock-cut cisterns at *Maloutena* likely date to the Hellenistic period and conform to the pear-shaped type, common elsewhere in Nea Paphos and across Cyprus (e.g. in Kourion), and attested from at least the fifth century BC (e.g. at Vouni) through to the Roman period (Młynarczyk 1990: 190, n. 129).

[26] The excavators' initial identification of this structure as a well has been sustained here, yet its interpretation as an underground cistern remains equally plausible and requires further verification. Likewise, the extremely early dating of this installation, placing its introduction long before the city's foundation as suggested by stone tools found nearby, should be treated with caution, although not implausible given that well-digging was practised in Cyprus from at least the Neolithic period (Flourentzos *et al*. 2017).





3. Underground rock-cut cisterns: a. UC.1 under VT66, west view; b. UC.2 at the intersection of Streets A' and 9; c. UC.2, cross-section (a. Phot. W.A. Daszewski, 1973; courtesy of IMOC PAS; b. 1996, courtesy of PCMA UW; c. processing: M.M. Romaniuk; based on: Daszewski 1998: Fig. 4).

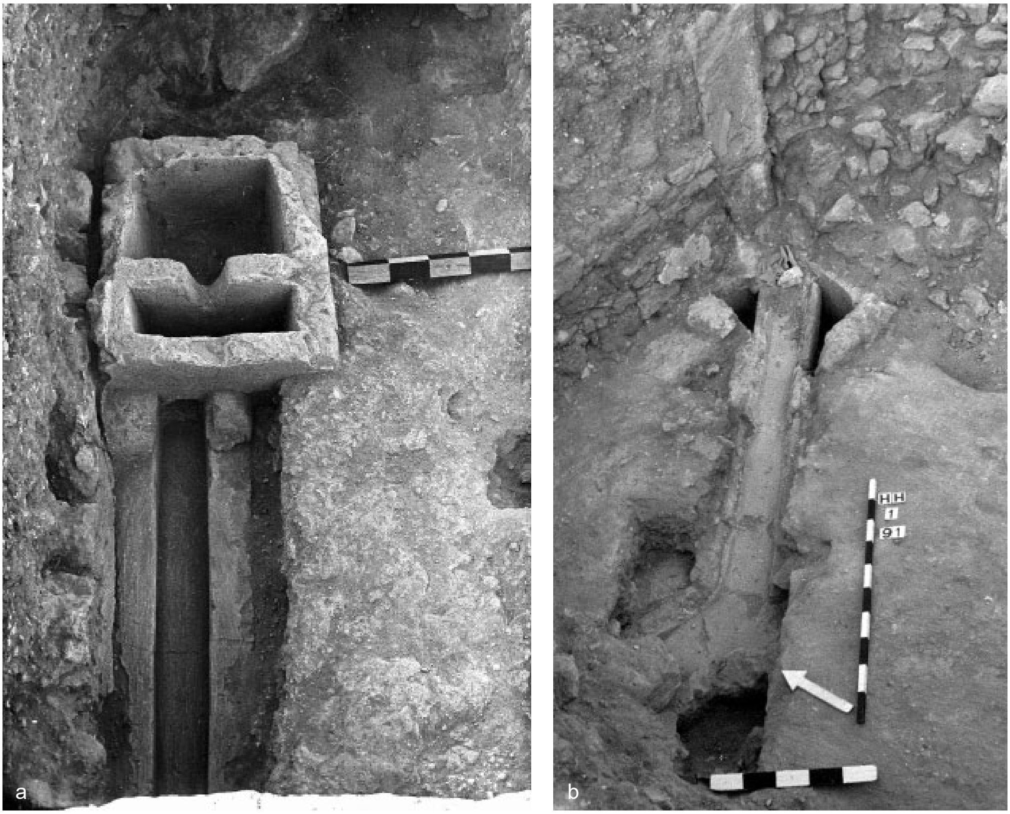
settling tanks (*prolakkia*) and drains into the cisterns and wells. There is, by contrast, no clear indication of municipal supply from this phase, at least at *Maloutena*.[27]

Water usage

Judging from the residential character of the area, namely the compact middle-class dwellings occupying *Maloutena* at the time, water was used basically for household activities such as cooking and laundry. It was probably also employed in small workshops, including a foundry, the presumed remains of which have been identified in the area.[28]

27 Although the subterranean rock-cut tunnel discovered on *Fabrika* Hill – presumably related to the water supply – may date to the city's beginnings, its second-century-BC origin appears more plausible (Balandier 2024: 63, 66; see footnote 43 below).

28 On the Hellenistic structures at *Maloutena*, including houses and workshops, see e.g.: Daszewski, Sztetyłło 1988; Młynarczyk 1990: 62, nn. 43–44; 184–193, 196–201.



4. Settling tanks: a. ST.1 with drain ID.1 under VT109, west view; b. ST.2 covered with drain ID.6 in HH13 (a. Phot. W.A. Daszewski, 1978; courtesy of IMOC PAS; b. 1991; courtesy of IMOC PAS).

Water disposal

Stormwater and wastewater from the buildings were drained through a well-organised street sewer network consisting of the large collectors fed by lateral inlets, aligned with the orthogonal street grid.[29] This system may have developed gradually, as suggests the chronology of the particular sewers, of which the largest one (max. 1.85m deep, 0.75m wide), SS.1, located beneath the main Street B (**Fig. 6**), is assumed to have been constructed in the city's early beginnings, whereas the smaller one, SS.2 beneath Street A, seem to belong to a later stage of the phase, i.e. the late third/early second century BC. In the same phase, street drainage also began to appear in the area of Paphian Agora.[30]

[29] For the general characteristics and chronology of the street sewers at *Maloutena*, in correlation with the streets, see Młynarczyk 1990: 62, 166, 170–174.

[30] Michalik 2025: channels of the Stage I: H, J, K. Street sewerage systems were common in Greek cities, known also in Hellenistic Cyprus, for example at Kition (Callot, Salles 1981; Salles 1983) and Ledroi (Michaelides, Pilides 2012: 38, 41).

5. Presumed well W.1 under VT91 (Phot. W.A. Daszewski, 1983; courtesy of IMOC PAS).

6. Main sewer SS.1 under Street B, west view (Phot. K. Michałowski, 1965; courtesy of IMOC PAS).

COMMENTARY

The initial phase of the city's existence was marked by its development into a major maritime port, shipyard, military garrison, economic and religious centre and – ultimately – the capital of the island ruled by the Ptolemies.[31] It adopted the orthogonal street layout of the Hippodamian type, widely employed across the Hellenistic world, which provided the framework for a sophisticated street sewerage system.[32] The construction of such urban infrastructure was undoubtedly undertaken under civic direction, given the substantial investment it required in terms of financial resources, continuous maintenance, and a sizeable labour force – the latter likely drawn from the resettled population of Marion and incomers from nearby Palaepaphos.[33] The implementation of this city-wide drainage network reflects a deliberate institutional commitment to the sustainability of the emerging urban centre, ensuring both efficient wastewater disposal and protection against seasonal flooding. By contrast, in the domain of water supply, the inhabitants appear to have been largely self-reliant, relying on household rainwater-harvesting systems and possibly wells in the absence (of any indication) of a centralised supply system. Local stationary sources presumably proved sufficient to meet the moderate needs of the earliest community of the city.

The model of water management observed at *Maloutena* during this phase is consistent with that found in many Greek regions.[34] Its adoption in Nea Paphos is hardly surprising given the shared environmental and cultural context, including the intense Mediterranean climate, karstic landscape, and the pervasive influence of Hellenic urban traditions. This cultural affiliation is reflected in public constructions – such as the Theatre on the southern slope of *Fabrika* Hill, erected around the turn of the fourth and third centuries BC,[35] and the gymnasium, attested only epigraphically since the following century[36] – as well as the increased importation of Aegean pottery[37] and the appearance of new cooking wares aligned with Greek culinary customs.[38]

PHASE II

WATER SUPPLY

A significant development occurred in the late second/early first century BC with the first introduction of terracotta pipelines at *Maloutena*. This was evidenced by the conduits

[31] Młynarczyk 1990: 108–129.

[32] Whether the Hippodamian layout in Nea Paphos was implemented at the city's foundation or later remains a matter of debate, yet principal streets – such as Street P – may have preceded others (Balandier 2024: 68–69), which could explain discrepancies in the assumed dating of the sewer channels.

[33] For Marion, see: Młynarczyk 1990: 26, 72–74; Rupp 1997: 251; for Palaepaphos, see Maier, von Wartburg 1985: 121.

[34] For references on ancient Greek water supply relying on cisterns and wells, see Klingborg 2023.

[35] Barker 2016: 92, 94.

[36] Młynarczyk 1990: 112, 138, 213–215.

[37] Papuci-Władyka 2019: 530.

[38] Nocoń, Marzec 2023: 89.

7. Hellenistic terracotta pipelines set TP.1 under eastern end of HH3 (1993; courtesy of IMOC PAS).

discovered beneath the eastern end of the HH3 portico (collectively designated here as the TP.1, **Fig. 7**), and by the single fragments of pipes attested in the late Hellenistic archaeological contexts.[39] The bodies of the conduits, faintly discernible in the excavation trench, hinder determination of their morphology, configuration or function. Therefore, it can be only assumed that they formed part of a household rainwater collection/drainage system or of a municipal water supply.[40] Evidence in favour of the latter interpretation may lie in the discovery of the terracotta pipelines beneath the streets of the Agora area, preliminarily dated to the same period.[41] These installations may have conveyed water

[39] E.g. contexts: F.8/02, F.22/02 and F.412/07 (PAM UW documentation 2002 and 2007).

[40] Hellenistic pipe systems, corresponding with the street pattern as was presumably the case in Nea Paphos, are known from e.g. Priene, Rodos-town and Lindos (Jansen 2000: 109). In Cyprus, terracotta pipelines dated to Hellenistic (or even Classical) period, was found also e.g. in Tamassos (Buchholz 1985: 249, 252, Figs 11, 14a-d; associated with contemporaneous house) and most likely Kition (Nicolaou 1976: 152, no. 14, on the site of Gymnasium).

[41] Information obtained from the Michał Michalik's presentation 'The shift in water pipe production and the transition in water supply. A study of pipelines from Paphian Agora: a preliminary project report' delivered at the 19th Meeting of the Postgraduate Cypriot Archaeology, Graz University, 1–3 December 2022.

from distribution centres, most likely situated at the city's highest points, the hills of *Fabrika* and *Fanari* (*c*. 26m and 20m asl, respectively, compared to *c*. 6–9m asl for the ancient levels at *Maloutena*), and fed by an extramural aqueduct.[42] The plausibility of this scenario is strengthened by the presence of a rock-cut tunnel atop *Fabrika*, likely hewn in this phase,[43] as well as by similar features on *Fanari*, accompanied by surface and subterranean reservoirs, albeit of obscure chronology.[44]

Alongside the pipelines, the earlier stationary water sources remained in use, supplemented by new ones such as bottle-shaped underground cistern UC.2 at the crossroads of the Streets 9 and A' (**Fig. 3b-c**), all attesting the sustained importance of this form of water supply. This assumption is supported by the presence of a well at the Agora, dated to this phase.[45]

Water usage and disposal

Water usage and disposal practices appear to have persisted largely unchanged from the preceding phase, given the absence of features suggesting otherwise.

Commentary

The late second century BC – particularly the period of Ptolemy VIII Euergetes II's rule, from his return from Cyprus to Alexandria in 129 BC until his death in 116 BC – can be regarded as a time of relative political stability, administrative efficiency, and reform within the Ptolemaic Empire.[46] At this time the threat from the Seleucids had finally subsided, the Ptolemaic navy established its headquarters in Nea Paphos, and a strong garrison was stationed in the city, manned by mercenaries from Lycia, Cilicia, and Ionia.[47] All these factors, together with economic prosperity indicated by increased pottery production and import,[48] must have contributed to a rise in population, reflected in the expansion of settlements in the Paphian *chora*.[49] This demographic growth certainly resulted in greater water demand, to which the establishment of a municipal water supply may have constituted a response. This initiative might have formed part of a wider programme of urban development around the second half of the second century BC, encompassing the construction

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42 On the aqueduct and water distribution in Nea Paphos, see Młynarczyk 1990: 222–223. For the present author's commentary, see Romaniuk 2021: 387–391.

43 See e.g.: Bessac 2016: 108–110; Balandier, Guintrand 2016: 137–142; 2024: 'Opération 3. Les ouvrages hydrauliques rupestres de la colline de Fabrika'.

44 Młynarczyk 2022: 125, 128. The three underground cisterns at *Fanari* are said to be filled with debris containing late Roman ceramic material.

45 Inv. no. S.173 (Miszk 2020: 142; Papuci-Władyka, Miszk 2020b: 508).

46 Hill 1940: 196.

47 Młynarczyk 1990: 129–131.

48 Nocoń, Marzec 2023: 89.

49 Rupp 1997: 249–259.

of city walls,[50] *tetrastoon* Agora[51] and temple atop *Fabrika*,[52] as well as the refurbishment of the Theatre.[53] The Alexandrian architectural influences evident in these projects may have extended to hydrotechnology, as implied by the rock-cut gallery on *Fabrika,* which may allude to the Alexandrian *hyponomoi*.[54] The technical know-how required for long-distance water conveyance was likely already present on the island, as suggested by the possible implementation of an aqueduct at Amathus by Ptolemy VI Philometor,[55] who may in fact have been also the one to initiate the aforementioned urban projects in Nea Paphos.[56] Notably, military engineers from Asia Minor – a region renowned for monumental waterworks – who were stationed in the Nea Paphos' garrison,[57] may have provided technological support in this domain. Roman influence, likewise, which had been growing since the early second century BC, may have contributed to a fusion of Hellenistic technologies such as siphons and subterranean conduits with the Roman concept of long-distance aqueducts, as exemplified in Pergamon.[58]

PHASE III

Water supply

By the mid-first century BC, the aforementioned pipelines, at both *Maloutena* and the Agora – and thus the municipal water supply in general – were likely decommissioned, as no conclusive archaeological evidence attests to their continued operation. In contrast, stationary water sources remained employed as evidenced by the underground cisterns UC.3–4 located south-east of tower VT80 and in VT16, as well as by the rainwater settling tanks ST.2–3 in the north-eastern corner of courtyard HH13 (**Fig. 4b**) and beneath VT73W.

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[50] Balandier 2024: 64, 66, 68; Balandier, Guintrand 2024: 'Opération 1. Recherches sur l'enceinte urbaine : les rempart Ouest et Sud'.

[51] Papuci-Władyka, Miszk 2020b: 507–508; the authors suggest that the Odeon-Asclepieion complex, adjoining the Agora to the west, may also have emerged at that time, contrary to Kyriakos Nicolaou's dating to the second–fourth centuries AD.

[52] Balandier 2024: 66.

[53] Barker 2016: 94–95.

[54] For this hypothesis and further details on this feature, see Cyril Abellan's study in Balandier, Guintrand 2024: 'Opération 3. Les ouvrages hydrauliques rupestres de la colline de Fabrika', as well as Balandier 2024: 63, 66.

[55] Aupert 2009: 28–29, 46; Aupert (Ed.) 2015: 85, 87. Hellenistic (or even earlier) aqueducts may have also existed in Kition (Nicolaou 1976: 143–157; Michaelidēs, Christodulidēs 2016: 29–47) and Kourion (Wright 1992: 175).

[56] Balandier 2024: 70.

[57] Młynarczyk 1990: 129–131.

[58] Lewis 2000: 647–648. As Młynarczyk (1990: 223) observes, conveying water across the wide valley separating the city from the *Ktima* plateau and the hills north of it, would have required the implementation of a siphon. To ensure sufficient pressure, the source would need to be placed no closer than the Tala region, some 8.5km to the north, at an altitude exceeding 200m asl.

Water usage

Among the key findings linked to water use are presumed domestic bathrooms with remnants of masonry-built hip-bathtubs GB.1–4 corresponding to the Greek *pueloi*, identified in HA19 (**Fig. 8**), VT6, VT116, and vis-à-vis the south-eastern corner of courtyard HH1, across the Street A'.[59] In addition, some water-related utility rooms have been revealed, such as WR.1–3 in VT16, VT107, and VT109/111 (**Fig. 9**). These are characterised by thick waterproof flooring and various associated fittings, such as the underground cisterns, slab-stone-built containers, and drains. While interpreted provisionally as laundries or dyeing workshops,[60] they might equally have functioned as bathrooms, or compact interior court-yards comparable to the room 2 in ERH. Owing to the disturbed archaeological contexts, they can only tentatively be dated to this phase.[61]

Water disposal

Several indoor drains can probably be attributed to this phase, including ID.2–4 discharging wastewater from rooms VT107, VT109/111, and VT116, towards the main collector beneath Street C, indicating that the street sewer network was still functioning. Also noteworthy is a small channel ID.5 discovered west of VT22 (**Fig. 10**), running between two low socles of possible *klinai*, presumably serving as a drain from the *andron*.[62]

Commentary

The beginning of this phase coincided with major political upheavals at the Ptolemaic court, in which Cyprus played a significant role. Roman involvement in these conflicts ultimately led to the annexation of the island as part of the Roman province of Cilicia in 58 bc. This complex political context, further destabilised by the later turmoil under Cleopatra VII, may have considerably weakened the capacity of the former magistrates of Nea Paphos to maintain the city's infrastructure, thereby contributing to the decline of its water system. The situation was likely exacerbated by the island's strained finances at the outset of Roman rule, due to the confiscation of the royal treasury of Ptolemy, King of Cyprus, as well as heavy taxation and usurious practices imposed on Cypriot cities by the Roman officials[63] – all of which curtailed the resources required for sustaining urban infrastructure. Setting aside the actual impact of these factors, it seems unlikely that the water

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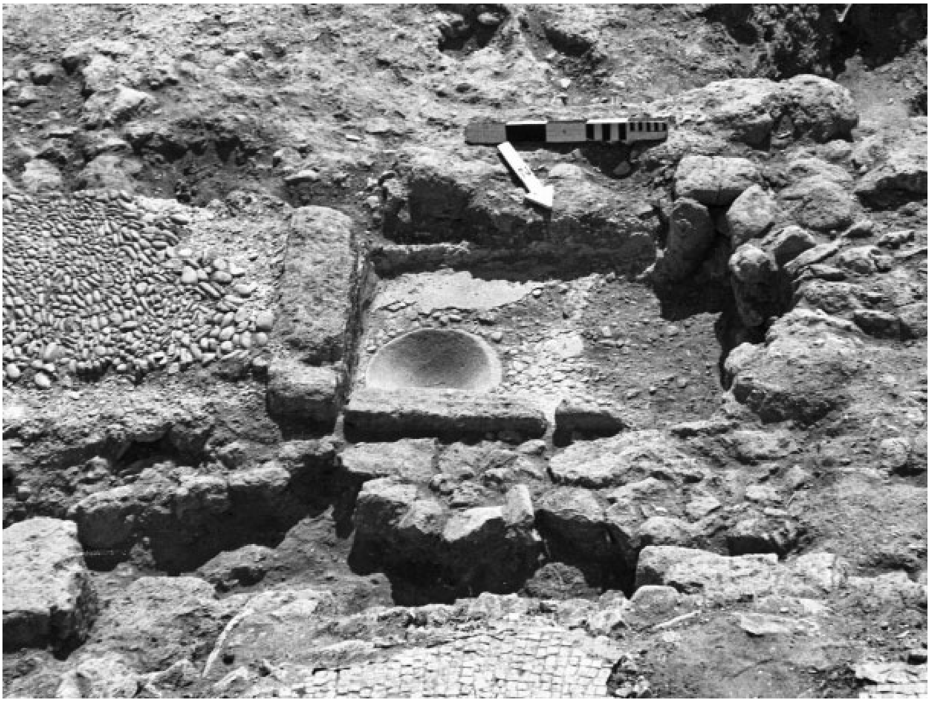
[59] Other early Roman examples of masonry-built hip-bathtubs in Cyprus are known from the bath complex in Paleokastro/Ayia Irini (Quilici 2015).

[60] Karageorghis 1979: 714; 1985: 951; Daszewski *et al.* 1984: 300.

[61] Installations uncovered within the northern wing of VT, including GB.3, ID.2–4 and WR.2–3, are usually mentioned collectively in publications and broadly attributed to the late Hellenistic/early Roman period (see Daszewski, Sztetyłło 1988: 201).

[62] Such drains constituted a characteristic feature of *andron* (Franks 2018: 29).

[63] Młynarczyk 1990: 132.



8. Remains of the supposed masonry hip-bathtub GB.1 in HA19 (1997; courtesy of PCMA UW).

9. Water-use utility room WR.2 in VT107 (Phot. A. Wichniewicz, 1982; courtesy of IMOC PAS).

10. A drainage ID.5 of the supposed *andron* west of VT22 (1987; courtesy of IMOC PAS).

system continued to function beyond 17/15 BC, when Nea Paphos was devastated by a severe earthquake. Paradoxically, this catastrophic event, followed by imperial financial aid for reconstruction and the conferment of honorific title *Augusta* (Σεβαστή) to the city by Emperor Augustus,[64] combined with the stabilising effects of the *Pax Romana*, may have created both the opportunity and the favourable conditions for the city's infrastructural and cultural redevelopment. It may have accelerated the process of gradual replacement of the Greek-origin elements, including the hip-bathtubs or *andron*, with structures more explicitly aligned with Roman cultural values and dominance, such as decorative pools which likely began to emerge either towards the end of this phase or at the beginning of the next (see below). This process appears consistent with broader urban transformations: the restoration of the Theatre,[65] the dismantling of city walls and the construction of lavishly decorated houses on the northern slope of *Fabrika*,[66] as well as at *Maloutena* – namely the ERH and early-stage HH[67] – all reflecting the city's swift recovery, the peaceful conditions of life, and the growing prosperity of its citizens under Roman rule.

[64] Mitford 1980: 1310; Maier, Karageorghis 1984: 250.

[65] Barker 2016: 95.

[66] Balandier, Guintrand 2016: 127–136; 2024: 'Opération 2. La Maison romaine au Nord de la colline de Fabrika'.

[67] For references see footnote 12.

PHASE IV

WATER SUPPLY

This phase witnessed the installation of new terracotta pipelines within the houses and beneath the streets of *Maloutena*. Their implementation occurred in at least two stages, as evidenced beneath Street A' (**Fig. 11**), where a second-stage conduit, TP.3, associated with the late-first/early-second-century-AD context, was laid above a first-stage one, TP.2, embedded in a layer dated primarily by mid-first-century-AD pottery.[68] Additional components of this system include reused perforated cuboid stone blocks of presumed siphon water tower(s) WT.1 (i.e. secondary *castella aquae*) in HH13 (**Fig. 12**),[69] as well as the distribution box DB.1 in HH1 integrated with the pipelines.[70] Collectively, these findings suggest that *Maloutena* was reconnected to the city's municipal water supply, comprising a pressurised pipeline network aligned with the orthogonal street grid. This interpretation finds support in a comparable pipeline system uncovered in the Agora, likewise constructed in two phases dated to the Julio-Claudian and Flavian periods, and associated with a possible siphon-tower base.[71] It is also plausible that, within the same phase, the large cistern atop *Fabrika* was constructed as an addition to the earlier Hellenistic rock-cut tunnel,[72] and the *nymphaeum* erected in front of the Theatre,[73] both likewise supplied by the aqueduct.

The stationary water supply was still being exploited, albeit with some modifications. The earlier rainwater settling tank ST.2 in HH13 was backfilled and superseded by a channel ID.6 (see **Fig. 4b**), which presumably conveyed roof run-off to the cistern UC.5 at the west side of the courtyard (**Fig. 13**).[74] This cistern featured a considerable large, rectangular opening (*c*. 1.60 x 0.70m), suggestive of a water-lifting device of the *saqiyah* type based on the vertical wheel with bucket-chain (WL.1).[75] The wheel's axis was likely supported by a pillar constructed of the repurposed water-tower blocks, the reuse of which may imply that the municipal water supply at some stage during this phase partially or entirely ceased to function, being supplemented or replaced entirely by this stationary

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[68] Romaniuk 2021: 386 (note that PP2, PP2.1, and PP3 were mistakenly described as overlying PP1 and PP4, whereas the opposite is the case). Similar terracotta pipes and pipelines were discovered also in other places in Nea Paphos and Cyprus; for examples see Romaniuk 2021: 372–373.

[69] For preliminary interpretation of these features as the components of water tower see Romaniuk 2021: 389–391. Secondary *castella aquae* in form of water towers used for pressurised water distribution throughout the city are emblematic of Roman hydrotechnology, most famously attested in Pompeii (Jansen 2000: 113, Fig. 7).

[70] Similar distribution boxes can be observed in water system of Kourion (Last 1975: 46, 54, Fig. 4, Tables A, E, Pl. X: 37).

[71] Miszk 2020: 147–149; Rosińska-Balik 2020: 190–191, Pls 64, 65: 2–3; inv. nos S.131 and S.182 (Julio-Claudian period pipelines), S.119 (Flavian period pipelines), S.125 ('water distributor').

[72] See footnote 43.

[73] Barker 2016: 98–99.

[74] The UC.5 may, in fact, be a well, yet this assumption requires verification.

[75] If this interpretation is correct, the feature would represent one of the earliest examples of its kind known in Cyprus, where such devices are attested generally from Late Antiquity; cf. Fourrier, Rabot, Chamel 2020 (Kition-Bamboula) and Empereur, Koželj 2017 (Amathus).

11. Early Roman terracotta pipelines: the earlier one, TP.2, in the background, and the later one, TP.3, in the foreground (Phot. H. Meyza, 2008; courtesy of PCMA UW).

12. Reused elements of the siphon water tower WT.1 in HH13, east view (Phot. H. Meyza, 2009; courtesy of PCMA UW).

13. Large rectangular opening of the underground cistern (well?) UC.5 in HH13, possibly equipped with water-lifting device WL.1 of *saqiyah* type (Phot. H. Meyza, 2009; courtesy of PCMA UW).

water source. The shallow *impluvium* DP.3 at the centre of courtyard HH13 (**Fig. 14**) was constructed in this or already in the preceding phase to collect rainwater from the roof gutters RG.1 and dispose it to the cistern UC.5. In its final form, the *impluvium* was provided with raised walls, presumably intended to collect and retain a greater volume of rainwater. While underground cisterns continued in use, many appear to have fallen into disuse by the late first or early second century AD, as indicated by UC.6–7 in HH1 and HH4. The inlet of the former, adapted to the level of the southern stylobate of HH1, was constructed above the distribution box DB.1 mentioned earlier, thereby marking its decommissioning. To the east of this cistern, a surface masonry-built cistern SC.1 was constructed (**Fig. 15**). The well W.2 beneath VT69S also remained operational. Collectively, these features attest to the enduring importance of stationary water sources in sustaining *Maloutena*'s water supply throughout the phase.

14. *Impluvium* DP.3 in HH13 (Phot. H. Meyza, 2009; courtesy of PCMA UW).

15. Rectangular, surface masonry-built cistern SC.1 in the south-eastern corner of HH1 (1991; courtesy of IMOC PAS).

WATER USAGE

The water infrastructure of this phase reflects notable advancements in water exploitation. In addition to utilitarian domestic applications – evidenced by the presumed laundry room WR.4 in HH7 and the possible continued use of earlier water-utility rooms WR.1–3 – water was also employed for decorative, recreational, and sanitary purposes. This is exemplified by the ornamental garden pools DP.1–2 in courtyard HH1 (**Fig. 16**), the Roman-style heated baths RB.1 in the south-western HH corner/RH (**Fig. 17**), and multi-seat latrines ML.1–2 in HH8 and HH8E (**Fig. 18**), the former and the latter quite possibly constructed yet in the previous phase. This picture must have been evolving over time. The larger of the two garden pools, DP.2, rectangular in form, underwent two construction stages, the latter marked by a significant reduction in depth, possibly reflecting a decline in water availability. Eventually, it was deliberately dismantled, along with the smaller, circular pool DP.1,[76] and the entire area of HH1 was covered with garden soil.[77] On this new surface level, a masonry cistern SC.1 was constructed in the south-eastern corner of the courtyard, presumably intended for watering garden plants with rainwater discharged through two near-bottom outlets.[78] The baths were also constructed no earlier than the end of the first century AD. They may have initially drawn water from the municipal water supply system (based on the pipelines of the second stage?), supplemented or replaced later by cistern UC.5 with water-lifting device WL.1. Sometime later the *praefurnium* of the baths was most likely intentionally blocked, signalling the abandonment of the bathing facilities.

WATER DISPOSAL

The Hellenistic street-sewerage system appears to have fallen into disuse, at least in part, around the middle of this phase. In its place, alternative solutions were introduced, notably the soak-pit SP.1 located south of RH1 (**Fig. 19**), which, via a drain running beneath this room, received wastewater from the basin north of RH2 and discharged it into the ground. This system, however, was also eventually abandoned before the end of the phase, apparently in parallel with the disuse of the baths.

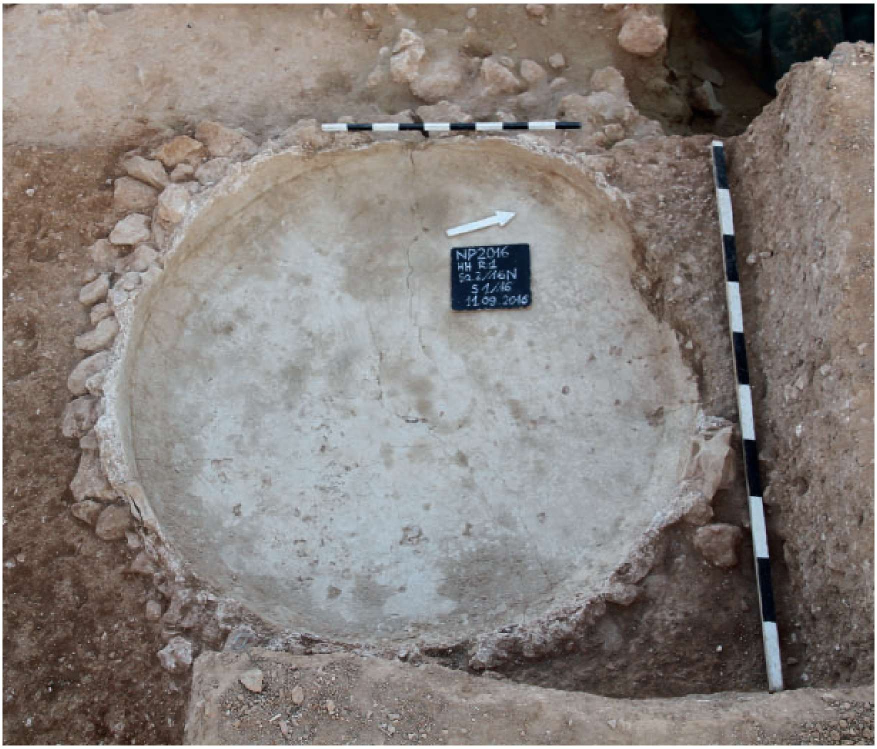
COMMENTARY

The introduction of the first-stage pipeline system, certainly associated with the inauguration of a new – or the renovation of the earlier (Hellenistic? Augustan?) – municipal water supply system in Nea Paphos may have formed part of the wider construction initiative

[76] Tentatively dated to between mid-first century BC and the mid-first century AD (Romaniuk 2017: 429), the pool was in all probability erected around the close of this span and dismantled soon thereafter (Meyza *et al.* 2017: 412–413, 415–416). Comparable contemporaneous examples are known from Pompeii (Romaniuk 2017).

[77] Daszewski 1994: 104–105; Meyza *et al.* 2017: 400, 405, 413.

[78] Similar installation was found adjacent to the south side of House I.XV.1 in Pompeii, in the garden shared with the House of the Ship Europa (Jashemski 1979: 238, Fig. 349; 1993: 62).



16. Decorative circular pool DP.1 in HH1 (Phot. H. Meyza, 2016; courtesy of PCMA UW).

17. Hypocaust system in HH31, part of the Roman-style baths RB.1 in the south-western part of the HH/RH (Phot. K. Woszczyńska, 2010; courtesy of PCMA UW).

18. Multi-seat latrines ML.1 in HH8 (1991; courtesy of IMOC PAS).

19. Soak-pit SP.1 south of RH1 (1993; courtesy of IMOC PAS).

undertaken under the emperors Claudius and Nero. During their reigns, aqueducts were provided for at least three other Cypriot cities – Keryneia, Salamis, and Soloi[79] – and it is highly probable that Nea Paphos, as the island's principal city, the capital and headquarters of the Roman governor, was likewise included in this programme. This inclusion may perhaps be echoed in the bestowal of the city's honorific title *Claudia* (Κλαυδία).[80] The water was certainly brought to and distributed from the *Fabrika* and/or *Fanari* hills, both optimal locations for the *castella divisoria*, and – with engagement of the siphon water towers – further distributed under pressure around the city. Such a scheme would correspond with contemporaneous Roman urban water supply systems, most clearly illustrated in Pompeii.[81] This alignment indicates that Nea Paphos was keeping pace with Roman hydrotechnical developments, a notion further supported by the appearance of installations characteristic of the Roman water culture at *Maloutena*, such as Roman-style baths, decorative pools, and communal latrines. These were all emblematic of a water ideology marked by grandeur, high consumption, public display, convenience, and technological sophistication, underscoring the assertion of Roman cultural dominance on the island.[82]

The end of this earlier municipal water supply system might have been brought about by the earthquake dated to AD 76/78. This event may have marked the moment when the first-stage pipeline system ceased to function, together with some of the water towers, settling tanks, decorative pools, underground cisterns, and street sewers – not unlikely including the latrines and water-related utility rooms. It might further represent the *terminus post quem* for the final construction phase of HH.

After the catastrophe, the Flavian emperors may have supported the city's reconstruction, subsequently honouring it with the title *Flavia* (Φλαουία), following the path set by Augustus.[83] As a result, a second-stage pipeline system would have been installed, now laid at an uplifted level of the streets, possibly incorporating some of the surviving elements of the earlier infrastructure.

The new water infrastructure, however, might have emerged somewhat later as well, as a result of the (re)building initiatives undertaken during the reigns of the first Antonine emperors, particularly Trajan and Hadrian, especially in the aftermath of the Jewish revolt in AD 116. This was the case in Salamis, Kourion, and most notably Amathus, where the aqueduct was renovated along with *nymphaeum* and the fountain.[84] This development likely relates to the baths in HH/RH, which may be contemporaneous with those

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[79] Information based on the inscriptions; for Keryneia, see Mitford 1950: 17–20, no. 9; for Salamis, see Nicolaou 1963: 48–49, no. 12; for Soloi, see Mitford 1950: 28–31, no. 15; see also Mitford 1971: 201–204, no. 106; 1980: 1317, n. 114 on running water supply in Kourion under Claudius.

[80] Mitford 1980: 1310.

[81] Jansen 2000: 111–125.

[82] For the characteristics of the Roman 'water culture' and the comprehensive overview of the adequate literature, see Rogers 2018.

[83] Mitford 1980: 1310–1311; Maier, Karageorghis 1984: 250.

[84] Aupert (Ed.) 2015: 34, 41–42, 85, 87, 103, Fig. 41. For the overview of the *nymphaea* in Cyprus see Wright 1992: 286–287.

at the Sanctuary of Apollo Hylates in Kourion and at the Agora of Amathus.[85] The transition of HH/RH baths from the municipal to stationary water supply, based on the cistern UC.5, possibly coincided with the building over of the settling tank ST.2 in HH13 by the drain ID.6 discharging most likely into this cistern, as well as with the appearance of the garden cistern SC.1 in HH1. These and subsequent changes in water infrastructure may have taken place as a result of the earthquake(s) that must have affected Nea Paphos during Hadrian's reign (after AD 126?)[86] and/or around the mid-second century AD.[87] The occurrence of both these events seems plausible. The first would have caused the final decommissioning of the baths, with a later, possibly intentional, blockage of the *praefurnium* in HH32, while the second resulted in the entire building's final destruction and abandonment. This later cataclysm, followed by levelling works undertaken for the construction of VT, must have contributed to the general obliteration of the Hellenistic–early-Roman structures at *Maloutena* (at least in its southern sector), including associated water infrastructure. Such a scenario is corroborated by comparable observations elsewhere in the city, particularly in the area of Agora (destruction of the East Portico),[88] *Fabrika* (abandonment of the temple[89] and grand cistern)[90] and House of Dionysos (destruction of the earlier house).[91]

CONCLUSIONS AND SUMMARY

This paper has delineated the four-phase evolution of water management at *Maloutena*, spanning the period from the end of the fourth century BC to the mid-second century AD. This sequence, marked by alternating intensification and decline in water supply, appears to correspond broadly with the established habitation/architectural periodisation of *Maloutena* and other key sectors of the city, including Agora, *Fabrika* Hill, and *Ktisto* (the House of Dionysos).[92]

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[85] Christodoulou 2014: 86–87. The baths RB.1, similarly to both abovementioned bath complexes, used most likely the wall-heating system employing terracotta spacers as suggested by examples found in the rubble layers covering RH4 (PAM UW documentation 1994). This technology seems to have been introduced no earlier than after the Flavian period (Farrington, Coulton 1990: 63–64) what may thus provide tentative *terminus post quem* for RB.1. The backfill of the soak-pit south of the RH1 receiving wastewater from these baths contained pottery comparable to the material from the destruction layers in House of Dionysos, dated to the third decade of the second century AD, what may constitute an approximate *terminus* for the decommissioning of the baths (Romaniuk 2021: 383, n. 53; PAM UW documentation 1993/pottery analysis report by Meyza). Additionally, the RH, considered previously as the later addition (of late second/early third century AD, see Daszewski 1999), proved to be part of the baths (Meyza, Zych 2015: 'Early Roman Mosaics'; Meyza 2020: 124).

[86] Kondoleon 1995: 7.

[87] A weight dated to AD 142/143, found in the post-earthquake debris on the Agora, offers a plausible *terminus post quem* for the latter (Miszk 2020: 151, 153; Łajtar 2021: 258, 260–261).

[88] Papuci-Władyka 2020: Table 1.

[89] Balandier 2024: 66.

[90] See footnote 43.

[91] Kondoleon 1995: 7.

[92] For *Maloutena* see e.g. Daszewski, Sztetyłło 1988; for Agora, see e.g.: Nocoń, Marzec 2023: Table 1; Papuci-Władyka 2020: Table 1, as well as Michalik 2025 for periodisation of changes in water drainage system at Agora; for the Theatre at *Fabrika*, see e.g. Barker 2016; for the House of Dionysos, see Hayes 1991: 212.

Regarding water supply, throughout the entire period under analysis (Phases I–IV) rainwater stored in cisterns and groundwater drawn from wells remained a significant, if not primary, source of water for the inhabitants of *Maloutena* and, by extension, Nea Paphos. The first municipal water supply, fed by the extramural aqueduct, might have been introduced after the middle of the second century BC (Phase II), probably ceasing to function by the late first century BC (Phase III). The new one would have been (re)instated around the mid-first century AD (Phase IV). It was possibly supplemented or entirely replaced sometime later by stationary sources equipped with water-lifting devices. Ultimately, all these elements were destroyed in one or more earthquakes by the mid-second century AD.

Water usage underwent notable changes throughout the period under study. During Phase I it was limited to basic domestic and workshop-related purposes. No evidence suggests that this situation changed in Phase II, despite the presumed introduction of a municipal water supply. From Phase III onwards, there are indications for progressive intensification of water use, namely for bathing purposes (domestic bathrooms with hip-bathtubs), laundry, and expanded household production, possibly including dyeing. In Phase IV, water served a considerably broader range of functions – decorative, recreational, bathing, and sanitary – as demonstrated by the presence of decorative pools, Roman-style baths, and multi-seat latrines.

Water disposal was managed by the advanced street sewer system, implemented already in Phase I and possibly expanded gradually over time, supplemented with an extensive network of indoor drains. It appears to have remained functional throughout the entire period under investigation (Phases I–IV), ceasing to operate only in the final phase. This longevity suggests sustained efforts by both Ptolemaic and Roman authorities to maintain the system in working order for around four centuries, attesting to its crucial role in the functioning of the city. When it eventually fell into disrepair, attempts were made to replace it locally with alternative solutions, such as soak-pits.

The conducted research suggests that the observed changes in water management at *Maloutena* were driven by a combination of environmental, political, and socio-cultural circumstances. This is most clearly visible in Phase III, a transitional period marked by the convergence of several critical determinants: the Roman takeover of Cyprus from the Ptolemies, the destruction of Nea Paphos by a severe earthquake, the city's subsequent reconstruction enabled by Augustus's financial support, as well as the cultural encounter between the local Greek-rooted community and the Roman newcomers. These factors initiated the process of gradual replacement of the Hellenistic water culture elements, such as hip-bathtubs, with features more closely aligned with Roman traditions, emphasising the decorative, recreational, and representational functions of water, embodied in ornamental garden pools, thermal baths, and aqueducts, all emblematic of Roman civilisation. These developments indicate a significant transformation in the lifestyle of the local community, which appears to have readily embraced Roman customs, wherein water became a marker of social status and cultural affiliation with *Romanitas.*

This study represents the first attempt to examine the water infrastructure of *Maloutena* in its entirety, with the aim of drawing broader conclusions about the local water management.

Nevertheless, given the constraints of research and the necessarily limited scope of this article, only selected objects and interpretations could have been presented, reflecting well the fragmentary character of the studied material. The multifaceted, qualitative approach adopted here – considering water infrastructure not solely in technological terms but within its wider historical, environmental, political, and socio-cultural context – appeared to be a valuable heuristic tool for interpreting fragmentarily preserved water systems. While such a method inevitably carries the risk of simplification or omission, it enables the identification of at least the general water management patterns and provides a good starting point for the further studies in this field. It should be emphasised as well that this approach yields valuable insights not only into the functioning of ancient hydraulic infrastructure, but also into the historical development of the investigated site and the cultural evolution and aspirations of its inhabitants.

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Table 1. List of the installations mentioned in the text and marked on Fig. 2

Water installation category	Designation	Location	Phase	Dating	Selected references
Distribution boxes	DB.1	HH1	(III?) IV	after the earthquake of 17/15 BC until the late first century AD (possibly the penultimate construction phase of HH; associated with TP.2?)	Meyza 2015: 449–450 (as a settling tank); Romaniuk 2017: 435, 437, Fig. 4 (as a settling tank); 2021: 384, Figs 10c, 12b (as a settling/distribution tank)
Decorative/ garden pools	DP.1	HH1	(III?) IV	as above	Meyza *et al.* 2017: 409, 412–413, 415–417, 423–427, Figs 11–12; Romaniuk 2017; 2021: 384, 388
	DP.2	HH1	(III?) IV	as above	Meyza *et al.* 2017: 401, 403–405, 408, 412–413, 415, Figs 3–5, 8; Romaniuk 2017: 433, 438; 2021: 384
	DP.3	HH13	(III?) IV	after the earthquake of 17/15 BC until the early second century AD (possibly the penultimate/last construction phase of HH)	Meyza *et al.* 2012: 413–414, Fig. 5; Brzozowska-Jawornicka 2019: 57, 60–61, 69, 72; 2021: 104, 107, Fig. 7
Greek-style bathrooms/ masonry hip-bathtubs	GB.1	HA19	III (IV?)	abandoned in the first century AD	Daszewski 1998: 128–129, Fig. 7
	GB.2	VT6	III (IV?)	first century BC	Daszewski 1968: 51; Młynarczyk 1990: 188–189
	GB.3	VT116	III (IV?)	late Hellenistic/early Roman period	Karageorghis 1985: 951
	GB.4	south of the HH1/Street A'	III (IV?)	early first century BC until the first/early second century AD	Daszewski 1994: 109; PAM UW documentation 1993 (contexts F. 121/93 and F.122/93)
Indoor drains	ID.1	VT109	I (II?)	early Hellenistic period (dating estimated on the basis of its stratigraphic position, approximately 0.70m below the late Hellenistic/ early Roman contexts; associated with ST.1)	see ST.1
	ID.2	north of VT107	III (IV?)	late Hellenistic/early Roman period	Karageorghis 1983: 943, Fig. 63; 1984: 949, Fig. 150; 1985: 951
	ID.3	north of VT109/111	III (IV?)	as above	Karageorghis 1979: 712, Fig. 85; 1983: 943, Fig. 63; 1984: 949; 1985: 951; Daszewski *et al.* 1984: 300
	ID.4	north of VT116	III (IV?)	as above	Karageorghis 1985: 951

Water installation category	Designation	Location	Phase	Dating	Selected references
	ID.5	west of VT22	III	first century BC until the first century AD (Julio-Claudian period?); initially dated to the second century AD	Karageorghis 1988: 836; Daszewski *et al.* 2004: 284; PAM UW documentation 1987
	ID.6	HH13	(III?) IV	late first/early second century AD (last construction phase of HH)	Daszewski 1992: 253; Meyza *et al.* 2012: 415
Multi-seat latrines	ML.1	HH8	(III?) IV	after the earthquake of 17/15 BC until the early second century AD (possibly the penultimate/last construction phase of HH)	Moretti, Brunet 1990: 975; Daszewski 1991: 83; 1992: 254; Christou 1996: 1089
	ML.2	HH8E	(III?) IV	as above	Christou 1996: 1089, Fig. 42; Daszewski 2016: 156, Fig. 7
Roman-style baths	RB.1	SW corner of HH/RH	IV	end of the first century until the first half of the second century AD (last construction phase of HH, see also above, footnote 85)	Daszewski 1994: 105, 107–109; 1995: 72; Meyza *et al.* 2012: 416–418, Fig. 10; 2014: 393, 395, 397, 399, Figs 2, 4–10; Meyza, Zych 2015: 'Early Roman Mosaics'; Meyza 2020: 124; PAM UW documentation 1993/pottery analysis report by Meyza
Roof gutters (with gargoyles)	RG.1	HH13	(III?) IV	after the earthquake of 17/15 BC until the early second century AD (possibly the penultimate/last construction phase of HH)	Meyza *et al.* 2012: 414; Brzozowska-Jawornicka 2019: 61, 69, Fig. 4c
Surface masonry-built cisterns	SC.1	HH1	IV	late first/early second century AD (last construction phase of HH)	Daszewski 1992: 253; Meyza *et al.* 2014: 399
Soak-pits	SP.1	Street A' (S of RH1)	IV	as above	Daszewski 1994: 108 (as a settlement tank); Romaniuk 2021: 383, n. 53 (as a settlement tank/soak pit); PAM UW documentation 1993/pottery analysis report by Meyza
Street sewers	SS.1	Street B	I–IV	late fourth/third century BC until the late first/early second century AD (possibly limited, secondary use up to the late Roman period)	Daszewski 1976: 208–209; Karageorghis 1981: 1005; 1984: 949–950; Młynarczyk 1990: 62, 172–173, 189, n. 121, Fig. 22, Ph. 24; Christou 1993: 744; Daszewski *et al.* 2004: 293; 2010: 504, 512; Meyza *et al.* 2011: 287
	SS.2	Street A	I–IV	late third/early second century BC until the late first/early second century AD	Daszewski 1972: 228; Karageorghis 1984: 949–950; 1986: 860; Młynarczyk 1990: 173–174, Ph. 27; Daszewski *et al.* 2004: 286–289, Fig. 3; Michalik *et al.* 2024;

Settling tanks	ST.1	VT109	I (II?)	early Hellenistic period (estimated on the basis of its stratigraphic position, approximately 0.70m below the late Hellenistic/early Roman contexts)	Karageorghis 1979: 714, Fig. 86; Młynarczyk 1990: 190–191, Ph. 43
	ST.2	HH13	III (IV?)	after the earthquake of 17/15 BC until the late first century AD (possibly the penultimate construction phase of HH)	Daszewski 1992: 253; PAM UW documentation 1988 (contexts F.66/91, F.72/91, F. 98/91)
	ST.3	VT73W	III–IV	first century BC until the first/early second century AD	Meyza 2003: 259–261, Fig. 3
Terracotta pipelines	TP.1	HH3	II	late second until the early first century BC	Daszewski 1994: 103; Romaniuk 2021: 384, 386, Fig. 12c, Table 4: PP17, PP18, PP19 (mistakenly as PP19, PP20, PP21 on the page 386)
	TP.2	Street A’	(III?) IV	mid-first until the mid-second century AD, with emphasis on the outset of this period (earlier than TP.3)	Meyza *et al.* 2011: 293, Fig. 9; Romaniuk 2021: 373, 382–383, 386, Fig. 8c-d, Table 4: PP2, PP2.1, PP3; PAM UW documentation 1993/pottery analysis report by Meyza
	TP.3	Street A’	IV	mid-first until the mid-second century AD (later than the TP.2)	Meyza *et al.* 2011: 293; Romaniuk 2021: 373, 382, 386, 387, 389, Fig. 8a-b, d, f, Table 4: PP1, PP4; PAM UW documentation 1988 (contexts F.32/88, F.49/88)
Underground rock-cut cisterns	UC.1	VT66	I–II	late fourth/early third century until 100 BC	Młynarczyk 1990: 185, 190 (as a well); Papuci-Władyka 1995: 180–182 (as a well and cistern)
	UC.2	Streets A’/9	I/II–III	second until the late first century BC (early Augustan reign)	Daszewski 1997: 119–120, Ph. 2; 1998: 125, Fig. 4; Papuci-Władyka 1998
	UC.3	SE of VT80	II/III–IV?	late Hellenistic/early Roman period (Julio-Claudian period?)	Daszewski, Sztetyłło 1988: 202; Młynarczyk 1990: 171, 190; PAM UW documentation 1988
	UC.4	VT16	II/III–IV	first century BC until the late first century AD	Daszewski 1968: 51; Karageorghis 1989: 832; Młynarczyk 1990: 189–190, Fig. 40
	UC.5	HH13	(III?) IV	late first/early second century AD (last construction phase of HH or earlier; in correlation with WL.1 and reused WT.1)	Meyza *et al.* 2012: 415

Water installation category	Designation	Location	Phase	Dating	Selected references
	UC.6	HH1	II/III–IV	second century BC until the late first/early second century AD	Daszewski 1992: 253–254; Meyza 2015: 450
	UC.7	HH4	II/III–IV	late Hellenistic period until the second half of the first century AD	Daszewski 1992: 253
Wells	W.1	VT91	I–IV	before the foundation of the city until the final construction phase of VT in the fourth century AD (see also above, footnote 26)	Karageorghis 1984: 953; Daszewski *et al.* 1984: 301; 2004: 292, Fig. 5 (as a cistern); Młynarczyk 1990: 190
	W.2	VT69S	(III?) IV	early Roman period	Daszewski 1976: 217; Młynarczyk 1990: 171 (as a well), 190 (as a cistern).
Water-lifting devices	WL.1	HH13, HH28S	IV	late first/early second century AD (last construction phase of HH or earlier; associated with UC.5 and reused WT.1)	see UC.5
Water-use utility rooms	WR.1	VT16	III (IV?)	late first century BC until the first century AD	Karageorghis 1989: 834
	WR.2	VT107	III (IV?)	late Hellenistic/early Roman period	Karageorghis 1983: 943, Fig. 63; 1984: 949, Fig. 150; 1985: 951
	WR.3	VT109/111	III (IV?)	as above	Karageorghis 1979: 712, 714, Fig. 85; 1983: 943, Fig. 63; 1984: 949; 1985: 951; Daszewski *et al.* 1984: 300
	WR.4	HH7	(III?) IV	after the earthquake of 17/15 BC until the early second century AD (possibly the penultimate/last construction phase of HH)	Moretti, Brunet 1990: 975, Fig. 96; Daszewski 1991: 82–84
Water towers (siphon blocks)	WT.1	HH13	(III?) IV	after the earthquake of 17/15 BC until the early second century AD (possibly penultimate/last construction phase of HH; secondary use in construction of WL.1)	Meyza *et al.* 2012: 415–416, Fig. 9; Romaniuk 2021: 389–391

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by K. de Lellis-Danys).

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