

## **The Aqueduct of Lanciano in Abruzzo, Italy: Reading and Interpretation as Means to Preserve an Unknown Landscape**

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### **ABSTRACT**

Among the elements that characterize the Italian landscape, the historical paths assume a significant interest for the testimonial value they represent. Since the end of 1800 they define the expression of the cultural politics of post-unitary Italy, attributing to the connections the potential of promoting economic and cultural exchanges between people with different history and traditions.

To the word “connections” various nets are attributable, as well as infrastructures as aqueducts.

In the literature, the theme of the aqueduct is quite examined, as evidenced by the great Romans heritage; this research rather considers the period from late 1800s to early 1900s, during which the projects for the hygienic improvement of Italian cities are included. A time where the technological evolution of hydraulic systems and their graphic representation becomes a means to support the development of Italian industrial society.

The territory of the present research is Province of Chieti (Italy), which includes the most important water supply of Abruzzo Region: the Aqueduct of Lanciano. It was built in 1897 to supply the city of Lanciano with the sources of Verde River flowing from the Majella Mountain Range.

According to the rules of the modern engineering, the pipeline is completely underground for about 26 km, defying a geologically rugged territory. Its characteristics of non-visibility and non-practicability are a challenge in terms of research and offer a new opportunity to preserve this territory. The aim of this paper/poster is reading and representing the landscape through unusual point of view; indeed they correspond to an underground water course, whose typological path gradually descends from internal sources toward the foothills, identifying specificity of historical and cultural permanence that no other instrument of information design can offer today.

**KEYWORDS:** Aqueduct, Hydraulic, Landscape preservation, Graphic representation, Abruzzo

### **1 INTRODUCTION**

Looking at the landscape we can be spectators in different ways: we can just capture views and sensations preserving them in our mind or we can understand, in semiotic sense, what the landscape reveals about men and societies which identify with it. It is like reading a book or attending a theatre exhibition; in both cases we need codes of reading in order to give meaning to what we see.

Is it possible therefore “reading” the landscape?

About reading, we refer to a written page, a set of signs or graphic elements of which we know the meanings and through which we convey thoughts and feelings; but is landscape made up of signs? According to semiotic theory, every object created as object of use has value as a sign, only when it is recognisable. So the landscape, made up of many recognisable signs, can be read and interpreted.

However, our interpretation cannot relate the individual elements but the whole environmental context: the ways in which elements take a meaning and a function as part of set, or rather how and why they are connected in the space, turning them into a written page.

The variety of visible and anthropic elements can make very complicated the reading of landscape, not to mention all that is imperceptible and unknown of it. The Aqueduct of Lanciano is an

emblematic case: its path is underground and its construction, that has marked one of the most important times of Abruzzo history, is almost unknown to the scientific community.

The reading of this landscape has been made through a graphic analysis, bringing to the surface the aqueduct path and revealing its relationship with environment. This interpretation has been obviously supported by archivist research about all historical events which have strongly influenced the social development of Chieti province.

Reading and interpretation have been finally means to walk in the landscape; a singular travel along an invisible path which reveals a new way to preserve the landscape.

## **2 HISTORICAL OVERVIEW: THE GREAT THIRST**

*“It is a labyrinth of alleys between crumbling houses and with a miserable appearance. In this mud ragged children and a multitude of pigs, more numerous than people, live in a jumble. It is a strange promiscuity to see, except in some places of Ireland. Inside a home, a child and a little pig are sleeping together on the floor. This fraternity is really emotional and it would be also fun if it were not for the dirty and insect along the streets. The new town has still houses built in the fields, has wider streets without cobblestones, but it is sufficient little rain to submerge them.”* (Lenormant , 1883)

The testimonies of several foreigners, whom travelled across Italy in the late 19<sup>th</sup> century, prove that these situations were frequent in many towns of Southern Italy.

In 1861 the Kingdom of Italy was founded to agglomerate the ex-Kingdom of Two Sicilies and Northern Italy into a single state. Despite unification, Italy’s population remained severely divided between wealthy elites and impoverished workers especially in the south.

Abruzzo Region (northern border of the ex-Kingdom) remained a marginalised territory for a long time, which extreme poverty still reflected the old economic system. Its economy was based exclusively on sheep farming and agriculture; there was not urban infrastructures to support a real change.

*“Who might ever believe that in Europe there are regions in which poor children and young women work the land as beasts of burden [...] when we are spectators of this miserable and degrading show it is impossible to erase the memory.”* (Lenormant, 1883)

Due to its orographic features, this region was naturally supplied with water. In areas nearby Majella Mountain Range the sources were pure and plentiful, and populations could drink them without danger of epidemics; but from hill areas to the coast, where collection and distribution of water would have needed several and expensive works, populations was satisfied with either well and fountain water or, in the worst way, with rain water.

The unsanitary condition caused an increase in disease. After the events in Naples, epidemics such as cholera and malaria ravaged all southern Italy. Polluted aquifers near residential areas, the lack of sewers and public ignorance of basic sanitary conditions, contributed to an unprecedented mortality rate; in period 1865-1867, in Chieti Province 2,646 persons died because of cholera, the highest number of mortality ever recorded in Abruzzo.

Serious social tensions brought the government to invest heavily in development of infrastructures. In 1887 was enacted a law on low-interest loans to execution of hygienic improvement works, laying claim as the land management as the right to plan it for the community benefits.

A sector in which the actions of public authority were highly operational is the public water system: 995 Italian municipalities took advantage of founding, included Lanciano that contributed, by building the Aqueduct, both to define the relationship between man and natural resources and to improve living standard of whole province.

## **3 THE ENGINEERING DESIGN AND HYDRAULIC CONCEPTS FOR THE LANCIANO AQUEDUCT**

Several studies for the construction of Lanciano Aqueduct began in 1897 with a project by Engineer Salvatore Fasciani, whom considered Majella Mountain Range as area to collect water. In 1898, the executive project “Lanciano Aqueduct with the sources of Verde River” was approved: it

provided for a cast-iron pipe extended for about 25 km from Fara San Martino (a little foothill town at 440 m.a.s.l.) to Lanciano (275 m.a.s.l.). Work began in 1900 under the supervision of Fasciani and was completed in a remarkable short time, three years. On June 5, 1904, the first water was received at Lanciano with great acclamation from citizens.

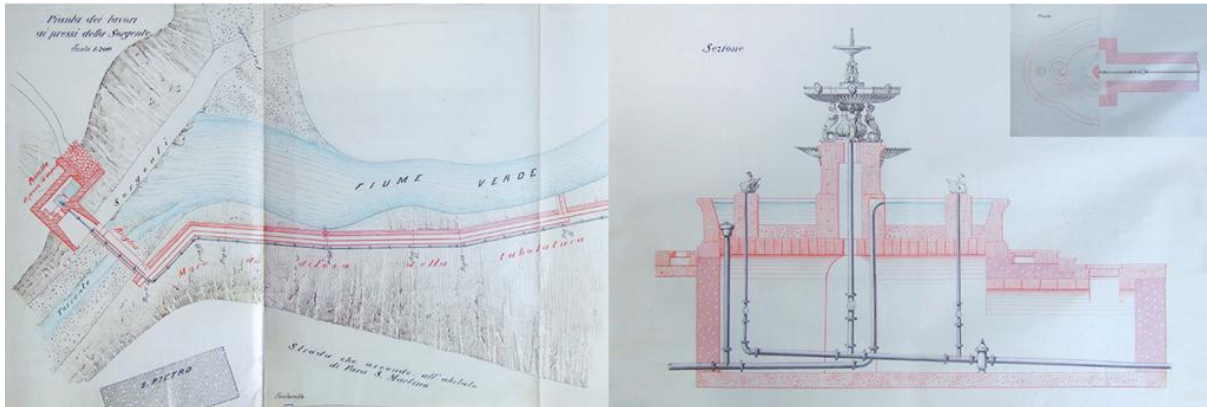


Figure 1: Original design: collection water at Fara San Martino and distribution in the ornamental fountain at Lanciano

There is no unique solution in engineering design; the success of a particular engineering work can be measured as much on its forms in relation to its function and materials applied, as in question of environment, aesthetic, economic, scale and utility. On these criteria, the Lanciano Aqueduct provides an outstanding case study of the factors inherent in the design of any successful engineering work.

The engineering design of this achievement can be considered in two parts: the hydraulic design and the structures necessary in order to ensure the amount of water required by Lanciano. The first step was to determinate the quantity of water to be delivered at the Aqueduct: the system was designed for a population of about 18,500 and an estimated flow rate of 15 litres per second. After that the engineer studied a number of potential water sources in the Lanciano area, it was decided to build a gravity system utilizing water from the sources of Verde River, flowing from the core of Majella Mountain.

This decision was an economic strategy because the advantage of using a gravity system is that it functions without employ any pumping machinery. However, in order to take advantage of the contour of the land, the route of Aqueduct was over very rugged ground; to maintain the constant slope of the Aqueduct from Gatehouse to Reservoir, Fasciani constructed different structures to ensure the water would flow under atmospheric pressure only and also to permit access so that the Aqueduct could be inspected all along its length.

#### 4 LANCIANO AQUEDUCT: NEW REPRESENTATION OF A COMPLEX SYSTEM

From historic research as starting point for the Landscape preservation, it draws inspiration the work conducted in the next phase of this research. It develops the Aqueduct design by three-dimensional graphic analysis, or rather by subjecting it to digital representation in order to create a new way to see this project and to perceive its landscape.

Today, the evolution in information design gives great possibilities for knowledge management and virtual prefiguration; by using the software SketchUp® and by importing GIS data available from Google Earth®, it was possible the modelling of the territory portion crossed by Aqueduct, with perimeter of 68.2 km and surface of 187 km<sup>2</sup>.

The 3D modelling obtained and, in particular, the complex surface of contour lines is an important digital instrument to understand the relationship between technical value of Aqueduct and landscape value of this territory.

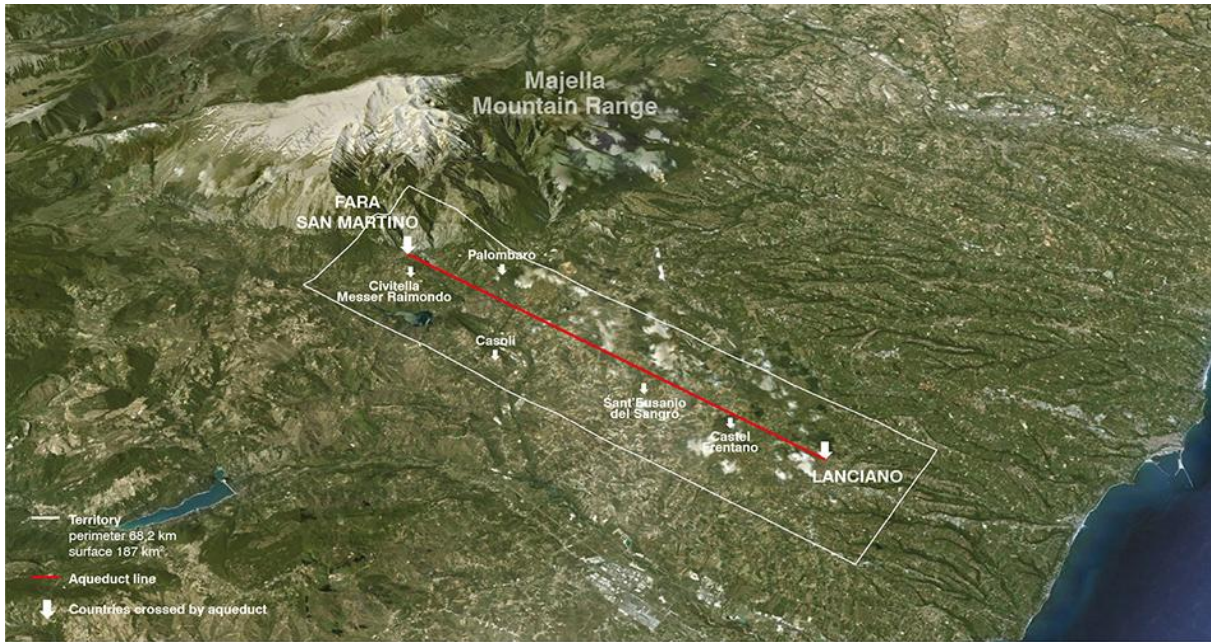


Figure 2: General view of the territory crossed by Lancia Aqueduct

The necessary operations to build the Aqueduct are three: collection, adduction, distribution.

The collection provides for the catching of water from the Verde River: this, flowing from the core of Majella, is captured and channelled into pipeline by a *tunnel* and a *gatehouse*. The adduction, instead, carries the water to Lanciano: the water from the gatehouse is conveyed underground into a cast-iron pipeline with a diameter of 20 cm; the pipeline covers a distance of about 24 km to *reservoir* located on Torremarina Hill. From gatehouse to reservoir the pipeline meets three major water course (included Verde River) which forces it either to be contained in *dikes* or to come out of ground by little *bridges*. Furthermore, the pipeline is equipped with *vents* and *drains* all along its length. The operation of distribution, finally, achieves the internal water mains at Lanciano: from reservoir a secondary pipeline conveys the water to water mains, where are placed an *ornamental fountain* and nine little *cast-iron fountains* for domestic, commercial and institutional purposes.

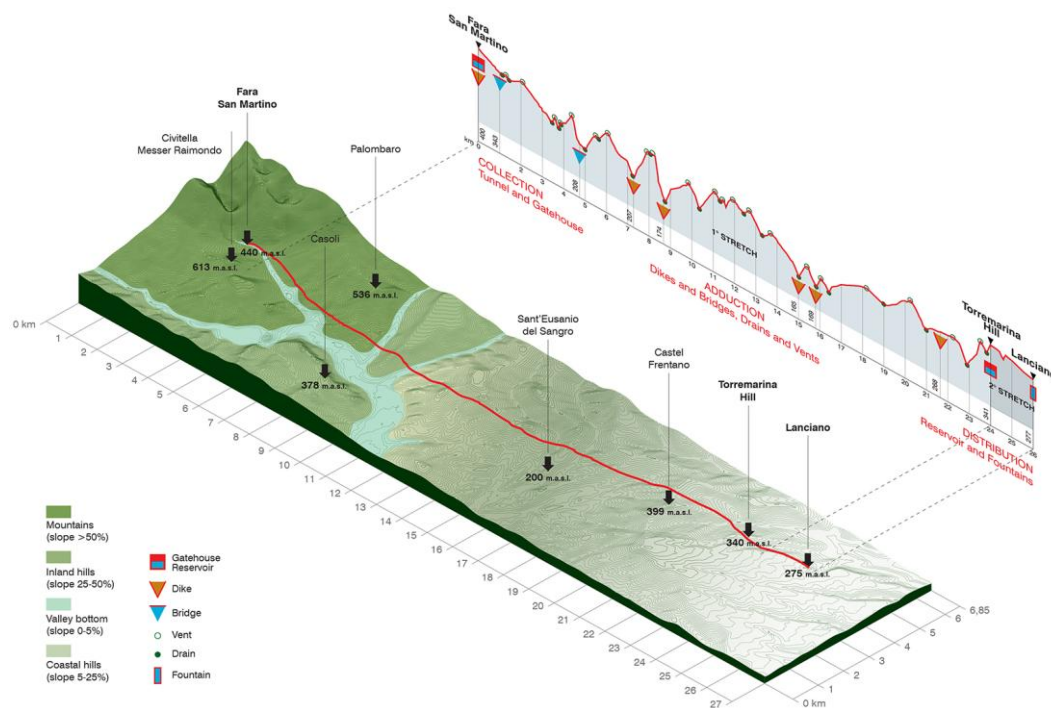


Figure 3: Graphic analysis of Lancia Aqueduct

The materials used for the construction of Aqueduct are the cast-iron for the pipeline and local stone for all its structures, gatehouse, culverts, embankments and reservoir. Of these structures, the reservoir and the monumental fountain were not constructed according to Fasciani's design.

After 1910 were adopted many modifications to the structures, especially in 1945 when the bombings of World War II severely damaged the Aqueduct line. Over time, its flow rate was insufficient to meet the new needs of Lanciano, whose districts had already extended beyond the fortification walls.

In 1949 several municipalities of Chieti province, included Lanciano, joined the Water Corporation of Chieti to construct a new water supply system: the Del Verde Aqueduct. It was completed in nine years and opened in 1958. Its construction was possible due to great operation of water collection, a new gatehouse, to a depth of about 3 km from core of Majella. It was estimated a flow rate of 1000 litres per second and almost all towns of Province were supplied with greater water.

Currently, Del Verde Aqueduct is composed of three major branches: Main Verde, North Verde and East Verde and are supplying 92/104 municipalities of Province; but in this context, Lanciano Aqueduct has always been an independent pipeline. In July 2012 it was closed and was opened the New Lanciano Aqueduct which is parallel to old.

Lanciano Aqueduct has gone through over a century of history. Despite its structural failures, it has endured the geomorphological changing of Abruzzo territory and the developing of the society; since 1904 the Aqueduct has not only supplied the town of Lanciano, but has actually determined the birth of industrial realities in Chieti province. The exploitation of energy deriving from the water flow has enabled the construction of several hydro-electric plants that have met the energy requirements for public lighting and the establishment of many factories. Some of these factories are known all over the world for the production of pasta, as De Cecco® and Del Verde® establishments at Fara San Martino.

This development would not have been possible without the efforts and design abilities of Salvatore Fasciani, whom saw in the construction of the Aqueduct of Lanciano a huge growth potential for the Abruzzo society.



Figure 4: Fara San Martino view - Old town centre on the left and De Cecco and Del Verde establishments on the right

## 5 CONCLUDING: INSIDE THE LANDSCAPE

The characteristics of an aqueduct are tied to the morphology of territory for technical reasons different from others infrastructures. As the photo documentation shows, my personal experience by walking over path of the Aqueduct from Fara San Martino to Lanciano has been a great opportunity to reflect upon this construction: it is an outstanding example of sustainable engineering because, inserted in the time and in the environment, has not had a negative impact on the territory. Thus, it has been a *sustainable* work before that the word was used, and perhaps even abused.



Figure 5: Inside the Landscape of Lanciano Aqueduct - view from Lanciano to Fara San Martino

There is also an objective value in addition to subjective value. The historic landscape of the Aqueduct continues to act on present time; its capacity to act is due to what it has left: its structures, the urban development, the memory.

The knowledge of the historic landscape is a kind of knowledge that if it were diffused by an appropriate communication process, it would increase opportunities of development and the integration between people and the territory. This research is just the first step: a communication process for the preservation of an unknown landscape, which provides suitable means for cultural initiatives based on the concept of eco-museum. *“There is not development without the effective, active and aware participation of the community, which is the holder of its territory. [...] Cultural capital is the first heritage and it is present, at least implicitly, in any development program worthy of this name. A rural or urban space, an agricultural or industrial landscape, specific flora and fauna, traditions and knowledge, memories rich in meaning, ways of life, are part of community’s capital developing.”* (de Varine 2005, pp. 9-23)

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