

## **An integrated conservation process between history and hydraulics. The case of the ancient masonry “Tower of waters” in Colorno, Parma**

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### **1. Introduction**

This paper aims at inspecting the role of an interdisciplinary approach in the knowledge and in the conservation process of the built historical heritage.

The project of restoration of the ancient “Tower of waters” in Colorno, a small town near Parma, represents an interesting opportunity to set up a strategy of “integrated conservation” (in the R. Di Stefano<sup>1</sup> acception [Di Stefano, 1979, 63]), starting from a deep environmental and historical analysis.

The Tower of waters was built at the beginning of the 18th century to provide water for the magnificent waterworks of the near Reggia di Colorno, a worldwide famous Ducal Palace which is located in the “Pianura Padana”, an area of Northern Italy where earth and water live side by side. The masonry tower of Colorno, now completely dismissed, is one of the few ancient hydraulic structures still surviving.

The study of this place has immediately evidenced the strict relationship between the built heritage and the water all around it; the present study is based on historical research, structural and architectural analysis and on hydraulic investigation of the complex canal network which was connected to the tower in order to revitalize it.

## **2. The case study: the ancient Tower of Waters in Colorno**

### **2.1. The site and the water**

The Tower of Waters stands up proud and majestic, despite its advanced state of abandonment and decay, in a very strategic place, in the middle of an area devoted to water (Fig.1). Indeed, ancient documents recall the latin toponym of Colorno as Caput Lurni (“the source of Lorno river”), thus emphasizing the strict link between this place and water.

The historical and environmental analysis of both the place and the structure has unraveled the key relationship between the tower and the water context. In a rural economy, which is mainly based upon mills and irrigation systems, water becomes a symbol of power and represents an innovative way of managing culture and economy of the territory. More specifically, this tower has represented the ludic aspect of water, by contributing to the magnificence of the palace, a typical aspect of a specific historical period, the Ducal 18th century. The Tower is surrounded by several buildings, belonging to different periods but all related to water: an ancient mill (Mulino della Corona), a 20th century factory for the production of oxygen (Fabbrica dell’Ossigeno) and some 15th century buildings (the so called “fishermen’s houses”), located just along the Lorno river, in the North of the tower, which seem to be the most ancient houses of the town.



Fig.1 - The Tower of Colorno (in red) stays in a very strategic place, in the middle of an area devoted to water, at the hydraulic node of the junction between the Lorno River, the Parma River and the Galasso Canal

Thus, in order to fully understand the value of this monument, it is fundamental to consider its historical and hydraulic features, also clarifying the complex system of water and the surrounding countryside. For this reason, the study has been articulated on different and parallel fronts of investigation, always dialoguing each other. In the first phase, an historical research was made on the original maps and on some still unedited iconographic sources, in order to define, through a comparative method, the transformations of the territory around the tower and the possible system of alimentation of the garden fountains (Fig.2, left). Secondly, the role of water into the tower was highlighted by a critical comparison between the findings of a precise architectural survey and some ancient drawings on “water machines”, obtained from coeval treatises (as Belidor, 1700). This approach made it possible to reconstruct the most probable mechanism used inside the tower before its conversion into a residential building, at the middle of 20th century (Fig.2, right).

## 2.2. The tower

The “Tower of waters” was built in 1709, maybe on the design of the architect Ferdinando Bibiena, on the remains of a previous hydraulic construction, a sort of basin, designed in the middle of the XVth century by the hydraulic engineer Aristotele Fioravanti from Bologna.

Certainly, the hydraulic gimmick inside the tower, which was used to pump the water into the garden of the palace (Fig.2, right), belonged to the 18th century, as testified by some documents and summaries of expenditure<sup>1</sup>. Actually, it had been used for this purpose for less than 30 years, since it was abandoned soon after its construction, due to problems in functioning and maintenance after the end of Farnese’s dynasty (1731).

Although no traces of the original water machine remain in the structure, it is possible to advance some realistic hypothesis on its most probable articulation, based on a variety of documents and treatises on the subject.

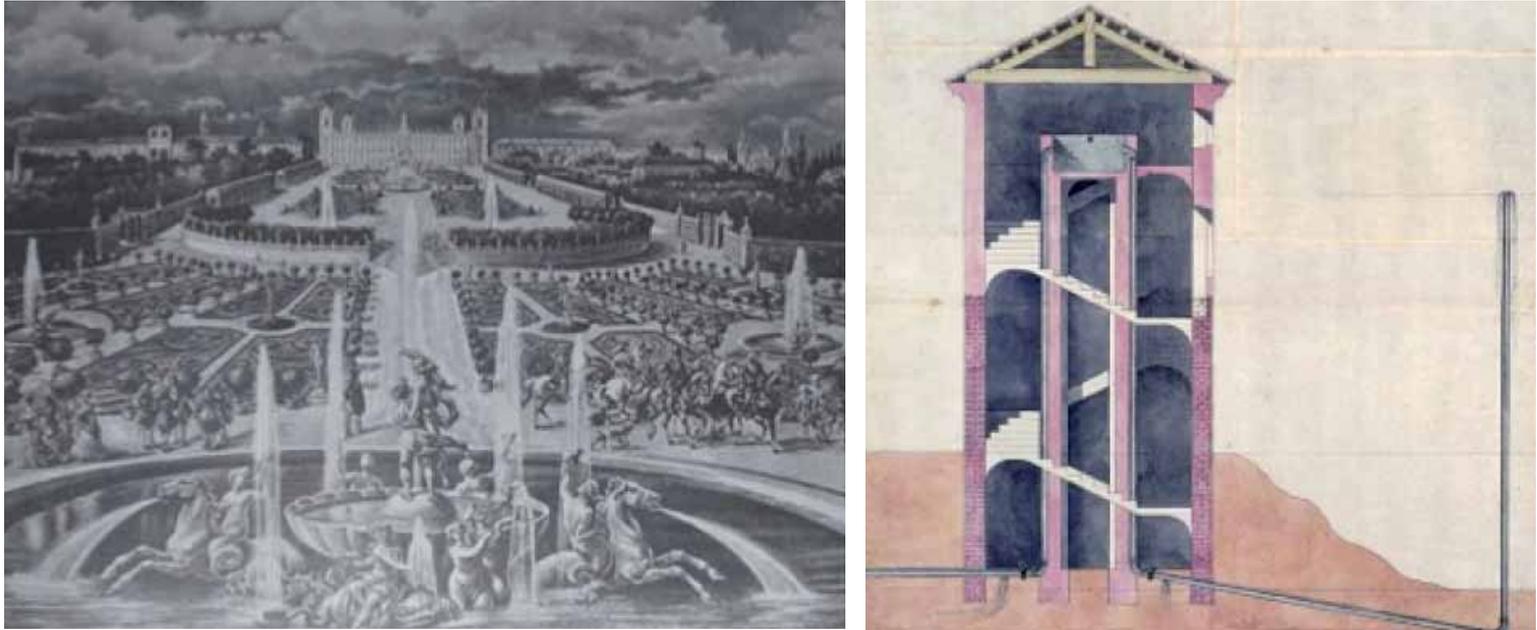


Fig.2 - On the left, a modern reconstruction drawing of the Fountains of the Ducal Garden of Colorno ; on the right, a drawing of the hydraulic gimmick inside the tower probably used to pump in the water (conserved in Fondazione Cariparma)

### **2.1.1. The architectural and structural survey**

The building has a quadrangular plan consisting of a main body 18 m high, the Tower (Fig.3, left), two small buildings, added more recently, on the south-west and south-east facades: the old Torchio da olio (oilpress) and a small chicken coop near the road, nowadays almost completely ruined.

The main body measures approximately 6 m by 11 m and it is clearly divided into two different spaces: the unique volume on the southwest side, occupied by the double-knee stairs, and the great vaulted space which constitutes more than the two-thirds in plan of the extension of the tower (Fig.3, right).

The entrance to the building is on the north-west, at ground floor, in a vaulted room which leads to the old Torchio; the stairs on the southwest lead up to the extrados of the ogival great vault, and to the intermediate wooden floors which were added later, at the height of 3 and 6 m, when the tower was used as a dwelling (Fig. 4, left). Each floor is divided into two rooms, fireplaces were added in the northern rooms and almost all the ancient windows have been splayed. The roof, wooden hipped with two central trusses, is partially collapsed and it caused the ruin of the floor below, the attic, which is nowadays accessible only via a temporary ladder.

Then, the tower uncannily extends also under the surface, where a pointed vault covers the Galasso canal - nowadays often dry - approximately at a height of 3.50 m from its bottom (Fig.4, right).

The façades, very compact unless the presence of a cornice at the level of the vault, are very tampered: several windows have been closed, at least partially, and the arcades at the top (5 round arches on the long sides and 2 on the others) have been also partially modified.

The careful investigation of architectural elements and building materials clearly unraveled the transformation of the original hydraulic machine into a resi-



Fig.3 - On the left, south view of the Tower of Waters; the great ogival vault on the Galasso canal, which constitutes the foundation of the tower

dential building, thus confirming the intention of keeping the original structure while renovating and adapting the building to a new function.

### ***2.1.2. The role of water***

The ancient hydraulic treatises allowed us to formulate the more reliable hypotheses of the ancient structural and functional organization of this tower, strongly modified over centuries, in which the presence of water and ancient equipments for its exploitation appears fundamental.

In ancient times, water flowed abundant in the Galasso canal, fueling not only the tower, but also all the surrounding buildings, which drew power and sustenance from the water itself. The Galasso canal's water was caught by the wooden wheel under the large pointed arch and then it was pumped at the extrados of the great vault, by the use of a plunger (Fig.6, left). In this way, the water reached the necessary height, to be exploited for the power of fountains, which were reached through a network of air or underground pipes, depending on the topography of the area.

All this was possible in a complex regime of waters, now partially modified by some recent hydraulic works, such as the insertion of two Vincian doors along the Lorno river.

The today challenge is therefore to find out a proposal for the reuse of this monument and the entire surrounding area, involving mainly the authorities that deal with water and its management. This node could be used in the future, as a living exhibition of the great work done in the past by the hydraulic engineers.

### **3. A possible strategy for integrated conservation: the project of valorisation and reuse**

Starting from these premises, the real challenge is to assure heritage preservation through environmental based strategies which may lead to even heavy

investments in order to bring the building back to a new life and value, both cultural and economical.

Water entering this ancient tower represents not only a scenographic instrument, perfectly in line with the tradition, but also a economic resource, crucial for the maintenance of power on the territory. Therefore, water's signs, suspended between scenography and management, have become the occasion for rethinking the development of this monument and its relations with the territory, in a comparative reading of territorial episodes and archival documents which ultimately lead to the design of a "museum of water" inside the tower.

Moreover, the investigation of both ancient and modern hydraulic data and the topographic survey of the area have highlighted the potential related to the installation of a micro hydroelectric plant, which could represent the needed economic boost for the restoration of the building and its surroundings.

In a recovery plan, the preliminary phase is always represented by the knowledge, both historical and territorial, necessary to create an architectural element able to dialogue with the surrounding landscape and with its own past. The historical analysis anticipates and strengthens the subsequent environmental studies.

### **3.1. The proposed intervention**

The proposed conversion of the Tower of Waters into a Museum foresees the insertion into the original volume of a new iron structure with the installation of audio-visual projections and models, as well as the reconstruction (a sort of replica) of the most probable hydraulic gimmick, which would repeat the ancient operating mechanisms for lifting water inside the tower (Fig.6).

Only after the works of strengthening and reinforcement of the structure, such

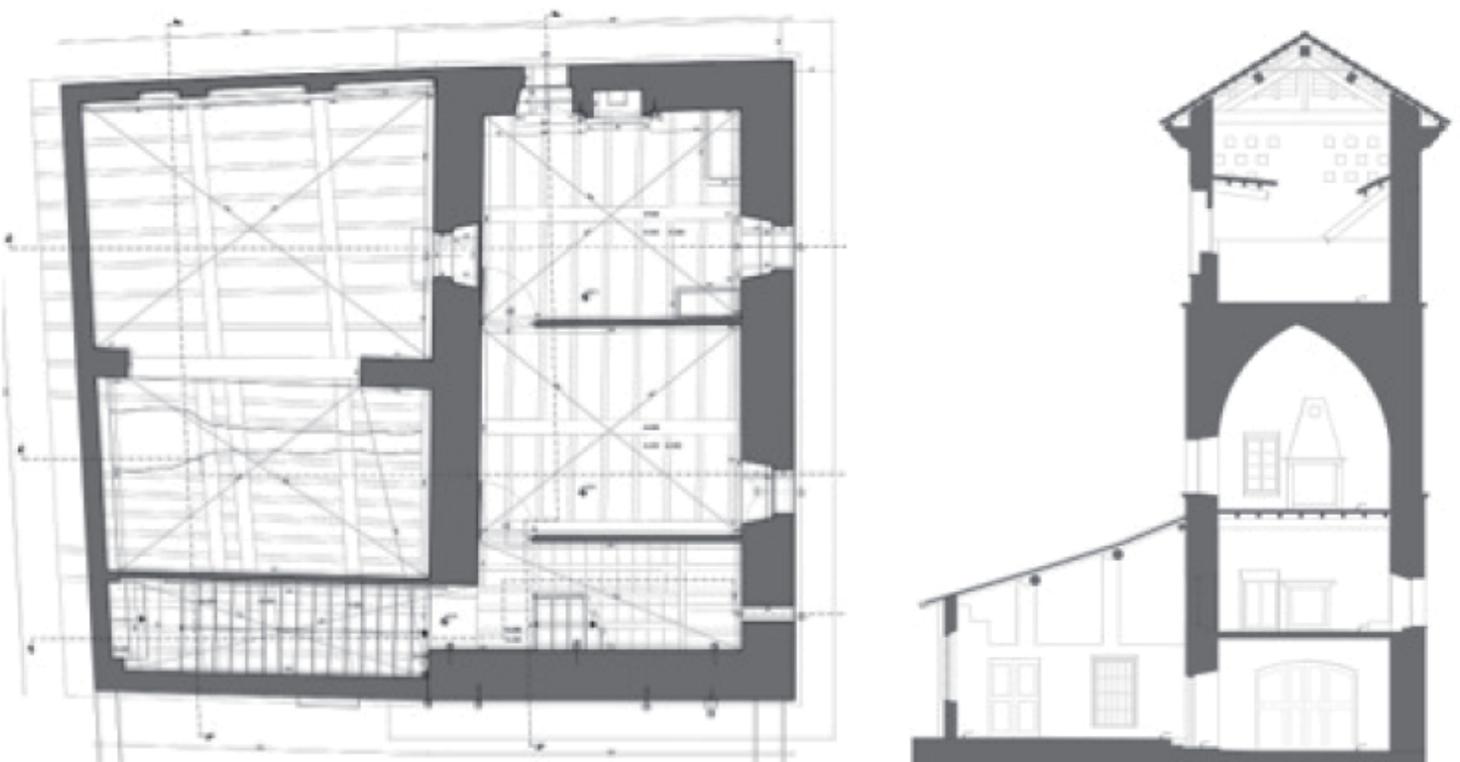


Fig.4 The structural survey of the first floor, with the indication of the beam warpings transversal section of the tower and of the near mill (Torchio)

as the insertion at two different levels of high resistance steel tie-rods, and the reconstruction of the roof in laminated wood, the project saw the removal of the different wooden floors which were added in more recent times and are, at present, in an advanced state of decay.

The introduction of a new structure, which is completely independent of the Tower masonry walls and is constituted by steel columns and beams and by glass floors, allows to create a museum space between vertical paths and exhibition spaces (Fig.7, right).

Moreover, a 1:1 scale reproduction of the most likely mechanism, i.e. a plexi-glass piston for lifting water, was added in the space formerly dedicated to the hydraulic mechanism; this insertion will make visible the flow of water through the tower, transforming it into a real “museum of itself”, educational and alive, which can be not only economically sustainable, but more, profitable.

### **3.2. The “power” of water**

Then, the project is extended to the surrounding territory, once again, recovering its fundamental role, through the privileged sign of waters. As mentioned before, a small hydroelectric power plant was present in the ancient construction added on the South-East side of the main body (the old Torchio) since the past and the water supply was provided by the Galasso canal, that was freely flowing under the tower. Fortunately the owners succeeded in preserving their title to exploit the natural difference in height between the Galasso and the water’s outflow in the Parma river and the possibility to use the waters delivered by the canal is nowadays still available.

Therefore, it is estimated that the inclusion of a micro hydroelectric power plant in the original place, in the room of the ancient Torchio under the tower could repay the works needed on the first phase of strengthening and global reinforcement of the tower. Indeed, despite a flow duration curve<sup>2</sup> is not available for the site, it is reasonable to consider a flow of 1.5 mc/sec for a period of 200 days/year which is sufficient for the production of more than 50 kW of power by the installation of a Micro hydro plant. For the particular kind of renewable energy produced, this plant could be eligible to obtain a particularly advantageous power purchase agreement and the annual energy produced by the plant could be awarded with a high per-kWh price with a profit of about 60000 € per year, for a period of twenty years. According to literature, the costs for Micro hydro power plants of the considered size can be estimated in about 2500 € per kW, leading to a rough estimate of less than 150000 €, except the minimal restoration costs to make the space available in the ancient “Tower of waters” suitable for the installation of the plant. The initial construction costs for the realization of the plant could be amortized in few years and the remaining profits could then be exploited for the further enhancement of the site. Moreover, this plant can act as a driving force for the subsequent self-sustenance of the tower itself, convincing the responsible of the hydraulic regime to intervene on the node.

## **4. Conclusion**

Water is the heart of Colorno. It flows into the village, under the surface, and

it penetrates inside the tower through a great arch and an hydraulic mechanism. Water seems to support the great walls made of bricks as the hydraulic system outside had supported for many years the Ducal power.

It stands out the crucial role covered by water in the supporting of the Tower, both economically and culturally. In this spirit, the suggestion is the creation of a Museum of Water in this structure, as the arrival point of a deep research conducted on the territory, by which emerged as peculiar and overriding the connection between the Tower and the surrounding landscape.

Finally It seems to give an answer to the question addressed by Italo Calvino in his "Armilli", in which, the author states, "it's like if the hydraulic engineers have finished their work and they have gone away before the bricklayers" [Calvino, 1972]. But, most of all, this project could represent the natural way of recovering a hidden monument and the environment around it, which always owed its importance and value to water.

Fig.6 - On the left, the scheme of the most probable hydraulic mechanism used into the tower, referred to ancient treatises (below). In the middle, the hydraulic gimmick reconstructed in plexi-glass, inserted into the tower in the project of reuse (right).

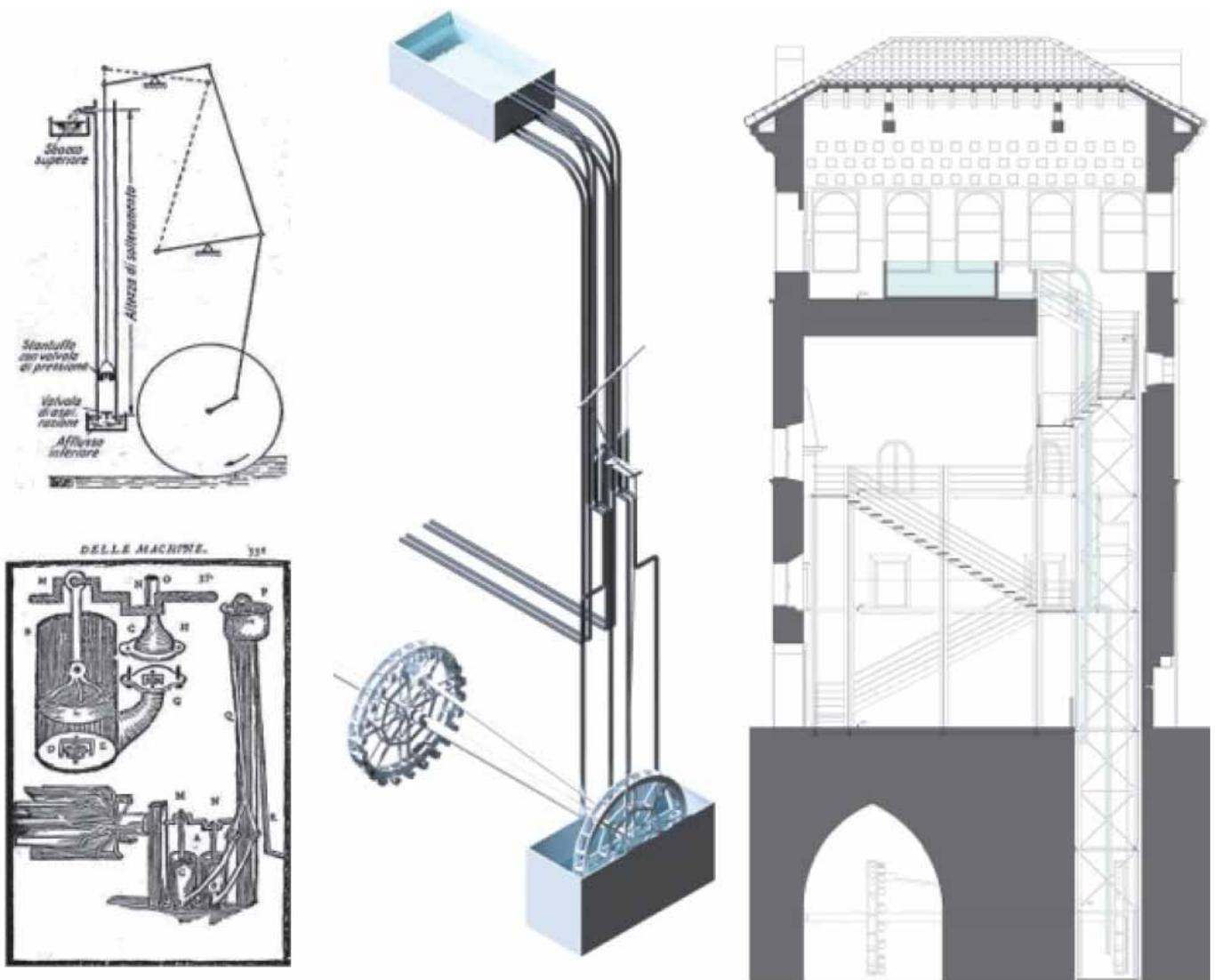




Fig.7 - On the left, the designed great cistern, repositioned at the extrados of the vault, after the restoration of the roof. On the right, some internal views, after the intervention, of the steel structure inserted in the unique original volume of the tower

### Notes

<sup>1</sup> Some payments are relative to the ducts, and some to the large tank on the top of the great vaulted system.

<sup>2</sup> A tool that allows to know the amount of time during which specified flow rates are exceeded at a given location.

### Acknowledgements

The project presented herein is realized as part of a collaboration between the research group of the University of Parma, the mayor of Colorno (M. Canova) and interested members of the Consortium of Reclamation of Parma and the Basin Authority for the River Po, which the authors want to thank. Heartfelt thanks go to the students L. Bergianti, M. Cesini and A. Loforese for the graphic material and the work done as part of their thesis research, forthcoming.

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