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Torrent or Trickle? The Aqua Alsietina, the Naumachia Augusti, and the Transtiberim

RABUN TAYLOR

Abstract

Using both the physical and testimonial evidence, this article attempts to present a coherent history of the Aqua Alsietina and the Naumachia Augusti, for which the aqueduct was originally built. After a survey of the primary sources, a reassessment of Roman techniques for measuring water volume in aqueducts is offered. The meager volume Frontinus ascribes to the Alsietina makes sense only if the Naumachia was out of use by his time—a reasonable conclusion if we recognize the increasing value of the land that it occupied in the Transtiberim. The major aim of this article is to locate the Naumachia securely and to characterize three distinct phases of the aqueduct's existence: the functional life of the Naumachia, the era of the water mills on the Janiculum, and the interval in between. Lastly, it uses the evidence of the Aqua Alsietina to resolve some questions about the water rights of those who had property fronting upon an aqueduct zone in the *ager Romanus*.*

INTRODUCTION AND PRIMARY SOURCES

The Aqua Alsietina (fig. 1), sometimes called Aqua Augusta, and its initial *raison d'être*, the Naumachia Augusti, are in many ways the most mysterious of all Rome's major waterworks. We owe what little we

know about the Alsietina's distribution system to the monumental studies of Rodolfo Lanciani, Esther Van Deman, and Thomas Ashby, who rely in turn on early modern antiquarians such as Raffaele Fabretti, Alberto Cassio, Carlo Fea, and Antonio Nibby; the very astute Frontinus commentary of Pierre Grimal; and a brief archaeological report of A.W. Van Buren and G.P. Stevens.¹ While a number of recent studies have dealt with Rome's aqueduct network in greater or lesser detail, none has directed much attention to the Alsietina.² Only Annamaria Liberati Silverio has inquired afresh into this aqueduct; but a welcome article on the naumachiae of Rome, including the Naumachia Augusti, has recently touched upon some of the issues I wish to address.³ My own goal is to synthesize what we know about the Aqua Alsietina, to draw some conclusions about its urban and sub-urban distribution in the first two centuries A.D., and to analyze the aqueduct's water concessions in the light of Roman law.

In examining the Alsietina and the Naumachia, we are forced to rely heavily on written sources, both primary and secondary. I begin with a *catalogue rai-*

* I extend special gratitude to Trevor Hodge, Deane Blackman, and another, anonymous, *AJA* reviewer for their valuable comments. Translations of the Latin and Greek are my own unless otherwise indicated. Where the Latin of Frontinus is not essential to my argument, I use the excellent English translation of Harry Evans in his 1994 book cited below.

The following abbreviations are used:

Ashby	T. Ashby, <i>The Aqueducts of Ancient Rome</i> (Oxford 1935).
Coleman	K. Coleman, "Launching into History: Aquatic Displays in the Early Empire," <i>JRS</i> 83 (1993) 48–74.
Evans	H. Evans, <i>Water Distribution in Ancient Rome: The Evidence of Frontinus</i> (Ann Arbor 1994).
FUM	E. Rodriguez Almeida, <i>Forma urbis marmorea: Aggiornamento generale 1980</i> (Rome 1981).
FUR	R. Lanciani, <i>Forma urbis Romae</i> (Milan 1893–1898).
Grimal	P. Grimal ed., <i>Frontin: Les aqueducs de la ville de Rom</i> (Paris 1944).
Lanciani	R. Lanciani, <i>Topografia di Roma antica. I commentarii di Frontino intorno le acque</i>

e gli acquedotti (MemLinc [ser. 3] 4, 1880) 215–616.

Liberati Silverio	A. Liberati Silverio, "Aqua Alsietina," in G. Pisani Sartorio and A. Liberati Silverio eds., <i>Il trionfo dell'acqua: Acque e acquedotti a Roma, IV sec. a.C.–XX sec.</i> (Rome 1986) 72–79.
Pace	P. Pace, <i>Gli acquedotti di Roma e il De aquaeductu di Frontino</i> (Rome 1983).
Richardson	L. Richardson, jr, <i>A New Topographical Dictionary of Ancient Rome</i> (Baltimore 1992).
Van Deman	E. Van Deman, <i>The Building of the Roman Aqueducts</i> (Washington, D.C. 1934).

¹ Lanciani; Van Deman; Ashby; Grimal; A.W. Van Buren and G.P. Stevens, "The Aqua Alsietina on the Janiculum," *MAAR* 6 (1927) 137–46.

² Pace; Evans; C. Bruun, *The Water Supply of Ancient Rome: A Study in Roman Imperial Administration* (Helsinki 1991).

³ Liberati Silverio; see also *Lexicon topographicum urbis Romae* I (1993) 61, s.v. Aqua Alsietina (A. Liberati Silverio). On the naumachiae, see Coleman. Oddly, Coleman says little about Trajan's naumachia.



Fig. 1. Engraving of feature believed to be a lost segment of the Aqua Alsietina. (From *FUM* fig. 43)

sonné of the most important primary sources on the aqueduct and the Naumachia. When using these sources in the text, I will refer to their numbers rather than the full citation.

A. Primary Sources on the Alsietina

A1. Frontin. *Aq.* 11.1–2 [2 B.C.]: “What reason moved Augustus, the most farsighted of emperors, to introduce the Aqua Alsietina, which is called the Augusta—water without favor, indeed hardly beneficial, and so never channeled for public use—I do not entirely understand; unless perhaps when he undertook to build the Naumachia, so that he should not draw upon more salutary waters at all, he introduced it in an isolated system and then, because it proved to be excessive for the Naumachia, he granted concessions to adjacent gardens and to private citizens for irrigation. By necessity, however, whenever the bridges are being repaired and the waters from

the near bank are cut off, it is customary in the Transiberine region for waters from it to serve as a supplement to the public fountains. It has its intake at Lacus Alsietinus at the 15th milestone of the Via Claudia on a branch road 6,500 paces to the right. Its conduit has a length of 22,172 paces, 358 on arcades.”⁴

A2. *CIL* VI 31566 = XI 3772a = *ILS* 5796 [between A.D. 4 and 37]: “The emperor Caesar Augustus, son of the deified [Julius? Augustus?], pontifex maximus, added the channel of Mens to the main conduit of the Aqua Augusta, which arrives at the Grove of the Caesars so that [water should flow continually] from it to the *rivales* who had been receiving it [only] until the trumpet call.”⁵

A3. Frontin. *Aq.* 18.8 [ca. A.D. 98]: “The lowest [aqueduct] of all is the Alsietina, which serves the Transiberine region and especially low-lying areas.”⁶

A4. Frontin. *Aq.* 22.1 [ca. A.D. 98]: “Neither the Virgo,

⁴ *Quae ratio moverit Augustum, providentissimum principem, perducendi Alsietinam aquam, quae vocatur Augusta, non satis perspicio, nullius gratiae, immo etiam parum salubrem ideoque nusquam in usus populi fluentem; nisi forte dum opus Naumachiae adgreditur, ne quid salubrioribus aquis detraheret, hanc proprio opere perduxit et, quod Naumachiae coeperat superesse, hortis adiacentibus et privatorum usibus ad inrigandum concessit. Solet tamen ex ea in Transiberina regione, quotiens pontes reficiuntur et a citeriore ripa aquae cessant, ex necessitate in subsidium publicorum salientium dari. Concipitur ex lacu Alsietino via Claudia miliario quarto decimo deverticulo dextrorsus passuum sex mil-*

ium quingentorum. Ductus eius efficit longitudinem passuum viginti duum milium centum septuaginta duorum, opere arcuato passuum trecentorum quinquaginta octo.

⁵ [Imperator Caesar divi f.] Augustus [p]ontif(ex) max(imus) [for]mam Mentis attrib(uit) [in r]Tivo aquae Augustae [q]uae pervenit in nemus Caesarum [ut] ex eo rivalibus qui [ad b]uccinam accipieb(ant) [aqua perennis fluere]t. The reconstruction is according to Ashby, which I find preferable to that of the *CIL*.

⁶ *Omnibus humilior Alsietina est, quae Transiberinae regioni et maxime iacentibus locis servit.*

nor the Appia, nor the Alsietina has settling tanks, that is, *piscinae*.⁷

A5. Frontin. *Aq.* 71.1–2 [ca. A.D. 98]: “The capacity of the Alsietina at its intake has not been recorded in the commentaries, nor has it been possible under the present circumstances to establish it for certain, since it receives from the Lacus Alsietinus and then from the Lacus Sabatinus near the Careiae only as much as the watermen have allotted. The Alsietina delivers 392 *quinariae*.⁸

A6. Frontin. *Aq.* 85 [ca. A.D. 98]: “The Alsietina has 392 *quinariae*. All of this is consumed outside the city, 254 *quinariae* in Caesar’s name and 138 *quinariae* by private parties.”⁹

B. Primary Sources on the Naumachia Augusti

See also **A1** above.

B1. Suet. *Aug.* 43.1 [2 B.C.]: “. . . he [Augustus] also gave a naval battle near the Tiber, having excavated the land on which the Grove of the Caesars now lies.”¹⁰

B2. Dio 55.10.7 [2 B.C.]: “. . . and a naval battle between the Persians and the Athenians was given in the place in which even now some traces of it can still be pointed out.”¹¹

B3. Aug. *Mon. Anc.* 23 [2 B.C.]: “I presented to the people the spectacle of a naval battle across the Tiber, in the place that is now the Grove of the Caesars, having excavated an area 1,800 feet in length and 1,200 in width. In it roughly 30 beaked ships, triremes or biremes, along with many smaller craft, did battle with one another. About 3,000 men, not counting the oarsmen, fought in these fleets.”¹²

B4. Pliny *HN* 16.200 [between A.D. 14 and 37]: “It is believed that the largest tree that has ever existed

up to our time was seen in Rome. Because of its capacity to amaze, Tiberius put it on view in the above-mentioned bridge of the Naumachia, supported by the wood that had survived [a fire]; and it lasted until the amphitheater of the emperor Nero [built in 57]. It was a beam of larch, 120 feet long, with an even thickness of 2 feet. The additional height seemed incredible to those who estimated its continuation to the top.”¹³

B5. Suet. *Tib.* 72.1 [30s A.D.]: “Only twice in all the time he was retired did he [Tiberius] try to return to Rome; once he sailed in a trireme as far as the nearby gardens of the Naumachia, having placed a guard along the banks of the Tiber to remove anyone who came to meet him.”¹⁴

B6. Dio 62.20.5 [A.D. 59]: “. . . he [Nero] feted the people on boats in the area where the sea battle had been under Augustus, and at midnight he sailed from it through a canal into the Tiber.”¹⁵

B7. Tacit. *Ann.* 14.15 [A.D. 59]: “. . . and little brothels and taverns were set up at the grove that Augustus had placed around his naval pond....”¹⁶

B8. Suet. *Tit.* 7.3 [A.D. 80]: “He [Titus] presented a naval battle in the old Naumachia, and in the same place gladiatorial contests as well as five thousand wild beasts of every kind on a single day.”¹⁷

B9. Dio 66.25.3 [A.D. 80]: “. . . and others staged a sea battle outside in the grove of Gaius and Lucius, which Augustus once excavated for the same purpose. And also in that place, on the first day there was a gladiatorial contest and a wild beast hunt, the [part of the?] lake fronting the statues [of Gaius and Lucius?] having been overbuilt with planks and surrounded by platforms; on the second day, there was a horse race; and on the third, a sea battle with 3,000

⁷ *Nec Virgo nec Appia nec Alsietina conceptacula, id est piscinas, habent.*

⁸ *Alsietinae conceptionis modus nec in commentariis adscriptus est nec in re praesenti certus inveniri potuit, cum ex lacu Alsietino et deinde circa Careias ex <S>abatino <tantum accipiat> quantum aquarii temperaverunt. Alsietina erogat quinarias trecentas nonaginta duas.*

⁹ *Alsietinae quinariae trecenta<e> nonaginta duo. Haec tota extra urbem consumitur, nomine Caesaris quinariae CC quinquaginta quattuor, privatis quinariae centum triginta octo.*

¹⁰ *Fecit . . . item navale proelium circa Tiberim cavato solo, in quo nunc Caesarum nemus est.*

¹¹ *καὶ ναυμαχία ἐν τῷ χωρίῳ ἐν ᾧ καὶ νῦν ἐστὶ σημεῖα τινα αὐτῆς δεικνύται Περσῶν καὶ Ἀθηναίων ἐποικίῃ.*

¹² *Navalis proeli spectaculum populo dedi trans Tiberim, in quo loco nunc nemus est Caesarum, cavato solo in longitudinem mille et octingentos pedes, in latitudinem mille et ducenti. In quo triginta rostratae naves triremes aut biremes, plures autem minores inter se conflixerunt. Quibus in classibus pugnaverunt praeter*

remiges millia hominum tria circiter.

¹³ *Amplissima arborum ad hoc aevi existimatur Romae visa, quam propter miraculum Tiberius Caesar in eodem ponte Naumachiaro exposuerat advectam cum reliqua materie, duravitque ad Neronis principis amphitheatrum. Fuit autem trabs ea e larice, longa pedes CXX, bipedali crassitudine aequalis, quo intellegebatur vix credibilis reliqua altitudo fastigium ad cacumen aestimantibus.*

¹⁴ *Bis omnino toto secessus tempore Romam redire conatus, semel triremi usque ad proximos Naumachiae hortos subvectus est disposita statione per ripas Tiberis, quae obviam prodeuntis submoveret.*

¹⁵ *ἔδειπνισε τὸν δῆμον ἐπὶ πλοίων ἐν τῷ χωρίῳ ἐν ᾧ ἡ ναυμαχία ὑπὸ τοῦ Αὐγούστου ἐγεγόνει· καὶ ἐξ αὐτοῦ νυκτὸς μεσοῦσης ἐς τὸν Τίβεριν διὰ τάφρου κατέπλευσε.*

¹⁶ *Exstructaque apud nemus, quod navali stagno circumposuit Augustus, conventicula et cauponae.*

¹⁷ *Dedit et navale proelium in veteri Naumachia, ibidem et gladiatores atque uno die quinque milia omne genus ferarum.*

men and after this an infantry battle. The Athenians, conquering the Syracusans (they used these names in the naval battle), went out onto the little island and attacked and captured a wall that had been built around the memorial."¹⁸

B10. Frontin. *Aq.* 22.4 [ca. A.D. 98]: "The conduit of the Alsietina ends behind the Naumachia, for which it seems to have been made."¹⁹

FRONTINUS'S MEASUREMENTS OF WATER VOLUME

Students of Frontinus correct him at their own peril. The aqueduct commissioner of Nerva and Trajan may successfully be accused of distortions or omissions in his treatise *De aquae ductu*, but to ascribe to him outright untruths, whether from ignorance or from dishonesty, requires extraordinary standards of proof. A pragmatic man with a genuine interest and personal involvement in the aqueduct projects under his direction, Frontinus can usually be trusted to know what he is talking about, unlike many of his more ambitious and encyclopedic literary predecessors such as Pliny the Elder and even Vitruvius. For this reason, it is profitable to analyze Frontinus's few statements about the Aqua Alsietina with close attention and respect and to do our best to understand how his statements might complement, or even clarify, the evidence from other sources.

In the group of chapters cataloguing the individual aqueducts' water distribution statistics (*Aq.* 79–86), the Alsietina is the only aqueduct of Rome whose delivery capacity Frontinus described in the present tense (**A6**). All the other lines were represented as they had been before he began his reforms. He withheld up-to-date information on his new distribution figures for the entire network of Rome's aqueducts, he tells us, because "things should not be set forth unless they have been completed, when we will have added them to increase the entire supply" (*Aq.* 88.4, transl. Evans). The Alsietina alone, it would seem, was left untouched by Frontinus's reforms; he could describe it in the present tense because it remained the same as he found it.

According to Frontinus's measurements, the Aqua Alsietina, though prone to fluctuations, delivered 392 measurable *quinariae* (**A6**). Before we proceed,

it would be well to examine the *quinaria*, or five-pipe, and its practical applications.

Pipes issuing from *castella*, i.e., distribution tanks, came in a number of regular sizes. In Rome the smallest, and standard, unit of capacity was the *quinaria*. One of the most vexing problems in aqueduct studies is what Frontinus means by this unit, which is nothing more than an established diameter of a pipe. Trevor Hodge complains:

There are two problems. As a matter of practical engineering, how can a simple pipe be used to measure a volume of water? And, second, how can a linear measurement, the diameter of a pipe, be used to express volume? It is like saying, in modern terms, that a city daily consumes 15 six-inch pipes. The vital element missing, for a figure with any meaning, is time, or rate of flow (which is a function of it). Thus, a six-inch pipe running at five feet per second gives us that concept of volume that, without the time or speed element, we seek in vain. But nowhere in Frontinus, or elsewhere, do we find any reference to speed of flow, without which listing the cross section or diameter of the pipe is idle and pointless. This has sometimes led to complaints that the ancients did not even realise that the volume of water flowing through a pipe depended quite as much on how fast it flowed as how big the pipe was. The truth almost certainly was that Frontinus fully realised the importance of measuring speed of flow, but simply could not do it.²⁰

The way that Frontinus could use a pipe of a certain diameter to represent a standard volume, Di Fenizio concluded, was always to install it in the *castellum* wall at the same distance below the average water level, thus ensuring a relatively uniform head of pressure in every *castellum*.²¹ He proposed that the *quinaria* pipe was set about 12 cm below the water level; this would force a minimum of 40 m³ per day through it.

Some such standard conditions must be assumed if the *quinaria* is to have any meaning at all. In a free-flow channel the speed of flow varied from one place to the next; but a *quinaria* was a measure used most often for pipes that had water flowing through them at a controlled level of pressure, which, for all intents and purposes, gave a uniform speed. The volume of an aqueduct's flow, therefore, could only be

¹⁸ ἄλλοι δὲ ἔξω ἐν τῷ ἄλσει τῷ τοῦ Γαίου τοῦ τε Λουκίου, ὅποτε ὁ Αὐγουστος ἐπ' αὐτὸ τοῦτ' ὠρύξατο. καὶ γὰρ ἐνταῦθα τῇ μὲν πρώτῃ ἡμέρᾳ μονομαχία τε καὶ θηρίων σφαγῇ, κατοικοδομηθείσης σάνισι τῆς κατὰ πρόσωπον τῶν εἰκόνων λίμνης καὶ ἱκρία περὶ λαβούσης, τῇ δὲ δευτέρᾳ ἵπποδρομία καὶ τῇ τρίτῃ ναυμαχία τρισχιλίων ἀνδρῶν καὶ μετὰ τοῦτο καὶ πεζομαχία ἐγένετο· νικήσαντες γὰρ οἱ Ἀθηναῖοι τοὺς Συρακουσίους (τούτοις γὰρ τοῖς ὀνόμασι χρῆσάμενοι ἐναυ-

μάχισαν) ἐπεξῆλθον ἐς τὸ νησίδιον, καὶ προσβαλόντες τείχεϊ τινὶ περὶ τὸ μνημεῖον πεποιημένῳ εἶλον αὐτό.

¹⁹ *Alsietinae ductus post Naumachiam, cuius causa videtur esse factus, finitur.*

²⁰ A.T. Hodge, *Roman Aqueducts and Water Supply* (London 1992) 299.

²¹ C. Di Fenizio, "Sulla portata degli antichi acquedotti romani," *Giornale del genio civile* 14 (1916) 227–331.

measured accurately at pipes issuing from castella or settling tanks, where they could be installed at a certain level to regulate the head of pressure.

It is rather easy to demonstrate that Romans could measure the volume of flow through a pipe based on the *quinaria* unit. All that was needed were two vessels of known volume and some kind of timing device: perhaps a water clock, or even a sundial. One had only to open the valve, mark off a specified time period while alternately filling and emptying the two vessels, shut off the valve, and then total up the number of times the vessels were filled. This measurement does not presume speed in mathematical terms (distance over time). Such a calculation at a castellum was of little use to the watermen.²² But the measurement of time was nonetheless essential, even if it was done in increments of hours or half hours for lack of more precise measuring devices. A Severan inscription from Lamasba in Numidia (*CIL* VIII, 4440, partially reproduced as *ILS* 5793) gives evidence of precisely this procedure. It records volumes of private concessions in units designated by the letter K (*kapita*?), or in two cases by *ollae* (jars), over a specified number of hours on a certain day of the year. The date was essential to the absolute measurement because of the variance in the length of sundial hours at different times of the year.

Once the volume *over time* had been established for a pipe of any given diameter under a given head of pressure, its value was known forever, and it could be referred to simply by the pipe's diameter in *quinariae*. In fact, as long as it was recognized that water discharge under a standardized head of pressure behaved predictably, volume over time—at least in the practical considerations of day-to-day management of the aqueducts—may have been of no concern at all. Pipes of standard diameter could be used to measure volume at any castellum or *piscina* (settling tank) without any other special equipment. Lead pipes themselves could not be manufactured to precise specifications of diameter,²³ but their critical diameters at the castellum wall could be kept quite uniform by the use of a *calix*, a bronze collar milled to

exacting specifications.²⁴ To measure the volume of water flowing through a castellum, the watermen needed to have a horizontal row of pipes of known diameters already installed with calices and valves at a specified level in the wall of the tank.²⁵ Then they shut off all the offtake pipes, including the measuring pipes. When the water in the tank rose to the specified level above the measuring pipes, indicating the desired head of pressure, the measuring pipes' valves were opened one by one (the water could simply be allowed to run off into a sewer) until equilibrium was established, i.e., the level in the tank neither rose nor fell. The capacities in *quinariae* of all the pipes with open valves were then simply added together. (I am grateful to Trevor Hodge and Deane Blackman for the observation that an empirical technique of this sort, relying upon what modern engineers call an integrated variable, was well within the competence of Roman watermen.)

Such an arrangement may be implicit in the plural *mensurae*, the word Frontinus uses for the measuring devices in the aqueducts' settling tanks (*Aq.* 66.4, 67.5, 69.2, 72.3). It is clear that similar gauges were used on tanks at an aqueduct's intake (when possible) and at the principal castella, because the diameters of the pipes in these three locations had been dishonestly manipulated by the watermen to give the impression of greater or lesser volume. This was a problem Frontinus had discovered throughout the system. Measuring devices (presumably pipes and calices) reportedly of the same gauge were found to be smaller at the settling tanks than at the intakes, and smallest of all at the castella (*Aq.* 75.1). This allowed water to be drawn off along the way without detection.

When properly calibrated, these devices offered the most accurate measurements, as Frontinus says; the Aqua Iulia's settling tank, for example, allows "clear measurements" (*manifestae mensurae*, 69.2), while the Claudia's settling tank is described as a place "where the measurements are certain" (*ubi indubitatae mensurae sunt*, 72.3). But Frontinus definitely had a more approximate technique of measuring volume, which, when necessary, he could apply directly in

²² "Hero [of Alexandria] would say that if velocity is doubled then so is quantity; or if area is halved then so is quantity. What Hero does not say is that $Q = VA$. Identifying the relevant parameters does not inevitably lead to the formulation of a general equation. And, in fact, to determine a real value for discharge, it is revealing to read Hero's recommendation: 'One should therefore dig a reservoir under the stream and note with the help of a sundial how much water flows into the reservoir in a given time, and thus calculate how much will flow in a day.' It

would work but it does not assume that $Q = VA$ "; N.A.F. Smith, "Problems of Design and Analysis," in A.T. Hodge ed., *Future Currents in Aqueduct Studies* (Leeds 1991) 121.

²³ Hodge (*supra* n. 20) 263.

²⁴ Frontin. *Aq.* 36, 112; Pace 145–49. No archaeological evidence of calices has ever surfaced, but we are sadly short of physical remains of castella in general.

²⁵ Frontinus is aware that a pipe placed lower in the wall of a tank than another of the same gauge will draw more water; see *Aq.* 113.2.

the channel. It is this method, used in the Aqua Appia, that has raised doubts about the Romans' technical competence in measuring water volume: "... At the 'Twins,' a place below Spes Vetus, where the Appia is joined to the branch of the Augusta, I found the depth of water to be 5 feet and its width 1 3/4 feet, making 8 3/4 square feet in area, equal to 22 100-pipes and a 40-pipe, which results in 1,825 quinariae. . . ."26 How, Hodge asks, did Frontinus use a cross section to measure volume without considering speed? One possible approach is simply to dismiss the problem of speed, as Günther Garbrecht does: "Da Wandrauheit, Gefälle und hydraulischer Radius bei den stadtrömischen Fernwasserleitungen im allgemeinen nicht sehr unterschiedlich waren, ist Frontinus über die Messung der durch-flossenen Fläche im großen und ganzen zu recht zuverlässigen Abflußwerten gekommen."²⁷ But the Romans could certainly have done better than simply hope for uniformity of conditions wherever they measured a cross section. In a 1984 article, Hodge proposed an elegant solution to the problem that does not presume the measurement of water speed, involving a portable sluice gate that could be fitted into an aqueduct channel and adjusted until the head built up behind the gate approximated the standard head used to measure quinariae in a castellum.²⁸

The only objection to this solution is that Frontinus does talk about the influence of water speed on some of his measurements. Along the Aqua Virgo (which had no settling tank, A4) at the seventh milestone in the farm of Ceionius Commodus, "the rate of flow is faster" (*velociorem iam cursum habet*, Aq. 70.3) than it is near the source, and thus more conducive to measuring volume. Water that is moving too fast, however, affects the measurements adversely. Frontinus says of the Anio Novus, "... it is evident that the actual volume [at the intake] is even in excess of our measurements. This can be explained because the rather swift source of the water, taken from a bountiful and fast-flowing river, increases its volume by its very speed."²⁹ It would seem that Frontinus was looking not just for conditions that would favor an accurate measurement, but indeed for a particular water speed: one that, ideally, would exactly equal the speed of water passing through the hor-

izontal row of measuring pipes in a tank under the correct head of pressure. When he found a place in the channel that approximated this speed (which would produce a reading established from prior experimentation), he could directly translate the naturally flowing water's area in cross section into an aggregate of cross sections in measuring pipe. This is exactly what he did for the Appia: an area of 8.75 Roman ft² is almost exactly equal to the combined cross sections of 22 100-pipes and one 40-pipe (by my calculations, 8.74 ft²).

Cross section was easy enough to establish. But how did Frontinus measure water speed directly in the channel without the mathematical concept of distance over time? I suggested above the establishment of benchmarks by prior experiment, and it is indeed by the use of benchmarks that Frontinus must have made his readings. When consulting a wind sock, a pilot gauges wind velocity not in terms of two variables (distance and time), but in terms of a single variable (length). There is no reason why the Roman watermen could not have devised some hydraulic variant on a wind sock: perhaps a mesh frame with a swinging door hinged at the top, which was thoroughly immersed in the current so as to present maximum resistance. By trial and error they could have established that the desired water speed was at hand when the door was forced open to a certain angle—say, half a right angle. The angle reading is thus the single variable needed to gauge speed. With such a simple and portable device Frontinus could quickly take speed measurements at many points along a channel. When he found a spot that yielded the critical angle within an acceptable range of fluctuation (in modern units of measurement, 45 plus or minus a few degrees), he had simply to measure the cross section of the water at that spot, and his estimate of quinariae was complete. Naturally, this was not the preferred method of measurement, since Frontinus could not always find a suitable spot in the channel. The question whether the Alsietina was measured by this method will be discussed below.

Most modern studies generally accept Di Fenizio's proposed volume of a quinaria, 40.6 m³ per day.³⁰ In fact, it would now seem to be somewhat excessive when tested against Blackman's 1978 calculations,

²⁶ Aq. 65.3, transl. Evans. The *centenaria*, or 100-pipe, was 11.281 digits in diameter (0.705 Roman ft), with a capacity of 81.45 quinariae. The *quadrigenaria*, or 40-pipe, was 7.135 digits in diameter (0.446 Roman ft), with a capacity of 36.58 quinariae (Aq. 50, 62).

²⁷ G. Garbrecht, "Mensch und Wasser im Altertum," in *Die Wasserversorgung antiker Städte* (Mainz 1988) 38. In personal correspondence, Deane Blackman has made essen-

tially the same argument, suggesting that Frontinus's quinaria was right "within a factor of 2, either way, of the actual flow rate"—an acceptable level of precision for his purposes.

²⁸ A.T. Hodge, "How Did Frontinus Measure the Quinaria?" *AJA* 88 (1984) 205–16.

²⁹ Aq. 73.6, transl. Evans.

³⁰ Di Fenizio (supra n. 21); Pace 150; Hodge (supra n. 20) 299–300.

which represent the most scientifically rigorous investigation of the flow of Rome's aqueducts to date.³¹ We begin with Frontinus's calculation of the total water capacity, 24,018 quinariae – 14,018 with authorized distribution (*Aq.* 78.1), and about 10,000 illegally tapped outside the city (*Aq.* 74.4). This total capacity, not just what was delivered at or near the end, is crucial to our comparison, because Blackman's independent method using available raw archaeological data presumes that no water along the way has been added, diverted, or lost.

Blackman estimates that the four largest aqueducts alone delivered about 7 m³ per second, or 604,800 per day. According to Frontinus, the total capacity of these four aqueducts – the Anio Vetus, Aqua Marcia, Aqua Claudia, and Anio Novus – was 18,433 quinariae (*Aq.* 66.2; 67.2; 72.2; 73.2), or 76.7% of the total capacity of the nine existing aqueducts, 24,018.³² If we apply this percentage to Blackman's estimate, we calculate that the total capacity in Rome's network was 788,527 m³ per day. Dividing this by the total number of quinariae, 24,018, results in 32.8 m³ per day. Given the futility of establishing precise numbers and the fact that Frontinus could not determine the capacity at intake of some of the smaller aqueducts, we can round up to 35 m³ per day – the figure I will use to represent a single quinaria.

VOLUME AND FUNCTIONS OF THE ALSIETINA

The most common mistake that scholars make about the Aqua Alsietina is to assume that 392 quinariae (**A5**, **A6**) was that aqueduct's customary volume. This has led to the assumption that the Naumachia Augusti, for which the line was expressly built,

actually functioned under these conditions.³³ There are two reasons why we cannot accept such an assumption. First, we know that by Frontinus's day all the Alsietina's meager volume was being delivered *extra urbem*, i.e., outside the regionary city (**A6**). If we assume the Naumachia was still functional, then we must conclude that it was entirely outside the 14th region – a particularly uncomfortable admission for the majority of scholars who accept that it lay in the plain just below the monastery of S. Cosimato.³⁴ I will return to this issue, but it is important to emphasize now that Frontinus's definition of the *urbs* is nothing more or less than the regionary city. The occasional confusion surrounding this matter³⁵ is inexplicable, for there is no equivocation about it at all in Frontinus's catalogue of delivery statistics (*Aq.* 77–86). (The area of continuous habitation called the *continentia*, which forms the urban boundary in some of the legal documents Frontinus transmits, does not concern him directly.) Anything *extra urbem* must have been outside all the regions, including the 14th. When Frontinus, rather confusingly, claims the Alsietina supplies the “Transtiberine region” (**A3**), he is referring not to the official 14th region, but to the broader area of suburban development.

The second reason is purely practical. We know the Naumachia's dimensions in plan, 533 × 355 m (1,800 × 1,200 Roman ft; **B3**). Though I argue below to the contrary, let us assume for the moment – to diminish the water volume postulated – that the pool was an oval rather than a rectangle, and that its average depth was 1.5 m, an acceptable draft for triremes, biremes, and other battle craft (**B3**), authentic or not.³⁶ I emphasize an average, because the

³¹ D.R. Blackman, “The Volume of Water Delivered by the Four Great Aqueducts of Rome,” *BSR* 46 (1978) 52–72.

³² If we add up the intake capacities given in *Aq.* 65–73, we actually arrive at a higher total: 1,825 (Appia) + 4,398 (Anio Vetus) + 4,690 (Marcia) + 1,206 (Iulia) + 2,504 (Virgo) + 392 (Alsiatina) + 4,607 (Claudia) + 4,738 (Anio Novus) = 24,360. The Tepula (not included here since Frontinus considered it part of the Iulia), Iulia, Virgo, and Alsietina could not be measured near their intakes, and probably had even larger capacities than recorded. The Anio Novus, by Frontinus's own admission, had a somewhat greater capacity than his measurements indicated (*Aq.* 73.6).

³³ Grimal 71, n.1; Pace 247, n. 1; Evans 112, but with serious reservations.

³⁴ The regionary catalogues record that two naumachiae were to be found in the 14th region. Since we know this region extended as far north as the Mons Vaticanus, the Naumachia Traiani is almost certainly one of the two. The Naumachia Domitiani, which has never been located, was apparently dismantled by Trajan, while the “naumachia” attributed to Philip the Arab is a fiction; see Richardson,

s.vv. Naumachia Domitiani, Lacus Philippi. We are left with the strong probability that the Naumachia Augusti is the other one intended. It was most certainly nothing more than a relic in the fourth century.

³⁵ For example, G. Panimolle, *Gli acquedotti di Roma antica* (Rome 1968) 129.

³⁶ Some believe these were not real battle craft, but miniatures or adapted barges. The 3,000 men involved in the spectacle, “not counting the oarsmen” (**B3**), might easily represent full crews for 30 naval ships; but an unspecified number of these participants also manned “many lesser craft.” Whatever the truth about the ships themselves, as Coleman has pointed out, a certain depth must be assumed in order to ensure the safety of participants jumping into the water from the decks. But Coleman's argument that curved walls could withstand the pressure of the water better than straight ones (Coleman 53) is questionable and only relevant if the water was contained by freestanding walls. This was not necessarily the case; it is repeatedly attested that Augustus excavated the pool out of the earth (**B1**, **B3**, **B9**).

floor of the pool probably sloped gently downhill toward the point of drainage. This would have required 243,253.5 m³ of water. According to Frontinus's measurements, the Alsietina was delivering 254 quinariae in the emperor's name, or 8,890 m³ a day, while the rest was reserved for private interests (A6). This is 206 fewer quinariae than the Euripus of Agrippa received in the Campus Martius. Under such circumstances it would have taken 27.4 days to fill the pool.³⁷ Nor could the entire 392 quinariae have been devoted exclusively to filling the Naumachia when time grew short; an Early Imperial inscription (A2) shows that once the Channel of Mens was added to the main conduit of the Alsietina in Augustus's later years or perhaps under Tiberius, private concessions were guaranteed around the clock.

Some have been willing to accept these limitations. Recognizing the possibility that such a sluggish movement of water through that vast pond presented a health risk, Pace suggests that the Naumachia was kept empty most of the time. But if the pool required a month to fill, it still faced the risk of stagnation in the process. The justifications become ever more labored as one follows this line of reasoning. Why introduce a special aqueduct for the Naumachia if most of its water was going to be shut off most of the time? Perhaps it was diverted, not shut off. Then why waste all that water by diverting it into the Tiber? Perhaps it was used for other purposes, such as irrigation. Then why does Frontinus describe the Alsietina's irrigation functions as an afterthought (A1)?

It is much more reasonable to conclude that during its active lifetime the Naumachia was kept full and flowing with a much more vigorous water supply than 254 quinariae, but that it had lapsed into

disuse by the time Frontinus was writing. Indeed, under Frontinus the Alsietina can be characterized as little more than an irregular trickle. Liberati Silverio has discovered that the source of the Alsietina, the Lacus Alsietinus, began to sink at around the end of the first century A.D. and never regained its former level. A second, lower intake channel was cut, but was never as successful as the first.³⁸ It was precisely at this time that Frontinus complained of fluctuations in the aqueduct's intake, which required constant attention from the watermen (A5). We know that by the time Dio Cassius was writing his history (the 220s and 230s) the Naumachia was not only out of use, but only partially intact (B2).³⁹ Frontinus observes, moreover, that the Alsietina's channel heads directly down the hillside to the Naumachia, yet he says *perhaps (forte)* Augustus brought in the aqueduct expressly to serve the pool (A1), "for which it seems to have been made" (B10; emphasis mine). Though his uncertainty would appear to be insincere, the fact that Frontinus could express uncertainty at all, when the physical evidence – the main channel leading directly to the Naumachia – would seem obvious to anyone with a passing knowledge of aqueducts, strongly suggests that the water had ceased to flow into the Naumachia, or even to the channel directly behind it.

There is no way to estimate the volume of the Alsietina before it began to fail, but it must have been much larger than the figure reported by Frontinus. On the other hand, it could not have been so enormous as that, for example, of the large aqueduct at Vienne, which is sometimes thought to have fed a naumachia.⁴⁰ The segment of the Alsietina's channel by the Viale 30 Aprile, which is discussed below, had the cross section of a regular aqueduct: 0.87 m wide, with an estimated height of just under

³⁷ Many have made estimates, but always under the misguided assumption that all 392 quinariae could be deployed to fill the pool. For example, assuming an elliptical shape and a depth of 1.7 m, full use of the entire capacity of 392 quinariae, and Di Fenizio's definition of a quinaria, Coleman (53–54) estimates that the Naumachia could be filled in 17 days. But public water could not be diverted to private use, or vice versa, except in legally durable fashion.

³⁸ Liberati Silverio 73.

³⁹ It is particularly surprising that Liberati Silverio (73, 78) believes the Naumachia was in continuous use well into the third century. The once-popular notion that Philip the Arab restored it (Aur. Vict. *Caes.* 28) must be discarded; see n. 34 above. Even the notion that the Naumachia would have used water in Caesar's name, rather than public water, is troubling; Suet. *Nero* 27.2 implies that it was a public monument.

⁴⁰ This aqueduct, 1.8 × 2.25 m in cross section, is es-

timated to have carried water at a maximum volume of 374,000 m³ per day, but averaging about 186,000; see M. Bailhache, "Étude de l'évolution du débit des aqueducs gallo-romains," in J.-P. Boucher ed., *Journées d'études sur les aqueducs romains* (Paris 1983) 24; J. Ruf and J. Place, "Dégagement d'une partie d'un grand aqueduc à Vienne (Isère)," *Rhodania* 1938, 84–87. Unspecified evidence has suggested to some that the line tapped the Gère River directly and did not flow perpetually. A few scholars have therefore argued that it fed a naumachia, while others propose that it was used periodically to flush the town's sewers; see J. Cottaz, "Les aqueducs romains de Vienne," in *Rhodania, Compte rendu du XIX^e Congrès* (Vienne 1937) 78; Bailhache (supra) 24. A. Grenier, *Manuel d'archéologie gallo-romaine* IV.1: *Les monuments des eaux* (Paris 1959) 112–13 suggests, however, that the aqueduct was used continually for fountains and baths.

2 m.⁴¹ Nibby's report of the Alsietina's intake channel at the Lago di Martignano (the ancient Lacus Alsietinus), now well above lake level, roughly replicates these dimensions. The segment he examined was about 3 × 5 ft in cross section (1 × 1.6 m).⁴² Various etchings, all derived from a single prototype, also show what is believed to be a lost segment of the Alsietina (fig. 1),⁴³ and it too, judging by the size of the reticulate blocks relative to the channel, appears to be of normal proportions.

This is significant because grand festivals at the Naumachia involved dry-land and naval spectacles on successive days, yet there is absolutely no way the pool could have been filled overnight. To fill an oval of its dimensions in 12 hours would have required a volume of about 486,500 m³ per day, or 13,900 *quinariae*—more than half of the entire system's capacity under Frontinus and nearly equaling the total of the urban distribution network. The aqueduct's limitations demanded special planning of the sort implicit in the accounts of Titus's festival of A.D. 80 (B8, B9). The gladiatorial contest and hunting spectacles took place not in the pool itself, which was necessarily full of water for the ensuing sea battle, but upon wooden platforms constructed (at least in part) directly over the water.⁴⁴ This was probably done in the area between the islet and the "shore." The islet may have been fairly close to the shore, since it would seem that the principal element of the bridge connecting them was a single piece of larch 120 Roman ft long (B4).

Liberati Silverio, who by her own calculations estimates that the Naumachia would have required a 15-day filling period under the conditions laid out by Frontinus, suggests that most of the Alsietina's water was coming from the secondary source at the Lacus Sabatinus (the modern Lago di Bracciano) that Frontinus calls *circa Careias* (A5).⁴⁵ While this source must have been important in the Alsietina's survival—and the aqueduct did survive, appearing both on the Severan marble plan and in the regionary catalogues—it cannot have been very large, or Fron-

tinus would have reported a greater total volume.⁴⁶ It is possible that this supplementary line is the Channel of Mens mentioned in the inscription (A2), but there is no way we can know.

Although there were undoubtedly periods when the Naumachia was emptied for maintenance, a number of hints in the sources suggest that during its useful life it was usually full. That the Alsietina was constantly flowing is indisputable; otherwise Augustus would not have granted irrigation concessions from it, and people would not have been using it every day, as we know they did from the inscription. The daily time restriction placed upon the *rivales* before the volume was augmented strongly implies that certain hours, probably at night, were devoted to recharging the Naumachia at a higher volume. As I have suggested, Frontinus's language (A1) implies that Augustus had not foreseen other uses for the Alsietina, as he surely would have if he had planned to keep the pool empty most of the time.⁴⁷

HYDRAULIC SYSTEM OF THE NAUMACHIA AUGUSTI

The Naumachia Augusti had a clear precedent. This was not the ephemeral naumachia Caesar built,⁴⁸ but the mighty *Stagnum Agrippae* in the Campus Martius, which was fed by the Aqua Virgo. This pool was on a smaller but still vast scale,⁴⁹ yet being a venue for casual recreation—not to mention an important aesthetic component of Agrippa's pleasure park—it must have been full most of the time.⁵⁰ No doubt Agrippa's *familia aquarum* developed an effective strategy for keeping the water free of undesirable flora and fauna. Skimming and scouring of algae was necessary under any circumstances, while the maintenance of an acceptable current would have minimized stagnation. A sizable fraction of the Aqua Virgo's daily capacity probably flowed through the pond and then into a channel that emptied into the Tiber. Whether or not this channel was the Euripus itself is debated. Robert B. Lloyd believed the Euripus was kept separate, and given the testimony of its cold temperature and purity, I

⁴¹ Van Buren and Stevens (supra n. 1); Van Deman 182–83.

⁴² Ashby 185 and n. 3.

⁴³ *FUM* 145.

⁴⁴ Coleman 53–54.

⁴⁵ Liberati Silverio 75–78.

⁴⁶ Nibby believed that he had discovered the feeder channel and reported that it was about 5 ft (1.6 m) high, roughly the same as the main channel of the Alsietina. Ashby 185–87 doubts, however, that Nibby's discoveries had anything to do with the supplementary line *circa Careias*.

⁴⁷ When he questions the emperor's motives for intro-

ducing the Alsietina, Frontinus is using a rhetorical device; he knows full well that the aqueduct was made expressly for the Naumachia, a monument that he probably considered as much of a planning blunder as a waste of resources. "Because it proved excessive for the Naumachia," Frontinus says, Augustus granted concessions.

⁴⁸ Richardson, s.v. Naumachia Caesaris; *RE* 16:2 (1935) 1970–74, s.v. Naumachie (Bernert).

⁴⁹ Coleman (50–51) estimates the dimensions of the stagnum at 180 × 220–300 m.

⁵⁰ R.B. Lloyd, "The Aqua Virgo, Euripus, and Pons Agrippae," *AJA* 83 (1979) 193–204, esp. 196 and n. 32.

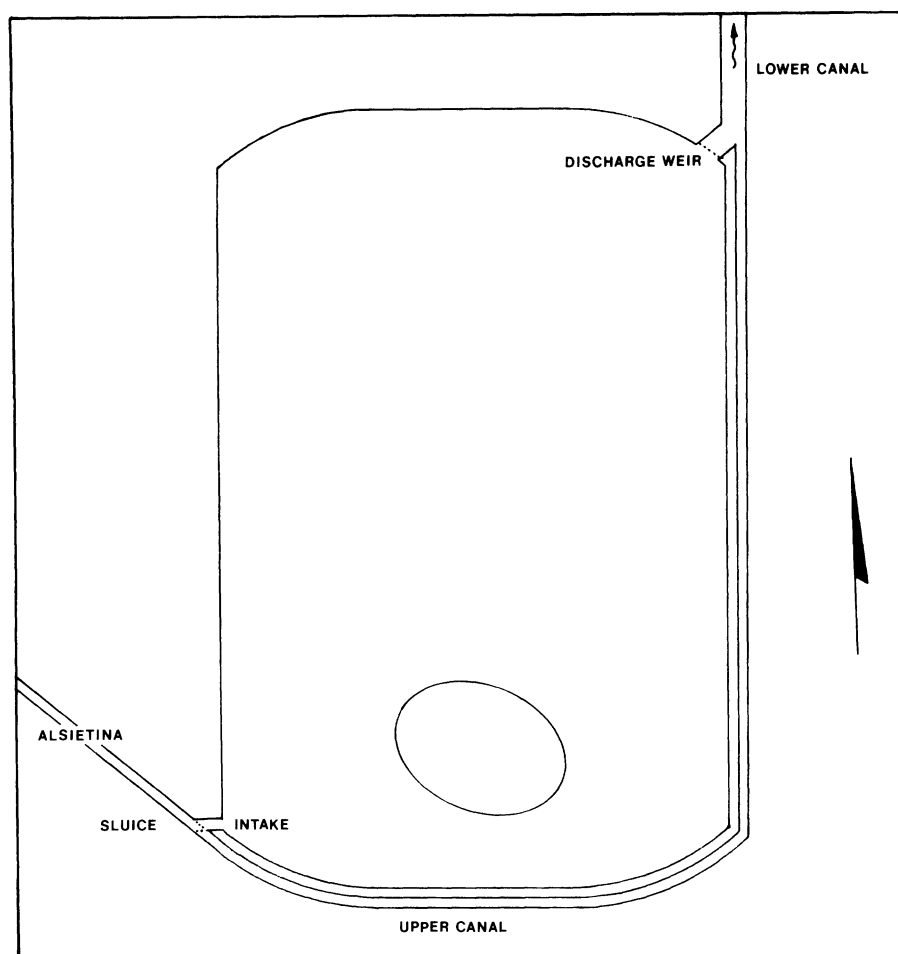


Fig. 2. Plan of the proposed drainage system of the Naumachia Augusti. The dotted lines at the intake represent the two alternate positions for a sluice gate. The dotted line at the point of discharge represents a weir of adjustable height. (R. Taylor)

am strongly inclined to agree.⁵¹ Having no further use for the water after it drained from the Stagnum, Agrippa probably discharged it into the river through an underground sewer. We know that the Naumachia Augusti likewise had a sizable discharge channel; indeed, it could not have functioned without it. But this watercourse was probably an open canal, for Nero sailed upon it down to the Tiber (B6).

Not only was water constantly flowing into and out of the Naumachia, it needed a mechanism whereby it could be drained completely for maintenance.⁵² Of course the water continued to flow, probably into the drainage canal, which might have begun as a bypass where the aqueduct emptied into the Naumachia. A sluice gate, which was normally positioned to allow the water to flow directly into the pool, could

have been swung to divert the aqueduct water into the canal, which must have extended from this point, somewhere on the southern or western side of the pool, halfway around the periphery and on to the river (fig. 2).

The Naumachia's outlet, as well as its intake, probably communicated with this canal. Above the outlet, the canal was small and could have been discreetly run just underground or below the seating banks. But between the outlet and the river it would have needed a much larger capacity to accommodate the water when the Naumachia was emptied quickly. This would have included not only the water pouring from the Naumachia, but also that continuing to issue from the Alsietina, which during the emptying process would have been diverted away from the

⁵¹ Lloyd (supra n. 50) 196–97.

⁵² Nero, so we are told, dined in the Naumachia (Suet. *Nero* 27.2). It is described on this occasion as *praechusa*, which could mean shut off at the intake, as the Loeb translation

understands it. More likely, though, he and his guests dined on boats as described in B6, and the word simply means that the area was temporarily closed off to the public.

pool's intake into the upper tract of the canal (fig. 2). The fullness of the canal, however, could be controlled at any time by adjustable weirs at the point where the Naumachia drained into it and where it in turn emptied into the Tiber (fig. 3). Under normal circumstances, the weir at the Naumachia drain was kept at a level where the outflow exactly equaled the intake from the aqueduct. At the regular rate of flow, this volume of water, being no more than that of the aqueduct itself, was not nearly enough to be navigable in a boat (fig. 3,A). Just as the current of the Euripus, even at 16,100 m³ per day (460 quinariae, *Aq.* 84.3), surely was slowed down to acquire a "swimmable" depth, the flow in the Naumachia's canal had to be arrested if it was to serve recreational purposes. This was easily achieved by means of a weir at the canal's point of discharge into the Tiber. The weir would have slowed the current and raised the water level enough to enable boats to navigate the canal at any time. If the canal was to be navigable when the Naumachia was not being emptied, the weir was kept high (fig. 3,B). When the Naumachia was being emptied, the weir was lowered to allow more rapid discharge into the river (fig. 3,C).

LOCATING THE NAUMACHIA

For all the Naumachia's size and prominence, its precise location, shape, and orientation have never been definitively established. At least three places in the floodplain of the Trastevere have been proposed. Fortunately, one of these three has the best claim, enjoying both physical plausibility and testimonial support, while the other two can be dismissed summarily on physical grounds alone. In the last century, Christian Hülsen drew attention to a description by Pietro Santi Bartoli of a bath complex, castellum, and water channel in opus reticulatum.⁵³ This account, written during the pontificate of Innocent X (1644–1655), seemed to indicate that the main channel of an aqueduct was to be found "alla Longara nel declivio del Gianicolo, sotto dove sermoneggiano li padri della Chiesa Nuova nel mese di maggio," a spot clearly marked on Lanciani's *Forma urbis Romae* near the double hairpin loop of the modern Viale del Gianicolo.⁵⁴ Hülsen surmised that Bar-

toli was describing the main channel of the Alsiatina and that the Naumachia must therefore lie in the floodplain to the east. But Lanciani rightly pointed out that the flats between the Janiculum and the river at this northerly point were too narrow to contain a naumachia 355 m wide.⁵⁵ What Bartoli saw was probably part of the Aqua Traiana's secondary distribution system.

Filippo Coarelli recently proposed that the Naumachia lay near the Porta Portuensis in a rectangular area that is partly preserved as a large blank space on fragment 28 of the Severan marble plan, i.e., between the modern Viale del Trastevere and the ancient Via Portuensis, extending north of the Via Parboni (see fig. 4,A).⁵⁶ But like the region described by Bartoli, the area between the slope of the Monte Verde and the ancient Via Portuensis is too narrow to accommodate the Naumachia Augusti, as can be seen clearly on figure 4.

The best claim for the Naumachia's position is also the oldest and most popular, but it has never, to my knowledge, been tested in detail. Cassio reported the discovery in 1720 of a channel buried about 9 m underground in the slope of the hill above the monastery of S. Cosimato (i.e., SS. Cosma e Damiano; fig. 4,B). Its dimensions were 1.78 × 2.67 m in cross section, and it was made of brick.⁵⁷ It was reportedly destroyed in 1849, but not before some soldiers in the Roman republican faction made their way up the Janiculum inside of it, threatening the French camp.⁵⁸ Though troubled by the large dimensions and the materials of this channel, Lanciani proposed that it was the final leg of the Alsiatina on its descent to the Naumachia, which he suggested lay in the plain below, in the heart of modern Trastevere.

Actually, this channel had been known since at least the 16th century, and others had drawn the same conclusion. Mauro and Aldroandi reported: "Fra la porta di ripa [i.e., Portese], e quella di S. Pancrazio, sotto la muraglia dirimpetto a S. Cosmo fu la Naumachia di Cesar, o di Augusto, che ve recò l'acqua Alsiatina . . . Se ne vede anco hoggi qui uno acquedotto, che poi s'asconde."⁵⁹ The "muraglia" was Aurelian's wall, the ruins of which still extended down

⁵³ Van Deman 181–82; Ashby 189.

⁵⁴ *FUR* pl. 19.

⁵⁵ Lanciani 343.

⁵⁶ F. Coarelli, "Aedes Fortis Fortunae, Naumachia Augusti, Castra Ravennatum: La via Campana Portuensis e alcuni edifici adiacenti nella pianta marmorea severiana," *Ostraka* 1 (1992) 39–54. Coleman accepts this hypothesis.

⁵⁷ Lanciani 343–44; *FUR* pl. 33.

⁵⁸ *FUM* 146–47; Van Deman 184.

⁵⁹ L. Mauro and U. Aldroandi, *Le antichità della città di Roma* (Venice 1556) 103–104. Later topographical guides of the 16th century repeat this information almost verbatim. The text continues, "e ne gli anni adietro conduceva questa acqua nella piazza di S. Maria in Trastevere." This is untrue; the authors, typically during this period, mistake the Alsiatina for the Aqua Traiana, which after Pope Alexander VI's restoration supplied the fountain in the piazza (Lanciani 378).

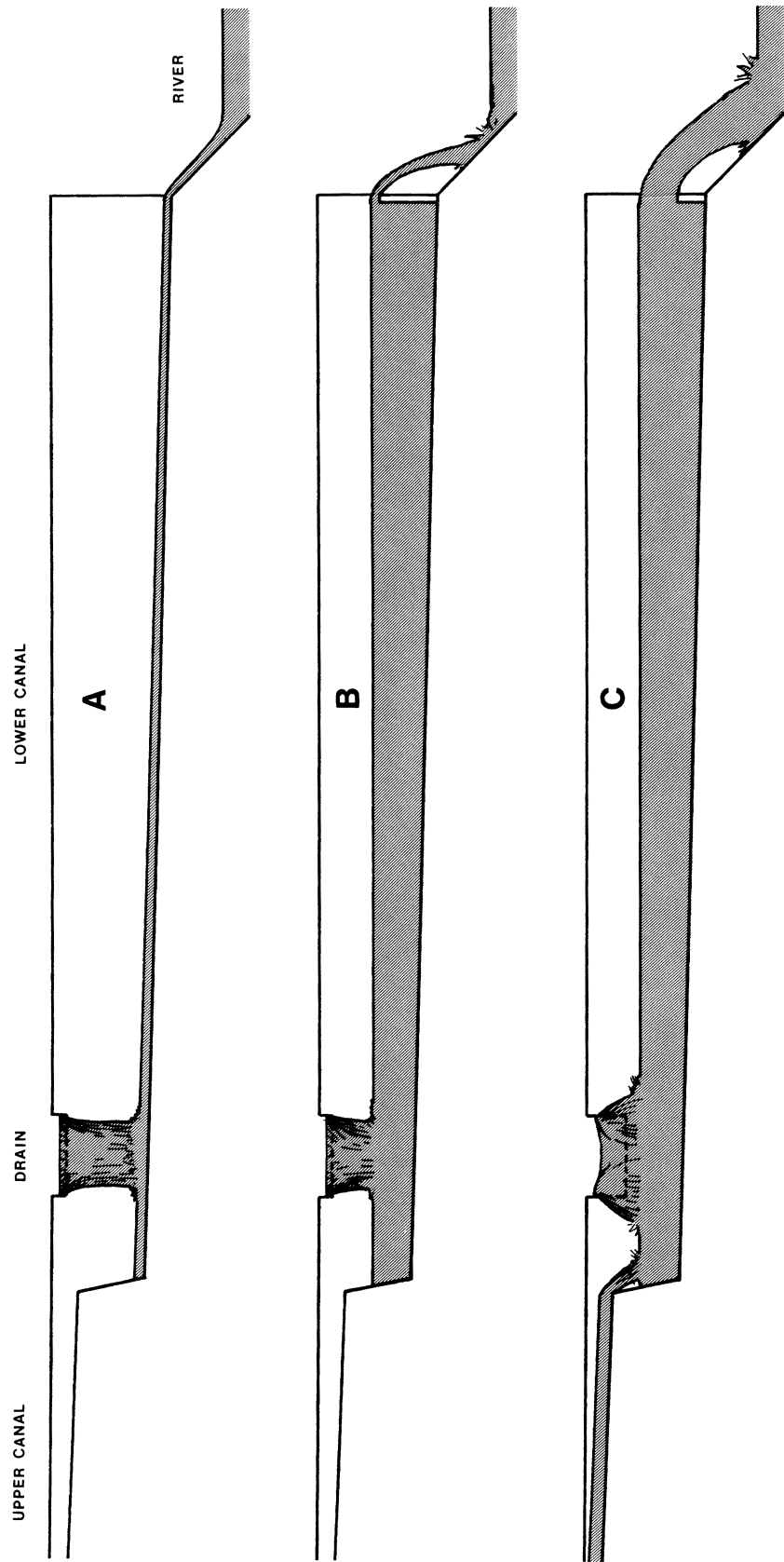


Fig. 3. Elevation of the proposed lower drainage system of the Naumachia Augusti, showing three alternate drainage schemes. The depth of water in the lower canal is controlled by weirs at the Naumachia's discharge point into the canal and at the canal's discharge point into the river. (R. Taylor)

the Janiculum to this area. Cassio may have been reporting on a segment somewhat further downhill, but Lanciani⁶⁰ places the general location of the excavation just inside the wall (fig. 4,B). Pace says that portions of the Naumachia, which (following Lanciani) he thinks was elliptical, have been found along the line from the Via Morosini through the Piazza di S. Cosimato to the Piazza di S. Maria in Trastevere.⁶¹ Apparently he refers, at least in part, to the curved blocks of stone reportedly discovered during excavations for the Standa department store on the west side of Viale di Trastevere (fig. 4,C).⁶² These reports are frustratingly anecdotal, but should not be dismissed out of hand. However, I seriously question the presumption that relatively small and isolated elements of stone describing the periphery of such a gigantic ellipse would demonstrate a perceptible curve.

More reliable are the recorded reports of black-and-white mosaics on an enormous scale found at a depth of 8 m along the Via di S. Francesco a Ripa between S. Francesco and S. Cosimato, marked on Lanciani's map. Bartoli reports that in the mid-17th century just west of the Piazza di S. Francesco were found "gran quantità di travertini" that continued under the street and apparently reappeared in the gardens northeast of S. Francesco, along with miscellaneous works of art. Lanciani believed these *travertini* to be the revetments of the pool.⁶³

It would be foolish to deny that the Naumachia and the surrounding Grove of the Caesars (i.e., of Gaius and Lucius Caesar) were in this region.⁶⁴ By virtue of its enormous size, the pool had to be quite near the center of the floodplain of modern Trastevere; we may thus plausibly conjecture that it was at least partly within the regionary city of ancient Rome, further confirming that the Alsietina was not supplying it in Frontinus's time. Despite Tacitus's claim that Augustus "placed" the Grove of the Caesars around the Naumachia (B7), the surrounding grove or garden was probably already well established in Augustus's time, given its proximity to heavily in-

habited quarters that would otherwise have encroached on the area.⁶⁵ Evidently parts of the grove extended to the Tiber, or at least nearby; sailing up from Ostia, Tiberius ventured as far as the southern reaches of the grove before turning back (B5). The Naumachia itself, however, occupying a large part of the lowlands in the Transtiberim, may have displaced an uninhabitable marsh toward the south.⁶⁶

Most scholars have concluded that the Severan marble plan yields no information about the whereabouts of the Naumachia. Since Rodriguez Almeida positioned cluster 37A in the Transtiberim⁶⁷ (left of H in fig. 4), it has become increasingly hard to understand how the Naumachia could have been in this area at all. The way around this conundrum, as I have suggested, is quite simple. By the Early Severan period the Naumachia per se had ceased to exist, and its vast area was being exploited, at least in part, for development. What Dio saw of this monument in the Late Severan period was nothing more than a few remains, perhaps of the periphery. The rest had given way to the inexorable demands of population growth in the lowlands and increased industrial importance of the district with the recent introduction of the flour mills up the hill.

Let us examine briefly the relevant sector of the marble plan, which was published lavishly in 1960 and brought up to date by Rodriguez Almeida in 1981.⁶⁸ This will seem slightly disorienting at first, since the plan was positioned with the southeast toward the top. When I refer to the top or bottom, left or right, in the ensuing discussion, I retain the original Roman orientation. Figure 4 also follows this convention. It represents all the identified fragments of the plan belonging to the Transtiberim (the Alsietina fragments are in a new position, for reasons that will be discussed below), as well as contour lines and a few modern features relevant to my argument. As can be seen, the original plan comprised rectangular marble slabs laid horizontally and vertically in alternating courses. Many fragments have preserved edges or clamp marks on the back, or both,

⁶⁰ *FUR* pl. 33.

⁶¹ Pace 147; see Lanciani 344.

⁶² Richardson, s.v. Naumachia Augusti.

⁶³ *FUR* pl. 34; Lanciani 344; Bernert (supra n. 48) 1971.

⁶⁴ Grimal (118–19, n. 6) argues that a fragmentary inscription found near S. Cosimato bearing the letters . . . OS.AVG.IMP . . . can be interpreted as a (posthumous?) dedication to Gaius Caesar, "[c]o(n)s(uli) aug(uri) imp(eratori)."

⁶⁵ Coleman (53) suggests that the area was previously occupied by the Horti Antonii, which passed to the public after Antony's death. This is possible; but assuming, as Coleman does, that Frontinus's quinary total for the Al-

sietina applies to the Naumachia, then the Naumachia itself cannot have been public property, for all of that total went either to the emperor or to other private parties (A5). The Grove of the Caesars would not have received that name, or its memorial monuments, until after the deaths of Gaius and Lucius Caesar in A.D. 2 and 4.

⁶⁶ L. Gazzola and L. Bascià, *La testata etrusca di Ponte Emilio in Trastevere* (Rome 1992) 18 and pl. 4.

⁶⁷ *FUM* 140–43, 146, fig. 44.

⁶⁸ G. Carettoni, A.M. Colini, L. Cozza, and G. Gatti, *La pianta marmorea di Roma antica (Forma urbis Romae)* (Rome 1960); *FUM*.



Fig. 4. Map showing the proposed positions of the Naumachia Augusti and the Aqua Alsietina in relation to the fragments of the Severan marble plan. The shaded rectangle represents the modern street pattern, the dotted rectangle the Naumachia. (R. Taylor)

which can assist in identifying their positions. The slabs also have slightly different thicknesses and dimensions. We know virtually all the dimensions, even for lost slabs, thanks to the nearly complete set of clamp marks left on the wall.

My preferred placement of the Naumachia appears on this map as a dotted rectangle. The upper, or southeast, corner, was completely overbuilt on an independent orientation. It is quite probable that the same orientation continued to the left into the area marked K, because excavations in 1888 made for the construction of the Viale del Re (now the Viale di Trastevere) revealed many ancient walls following the same axis.⁶⁹ It may plausibly be surmised, however, that virtually all the rest of the developed area within the limits of the old Naumachia assumed the pond's orthogonal orientation, which runs at roughly 45° angles on the marble plan. Almost all of the buildings represented on cluster 37A (from J upward on fig. 4) are of the same orientation as those in the lower left of cluster 33 (left of C), which in turn have the same orientation as the modern region marked out in the shaded area. They are laid out in a simple orthogonal plan, which is completely different from the orientation of blocks to their southeast, i.e., at the top, as noted above, and to their west, i.e., at the bottom of 37A. If we superimpose the outline of the Naumachia so that its western side is conterminous with the line of *cellae* at the bottom of 37A where the new orientation begins (HJ), we can see that there is an evident correspondence between its area and the area of orthogonal development.

A closer look reveals a number of intriguing details:

1) The distance along the Viale della Lungaretta from the Vicolo dell'Arcaccio, where the orthogonal planning begins, to the western extremity of the Piazza di S. Maria in Trastevere, where it appears to end (IJ), is *almost exactly* the width of the Naumachia as reported in the *Res gestae*. I confirmed this with measurements on Lanciani's map,⁷⁰ which yielded a distance of 180 mm, that is, 360 m on a scale of

1:2000, to the far edge of the Vicolo dell'Arcaccio. Recall that Augustus's 1,200 Roman ft translates to 355 m.

2) Many streets and monuments in and near the shaded area, some preserved on the marble plan and some not, followed precisely the same orientation in the early modern period. These include the church and surrounding complex of S. Maria in Trastevere (J), the *titulo* of S. Callisto, the Vie Luciano Manara (EF), Agostino Bertani, and S. Cosimato, and miscellaneous excavated walls recorded on modern maps.⁷¹ Clearly the orthogonality extended all the way south to the area now occupied by S. Cosimato, although some areas in between ceased to be inhabited continuously in the Middle Ages,⁷² and consequently lost their street pattern. The cloisters of S. Cosimato are slightly off alignment, but the eastern edge of its property (D) runs along the orthogonal axis, as do the twin insulae or horrea just above it on the marble plan.

3) The axis GH, partially preserved in modern streets, seems to correspond to an ancient street on the marble plan.⁷³

4) A number of unidentified edge fragments of the marble plan are on the same 45° orientation and might belong in this area. A particularly intriguing edge fragment is 471, which could represent a border of the Naumachia in a still-undeveloped zone. The parallel lines might represent the old spectator seat banks. I have tentatively placed the fragment at position L, since this area—judging from the large vacant zone on the marble plan (C)—would appear to have remained undeveloped. This zone may well have persisted as the residual Grove of the Caesars, much reduced from its old dimensions. Vestiges of the Naumachia were still visible not only to Dio, but probably to the compilers of the regionary catalogues as well.

5) The placement of the pool conforms well to the contours of the Transtiberim. The land accommodating it rose about 5 m from east to west, a gradient that could easily have been overcome in the excavations. Almost all of the proposed Naumachia

⁶⁹ *FUR* pl. 33.

⁷⁰ *FUR* pls. 27–28.

⁷¹ *FUM* 140–43; *FUR* pls. 27, 33; Gazzola and Bascià (supra n. 66) pls. 6–7.

⁷² R. Krautheimer, *Rome: Profile of a City, 312–1308* (Princeton 1980) 254.

⁷³ Rodríguez Almeida (*FUM*) has already noted the axial correspondence of the streets in this area with fragment 37A. He aligns this particular street, however, with EF rather than GH. I am hesitant to draw any definitive conclusions

about the correct alignment, due to the well-known surveying inaccuracies documented in other areas of the marble plan. But Rodríguez Almeida does seem to place S. Maria in Trastevere and its piazza much too far to the east in relation to the fragment, and this skews the rest of his interpretation. Gazzola and Bascià (supra n. 66) 19, pl. 5, are more precise when superimposing the fragments of the marble plan on their modern map, but some of the orientations that emerge from their treatment of the evidence differ slightly from my own.

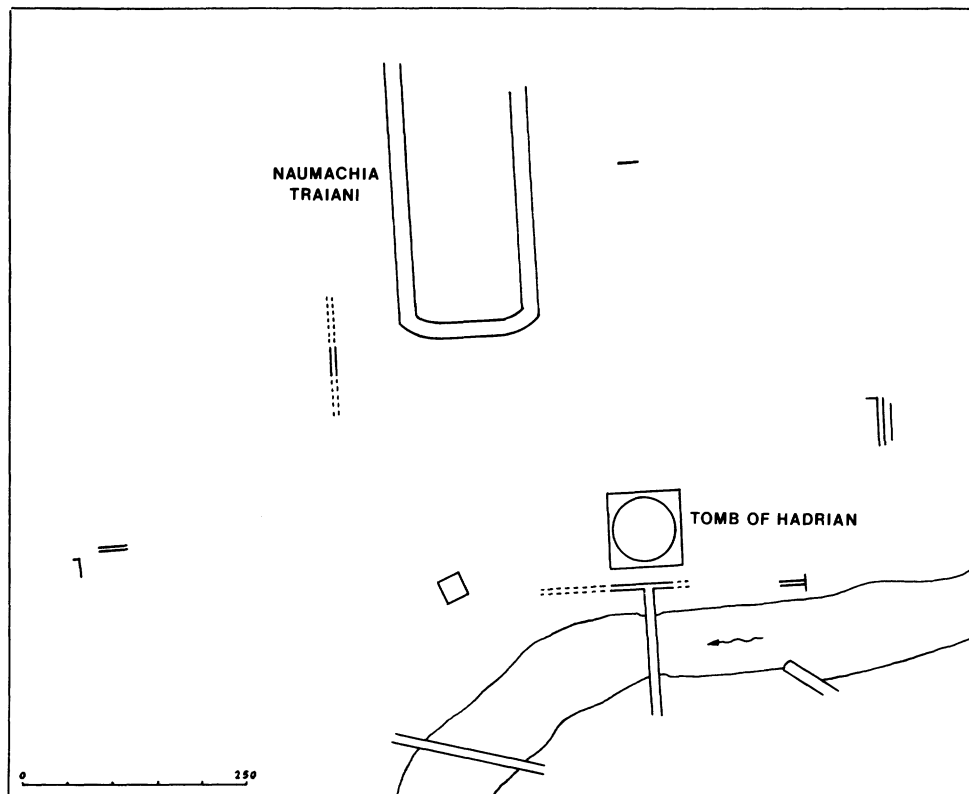


Fig. 5. Map of the Naumachia Traiani and other ancient remains in its vicinity. Scattered excavations throughout this area show that the streets and buildings followed an orthogonal plan. (R. Taylor)

lies between the 15 and 20 m lines, as far as we can tell (we can only approximate the ancient contours in some of these areas).

The strongest argument for a modified rectangular shape, besides the orthogonal city plan still evident in the northern Trastevere, is the shape of the pool's epigone, the Naumachia Traiani. This was the pool to which Suetonius made tacit comparison when he referred to the Naumachia Augusti as the "old" Naumachia (**B8**). Many remains of the structure were excavated and drawn in the 1740s, and others were unearthed in a piecemeal fashion in the 19th and 20th centuries. It appears in part on Lanciani's

map as the "Gaianum"⁷⁴ and, with a different alignment, on the *Carta archeologica di Roma* northwest of Hadrian's tomb.⁷⁵ The editors of the map doubted that this was a naumachia at all, but more recent scholarship accepts the identification.⁷⁶ The *Carta*, using evidence discovered in the 1920s along the Via Terenzio, correctly realigns the entire complex with Hadrian's tomb. Indeed, it seems that this whole area was laid out on an orthogonal grid oriented to the tomb (fig. 5),⁷⁷ suggesting a conformity to a preexisting orientation. The beveled and gently curved corners seem to echo the slight inward deflection of the ancient street on the marble plan at the northwest

⁷⁴ *FUR* pl. 7.

⁷⁵ *Carta archeologica di Roma* (Florence 1962) pl. 1E.

⁷⁶ See Richardson (supra n. 62) and especially C. Buzzetti, "Nota sulla topografia dell'Ager Vaticanus," *QITA* 5 (1968) 105–11. The description of the 18th-century excavations is inconsistent concerning the width of the structure's inner area, sometimes claiming 460 palmi (102.8 m) and sometimes 530 (Buzzetti 106, n. 6). Buzzetti's reconstruction favors the former, but the original illustrations, and Lanciani's *FUR*, clearly represent the latter dimension, which is preferable in the light of one apparently unnoticed fact: 530 palmi (1 palmo = 0.2234 m) is 400

Roman ft (118.4 m), precisely a third of the width of the Naumachia Augusti. F. Clementi, *Roma imperiale nelle XIV regioni augustee secondo gli scavi e le ultime scoperte* (Rome 1935) 300–301 reports the dimensions as 118.9 × 177.6 m, a 2:3 ratio as in the Naumachia Augusti. But the evidence compiled by Buzzetti, though he himself does not recognize it, demands a length of at least 250 m, if not more.

⁷⁷ Wall sections well to the north and east of the tomb, both excavated in the late 1880s, are in exact alignment with both axes of the tomb. See *FUR* pl. 7 and Buzzetti (supra n. 76) 110.

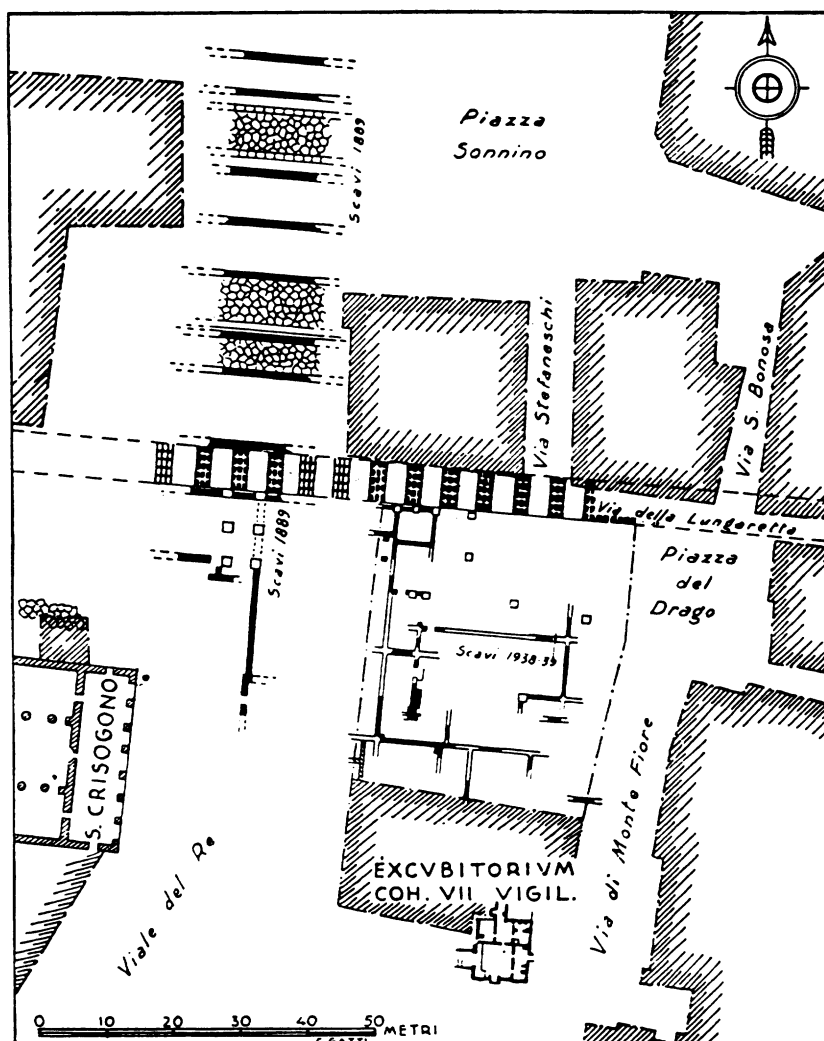


Fig. 6. Plan of excavations just south of the viaduct of the Via della Lungaretta. (From G. Gatti, *BullCom* 68 [1940] 131, fig. 2)

corner of Augustus's pool, which corresponds to the Piazza di S. Maria in Trastevere (the square above J in fig. 4). If the Naumachia took this shape, then we may postulate that its capacity, at an average depth of 1.5 m, was in the neighborhood of 270,000 m³.

Like Trajan after him, Augustus did not invent the orientation of his Naumachia. Its origins lie in the ancient street corresponding to the Via della Lungaretta (fig. 4,IJ) and several roughly parallel streets to the north. This street goes back to Republican times and has continued to be an important thoroughfare ever since. The part of it just northeast of S. Crisogono crossed a swampy slough on a viaduct (fig. 4,O; fig. 6). The excavators date this work, and

the street itself, to the initial construction of the Pons Aemilius, to which the street leads, in the second century B.C.⁷⁸ Augustus may have filled in parts of this depression south of the viaduct, but it would have offered a perfect site for the lower discharge canal of the Naumachia.

South of the viaduct, excavations have turned up a number of ancient ruins, all more or less on axis with the street and the Naumachia (fig. 6; fig. 4,P). The best-known ruins are those of the *excubitorium* of the seventh cohort of *vigiles*, the fire brigade of ancient Rome. This building originated as a house, and its terminus post quem, taken from a brick stamp, is A.D. 123. Graffiti indicate that it served as a fire

⁷⁸ G. Gatti, "Il viadotto sulla via Aurelia nel Trastevere," *BullCom* 68 (1940) 129-41; Gazzola and Bascià (supra n.

66) 26-27, fig. 7, pl. 6.

station from at least 215 to 245.⁷⁹ The probable Hadrianic date of the house suggests that the northern reaches of the Naumachia and Grove of the Caesars were already suffering encroachment a few decades after Frontinus's death.

The Naumachia extended southward about as far as the monastery of S. Francesco. The position of the mosaics found in the 18th century between this complex and that of S. Cosimato (fig. 4.Q) is quite plausible, but it is initially puzzling to learn that travertine elements were found just northwest of the Piazza di S. Francesco (R), an area that would seem to be well within the borders of the pool. They extended under the street, we will recall, and more were found in the gardens of S. Francesco (S).⁸⁰ While this latter group corresponds well to the edge of the proposed Naumachia, the group at R decidedly does not. If similar travertine elements were indeed found on the site of the Standa department store or next door at the Ministry of Public Instruction (C), then these two finds (R and C) probably belong to the islet within the Naumachia. That would explain why the travertine blocks at C were reportedly cut to a perceptible curve.⁸¹

When we ponder the size of the Naumachia in relation to the lowlands of the Transtiberim in general, its fate is hardly surprising. The real surprise is that it survived as long as it did, for it occupied nearly 200,000 m² of premium real estate in the fastest growing region of the city. We last hear of the Naumachia in use during the principate of Titus. One wonders if the great fire in Rome during that emperor's short reign, only 16 years after the great conflagration of 64, prompted many Romans to move across the Tiber River, where huge fires were much less common. Nero, we know, removed the rubble from the fire in boats to the marshes around Ostia (Tac. *Ann.* 15.43). Perhaps Titus and Domitian found a ready repository for the new rubble in the Naumachia, as well as for the outfill from Domitian's own naumachia, which was built somewhere near the river (Suet. *Dom.* 4.2) but probably away from the urban sprawl. Once parts of the Naumachia were filled, they could be sold or leased for new development. Trajan, who excavated his naumachia in the Vatican, may have completed what Domitian began. His pond was

well within the developed area, and so he might have relinquished imperial control over most of the Grove of the Caesars in compensation for his own consumption of prime land. Trajan had another incentive for urbanizing the lower Transtiberim, namely, his development of the town of Portus and the consequent growth in importance to Rome of the Via Portuensis. Whether or not Trajan was a major force in the overbuilding of the Naumachia Augusti, it is very likely that the emergence of this new urban zone in the late first century offered a good reason for the introduction of the Aqua Traiana to Rome in 109. In any case, the inexorable growth of the Transtiberim ensured that, sooner or later, the Naumachia Augusti was doomed.

THE CONDUIT ABOVE S. COSIMATO

Much remains to be learned of this mysterious pond, but we can now be reasonably certain of its position and orientation. On the other hand, the ruin that initially signaled the Naumachia's proximity, the subterranean channel by S. Cosimato, may not have been what it seems at all. It was almost certainly not part of the Aqua Alsietina per se, or of any other aqueduct. Its dimensions, 1.78 × 2.67 m, are much too large to belong to the Alsietina, which higher up on the Janiculum was only 0.85 m in width. Even if we concede a certain variability in the size of any conduit along its length, this section is unacceptably anomalous. Among the statistics of the four aqueducts studied by Blackman, there are only four recorded instances over hundreds of kilometers where the channels attain a comparable width (1.7 m or more), and in every case Blackman attributes them to either exceptional circumstances or error in the measurements.⁸² If anything, the channel at this point, near the end of a steep descent from the top of the Janiculum, should have required a *smaller* cross section than normal. When channeled water runs faster, it runs more shallowly, and can be accommodated in a smaller conduit than would be required at a normal gradient.

This great conduit found on the slopes above S. Cosimato was probably not the *specus* of an aqueduct, but a main sewer, collecting runoff from a wide watershed on the Janiculum.⁸³ It was near the Nau-

⁷⁹ A. Pellegrini, "La settima coorte dei vigili, scava di Roma," *BdI* 181 (1867) 9; R. Lanciani, *The Ruins and Excavations of Ancient Rome* (London 1897) 549; J.S. Rainbird, "The Fire Stations of Imperial Rome," *BSR* 54 (1986) 154–55.

⁸⁰ Lanciani 344.

⁸¹ Richardson (supra n. 62).

⁸² Blackman (supra n. 31) 58–60 and n. 18.

⁸³ Van Deman (184) believes the ruin above S. Cosimato was a castellum, probably of Trajanic date, for the distri-

bution of surplus water nearby. She does not explain how such an arrangement would work or why it would be found so far underground. The Trajanic date seems somewhat arbitrary. Van Deman is justifiably uncomfortable ascribing any castellum to the Alsietina prior to Frontinus, who declared that it had none inside the city. But the Aqua Traiana was lined with reticulate, of which there was no trace here. We are probably dealing with masonry that post-dates Trajan.

machia for a good reason: it made use of the pool's drainage canal, which, I have suggested, would have begun at the intake on the west side and made its way around the periphery of the pool. The sewer could have emptied into the drainage canal at any point along the canal's course, as long as the dimensions of the latter were rendered adequate to deal with it.

The long-held assumption that the ruin above S. Cosimato was an aqueduct is understandable. A similar mistake was made in Lyons, in a region whose Roman topography is better understood than the Transtiberim. On the steep slopes above the Federal Sanctuary, built in the late first century B.C. on a massive terrace in what is now the suburb of Condate, a Roman conduit of enormous dimensions was reported in 1762. For about two centuries it was assumed to be an aqueduct serving the amphitheater and sanctuary lying below, but in this century it was recognized to be part of a Roman drainage system diverting runoff completely around the sanctuary and its waterworks.⁸⁴

Drainage is one of the most neglected of all subjects in topographical studies, yet it is sometimes essential in understanding how and why ancient waterworks were situated as they were. To keep drainage water separate from aqueduct and spring water, especially at lower levels, was a significant engineering challenge. Any plan for a naumachia would have included a strategy to keep unwanted water *out* of such an enormous, low-lying receptacle. This was a particularly difficult proposition on the floodplain below the Janiculum. The watershed of the hill, both from springs and from rain and aqueduct runoff, must have been manifold and widespread. The channel above S. Cosimato would appear to be a trunk line of the east slope's sewer system. If this is the case, then its reidentification may ease one of the more troubling problems in the region's topography, the dearth of verified Roman drainage channels. No ancient sewer line has ever been identified in the Transtiberim, yet the area was hardly habitable without a sophisticated drainage system.⁸⁵

Whether or not this sewer was part of the Augustan plan is an open question. It was reportedly of opus latericium. No specus in Rome's aqueduct system was made of such a fabric until decades after the Augustan period.⁸⁶ This in itself is not a prob-

lem, however; channels of every kind were constantly being restored and enlarged throughout the history of the Empire. Today the visible parts of the Roman aqueducts are mostly in brick, except in the plain just east of Rome. Most of these remains represent work done well after the original aqueducts were introduced. Drainage in the Transtiberim needed constant attention, as it does in any heavily populated lowland in the shadow of a precipitous watershed, such as Rio de Janeiro or Hong Kong. If the entire sewer *qua* sewer dated after the first century A.D., however, then it was designed to drain into a canal that was essentially derelict, since the latter was probably no longer channeling Alsietina water. The sewer may thus have been an opportunistic adaptation of a hydrological feature that had ceased to function as originally intended. One might even suggest that the sewer line, at least in its lower tract, commandeered the defunct lower channel of the Alsietina, which, like the canal to which it led, would have been widened to accommodate the anticipated volume of runoff.

COURSE AND DISTRIBUTION OF THE ALSIETINA

Only one urban fragment of the Aqua Alsietina's main channel is known, the section of the conduit found high on the Janiculum, next to the Viale 30 Aprile, running somewhat south of and lower than the conduit of the Aqua Traiana.⁸⁷ Although only about 1 m of its length could be examined, it appeared to be oriented generally in the direction of S. Cosimato (fig. 4). It was lined with crude Augustan reticulate, and its mineral deposits were relatively low in calcium carbonate, as might be expected of lake water in the volcanic region northwest of Rome.

A partial representation of the Aqua Alsietina survives on fragments of the Severan marble plan, but nobody has been able to make much sense of it. The course of the aqueduct, though it is thought to have run underground in the area of the city, is represented by an arcade in profile upon a groundline. On the same alignment as the arcade are preserved fragments of the letters [Alsie]TINA. Another fragment bears the upper parts of the letters AQV[a], and probably goes with the other, though not necessarily in a stacked configuration as Rodríguez Almeida surmises.⁸⁸ The most puzzling feature is an apparent right-angled turn in the channel, traces of

⁸⁴ A. Audin, *Essai sur la topographie de Lugdunum* (Lyons 1956) 149.

⁸⁵ P. Narducci, *Sulle fognature della città di Roma* (Rome 1889) 55–57; C. Mocchegiani Carpano, "Le cloache dell'antica Roma," in R. Luciani ed., *Roma sotterranea* (Rome 1984) 176.

⁸⁶ Van Deman, *passim*.

⁸⁷ Van Buren and Stevens (supra n. 1); Van Deman 183; M. Bell, "An Imperial Flour Mill on the Janiculum," in *Le ravitaillement en blé de Rome et des centres urbains des débuts de la République jusqu'au Haut Empire* (CEFR 196, Rome 1994) 73–89, fig. 6.

⁸⁸ *FUM* pl. 30.

which are barely visible in the fragment cluster 37B (fig. 4,M). The oblique channel is drawn as the arcade in profile. Before the left-hand turn, however, the channel is drawn differently. The top line of the arcade has moved below the groundline to form a double line that might represent an underground channel or one at ground level. The large cluster 37C preserves parts of a conduit drawn in the same way (fig. 4,N). But the 37C cluster is of a different thickness from 37B and belongs to a separate slab of marble.⁸⁹ There is no reason to assume that it should be associated with the same aqueduct, for presumably all of the city's aqueducts in the undeveloped areas were represented by the same conventions on the marble plan. Rodríguez Almeida, however, believes that it does, and he reconstructs the two clusters as belonging on adjacent slabs of the plan. The reconstruction is not only awkward, it also disregards the position and orientation of the actual channel found on the Janiculum. I have taken the liberty of redrawing the clusters on figure 4 in more plausible positions. The arcade, which heads off sharply to the left, is discussed below.

The Alsietina was a relatively isolated system. It had no castella inside the city: their absence is verified by the sum of castella Frontinus attributes to the other aqueducts (Aq. 79–86), which equals his total of 247 (78.3). (There are many textual problems with the numbers in Frontinus's text, but the totals of castella, both for the individual lines and for the sum, are secure in the manuscript tradition.) Because Frontinus was unable to measure the volume at its intake (A5), we may also conclude that there were no tanks near the Lacus Alsietinus and Sabatinus.⁹⁰ He was, however, able to measure the Alsietina's total volume of *delivery*. We have seen that there were two methods of measuring volume, one from a tank and a less accurate method in the channel itself. Although the Alsietina had no castella *intra urbem*, there is no reason to insist that it did not have a principal castellum somewhere in the vicinity of the city. For such a tank we can readily cite two reasons. First, it could substitute for the settling tank the line never had (A4). Second, we know that the Alsietina could serve

as an emergency supplement to the Transtiberine service of other aqueducts whenever the bridge siphons were shut off for maintenance (A1), so it had to be connected by pipes to a few important castella in the Transtiberim belonging to the other lines. In the most logical arrangement, these pipes would have emanated from a single point of distribution. If this castellum existed, it was higher than any other in the city, but probably—because of the poor quality of the Alsietina's water—it was used exclusively as an auxiliary tank. Under normal circumstances the feeder lines leading from it to the tanks of the Appia, Anio Vetus, Marcia, and Virgo were kept shut off. Frontinus could easily have determined accurate measurements of delivery volume from it nonetheless.

Elevations of the Alsietina's Concessions

Frontinus's notion of an aqueduct's elevation needs brief comment. Frontinus (Aq. 18) says:

All the aqueducts arrive in the city at different levels. Therefore some flow in higher places, while others cannot be raised to the more eminent regions; for even the hills have gradually grown with the rubble from frequent fires. There are five aqueducts whose height allows them to be raised to every part of the city, but of these, some are driven by higher, some by lower, pressure. The highest is the Anio Novus, followed by the Claudia. The Iulia has third place, the Tepula fourth, then the Marcia, which even equals the Claudia at its source. The men of old brought in [aqueducts] at a lower elevation [*derectura*], either because leveling had not yet become a fine art, or because they buried the aqueducts below ground on purpose, since frequent wars were still being waged against the Italians. But now, in whatever place the channel has collapsed with age, for the sake of directness they abandon the circuitous routes around the valleys, and are brought through on substructures and arcades. The Anio Vetus takes sixth place for elevation; it too would be adequate to reach even the high places in the city if substructures and arcades were built in the valleys and low places where the conditions required it. The Virgo is next in elevation, then the Appia; since these were brought from the *ager* of Rome, they could not be raised to so great a height. The Alsietina is lowest of all; it serves the Transtiberine region and especially low-lying areas.⁹¹

⁸⁹ FUM 145.

⁹⁰ Grimal 86, n. 81.

⁹¹ *Omnes aquae diversa in urbem libra perveniunt. Inde fluunt quaedam altioribus locis et quaedam erigi in eminentiora non possunt; nam et colles sensim propter frequentiam incendiorum excreverunt rudere. Quinque sunt quarum altitudo in omnem partem urbis adtollitur, sed ex his aliae maiori, aliae leviori pressura coguntur. Altissimus est Anio Novus, proxima Claudia, tertium locum tenet Iulia, quartum Tepula, dehinc Marcia, quae capite etiam Claudia libram aequat. Sed veteres humiliora derectura*

perduxerunt, sive nondum ad subtile explorata arte librandi, seu quia ex industria infra terram aquas mergebant, ne facile ab hostibus interciperentur, cum frequentia adhuc contra Italicos bella gererentur. Iam tamen quibusdam locis, sicubi ductus vetustate dilapsus est, omisso circuitu subterraneo vallium brevitatis causa substructionibus arcuationibusque traiciuntur. Sextum tenet librae locum Anio Vetus, similiter suffecturus etiam altioribus locis urbis, si, ubi vallium submissarumque regionum condicio exigit, substructionibus arcuationibusve in is erigeretur. Sequitur huius libram Virgo, deinde Appia: quae cum ex urbano agro perducer-

This passage is essential to our understanding of water distribution within the city. It immediately raises the question, "What does Frontinus mean by elevation?" No aqueduct has a single elevation, since it gradually descends from a high point to a lower point. Frontinus plainly does not mean the elevation of the source, although that plays an important role: one of his principal points in this passage is that some aqueducts take better advantage of their source elevation than others. Without the benefit of archaeology, it would be easy to conclude that Frontinus is referring to the elevation of an aqueduct's channel at the point where it enters the city. The Aqua Alsietina stands in jarring conflict with this conclusion, however, for remains of it have been found high on the Janiculum Hill by the Viale 30 Aprile. Yet this aqueduct, found at the city's highest point, was by Frontinus's standards the "lowest" of them all. Frontinus must therefore be referring to the height of an aqueduct's water at its first major castellum within the city. By this standard, the Alsietina was indeed the lowest of all Rome's aqueducts, for as we have seen, in Frontinus's day it had no castellum inside the city at all, but apparently proceeded in a free-flow channel directly down the slope of the Janiculum to its terminus just behind the Naumachia of Augustus (B10). The extramural castellum proposed above, if it existed, was normally not in use.

It is no surprise then that according to Frontinus the Alsietina mainly served "low-lying areas." Upon reflection, however, this statement is very troubling. After all, the Alsietina delivered *all* its water outside the city, and its approach route outside the city must have been very high indeed—higher than the 71 masl measured at the channel section on the Via 30 Aprile. Where, then, were those 392 quinariae delivered, and why were the heights of the Janiculum disregarded? This question vexed Venuti in the 18th century,⁹² and has troubled many scholars since. I can offer no definite answer, but two related matters—one, a probable fact offered by Frontinus, the other, an inference drawn from it—may explain the dearth of concessions on the hill: 1) when the aqueduct was

introduced, Augustus had no intention of watering the estates along the way; and consequently, 2) the channel of the aqueduct was kept well underground for most of its course, even along its descent down the Janiculum. Frontinus tells us that out of the Alsietina's total length of 22,430 paces, only 358 were on arcade (A1), and there is no mention of other substructures. Concession pipes and other distribution equipment were afterthoughts, and were probably considered worthwhile only if they could be attached to parts of the channel that were near or above ground level. This was more easily achieved at the point where the channel emerged somewhere on the lower hillside. Most of the beneficiaries of the Alsietina were downhill from this point, in the southern suburban gardens and estates wedged between the converging Tiber and Monteverde, in a zone perhaps extending as far downstream as the wharves at Pietra Papa.

To a large extent, the Alsietina's delivery extra urbem was therefore effected not before its water entered the regionary city, but rather after it left. Given the apparent necessity of concentrating the Alsietina's distribution in the southern part of the Transtiberim, it is gratifying that the only physical evidence found to date of the aqueduct's delivery system appeared in this very area. During excavations for a hospital, a Roman *vivarium*, or fish hatchery, was unearthed on the slopes above Pietra Papa. Its intake was a channel rather than a pipe, and the reticulate masonry was virtually identical to that of the Alsietina's specus on the Janiculum.⁹³ Though it was initially taken to be mid-Imperial, scholars have subsequently concurred that it was part of the Alsietina's Late Augustan concession network. The channel and a canal connected to it were uncovered, in part, over a length of 45 m. Its elevation descended from 49.1 masl to 48.5 masl, giving it a gradient in this region of 1:75. Rarely reported is Mancini's additional observation that remains of other ponds were also found nearby, along with pipelines made from joined blocks of tufa "costituenti un intricato sistema di diramazioni d'acqua tutte

entur, non in tantum altitudinis erigi potuerunt. Omnibus humilior Alsietina est, quae Transtiberinae regioni et maxime iacentibus locis servit.

⁹² R. Venuti, *Accurata, e succinta descrizione topografica delle antichità di Roma*², ed. S. Piale (Rome 1824) 2.185–86. To resolve the apparent paradox that the Alsietina delivered all its water outside the city but especially to the lowest areas, which were mostly inside the city, Venuti suggested: che due dovessero essere le quantità di quest'aqua. L'una incerta, la quale servisse per la Naumachia, e per i luoghi adiacenti; l'altra determinata nelle dette 392 quinariae si

consumasse tutta fuori della Città (2.186). He goes on to argue that Frontinus's data can be explained by the fact that the regions extended outside the walled city, which contained the Naumachia. This explanation is unusually weak—not only because it assumes that there was a continuous wall around the Transtiberim in the Early Empire, but because Frontinus's definition of the city corresponds to the 14 regions.

⁹³ G. Mancini, *NSc* 1924, 55–61; Van Deman 184–85; Liberati Silverio 75.

irradiantisi dallo speco principale.” More likely, they radiated from a castellum, perhaps one of the “conserve d’acqua” found in the area. Even fragments of lead pipes were found among the debris cast into wells. Hadrianic baths and other evidence of aqueduct water supply have been found at the wharves below, but they cannot be positively linked to the Alsietina. Other likely southern properties benefiting from the aqueduct were villas and gardens near the river. The blank area labeled A on figure 4 was undoubtedly one of these gardens, *pace* Coarelli. Many must have been imperial properties, since 254 of the total 392 quinariae, or 8,890 m³ per day, were delivered in Caesar’s name (A6). The Grove of the Caesars probably was not included among the beneficiary properties. As the site of the Naumachia, it was almost certainly inside the regionary city, at least in part, and may have retained older aqueduct connections for irrigation.⁹⁴

Others, the minority of “high” beneficiaries—private farms, perhaps—must have been northwest of Rome, in the valleys and depressions where the channel emerged from the ground or ran along hillside contours on its way to the city. The introduction of the supplementary line called the Channel of Mens changed none of these arrangements, but simply made existing concessions more abundant. These properties, once a mere denouement to the Naumachia, seem to have become the Alsietina’s sole reason for existence after the demise of the Naumachia, at least for a while.

The Alsietina and the Water Mills

The fact that the aqueduct endured into late antiquity may testify to a renewal of its civic importance. Wikander has argued that it was the principal engine of the flour mills on the Janiculum in late antiquity.⁹⁵ His claim is attractive, especially in light of Bell’s hypothesis that a channel running parallel to that of the Alsietina, dated by Van Buren and Stevens to about the third century A.D., was a mill-race.⁹⁶ It ran parallel to, and about 10 m north of, the old Augustan conduit (fig. 7,b). It is hoped that excavations on the grounds of the American Academy will settle this question shortly.

From what we know or can infer about the Alsietina, however, it is hard to see how it could have dominated the Aqua Traiana in this respect. In late antiquity its volume was feeble by comparison, and much of its original course down the hill, we have already suggested, must have been underground. On the other hand, when the flour mills were introduced on the Janiculum, parts of the rapidly descending Alsietina may have been intentionally raised or rebuilt to accommodate millraces. This might explain the later parallel channel. It has now been established that the mills were introduced in the Early Severan period, or perhaps even under Commodus, at which time the post of *curator aquarum et Miniciae* began to appear on inscriptions.⁹⁷ The odd digression of the Alsietina on cluster 37B of the Severan marble plan (the aqueduct’s identity is confirmed by the fragmentary inscription above the digression) may therefore have something to do with these changes. Part of the aqueduct represented as an arcade may be a Severan digression of the conduit from its original southeasterly route. This sharp bend, which is something less than a 90° left turn, may have taken the aqueduct northeast on an actual substructure or arcade (fig. 4,M). It ran obliquely down the hillside, curtailing its precipitous gradient and perhaps taming the water for industrial and horticultural use along the way. It may have been associated with the introduction of the putative *Thermae Septimianae* in the northeastern part of the floodplain. Could this branch be the so-called Aqua Severiana, a name that appears only in the appendix of one regionary catalogue and in Polemius Silvius (*Notitia* appendix 9; Pol. Silv. 309)? A name so rarely cited probably does not point to a new water supply but might have been applied to an urban branch of an old aqueduct leading to a new imperial bath.

It is at least possible that the strange symbol for the higher segment, which looks like arches without spandrels, is actually meant to represent millwheels. Fragment 37C has the same symbol and may belong to either the Alsietina or the Traiana. I have drawn this segment as part of the Traiana at the very bottom of the plan (fig. 4,N) because it can be positioned to reflect approximately what the Traiana itself does:

⁹⁴ Before its dedication to Gaius and Lucius, this park was probably one of the grand properties that had benefited when the Transtiberim was systematically watered with the Appia, Anio Vetus, Marcia, and Virgo (Aq. 79–81, 84). Its old aqueduct connections must have been maintained even when the Alsietina was brought directly onto

the property.

⁹⁵ O. Wikander, “Water Mills in Ancient Rome,” *OpRom* 12 (1979) 24–25.

⁹⁶ Bell (*supra* n. 87) 82.

⁹⁷ Bell (*supra* n. 87) 84–86.

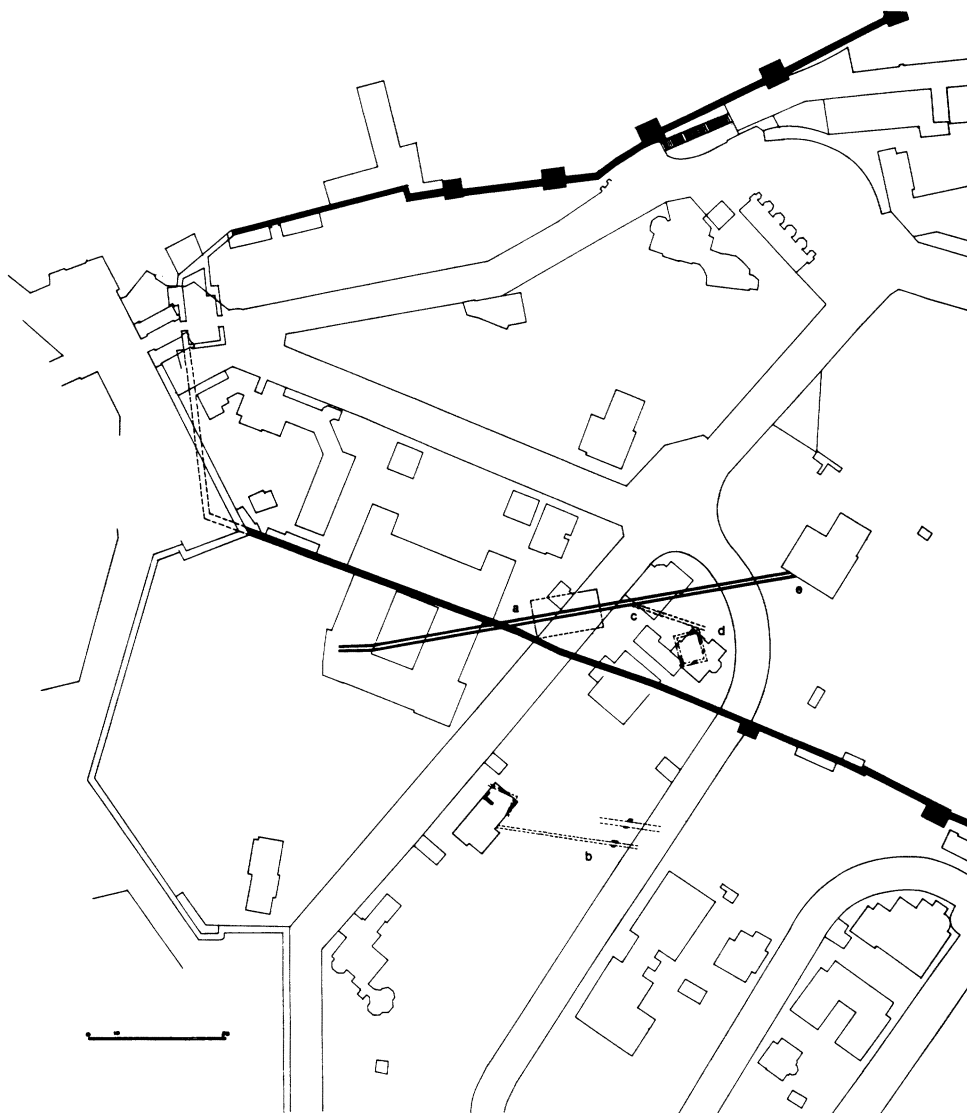


Fig. 7. Map of the known remains of the Aqua Traiana and Aqua Alsietina systems on the Janiculum. The Alsietina (point b) appears to run parallel to a later channel that may have belonged to a mill or sequence of mills. (From M. Bell, in *Le ravitaillement en blé de Rome et des centres urbains des débuts de la République jusqu'au Haut Empire* [Rome 1994] fig. 6, courtesy M. Bell, III)

it turns northwest (on the marble plan, downward) and joins up with the Via Aurelia. The orientation of the specus on cluster 37C is in fact very close to the orientation of the visible fragments of the Aqua Traiana in opus reticulatum visible along the Via Aurelia today.

It should be no surprise that mills are depicted along this segment. They probably began well out-

side the Aurelian walls (which, being post-Severan, of course, were built after the earliest mills) along the saddle of high land that brought the Via Aurelia to the city.⁹⁸ Bell's proposed mill for the Alsietina is well outside the walls, too. The mills on the Janiculum proved so essential to the city's sustenance in late antiquity that Procopius could assume the Aurelian walls west of the river were built specifically

⁹⁸ We know that in the seventh century Pope Honorius I built a mill on the Aqua Traiana as far west as the basilica of St. Pancras (*Liber Pontificalis* 72); H. Jordan and C. Hülsen,

Topographie der Stadt Rom im Alterthum (Berlin 1871–1885) 2.225–26.

to protect them (*Goth.* 1[5].19.8–9). There can be little doubt that they existed in significant numbers along the upper slopes of the Janiculum, far exceeding the scale of the 14-mill run of the Barbegal aqueduct near Arles.

LEGAL RIGHTS OF RIVALES OF THE ALSIETINA AND OTHER AQUEDUCTS OF ROME

The inscription of the Channel of Mens refers to the beneficiaries of the Aqua Alsietina as *rivales* (A2). To gain some appreciation for the way in which these people—or more correctly, their property—benefited from the aqueduct, we must now follow the chase into a neglected march of Roman water law.

Rivales, so Ulpian (*D.* 43.20.1.26) tells us, are “those along the same watercourse who conduct water [from it]” (*qui per eundem rivum aquam ducunt*). He opines that a rivalis has rights to this water not only for irrigation but for everyday use and convenience (*usum . . . et commodum nostrum*, 43.20.1.11), and can conduct the water to any place, not just the immediately adjacent property (43.20.1.12). The Latin requires some commentary. *Ius aquae ducendae*, the legal right implied here, refers to drawing water by a conduit, whereas *iūs aquae hauriendae*, the other most commonly cited water right, refers to drawing water by other means like buckets or water-raising devices (43.20.1.6). The ambiguous usage “to draw off,” often used indiscriminately of both rights in translations of the *Digest* and Frontinus, is misleading. I will term these acts “conducting” and “hauling up,” respectively. *Rivus* is a general term meaning any small course of water flowing in a concave channel, natural or man-made.⁹⁹ A rivalis, then, might be conducting or hauling up water from either a natural stream or an aqueduct. It is much easier to envision a rivalis conducting water from a raised aqueduct than from a natural stream, which would follow the lowest course in the vicinity and could be neither piped nor channeled in any direction but downstream unless it was first raised artificially.

It has been argued that the rights associated with *aquae ductae* are manifestly different from those rel-

ative to *acque fluenti*, i.e., streams and rivers,¹⁰⁰ but the internal evidence of the *Digest* is unclear on this matter, and seems instead to minimize any legal distinction between public aqueducts and unnavigable natural watercourses. Our inscription, referring as it does to the rivales of an aqueduct, and Ulpian’s carefully vague definition of a rivus seem not to discriminate.

The volume of water that rivales could by rights conduct from a channel was strictly circumscribed. By praetor’s edict, water granted to a property had to be conducted from the channel in the same manner each year as in the previous year, with no increase in volume (*D.* 43.20.1.15). This edict, or a similar one, was Augustan at the latest, because the jurist Labeo (d. A.D. 10 or 11) commented on it (*D.* 43.20.1.16). There does seem to have been a class of people who received rights of daily water directly from the channels, and who, in Pomponius’s opinion, were allowed “to insert a pipe into a rivus or do anything else, so long as he does not make an estate worse for its owner or the water delivery worse for the rivales” (*vel fistulam in rivo ponere vel aliud quodlibet facere potest, dummodo ne fundum domino aut aquagium rivalibus deterius faciat*, 43.20.3.5). There is nothing in this passage that prevents us from assuming that aqueducts, not just natural streams, are intended by it.¹⁰¹ It seems to describe a more flexible right than the one expressed by the praetor above, and may have been edited to reflect a later legal situation; but it should be emphasized nevertheless that all of these rights were limited, both in scope and in the number of benefited persons or properties, and were granted only by the proper authorities.

As the term implies, a rivalis conducted water directly from an aqueduct’s channel, not from a castellum. The crucial distinction between these two modes of conducting water, Ulpian implies, is that water taken directly from the channel is *a capite*, while castellum water is not so guaranteed (*D.* 43.20.1.7, 39); for by the jurist’s rather mysterious definition a castellum may contain water not just from a watercourse, but from “any other public place” (*vel ex rivo vel ex*

⁹⁹ Ulpian (*D.* 43.21.1.2) defines it as “a place hollowed out along its axis, in which water may flow” (*locus per longitudinem depressus, quo aqua decurrat*). By general consensus, watercourses were sorted into two categories of size, a river (*flumen*) being larger, and a *rivus* smaller (*D.* 43.12.1.1). But either type of watercourse could flow in a natural or an artificial channel without legal differentiation (on *flumina*, see *D.* 43.12.1.8). An aqueduct was a type of artificial *rivus*.

¹⁰⁰ G. Longo, “Il regime delle concessioni e le derivazioni di acque pubbliche nel diritto romano classico e gius-

tiniano,” *Annali della Facoltà di lettere e filosofia, Università di Macerata* 23 (1958) 53–78.

¹⁰¹ Pomponius begins 43.20.3 by discussing public rivers (*flumina*), but only because he is talking about vicissitudes (such as the changing of course) that would never befall a functioning aqueduct. The passage switches to the more general term *rivus* as soon as it becomes legally necessary. The last sentence in this section, 43.20.3.6, is clearly referring to some sort of aqueduct on a bridge, though nothing else is clear about it.

quo alio loco publico, 43.20.1.41).¹⁰² Water *a capite*, “from the head,” flowed directly from a perpetual and identifiable source—a spring, a river, or a lake.¹⁰³ Rome had public aqueducts originating from all three types of source.¹⁰⁴

An important distinction between the rights of conducting water *a capite* and *ex castello* is that the former was a right *in rem* while the latter was usually a right *in personam*. That is to say, the right to extract water directly from a channel, along with the benefit of a praedial servitude, was attached to a plot of land in perpetuity and was not extinguished when the land changed hands through inheritance, sale, or possession (*D.* 43.20.1.29, 37–39). In contrast, according to Frontinus (*Aq.* 107.1), the right of conducting water from a castellum “devolves neither to heir, nor to buyer, nor to new owner” (*neque heredem neque emptorem neque ullum novum dominum praediorum sequitur*).¹⁰⁵

The rights *in rem* for those living alongside aqueduct channels were justifiable. When each aqueduct was first introduced, these rights may have been granted selectively as an incentive to possessors to sell the strip of land crossing their land designated for the continuous public zone around the aqueduct (*Aq.* 126–28). They were expressed as a servitude that burdened the public zone, from which the service pipe was led, and benefited the property to which the water was conducted.¹⁰⁶ The fact that the water was *a capite* or *ex fonte* was important in establishing

the servitude (*D.* 8.3.9; 43.20.1.7, 39). Capogrossi Colognesi has explored the reasons for this in detail, although his investigations focus on water sources that are privately owned.¹⁰⁷ The authentication of a *public* aqueduct's source guaranteed the aqueduct's two most important legal characteristics: its nature as perennial “living” water (i.e., constantly recharged at the source) and its status as public property.¹⁰⁸

Now that the rights of *rivales* have been all too neatly laid out, it must be said that Frontinus presents a very different picture for Rome. According to him, Rome's aqueducts have no legally recognized *rivales* with the right to *conduct* water directly from the channel. Frontinus gives abundant testimony that from the time of the Augustan senatorial aqueduct decrees until Trajan's day, in its own aqueduct network the city of Rome did not confer the *ius aquae ducendae* to *rivales*, but only the *ius aquae hauriendae*. Already in the *lex Quinctia* of 9 B.C. this fact is plain: “Let nothing be asked of this law that would impair the right of anyone with present or future permission from the water commissioners to raise or haul up water from those sources, channels, conduits, or arcades except by wheel, water screw, or machine, provided that there be no new well shafts or [pipe] outlets.”¹⁰⁹ In other words, new concessions upon any part of a Roman aqueduct's channel may be granted *only as rights of hauling up water manually*. No machines are allowed, and certainly no pipes.

¹⁰² Castella might certainly draw from rain cisterns, or from aqueduct-fed cisterns that were supplemented by rain. This may be the alternative source Ulpian is hinting at, but we should not discount simple ignorance of water distribution systems, which Ulpian betrays elsewhere. Rather confusingly, Paulus (*D.* 8.2.28) gives the opinion that rain-water is considered perpetual water, and may thus legitimately be used in servitudes. This comment may be a later interpolation.

¹⁰³ L. Capogrossi Colognesi, *Ricerche sulla struttura delle servitù d'acqua in diritto romano* (Milan 1966) 1–51.

¹⁰⁴ From springs, the Appia, Marcia, Tepula, Iulia, Virgo, Claudia, Traiana, and Alexandrina; from rivers, the Anio Novus and Anio Vetus; from two lakes, the Alsietina.

¹⁰⁵ Later, however, this distinction was no longer absolute; Ulpian notes that some castellum grants were given to estates in perpetuity. A. Palma, “Le derivazioni di acqua *ex castello*,” *Index* (Naples) 15 (1987) 439–57 has recently argued that in the case of castella established by the authorities for exclusively private use, servitudes—and thus perpetual rights—could routinely be established. Whether or not this is true, both Frontinus and Ulpian remark that it was easy for a new owner to renew a water grant *ex castello* (*Aq.* 109.3; *D.* 43.20.1.43). Frontinus calls it *ius aquarum impetratum* (*Aq.* 128.2), water rights obtained by request.

¹⁰⁶ Servitudes burdening the fronting properties can also be envisioned. For example, estates through which

the aqueduct passed underground may have benefited from those in which the aqueduct lay above ground, where it could be more suitably tapped. We will recall that benefited properties did not have to front directly upon the aqueduct.

¹⁰⁷ Capogrossi Colognesi (*supra* n. 103) 1–51.

¹⁰⁸ All perennially flowing streams and rivers were public by definition (see *D.* 43.12.1.3, 14–15), but springs and lakes, which were often the source of public aqueducts, did not have such unambiguous status. Public ownership of such sources had to be established before a public aqueduct could be built. Inscriptions attest to aqueduct projects *a capite* or the private donation of a public aqueduct *and its source* to a town; see Capogrossi Colognesi (*supra* n. 103) 88–96.

¹⁰⁹ *Quo minus ex iis fontibus, rivis, specibus, fornicibus aquam sumere, haurire iis, quibuscumque curatores aquarum permiserunt, permiserint, praeterquam rota, calice, machina liceat, dum ne qui puteus neque foramen novum fiat, eius hac lege nihilum rogato* (*Aq.* 129.11). *Rivales* of the Roman aqueduct network, it would seem, were free to draw water from aqueduct channels by hand, but not by water-lifting devices—most commonly, no doubt, with buckets lowered down the intermittent service shafts. Grimal (99–100, n. 155) sees this as a great constraint upon the *rivales*, essentially confining their concessions to overflow water within the city. This interpretation is unnecessarily restrictive.

Frontinus lived by a rigid rule, which he backed up with evidence from the Augustan senatorial decrees and laws: In past, present, and future, nobody legally *conducted* water for private use from public aqueducts unless 1) it was granted by the emperor or had been originally commuted by Augustus into an imperial *beneficium* (Aq. 74.4; 88.2; 99.3; 103.2; 105.1; see D. 43.20.1.39–42), and 2) it was conducted *ex castello* (Aq. 106.1–3; 109.6). Water grants from the aqueducts were exclusively *in personam*, “except those granted for use in baths or for the purpose of hauling up” (*exceptis quae in usum balinearum essent datae aut haustus nomine*, Aq. 108). By Frontinus’s time, even the baths’ perpetual rights had been revoked (107.2). This left only the right of hauling up; being thereby a right *in rem*, it would have been attached to properties near the aqueduct zones.

The circumstances of the Aqua Alsietina seem to have defied the strict policies against conducting water from the channel. Not having any urban distribution system to be protected, it was the channel-tapping aqueduct par excellence. Of course its beneficiaries could have used castella like all others who legally conducted off Rome’s aqueduct water, but the use of the term “*rivales*” in the Augustan inscription pertaining to this aqueduct (A2) indicates that they did not. Were they simply hauling up their daily water according to rights protected by the *lex Quinctia*? Possibly, but it would seem a formidable task to raise all that irrigation water in buckets every day until the evening trumpet sounded.¹¹⁰ And what was the use, in later times, of receiving water at night if it could not be conducted in pipes to irrigate one’s gardens? Surely slaves did not begin operating 24-hour torchlight bucket brigades when Augustus brought in the Channel of Mens. These *rivales* must have had some special legal dispensation or a strong claim to a right that Frontinus does not acknowledge.

Perhaps they were not unique, despite Frontinus’s militant assertions that all channel tappers were law-breakers. First we need some idea of the scope of this “illegal” activity in the late first century A.D. Some channels that ran mostly underground were subject to an astonishing amount of tapping. A typical Roman aqueduct’s course (the Appia and Virgo were exceptions, running deep underground) consisted largely of channels cut into hillsides along the con-

tours of the slopes, where, though technically underground, they could easily be tapped to serve the valleys below. According to the record books, the Anio Vetus had no arcades at all and ran underground for 42,779 paces out of a total length of 43,000. While it yielded only 262 *quinariae* of legal concessions before reaching its settling tank near the city, an amazing 1,774 additional *quinariae* were either leaking out or being tapped without authorization along the same length—44.2% of the total volume at intake of 4,607 (Aq. 66.3–5).

The Aqua Marcia’s statistics tell a similar tale. Its legitimate delivery above its settling tank was only 95 *quinariae* (Aq. 67.3) along a distance of about 55 Roman miles (the line’s total length was 61.7 miles; 7.8). This is to be expected, presuming that the officially approved concessions were from small rural castella built for a few privileged landholders. But the “illegal” concessions from the Marcia’s channel were staggering. Along with leakage, they accounted for 2,499 *quinariae*, more than half of the Marcia’s total intake volume of 4,690. Does this contrast simply reflect a stark frugality and rigidity of the imperial concession volumes in the face of burgeoning needs and appetites for water among the *rivales*? Or did the landholders along the way have a reasonable claim to at least some of the water than Frontinus recognized as illegally commandeered?

Frontinus estimated that the total volume of pirated water in Rome’s aqueduct system—that is, all water conducted off from the aqueduct channels that had not been granted by the emperor—was 10,000 *quinariae* (Aq. 74.4). “The reason for this is the dishonesty of the watermen who, we have learned, extract water from public conduits for the use of private parties. But also many possessors around whose fields the water is led puncture the channels of the aqueducts, with the result that public conduits interrupt their progress for the use of private parties or gardens.”¹¹¹

It is easy to understand Frontinus’s outrage at the fraud of corrupt watermen. In the final analysis, however, it is much more difficult to believe, given what we know about the rights of *rivales*, that the occupants of frontage properties were conducting off as much water illegally as Frontinus claims. For one thing, he does not seem to allow that some of the

¹¹⁰ Rationing water to *rivales* was a common arrangement; Pomponius speaks of the right to conduct water during day or night hours, but not continually (D. 43.20.2), while Ulpian mentions servitudes limited to even more intermittent use, such as every second, third, or fifth day (43.20.1.22).

¹¹¹ *Cuius rei causa est fraus aquariorum, quos aquas ex ductibus publicis in privatorum usus derivare deprehendimus. Sed et plerique possessorum, quorum agris aqua circumducitur, formas rivorum perforant, unde fit ut ductus publici hominibus privatis vel ad hortorum <usum> itinera suspendant* (Aq. 75.2–3).

"loss" of water along the way was the consequence of the express right, preserved in his own treatise, for some possessors of frontage properties to haul up water from the service shafts by hand. Second, Frontinus's interpretation of some of the supporting legal evidence is very restrictive. Note, for example, the following passage he cites from the *lex Quinctia*:

Whosoever after this law is passed shall knowingly and with malice pierce, break, or oversee the piercing or breaking of, or make worse, the channels, conduits, arcades, pipes, pipelets, castella, or basins of the public waters that are conducted to the city, such that those waters or any part of them should be less able to go, fall, flow, arrive, or be conducted into the city of Rome, or such that it cannot emerge, be distributed, be divided, or be directed into castella or basins in the city of Rome and in those places or structures that are, or shall be, the city's area of continuous habitation, [or] in those gardens, estates, or places to whose owners, possessors, or usufructuaries water has been, or shall have been, granted or bestowed—he shall pay damages of 100,000 sesterii to the people of Rome.¹¹²

Frontinus would read this to mean, "You may not tap the channel under any circumstances, or use an existing tap in the channel, since you are prohibiting a part of the public waters from flowing into the city as originally intended." An effective response might be, "This pipe has been here since time immemorial. Therefore the water in it is not now, and never has been, part of the public waters conducted to the city." Nor can I be accused of piercing the channel, since it was already pierced." The claim of prolonged use was a powerful one in Roman Imperial law, and was even stronger if it extended back to the Republic, when the laws were probably not so strict or apt.

¹¹² *Quicumque post hanc legem rogatam rivos, specus, fornices, fistulas, tubulos, castella, lacus aquarum publicarum, quae ad urbem ducuntur, sciens dolo malo foraverit, ruperit, foranda rumpendave curaverit peiorave fecerit, quo minus eae aquae earumve quae queat in urbem Romam ire, cadere, fluere, pervenire, duci, quove minus in urbe Roma et in iis locis, aedificiis, quae urbi continentia sunt, erunt, in is hortis, praediis, locis, quorum hortorum, praediorum, locorum dominis possessoribus usus] fructuariis] aqua data vel adtributa est vel erit, saliat, distribuatur, dividatur, in castella, lacus immittatur, is populo Romano HS centum milia dare damnas esto* (Aq. 129.4).

¹¹³ In essence, it would seem that by trying to reclaim the water that the *rivales* believed was their right, Frontinus was challenging them to avail themselves of the praetor's interdict cited by Ulpian and to take their claim to court. This was to Frontinus's benefit, because those who did not feel they had a legitimate claim would not respond to his challenge. Of course Frontinus was out to catch the big fish, not to tie up the courts with petty claims. His strat-

egy had the dual advantage of exposing the most blatant and most recent abusers of water *a capite* while renewing the claims of everyone else. It must be noted, however, that Frontinus never characterizes the situation in these terms at all. He judges all but those on the books to be guilty, offering them public amnesty if they express formal contrition and declining to take the others to court out of sheer generosity (Aq. 130.3–4).

Which leads us to the third limitation of Frontinus's claims—the fact that his only detailed source of information on these matters is the imperial record books. They began to be kept systematically only in 11 B.C. (Aq. 99.2–3). Before that, such matters, "which, having been managed, more or less, by magisterial authority, had lacked legal definition" (*quae . . . quasi potestate acta certo iure egisset*, 99.2), were the province of various magistrates, usually censors or aediles (95.1–2). In many cases, a praedial claim to a tap in the channel may have preceded the Empire by decades or even centuries. Frontinus's sweeping charge of illegality for all water conducted to private parties *a capite* may have been nothing more than a challenge to the *rivales* to present proof of their rights to all the water they were conducting onto their properties.¹¹³ These rights, especially if they were of long duration, would have been as hard to prove—or disprove—as an old transfer of title. Indeed Frontinus's plan was rather like a public strategy aimed at curing defect in land titles, for he relented in the end, allowing many of the unauthorized tappers, or at least those whose claims were not outrageous, to continue enjoying their water *ex beneficiis* of the emperor (88.2; 130.1–4). Each tap was then recorded as a legitimate imperial concession, and its volume limit strictly enforced (103.2–3). One wonders if Frontinus had set off a legal imbroglio that would lead to changes in interpretation of the law. Pomponius gives the opinion that "a conduit of water whose origin is beyond memory is held to be legally established in space."¹¹⁴ And in *D.* 43.20.1.10, 39 Ulpian asserts that a *rivalis* could claim *ius aquae ducendae* not only if the right existed, but also if he had merely acted in the belief that the right existed.¹¹⁵ Frontinus's action, which

¹¹⁴ *Ductus aquae, cuius origo memoriam excessit, iure constituti loco habetur* (*D.* 43.20.3.4).

¹¹⁵ Aristo, a jurist active during Frontinus's career, interprets the *ius adpulsus pecoris*, the right of leading herds to water, in much the same way (43.20.1.19). Elsewhere Ulpian observes that a public river is not made worse for its users simply by virtue of a diminution of its volume (43.13.1.3). He seems, however, to be referring only to rivers and not to artificial channels; that is, he is concerned about their navigability.

would have packed the claims courts virtually overnight, was just the sort of engine for such a reform.

Frontinus's amnesty only confirmed that the "castellum club" of Rome was a legal fiction. Though some of those 10,000 quinariae he claimed to have been pirated directly from the channels were reclaimed for the public, the majority remained with individual properties that had tapped the channels directly (87.2–88.3; 130.1–4). Frontinus had no choice but to recognize this class of imperial concessions conducted *a capite*. But we may conclude, though he does not say, that following the strict rules for Rome's aqueduct network that had been in place since Augustus's time, all these new grants were made *in personam* rather than *in rem* as they are characterized in the *Digest*.

Frontinus's actions may finally have put all Rome's aqueducts on an equal legal footing with the Aqua Alsietina, which from the Early Empire would seem to have had *rivales* conducting water from its channel in a legally recognized manner. This aqueduct remained physically unique, for most of its *rivales*

at the time were clustered at the very end of the line, benefiting, as it were, from the line's failure in its original purpose. The praetor's interdict protecting *rivales* was valid both inside and outside cities (*D.* 43.20.1.14), but it was assumed to apply in most cases to rural farms along an aqueduct's approach to a city. The Aqua Alsietina was atypical in this respect, but its course, running mostly underground like that of the Appia and the Virgo, probably made tapping difficult along its upper route except in the rare valley crossing. Had it been physically accessible along its route to the city, like the Anio Vetus or the Aqua Marcia, it would surely have had many more *rivales* there and fewer in the lower Transtiberim.

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