MODULE 2

2.3. HYDRAULIC INFRAESTRUCTURE

By ***Luis García Pulido***

School of Arabic Studies (CSIC)

The unique geographical location of the city of Granada, where the last ridges of the Sierra Nevada meet the plain of La Vega, has enabled water to play an important role despite only moderate rainfall. This territory is characterised by the existence of an extensive network of waterways, thanks to the interaction of the continental Mediterranean climate with a high mountain range which retains and favours rain. As a result, there is a plethora of seasonal streams feeding the watersheds of the rivers Darro, Genil, Beiro, Monachil, etc., making this water available to the city.

There are also aquifers in the nearby mountains which generate springs and artesian wells of various sizes. Granada and the Alhambra, which act as a hinge line in the abrupt terrain of the mountains to the east and the vast plain spreading westward, could develop thanks to these local water resources.

Given the lack of records and archaeological evidence of water supplies in the 8th to 10th centuries, it is probable that the water supply system of earlier periods had deteriorated or been abandoned. At that time water was carried in from the river Darro, with city walls protecting access to the riverbank.

When the Caliphate of Cordoba fell apart and the Zirid dynasty conquered the kūra of Ilbīra, the strategic advantages of the hilltop location of Hisn Garnāta made it a good choice for the capital of their kingdom. After the Albayzín hill was reoccupied in the early 11th century, work began to ensure a good water supply to the city and its gardens and farms, creating the medieval system of irrigation canals or acequias which would be completed in later periods. Given that the historical mentions of the hydraulic systems coming into use coincide with the rule of the last two Zirid emirs, Bādīs Muzaffar (1038-1073) and ʻAbd Allāh (1073-1090), it may be at that time when the infrastructure was begun which would enable the settlement and urban development of the Alcazaba of Granada and the madīna which was

pringing up at its feet, which probably owed its speedy growth to the possibilities created by this infrastructure.

The alfaqui Abū Ya'far Ibn al-Qulay'ī (m. 1104-1105), vizier of 'Abd Allāh, was a driver of the Acequia Gorda, according to Ibn al-Jaṭīb in his Iḥāta. Meanwhile, the same work indicates that Mu'ammal (m. 1099), an important public figure during the rule of the last two Zirid emirs, built a public fountain in the Puerta de los Alfareros gate, which must mean that the urban branch of the Acequia Gorda, known later as Acequia de la Ciudad, had already been built at least to that point. Mu'ammal is also credited with the construction of the Acequia de Aynadamar (Fuente de las Lágrimas), which brought water to the Albayzín hill from the Fuente Grande of Alfacar, and the Acequia del Cadí, which ran above the Acequia Gorda and could reach higher levels in the Nayd area, initially occupied by market gardens.

Both the alfaquis of Zirid Granada continued to hold important posts after the city was conquered by the Almoravids in 1090. During this period and the Almohad period, from the end of the 11th century to the first third of the 13th century, the city continued to grow, although its growth was not as spectacular as in the 11th century. Two centres were gradually populated beginning with garden areas irrigated by these acequias: Axares, and al-Fajjarīn or Alfareros.

The city began to expand to where the Vega plain met the Albayzín hill, around the historic road which must have connected Madīnat Ilbīra to Garnāta Alyahud (Granada of the Jews), which after becoming part of the urban fabric, would be its main north-south thoroughfare, Calle Elvira street. The other major expansion was on the side where the Alcazaba de Granada connected with the river Darro, near what must have been the other great historic road included in the city, becoming its main east-west thoroughfare, the main streets of which would be Calle San Juan de los Reyes and Calle Zacatín streets. Parallel to this axis, the Acequia de Axares must have also been set up by the Zirids, as its urban route began in the neighbourhood of the same name, and its final destination must have been the great mosque and Plaza de Bibarrambla square.

The Acequia de Aynadamar made it possible to live on the Albayzín hill, where it supplied the area of the Zirid fortress as well as the entire population thanks to a network of numerous public aljibes or cisterns, often linked to the mosques, while the Acequia de Axares enabled the development of Madīna Garnāta,

as a branch of the canal followed Calle Elvira street to the gate of the same name. Meanwhile, the neighbourhoods nearest the left bank of the Darro got water from the Acequia de Romayla, which branched off from the Axares canal and crossed to the other side of the river.

The Nasrid dynasty, from the 13th to 15th centuries, produced the last expansions of the city, not onto the Vega plain, as might have been expected, but into higher areas which offered more protection from the advancing Christian forces. At the same time, other emptier spaces were filling up, such as the district of al-Fajjarīn, where the oligarchy of Granada built large country houses, and the contiguous Nayd neighbourhood began to be occupied.

The first king of this dynasty, Muḥammad ʻAbd Allāh ibn al-Aḥmar (1232-1273), decided to transfer the seat of power from the Alcazaba Vieja to the Colina Roja, where there was already a military enclosure, laying the foundations of what would become a true palatine city with all the elements characterising a medieval Islamic town, but on a smaller scale. First, he ensured there was a water supply, ordering the construction of the Acequia Real in 1238, which took water from the river Darro. This plan would enable and structure the development of the new city.

At the peak of prosperity of the Nasrid dynasty, Muḥammad V (1354-59 /1362-91) decided to establish a circle of farms and country houses next to the Alhambra but at higher altitudes than the existing orchards of the Generalife, so the volume of the Acequia Real had to be doubled and another canal provided to raise the water by a series of hydraulic devices to the Cerro del Sol.

The water was distributed in Andalusi Granada using acequias (canals and irrigation ditches) which were mostly uncovered outside the city, and ran through various types of pipe inside it, including atanores (interlocking clay tubes). Water was stored in albercones and albercas (reservoirs), public and private aljibes (cisterns), and tinajas (large clay vessels). As well as the excellent network of acequias, the most notable of these systems was the thirty or so public aljibes provided on the Albayzín hill, unequalled in any city of al-Andalus. The water supplied by these Andalusi acequias was used for three purposes, often simultaneously:

- Irrigating farms and gardens, permitting the introduction, adaptation and intensive production of fruit and vegetable species which led to the "green revolution" of al-Andalus and the creation of much of the landscape we have inherited, despite later transformations and changes.
- Driving pre-industrial hydraulic devices, enabling the transformation of products and raw materials, without reducing the flow of water through the acequias.
- Providing water, not only for the country and town homes of the rich, but also for the general population which lived in the cities and worked the fields.

These three basic life-sustaining functions of the acequias can still be admired in the configuration of many landscapes in and around Granada, in the hydraulic infrastructure which remains (springs, canals, aqueducts, reservoirs, cisterns, drinking troughs, wells, underground galleries, etc.) and in the architecture of water (public baths, ablution fountains, watermills, flood barriers, floodgates, etc.), while residential buildings also had strong links to water in various domestic spaces.

The Catholic Monarchs, amazed by the sophistication of the hydraulic systems of Granada, maintained them as much as possible, issuing ordinances and measures based on Muslim customs of water distribution.

Most of this complex and well-articulated hydraulic system lasted until fairly recently, and a great deal of infrastructure, some still in use, can still be seen today to attest to its splendid past.