



Water harvesting system in Sassi di Matera

Traditional water harvesting system
in Sassi di Matera, Italy

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Figure 1: View of Sassi di Matera and Gravina di Matera

Traditional water harvesting system in Sassi di Matera, Italy

Context.

Location: Matera, Basilicata region, Italy.
Landscape Type: Ravine.
Area: 10.16km².
Function: Cave dwellings, water storage.
Water Quality: Rain water.

Sassi di Matera, located in Matera, Basilicata region, Italy. It is near a stream called Gravina di Matera, which belongs to the catchment area along with Gravina di Picciano and Stream Jesce and finally goes in to the Bradano river. It was named a UNESCO World Heritage Site in 1993 and was nominated as European Capital of Culture in 2019. This historical center is now surrounded by the expanded urban area and a natural archaeological park on the other side of the ravine called Parco della Murgia Materana.



Figure 2
Country Scale



Figure 3
Catchment Scale

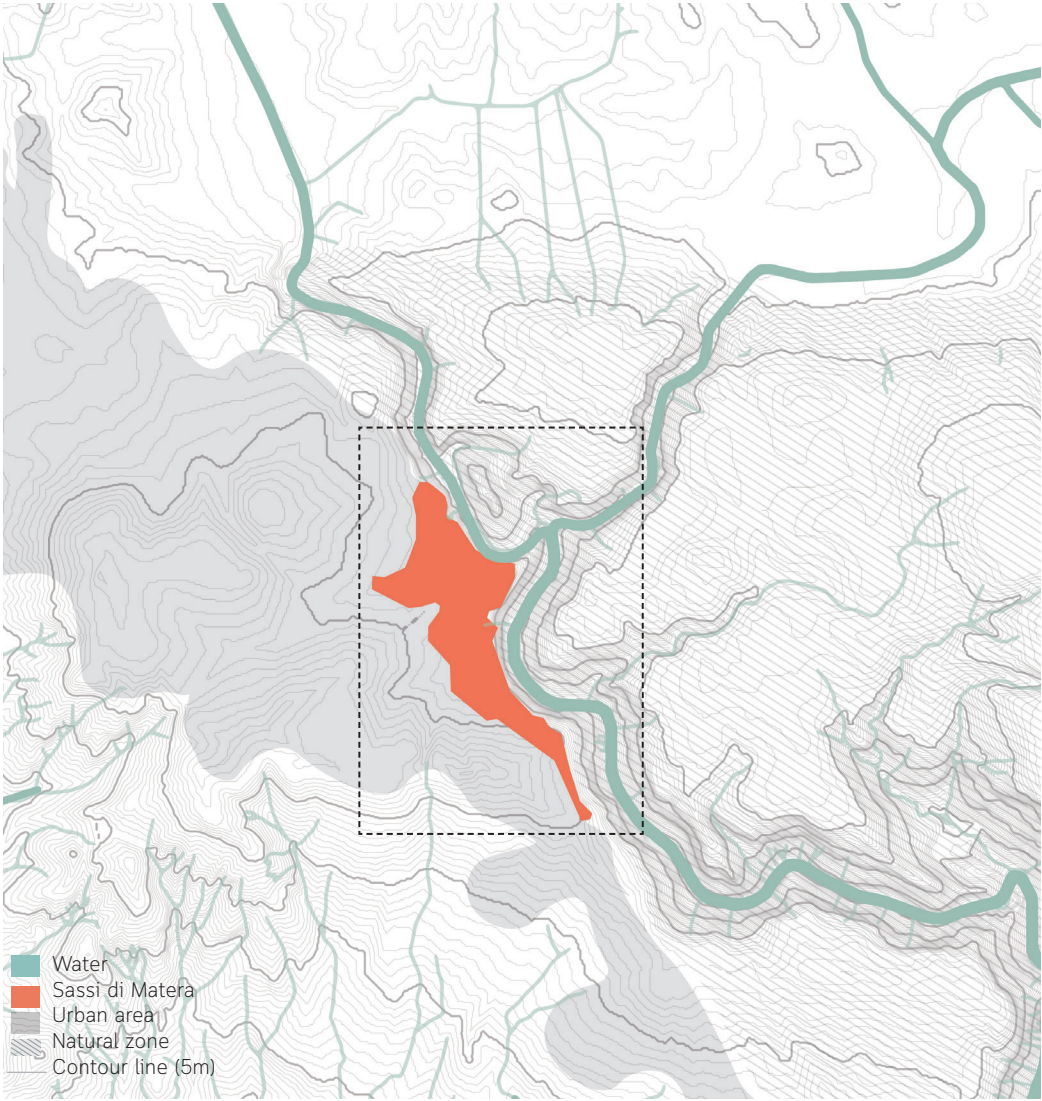


Figure 4
Regional Scale

Climate.

Climate zone: Subtropical
Sub-climate: Warm mediterranean climate

Climate & Weather Averages

High t°: 32°C
Low t°: 2°C
Mean t°: 16°C
Precipitation: 49.4 mm
Humidity: 61%
Dew point: 4°C
Wind: 8.8 km/h
Pressure: 1015 mbar
Annual Rainfall: 593 mm per year

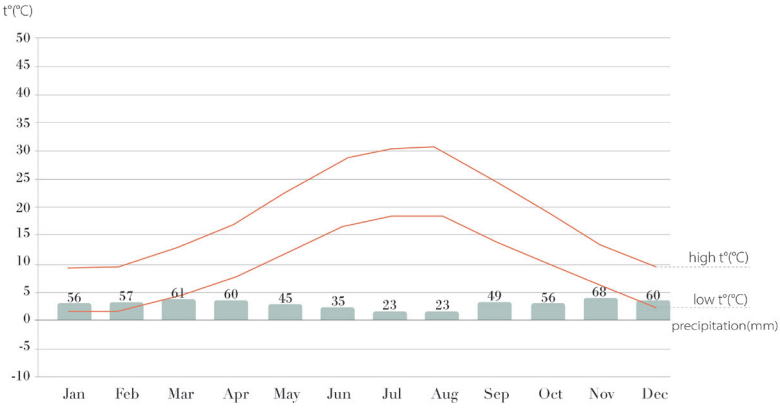


Figure 5
Temperature and amount of rainfall

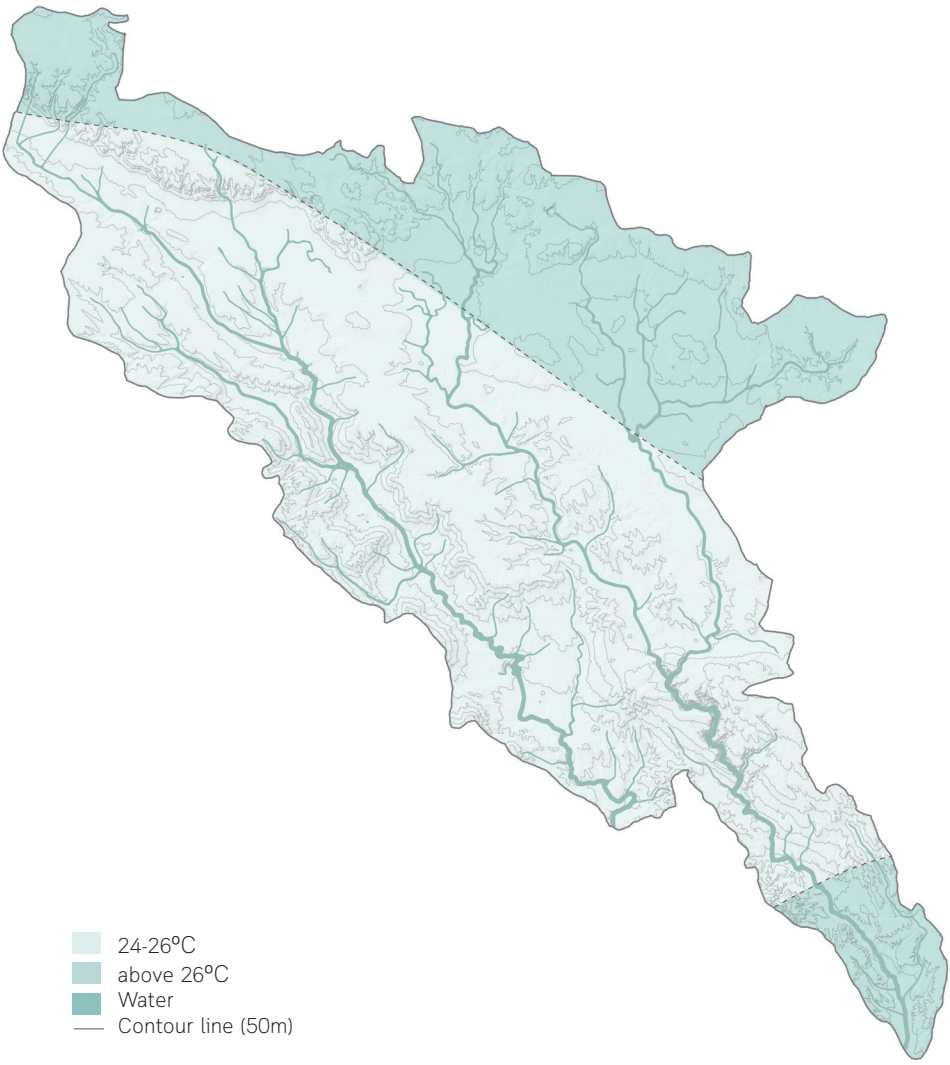


Figure 6
Mean temperature of July

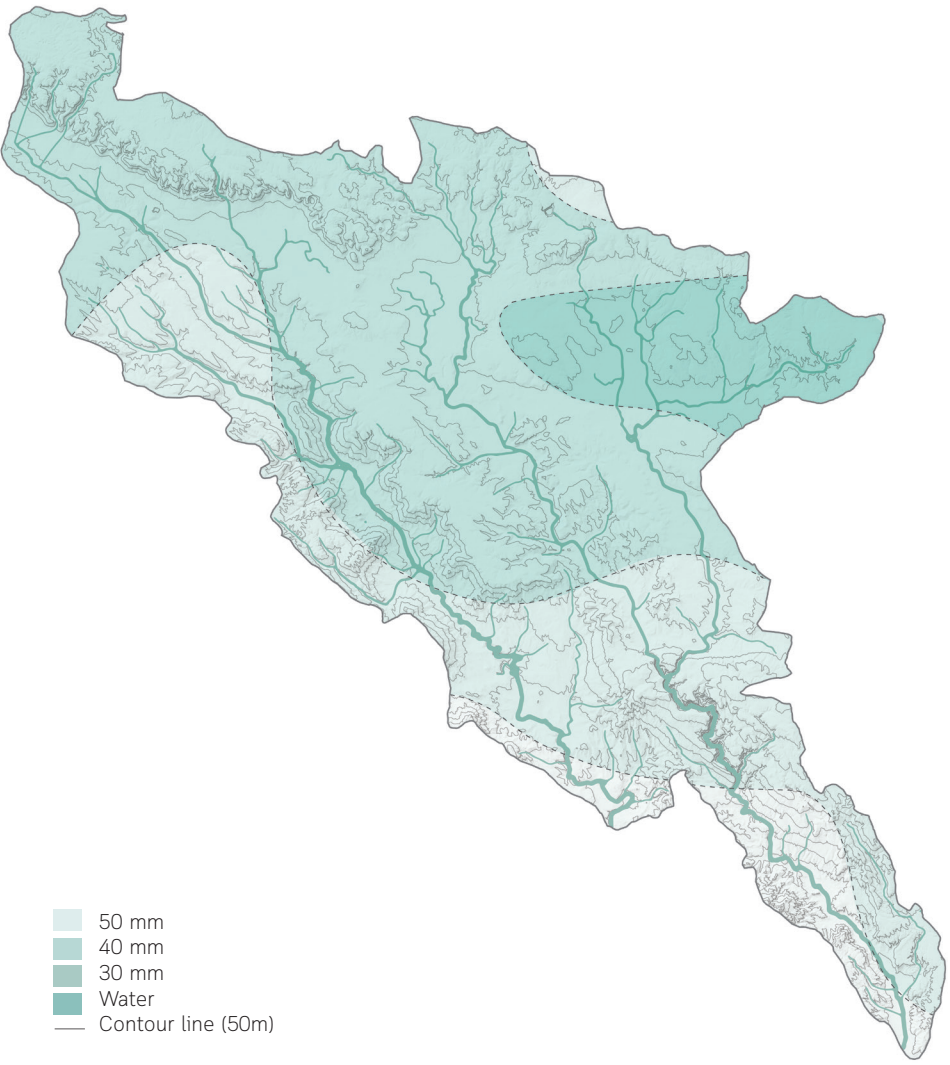


Figure 7
Annual precipitation

Historical photos.

The grabiglioni, an important water channel in Sassi di Mater, is also the center of public life.

The vicinato, a common courtyard where children would play together and everyone helped each other out, is always accompanied with a cistern serving 4-6 families, so it naturally becomes the place for different domestic chores and social interactions.

Figure 8: Conditions of Grabiglioni (Up left).
Figure 9: People gathered around the Grabiglioni (Up right).
Figure 10: The basic neighborhood unit “vicinato” (Bottom left).
Figure 11: Boy holding a water vase (Bottom center).
Figure 12: People gathered in “vicinato” for social intercourse and domestic chores (Bottom right).



Traditional water harvesting system in Sassi di Matera, Italy

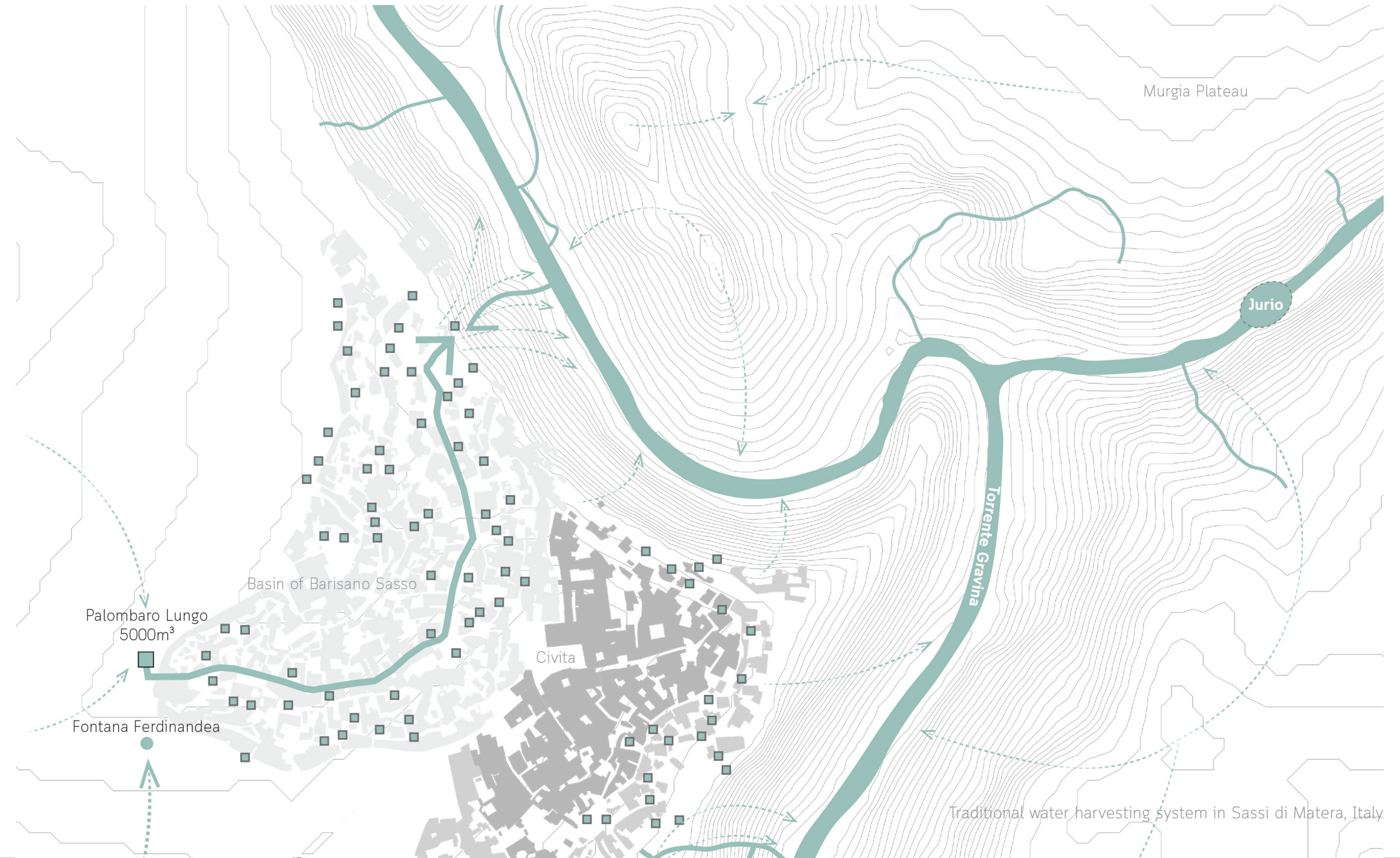
Water system.

The two districts of Matera, Sasso Caveoso and Sasso Barisano, were built in the eroded terraced land near the natural water courses, called Grabigioni, and formed by buildings and rock architectures carved into the rock of the Murgia Matera. Together with the Civita district (built on the spur that separates the two Sassi), they constitute the historic center of the city of Matera.

The water-harvesting system was composed of cisterns, catch basins, ponds, wells, fountains, condensers, neviera, as well as horizontal and vertical water channels.

About 2210 cisterns were identified using a statistical approach, including 2039 small bell-shaped cisterns, 170 neighborhood cisterns and two large cisterns of 1,300 and 5,000 m³ each. Water not only shaped the physical part of the city, but also influenced the way people live and work. The successful water-harvesting system created an agro-pastoral society where most people were engaged in agriculture and husbandry, and about 56% were still land-working peasants in 1754.

Figure 13: Traditional water system plan of Sassi di Matera in 1700s.



- Large cistern
- Fountain
- Surface water
- Grabigioni
- Natural watercourse
- Water flow
- Civita
- Caveoso Sasso
- Barisano Sasso
- Contour line (5m)



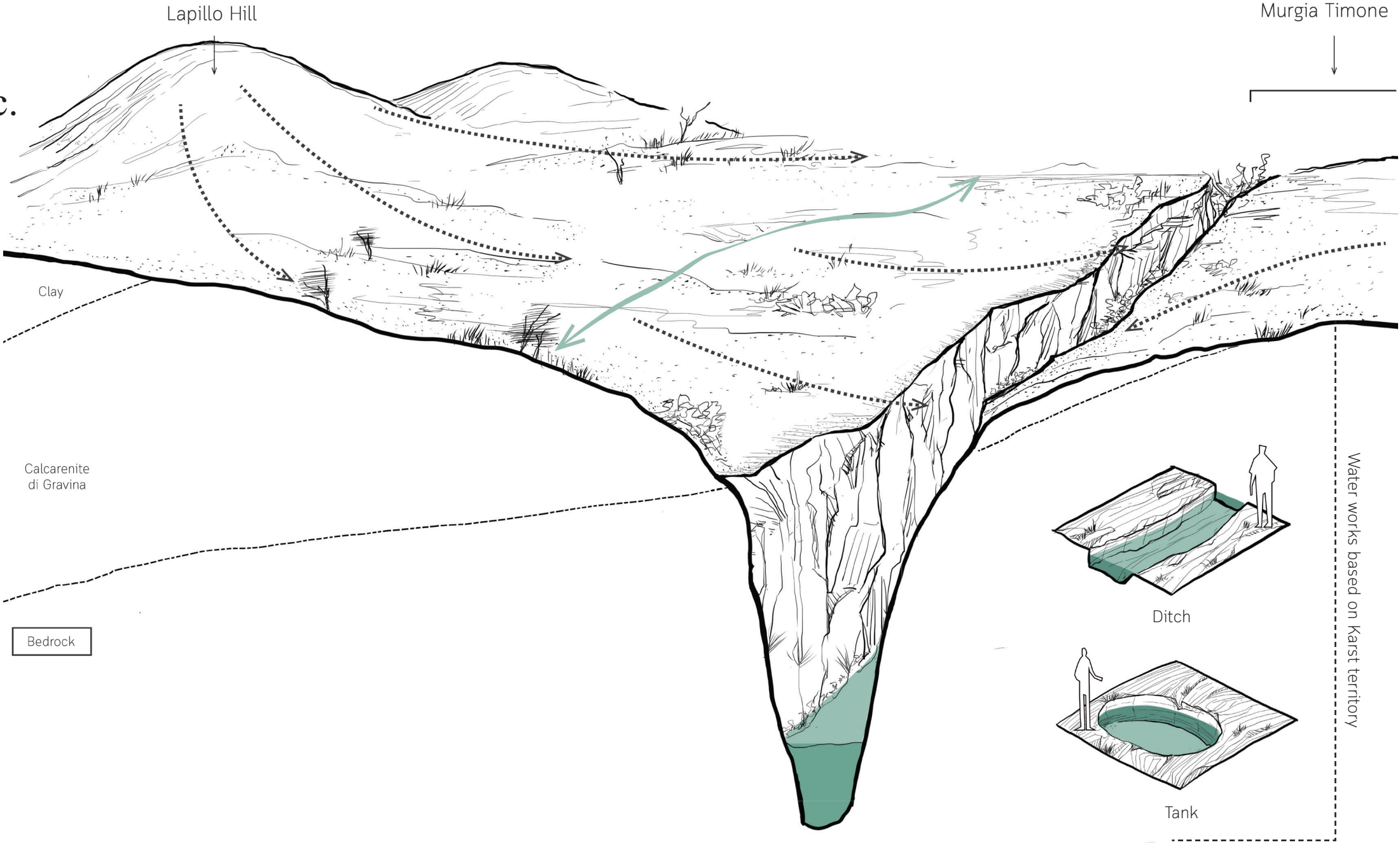
Traditional water harvesting system in Sassi di Matera, Italy

Water works since Palaeolithic.

Due to low precipitation throughout the year, water was a scarce resource in this area and people cleverly managed to live with water relying on the unique geological and topographical conditions. The first settlements date back to Paleolithic times on the opposite side of Sassi di Matera.

In the Neolithic village of Murgia Timone, there is a system of tanks which are dug into the limestone to collect rainwater and get drinking water. The utilitarian ditch with the function of draining the soil and collecting water and manure is also found. These water works make it available to passing-by herds and becomes the basis for the transformation from nomadic life style to agro-pastoral society later in Sassi.

Figure 14: Section of both sides of Gravina di Matera in Palaeolithic period.
Figure 15: Water works based on Karst territory on Murgia Timone (Bottom right).



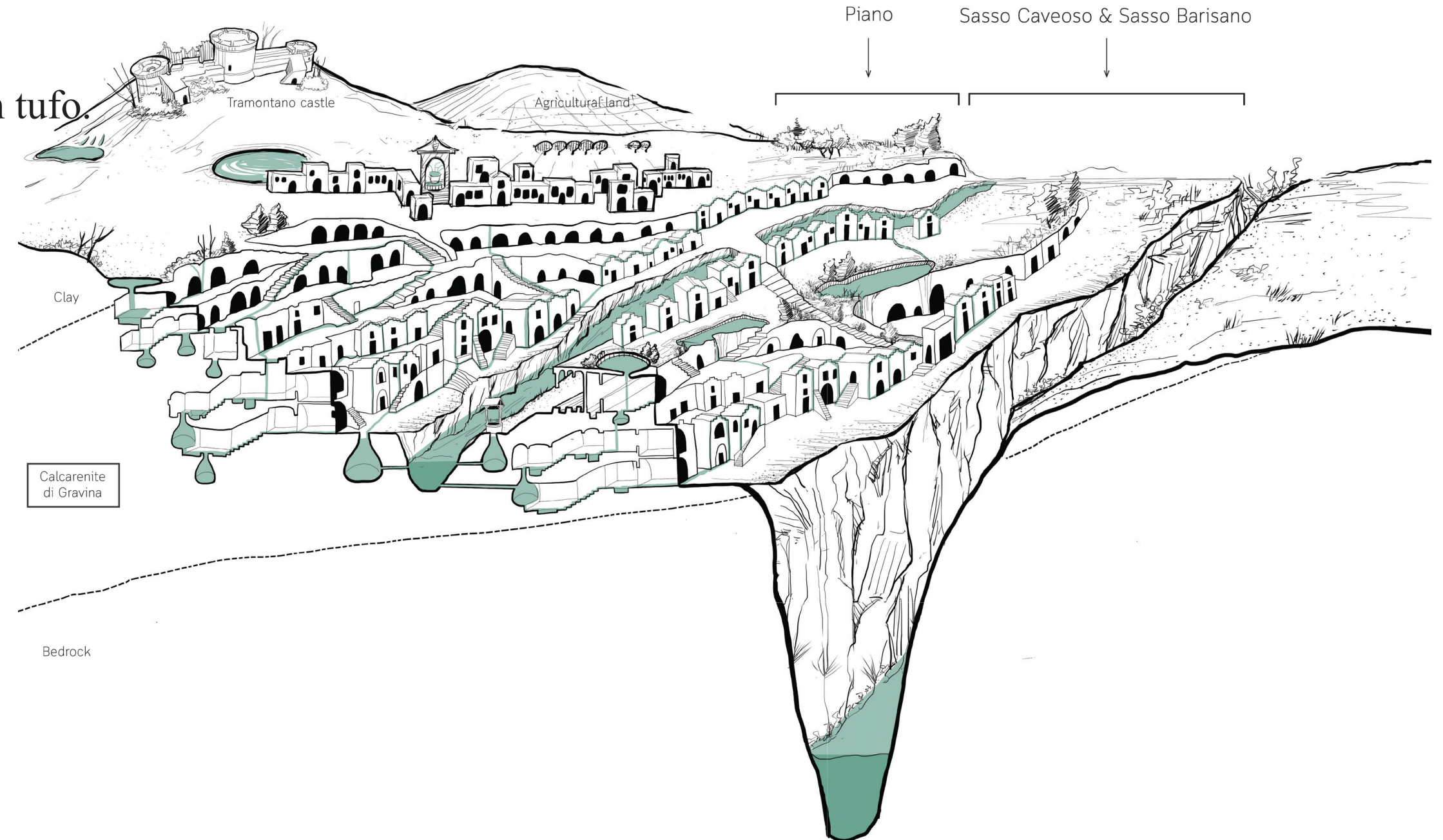
Water system originated from tufo.

Sassi di Matera is a city shaped by water and rocks. Instead of building directly near water, the Gravina, they had taken full use of the soft rocks (Calcarenite di Gravina, also called tufo) to create caves dwellings, houses, and cisterns to store rainwater for production and domestic use since the Bronze Age.

The section shows the city and the water-harvesting system based on tufo, and there is a close relationship between the water space and public space, e.g. the stairs connecting different heights are not only for people to go up and down, but also for water to flow.

Interestingly, wealthy people moved to the flat plain above the ravine, the piano; and so began a process of hierarchical ordering of space by class. This separation continued over the following centuries and resulted in the emergence of two antithetical worlds, the Sassi and the piano, which did not meet physically or interact socially. Dominating physically and economically, the elite became like spectators at the theater, watching from their windows and balconies as the peasants acted out their lives in the Sassi.

Figure 16: Section of both sides of Gravina di Matera in 1700s.



Circular water system.

There are three types of water source in Sassi, rain water, natural spring, and moisture. In a natural condition, they will directly go into the Gravina di Matera, but with the help of the circular water system, they are used in a sustainable way for production, domestic use and drinking purposes.

Firstly, the rain water, which is also the dominant source in Sassi, is collected in lakes, ponds or catch basins at first, then goes into cisterns of different sizes with the help of horizontal and vertical water channels on roof, stair, wall and ground. Some cisterns are interconnected by underground pipes, while others are quite private and isolated. There is also a water tank that is completely isolated, and it is used as the condenser to collect moisture, which is also a hidden water source in Sassi. In addition, a natural spring near Tramontano Castle is the only drinkable water source, which is later led to the Fountain Ferdinanda for people to use.

Figure 17: Circular diagram of the traditional water harvesting system in Sassi di Matera around 1700s.

Figure 18: Circular diagrams of water usage (Bottom left).



Traditional water harvesting system in Sassi di Matera, Italy

Rainwater is used as a public resource. Most cisterns rely on the rain water collected by the small channels with the buildings nearby. There are a lot of cisterns connecting to the two main drainage systems called grabigioni in Sassi. Water space is always accompanied with public life. Town cistern (5000m³) is not only where all citizens share the water, but also the center of public life because of the plaza on top of it. Neighbourhood cistern and well (50m³) are the place for daily gatherings, and the lake and ponds become the natural gardens for people to get close to nature.

Rainwater is also collected each house. The natural caves are enlarged digging deep in a sloping direction, in order to allow either the harvest of water flow and the natural lighting. Private cistern is always of smaller size about 10m³, and catch basins and water channels of different levels help water run smoothly and become more and more clean.

The City of the Sassi also has evidence of neviera, in which snow taken from roofs and streets was stored by piling it inside from above, interspersed with layers of straw as insulation, to produce ice. In these fridges, the ice was also stored until the following winter and was used for domestic use or sold in rolls.

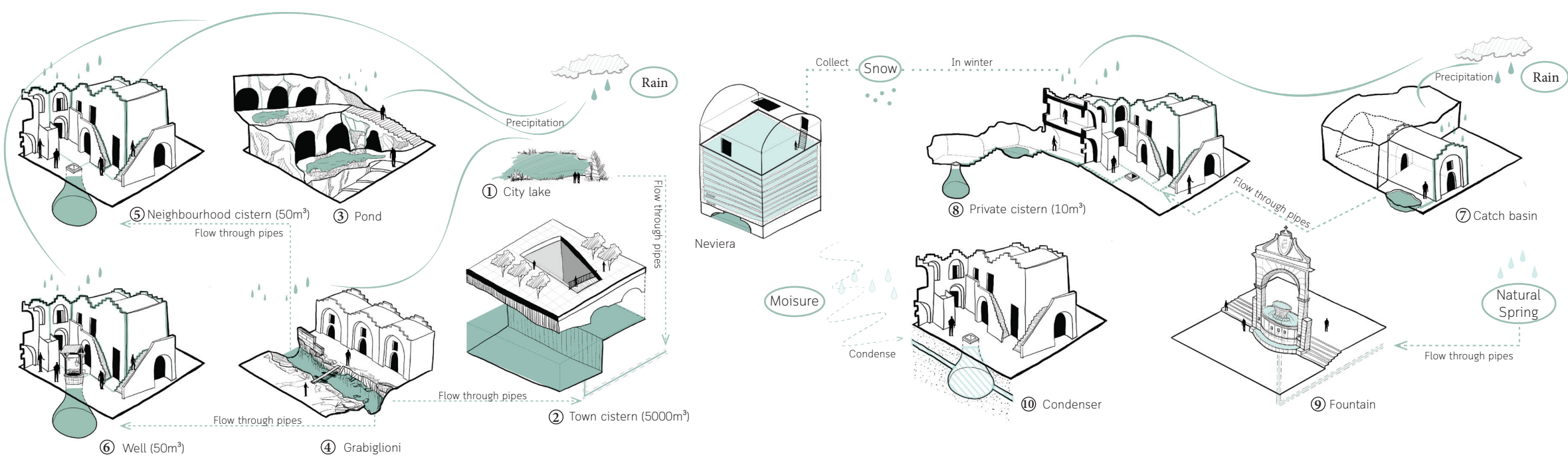


Figure 19: Public rain water cycle (Left).

Figure 20: Private rain water cycle (Top right).

Figure 21: Moist cycle (Bottom left)

Figure 22: Spring water cycle (Bottom right)

Conclusion.

The traditional water harvesting system in Sassi di Matera is a perfect example, showing the harmonious relationship between human and nature where humans can live with water in a sustainable way. It is water that shaped Sassi physically, socially, and culturally.

Landscape values - Sassi di Matera shows perfectly how the artificial water system and living space are integrated into its natural surrounding. The primitive water works which were dug in limestone and the water system of Sassi originated from the local tufo layer proved that craftworks by humans can be integrated perfectly into the natural world. The man-made settlement becomes the landscape closely related to nature.

Social values - Because water is of vital significance in the agro-pastoral society, the water harvesting space in Sassi is closely related to public space. It naturally becomes the place for different domestic chores and social interactions. The vicinato with underground cisterns for sharing water is the basic neighbourhood unit; fountains for providing fresh drinking water are the meeting points; grabiglioni and plaza above the town cistern marking the bigger gathering place. All these places related to water weave a special social network in Sassi di Matera.

Material and tangible values - The water harvesting system and the stone dwellings of Sassi depends on the local material, Calcarenite di Gravina (also called tufo), so they are also the tangible cultural heritage we can directly see, experience, and learn from.

Values of sustainability and circularity - Rainwater, spring water as well as moisture are used in a sustainable way for production, domestic use and drinking purposes. There is also a sustainable use of the buiding materials (local rocks), because houses built next to the caves and cisterns were

made from the same rocks.

Ethnographic and identity values - The close relationship between human and water is the invisible legacy under its visible stone architectures. The outer form and internal mechanics of Sassi di Matera should be valued equally.

Lessons to learn - The water system itself is now too obsolete to be used, and the water space holding many cultural and social values is forgotten. However, it is important to preserve it and to show that collecting rainwater, being sustainable in re-use and sharing it's not only a demand of the climate change times, but was done ages ago to be able to survive. The sustainable circular system, and the social network and green space based on water are the most precious wisdoms. The system itself is hidden, but the caring ideas of water is never hidden for old Sassi people for they lived close to water in their everyday's life. This is something to learn from - to preserve and to pass on to future generations - even to understand it and adapt it to current challenges.



Figure 23

Sassi and Gravina di Matera

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Note: Some of the drawing have based on information from website and news of following sources, then elaborated and interpreted by author.

Illustration Credits

Figure 1: View of Sassi di Matera and Gravina. Retrieved from https://upload.wikimedia.org/wikipedia/commons/f/fe/Matera%2C_la_gola_05.jpg and made by author

Figure 2: Country scale. Made by author, information from <https://maps.princeton.edu/catalog/stanford-mn871sp9778>

Figure 3: Catchment scale. Made by author, information from <https://www.openstreetmap.org/>

Figure 4: Regional scale. Made by author, information from <https://www.openstreetmap.org/>

Figure 5: Temperature and amount of rainfall, Made by author, information from <https://en.climate-data.org/europe/italy/basilicata/matera-1153/>

Figure 6: Mean temperature of July. Made by author, information from Bruna, S., Mercuri, A., Cervelli, C., Braglia, L., Benedetti, L.D., & Schiva, T. (2005). Genetic Characterization of *Myrtus communis* L. Wild Genotypes Using AFLP Markers.

Figure 7: Annual precipitation. Made by author, information from Crespi A., Brunetti M., Lentini G., Maugeri M., 2018, 1961-1990 high-resolution monthly precipitation climatologies for Italy, *International Journal of Climatology*, 38, 878-895, DOI: 10.1002/joc.5217.

Figure 8: Conditions of Grabiglioni in 1905. Photo from <https://www.sassitour.it/grabiglioni-tracce-invisibili-della-matera-piu-antica/> and made by author

Figure 9: People gathered around the Grabiglioni. Photo

from <https://www.wikimatera.it/cosa-vedere-a-matera/il-palombaro-lungo-ed-il-sistema-di-conservazione-delle-acque/i-grabiglioni-nei-sassi/> and made by author

Figure 10: The basic neighborhood unit “vicinato”. Photo from <https://hannahsegerkrantz.com/vicinato-research>

Figure 11: Boy holding a water vase. Photo from <https://www.finarte.it/asta/fotografia-milano-2019-04-18/mario-carbone-matera-i-sassi-7101>

Figure 12: People gathered in “vicinato” for social intercourse and domestic chores. Photo from <http://www.muvmatera.it/aspFoto/scheda-detail.asp?id=423> and made by author

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Figure 21: Moist cycle. Made by author

Figure 22: Spring water cycle. Made by author

Figure 23: Sassi and Gravina di Matera. Photo from <https://stylecaster.com/sextantio-le-grotte-della-civita/>

Water stories.



Vicinato (with underground neighbourhood cistern)

social intercourse & domestic chores

The vicinato, a common courtyard where children would play together and everyone helped each other out, is always accompanied with a cistern serving 4-6 families, so it naturally becomes the place for different domestic chores and social interactions.

Climate: Warm mediterranean climate
Year: 1700s-1950s
Water type: Rainwater
Meaning: Domestic and agricultural use



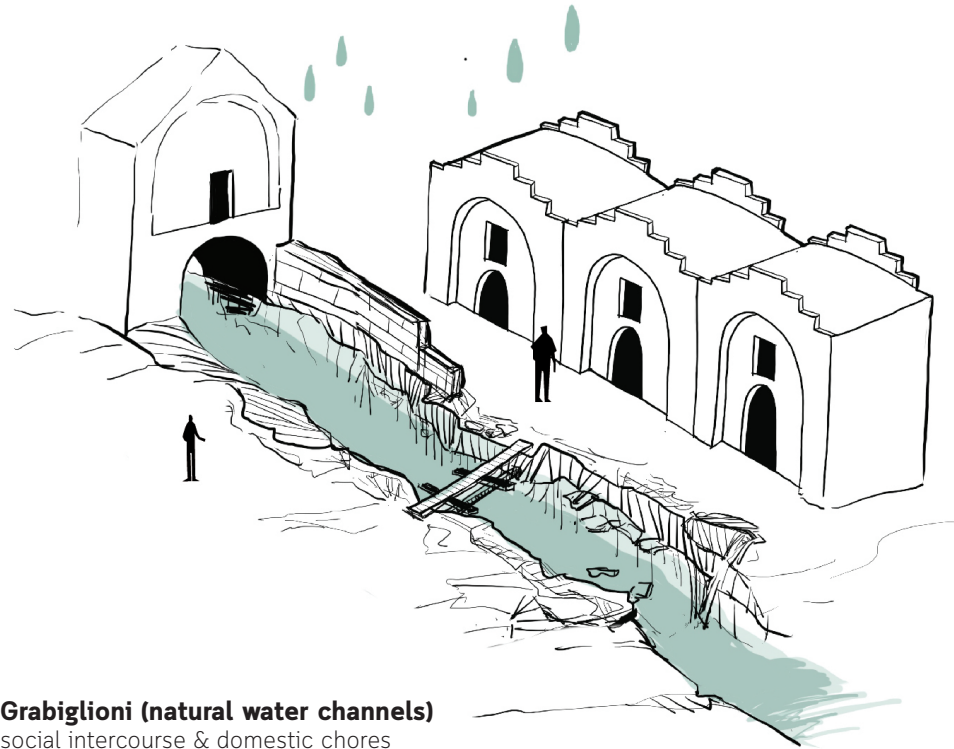
Fountain

drinking water & meet of young people

Woman had to collect drinking water for the family from fountains at that time, and sometimes young people would meet at the spot. The drawing above shows a young lad giving a flower to a girl with a vase, which implies the social characteristic of the fountain.

Climate: Warm mediterranean climate
Year: 1700s-1950s
Water type: Spring water
Meaning: Drinking

Landscape element.



Grabiglioni (natural water channels)

social intercourse & domestic chores

Grabiglioni, the main drainage system in Sassi di Matera, not only serves as the center of public life because of its surrounding urban divisions called Sasso Caveoso and Sasso Barisano, but also provides cultivable land and humus through the collection of sewage.

Climate: Warm mediterranean climate

Year: 1700s-1950s

Water type: Rainwater

Meaning: Domestic and agricultural use