European Journal of Geography Volume 9, Number 3:62-79, September 2018

APPLICATION OF A METHOD TO ASSESS HYDRAULIC HERITAGE AS REGARDS DIVERSION DAMS IN THE JÚCAR RIVER BASIN. A DECISION-MAKING TOOL

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Abstract

The Mediterranean area is distinctive for its acute water deficit. This scarcity of water has led to the gradual construction of historical, sustainable irrigation systems of significant cultural and scenic value. It is essential to identify and evaluate these systems and their hydraulic assets in order to come up with proposals aimed at managing and conserving them. In this study, a method is used to assess the hydraulic heritage in ninety three (93) weirs or diversion dams located in the eastern Iberian Peninsula, following a proposal by the Júcar River Basin Authority (*Confederación Hidrográfica del Júcar*). It is a quantitative method using various criteria that also takes into account the participation of social agents. Its application has enabled these water-damming works to be classified according to the interest in them in terms of heritage. A public administration's use of the method confirms that it is an effective evaluation instrument to prioritise activities involving management and appreciation of these assets.

Keywords: *evaluation method, hydraulic heritage, diversion dams, historical irrigation systems, public participation*

1. INTRODUCTION

Water is a necessary resource for life due to its many uses such as supplying humans and animals, irrigation and producing energy or mechanical forces for agricultural and industrial activities. This asset is found in most landscapes as a primary scenic sight. A lack or scarcity of it affects the layout of the territory and explains how different societies relate to the medium. The human activity applied in order to access and manage this resource has generated an impressive cultural wealth, which we can call "hydraulic heritage".

In regions with a Mediterranean climate, precipitation is irregular and practically non-existent at the hottest times of year, leading to water stress. As a result, highly complex distribution systems have been created to regulate and distribute flows (Hernández and Olcina, 2013). As indicated by Maass and Anderson (2010), irrigation is mankind's response to aridness; it is the way to drastically reduce uncertainty in the face of adverse natural conditions. Irrigation means the land receives more water than it would naturally, thanks to human ingenuity in developing hydraulic artefacts and techniques. It is the response to anthropic ecosystems created in arid and semi-arid areas with a water deficit (Hermosilla, 2010).

The availability of water resources has historically been one of the factors that determine the location of human settlement in the Mediterranean area, so that irrigation is associated with the presence of population hubs. Together with the cultivated areas they supply, the historical Mediterranean irrigation systems make up the local cultural landscapes as regards water and are the identifying hallmarks of numerous regions. They are cultural because they represent a long history of adaptation to the natural environs, while they also form part of the heritage by representing relationships of affinity and identity. They are physical areas of undoubted value in terms of heritage and landscape. The rigid nature of areas with water systems and the difficulty in extending them restricts strategies for human settlement and population growth.

Cultural heritage grows around water, reflected in a deeply-rooted hydraulic architecture, specific landscapes, and the transfer of traditional know-how and regulations governing the use of the water. Water management in irrigated areas represents an immaterial legacy seen in the timetables for irrigation, ancestral knowledge passed on through generations, as well as irrigation techniques and institutions (the Irrigation Communities or *Comunidades de Regantes* and Water Courts or *Tribunales de Aguas*) with their own regulatory and legal framework based on legal orders and rules.

Activity in traditional irrigated areas requires different procedures to be carried out and tasks that are typical in dealing with cultural heritage, which enable and ensure true knowledge is learned about them (Mata and Fernández, 2010). In order to evaluate the hydraulic heritage and its associated landscapes, it is first necessary to describe and classify it.

As a result of the growing interest in protecting and managing cultural and natural heritage, different assessment methods have appeared in the latter decades of the 20th century and in the 21st century. Methods have arisen that are linked to heritage concerning architecture (Kalman, 1980; Guarini and Battisti, 2016); geology (Costa-Casais *et al*., 2015; Stafa *et al.*, 2016; Pereira *et al.*, 2015), hydrology (Cruz *et al*., 2014); landscapes (Otero *et al*., 2007; Varjú *et al*., 2014); palaeontology (Ávila *et al*., 2016; Sá dos Santos *et al*., 2016); culture (Morano *et al*., 2016) and environmental tourism (Safarabadi, 2016). However, there is no record of any assessment method in the field of hydraulic heritage except for the one carried out by the ESTEPA research group (Hermosilla and Mayordomo, 2017). This method makes it possible to design activities for conservation, management and appreciation of historical irrigation systems and their assets. The nature of its indicators allows us to create a hierarchy of hydraulic assets according to their interest value in terms of heritage. The method is intended to become a recognised instrument used by governments in taking decisions in order to prioritise suitable measures and strategies.

In order to take advantage of water resources and use them suitably, irrigation systems have different hydraulic assets whose purposes are to collect, convey, distribute, accumulate and use water. Water network systems start by capturing water. The purpose of such works is to capture surface water (weirs, dams, water wheels, etc.) or subterranean water (springs, drainage galleries, wells, motors, Persian wheels, etc.) (Hermosilla and Peña, 2013). The most common method for halting and diverting surface water is to build dykes in the river channels, more commonly known in Spain as an *azud* (diversion dam or weir). This is a dam perpendicular to the river's flow, which diverts it to one or both of its banks into an irrigation canal through which it then flows. Its height is determined by the depth of the river channel. Diversion dams stand out for being a rather ubiquitous asset around the Mediterranean, as well as for their antiquity, since the technique has been used by experts from various civilisations such as Persians, Romans, Moors, etc. Apart from the contributions from Romans, the Moors were the big drivers behind the irrigation systems in Spain. Indeed, the Spanish word *azud* (diversion dam) comes from Arabic and means obstacle or barrier (Box, 1992).

In our study, the abive method is applied to ninety three (93) diversion dams located in the eastern sector of the Iberian Peninsula in the area of the Júcar River Basin Authority (CHJ in Spanish). This entity, which is responsible for administering and controlling the publicly-owned water system, is interested in cataloguing and evaluating these assets since assessment criteria are needed in order to take action on them. This project therefore connects the basic research done by the *Universitat de València* with the practical application required by the CHJ.

2. STUDY AREA

The CHJ has identified about 1,200 diversion dams within its territorial scope. Since this is such a great number, a selection process was carried out for those to be evaluated, due to the economic and time restrictions. Almost a hundred diversion dams were chosen, located in seven sectors subject to priority activity by the CHJ (Figure 1). They are integrated into places where specific plans are being implemented that are related to river restoration. The results of applying the method enable action to be taken on these hydraulic features and to prioritise investments, with a commitment to conserving the ones with the best assessments.

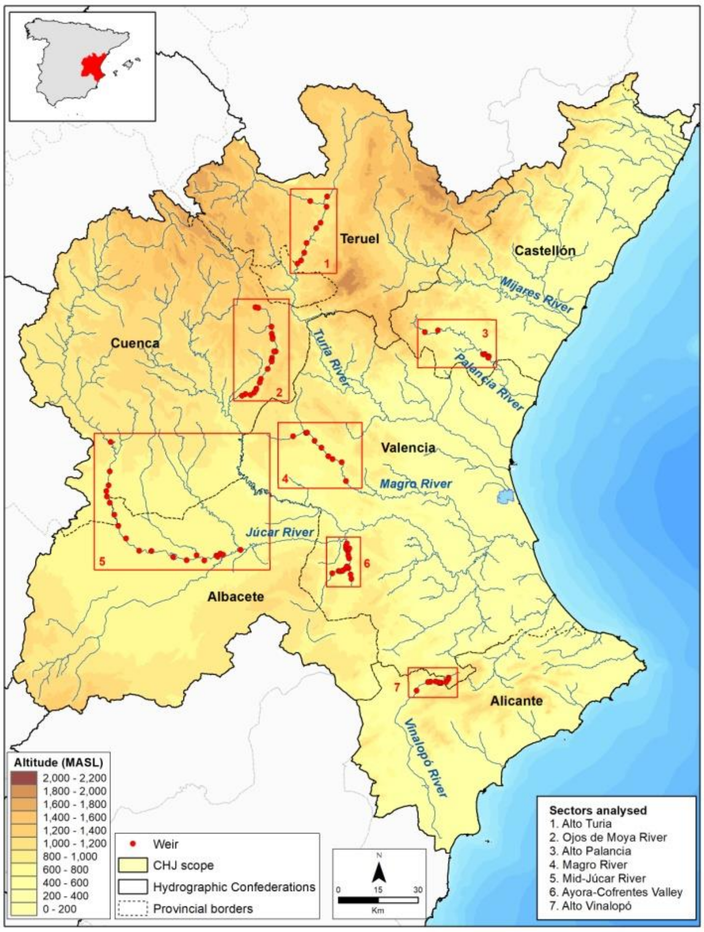

Figure 1. Location of the areas under study. Source: The authors.

The areas studied are:

1- Alto Turia: This stretch of river runs through the province of Teruel. Nine diversion dams were studied, seven of which are located in the River Turia and the other two in its tributaries the Alfambra and the Guadalaviar.

2- Ojos de Moya River: This runs through the province of Cuenca and is a tributary of the River Cabriel along its left bank. In the Ojos de Moya River basin, 22 diversion dams were studied, of which two are in the River Algarra, which is one of its headwaters.

3- Alto Palancia: Six diversion dams were evaluated, located in this river on the course in the province of Castellón.

4- Magro River: Nine diversion dams were studied in this sector, although one of them is located in one of the headwaters, the River Madre.

5- Middle course of the Júcar River: 20 diversion dams were studied in the provinces of Cuenca and Albacete.

6- Ayora-Cofrentes Valley: 18 diversion dams were studied in the river channels of the Zarra, Reconque and Cautabán Rivers and in the Murrell watercourse.

7- Headwaters of the Vinalopó River: 11 diversion dams were evaluated in the provinces of Valencia and Alicante.

3. METHODOLOGICAL APPROACH

3.1 Work method

The proposed method has 4 implementation phases:

- 1st phase. Consultation and analysis of information sources. A theoretical corpus is created by consulting bibliographies in different institutions, as well as electronic documents obtained via the Internet. Existing map and technical plan sources are analysed and the irrigation regulations are studied for each Irrigation Community related to the diversion dams under assessment.
- 2nd phase. Fieldwork. A fact sheet is created with basic information about each diversion dam, and then measurements and photos of the asset and its surroundings are added to this. This information is subsequently used in drafting the definitive fact sheet and to draw up the heritage scores for each hydraulic construction.
- 3rd phase. Panels of experts. These are activities in addition to the assessment method, based on participation. To carry them out, different groups were consulted such as representatives from town councils, from the CHJ, from the Irrigation Communities and some environmental associations.
- 4th phase. Analysis and interpretation of the results. This consisted of various tasks like drawing up the information collected in the fieldwork, assessing the heritage of the diversion dams by applying the method, as well as drafting reports and creating a geographic information system (GIS).

3.2 Evaluation system

The method is designed to be able to carry out an assessment of any asset related to hydraulic heritage as regards its functions in terms of capturing, conveying, distributing, accumulating and using water. However, this study only analyses one specific asset for capturing water: diversion dams. The evaluation method is quantitative with various criteria. The explanation of the method given below is specified in the publications by Hermosilla and Mayordomo (2016 and 2017). It has been designed using 12 assessment criteria divided into 3 categories or homogeneous groups of values (intrinsic, heritage, potential and feasibility). Each criterion is broken down into 3 variables so that each system is built upon 36 indicators. At the same time, there is an additional category with bonus indicators such as optional supplementary activities that may include the participation of social agents (Table 1).

The 36 variables that make up the method are evaluated for each of the diversion dams analysed. A value of “1” is given if it complies with the quality, but if not it is given a “0”, with no weighting. The sum total of the 36 indicators gives us each diversion dam’s total score. Each criterion and category is also evaluated individually, so that they also have specific scores.

Table 1. Structure of the methodological system for hydraulic heritage assessment: categories, criteria and variables

Categories	Criteria	Variables	
Intrinsic values	1. Representativeness	1.1.	Representative because of its construction features
		1.2.	Representative because of its functionality features
		1.3.	Representative because of the type of system in which it is integrated
	2. Authenticity	2.1.	Faithful to the original image
		2.2.	Actions that preserve the asset's harmony
		2.3.	Changes not harmful to the system
	3. Integrity	3.1.	Optimal conservation
		3.2.	Original use
		3.3.	Conservation and wise use of the system
Heritage values	4. Water culture	4.1.	Importance of water in the locality
		4.2.	Importance of the system in which it is integrated
		4.3.	Importance in relation to assets of the same type
	5. Historical and social value	5.1.	Recognition and awareness by the local society
		5.2.	Written, map and/or photographic references
		5.3.	Age
	6. Technology	6.1.	Ingenuity of the technique used
		6.2.	Technological innovation and improvement
		6.3.	Levelling techniques
	7. Artistic value	7.1.	Artistic value
		7.2.	Artistic value of the system's design
		7.3.	Measures taken for the protection of the original artistic design
	8. Territorial value	8.1.	Interesting landscape area
		8.2.	Visibility of the asset
		8.3.	Harmony with its environment
	9. Hydraulic value	9.1.	Belonging to a benchmark traditional irrigation system
		9.2.	Located in an irrigation system of significant importance
		9.3.	Dimensions in relation to the whole area
Potential and feasibility values	10. Awareness of social agents	10.1.	Public or public-private investment
		10.2.	Inclusion in tourist-cultural routes or circuits
		10.3.	Documentary, graphic and audio-visual material for promotion
	11. Potentiality	11.1.	Possibility of an integrated action
		11.2.	Potential socio-economic profitability
		11.3.	Legal status and ownership
	12. Vulnerability	12.1.	Vulnerability of the asset
		12.2.	Vulnerability of the system
		12.3.	Intrinsic vulnerability or fragility
BONUS INDICATORS			
Bonus indicators	Bonuses according to the asset's characteristics	Bonus indicators assess the presence of particular attributes (namely, aspects that are unusual but have an extraordinary value) for each type of asset evaluated. They provide additional significance to a particular asset and, therefore, their absence does not detract from the final score.	
COMPLEMENTARY ACTIONS			
Participation of social agents	Panel of experts Panel of local experts: (local and supra-municipal) government technicians, and also local specialists Likert Scale Questionnaire Round table		

Source: Hermosilla and Mayordomo (2017)

The category called "intrinsic values" is made up of the criteria of representativeness, authenticity and integrity. It takes into account characteristics of the hydraulic asset itself and its significance with respect to other assets of the same kind. Representativeness puts a value on the construction's attributes and their relationship with the general characteristics of assets of the same kind. Authenticity is the degree to which the asset, its associated irrigation and/or storage system and its environs conserve their original appearance. Integrity consists of the state of preservation and extent to which the asset and its system still work today.

"Heritage values" include the cultural and environmental characteristics that determine and influence the asset's own particularities. This category includes water culture, historical-social, technological, artistic, territorial and hydraulic criteria. Water culture takes into account the qualitative importance concerned with the specific contexts of water at different territorial levels. The historical-social criterion identifies the historical value these hydraulic assets are deemed to have for a specific period and society. The technology indicator is based on specific techniques used in building the asset, the levelling techniques (skill in maintaining the gravity-fed water level) and the system's hydraulic engineering. The territorial criterion refers to the interaction between the hydraulic construction and the scenic factor of its location. The hydraulic aspect concerns the existence of an exemplary irrigation system in the territory of significant importance as regards the area it irrigates.

The "potential and feasibility values"—which include the criteria of awareness of social agents, potentiality and vulnerability— assess possible future scenarios for the asset for it to be renovated and appreciated. The first of these refers to the level of social agents' involvement in protecting and disseminating the hydraulic heritage assets by investing in their conservation and drawing up tourist and cultural routes. Potentiality is linked to the ease in implementing activity to recuperate the assets and their systems, and to regain appreciation of them, as well as the socio-economic profitability generated by such activity. Vulnerability takes into account possible natural or anthropic threats and the fragility of the asset due to its own characteristics.

The method takes into account a specific consideration for each type, evaluating the presence of certain unique aspects of the hydraulic constructions. These characteristics give the asset added value, such that if they are missing then the global score does not fall. For diversion dams, bonus indicators are given when they have one of the following characteristics: a length of over 100 metres; a ramp specifically for fish and invertebrates to be able to overcome the obstacle; drains to withdraw muddy deposits; and the construction of sandpits to catch and remove earth.

The method includes the possibility of carrying out complementary activities based on participation of social agents. These qualitative techniques encourage participative strategies of governance and may be decisive in the future management of these assets (Rodríguez-Darias *et al.*, 2016). They use of a panel of experts with different local specialists as well as surveys carried out among the local populace. The latter have not been carried out due to their complexity and the time limits for implementing them. The panel of experts includes specialists in the hydraulic heritage in each of the areas analysed. Local politicians, municipal and supra-municipal technicians from the government, members of the irrigation communities, university experts and technicians from the CHJ were called upon. This technique is divided into two parts: in the first one, each expert fills in a questionnaire about the hydraulic heritage being analysed, while the second one involves a round table of the attendees, which addresses the main problems affecting each of the participating groups.

The questionnaire uses a Likert scale measuring technique, adding up each scale cumulatively. It is based on 36 items that are established corresponding to each one of the variables in this method. They measure the specialists' favourable or unfavourable opinion or attitude regarding the assets analysed. The experts reply to each statement with five levels of response: completely agree (2 points), agree (1 point), indifferent or undecided (0 points), disagree (-1 point) and completely disagree (-2 points). The score from each person is determined by the sum of their replies given to each item. It varies from -72 points to 72 points. The numbers obtained are ordinal, so intervals of equal distances between the resulting scores should not be established. Furthermore, the five alternatives can be combined into two categories (favourable and unfavourable) for comparison with the technical evaluation.

4. RESULTS

One of the advantages of this work lies in putting into practice the applicable methodological system for the 93 diversion dams studied. Firstly, the technical assessment carried out is studied, with the results obtained for the different categories and criteria, as well as the bonus indicators for certain assets. Secondly, we look in detail at the different panel discussions held in the areas studied.

4.1 Technical evaluation

The heritage evaluation applied in each of the diversion dams is shown in Figure 2. The maximum score that the assets studied could reach is 3,348 points, which is the result from multiplying the number of assets (93) by the number of variables (36). However, the sum total of the scores assigned to these hydraulic constructions comes to 2,152 points, meaning an average global evaluation of 6.4 points on a scale of ten. The average scores for each area analysed vary from 5.4 points for the Ojos de Moya River to 7.6 points for the Magro River. As regards the level of operability, 61.3% of the assets are still in use, whereas the rest have been abandoned (34.4%) or have disappeared (4.3%). Figure 3 shows the Heritage evaluation on a map for each diversion dam in the seven zones under study.

The number of hydraulic assets in the inventory, grouped according to the evaluation levels established, can be seen in Table 2. A high or very high evaluation of above 7.1 points was reached for 46.2% of the assets catalogued, which shows there is significant water heritage. A quarter of the hydraulic constructions got scores that were low, very low or of no interest. These are diversion dams showing significant signs of deterioration and which are not in use.

Table 2. Distribution of the diversion dams according to levels of evaluation

Evaluation	No. of assets	Percentage (%)
Very high (8.6-10)	8	8.6
High (7.2-8.5)	35	37.6
Medium (5.8-7.1)	26	28.0
Low (4.4-5.7)	13	14.0
Very low (3-4.3)	5	5.4
Of no interest (<3)	6	6.4
Total	93	100

Source: The authors

The eight hydraulic constructions with the highest scores are of a significant size. They are in working order and give rise to irrigation systems of significant importance. Their state of conservation is optimal. Two of the diversion dams with the best scores are the *Presa de Moranchel* and the *Presa de los Comunes* (Figures 4 and 5).

				INTRINSIC VALUES									HERITAGE VALUES																											POTENTIAL AND FEASIBILITY VALUES															
				REPRESENTA-TIVENESS			AUTHENTICITY			INTEGRITY			WATER CULTURE			HISTORICAL AND SOCIAL VALUE			TECHNOLOGY			ARTISTIC VALUE			TERRITORIAL VALUE			HIDRAULIC VALUE			AWARENESS OF SOCIAL AGENTS			POTENTIALITY			VULNERABILITY					
No.	MUNICIPALITY	AREA*	NAME	1.1.	1.2.	1.3.	2.1.	2.2.	2.3.	3.1.	3.2.	3.3.	4.1.	4.2.	4.3.	5.1.	5.2.	5.3.	6.1.	6.2.	6.3.	7.1.	7.2.	7.3.	8.1.	8.2.	8.3.	9.1.	9.2.	9.3.	10.1.	10.2.	10.3.	11.1.	11.2.	11.3.	12.1.	12.2.	12.3.	SCORE	ASSESSMENT	No.
1	TERUEL	01	AZUD DE MOLINS DE REY	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	0	0	1	0	1	1	1	0	7.8 (28)	HIGH	1
2	TERUEL (SAN BLAS)	01	PRESA DEL CARBURO	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	1	0	1	0	0	0	7.2 (26)	HIGH	2
3	TERUEL	01	AZUD DEL MOLINO NUEVO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	0	0	0	0	0	1	0	1	1	7.5 (27)	HIGH	3
4	VILLASTAR	01	AZUD DE VILLASTAR O DE LOS HOYOS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	0	0	0	0	0	1	1	1	1	8.1 (29)	HIGH	4
5	VILLASTAR	01	AZUD DE VILLEL	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	6.7 (24)	MEDIUM	5
6	VILLEL	01	AZUD DE LAS MASADAS	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	1	0	6.1 (22)	MEDIUM	6
7	VILLEL	01	AZUD DE LA PIEZA DE LA NOGUERA O DE LIBROS	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	0	1	0	0	1	0	1	0	1	1	7.2 (26)	HIGH	7
8	LIBROS	01	AZUD DEL RAMBLAR	1	1	1	1	0	0	0	1	0	1	0	0	1	1	1	1	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	4.4 (16)	LOW	8
9	LIBROS-CASTIELFABIB	01	AZUD DEL ALMACÉN	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1	6.7 (24)	MEDIUM	9
10	ALGARRA	02	AZUD DE LA LUZ	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	0	5 (18)	LOW	10
11	CASAS DE GARCIMOLINA	02	PRESA DEL LAVADERO	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	1	0	1	1	1	1	7.5 (27)	HIGH	11
12	MOYA	02	PRESA DE LA CALDERA	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	2.2 (8)	NO INTEREST	12
13	LANDETE	02	PRESA MOLINO DE LANDETE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	1	0	0	0	0	0	1	1	0	1	7.2 (26)	HIGH	13
14	LANDETE	02	AZUD DE LA VAERA	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	6.1 (22)	MEDIUM	14
15	LANDETE	02	PRESA DEL MOLINO DE MIJARES	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0	5.3 (19)	LOW	15
16	GARABALLA	02	PRESA DE LA COBAÑERA	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8 (3)	NO INTEREST	16
17	GARABALLA	02	AZUD DE LA C.R. DE GARABALLA O TOMA DEL ARMAJAL	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	0	6.4 (23)	MEDIUM	17
18	GARABALLA	02	PRESA DEL MOLINO RIVES	1	0	1	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	0	1	0	1	0	1	1	0	0	0	0	0	1	1	1	0	1	1	6.4 (23)	MEDIUM	18
19	GARABALLA	02	PRESAS DE LA HOZ	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	7.2 (26)	HIGH	19
20	GARABALLA	02	AZUD DEL GALENO	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	1	0	1	1	1	0	7.5 (27)	HIGH	20
21	GARABALLA	02	PRESA DEL MOLINILLO O MOLINO DEL VADO	1	0	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0	0	1	1	1	0	0	1	6.4 (23)	MEDIUM	21
22	MIRA	02	PRESA DEL MOLINO DE PEÑA CARRO	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	1	0	5.3 (19)	LOW	22
23	MIRA	02	AZUD DE LA PRESA VIEJA	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	1	0	1	1	1	0	7.5 (27)	HIGH	23
24	MIRA	02	PRESA DEL MOLINO DE LA TÍA CAROLINA	1	0	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	1	0	0	0	0	1	1	0	0	1	1	0	0	1	0	1	1	0	1	5.8 (21)	MEDIUM	24
25	MIRA	02	PRESA DEL MOLINO DE LA TÍA VICENTA	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.4 (5)	NO INTEREST	25
26	MIRA	02	PRESA DEL MOLINO DEL TÍO JULIÁN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	0	0	1	0	1	0	0	1	7.8 (28)	HIGH	26
27	MIRA	02	PRESA DE LAS HOCES	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	3.1 (11)	VERY LOW	27
28	MIRA	02	PRESA DE LA HUERTA DE DON EMILIO	1	0	1	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	3.6 (13)	VERY LOW	28
29	MIRA	02	PRESA DE CAÑAVEDIJA	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	5 (18)	LOW	29
30	TERESA	03	AZUD DE LA ACEQUIA PEQUEÑA	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1	7.2 (26)	HIGH	30
31	VIVER	03	AZUD DE LAS QUINCHAS	1	0	1	1	0	0	1	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	1	0	0	0	0	0	1	0	1	0	5.3 (19)	LOW	31
32	SONEJA	03	AZUD DEL MOLINO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	8.9 (32)	VERY HIGH	32
33	SONEJA	03	AZUD DE LA HUERTA NUEVA	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	1	1	1	1	6.1 (22)	MEDIUM	33
34	SOT DE FERRER	03	AZUD DE LA ACEQUIA MADRE DE SOT DE FERRER	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1	7.8 (28)	HIGH	34
35	SOT DE FERRER	03	AZUD DE LA ACEQUIA VIEJA DE SOT	1	0	1	1	0	0	1	0	0	1	0	1	1	1	1	1	0	1	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	4.4 (16)	LOW	35
36	CAUDETE DE LAS FUENTES	04	AZUD DE LA PRESA	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	0	0	0	1	0	1	0	0	1	6.7 (24)	MEDIUM	36
37	UTIEL	04	PRESA VIEJA	1	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	0	1	1	0	1	7.8 (28)	HIGH	37
38	UTIEL	04	PRESA NUEVA	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1	1	1	8.6 (31)	VERY HIGH	38
39	REQUENA (BARRIO DE LOS TUNOS)	04	LA PRESILLA O LOS TORNOS	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	0	1	0	1	0	7.2 (26)	HIGH	39
40	REQUENA (SAN ANTONIO)	04	PRESA DE SAN ANTONIO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	1	1	8.6 (31)	VERY HIGH	40
41	REQUENA (EL PONTÓN)	04	PRESA DEL PONTÓN	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	1	0	1	1	7.8 (28)	HIGH	41
42	REQUENA	04	PRESA DEL RÍO MAGRO	1	1	1	1	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	1	7.5 (27)	HIGH	42
43	REQUENA	04	AZUD DEL MOLINO DEL ATRAFAL	1	0	1	1	0	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	1	0	0	1	6.1 (22)	MEDIUM	43
44	REQUENA (HORTUNAS)	04	PRESA DE LA ACEQUIA DE HORTUNAS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	1	0	1	1	8.1 (29)	HIGH	44
45	ALARCÓN	05	PRESA DE HENCHIDEROS	1	1	0	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	0	1	1	1	1	0	1	7.2 (26)	HIGH	45
46	EL PICAZO-VILLANUEVA DE LA JARA	05	AZUD DE EL PICAZO	1	1	0	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	0	1	0	0	0	6.1 (22)	MEDIUM	46
47	SISANTE-ALARCÓN	05	EL CONCEJO	1	1	0	1	0	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	3.3 (12)	VERY LOW	47
48	CASAS DE BENÍTEZ-ALARCÓN	05	LA LOSA	1	1	0	1	1	1	1	0	0	1	0	1	1	1	1	1	1	0	1	0	0	1	1	1	0	0	1	1	0	0	1	1	1	1	1	1	6.9 (25)	MEDIUM	48
49	SISANTE-ALARCÓN	05	PRESA DE LOS NUEVOS	1	1	1	1	1	1	1	0	0	0	0	1	1	0	1	1	1	0	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	7.2 (26)	HIGH	49
50	VILLALGORDO DEL JÚCAR-SISANTE	05	PRESA DE BATANEJOS	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	0	1	1	1	1	8.1 (29)	HIGH	50

Figure 2. Technical heritage evaluation of the 93 diversion dams analysed. Source: The authors.

				INTRINSIC VALUES									HERITAGE VALUES																		POTENTIAL AND FEASIBILITY VALUES											
				REPRESENTA-TIVENESS			AUTHENTICITY			INTEGRITY			WATER CULTURE			HISTORICAL AND SOCIAL VALUE			TECHNOLOGY			ARTISTIC VALUE			TERRITORIAL VALUE			HIDRAULIC VALUE			AWARENESS OF SOCIAL AGENTS			POTENTIALITY			VULNERABILITY					
No.	MUNICIPALITY	AREA*	NAME	1.1.	1.2.	1.3.	2.1.	2.2.	2.3.	3.1.	3.2.	3.3.	4.1.	4.2.	4.3.	5.1.	5.2.	5.3.	6.1.	6.2.	6.3.	7.1.	7.2.	7.3.	8.1.	8.2.	8.3.	9.1.	9.2.	9.3.	10.1.	10.2.	10.3.	11.1.	11.2.	11.3.	12.1.	12.2.	12.3.	SCORE	ASSESSMENT	No.
51	CASAS DE BENÍTEZ-VILLALGORDO DEL JÚCAR	05	PRESA DE GOSÁLVEZ	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	8.3 (30)	HIGH	51
52	FUENSANTA-TARAZONA DE LA MANCHA	05	PRESA DE LA MANCHEGA	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	1	1	6.1 (22)	MEDIUM	52
53	TARAZONA DE LA MANCHA-LA RODA	05	PRESA DEL CARRASCO	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1	1	1	1	1	0	0	1	1	1	0	0	1	0	0	0	1	1	0	1	0	1	6.1 (22)	MEDIUM	53
54	ALBACETE-TARAZONA DE LA MANCHA	05	PRESA DE LA MARMOTA	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	0	1	1	1	1	0	1	6.9 (25)	MEDIUM	54
55	ALBACETE-TARAZONA DE LA MANCHA	05	PRESA DE LOS PONTONES	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2.8 (10)	NO INTEREST	55
56	ALBACETE-MOTILLEJA	05	PRESA DEL TORCÍO	1	1	1	1	0	1	1	0	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	0	0	0	1	1	6.4 (23)	MEDIUM	56
57	ALBACETE-MAHORA	05	PRESA DE LOS FRAILES	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3.1 (11)	VERY LOW	57
58	MAHORA-VALDEGANGA	05	PRESA DE BOLINCHES	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	8.1 (29)	HIGH	58
59	VALDEGANGA	05	PRESA DE HENCHIDEROS	1	0	0	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0	4.2 (15)	VERY LOW	59
60	VALDEGANGA-JORQUERA	05	PRESA DE MORANCHEL	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	8.9 (32)	VERY HIGH	60
61	VALDEGANGA-JORQUERA	05	EL PRESÓN	0	1	1	1	0	0	1	0	0	1	1	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	4.7 (17)	LOW	61
62	JORQUERA	05	PRESA DE ALCOZAREJOS	0	1	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2.8 (10)	NO INTEREST	62
63	JORQUERA	05	PRESA DE LA VILLA	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	7.2 (26)	HIGH	63
64	JORQUERA	05	PRESA DE LOS DORNAJOS	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	8.9 (32)	VERY HIGH	64
65	AYORA	06	PRESA DE LAS CUEVAS DE POLOPE O DEL CRUCE DEL PINO VERDE	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	0	1	0	1	6.7 (24)	MEDIUM	65
66	TERESA DE COFRENTES	06	PRESA DEL RECONQUE	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	6.1 (22)	MEDIUM	66
67	TERESA DE COFRENTES	06	PRESA DEL MACIL	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	6.7 (24)	MEDIUM	67
68	ZARRA	06	PRESA DEL CANAL DE LA HOZ	1	0	1	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	0	1	0	0	5.6 (20)	LOW	68
69	ZARRA	06	PRESA DE LOS COMUNES	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	8.9 (32)	VERY HIGH	69
70	ZARRA	06	PRESA DEL RENTÓN	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	1	0	1	1	0	0	7.2 (26)	HIGH	70
71	ZARRA	06	PRESA DE LA ACEQUIA MADRE	0	1	1	1	0	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	1	1	1	0	5.8 (21)	MEDIUM	71
72	ZARRA	06	PRESA DE LA ARBOLEJA DE ARRIBA	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	8.1 (29)	HIGH	72
73	TERESA DE COFRENTES	06	PRESA DE LA ARBOLEJA DE ABAJO	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	1	7.8 (28)	HIGH	73
74	TERESA DE COFRENTES	06	PRESA DE LAS TORCAS	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	1	1	0	1	1	7.8 (28)	HIGH	74
75	JARAFUEL	06	PRESA DE VELILLA	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0	1	0	0	0	1	0	1	1	1	1	7.5 (27)	HIGH	75
76	JARAFUEL	06	PRESA DE CAL Y CANTO O DE LOS JALANCINOS	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	1	0	1	1	6.1 (22)	MEDIUM	76
77	JARAFUEL	06	PRESA DE LA RINCONÁ	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	1	1	1	1	6.4 (23)	MEDIUM	77
78	JALANCE	06	PRESA DEL REGAJO	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	1	1	0	1	1	0	7.8 (28)	HIGH	78
79	JALANCE	06	PRESA DE LA OLIVERIQUIA	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	1	1	1	8.1 (29)	HIGH	79
80	JALANCE	06	PRESA DE BÚCAR	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	5.6 (20)	LOW	80
81	JALANCE	06	PRESA DEL HOYO	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	1	1	1	6.4 (23)	LOW	81
82	JALANCE	06	PRESA DEL CARCHE O DE LA RAMBLA	0	1	1	1	0	0	1	1	1	1	0	0	0	1	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	5 (18)	MEDIUM	82
83	BOCAIRENT	07	ASSUT DE ELS BRULLS	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	2.8 (10)	NO INTEREST	83
84	BOCAIRENT	07	ASSUT DE LA BORRERA	0	1	1	1	0	0	0	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	0	0	0	0	1	0	1	1	1	1	0	0	5.6 (20)	LOW	84
85	BOCAIRENT	07	ASSUT DE LA TOSCA O DEL REG MAJOR	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	0	8.6 (31)	VERY HIGH	85
86	BANYERES DE MARIOLA	07	ASSUT DEL MOLÍ DE L'OMBRIA O DE LA FONT DEL SAPO	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0	0	7.2 (26)	HIGH	86
87	BANYERES DE MARIOLA	07	ASSUT PRIMER DEL MOLÍ SERRELLA	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	8.1 (29)	HIGH	87
88	BANYERES DE MARIOLA	07	ASSUT SEGON DEL MOLÍ SERRELLA	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	8.3 (30)	HIGH	88
89	BANYERES DE MARIOLA	07	ASSUT DEL MOLÍ SOL	0	1	1	1	0	1	0	0	0	1	0	0	1	1	1	1	0	1	0	1	1	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	6.1 (22)	MEDIUM	89
90	BANYERES DE MARIOLA	07	ASSUT CAMP D'ORO	1	1	1	1	1	0	1	0	0	1	0	0	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	1	0	1	6.1 (22)	MEDIUM	90
91	BANYERES DE MARIOLA	07	ASSUT DEL MOLÍ SANZ	1	1	1	1	1	0	1	0	0	1	0	0	1	1	1	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	1	0	1	1	0	1	5.3 (19)	LOW	91
92	BANYERES DE MARIOLA	07	ASSUT DE LA SÉQUIA MAJOR DE BENEIXAMA	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	8.6 (31)	VERY HIGH	92
93	BENEIXAMA	07	ASSUT DE LA SÉQUIA DE LA FOIA	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	0	1	1	0	1	1	0	1	7.2 (26)	HIGH	93
TOTAL VARIABLES				72	71	84	69	47	60	73	57	52	86	53	59	85	84	93	91	73	86	56	57	42	70	52	86	46	28	58	18	12	13	59	26	74	51	52	57	2.152	MEDIUM	
AVERAGE VARIABLES				7,7	7,6	9,0	7,4	5,1	6,5	7,8	6,1	5,6	9,2	5,7	6,3	9,1	9,0	10	9,8	7,8	9,2	6,0	6,1	4,5	7,5	5,6	9,2	4,9	3,0	6,2	1,9	1,3	1,4	6,3	2,8	8,0	5,5	5,6	6,1	6,4		
AVERAGE CRITERIA				8.1			6.3			6.5			7.1			9.4			9.0			5.6			7.5			4.7			1.5			5.7			5.7					
AVERAGE CATEGORIES				7.0									7.2																		4.3											

*Areas: (01) Alto Turia; (02) Ojos de Moya River; (03) Alto Palancia; (04) Magro River; (05) Mid-Júcar River; (06) Ayora-Cofrentes Valley; (07) Alto Vinalopó.

Figure 2 (cont.). Technical heritage evaluation of the 93 diversion dams analysed. Source: The authors.

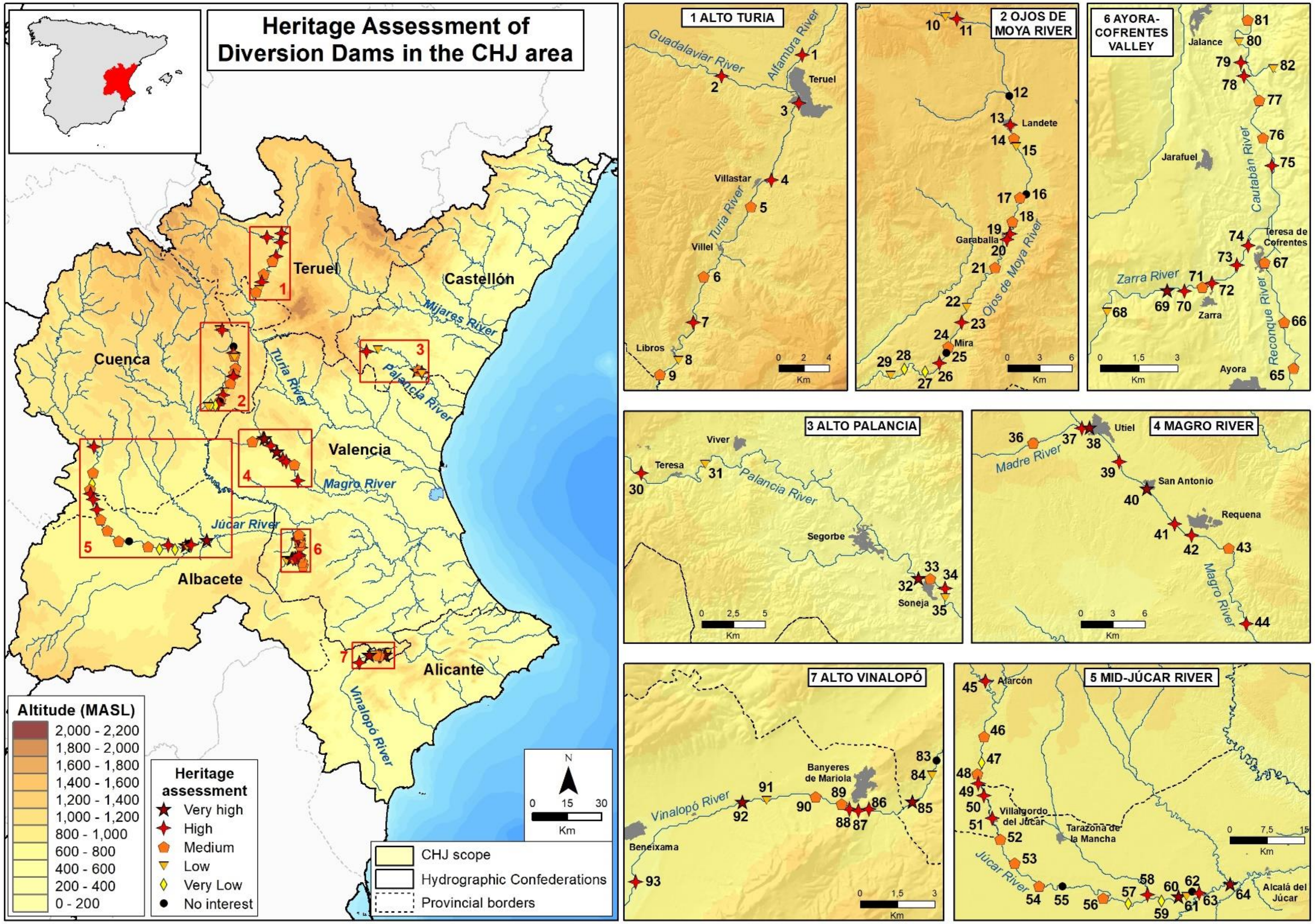

Figure 3. Global technical heritage evaluation of the 93 diversion dams analysed. Source: The authors.

Figure 4. Presa de Moranchel, Mid-Júcar River.

Figure 5. Presa de los Comunes, Ayora-Cofrentes Valley.

By analysing the scores by criteria, it is possible to study the diversion dams' characteristics and peculiarities. Table 3 shows the scores for each indicator for the 93 elements as a whole. The most highly valued criterion is the historical-social one (9.4 points), since they are assets recognised by local society that appear in numerous bibliographical and archive documents, and which in some cases are several centuries old. Technology is the criterion with the second best score (9.0 points). This values the complexity of the technique used in building the diversion dam and in designing its associated irrigation system, which necessitates maintaining a stable level of flow by levelling techniques. The criterion with the worst evaluation is the awareness of social agents, at only 1.5 points. This is due to the scarcity of public and private investment aimed at promoting water heritage, together with the lack of cultural and tourist publicity. The second worst evaluated criterion is the hydraulic one (4.7 points), since there are not many assets integrated into systems of notable interest.

Table 3. Evaluation of the assessment method criteria

Categories	Criteria	Score	Assessment
Intrinsic values	1. Representativeness	8.1	Very high
	2. Authenticity	6.3	Medium
	3. Integrity	6.5	Medium
Heritage values	4. Water culture	7.1	Medium
	5. Historical and social value	9.4	Very high
	6. Technology	9.0	Very high
	7. Artistic value	5.6	Low
	8. Territorial value	7.5	High
	9. Hydraulic value	4.7	Low
Potential and feasibility values	10. Awareness of social agents	1.5	No interest
	11. Potentiality	5.7	Low
	12. Vulnerability	5.7	Low
Average		6.4	Medium

Source: The Authors

We have identified seven diversion dams with bonus indicators out of those catalogued in the study area. Five of them, located in the Júcar River, are over 100 metres long. The longest two are the *Presa de Los Nuevos* (165 m) (Figure 6) and the *Presa de los Dornajos* (160 m.) The other two are given bonus points for having a ramp to improve river connectivity for invertebrates and fish to go upstream. These are the *Azud del Molino* and the *Azud de la Pieza de la Noguera* or *de Libros*.

Figure 6. Presa de los Comunes, Ayora-Cofrentes Valley.

4.2 The panels of experts: territorial participation

Eight panels of experts were held, one in each of the areas analysed, except for the middle course of the Júcar River, where two were held, since the sector under study is very long. This zone includes part of the provinces of Albacete and Cuenca and contains 20 diversion dams separated by a distance of approximately 125 km of river between the two at each far end. As explained above, the panel of experts involves a questionnaire that the attendees must fill in and a round table to debate the hydraulic heritage in each area.

We found a series of difficulties in implementing the participatory activities involved in the method. There was low participation in rural areas, which affected the number of questionnaires answered by experts. One paradigmatic example of this lack of reply is seen in the Júcar River area, since except for the towns of Valdeganga and Jorquera there are no traditional irrigation systems and therefore no farmers that collect the flow from the river. Most of the diversion dams are supplied by small electric power stations. Another limitation is seen in each expert's lack of knowledge about all of the diversion dams. Sometimes, the assets they identify in their municipality are only some of those that exist. In the case of agricultural farmers, they often only distinguish the diversion dam and system that irrigates their lands, while the other specialists usually know only the main water catchments or the ones nearest to the urban hub. The experts' subjectivity raises another difficulty, because sometimes they give biased replies depending on their interests. If they are in favour of conserving the diversion dams, their statements tend to be favourable regarding the asset, whereas if they aim to demolish the construction to improve the river's connectivity, their replies are negative. Due to these drawbacks, it was decided not to include statistics related to the exploitation of the data, so it has not been possible to establish conclusive results from the questionnaires given to the experts.

When the questionnaires had been answered, eight round table discussions were scheduled among the local and supra-municipal specialists. They are based on debate among the attendees and the different points of view. Thus, the experts' opinions and evaluations enable us to get valuable qualitative information about the historical irrigation systems.

Common subjects repeatedly came up in the round table discussions held. The most common problem described by the attendees is the lack of maintenance and cleaning of the riverways by the basin's organisational body (CHJ), which is responsible for doing these tasks. The profusion of reeds and canes block the diversion dams and hinder much of the flow from being diverted into the irrigation canals. The accumulation of fallen trees and undergrowth creates obstructions in the riverways, which at times of high flow increases the damage caused by flooding. Another controversy found in the debates involved opposing opinions between farmers and social groups seeking to improve the longitudinal connectivity and restore the rivers to their natural state. The farm and irrigation workers expressed their concern about the possible demolition of the irrigation diversion dams, since they are necessary to supply their lands. In the Alto Vinalopó area, not only agricultural farmers but society on the whole and the local government seem to be very involved in protecting and conserving their hydraulic heritage. In this vein, two kinds of activity are seen: the creation of a platform in defence of the diversion dams and the declaration of a route in the municipal area of Banyeres de Mariola as an Asset of Cultural Interest, which includes four diversion dams that used to supply several paper mills (Albero and Castelló, 2014). However, the groups that intend to reintegrate the riverways back to their original state are in favour of demolishing or at least adapting the diversion dams to help improve the rivers' resilience and environmental state.

4. CONCLUSIONS

The Mediterranean irrigation systems have historically been created in places with a water deficit, by creating different techniques and hydraulic constructions. They make up cultural landscapes of highly valued heritage. In order to give values to the “water heritage”, it is necessary to identify and evaluate it. By implementing a methodical system of evaluation, it is possible to create a hierarchy of hydraulic constructions according to their significance or interest in them in terms of heritage. Applying it to over 90 diversion dams located in the eastern Iberian Peninsula makes it possible to implement proposals for coherent, suitable action in order to manage and operate them. These constructions for capturing and distributing water are found in seven areas of priority interest for the CHJ, which needs them to be catalogued and evaluated in order to take action regarding river restoration.

The method enables any type of hydraulic construction to be evaluated, although in this study it has been applied solely to diversion dams. It is based on three categories that cover a total of 12 criteria, which assess general principles concerning cultural heritage. Each criterion has three variables, so that there are a total of 36 indicators. Furthermore, participatory activities are proposed to complement the methodological system, such as holding several panels of experts.

By applying the methodical system to the 93 diversion dams analysed, it has been possible to evaluate water heritage made up of a valuable hydraulic architecture with irrigation systems of undeniable cultural and scenic value. The criterion that got the highest score is the historical-social one, since these are constructions recognised by the populace with numerous written references about them. The criterion with the lowest evaluation score is the awareness of public and private social agents due to a lack of investment. Therefore, greater dissemination and education about these assets is necessary.

As for action complementary to the method, eight panels of experts were organised. The low participation in some rural areas has restricted the number of questionnaires answered. This limitation is aggravated by some specialists’ great subjectivity in giving their replies. We are aware that implementing these activities is the most fragile aspect of the assessment method. Nevertheless, we consider it to be very worthwhile to gather opinions from experts about each location’s hydraulic heritage, since they are usually truly very knowledgeable users in the territory analysed.

The method used has made it possible to carry out a practical, simple evaluation of the water heritage. The indicators are easy to understand and apply, so we consider this to be a useful system. The criteria that form the basis of the method’s system are objective, though it is true that interpretation of some variables may be questionable and the scoring system could be improved. The technical application of the method gives valid results without the need for complementary action. Nevertheless, we consider participation of social agents to be fundamental, although the results may not always be desirable. The evaluation method is an open system that may be susceptible to revision to perfect it. It enables different types of hydraulic constructions to be evaluated and can be applied in any territory. For government administrations, it is an effective tool for managing and evaluating hydraulic heritage.

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