

SEVILLA



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LT 3

PATRIMONIO Y
REHABILITACIÓN

HERITAGE AND REHABILITATION / PATRIMONIO Y REHABILITACIÓN

- p. 565-574: **NEW KNOWLEDGE ABOUT THE CHURCH OF SANTA MARÍA IN CARMONA** / p. 575-585: **NOVEDADES EN TORNO A LA IGLESIA DE SANTA MARÍA DE CARMONA**
Ojeda Barrera, Alfonso
- p. 587-596: **GEOMETRY AND CONSTRUCTION THROUGH THE SACRED SPACE OF ANDRÉS DE VANDELVIRA** / p. 597-607: **GEOMETRÍA Y CONSTRUCCIÓN A TRAVÉS DEL ESPACIO SACRO DE ANDRÉS DE VANDELVIRA**
Estepa Rubio, Antonio
- p. 609-619: **AN APPROACH TO THE IDEAL CONCEPT OF URBAN PLANNING IN THE 18TH CENTURY: COLONIAL SETTLEMENTS IN ANDALUSIA** / p. 620-630: **APROXIMACIÓN AL URBANISMO IDEAL EN EL S. XVIII: LAS NUEVAS POBLACIONES DE COLONIZACIÓN EN ANDALUCÍA**
Quevedo Rojas, Carlos
- p. 631-642: **POWER PLANT REUTILIZATION STRATEGIES ENEL POWER PLANTS AND PORT OF GENOA CASE-STUDY** / p. 643-655: **ESTRATEGIAS DE REÚSO DE LAS CENTRALES ELÉCTRICAS. LAS CENTRALES ENEL Y EL CASO ESTUDIO DEL PUERTO DE GÉNOVA**
Olivieri, Davide
- p. 657-664: **TECHNICAL-TECHNOLOGICAL AND MATERIALS COMPARATIVE ANALYSIS BETWEEN ITALIAN AND SPANISH MEDIEVAL SHIPYARD (THE CASE OF VENICE AND SEVILLE)** / p. 665-673: **ANÁLISIS COMPARATIVO TÉCNICO-TECNOLÓGICO Y DE MATERIALES ENTRE LOS ASTILLEROS MEDIEVALES ITALIANOS Y ESPAÑOLES (LOS CASOS DE VENECIA Y SEVILLA)**
Debenedictis, Domenico; Robador González, María Dolores; Pagliuca, Antonello
- p. 675-684: **STRATEGIES FOR CONSERVATION OF RELIGIOUS HERITAGE IN THE METROPOLITAN AREA OF LYON/SAINT-ÉTIENNE (FRANCE). SHORT RESEARCH STAY AND METHODOLOGICAL TRANSFER** / p. 685-695: **ESTRATEGIAS PARA LA CONSERVACIÓN DEL PATRIMONIO ECLESIAÍSTICO EN LA METRÓPOLIS LYON/SAINT-ÉTIENNE (FRANCIA). LA ESTANCIA BREVE INVESTIGADORA COMO VÍA DE TRANSFERENCIA METODOLÓGICA**
Mascort-Albea, Emilio J.; Meynier-Philip, Mélanie
- p. 697-709: **HYDRAULIC HERITAGE AND THE CONSTRUCTION OF THE TERRITORY: THE IRRIGATION COMMUNITIES** / p. 710-722: **EL PATRIMONIO HIDRÁULICO EN LA CONSTRUCCIÓN DEL TERRITORIO: LAS HEREDADES**
Delgado Quintana, Guacimara
- p. 723-731: **SUSTAINABILITY AND CONSERVATIVE REHABILITATION OF EXTREMADURAN PATRIMONIAL RURAL ARCHITECTURE AGAINST CLIMATE CHANGE. VEGAVIANA, CASE STUDY** / p. 732-741: **SOSTENIBILIDAD Y REHABILITACIÓN CONSERVADORA DE LA ARQUITECTURA RURAL PATRIMONIAL EXTREMEÑA CONTRA EL CAMBIO CLIMÁTICO. VEGAVIANA, CASO DE ESTUDIO**
Bote Alonso, Inmaculada
- p. 743-754: **TOWARDS A METHODOLOGY FOR THE ASSESSMENT OF VISUAL IMPACT CAUSED BY RENEWABLE ENERGY FACILITIES ON THE LANDSCAPE IN CULTURAL HERITAGE SITES** / p. 755-766: **HACIA UNA METODOLOGÍA DE VALORACIÓN DEL IMPACTO VISUAL CAUSADO POR INSTALACIONES DE ENERGÍA RENOVABLE EN EL PAISAJE EN EL ENTORNO DE LUGARES PATRIMONIO CULTURAL**
Diego Rodríguez, Jesús Carlos; Chías Navarro, Pilar
- p. 767-772: **THE URBAN RENOVATION IN PUEBLA, MEXICO. THE HISTORICAL CENTER AS EXPERIMENTAL SPACE. THIRTY YEARS OF CITY TRANSFORMATION** / p. 773-779: **LA RENOVACIÓN URBANA EN PUEBLA, MÉXICO. EL CENTRO HISTÓRICO COMO ESPACIO EXPERIMENTAL. TREINTA AÑOS DE TRANSFORMACIÓN DE LA CIUDAD**
Cortés Moreno, Jorge David
- p. 781-790: **THE ORNATE IN THE ARCHITECTURE OF TENERIFE AND GRAN CANARIA: 1865-1935** / p. 791-800: **EL ORNATO EN LA ARQUITECTURA DE TENERIFE Y GRAN CANARIA: 1865-1935**
Sabina González, José Antonio
- p. 801-807: **THE CONSERVATION OF THE CONSTRUCTIONS LOCATED ON PROTECTED NATURAL AREAS: RESEARCH EXPERIENCE IN DOÑANA** / p. 808-815: **LA CONSERVACIÓN DE LO CONSTRUIDO EN LOS ESPACIOS NATURALES PROTEGIDOS: EXPERIENCIA DE INVESTIGACIÓN EN DOÑANA**
Rincón Calderón, José María; Galán Marín, Carmen; Sanchez Fuentes, Domingo
- p. 817-827: **TRANSHUMANCE HERITAGE IN THE STRUCTURING OF THE LANDSCAPE, CITIES AND ARCHITECTURE** / p. 828-838: **EL PATRIMONIO DE LA TRASHUMANCIA EN LA VERTEBRACIÓN DEL TERRITORIO, LA CIUDAD Y LA ARQUITECTURA**
Gutiérrez Pérez, Nicolás
- p. 839-848: **INTERVENTION IN THE HERITAGE OF RURAL COLONIZATION ARCHITECTURE. THE VILLAGES OF LOS MONEGROS** / p. 849-859: **INTERVENCIÓN EN EL PATRIMONIO DE LA ARQUITECTURA RURAL DE COLONIZACIÓN. LOS POBLADOS DE LA COMARCA DE LOS MONEGROS**
Prieto Mochales, Luis
- p. 861-870: **MODERN ARCHITECTURE IN MANZANILLO, COLIMA, MEXICO 1930-1970 (TRANSFER AND ADAPTATION)** / p. 871-880: **ARQUITECTURA MODERNA EN MANZANILLO, COLIMA, MÉXICO 1930-1970 (TRANSFERENCIA Y ADAPTACIÓN)**
Yáñez Ventura, Marco Antonio; López García, J. Jesús
- p. 881-893: **FIRST INTERNATIONAL ARCHITECTURAL JOURNEY OF JUAN MADRAZO** / p. 894-906: **PRIMER VIAJE INTERNACIONAL ARQUITECTÓNICO DE JUAN MADRAZO**
Fernández Martínez, Margarita María
- p. 907-918: **HOUSES, COURTYARD TENEMENT HOUSING, INNS AND SHOPS IN 16TH SEVILLE. ARCHITECTURE, DRAWING AND GLOSSARY OF MASTER BUILDERS** / p. 919-930: **CASAS, CORRALES, MESONES Y TIENDAS EN LA SEVILLA DEL SIGLO XVI. ARQUITECTURA, DIBUJO Y LÉXICO DE ALARIFES**
Núñez González, María
- p. 931-939: **TOWARDS THE CONSTRUCTION OF ATLAS OF SURVIVING ARCHITECTURES** / p. 940-949: **HACIA LA CONSTRUCCIÓN DEL ATLAS DE ARQUITECTURAS SUPERVIVIENTES**
Tejera Mujica, Noemi
- p. 951-960: **TRANSFORMATIONS OF THE ALCÁZAR OF SEVILLE THROUGH ITS IMAGES (1902-1969)** / p. 961-971: **TRANSFORMACIONES DEL REAL ALCÁZAR DE SEVILLA A TRAVES DE SUS IMÁGENES (1902-1969)**
Bañasco Sánchez, Pablo
- p. 973-980: **THE ARCHITECTURE OF POWER. THE ISLAND INSTITUTIONS AND AUTONOMOUS BODIES. ANALYSIS OF THE CASES: GRAN CAÑARIA, TENERIFE AND MADEIRA** / p. 981-987: **LA ARQUITECTURA DEL PODER. LAS INSTITUCIONES INSULARES Y ORGANISMOS AUTÓNOMOS. ANÁLISIS DE LOS CASOS: GRAN CANARIA, TENERIFE Y MADEIRA**
Hernández Cruz, Ricardo Kevin
- p. 989-998: **PROPOSAL FOR AN INDICATORS SYSTEM OF URBAN INTEGRATION OF THE MARITIME PORTS HERITAGE** / p. 999-1009: **PROPUESTA PARA UN SISTEMA DE INDICADORES DE INTEGRACIÓN URBANA DEL PATRIMONIO PORTUARIO MARÍTIMO**
De las Peñas García, Jesús
- p. 1011-1020: **EMPIRICAL METHOD APPLIED IN RESEARCH ON RESIDENTIAL ENERGY RETROFITTING** / p. 1021-1031: **MÉTODO EXPERIMENTAL EN LA INVESTIGACIÓN SOBRE REHABILITACIÓN ENERGÉTICA RESIDENCIAL**
Escandón, Rocío; Blázquez, Teresa; Martínez-Hervás, Mónica; Suárez, Rafael; Sendra, Juan José
- p. 1033-1042: **AESTHETICS OF RUINS AND ETHICS OF ARCHITECTURAL DESIGN: NEW INTERVENTIONS ON ARCHAEOLOGICAL HERITAGE** / p. 1043-1053: **ESTÉTICA DE LAS RUINAS Y ÉTICA DEL PROYECTO ARQUITECTÓNICO: NUEVAS INTERVENCIONES EN EL PATRIMONIO ARQUEOLÓGICO**
Bagnato, Vincenzo Paolo

HYDRAULIC HERITAGE AND THE CONSTRUCTION OF THE TERRITORY: THE IRRIGATION COMMUNITIES.

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Summary: As can be seen in many documentation from the 15th century, when the first European conquerors arrived in the Canary Islands, they observed how the canarian developed simple strategies for capturing and channeling the waters for the irrigation of the orchards. In the repartimientos, initiated in 1485, the lands were distributed with the water, linking the water of the summits to the low lands, where the first great monoculture, the sugar cane, was implanted. Once the irrigated lands were distributed, the grateful ones formed the first irrigation community, called generically heredad. From this moment, the irrigation ditches are spreading over the territory, generating a rich heritage that still exists, and whose territorial logic is the one that is intended to unravel with the current thesis.

Key words: Territory, Landscape, Irrigation ditches, Irrigation communities, Hydraulic heritage.

1. Introduction

The hydraulic heritage of the island of Gran Canaria, in the Canary Islands, has been approached from a long time ago through various studies and publications, which in a specific or generic way have been forming a general overview of the island's hydraulic system.

In the current thesis, it is intended to give a new vision of the hydraulic heritage understood from the territorial perspective, through the relationships that occur between the hydraulic systems and the territory. The main hypothesis of work, which is intended to justify is to demonstrate the relevance that the Heredades (irrigation communities) have had as a configurator element of the territory where they are inserted, making for this an analysis of the environment where they are implanted, the framework that are shaping and heritage associated, all on the documentary basis and existing material witnesses, unraveling in parallel the territorial logic of the settlements linked to the Heredades as well as their distribution in the territory.

The work will be approached from two scales, the general one, with the Heredades in their insular context and the particular one, with the analysis of two Heredades: the Heredad de Aguas de Arucas y Firgas, in the North of the Island, and Acequia Real, Aguatoná, Santa María y Los Parrales, in Ingenio and Agüimes, in the East.

This communication presents the results and partial conclusions of the thesis, being this in the documentation phase.

2. Objectives and methodology

To demonstrate and justify the main working hypothesis, a set of general and specific objectives are established according to each stage of the work:

2.1. General objectives

The main objective of this work is to offer a transversal view of the hydraulic heritage and the territory where it is located, materialized in the specific case of the Heredades and how they have been shaping the territory over time.

We understand this configuration as a continuous process, which began as a result of the conquest and colonization, with the distribution of land and water in the fifteenth century and which extends today, in a dynamic territory in continuous transformation in which hydraulic systems must find new forms of dialogue to ensure their survival, as a witness to the importance they have had in the configuration of the territory.

Specifically, the following objectives are pursued:

- Understand the hydraulic systems in their territorial context, and how they have been conforming the territory where they extend. What happens both in the final zones, that is to say in those towards where the water is directed and what is happening along the whole route.

- Create a model of study that allows its extrapolation to other areas of the island or even to other places in which the territorial development departs from the same bases as the one of study.
- Open new fields of study.
- Know materials, construction systems and their continuity of use over time and thus obtain a greater number of parameters with which it is possible to advance in conservation proposals and improvements of hydraulic systems.

2.2. Specific objectives

Specific objectives are established for each phase of work developed.

Mainly, there are three blocks of work which, although they overlap and alternate over time according to the needs of research, will follow concrete objectives:

2.2.1. Objectives in the documentation phase

Once the main documentary sources, archives and bibliography have been identified, the theoretical framework that forms the basis on which to construct the territorial hypothesis is formed. From there, the objectives to achieve will be the following:

- Conform a conceptual framework and position the thesis within it.
- To create a documentary and cartographic corpus as a framework for research and as a basis for the successive phases of work development.
- Establish a theoretical model of growth and development in relation to the sources consulted.
- Identification in the documentary sources of all the elements that have formed part of the *Heredades* or that depends on them: sugar engines, mills, irrigation canals ... etc.
- Identify in the sources all the documentation related to the raw materials and construction techniques of the systems: quarries, processing of materials, skilled labor, and construction systems employed.
- Look for parallels with other regions regarding the creation of similar systems and construction techniques. Importation of techniques. The case of Madeira.
- To establish an initial typological and chronological classification for the elements that compose the hydraulic systems. Identification of the main and secondary ditch, by age, flow and other data that are extracted from the documentation.

2.2.2. Objectives in the field work phase

Based on the information obtained in the documentation phase, the following actions will be carried out:

- Create a database capable of storing all the relevant information obtained from the field work. This database must allow the data to be cross-checked and the appropriate conclusions drawn.
- Identify all the elements that make up the system. Comparison of existing elements and their location in relation to bibliographic documentation.
- Define the elements identified in the typological and chronological classification.
- Establish a growth and development model in relation to the existing evidence in the territory.

2.2.3. Objectives in the analysis phase

- Compare the theoretical model of growth and development established in the documentation phase with the material evidences obtained in the field work phase.
- Analysis of materials and construction systems and relation with the phases or time of construction.
- Comparative of two *Heredades*: territorial and constructive.

2.3. Methodology

The methodology used can be divided into two large blocks, which are developed in parallel according to the needs of the research itself and the final block of conclusions with the crossing of the two previous blocks:

2.3.1. Documentary work

Identification of the primary sources of information is essential in this block. Once the sources are located and identified, the documentation and analysis will be carried out in relation to the proposed objectives (discussed in the previous point).

Within the documents needed in this phase, in addition to the specific bibliography, we have consulted:

- Documents deposited in the Heredades, mainly those related to the construction of ditches, corners, boxes of distribution and any other element that is his own.
- Cartography: current and historical.
- Historical photograph.

All this documentation will be continually crossed with the field work, since each relevant information will have a territorial reflection with which to cross. Also, a theoretical territorial registration of heritage will be elaborated that will be the ones that are visited in the phase of field work, as well as improve a classification and subclassification of the parts that make up the hydraulic system.

2.3.2. Field work

- Desig the database

Before to do the fieldwork, it will be necessary to create a georeferenced database containing all relevant fields that we want to know about the good. It will take as reference some basic fields, such as those already contained in other existing databases (denomination, location, location ...), while others will be exclusive to the research itself, such as classification. All this in order to achieve the objectives estimated for this phase.

- Field work

Once identified and located the assets that are related in the documentation, will proceed to make the field visit of the buildings and study areas previously selected in the documentary work phase, in which in addition to taking the necessary photographs, will be filled the fields that are considered appropriate from the on-site form. It will be of special relevance to indicate those relating to the general characteristics, construction materials, state of conservation and if it is in use. In this phase the validity of the classification will also be verified and will be modified if necessary.

- Development of the Geographic Information System

As the last phase of the fieldwork, all the information contained in the geo-referenced database will be dumped in the GIS, which in turn will already contain all the relevant planimetric information obtained in the documentary work phase.

2.3.3. Analysis of the data obtained and conclusions

Finally, in the last stage of the work, all the information related to the two previous parts will be crossed, analyzing the data obtained in order to elaborate the final conclusions and possible proposals.

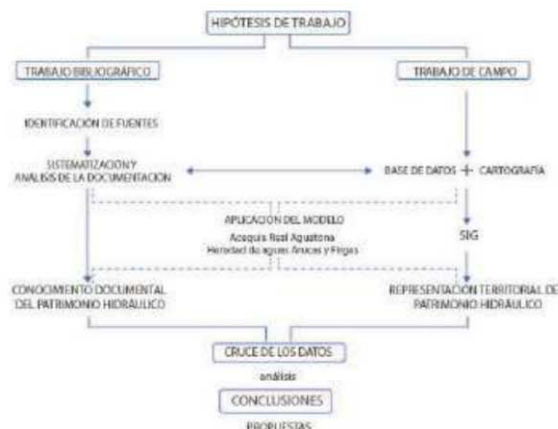


Fig.1 Document working scheme (Own elaboration)

3. Status of the issue

The bibliography that has dealt with hydraulic systems, both internationally and in the Canary Islands, is many and varied.

In an international context, authors such as Thomas Glick (Glick, 1996) study the relationships between traditional irrigation systems in the old and new world and Alberto Vieira and Raimundo Quintal, with specific studies on the Madeira levadas (irrigation ditches in Madeira). At national level, there are studies on the ditches of Andalucía, Murcia and Lorca, Sierra Nevada, Cataluña and Valencia among others.

In the Canary Islands, we found the descriptions at ethnohistorical sources, where aboriginal preexistence of ditches is described, (Marín de Cubas, 1986: 259), the installation and location of sugar mills (Abreu, 1940: 172) or, indirectly, when they refer to the repartimientos of water and lands. From the fifties of the twentieth century, specialized publications on the subject began to appear, such as the publication of Hernández Ramos, Heredades de Agua in Gran Canaria, or Benítez Padilla, Gran Canaria and its Hydraulic Works. But it will be in the last thirty years when there will be an increase in specialized documentation on this subject, with an increase in the number of publications and approaches around water and water systems, and with the appearance of inventories and catalogs, where they begin to register in order to protect the elements belonging to traditional hydraulic systems, thus recognizing not only their functional value but also their patrimonial value.

The reference bibliography in this topic, in addition to the one related to hydraulic systems or Heredades, has been limited to that which may be of interest when analyzing the implantation, growth, transformation or patrimonialization of these systems.

3.1. Conquest and colonization: ethnohistoric sources, repartimientos and sugar cane

As mentioned above, when the Europeans arrived to conquer the islands in the 15th century, they observed how the natives used simple irrigation techniques to bring water from the ravines or springs to the cereal growing areas located in the low productive plains for cultivation. This is what authors such as Marín de Cubas and Abreu y Galindo (Abreu and Galindo, 1940: 112) point out.

With colonization and distribution of lands and water, these simple networks are replaced by a more complex system, necessary to bring water to sugarcane crops and to sugar mills, the first large monoculture established in a first the most fertile and suitable areas for the cultivation of sugar cane, distributing subsequently the dry land (Díaz, 2013: 45). These beginnings are recorded in the ethnohistorical sources of the chronicles of the conquest of the Islands by Gómez Escudero and Gaspar Frutuoso among others (Gómez, 1936: 60-62), as well as in the different Datas contained in the Book of Protocols and Repartimientos of the Lands, year of 1542, Reales Cédulas and ordinances, worked by authors like Jiménez Sanchez, Suárez Grimón, Ronquillo and Aznar. According to Aznar (Aznar, 1992: 286), the island of Gran Canaria was divided into three distribution districts: Las Palmas, Gáldar and Telde. The district of Gáldar extended from Aumastel to the village of Nicolas, Las Palmas would go from Aumastel to the border of Telde and that it would extend through the rest of the island to the town of Nicolás. Deliveries, taking into account that there was no fixed system during the whole process, could be water and land, land or water, and the latter could be used for industrial purposes such as the installation of a mill or sugar mill (Aznar, 1992: 290). Sugar cane is planted immediately after the conquest and before the official land distribution. Since already 1485 there are references of sugar mills in full yield (Gambín, 2014: 248), which it means that already in those early dates, diversion and channelization had begun to be carried out to bring the waters to plantations and sugar mills in those areas that were not adjacent to permanent channels of water. In 1493, Tomas de Palenzuela was given lands in Firgas and in the Vega de Arucas, where he soon installed a sugar mill next to the hermitage of San Juan Ortega (Firgas) and two in Cerrillo (Arucas). Rosales (Rosales, 1977: 5) states that the waters of the rising of Las Madres in Firgas were granted to Palenzuela, who opened the ditch, initially of land, between Las Madres and Firgas and later of Firgas to Arucas, a work of about twelve kilometers completed around 1546 (Pérez, 1991: 42), for the movement of the trapiches and the irrigation of the land (Rosales, 1977: 5).

This new crop was located in the irrigated lands of the island, creating its own system of occupation of the territory and attracting workers who were gradually colonizing the areas dedicated to sugarcane.

The growth of population around these units of exploitation caused some of the first parishes of Gran Canaria, such as Arucas, Moya and Agaete (Lobo, 2013: 104-105) to be created.



Fig.2 Distribution of cane crops and sugar mills (Camacho, 1961:19)

3.2. The Irrigation Communities

In the repartimientos initially carried out, by which the water was granted to the lands susceptible of being watered, the distribution of waters was made following certain requirements that gave rise to the constitution of the irrigation communities (Heredades de Aguas) around the year 1505 and which is extensively developed in the Hernández Ramos publication (Hernández, 1954: 25, 38-39, 47).

This in practice led to the total flow, called "gruesa", being owned by all heirs, in the same way as the main ditch. Until the water reached the irrigation zone owned by each heir, it did not have its corresponding fraction, called dula, regulated in flow and time and assigned by turns. Being the joint waters, it was obligation of the heirs to cooperate in the maintenance of the networks of ditches and other hydraulic elements. The figure of acequero appears, which was the man in charge of an irrigation community to distribute and monitor the water distribution, as well as to maintain the extraction points, the distribution network and the storage places. The water mayor, had the function of mediating in water disputes (Díaz, 2000: 130).

For the island of Gran Canaria, we do not have a relation of original irrigation communities (Heredades de Aguas), although according to Diaz Cruz (Díaz, 2013: 46), Hernández Ramos and Suárez Grimón and Quintana Andrés, we can find the Heredades de Agüimes, Agazal de Gáldar, Arucas y Fircas, Santa Maria y Parrales (Agüimes), Acequia Real y Aguatona (Ingenio), the Heredad del Dragonal, and the Heredad de Tenoya already in the early sixteenth century. Over the centuries, irrigation communities continue to appear, either by dividing the originals or by creating new ones. On the island of Gran Canaria in 1857, listed according to Dr. Don Domingo Déniz, some 140 irrigation communities are recorded, identifying their corresponding main flow and dulas, which Benítez Padilla collects in his book Gran Canaria and his Hydraulic Works (Benítez, 1959: 192-198).

In the area of Ingenio and Agüimes, for example, studied by Suárez Grimón and Quintana Andrés, in 1782 the majority of existing irrigation communities in Agüimes are already configured, distinguishing between principal heredades, nine, and secondary, five, arising at different times and not only in the Barranco de Guayadeque, but in other ravines and payments of the jurisdiction (Suárez and Quintana, 2003: 500). In 1807, for the entire jurisdiction of Agüimes ten inheritances were constituted (Suárez and Quintana, 2003: 500).

Tabla 1. Irrigation communities, Agüimes 1807 (Suárez y Quintana, 2003: 501)

lugar o pago	name
La villa (two)	Acequia de Santa María (dula each 28 days) Acequia Basinera o los Prrales (dula each 30 days)
Ingenio (two)	Acequia Real (dula 120 days) Acequia de Aguatona (dula each 30 days)
Valle de Temisas (two)	Acequia de Juncal Alto Acequia de Longueras (nex to Acequia Alta, dula each 16 days in 1770) Acequia de Ramírez
Corralillos (one)	Acequia de Corralillos
Carrizal (two)	Main mine of Barranco de Guayadeque Mine of Barranquillo de las Majoreras or Seminario (dula each 32 days and in 1795 each 36 days)

For the area of Arucas and Firgas are several authors and publications that deal with the evolution of the draw up of the ditches that make up the Heredad: as we saw in the previous section, in a first phase at the beginning of the sixteenth century, Acequia Real, built by Tomás Rodríguez de Palenzuela, arrived from Las Madres to Firgas and later to the mills of El Cerrillo in Arucas. According to the publication of Rizkallal Santana, Don Miguel de Timagada, in turn, was a beneficiary of the San Juan fountains, opening ditch from these sources to the Palenzuela, in el Repartimiento, Firgas (Rizkallal, 1990: 38). At the same time, Juan de Ariñez, who obtained Ariñez water springs in the repartimientos, opened in 1,522 the new acequia, Ariñez or Mayorazgo, to carry the water through the Firgas irrigation community from the ravine of Aumastel to Arucas, in a ditch parallel to that of Palenzuela, which crossed Arucas and reached Trasmontan by the Hoya San Juan, where the sugar mill was located (Caballero, 1973: 96-97). Around the year 1572, Pedro Cerón, who made the Palenzuela estates, needed to take the water to a property of the Mayorazgo known by the name of the Prior, reason why it was necessary to take the irrigation ditch of Arucas to Trasmontaña in the stretch known as Acequia Alta (Rosales, 1977: 7). Already in 1862, a ditch was built along the ravine of Valsendero from the sources of Los Chorros, to join with the waters that are born in the Barranquillo of Rapador, to reach Las Madres, Firgas (Rizkallal, 1990: 39)

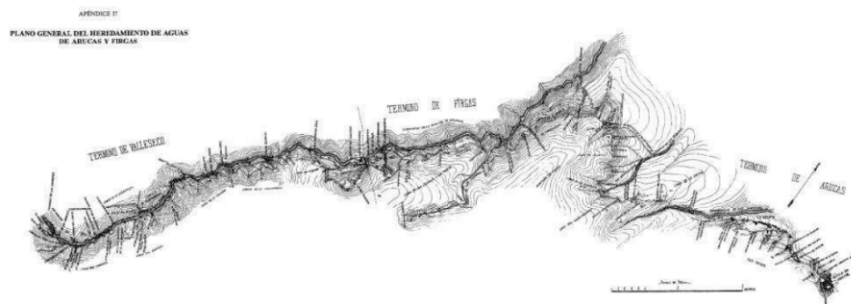


Fig.3 Heredad de Aguas de Arucas y Firgas (Rizkallal, 1990:120).

3.3. Hydraulic works and their construction techniques.

From the first years of colonization, the system of mines was generalized to obtain water, consisting of opening a trench longitudinal or transverse to the channel of the ravine to capture the filtrations of groundwater and then divert them to the regulating ponds, which in most of the cases were constructed taking advantage of hollows of the terrain (Suárez, 2001: 91). The initial canals were made by means of slits in the rock or in earth, in this case compacting the mud of its sides to form the edges and later waterproofing it with mud and clay (Díaz, 2000: 128), or reinforced with masonry walls. At points of difficulty, wood channels were used, which in time were replaced by factory works (Suárez, 2005: 17). Over time, the nets were extended and the primitive channels were replaced by ditches built with carved stone and lime stone, more resistant, safer and with greater capacity. At the points where the main ditch or royal ditch was diverted to distribute the water to each heir, the water diversion were placed, which later gave rise to the boxes of distribution (cantonerias). The cantonerias are masonry boxes that divide the water into equal portions, where each mouth represents a hoe, may also be of medium or double capacity (González, 1991: 476), and are described in more detail in publications such as Medina Peñate.

In the course of the irrigation ditches, washing facilities and water mills were installed, to take advantage of the flow of water. When the ditches passed through the populated areas, the heredades built public sinks at the request of the interested parties (Rizkallal, 1990: 44), placing slabs of carved stone sloping over the channel of the irrigation channel, and may even be covered (Díaz 2000: 131). The location of the water mills and sugar mills was initially linked to the main population centers, Las Palmas, Telde, Agüimes and Gáldar, to supply the workforce (Quintana, 2001: 35). Subsequently, they increased in number according to the population demand, as a concession of the Heredad in a personal capacity, following the request of the interested parties to the government board or the president of the Heredad (Díaz, 1988: 61). In 1833, in the Heredad de Aguas de Arucas and Firgas, there are nine flour mills moved by their waters distributed by the municipalities of Valleseco, Firgas and Arucas (Rizkallal, 1990: 50-51), installing until the end of the nineteenth century four in Valleseco, five in Firgas (one of them, Guadalupe was not moved by the waters of the Heredad) and seven in Arucas, one of which, the last one of the ditch, only occasionally moved with waters of the irrigation community (Díaz, 1988: 147-211). In the municipalities of Ingenio and Agüimes, in the basin of the barred of Guayadeque and the irrigation community of the Real Acequia of Aguatona and Santa Maria and the Parrales, seven mills are identified in Ingenio and four in the town of Agüimes, all moved with the waters of the heredad, and three in Temisas (one moved by the waters of the High Juncal and two by the Longueras) (Díaz 1988: 524-572).

In the twentieth century, with the development of banana cultivation, heredades and individuals were forced to seek new hydraulic resources, increasing derivations and size and number of ponds, reserving the coastal wells to the tomato, resistant to brackish waters (Benítez, 1959: 202), which meant that the transformation of the territory, and therefore of the landscape, became more intense as the technical requirements for the irrigation of the new crops increased. The Heredad of Arucas and Firgas, built at the beginning of the century a reservoir to collect leftover water from the winter floods in the barranquillo del Pinto, at the head of the irrigated areas, which was followed by another dam a few years later. From there, begins the construction of the great reservoirs of the island, registered in the publication of Benítez Padilla and worked by González González in several publications.

3.4. Territory and inventories of ethnographic and architectural heritage

From the territorial point of view, the cultivation of sugar cane produced an ordering of the territory imposed by the sugar model, whose influence was not only limited to the areas occupied by that crop but also affected the entire island territory, as is reflected in the publication of Santana Santana and in the Special Territorial Plan for Historic Heritage (PTE-6), where the development of the hydraulic system: water capture, transport, distribution and storage played a fundamental role. This model, established in the 15th century, expands and consolidates until the 18th century (Santana, 2001: 337), where agricultural practices and irrigation systems remain the traditional ones with little improvement. At the end of the nineteenth century, the traditional agricultural model began to enter into crisis due to the development of the new economic model based on the Puertos Francos Decree and the emergence of the first tourist establishments (Santana, 2001: 337). The new implanted crops, banana and tomato mainly required an intensification of the water resources, reason why new mines, wells and galleries were realized and dams, albercones and maretas (types of ponds) were constructed. Since the mid-twentieth century, a new territorial model has been imposed, characterized by a change in economic orientation, which tends towards the tertiary export sector, which favors an improvement in both external and internal communications and a urbanization process, which in many cases led to occupy spaces previously allocated to agrarian activity (PTE-6, 2012: 160).

In 1993, the inventory of the ethnographic heritage of Gran Canaria, started by the Directorate General of Historical Heritage and started in 1995 by the Foundation for Ethnography and Development of Canary Crafts, FEDAC, began to be elaborated. All the field work done with the records of the heritage located all over the island, was turned into index cards that ended up forming a georeferenced database, with all the properties registered and georeferencing, documentation that was provided to the municipalities to serve as a basis in the development of charters and catalogs of heritage protection. This inventory, which continues to be updated, counts at the time of the communication with about ten thousand registered elements, which identifies an amount of 4435 elements under hydraulic activity, which is the largest group. In the work carried out by Ramón Ojeda in 2002, we see that, for example, in the municipality of Arucas, of the 749 ethnographic goods inventoried, 470 belong to the hydraulic activity, because of the traditional agricultural vocation of Vega de Arucas and constructive activity of the Heredad of Arucas and Firgas (Ramón, 2002: 265). The panorama is repeated in the municipality of Firgas.

In 2009, in the work developed by the M & D Surveying team, the main and royal ditch tracings of the main irrigation communities of the island were topographed and georeferenced, as well as the main properties linked to each one. For example, in the Heredad de Aguas de Arucas and Firgas, the royal

ditch was topography from Las Madres to Arucas with a total of 136 associated element registers, which include boxes of distribution, ditches and public sinks among others.

3.5. Analysis of identified publications and lines of research

The publications of the hydraulic heritage are diverse, not existing a single path but a same theme treated from different perspectives in which concepts are approached at different scales.

Analyzing the publications, we can identify a first line of research, where we find publications with a clearly historical approach, for example those specialized in the *Heredades* specifically, where the subject is approached well from an overview of irrigation communities and *heredamientos*, as the publication of Hernández Ramos or Díaz Hernández, or in a very specific way, focusing on some chronological period or the specific documentary study of an Heredad, such as those of Rosales Quevedo and Rizkallal in the case of the Heredad de Aguas de Arucas y Firgas or Suárez Grimón and Quintana Andrés with content on that of Ingenio-Agüimes, there being also some that moves on both scales, such as the publication of Navarro García. There is also a great amount of information contained in publications that refer to the historical landscape as the Santana Santana publication and the initial colonization stage of the Island, with the first land and water *repartimientos*, such as the publications of Aznar Vallejo, Suárez Grimón and Quintana Andrés, and the cultivation of sugar cane, such as the publications of Viña Brito and Lobo Cabrera. From this it is possible to extract a first line of investigation on the changes produced in the territory during the colonization and later moments, focused on the study of the initial tracts of the *Heredades* and as they are transformed as the *repartimientos* advance initially, and with the changes in the models of occupation of the territory in more recent stages.

In a second large block we can group the investigations that deal with the hydraulic works and their construction techniques, in which they are approached in a general way as the publication of Benítez Padilla or they analyze in detail some concrete elements, as the systems of capture and distribution of water in the publications of Suárez Moreno, dams in Gonzalez Gonzalez's publications, or industries directly related to irrigation ditches and estates, such as the publications of sugar mills and water mills by Camacho and Díaz Rodríguez, fundamental for understanding and compare systems and construction techniques used. Here we should also highlight the doctoral thesis of Ramon Ojeda in 2002 on the ethnographic inventory of the FEDAC, which analyzes the territorial distribution of inventoried properties, and the study of memory, layout and hydraulic elements of the *Heredades* carried out by M & D Topography, since both documents constitute one of the main sources of information when dealing with the territorial distribution of *heredades* and hydraulic systems.

And finally, there is a third line of research with a clearly patrimonial approach where some of the elements previously studied are treated from the perspective of conservation and use as patrimonial resource. In this section some publications of Suárez Moreno, Ramos and Salazar, Medina Peñate and the Territorial Heritage Patrimony Plan (PTE-6) stand out.

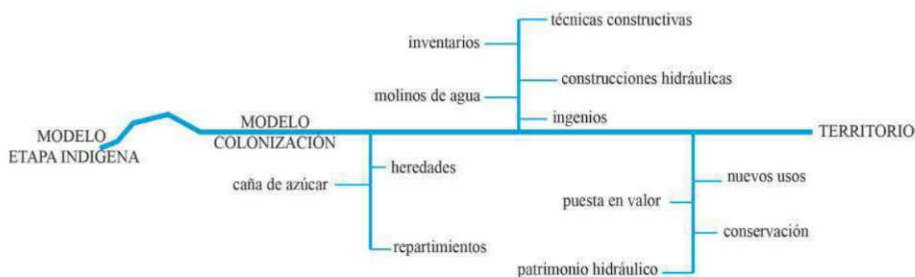


Fig.4 Esquema de las líneas de investigación existentes en el Patrimonio Hidráulico (Elaboración propia).

It is important to emphasize here, due to the interest that the topic has for the thesis, the analysis of the territorial approach of the previous publications, since if we make a transversal reading to the three lines of research previously explained, we see that in all of them this theme its deal in a different form and with different degrees of precision, from the enunciation of the location of certain elements, such as the publication of Caballero Mujica with the description and location of the mills, the territorial location in planes made by hand, such as the planes that brings Rizkallal of the Heredad de Aguas de Arucas y Firgas and those of Díaz Rodríguez of the water mills, to the most recent documents that employ georeferencing techniques and the elaboration of data bases, such as the work of Ramón Ojeda, M & D Surveying and the PTE-6.

4. Results of the documentation phase: Towards a new vision of hydraulic heritage

The results of the documentation phase in which we find ourselves can be grouped into two blocks:

4.1. Positioning of the thesis in relation to the conceptual framework and the state of the issue

- The territorial approach as a common thread: as has been analyzed in the documents that form part of the aforementioned lines of research, the territorial location of the elements that make up the hydraulic systems are approached in different ways and with different degrees of precision, from simple description to georeferencing. In the current thesis, we intend to reveal and cross all this documentation in such a way as to allow us to establish a theoretical model of growth and development of the hydraulic systems and territories studied in relation to the sources consulted, a model that will be compared with that obtained in the phase of the field work. All this will be done through the elaboration of a geo-referenced database that allows us at any time to identify and locate any element of the hydraulic system in the territory and analyze their relationships. This documentation will give us information in addition to the growth and development of the territory, appearance, forms of growth and urban structure of population nuclei and farmland (full and empty) linked to hydraulic systems.

This can be seen, for example, when analyzing in detail some of the tracings of the *Heredades* of Gran Canaria, where we can advance as certainly these systems, are vertebrated elements of the territory where they settle, configuring it as if of management plans were treated but following the logic of water. We will be able to establish guidelines of analysis in all its route, and thus to see that it happens in the different zones that the own irrigation ditch generates, for example that happens in the zones of passage (A), zone of ramification (B) and zones of destination (C).

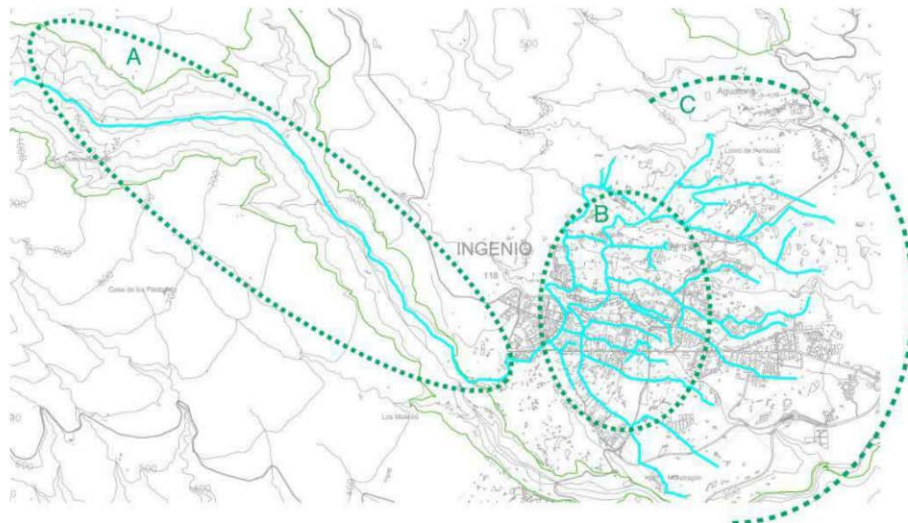


Fig.5 Acequia Real de Aguatona, Ingenio.

- The construction techniques in relation to the growth and development of the *Heredades*: once established the theoretical model of growth and development, in a closer approach to the elements that compose these complex systems, will proceed to the classification of the same identifying the different materials and construction techniques used over time in relation to the construction or growth /expansion phases as the networks extend over the territory (identification of the main and secondary ditch by cronology, flow and other data that are extracted from the documentation), that is, to relate the construction phases to the growth model proposed in the previous point, which will allow to establish an initial typological and chronological classification for the elements that make up the hydraulic systems.

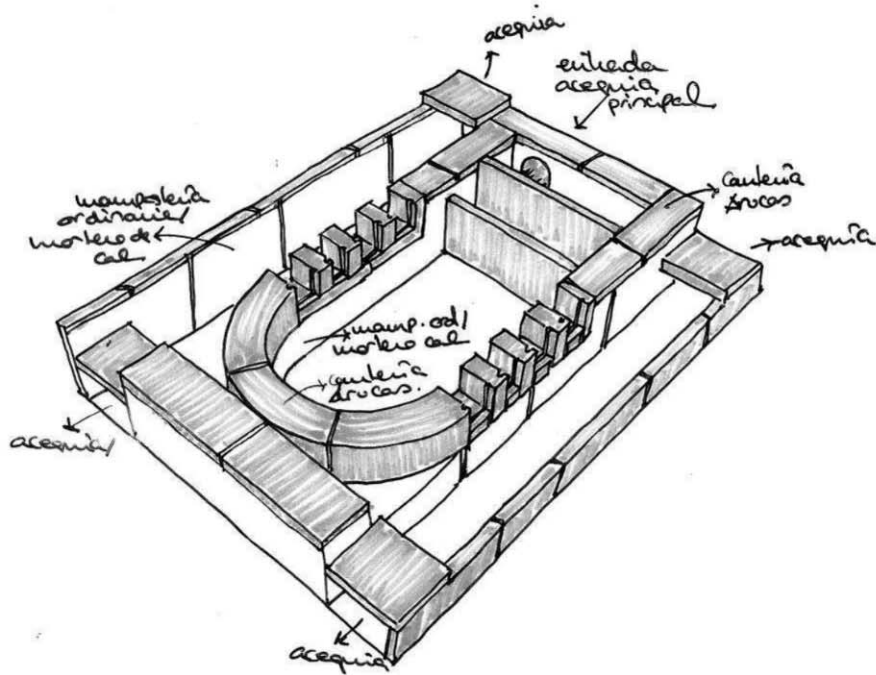


Fig.6 La Furriela distribution box (cantonera), Parque Gourié. (Own elaboration).

- From hydraulic systems to hydraulic heritage: finally, we will also take into account the patrimonial vision of the elements that make up the hydraulic systems, vision that contain more and more publications given the importance of these elements in order to propose a proposal of future. Knowing their materials, construction systems and their continuity of use over time, as well as thinking of them as a patrimonial resource will allow us to obtain a greater number of parameters with which to advance in possible proposals of conservation and improvements of the hydraulic systems, not only as functional but patrimonial elements.

4.2. Growth model and theoretical development of the irrigation community of Arucas and Firgas

In a detailed analysis of the historical documentation consulted on the layout of the Heredad de Aguas de Arucas and Firgas, we can advance the model of growth and development of this Heredad, which will contrast with that obtained from the field work in the successive phases from work.

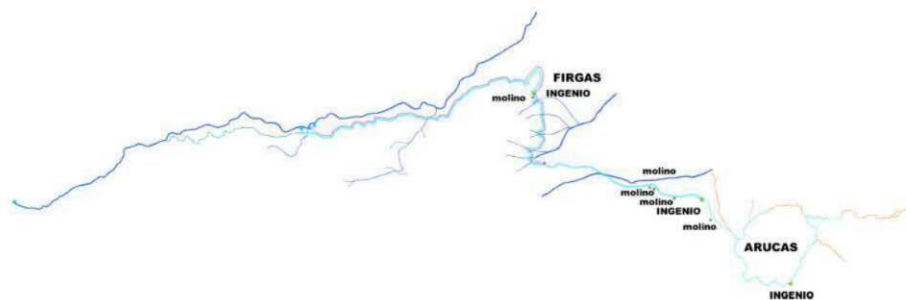


Fig.7 Scheme of the growth model and development of the Heredad de Arucas y Firgas. (Own elaboration).

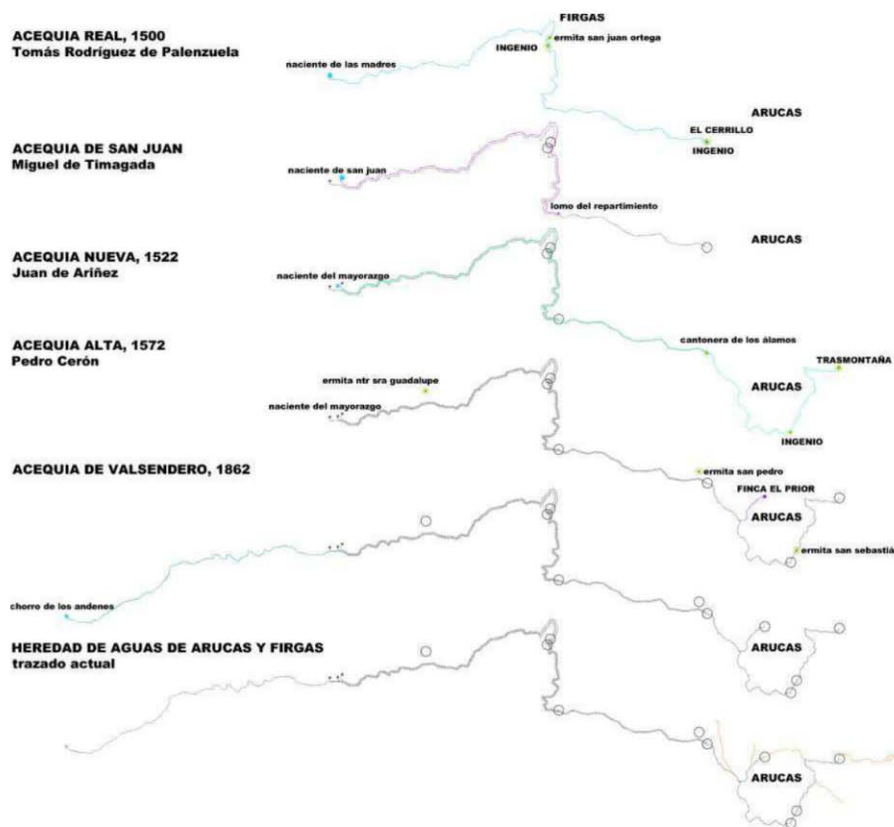


Fig.8 Phases of the growth and development model of the Heredad de Arucas y Fargas. (Own elaboration).

From these schemes it can be concluded that the historical documentation gives us relevant information about the constitution of the ditches since its implantation around the year 1500, being able to identify the phases that have had.

Still, regarding this model, there are some issues of documentation that will remain pending confirmation in successive phases of work:

- Extension of Acequia Alta in the first phase: The Prior estate, according to Caballero Mujica (Caballero, 1973: 101), had five and a half lots and bordered above with the "Arucas Mountain and below with the Camino Real which goes to the sea, "currently comprising the area between the road Arucas to Mountain Cardones by Trasmontana, old road to the coast of Bañaderos and road from Arucas to Agaete, where is the manor house of the Marquis of Arucas (Caballero, 1973 : 101). Exact location of the estate and connection with Acequia.
- Confirmation of the extension of the New Acequia: According to Rizkallal, (Rizkallal, 1990: 38), Juan de Ariñez built the ditch of Ariñez from the sources of Mayorazgo to join with that of Palenzuela in Los Álamos, Fargas. This is taken from the publication of Caballero Mujica (Caballero, 1973: 100), where he states that Juan de Ariñez had properties in Los Álamos, near El Cerrillo, and that, according to Camacho (Camacho, 1961: 25- 26), it was a question of constructing a new ditch parallel to the one existing that merged with the main in La Goleta and El Cerrillo until arriving at Trasmontaña by Hoya San Juan. It is to be supposed therefore that the irrigation ditch did not end at Los Alamos, but merged in that zone with the Acequia Real, and continued until Trasmontaña.
- Ramal Hoya San Juan-Trasmontaña: The location of Juan de Ariñez's genius, according to Caballero Mujica (Caballero, 1973: 97), (and as interpreted by the Legajos of the Provincial Historical Archive) establishes it next to the bridge built in Isabel's time II, crossing the barren of the Vega de Arucas, where their properties were located and was conducive to the installation of the mill, so the continuity of the canal to Trasmontaña at this time, according to documentary sources is not clear.

5. Conclusions of the documentation phase

- The existing research lines around hydraulic heritage are based mainly on the historical study of all or some aspect of hydraulic systems or *Heredades* and to a lesser extent in the study of their territorial, technical or patrimonial characteristics.
- The current thesis opens a new line of research, studying the hydraulic heritage from all aspects and providing a technical and overall view of the same that has not been offered up to now.
- It will also allow us to create a model of study that allows its extrapolation to other areas of the island or even to other places where territorial development starts from the same bases as the study.
- The documentation phase for the irrigation ditch of the Arucas and Firgas Waters has produced a model of growth and development of the *Heredad* from its constitution until the present time. This theoretical model has some areas of uncertainty that should be clarified in the next phases of the thesis.
- The field work, fundamental in the elaboration of the document, will allow us to know materials, construction systems and their continuity of use over time and thus obtain a greater number of parameters with which it is possible to advance in possible conservation proposals and improvements in hydraulic heritage.

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