Waterworks and Water Systems in Sant'Agata dei Goti. Towards an Integrated Informative System

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Abstract

The research presents an integrated description of an area in the Campania region between the slopes of the Taburno mountain range and the Terra di Lavoro hills with its numerous infrastructures and factories built from the seventeenth century onwards, small tiles in a cultural-landscape mosaic that still preserves the original engineering works for the supply and distribution of water resources.
Before initiating the study a methodology had to be established to integrate the quantitative data – the geometric and dimensional characteristics of the buildings – with the qualitative data regarding the perception of the landscape and urban image as well as their possible visual appeal.
The study focused on the network of manufacturing and pre-industrial activities along the river north of Sant'Agata dei Goti. The data gathered from historical, iconographic and archival documentation was combined with all the other information (position, orientation, characterisation of the water supply system) and with the data from the digital, photogrammetric and aerial photogrammetric survey.
The goal was to create a structured and georeferenced database, organised according to formal, functional, and building types, so as to develop a useful tool to understand and enhance architectural and landscape heritage as well as promote initiatives involving conservation and digital fruition.

Keywords: survey, information system, landscape, enhancement.

Introduction

Water has always been an added value for the landscape and economy of the old Campania Felix region. Small torrential streams between the slopes of Mount Taburno and the Tagliola gorges at the mouth of the valley towards the municipality of Sant'Agata dei Goti wind their way between labyrinthine meanders, embankments, woods and plantations, creating the 'weave' of the landscape; the streams input into the Isclero river which from the Caudina valley, located in a north-west direction, cuts through the Moiano gorge and then merges with the Volturno river.
More or less visible fragments of former infrastructures can be glimpsed nestling in the vegetation while travelling upriver; these infrastructures were used when close ties existed between this area and the Terra di Lavoro province.

As far back as the seventeenth century numerous activities chiefly involving the transformation of agricultural products or textile manufacturing were powered by the waters of the Isclero river thanks to a widespread network of channels and hydraulic engineering works such as the Carolino [Serraglio 2008] and the Carmignano Aqueducts [Fiengo 1990].
The many different forms, dimensions and locations of this extensive heritage of industrial architectures depend on the morphological, hydrological, historical and cultural peculiarities of the territory. The 16 weaving mills that have been identified, in some cases hidden in the dense vegetation, often abandoned and unknown to most, have evolved differently; this is due more to the adaptability of the water

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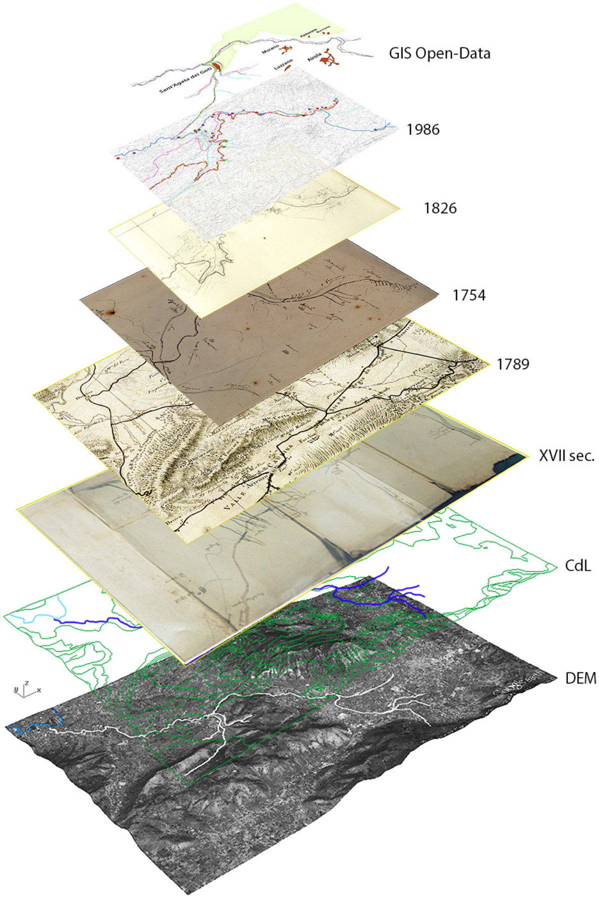
Fig. 1. Overview of the information system; from the bottom to the top: DEM; Level Curve model; Pianta dell'acqua di S. Agata de' Goti… [AAVV XVII sec.]; Carta Topografica delle Reali cacce di Terra di Lavoro… [Rizzi Zannoni 1789]; Disegno a penna che delinea il percorso… [Vanvitelli 1754]; l'Acquedotto Carolino [Pattuarelli 1826, p. 105]; IGM del 1984, Tav. 17; digital model of water infrastructure, (graphic elaboration by the author).



transportation infrastructures and milling systems used to increase yield than to their structure – always in local stone and with a similar topological and spatial distribution. Over the years this infrastructural network has shaped the territory, leaving numerous traces such as embankments, water channels, ravines, small inspection huts, weaving mills and bridges to "organise" or "correct" the irregularities. While inputting into the overall "design", these infrastructures have acted as elements linking and mediating between the city and its surroundings.

The initial informative models

The current urban landscape includes an extensive multifaceted repertoire of archaeological-industrial sites; the fist step was to insert their geometric and topological characteristics and all the pertinent qualitative-quantitative features in a georeferenced database (fig. 1); the comprehensive mapping of the state of the sites revealed a stratified ensemble of components implicit in the structure of the data in order to establish the 'functioning' of the area along the Isclero river.
The study and analysis of archival documents revealed that a string of small businesses were located along the banks of the Isclero; these businesses acted like a 'productive machine' facilitating the creation of fish ponds, washhouses, wells, fountains, animal sheds, product processing huts, and cabins for the inhabitants.
Superimposing and comparing the historical-cartographic documents in a GIS environment highlighted the extent of the operational and environmental transformations that have taken place over the centuries and affected the course of the riverbed, prompting a relocation of the watermills and weaving mills to where they currently stand.
The historical reconstruction of the work of the engineers active during that period shows how their design of the hydraulic works at the outer edges of the built - water supply and outlet channels, filters, sluices, wells – was well-suited to the context and that they solved all the jurisdictional aspects and any conflict of interest between the public and private domain. In fact, since the buildings used to produce iron and copper were economically more important [Bianchini 1834] they were present along the river banks north of Sant'Agata dei Goti during different periods in time (fig. 2).
The building known as the *Mulino-Ferriera Alviggi* (fig. 3) un-

Fig. 2. Overview of the Isclero river belt, north of the inhabited Sant'Agata dei Goti, with the network of water supply and service distribution to factories and mills (graphic elaboration by the author).

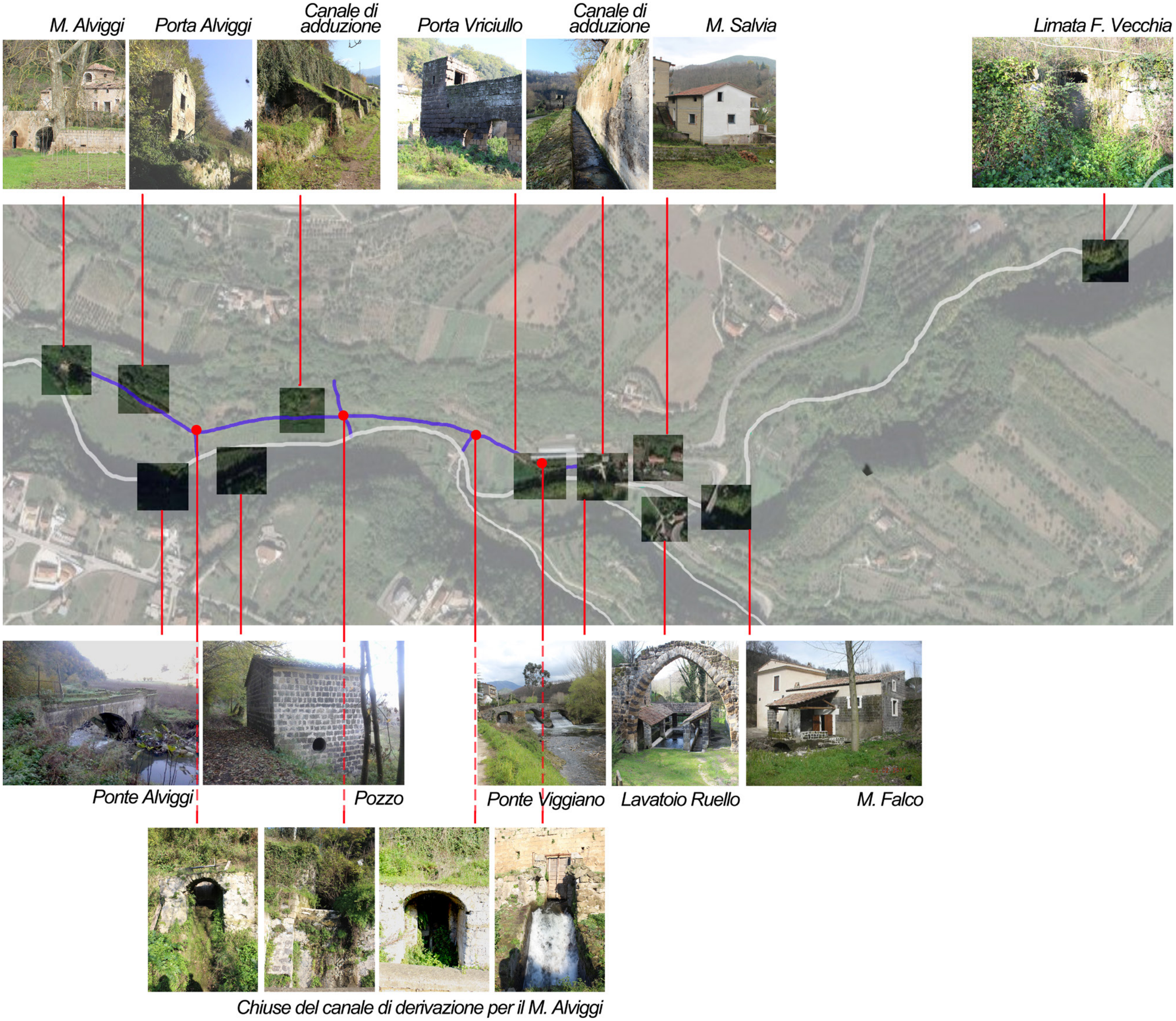


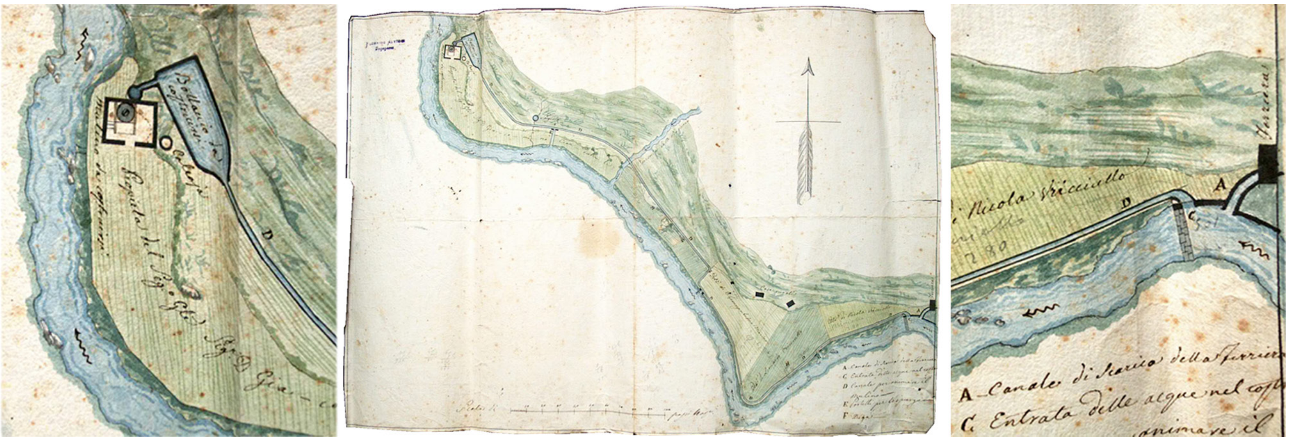
Fig. 3. The complex of the «Mulino-Ferriera Alviggi» in a top view from drone (photography by the author).

doubtedly represented not only an important productive facility in the region, it also contributed to the development of civil society [Rubino 1978, p. 1]. The mill was part of the extensive restructuring and modernisation project implemented by the Bourbons and in fact the site was known as the valley dei ferrari (of the iron workers), (Carolingian Cadastre, 1752). After the Bourbon project this former iron and steel centre in southern Italy became a Hydroelectric Plant supplying electric lighting in the early years of the twentieth century [De Martino, Suppa 2017, p. 429].

It is not easy to establish exactly when it was rebuilt or whether it involved renovating and upgrading a pre-existing building. Several documents show that the first ironworks was located to the east in an area known as the "ferrera" [AAVV 1350-1386, ff. 10-13]. The site is also cited in the reports commissioned by King Charles III of Bourbon to obtain a clear picture of the waters he intended to "divert" to the Carolingian Aqueduct [Fiengo 1990, p. 109]. The estimate drafted by engineer Lorenzo Ruggiano [AAVV 1687] talks of an area called "Limata della Ferrera Vecchia e la sua fabbrica» which in 1689 was unusable; all that remained was "some of its walls", but there is no indication of where it was located [AAVV 1689, p. 152v]. The only helpful maps that exist are: the *Topographical and hydrographical map of the area around Naples* (IGM FI, 1817-1819) and the *Map of Southern Italy* (IGM FI, 1863). Both maps place the "Ferrera Vecchia" building further up, beyond the Viggiano bridge, in a spot that corresponds neither to the graphic images drawn by engineer Alviggi [Alviggi 1853-54], nor to current local toponym. Instead if we step back in time, this site is compatible with statements by Duke Giacomo Cosso when he speaks of the damage to his "Ferriera, e Ramiera" [ironworks and copper works] after the construction of the Carmignano Aqueduct [Arena, Dentice Massarenghi 1796, p. 4]. In fact, the reply sent by Cesare Carmignano and Engineer Alessandro Ciminelli to his summons to appear in court [Mauri, Vargas Macciucca 1759, p. LXXIV] contains information about the state of a "Ferriera, e Ramiera" where "new Buildings were useless, since part of the old buildings were under water and useless […]; but to eliminate any disagreement he said,

they would be rebuilt elsewhere at his expense, in other words in the locality known as S. Francesco Vetere" [Mauri, Vargas Macciucca 1759, p. LXXV]. By using the adjective "old" he clearly indicates that it was a dilapidated "ancient building" in ruins, but at the same time, he differentiates it from another building, the «new» building used for the same purpose and present in the area of Sant'Agata. In fact, the «Book in which all rents are recorded, [...] beginning in this year, 1756 [...]" specifies that the rent contract applies to two territories respectively called Limata della Ferriera vecchia and Limata della Ferriera nuova [AAVV 1756].
In the first drawings of the Alviggi mill [Alviggi 1853-54] the area where the new structure was to be built appears to be free of any other constructions; the general plan (fig. 4) also provides accurate and irrefutable information about the site of the previous Ferriera. A beautiful watercolour shows a small building, outlined in black China ink, towards the mountains beyond the river, close to the Viggiano bridge.
The building, labelled «Ferriera», was active in the Sant'Agata territory as a «tanning house, ironworks and copper works» [AAVV 1689, p. 152v] up until the first half of the nineteenth century (it was later turned into the Salvio mill and is now used as a house).
The area north of Sant'Agata dei Goti was strategic in the steel industry; the infrastructures required careful planning of the water catchment, supply and flow of water to the hydraulic milling machines. This involved establishing the right size of the water catchment basins and regulating canals.
The first problem the engineer Federico Alviggi had to solve was how to overcome a bed fall and ensure a big enough volume of water so that work could continue even during droughts. His solution exploited the orography of the land. The water deviated from the Isclero river – "more specifically in the locality known as Viggiano bridge, the latter having three spans forming a dam at the point of diversion of the waters of the artificial canal" [Alviggi 1934, p. 6] – are channelled into a "regulating canal with tuff masonry walls, 978.65 metres long, partially raised and partially entrenched; not far away from the hillside it is equipped with a surface spillway, and afterwards with overflows and hydraulic screw gates, and with a final outlet channel" [Alviggi 1934, p. 5]. The canal ended in the main «bottazzo», i.e., a catchment basin with masonry walls. From here water flowed downwards into the mill.
The mill had two floors (figs. 5, 6): two millstones were located on the ground floor while the upper floor was reserved for the miller. After further enlargement, an ingenious bypass system was created to serve four basins incorporated into the load-bearing masonry structure [Alviggi 1934, p. 8]; they were connected to the main basin by a longitudinal canal at the foot of the tuff ridge. The canal was also used when the waters were too high and were

Fig. 4. Historical cartography of the Isclero river belt north of Sant'Agata dei Goti [Alviggi 1853-54].



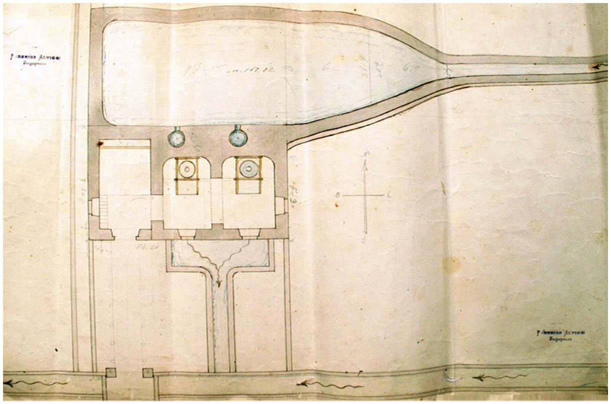


Fig. 5. Plant of the mill with the water system. Drawings of the «Mulino-Ferriera Alviggi» [Alviggi 1853-54].

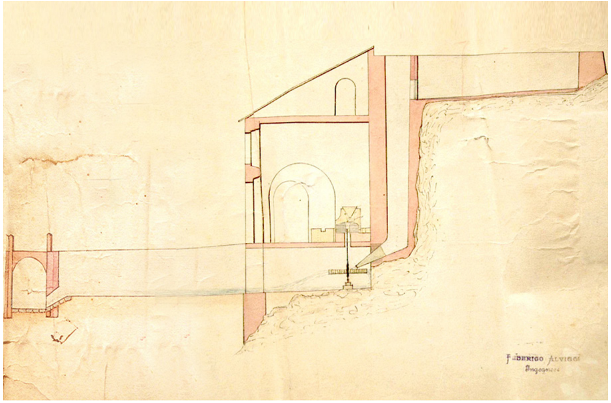


Fig. 6. Section of the mill with the water system. Drawings of the «Mulino-Ferriera Alviggi» [Alviggi 1853-54].

allowed to flow into the river [Alviggi 1934, p. 9].
Three millstones were located in several ground floor areas (still visible); the two big areas were used as a depot, plus a room for the miller, with a small area for the grain grinder next to it. A small flight of steps led to the first floor with a big terrace, four small rooms, and two rooms to store the grain [Alviggi 1934, p. 3]. The mill was active until the second half of the nineteenth century when it had to deal with another product of hydraulic energy: electricity, which led to the construction of a new mill, "next to the Alviggi Mill" [Alviggi 1934, p. 3]. The new mill did not function for long: abandoned and dilapidated it is impossible to instantly interpret its parts, except by reading the draft project report [AAVV 1901, p. 1]

Survey methodology

The methodological approach used integrated survey techniques and instruments to digitally acquire the geometric and chromatic data for the analysis and, more in general, the project to enhance the existing structures. Extremely accurate data is required in certain very specific fields such as industrial archaeology; this data can be obtained by using technologies that integrate traditional survey methods based on passive sensors (image-based) such as high resolution digital photogrammetry [Blais 2004; Guidi et al. 2009; Fiorini, Archetti 2011; Velho, Frery, Gomes 2009; Fiorillo et al. 2013; D'Agostino, Antuono, Pepe 2015]. In order to save time and money, these technologies can replace the ones which use active sensors (range-based), integrated with automatic image processing methods such Structure from Motion [Del Pizzo, Troisi 2011] and segmentation and classification of data [Weinmann, Weinmann 2017; Ozdemir, Remondino 2019]. Choosing the most suitable methodology and technology, and integrating different solutions and technologies, was the best approach for the site of the "Mulino-Ferriera Alviggi" since it would establish the qualitative level of the survey, given the complexity of the object and the communicative goals of the study. The survey programme became an exemplary and repeatable multiscalar study model that can be applied to other buildings with the same geometric-configurative complexity and communication potential.
The survey project was performed using passive terrestrial and aerial technologies to collect comprehensive data (fig. 7). Gathering documents and making a preliminary onsite visit was crucial in order to identify the critical areas that would influence the definition of the points and photographic shots, on the basis of the resolution of the images and scale of representation of the graphic restitutions.
The aerial photographic survey campaign was performed using a Mirrorless Canon Eos M camera mounted on a 4K Xiaomi Mi drone that could either create nadir images, required to acquire detailed images of the covered area, or images produced with a tilted camera in order to survey

and complete the spatial data and permit better, quicker and cheaper alignment with the terrestrial images [Fallavollita et al. 2013; Nex, Remondino 2014]. Mapping the site led to over 1,000 images, acquired at a height of roughly 30-40 metres. Given the conformation and narrowness of the river at that point, the wind and vegetation were an influencing factor. Due to the orographic conditions and difficult access to the site, we drafted a Mission Planner, a waypoint itinerary with tap to fly and circle trajectories that the drone followed based on Google Maps and an onboard GPS, combined with a 720p live video streaming which was useful to follow the drone's flight around the object. This technology made it possible to cover the whole study area once we had established the following: the flight trajectory, the start and end of the recording, the flight height, and the camera's speed and shot angle to ensure adequate superimposition of the shots within a sequence (fig. 8).

The photographic, georeferenced sequences involved several shot points and camera tilts [Barazzetti, Scaioni, Remondino 2010]. The photographs initially focused on the state of the site; they were executed along convergent axes, from south-east to north-west, in a F1 direction; this enabled identification of most of the dominant planes of the main façade of the complex architectural object. The second series, in a F2 direction (tiled by 30°) enabled identification of the upper dominant planes. Finally another series in a F3 direction (longitudinal axis) completed the photographic campaign of the whole object in question.
The dense vegetation along the south-west and north-e-

Fig. 7. Overview of the different photogrammetric and aerophotogrammetric modes of shooting and three-dimensional reconstruction of the «Mulino-Ferriera Alviggi» (graphic elaboration by the author).

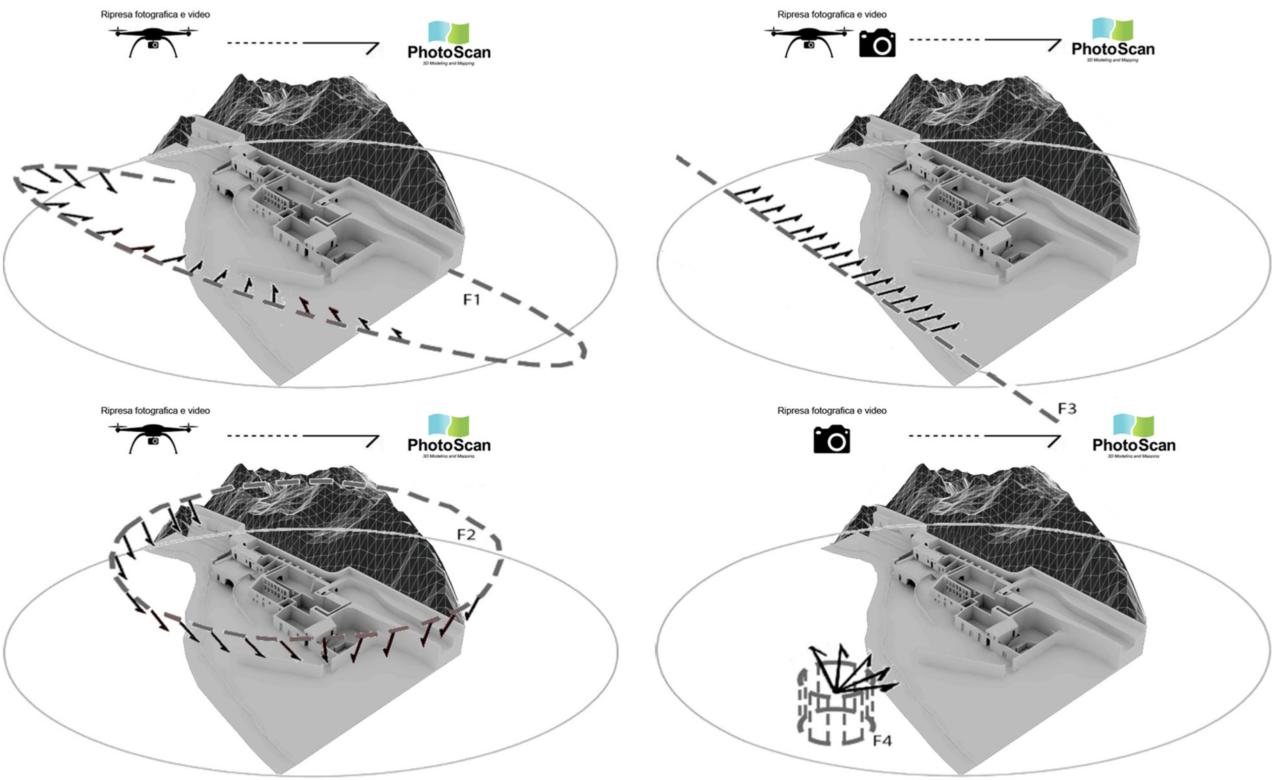


Fig. 8. Mission Planner Overview with longitudinal direction and zenith camera angle, «Mulino-Ferriera Alviggi» (graphic elaboration by the author).

ast side of the building was one of the critical elements influencing the direction of flight (e.g., the tall tree located in front of the main façade). This difficulty, and the complex spatial layout of several areas of the complex (e.g., the grinding area to the east next to the main loading «bottazzo»), led to gaps in the points cloud and noise; to solve this problem burdensome filtering and integration with a photographic survey (F4) was required, including in some areas inside the original nucleus of the mill (this part of the survey was performed using a digital Reflex Canon EOS 600D camera with a EFS 18-55 mm lens and a Reflex K&F Concept TM 2324 tripod). A network of 25 data capturing stations referenced using single points and typoints were related to the points clouds obtained through aerial photogrammetric images (fig. 9).
The SfM and multi-stereo matching algorithms have made it possible to rebuild the cloud of high-resolution, filtered and decimated points to reduce computational burdens, from which to derive a DSM/DTM and the georegerenziate orthophotos geotiff of the site integrated to the discrete geometric data in GIS environment through LAS dataset tools [Remondino, Ozdemir, Grilli 2019] to achieve morphological and relational analysis, operating for different elevation and visibility ranges, useful to reconstruct the spatial values of the architectural complex (fig. 10), with reference also to the widespread degradation phenomena.

GIS-UAV integration to analyse the territory

The creation of interoperable, multiscalar platforms testifies to why the digital model needs to be integrated, in other words because its spatial and metric data, on a DEM or DTM cartographical support, implements the analyses of the landscape and its hydraulic-productive systems.
Each architectural element in this three-dimensional informative system represents an entity to which hetero-geneous information has been added based on an archival system that constantly updates and increases the in-formation contained therein. The "Mulino-Ferriera Alviggi" is just one fragment of a much bigger productive area along the river; its codification helps to re-interpret changes in the architecture and landscape.
The coding, standardization and classification of data from the historical, iconographic and photographic documentation about the conservation status of the site, with the

results of the terrestrial and aerophotogrammetric survey –, allowed the comparative reading of the information to describe the transformations of the territorial context and its water and production component.
The thematic and temporal comparison, through the rubbersheet for "recurrent points" of the carto-photographic and historical database, allows to rediscover the system relations between the building and the context, restoring the picture of the "operation" of the Isclero river belt, with the recognition of its physical-environmental and geomorphological characteristics (fig. 11).
The quantitative-typological information model shows the landscape, its history, the evolutionary dynamics of the riverbed, and the canals leading to the mills; it also reveals how all that changed after the alterations made over the centuries not only affected the way the mills functioned, but also led to a change of location.
This results in a geo-referenced database which, through segmentation and classification into geometric-typological classes, contains formal and functional attributes, including a composition of summary cards and a cataloguing of images oriented according to the observation points, to be recalled through direct links, to describe the individual artifacts and their conservation status, useful tool to enhance the landscape heritage and promote actions of digital enhancement and enjoyment.
The integration of the topographical and cartographic data with the categorization of archival images creates keys of reading of multidimensional reality where each point of the territory has a different 'depth of information' given by the construction of thematic layers that incorporate not only data, numbers and signs, but also the perception of places through images for qualitative analysis.

Conclusions

The integration of digital-analogue heterogeneous data with geometric and topographic data into a synthetic information model of the investigated reality, acquired through digital photogrammetric survey techniques (terrestrial and aerial)requires a process of discretisation and segmen-

Fig. 9. View from the south-east of the photogrammetric model of the «Mulino-Ferriera Alviggi» (graphic elaboration by the author).

tation into stratum information units, classified into categories and subcategories, which facilitates the relationship of information through the functions of spatial analysis capable of responding to the problem of "representation" of complex production realities such as that of "Mulino-Ferriera Alviggi". The relational structure of the data, able to reveal a stratified set of components, opens to new forms of interactive and dynamic analysis useful to understand the transformations of the local productive reality, linked to geomorphological aspects and connected to the hydraulic supply network, with significant repercussions on the perceptive component of the places. The possibility

Fig. 10. Plan and elevation of the photogrammetric model of the «Mulino-Ferriera Alviggi», integration of data from terrestrial and aerial technology and return of water supply and distribution (in blue) of service to the premises of the complex (graphic elaboration by the author).

of obtaining geometric and spatial data of greater detail and precision, through the survey with UAV systems and implemented in GIS environment, facilitate understanding of the dynamics of phenomena acting on a given environment, facilitating the monitoring of the territory for control or planning purposes and the diagnosis of materials and the analysis of the state of degradation of such artifacts.

At the same time the adoption of such models and predictive methods favors those stresses for the recovery and enhancement of a past that can be, at the same time, evocative fragment, anatomical text, historical testimony, pretext for new experiments, as well as instrumental object to the knowledge and dating of himself and the related historical building of his reference territory.

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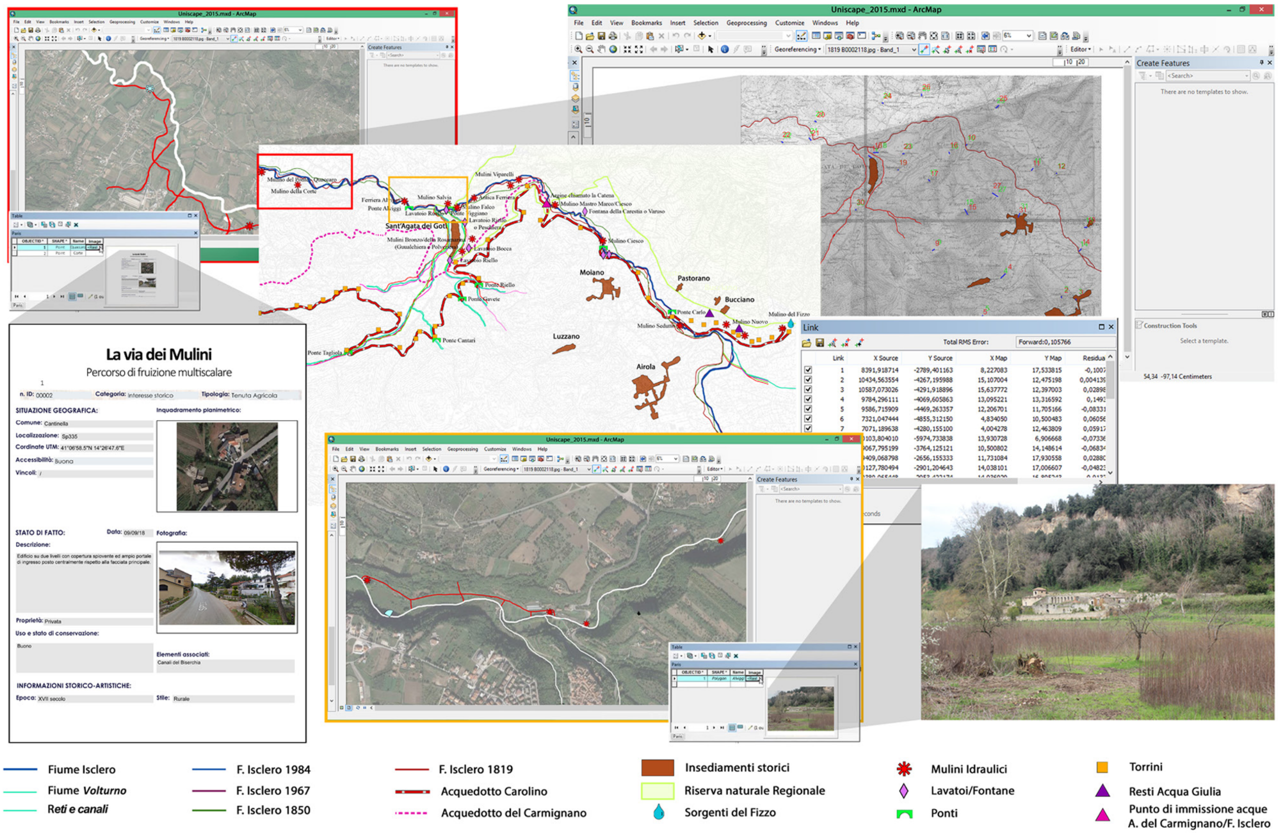
Fig. 11. Overview of the Information System: layering of paths, water and production systems along the river; cataloguing of architectures and artifacts; categorization of the perceptive component (graphic elaboration by the author).



Reference list

AAVV (1350-1386). *Diversa Mensae Episcopalis*. Fondo Jura, tomo V, parte III. ADSAG -Archivio Diocesano di Sant'Agata dei Goti.

AAVV (1687). *Processetti per le intestazioni dei Feudi*. Regia Camera della Sommaria, Materia Feudale, vol. 63, processo 930, cc. 17r – 60v. ASN - Archivio di Stato di Napoli.

AAVV (1689). *Copia estratta dalla relazione Apprezzo della Città di S. Agata*. Fondo Atti Demaniali, n. 201. ASB - Archivio di Stato di Benevento.

AAVV (1756). *Libro in cui si registrano tutti gli assensi delli Affitti dell'Eccellentissima Ducal Camera Padronale, principiato in quest'anno 1756. Agente il Razionale D. Menna Albanese et erario il Magnifico Crescenzo Cimino*. ASCSAG - Archivio Storico del Comune di Sant'Agata dei Goti.

AAVV (1901). *Preventivo per la spesa d'impianto Pubblica Illuminazione*. Cartella n. 10. ASCSAG - Archivio Storico del Comune di Sant'Agata dei Goti.

AAVV (XVII sec.). *Pianta dell'acqua di S. Agata de' Goti e sua descrizione de' Confini Durazzano, la Valle, Mataloni, fondo Carafa di Maddaloni e di Colubrano*. II H/2. ASN -Archivio di Stato di Napoli.

Alviggi, C. (1853-54 ca.). *Disegni del "Mulino-Ferriera Alviggi"*. Napoli: AfA - Archivio famiglia Alviggi.

Alviggi, C. (1934). *Relazione tecnica del molino agricolo a cereali, a forza motrice idraulica*. Napoli: AfA - Archivio famiglia Alviggi.

Arena O., Dentice Massarenghi, G. (1796). *Saggio delle azioni promosse dalla Fedelissima città di Napoli contra il Sig. D. Giuseppe Carmignano, e 'l Patrimonio di Carnevale, anno 1796, Acqua di Carmignano*, fascio n. 1833, Acqua di Carmignano, Napoli: ASCN - Archivio Storico del Comune di Napoli.

Barazzetti, L., Scaioni, M., Remondino, F. (2010). Orientation and 3D modeling from marker less terrestrial images: combining accuracy with automation. In *The Photogrammetric Record*, vol. 25, n. 132, pp. 356-381.

Bianchini, L. (1834). Sullo stato delle ferriere del Regno di Napoli. In *Il Progresso delle Scienze, delle Lettere e delle Arti*, quaderno XVII, pp. 108-125. Napoli: Porcelli.

Blais, F. (2004). Review of 20 years of range sensor development. In *Journal of Electronic Imaging*, vol. 13, n. 1, pp. 231-243.

D'Agostino P., Antuono, G., Pepe, F. (2015). Action cameras in digital photogrammetry. Experiences of comparison of dense point clouds. In *Proceedings of VII Convención de Agrimensura*. La Habana, Cuba, 23-26 de septiembre 2015, pp.1-12. La Habana: Editorial Obras.

De Martino, G., Suppa, M. (2017). Didattica, Ricerca, Tutela. Il caso del mulino-feriera Alviggi a Sant'Agata de' Goti. In *Scienza e Beni Culturali, Atti del XXXIII Convegno Internazionale Le nuove frontiere del restauro, trasferimenti, contaminazioni, ibridazioni.* Bressanone 27-30 giugno 2017. Treviso: Edizione Arcadia Ricerche Srl.

Del Pizzo, S., Troisi, S. (2011). Automatic orientation of image sequences in cultural heritage. In *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Science*, vol. 38, n. 5/W16, pp. 293-300.

Fallavollita, P. et al. (2013). UAS for archaeology. New perspectives on aerial documentation. In *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences. Proceedings of UAV 2013*. Rostock, 4-6 September 2013, vol. 40, n. 1/W2, pp. 131-135.

Fiengo, G. (1990). *L'acquedotto di Carmignano e lo sviluppo di Napoli in età barocca*. Firenze: Olschki.

Fiorillo, F. et al. (2013). 3D digitization and mapping of heritage monuments and comparison with historical drawings. In *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Proceedings of XXIV International CIPA Symposium*, Strasborurg, 2-6 September 2013 vol. II-5/W1, pp. 133-138.

Fiorini, A., Archetti, V. (2011). Fotomodellazione e stereofotogrammetria per la creazione di modelli stratigrafici in archeologia dell'architettura. In *Archeologia e Calcolatori*, n. 22, pp. 199-216.

Guidi, G. et al. (2009). A multi-resolution methodology for the 3D modeling of large and complex archeological areas. In *International Journal of Architectural Computing*, vol. 7, n. 1, pp. 39-55.

Mauri, C., Vargas Macciucca F. (1759). *Ragioni per la diversione ordinata dalla Maestà del Re di alcune acque d'Airola per la Regal Villa di Caserta, Napoli.* 5 agosto 1759, e pubblicato nel 1827, SBN, XV, C 17. Napoli: SNSP - Società Napoletana Storia Patria.

Nex, F., Remondino, F. (2014). UAV for 3D mapping applications: a review. In *Applied Geomatics*, n. 6, pp. 1-15.

Ozdemir, E., Remondino, F. (2019). Classification of aerial point clouds with deep learning. In *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences*. Proceedings of Geospatial Week 2019, Enschede, 10-14 June 2019, vol. XLII, n. 2/W13, pp. 103-110.

Pattuarelli, F. (1826). *Caserta e San Leucio*. Napoli: Stamperiae Colubrano.

Remondino, F. Ozdemir, E., Grilli, E. (2019). Nuvole di punti semantiche. In *Geomedia*, vol. XXIII, n. 2, pp. 12-13.

Rizzi Zannoni, G.A. (1789). *Carta Topografica delle Reali cacce di Terra di Lavoro e loro adiacenze, IGM FI sez. cartografia storica*. Inv. gen. n. 57, doc. n. 10.

Rubino, G.E. (1978). *Archeologia Industriale e Mezzogiorno.* Roma: Giuditta.

Serraglio R. (2008). L'acquedotto Carolino: il sistema produttivo dei mulini. In *Storia dell'Ingegneria, Atti del Secondo Convegno Nazionale.* Napoli: Cuzzolin Editore.

Vanvitelli, L. (1754). *Disegno a penna che delinea il percorso del condotto che porta l'acqua a Caserta Nuova.* BNN, sala mss., Autografi Vanvitelliani, XV A9 bis, busta 4, f. 13.

Velho, L., Frery, A.C. Gomes, J. (2009). *Image Processing for Computer Graphics and Vision.* Cham: Springer.

Weinmann, M., Weinmann, M. (2017). Geospatial Computer Vision based on multi-modal data - How valuable is shape information for the extraction of semantic information? In *Remote Sensing*, vol. 10, n. 1, pp. 1-20.