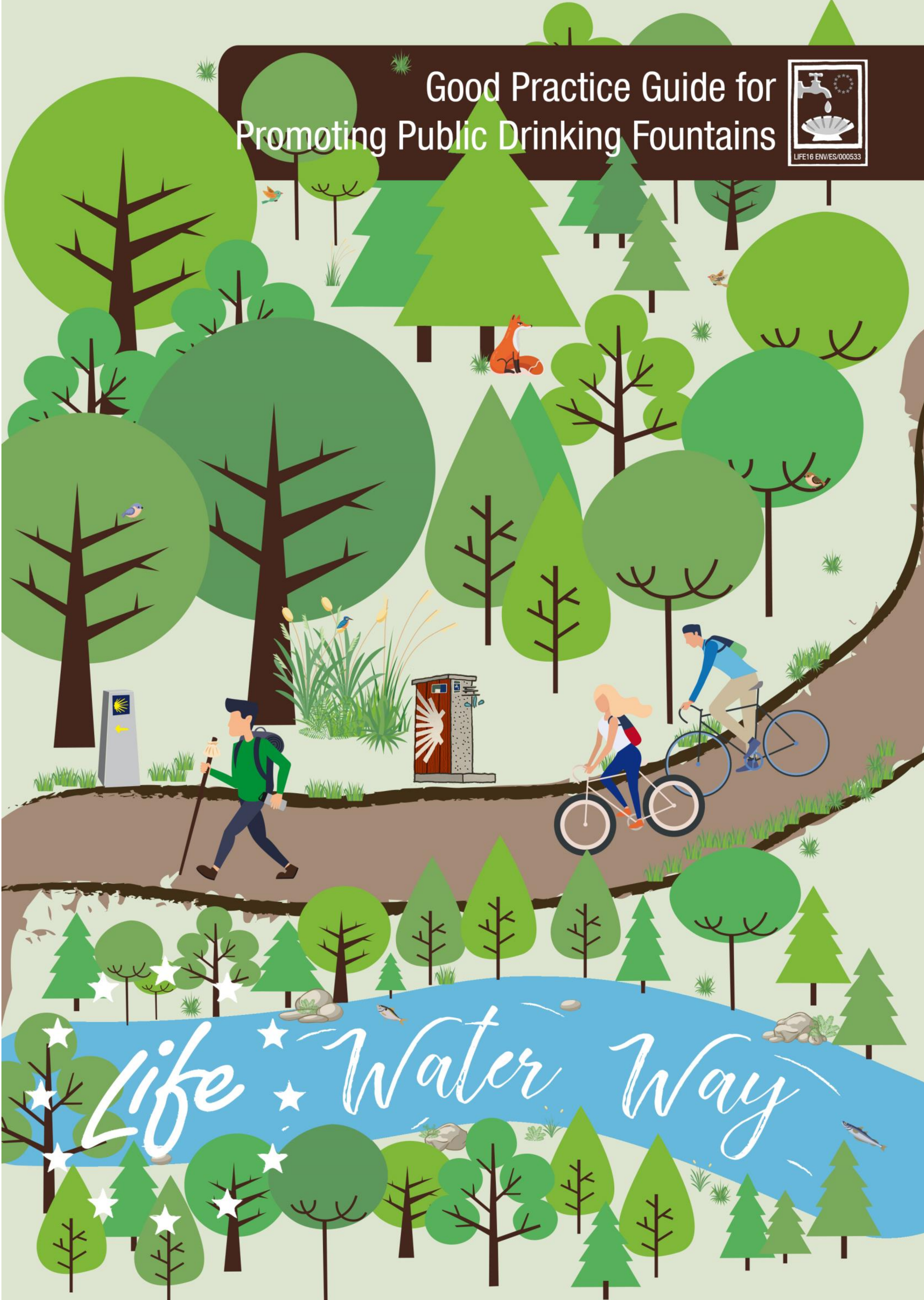
Good Practice Guide for Promoting Public Drinking Fountains

LIFE16 ENV/ES/000533



[Acronym and Project Title] LIFE16 ENV/ES/000533 WATER WAY "CREATING A NEW CONCEPT OF PUBLIC DRINKING FOUNTAINS AND TESTING THEIR VIABILITY ALONG THE "CAMINO DE SANTIAGO" (SAINT JAMES WAY)"

[Duration] From 1 July 2017 to 30 June 2021. [Website] lifewaterway.eu

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Photo courtesy of the National Federation of Group Water Schemes (the Republic of Ireland), in appreciation for their collaboration during the project.

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1 abstract

«The Life Programme is the funding instrument of the European Union for the development of environment and climate actions, with the aim of providing solutions and practical improvements to 'live well, respecting the limits of our planet'».

«The new Drinking Water Directive designs rules to offer high-quality tap water across the EU and reduce plastic waste».

«The scope of the Life Water Way project is one of the many "Saint James Ways" routes known as the English Way. This Cultural Route of the Council of Europe owes its name to pilgrims from Ireland, Great Britain and other Northern Europe countries that dock at the ports of A Coruña and Ferrol in order to reach the capital of Galicia».

« In this line of eco-innovation, the goal of the Life Water Way project is simple: to facilitate high-quality drinking water consumption along the English Way, as an example of the mitigation of the environmental impacts derived from the consumption of bottled water along European cultural and natural routes ».

«In this way, a new model of drinking fountain suitable for filling reusable bottles was designed, including an autonomous low-cost treatment prototype, in places where drinking water is not available. In addition, a pilot network was built, consisting of 28 new micro-supply points (approximately one every 6 km) from water supply networks, wells and natural springs existing along the Way, in accordance with drinking water regulations. Therefore, a pilgrim could fill a half-litre canteen on a regular basis. Furthermore, a maintenance network for cost recovery was introduced based on the online reusable bottle sales».

«Finally, the project has determined a strategy based on three tools for promoting the installation of drinking fountains in public spaces in municipalities: (1) a good practice guide, (2) a grant scheme for the financing of investment costs and (3) a quality certification to award the best drinking fountains».

2 introduction

"As the mayor of a rural community, I'm pleased to have contributed to the recovery of our natural resources, a treasure without which Galicia would not be as we know it."

José Antonio Santiso Miramontes
Mayor of Abegondo and President of the Mariñas Coruñesas e Terras do Mandeo Biosphere Reserve.

"The Life Water Way is an excellent example of cooperation among different local authorities to offer their citizens a great service."

Valentín González Formoso
President of the A Coruña Provincial Council

"Treated natural springs are the solution for micro-supplying drinking water along natural routes where it isn't possible to connect to controlled water supply networks."

Mª Teresa Guiérrez López
Director of the Public Company Augas de Galicia
Department of Infrastructure and Mobility

"The existence of water sources that are guaranteed to be healthy and drinkable encourages the consumption of tap water in outdoor activities, which is the objective of the new European Directive on the quality of water intended for human consumption.

Carmen Durán Parrondo
General Director of Public Health – Regional Health Department

"ITG has provided the technology needed to be able to remotely control and directly purify water on demand in the pilot network of drinking fountains along the English Way, promoting an efficient and healthy use of this resource.

Carlos Calvo Orosa
General Director of the Galician Technological Institute (ITG)

"Providing drinking water through public drinking fountains promotes the sustainability of the Saint James Way."

Ildefonso de la Campa Montenegro
Director of the Plan Xacobeo Management Company

3 context

In rural Galicia, which is rich in water sources, natural springs are very commonly used to provide drinking water and, even though they lack drinking water purification systems, the quality of the water is highly valued by the population. In fact, inhabitants of nearby towns also frequently go to these springs to collect water from them. These springs are also often used by visitors who hike local cultural trails and routes such as the Saint James Way.

Nevertheless, this traditional drinking water supply presents risks that are not sufficiently controlled and must be identified as "not guaranteed safe drinking water".

The Life Water Way project provides a solution for this need, creating a new model of a drinking fountain that makes it possible to supply water that is guaranteed to be safe and drinkable from underground water sources using an independent water purification system. It also has a dispensing system designed to be used exclusively to fill reusable bottles. The aim is to promote the consumption of drinking water with a low environmental impact that is, at the same time, safe and hygienic.

Furthermore, in the case that there are controlled municipal water supply networks available, the project encourages, for the sake of economic sustainability, the installation of the drinking fountains connected to these networks and with the same dispensing system.

4 objective

This good practice guide is part of the strategy to promote the retrofitting and/or installation of tap water drinking fountains in public spaces using reusable bottles.

The content of this guide is aimed at the "owners" of public drinking fountains, mainly municipalities, but also Communities of Users, as a tool that will facilitate compliance with the requirements for public drinking fountains with regards to health guarantees, accessibility and removing any discriminatory barriers to their use.

5 definitions

Aquifer
A permeable geological formation located beneath the surface that allows for the storage and circulation of water through its pores and/or cracks. In Galicia, mostly unconfined aquifers can be found, with the water table forming their upper boundary, that vary in response to rainfall, seepage and recharge. Two distinct zones can be distinguished: (1) the zone of saturation zone, which is located above the impermeable stratum and where water completely saturates the pores and cracks in the rocks, and (2) the zone of aeration or the vadose zone, located between the water table and the surface, where not all the pores are completely saturated with water.

Raw Water
Raw water is the name given to water that has not been treated in any way and is generally found in natural surface and groundwater sources and reservoirs.

Catchment
The surface and groundwater control and diversion installations needed to transfer water from the abstraction zone to the raw water pipelines.

Community of Users
Public corporations, attached to the corresponding Basin Organisation, that are established with the purpose of organising the internal management of the systems that supply more than two dwellings sharing the same concession.

Raw Water Conveyance
Any pipework that carries water from the abstraction area to the treatment area or, in its absence, to the main water tank.

Drainage Basin
The area of land for which the surface runoff flows in its entirety through a series of streams, rivers and possible lakes to the sea via a single mouth, estuary or delta. The drainage basin is considered to be indivisible from a resource management point of view.

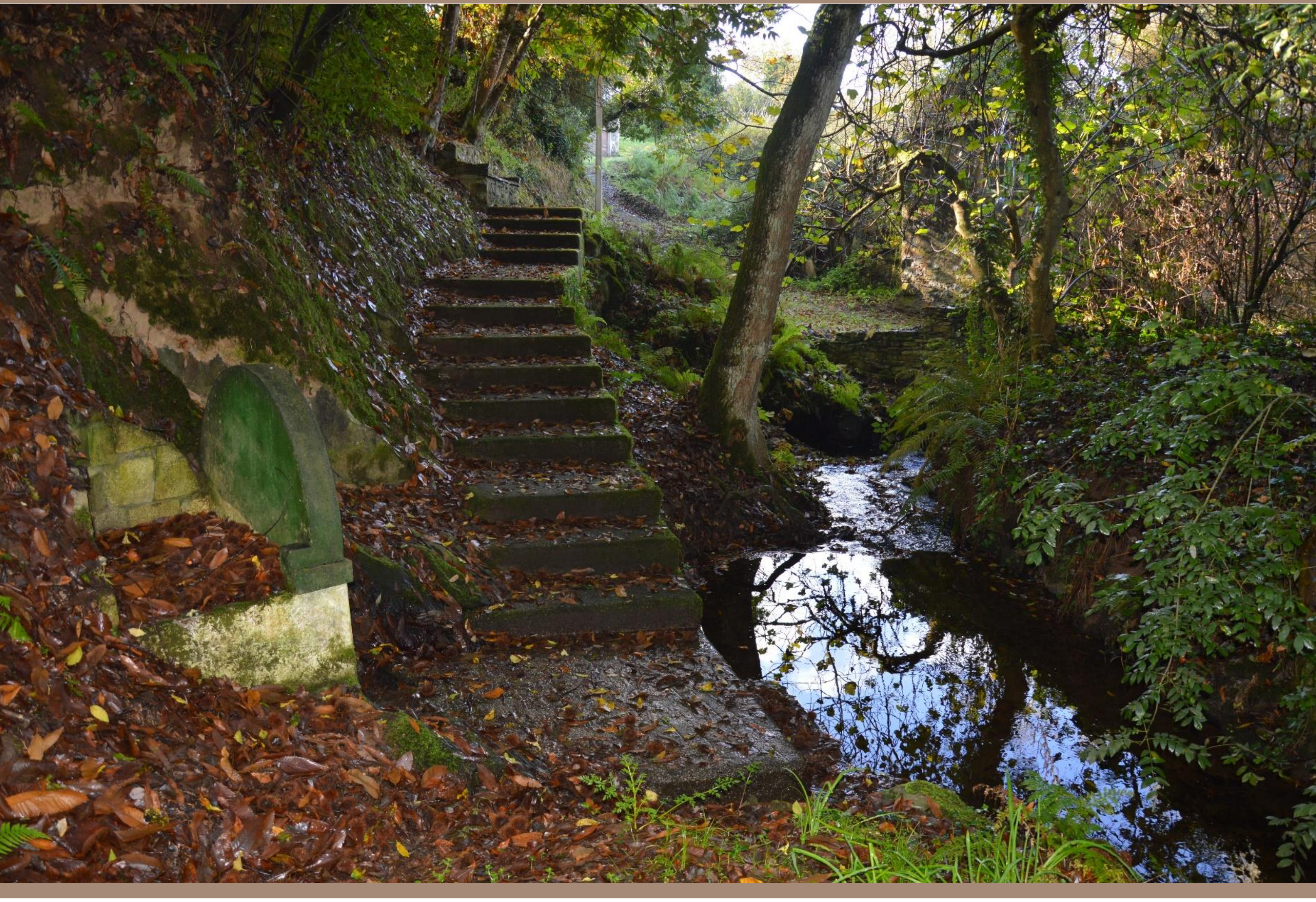
Drainage Basin Boundaries
The land and marine area consisting of one or more neighbouring drainage basins and the transitional, groundwater and coastal waters associated with these basin(s). I

Manager
The individual or public or private entity responsible for the supply, part of the supply or any activity linked to the supply of water for human consumption.

Source Protection Perimeter	Conditions on certain activities or installations that may affect the quantity or quality of the groundwater abstracted and that require a favourable report from the Basin Organisation in order to be authorised (in accordance with Article 173 of the Public Water Domain Regulations).
Self-monitoring and Management Protocol (SMP)	A document containing all the information concerning the water supply aimed at preventing or reducing the risks to which it may be subjected through the implementation of preventative measures. This document is divided into three parts: general information, risk identification and specific plans.
Distribution Network	The set of pipes and control and manoeuvring elements that allow the distribution of water from the treatment plants or reservoirs to the users' connections.
Water Registry	The public registry of water uses in which the rights to the private use of water, acquired by their holders via administrative concession or as established by a legal provision, are registered.
Independent Supply Systems	Independent uses of water that are not connected to the municipal networks where the owners are the water users themselves.
Supply Systems	The installations that connect the domestic water abstraction areas with the household connections. Depending on the type of water use registered in the water registry, a distinction can be made between municipal and independent systems.
Spanish National Drinking Water Information System (SINAC)	This is a health information system that collects data on the characteristics of the water supplies and the quality of drinking water supplied to the Spanish residents.
Treatment	The drinking water treatment plants found upstream of the distribution network and/or reservoir that are designed to ensure that the water supply meets the minimum health criteria for water for human consumption.
Parametric Value	The maximum or minimum level set for each of the parameters to be monitored.

Supply Area

A geographically defined area that is defined and registered by the health authority on the basis of a proposal from the water supply manager, or parts thereof, and cannot exceed the provincial level. In said areas, the water for human consumption comes from one or more abstraction points and the quality of the water distributed can be considered homogeneous throughout most of the year.



6 background

6.1 the new directive on water intended for human consumption

The European Commission wishes to ensure that tap water is safe to drink throughout the entire European Union.

For this purpose, the new[1] European Directive on Water Intended for Human Consumption establishes standards and health criteria for safe drinking water, keeping citizens informed and promoting the consumption of tap water to advance sustainable development goals.

The main measures proposed to the Member States to improve access to safe drinking water include the following:

- Launch informational campaigns to promote tap water as a safe and free drink[2].
- Ensure that consumers can access information regarding the quality of their drinking water.
- Ensure that drinking fountains are installed in outdoor public spaces[3].

1 Directive (EU) 2020/2184, which replaces "Directive 98/83/EC of the Council of 3 November 1998 on the quality of water intended for human consumption. Members States must transpose this Directive into national laws by 12 January 2023.

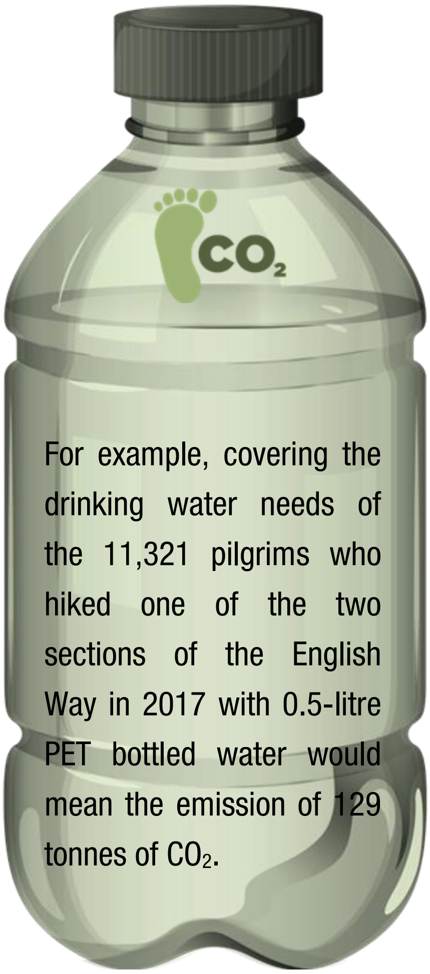
2 In the case of restaurants, canteens and food businesses, a small service fee is allowed.

3 Where technically feasible and taking into account the specific local conditions such as climate and geography.

6.2 the carbon footprint of water

Proximity consumption refers to the distance between the point of origin and the location where the product is actually used.

The goal behind making drinking water available in public spaces through the use of drinking fountains equipped to refill reusable bottles is an attempt to minimize the undeniable ecological impact. This impact is caused by the energy consumed in and the CO2 emissions resulting from the manufacturing of the plastic itself and the single-use packaging, as well as the problems caused by the waste that single-use packaging generate once they are discarded.



For example, covering the drinking water needs of the 11,321 pilgrims who hiked one of the two sections of the English Way in 2017 with 0.5-litre PET bottled water would mean the emission of 129 tonnes of CO_2.

Moreover, the benefits of consuming tap water should also include reducing the carbon footprint created by the transport and distribution of bottled water, which, in the vast majority of cases, travels a considerable distance using means of transport and fuels that have a significant environmental impact.

Choosing tap water is a form of proximity consumption that implies taking advantage of a service with a lower carbon footprint that is available in our local environment.

This amount would be equivalent to that generated by an average car travelling 1 million kilometres or going between A Coruña and Santiago (73 km) 38 times a day for a full year[4].

4 Source: Life Water Way, Action C2 “Monitoring plan for measuring the socio-economic impact of the project”. Deliverable: “Study of alternative distribution models that allow for cost recovery”.

7 legal framework and competences

7.1 legal framework

7.1.1 water use

- Royal Legislative Decree 1/2001, of 20 July, by which the revised text of the Water Act was approved.
- Royal Decree 849/1986, of 11 April, by which the Public Water Domain Regulations were approved.
- Royal Decree 817/2015, of 11 September, in which the criteria for monitoring and assessment of the status of surface waters and environmental quality standards were established.

7.1.2 quality of water intended for human consumption

- Royal Decree 140/2003, of 7 February, by which the health criteria for the quality of water intended for human consumption were established. This regulation is the transposition of Directive 98/83/EC, on the quality of water intended for human consumption, into Spanish law.

7.2 competences

The main agents and competences in the supply of water intended for human consumption in the Autonomous Community of Galicia are listed below.

7.2.1 municipalities

The current legislation grants municipalities two main competences with regards to water supply: **(1)** the Law Regulating the Basis of Local Governments (LRBRL, for its Spanish acronym)[5], which establishes that local councils must provide domestic drinking water supply services, and **(2)** the health legislation[6], which establishes municipalities as the public administration responsible[7] for ensuring that the water supplied in their territories is suitable for human consumption, including public drinking fountains.

In order to distribute drinking water, municipal water supply systems are created that must have been granted a concession from the Basin Organisations in accordance with Article 123 of the Public Water Domain Regulations (PWDR).

7.2.2 owners of independent systems

In those rural areas not connected to the municipal water supply networks, supply to households can be provided by Communities of Users, which normally have fountains available in open spaces to offer water to consumers.

As in the previous case, the owners of this type of system must have been granted a concession that has been recorded in the Water Registry of the corresponding Basin Organisation.

5 Article 26.1 of Law 7/1985, of 2 April, Regulating the Basis of Local Governments.

6 Article 4 of RD140/2003 of the Royal Decree 140/2003, of 7 February, by which the health criteria for the quality of water intended for human consumption were established.

7 Municipalities are responsible for ensuring that the water supplied in their territories through any system included in the scope of application of RD 140/2003 are suitable for human consumption. Moreover, city councils must also monitor consumers' tap water in their own supply systems as well as in the independent systems that provide service to areas in which there is no municipal water supply network.

7.2.3 managers

The managers of the water supply (either the owners themselves or companies contracted to provide this function) carry out all the activities related to treatment, maintenance and control of the water supply and ensure the health and safety conditions of the installations in order to guarantee the quality of the water intended for human consumption.

To this end, it is mandatory for each manager[8] to have a Self-monitoring and Management Protocol for their water supply.

7.2.4 provincial councils

The modification[9] of Article 26.2 of the LRBRL strengthens the role the Provincial Councils play and grants them the power to coordinate the drinking water supply, among other services, for municipalities of less than 20,000 inhabitants. In order to do this, they must have received the express consent of said municipalities.

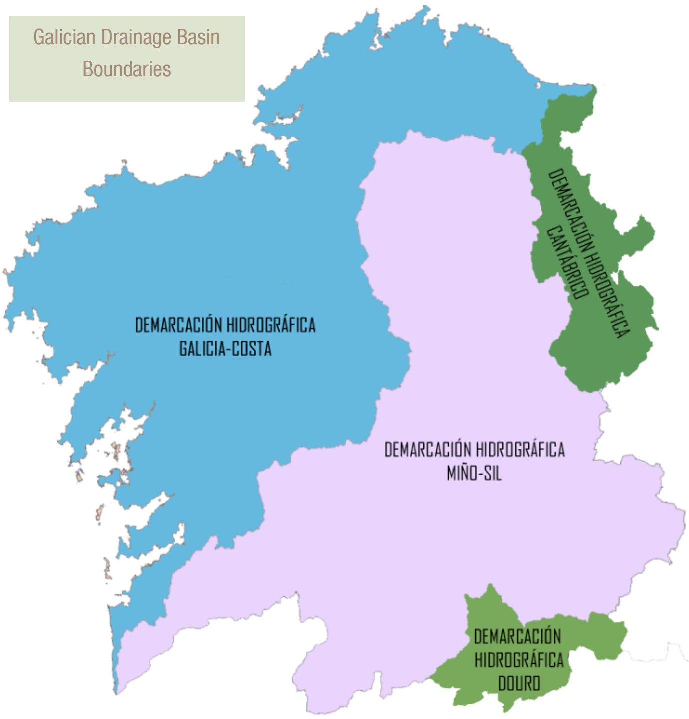
Cañás Water Treatment Plant (Carral)

8 It is worth noting that more than one manager may be responsible for a single water supply system. For example, this may occur when one company is responsible solely for the abstraction of raw water while another carries out the water treatment and distribution.

9 In accordance with Law 27/2013 on the Rationalisation and Sustainability of Local Administrations.

7.2.5 basin organisation

The basin organisations are public entities that manage the Public Water Domain (PWD)[10] within their drainage basin districts.



As seen in the illustration, there are four drainage basin districts in Galicia:

(1) One intra-community district (Galicia-Coasts), managed by *Augas de Galicia* in its role as the Autonomous Community of Galicia's Water Administration.

(2) Three districts that correspond to the inter-community basins, managed by the hydrographic confederations: Miño-Sil, Cantabrian and Duero.

The main competences of the basin organisations as regards water intended for human consumption are as follows:

- Grant concessions and authorisations for water use and its monitoring.
- Ensure that water quality in the natural environment is conserved.
- Provide information on the quality of the water intended to be used in the production of drinking water (before its abstraction).
- Determine and assess, in conjunction with the *Regional Health Department*, the presence of contaminants in water intended to be used in the production of drinking water.

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10 In accordance with Royal Legislative Decree 1/2001, of 20 July, by which the revised text of the Water Act was approved, the public water domain includes, among other assets:

- Inland Waters, both surface and groundwaters, regardless of their recharge time.
- Natural stream channels, whether continuous or discontinuous.
- The beds of lakes and lagoons and those of surface reservoirs in public watercourses.
- Underground aquifers for the purposes of making use of or affecting water resources.
- Water from the desalination of seawater.

7.2.6 the regional health department

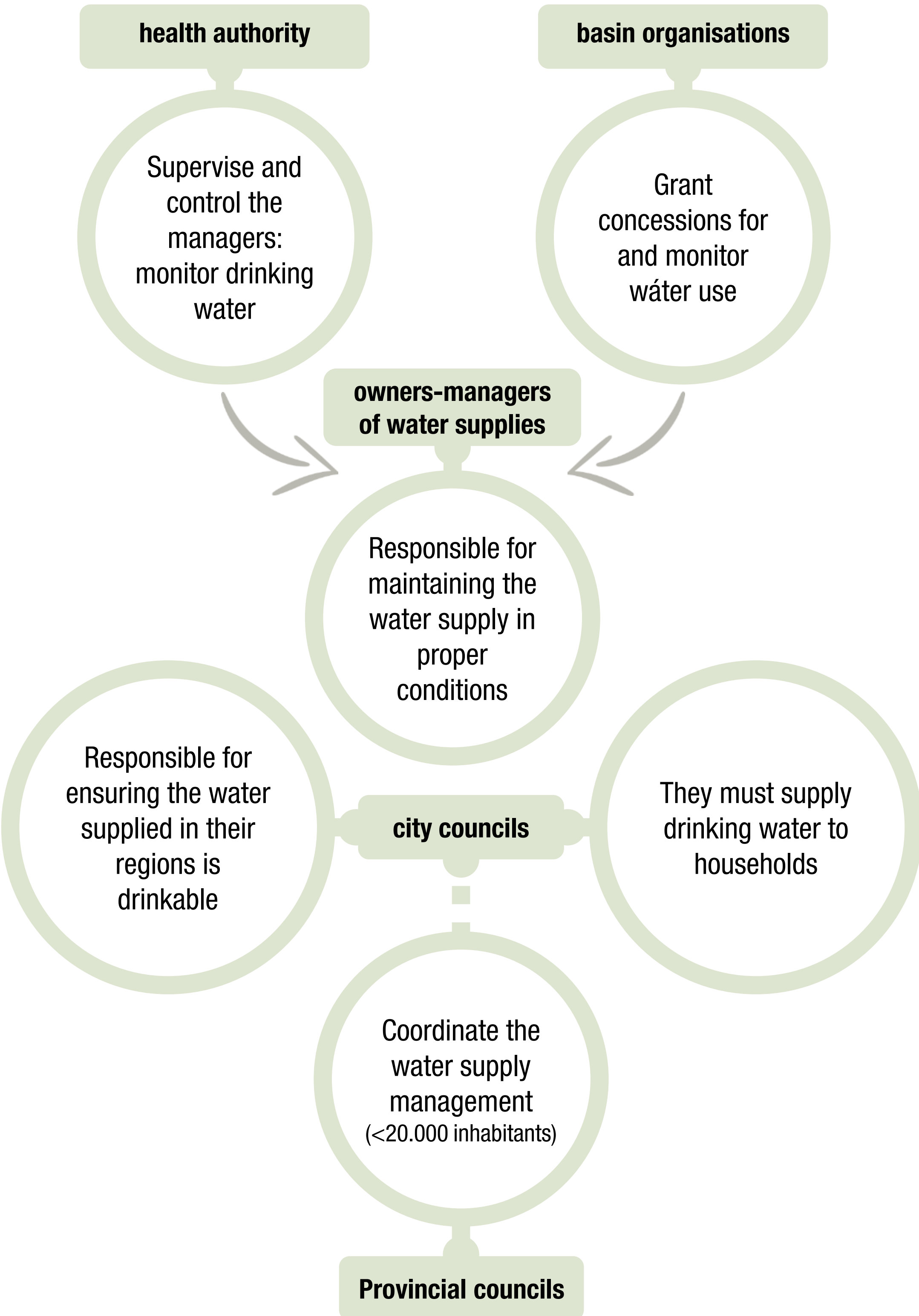
In accordance with Royal Decree 140/2003, the *Regional Health Department*, in its role as the Autonomous Community of Galicia's Health Authority, monitors and supervises the actions of the water supply managers, in accordance with the Monitoring of Water Intended for Human Consumption Programme.

The general objective of this programme is to efficiently monitor and supervise the water intended for human consumption in Galicia in order to prevent any possible risks to human health resulting from water contamination or reduce said risks as much as possible, in addition to maintaining the general population sufficiently informed.

The main competences of the *Regional Health Department* regarding water intended for human consumption are as follows:

- Supervise the performance of the Managers: monitoring drinking water in order to ensure it is safe and healthy.
- Manage the SINAC so that it includes all systems that supply more than 50 individuals and ensure that analytical bulletins are published on time.

The following diagram summarises the competences described:



8 water quality

Water composition is significantly affected by environmental characteristics, both natural and those caused by human activity. For this reason, water may contain substances and micro-organisms that could cause potential health risks. This is why **health criteria** have been established to guarantee an adequate, healthy and clean water supply.

These health criteria have been established in Royal Decree 140/2003 and are based on the determination of a set of **parameters and parametric values** that drinking water must meet at the point where it is made available to consumers.

The controlled parameters are divided into various groups:

- Microbiological and chemical parameters. Those that, if the maximum legally established limit is exceeded, could result in health problems for the population.
- Quality indicators. Parameters that indicate how efficient the water treatment processes have been and the organoleptic characteristics of the water. If these indicators exceed the legally established limit, this does not necessarily imply a risk to individuals' health.
- Finally, there are parameters related to physical characteristics such as radioactivity in water. In this instance, the legally established limits are well below levels that could result in health problems.

These values are based mainly on the recommendations of the World Health Organisation with regards to public health. In some cases, the precautionary principle is applied in order to ensure high levels of protection for the population.

The following sections list the analytical parameters that must be within the limits set by the aforementioned regulations (Royal Decree 140/2003) in order to ensure that the water is suitable for human consumption.

8.1 microbiological parameters

Untreated water normally contains a large number of micro-organisms. While most of these are harmless, others may be present that are known to cause illnesses in humans.

For this reason, raw water must be disinfected in order to eliminate these micro-organisms before it is consumed.

Microbiological contamination is expressed in CFU (Colony Forming Units) by unit volume. Normally, this figure is obtained by starting with an amount of water that is filtered, subsequently incubating the residue on a dish. After a period of time, the bacterial colonies that have developed are counted.

Bacterial growth in a Petri dish.

The microbiological parameters established in the aforementioned regulation (RD 140/2003. Annex 1 – Part A) are as follows:

PARAMETER	PARAMETRIC VALUE	UNITS
Escherichia coli	0	CFU in 100 ml
Enterococci	0	CFU in 100 ml
Clostridium perfringens (including spores)	0	CFU in 100 ml

In all three cases, the parametric value is 0 CFU/100 ml, so a positive result would indicate that the water is not suitable for human consumption.

- *Escherichia coli* (or *E. Coli*) is a micro-organism that is very commonly found in both human and animal faeces. It occurs in natural water as well as treated water that has had recent faecal contamination and where disinfection treatments have been ineffective or insufficient.
- *Enterococci*, due to their faecal origin and longer persistence in water, are used as a supplementary indicator of the effectiveness of water treatment processes.
- *Clostridium perfringens* is an anaerobic sporulating micro-organism. It is present in faeces in lower proportions than *E. coli*, although it can also come from other environmental sources. Its spores can be resistant to disinfection processes and survive in water much longer than coliforms. Its presence may mean that filtration and/or disinfection processes have not been sufficient. It may also indicate poor cleaning of water pipes or tanks. When there is a positive result for *Clostridium perfringens* and there is also a turbidity in the water higher than 5 NTU (Nephelometric Turbidity Unit), the water should be checked for *Cryptosporidium* or other parasites if the health authority considers it to be appropriate.

8.2 chemical parameters

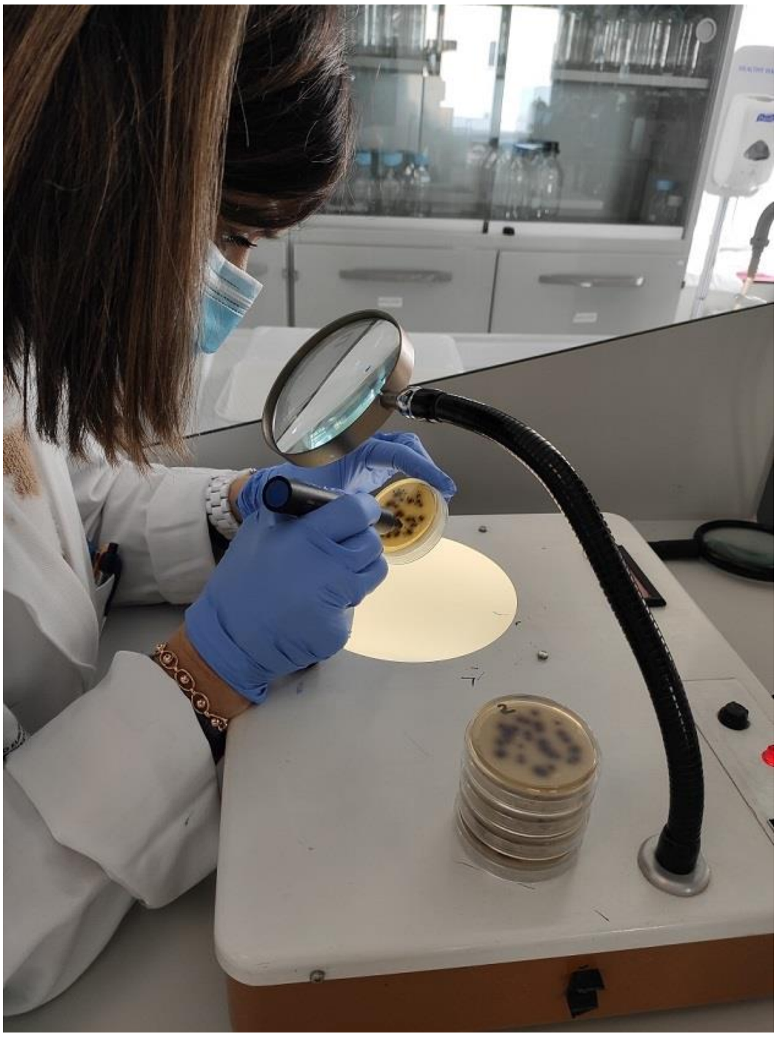
The 24 chemical parameters listed in the following table (RD 140/2003. Annex I – Part B) are considered to be basic parameters. In other words, if the concentration exceeds the parametric value, the water is automatically considered NOT SUITABLE for human consumption.

PARAMETER	PARAMETRIC VALUE	UNITS
Antimony	5	µg/l
Arsenic	10	µg/l
Benzene	1	µg/l
Benzo(α)pyrene	0.01	µg/l
Boron	1	mg/l
Bromates	10	µg/l
Cadmium	5	µg/l
Cyanide	50	µg/l
Copper	2	mg/l
Chromium	50	µg/l
1,2-Dichloroethane	3	µg/l
Fluoride	2	mg/l
Polycyclic hydrocarbons	0.10	µg/l
Mercury	1	µg/l
Microcystin	1	µg/l
Nickel	20	µg/l
Nitrate	50	mg/l
Nitrite	1	mg/l
Total pesticides	1	µg/l
Individual pesticides	0.10	µg/l
Lead	10	µg/l
Selenium	10	µg/l
Total trihalomethanes	100	µg/l
Trichloroethene +Tetrachloroethene	10	µg/l

Chemical parameters can be classified according to their nature:

- Inorganic: Antimony, Arsenic, Boron, Cadmium, Cyanide, Chromium, Fluoride, Mercury, Nitrate, Nitrite and Selenium.
- Related to materials: Copper, Nickel and Lead.
- Organic: Benzene, Benzo(a)pyrene, 1,2-dichloroethane, Polycyclic Aromatic Hydrocarbons, Microcystin and Trichloroethene + Tetrachloroethene.
- Disinfection by-products: Bromate and Trihalomethane.
- Pesticides: Total Pesticides and Individual Pesticides

The maximum concentrations allowed, or parametric values, are expressed in mg/l (milligrams of substance per litre, equivalent to ppm or parts per million) or µg/l (micrograms of substance per litre of water).



8.3 indicator parameters

The following table (RD 140/2003. Annex I – Part C) lists the 19 indicator parameters that are included in the current legislation. If the concentration exceeds the parametric value, the water may still continue to be SUITABLE for human consumption at the discretion of the Health Authority and in accordance with the values agreed upon by the various Autonomous Communities. Nevertheless, the anomaly must be corrected.

PARAMETER	PARAMETRIC VALUE	UNITS
Coliform Bacteria	0	CFU/100 ml
Colony count at 22º C	100	CFU/1 ml
Aluminium	200	µg/l
Ammonium	0.5	mg/l
Total organic carbon	No anomalous changes	mg/l
Residual combined chlorine	2	mg/l
Residual free chlorine	1	mg/l
Chloride	250	mg/l
Colour	15	mg/l Pt/Co
Conductivity	2,500	µS/cm at 20 ºC
Iron	200	µg/l
Manganese	50	µg/l
Odour	3 at 25º C	Dilution rate
Oxidability	5	mg of O2/l
pH	≥ 6.5 and ≤ 9.5	pH units
Taste	3 at 25º C	Dilution rate
Sodium	200	mg/l
Sulphate	250	mg/l
Turbidity	1 – 5	NTF

75% of the water abstracted from natural springs as part of the Life Water Way diagnostic activities was below the minimum parametric value established for pH by the health regulations.

The main reason for this is the low presence of carbonates in the schistose and granitic rocks that characterise the surrounding environment. If the soil contained carbonates, the natural acidity of rainwater due to dissolved CO_2 would be neutralized almost immediately.

Although the Galician Health Authority can accept this value within the qualification of "suitable for human consumption", selecting the appropriate materials to be installed in the catchment, treatment and dispensing infrastructures is essential due to the influence of the acidity of the water on the solubility of the metals.

8.4 radioactivity

The purpose of radioactivity analyses is to provide information on the presence of natural or artificial radioactive substances in water intended for human consumption. The following parameters must be measured (RD 140/2003. Annex X):

PARAMETER	PARAMETRIC VALUE	UNITS
Radon	500	Bq/l
Tritium	100	Bq/l
Indicative Dose (ID)	0.10	mSv

- RADON: Point 4.2 of Annex X of Royal Decree 314/2016 indicates that radon must be measured whenever the source of the water intended for human consumption is underground.
- TRITIUM: Point 4.3 of Annex X indicates that tritium must be measured whenever the water comes from surface sources and the catchment may be affected by an anthropogenic source of tritium or other artificial radionuclides in accordance with the information provided by the Spanish Nuclear Safety Council (CSN, for its Spanish acronym). For this reason, generally speaking, it is not necessary to measure for tritium in Galicia unless there is a suspicion that it is present or the CSN provides information regarding this issue.
- TOTAL INDICATIVE DOSE: Point 4.4 of Annex X indicates that in order to determine the total indicative dose (ID), the measurement of the gross alpha activity concentration levels and the gross beta activity concentration levels must be used, in accordance with a specific methodology that establishes that in the event that the result of these two measurements is less than 0.1 and 1 Bq/l, respectively, the ID can be considered to be less than or equal to 0.1 mSv/year. Therefore, in these cases, no further radiological assessment, i.e., analysis of specific natural and artificial radionuclides, would be necessary.

9 basic features of water sources

To encourage people to drink tap water in public spaces, installing drinking fountains that allow for the refilling of reusable bottles is advisable.

From among the different types, for health reasons, this guide is limited to drinking fountains with a falling water flow and a lower basin or grate for water drainage.

The need for this type of installation is based on the following aspects.

a. The lack of infrastructures for supplying drinking water in outdoor spaces and along cultural or natural routes, which are being used more and more frequently by people for sport, games, tourism or leisure activities[11].

Life Water Way Fountain in San Caetano (Santiago de Compostela)

b. In most of the existing drinking fountains, water can only be drunk directly from the fountain, and they are not designed to refill containers under conditions that meet accessibility and health criteria.

11 This outdoor activity reduces sedentary lifestyles and improves the health of the population. A clear example of this trend is the evolution of the number of pilgrims on the Saint James Way, as a sustainable tourism alternative, which went from 125,141 in 2008 to 327,378 in 2018 (an increase of more than 160% in 10 years).

c. The gradual disappearance of natural springs[12] intended for human consumption that, due to the fact that they are not treated, must be marked as water that is “not suitable” or “not guaranteed safe”.

The main aspects which must be taken into consideration in the installation of public drinking fountains that respond to the above-mentioned shortcomings are as follows:

- Justification of the need
- Type
- Treatment system
- Self-monitoring and maintenance plan
- Signposting
- Accessibility and dispenser system
- Drainage of the wastewater
- Adaptation of the area surrounding the drinking fountain

The following sections provide further information regarding the aforementioned aspects, based on the study of the solutions tested in the Life Water Way project.

12 In rural Galicia, natural springs are highly valued and used by both urban and local populations as a supply of drinking water. Nevertheless, according to the studies carried out, in practically all of these springs, the water is not suitable for human consumption because it exceeds the microbiological parameters.

9.1 justification of the need

In the past, the function of public fountains was to supply homes that were not equipped with running water. Currently, in our area, fountains continue to serve this purpose only in areas with a vulnerable population that have limited access to basic resources.

Thus, apart from other considerations, the drinking fountains included in this guide should be installed in those areas where there is a demand for drinking water for outdoor activities that are primarily related to leisure.

For this reason, in order to analyse the needs, the population that would benefit from these installations must be quantified, i.e., those who would actually use them, according to the following actions:

- Places of interest for the local population according to urban planning regulations: open spaces, green spaces, facilities or similar areas. This would include people who use playgrounds, squares, beaches, sports facilities, schools, etc., and could be estimated based on their average traffic (squares or playgrounds) or capacity (sports facilities or schools).
- Places of touristic interest: spaces included in the cultural heritage catalogues, protected natural spaces, routes and footpaths. In this case, the registers or other statistical resources that record the number of visitors may be consulted.

Most of the actions will require the installation of a single drinking fountain per space. However, the number of fountains installed could be increased if the number of potential users justifies this.

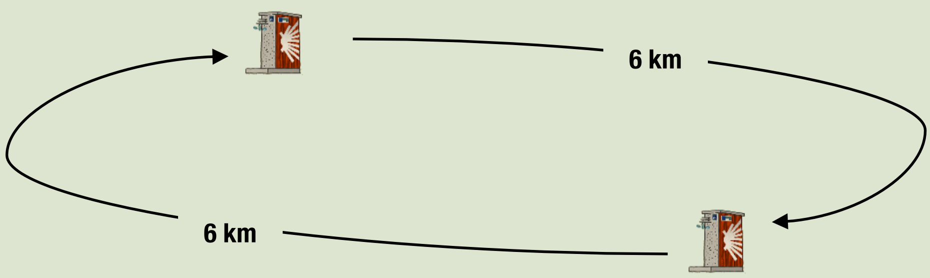
Example of multiple drinking fountains installed in Brussels Square.

As a reference, considering a flow rate of 6 litres per minute, appropriate for filling bottles and avoiding splashing, filling a 0.5-litre bottle would take 5 seconds. So, for example, the wait time would be 50 seconds in a square where it is estimated that the demand would frequently be 10 users at the same time. This wait time may be acceptable for an uncrowded children’s playground, but not in the case of a sports facility where the resting time may be limited.

In the case of trails and routes, the recommendation is to place one drinking fountain at the trailhead and then another every 6 kilometres[13].

For a 6-kilometre, circular trail, one drinking fountain would be enough. In the case of linear trail with the same distance, this would mean a distance of 6 km each way. A drinking fountain should then be placed at both the trailhead and end of the trail. Finally, on one-way routes where hikers do not return to the trailhead, such as the Saint James Way, drinking fountains should be placed every 6 km along the route.

Placement of drinking fountains along routes



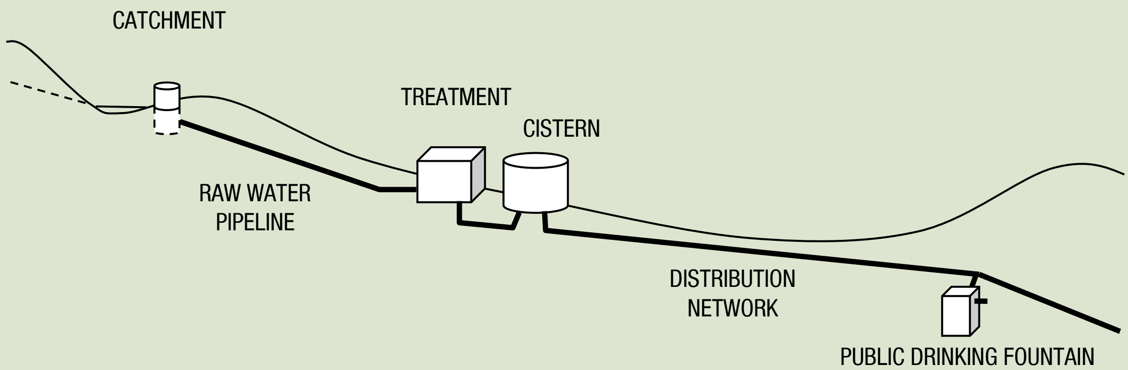
13 This length and the ½ litre correspond to the estimated distance a pilgrim can walk in one hour and their maximum water needs for that Interval.

9.2 type

The first step of the project to install public drinking fountains is to determine the availability of water. Depending on the source of the water, the *Regional Health Department* differentiates between two type of public drinking fountains:

1. Drinking fountains connected to a water supply network[14].

Fountains connected to a water supply network



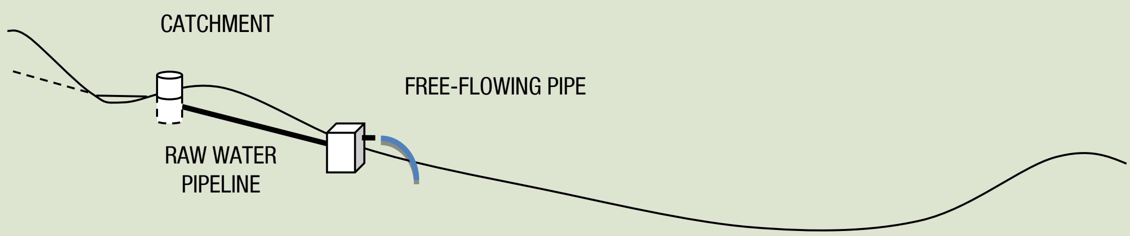
2. A natural water source is defined[15] as a catchment not used for commercial purposes and not connected to any reservoirs, cisterns or distribution networks.
   - An untreated natural water source.
   - A treated natural water source.

14 Water supply: the set of installations used to abstract, convey, store, transport and distribute water intended for human consumption to consumers' connections with the allowance and quality stipulated in this provision.

15 Article 2.6 of RD140/2003, of 7 February, by which the health criteria for water intended for human consumption are established.

Strictly speaking, a natural water source is comprised of two elements: a water catchment installation and a free-flowing pipe[16]. In some cases, there is a raw water pipeline between these two elements which is used to bring the supply point closer to the public space where the water is needed. On the other hand, there are networks of natural springs which were once used to supply water to historic towns, such as Santiago or Betanzos. The structure of these systems is similar to the previous one, but with more than one dispensing point and, in the case of the aforementioned towns, more than one catchment[17].

Untreated natural water source



However, since homes are now directly supplied with running water, the water needs covered by public drinking fountains have decreased while, at the same time, the quality and health requirements that must be met by water intended for human consumption have increased. Thus, raw water from a natural source should no longer be directly consumed and it would also not be feasible to treat all the water collected by these natural water sources.

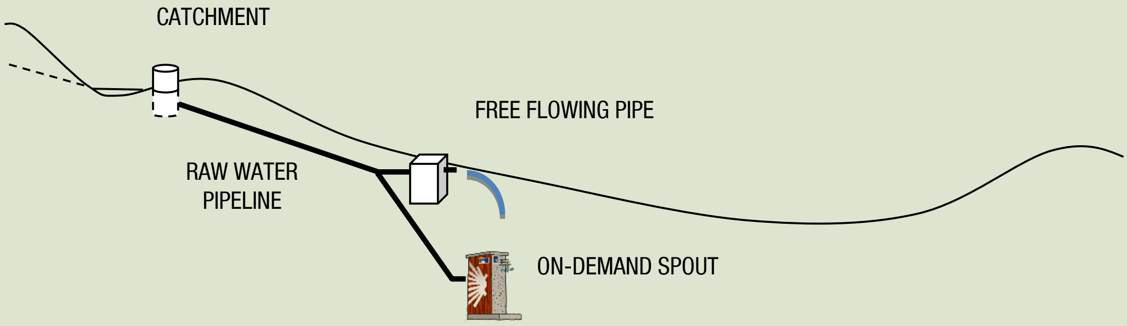
Therefore, the consumption of water that has not been monitored or treated is a health risk, and treating all water that comes from a natural water source so that it is able to be used as drinking water is an inappropriate use of resources since nearly all of the water from these sources is discharged into the environment without being used as drinking water.

16 As a general rule, water is made available at natural sources via a free-flowing pipe without the need to activate any mechanism, facilitating its collection. The reason for this is that, due to the fact that the water is untreated, it is not advisable to store the water and, rather, it should be allowed to flow freely either for use elsewhere or by channelling it into rivers and streams through a network of drains or directly through natural or constructed irrigation. The fact that the water flows freely, according to the flow provided by the spring, is positively valued by users. There are even popular sayings, which can be translated as "*a running fountain is good for people*" or "*running water doesn't kill people*".

17 The catchments were located some distance from the town centre, normally in wooded areas, as far as possible from any sources of contamination resulting from the use of land for agricultural purposes or the wastewater generated in homes. Furthermore, in the case of the springs in Betanzos and some in Santiago, water from the spring could be taken from an underground gallery.

Therefore, the system proposed for natural springs in this Guide, and that tested in the Life Water Way project, consists of treating only the water that will be consumed and allowing the remaining water to flow freely.

Treated natural water source



It should be noted that natural water sources that supply an average of less than 10 m^3 per day or fewer than 50 people are excluded from the scope of the legislation concerning water intended for human consumption.[18]. This means that for this type of fountain in our Autonomous Community only the "Drinking fountain self-monitoring and signage plan", drafted by the *Regional Health Department* for this purpose, must be complied with. This issue will be dealt with below in the section "Self-monitoring and management".

The installations covered by this good practice guide are those classified as public drinking fountains connected to a drinking water supply network ("Case A") and treated natural water sources ("Case B"), according to the diagrams provided above. These are the only two cases permitted by the Health Authority, providing that current legislation is complied with, in order to be able to mark them as being "drinking water".

18 Paragraph 2.f) of RD 140/2003 states that: "The following are excluded from the scope of this Royal Decree: all water intended for human consumption that comes from individual supplies used for domestic use or natural springs that supply an average of less than 10 m^3 per day or less than 50 people, except in those cases in which there is a perceived risk to human health derived from the quality of the water. In this case, the Health Authority will require the local administration to adopt the measures necessary to comply with the provisions of this Royal Decree for these water sources."

9.2.1 case A: public drinking fountains connected to a drinking water supply network

The best option for ensuring that water is safe for a public drinking fountain is to opt for connecting it to a controlled drinking water supply network.

The drinking fountains should be placed near the general distribution network[19], so that the length of the connection is reduced as much as possible, and terminal pipelines with little demand is avoided.

The main aspects which must be taken into account regarding the source of the water with this type of fountain is to corroborate that the water supply network to which the fountain will be connected:

- Has a Self-monitoring and Management Protocol.
- Is being monitored by the Health Department.
- The owner of the catchment in the supply area has a concession granted by the corresponding Basin Organisation.

In order to do this, it is advisable to consult the information provided by the SINAC which includes for each area:

- The supply area
- The source of the water
- The water treatment
- The available distribution networks

19 Under no circumstances should public drinking fountains be connected to irrigation networks.

9.2.2 case B: fountains connected to treated natural water sources

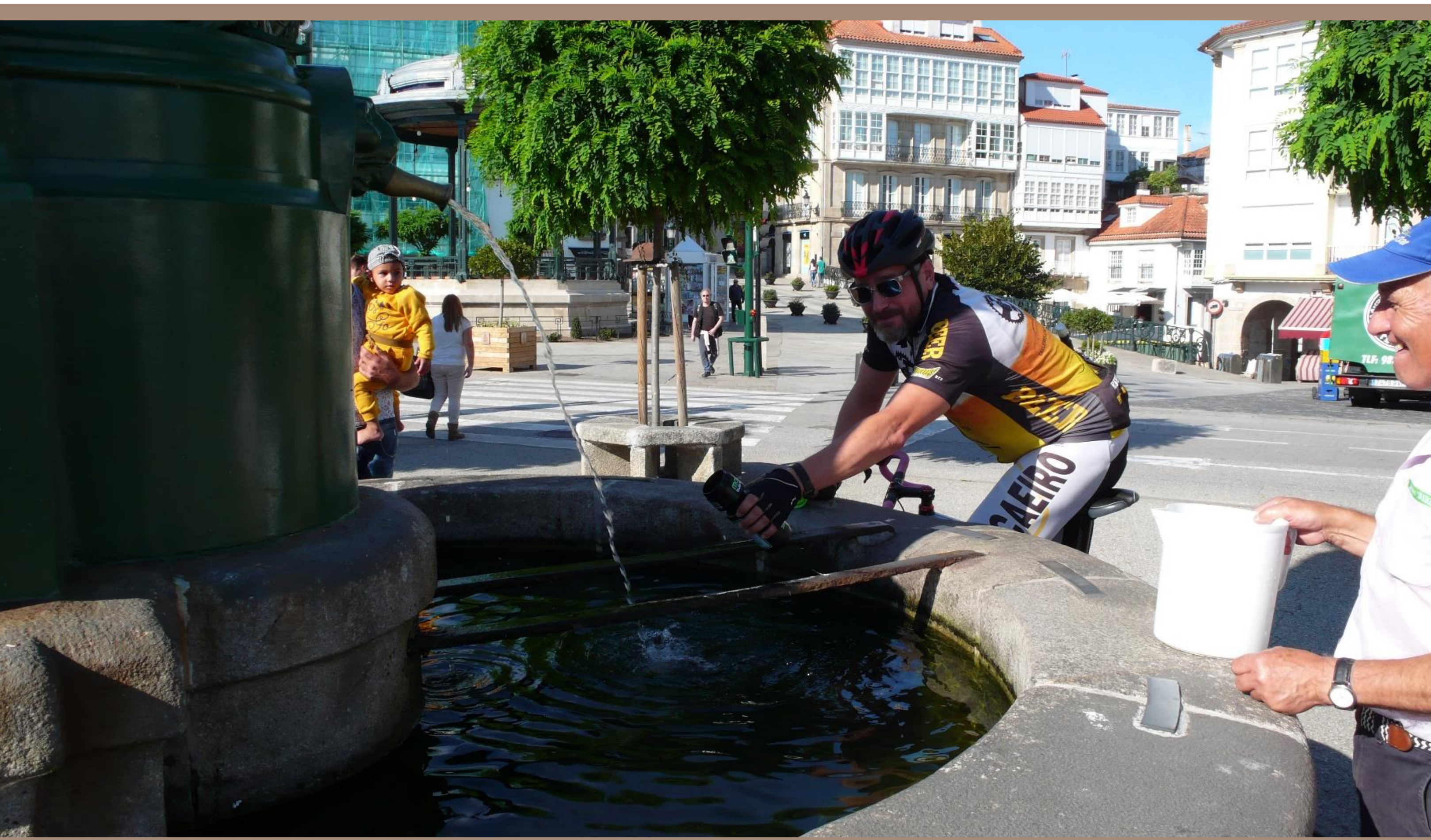
Providing fountains connected to treated natural water sources in public areas of interest is only justified if there are no controlled water supply networks in the surrounding area or, if they do exist, extending these networks is not feasible.

Additionally, installations that require the construction of new catchments are not recommended due to their elevated financial costs.

In this case, the solution is to make an inventory of the available groundwater deposits and assess their suitability as a source of water for human consumption.

Thus, once they have been located, the following must be determined with regards to these sources:

- Source of the water and type of catchment
- Risk identification and assessment
- Preventative measures



9.2.2.1 source of the water and type of catchment

The first step in assessing a catchment is to determine the actual location of the site and the way in which the water is abstracted from the aquifer. The difficulty of this task lies in the fact that most of these infrastructures are not accessible (because they are buried) and the registers are not available or cannot be located. Thus, it is sometimes not possible to verify where the water from a natural source actually comes from.

> Determining the source of the water is essential for recovering the catchments. In these cases, statements from users, neighbours or technicians who have been involved in their construction or maintenance must be relied upon.

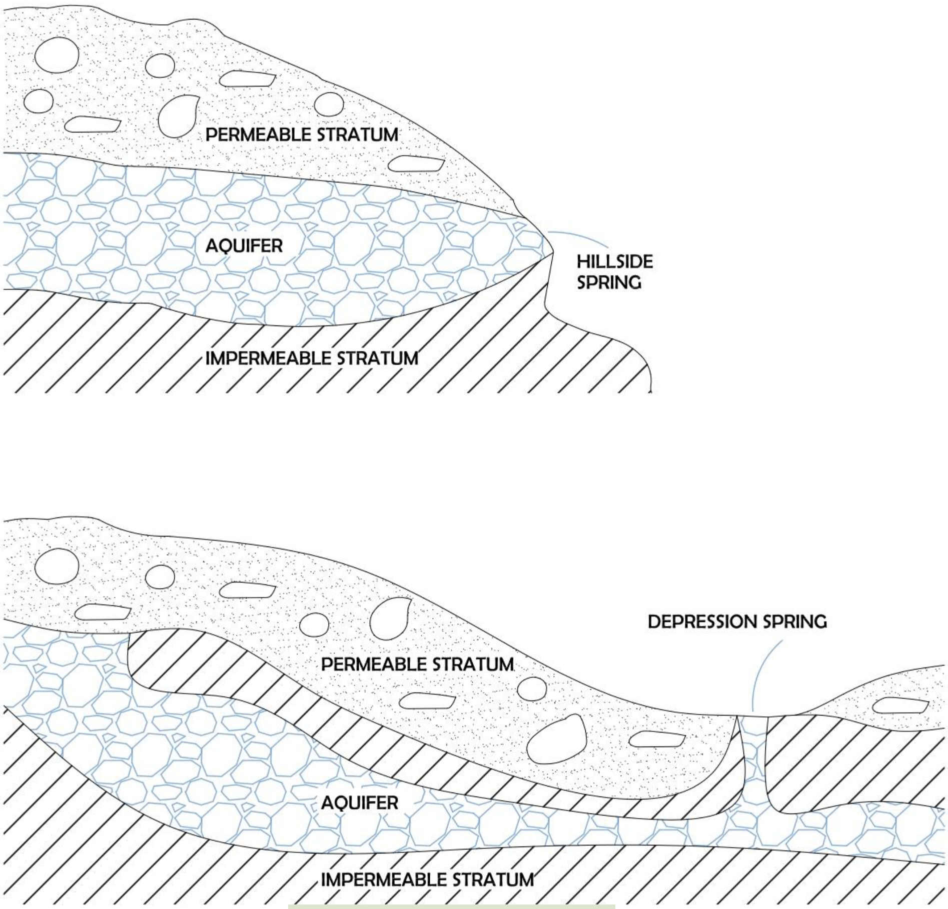
9.2.2.1.1 types of springs

A spring is a place where there is a natural discharge of groundwater that can be either temporary or permanent. Generally speaking, water infiltrates the ground, flows through permeable strata such as gravel, sand or fissured rock and emerges in areas where there are impermeable strata that prevent further penetration into the bedrock.

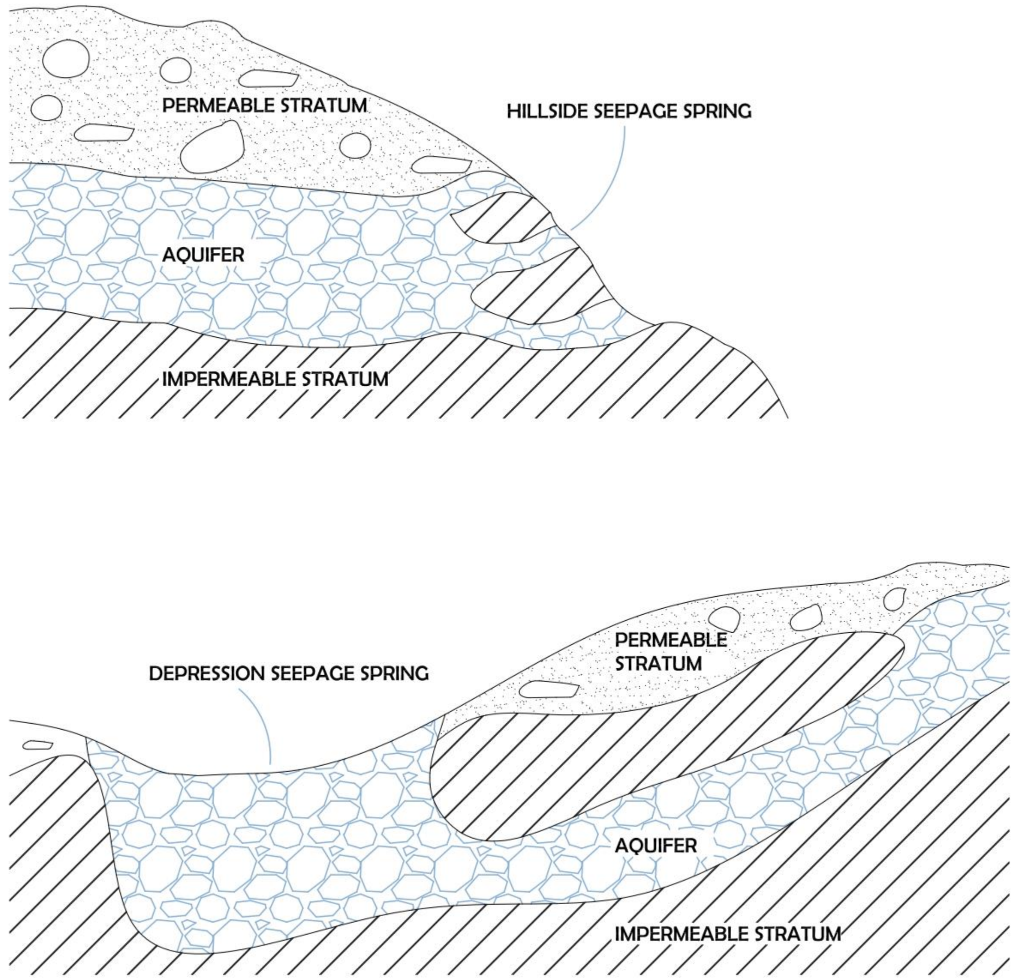
Springs can be classified according to:

- Their location:
    - Hillside: the water flows horizontally.
    - Depression: the water rises to the surface from the ground.
- And their discharge point:
    - Single point: the discharge is concentrated at one specific point or in a small area.
    - See page: the discharge occurs at several points over a larger surface area.

The following illustrations show the four resulting types of springs.



Single-point Springs



Seepage Springs

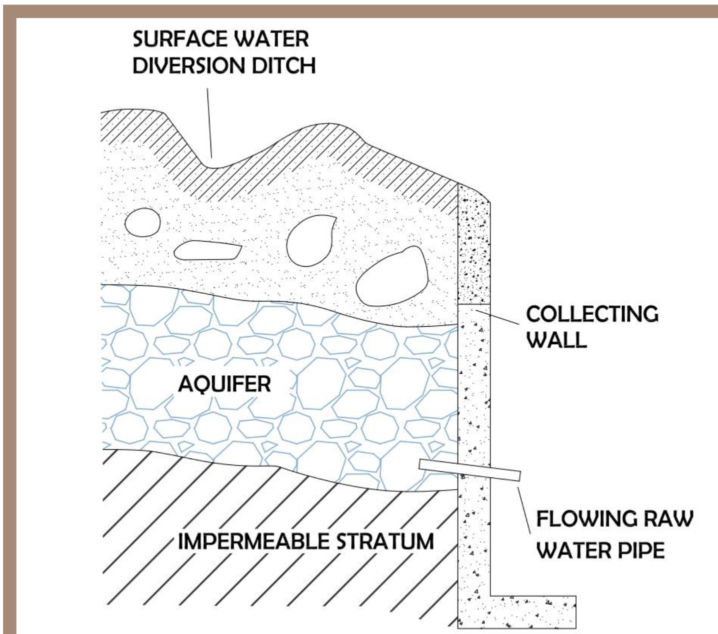
9.2.2.1.2 catchment of a single-point spring

Single-point springs are the most common type of natural spring and are usually located immediately behind the discharge pipe.

Galicia is home to many of this type of spring, which is a water resource that is simple to exploit and does not require the installation of pumping systems. This is why they have traditionally used to supply water to the population by means of simple catchment systems. Thus, in addition to natural water sources, they are still used in rural areas in autonomous community systems.

The following diagrams detail the main characteristics of the two types of catchment systems for natural springs that are used for single-point hillside springs:

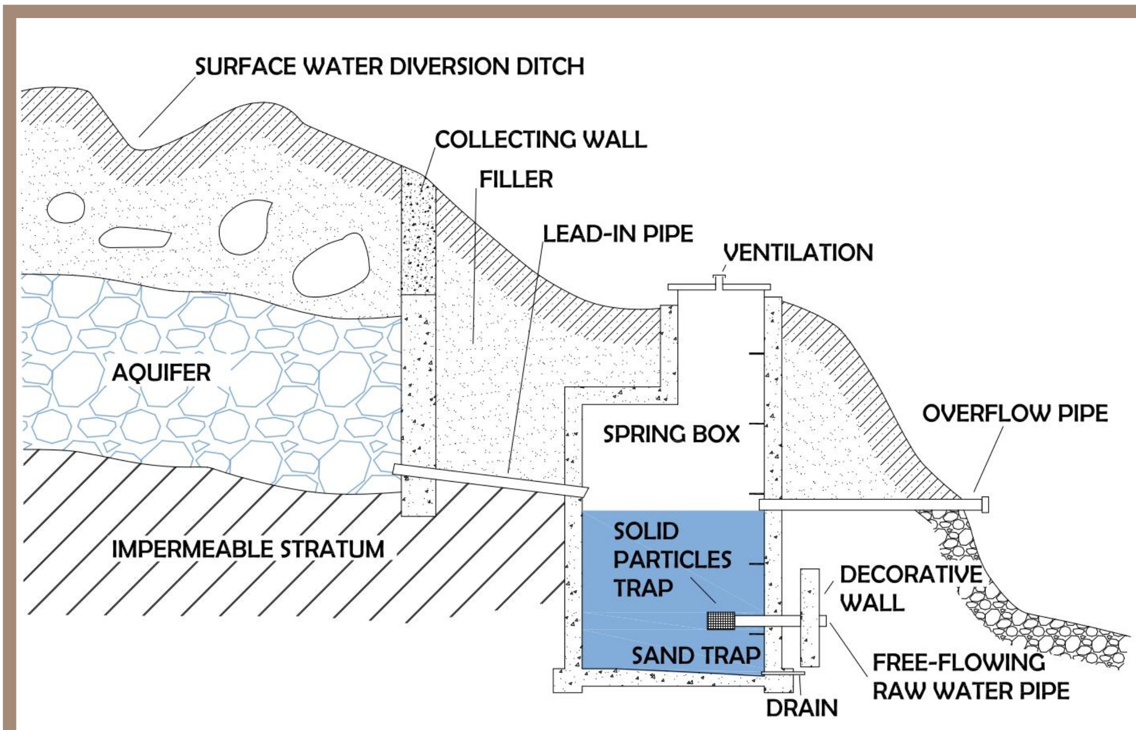
- Model 1 is the simplest construction and consists of a collecting wall (intake) that allows for the accumulation of water and a recessed pipe that channels the water and is visible at the discharge point. The wall is normally embellished.



Single-point spring catchment (Model 1)

- Model ❷ is similar to the previous model, with the difference of having an intermediate chamber between the intake and the discharge point that are connected by means of a lead-in pipe.

  This structure is called a spring box and its purpose is to store a certain amount of water and, acting as a decantation tank, to remove small particles from the water that are deposited in the sand trap. The disadvantage of this system is that it obviously requires maintenance. Thus, depending on the quality of the spring and the watertightness of the chamber, it is necessary to empty and clean the box regularly. For this reason, the spring box is normally equipped with a drain located at the bottom. Additionally, it can also have a screened solid particle trap to minimise the amount of particles that enter the lead-in and outlet pipes. Finally, it is equipped with an overflow pipe to release water if the outlet pipe is not sufficient for draining the flow during periods of maximum inflow.

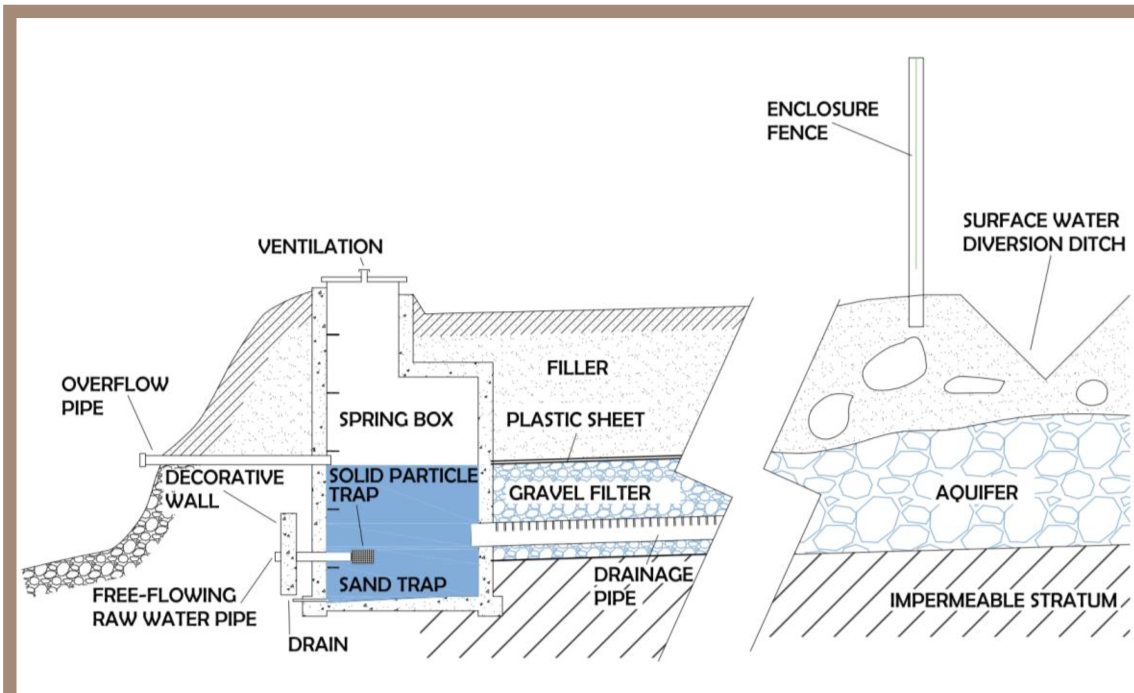


Single-point spring catchment (Model ❷)

9.2.2.1.3 seepage spring

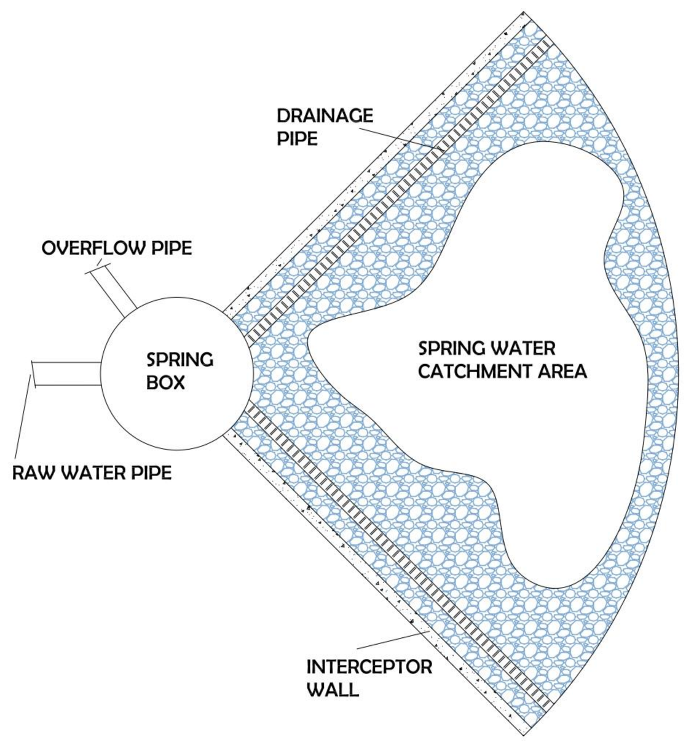
In the case where the spring inflows are spread out over a larger area, the solution is to collect the water by means of a gravel filter drain and channel it to a tank. The upper layer of the drainage area should be impermeable so that contamination by surface water is avoided. Furthermore, the water must be kept below the initial discharge level at all times in order to prevent excess pressure from accumulating.

The perimeter of the spring catchment area is protected by a ditch that is used to divert run-off water and an enclosure to control access.



Elevation view of a seepage spring catchment with a gravel filter (Model 3)

Model ❸ can be enhanced by building interceptor walls located downstream from the drains, facilitating higher catchment yields.

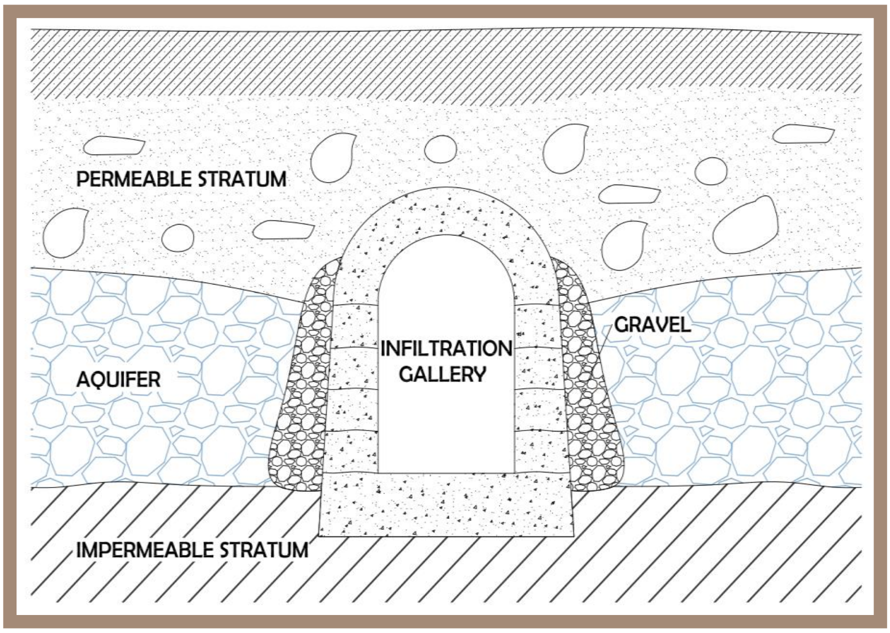


Plan view of a seepage spring catchment with a gravel filter and interceptor walls (Model ❸)

9.2.2.1.4 galleries

In the case of diffuse discharge points in areas of fissured rock, water can be collected by means of horizontal tunnels or infiltration galleries, normally ending in a spring box.

The protection measures are similar to those used for the previous case.



Infiltration Gallery Diagram (Model 4)

The Diana Cazadora spring in Betanzos takes advantage of two springs located in San Xiao called the Principal and Raíña. Water is collected by means of two infiltration galleries that are 67 m and 18 m long and that end in the 6-metre-deep San Xiao das Viñas spring box.

Image of one of the galleries in the Diana Cazadora spring (Betanzos)

9.2.2.1.5 water wells

Another catchment category is that of water sources connected to wells or boreholes. This is a rather common supply solution in areas where there are no natural springs or municipal water supply networks. They require the installation of a pumping system.

A well is defined as a vertical borehole drilled to a sufficient depth in order to reach the aquifer. Depending on the technique used in its construction, a distinction is made between two types of wells:

- Shallow artesian wells: in the absence of surface discharge points, wells have traditionally been manually excavated in order to reach the water table. Although these still exist, few are currently used as sources of drinking water since, due to their shallow depth, the amount of water supplied and/or the quality of the water is insufficient. As a result, many are in a state of disrepair.
- Boreholes or auger wells: these are vertical, mechanically drilled boreholes with small diameters. They are currently the most widespread solution used since they have the advantage of being able to reach great depths at an affordable cost. This makes it easier to obtain operating flows that meet the demand.

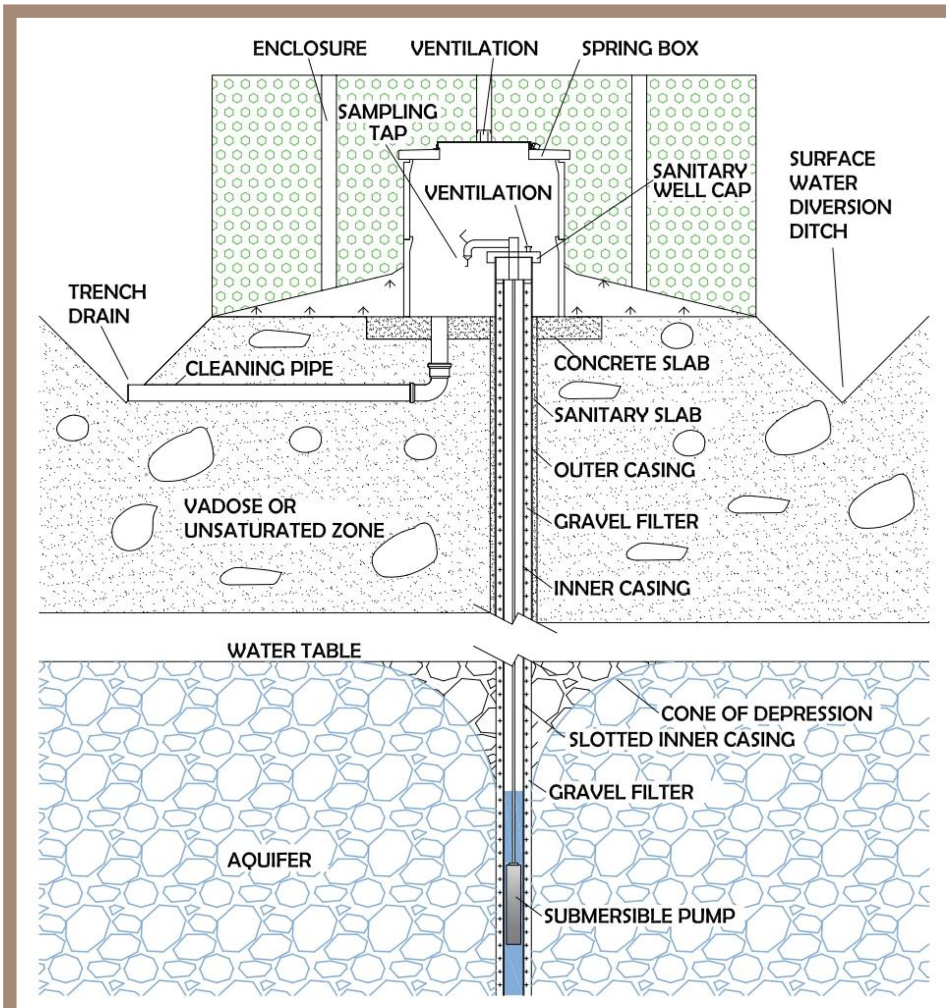
    To prevent contaminated water from entering the well, a sanitary seal is created by injecting cement mortar and/or bentonite into the annulus between the ground and the outer casing.

    By constructing a gravel filter between the soil wall and the slotted inner pipe, fine particles are prevented from entering the intake zone.

    As regards the pumping equipment, from a technical point of view, the best option is a submersible electric pump, preferably made from stainless steel. The main advantage of this type of pump is their greater efficiency.

    The parapet wall must be topped with a well cap to prevent foreign elements (insects, small animals, etc.) from entering the well and contaminating the water.

Finally, the borehole must be protected by an external spring box equipped with an aeration and drainage system that allows it to be cleaned.



Borehole with a sanitary seal and gravel filter (Model 5)

The sanitary seal accounts for only 4% of the total annual investment cost and is a well's main protection against bacterial contamination. Studies show that in wells without a mortar seal the probability of water contamination by *E.coli* is three times higher. Other studies suggest that insects entering the wells are the main cause of coliform contamination due to the absence of a seal or the use of inadequate well caps that do not provide the appropriate health guarantees.

The fact that the location of the intakes is not known is a significant obstacle as this prevents improvements to the spring box and the maintenance work determined by future self-monitoring and management plans from being carried out. Furthermore, establishing source protection perimeters around the catchments would not be possible. For this reason, the use of catchments where the source of the water cannot be determined should be rejected.

"Marcial Calvo Fountain". Narón

9.2.2.2risk identification and assessment

Once the source of the water has been established, the next step in assessing a catchment is to identify the existence of any possible risks for human consumption and, subsequently, to establish preventative measures to control them.

In this context, the following terms are defined:

- Risk and hazardous event: any agent that can cause harm. The most frequent risk found in the water supply from a natural source is the unsuitable quality of the water due to biological, chemical or physical agents.
- Event: an incident or situation that can lead to the appearance of a hazard, such as effluent discharges in the catchment area.
- Risk: the possibility of a hazard occurring.

The proposed five-step approach for identifying and assessing risks in a catchment is explained below:

① Pressures → ② Flow rate → ③ Quality → ④ Infratructures → ⑤ Maintenance

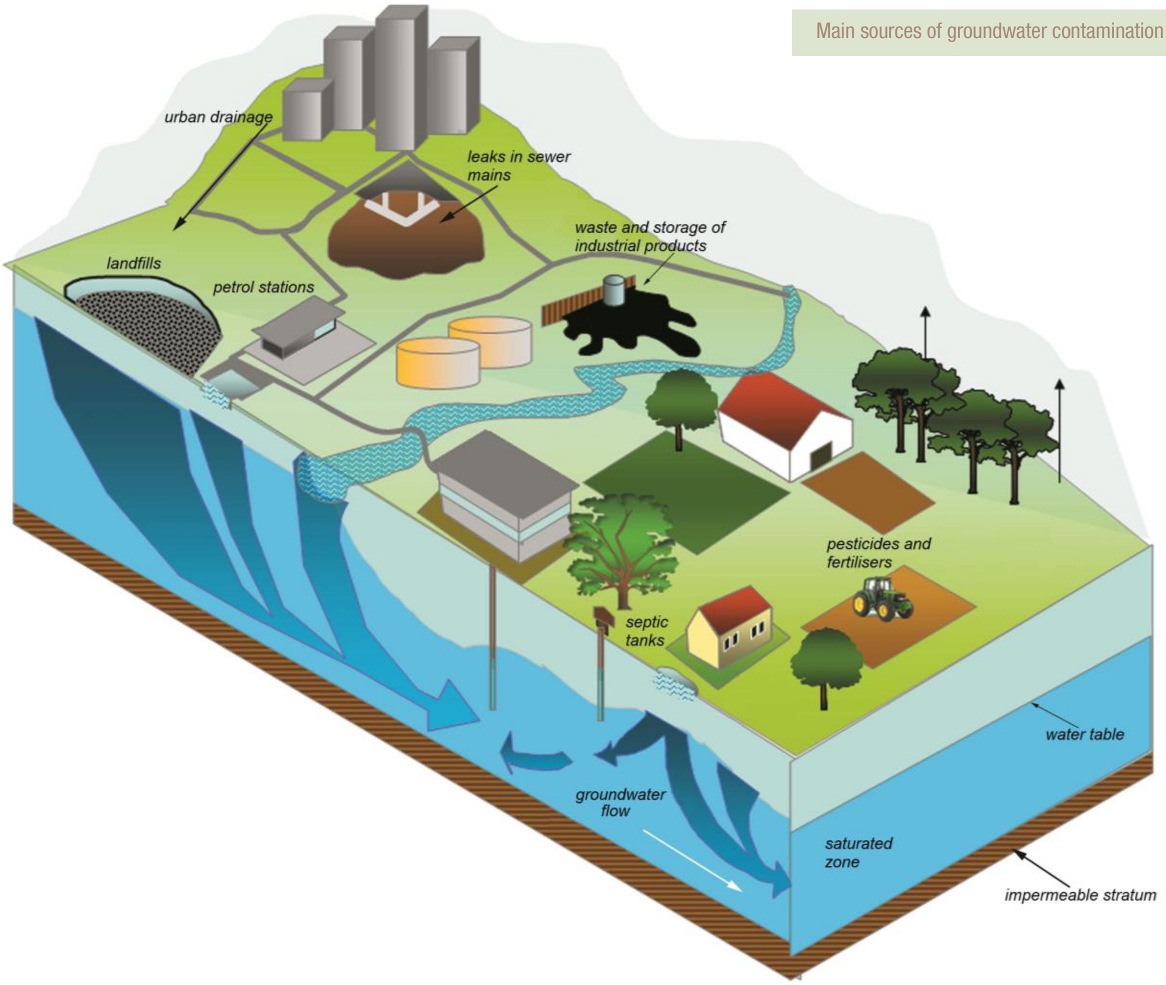
1 Identifying the pressures to which the catchment is subjected

Catchments should be located at higher elevations, higher than any source of contamination that could lead to a damaging alteration of the natural water quality. The sources of most anthropogenic contamination processes in rural areas are as follows:

Household Activities

- Leaks in the sewage mains seeping into the ground.
- Seepage of sewage from cesspits and septic tanks.

- Direct discharge of domestic wastewater and septic tanks.
- Abandoned or poorly constructed catchment wells containing water that flows directly into aquifers and that can contaminate groundwater.



Main sources of groundwater contamination

Agriculture and Livestock

- The use of synthetic fertilisers and pesticides.
- The storage and use of organic fertilisers.
- Sewage sludge used in agriculture.

Others

- Leachate from landfills containing improperly sealed solid waste
- Forest fires.
- Industrial spillages: mines, petrol stations, etc.

In order to identify the pressures to which a catchment area is subjected, catchment inspection form A has been provided and included in Annex 01.

2 Assessment of the available flow rate.

The quantity of water available in an underwater catchment depends, on the one hand, on the hydrological conditions and characteristics of the aquifer and, on the other hand, the quality of the catchment construction.

In order to quantitatively assess the resource, a hydrogeological survey based on the results of spring gauging and/or well pumping tests is ideal.

It is important to evaluate the available flow measurements for at least one hydrological year[20]. The reason for this is that many springs show marked fluctuations in flow, sometimes to the point being completely depleted after the summer season.

In this regard, it should be noted that, according to the studies carried out by Augas de Galicia[21], climate change could exacerbate the current problems experienced in guaranteeing water supply from natural sources that collect water from springs in areas with shallow water tables.

For this reason, it is especially important to carry out a thorough study in order to determine the availability of a sufficient flow throughout the entire year. Even though the water needs of a public drinking fountain are not substantial, it would not be logical to have fixed water supply point fed by springs that are likely to dry up during the summer when the demand for water is at its highest.

20 A hydrological year is a period of 12 months during which precipitation is measured over a given drainage basin. In Spain, the hydrological year begins on 1 October and ends on 30 September.

21 Hydrological Survey LIFE12 ENV/ES/000557 - LIFE RURAL SUPPLIES, July 2016. Javier Samper, Acacia Naves, Luis Montenegro, Bruno Pisani, Alba Mon and Jesús Fernández.

Gauging a channelled spring is a rather simple operation. All that is needed is a calibrated container and a stopwatch. For example, a catchment providing a flow rate of 6 litres/minute should fill a 5-litre container in 50 seconds.

Moreover, if it is possible to obtain a conductivity meter, it is advisable to record not only the flow rate but also the electrical conductivity[22] and temperature of the water. These data provide valuable information about the quality of the water collected. The following table lists the data that should be taken monthly at each catchment for at least one year.

RECORD LOG	UNIT
Date	hh:mm – dd/mm/yy
Flow rate	litres/second
Electrical conductivity	µS/cm
Temperature	ºC

22 The underground water in Galicia is normally soft and, therefore, has very low electrical conductivity. Thus, high values or abrupt variations could be an indication of contamination, which could come from a variety of sources.

Gauging the *Fonte do Paraíso* (Neda) Spring

It is important to clarify the concept of “maximum water demand” for this type of water source. With regard to the necessary flow, the demand is highly variable and depends, on the one hand, on its location and, on the other, the need for drinking water, which, in turn, is strongly influenced by the ambient temperature. As an example of an extreme case, 628 litres would cover the average daily demand for a fountain for users of the French Way to Santiago (the most used) in the month of August 2010 (the last Holy Year with a registered traffic of 38,930 pilgrims). This low volume and the low flow rate required (6 litres/minute) would make it possible to use most of the available catchments, except those that dry up in the summer season.

3 Assessing the quality of the catchments' raw water

For this task, the best option is to contract a laboratory specialised in analysing drinking water quality[23] to assess the samples and use the parameters established by the *Regional Health Department* for completing a comprehensive analysis of natural water sources[24].

In order to illustrate the importance of identifying the risks associated with untreated natural water sources, it must be noted that, all of the 35 sources of this type sampled in the diagnostic actions carried out as part of the Life Water Way project failed to meet at least some of the quality parameters established for water intended for human consumption.

As regards the physico-chemical hazards reported, apart from acidity and two cases in which the aluminium and manganese parameters were not met (a relatively common occurrence in Galician aquifers), the main issue detected was the presence of nitrates in the water. The source of this problem can be found in some of the household, agricultural and livestock activities indicated in the previous sections. Solving this issue is normally quite complicated, so it is advisable to look for an alternative catchment.

4 Assessment of the catchment infrastructures.

This assessment is done on the construction materials and protective measures.

In order to facilitate the identification of any possible event, Annex 01 includes the B forms for the structural inspection of catchments for springs (1) and wells (2), according to the types described in the section "Source of the water and type of catchment".

23 The analytical methods used by the laboratory must be accredited by the UNE-EN /ISO-IEC 17025 standard or the laboratory must ensure that these methods are validated and documented in accordance with this standard.

24 The approximate cost of this service is around €300 (plus VAT) per catchment.

❺ Identifying possible risks associated with improper maintenance.

Since homes began to be supplied with running water, most of the natural water sources have fallen into disuse, and maintenance work on the catchments has been neglected. Therefore, based on the characteristics of these infrastructures, it is necessary to determine what actions must be carried out and how frequently so that the efficiency of the water disinfection equipment is not compromised. For example, in a model ❷ catchment, if the sand trap is not emptied and the solid particle trap is not cleaned, the pre-treatment process with roughing filters will not be effective (see image below).

Improperly maintained Model ❷ spring box.

9.2.2.3 preventative measures

A preventative measure is any action aimed at eliminating or reducing a potential risk to acceptable levels.

Based on the experience of the Life Water Way project, in catchments with sufficient flow rates, where the water source is known, and only microbiological concerns are present, the risks can be controlled by adopting the following preventative measures:

(1) Adapting the catchment to the type of spring and establishing source protection measures (see the section on "Source the water and type of catchment").

(2) Installing a water treatment system that is appropriate for the quality of the raw water.

(3) Correctly implementing a self-monitoring and management protocol specifically prepared for the water source.

One of the conditions for maintaining the natural quality of springs is to adopt a proactive protection policy for their catchments.

If the catchment is protected with a well-constructed structure, made from inert materials that do not disintegrate and obstruct the "veins" of the aquifer and the outsides are impermeable, preventing the possible entry of polluted surface water, the necessary conditions will have been met for a safe use of the water.

9.2.2.4 establishing source protection perimeters

Studies indicate that the water in most Galician springs is unsuitable for human consumption from a bacteriological standpoint due, in part, to a lack of land use planning in the areas surrounding the catchments.

The current applicable legislation includes measures such as the corresponding basin organisation establishing source protection perimeters, among other measures.

Establishing a source protection perimeter consists of land-use planning in the areas surrounding the catchment in order to adapt said land use for the purposes of:

- Avoiding the discharge of contaminants that could affect the quality of the water collected.
- Controlling the development of any new activity that is not compatible with the preservation of the water resources collected.
- Strengthening prevention and control measures in the catchment areas.

The groundwater catchment protection principle can be adopted by means of implementing three successive perimeters or zones (see diagram):

Zone I – Immediate Surroundings

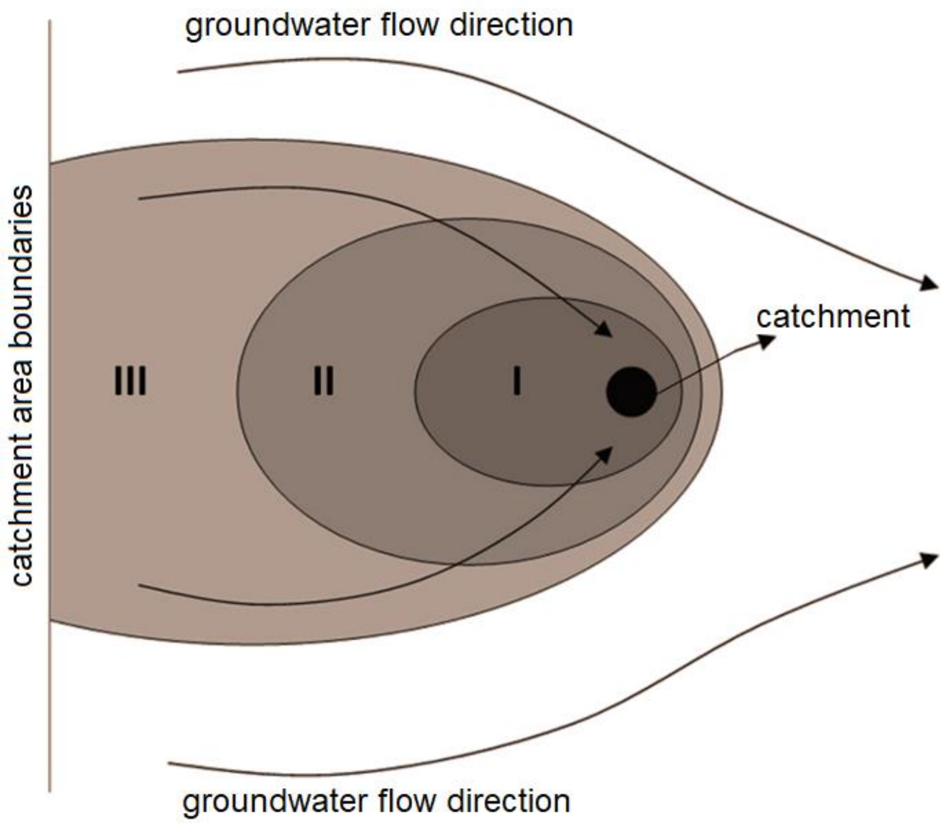
The main purpose of this first perimeter is to prevent the deterioration of the catchment facilities and/or to prevent the discharge of contaminants in the immediate vicinity of the catchment. Considering micro-organisms as contaminants, a 1-day time of travel has been established for this zone. Distance will be calculated taking into account the hydrogeological properties, the flow regime, etc. Total restrictions will be imposed upon the resulting area, and any activity not related to the operation and maintenance of the catchment will be prohibited. Whenever possible, the land within this perimeter will be acquired, fenced and maintained by the Community of Users or the corresponding governmental body.

Zone II – Intermediate or Nearby

This is an area with the maximum level of restrictions in which it is necessary to limit the type of activities that may be carried out in order to protect the water from any type of contamination. The criterion for establishing this perimeter is the prevention of bacteriological contamination. Thus, there will be a minimum 50-day time of travel from the injection point to the catchment point.

Zone III – Outer

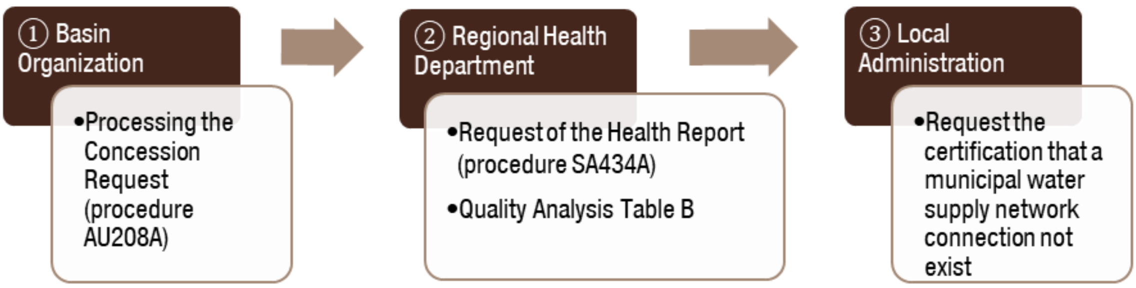
This is an area with moderate restrictions that aims to protect against more persistent contamination. The time of travel for this zone is established at several years. The geometry of this zone is determined by the groundwater recharge zone (which may coincide with the catchment area if the boundaries of the surface and groundwater basins are the same). The restrictions are not as severe as those for the intermediate zone.



9.2.2.5 administrative concession processing

The use of water from treated natural sources requires an administrative concession, regulated in Article 130 of Royal Decree 849/1986, on the Regulation of the Public Water Domain.

The following diagram summarises the procedure:



Besides complying with the current legislation, the main advantage of obtaining a concession for the private use of water lies in the fact that this recognition means being able to defend the catchment from potential threats such as new applications for concessions by third parties for areas under the minimum distances, discharges, etc. Thus, the holders of water concessions will be protected by the basin organisation, which will protect them from anyone who, without having their own registered concession, opposes or obstructs the holder's rights

Additionally, when processing the concession for the use of water from treated natural water sources, the basin organisation may establish source protection perimeters on aquifers in order to prevent their contamination. This procedure can be initiated at the request of the municipal authority.

9.3 treatment system

Current drinking water regulations stipulate that water must be safe and clean and, therefore, not contain any type of micro-organism, parasite or any other substance in a quantity or concentration that could pose a risk to human health. Moreover, all water intended for human consumption must be disinfected before being distributed to consumers.

9.3.1 case A: public drinking fountains connected to a drinking water supply network

Water supplied by a fountain connected to a controlled drinking water supply network complies with all health guarantees. These guarantees are endorsed by the Health Authority which, by means of health monitoring programmes, verifies that the supply systems function correctly and are properly maintained by the owner and the manager.

For this reason, tap water is, a priori, the safest water available as it is constantly analysed throughout the entire process: abstraction, treatment, distribution and delivery.

Although it is assumed that water quality criteria are met, the taste or odour of tap water may vary from one supply system to another. This is due to small variations in parameters such as turbidity and residual disinfectants and primarily depends on the source of the water (surface or groundwater), the type of treatment, the state of the installations, rainfall and the ambient temperature.

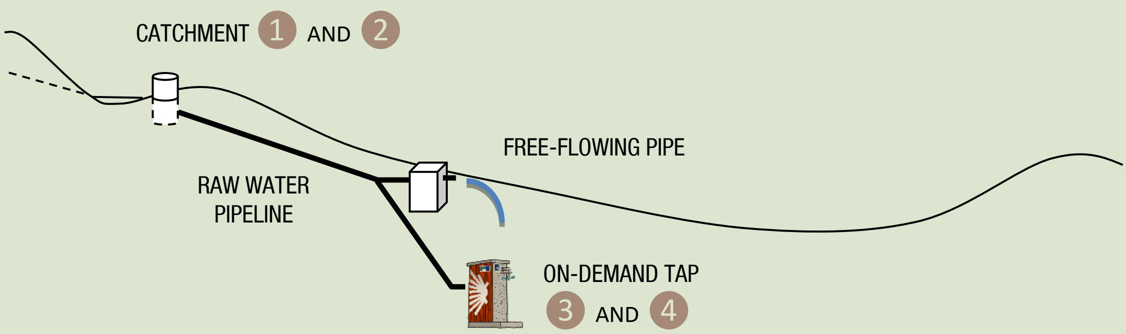
For this reason, in order to standardise the organoleptic properties of the water distributed in the network of drinking fountains along the English Way to Santiago, the Life Water Way project has equipped this type of fountain with two cartridge filters (10 µm / activated carbon). The use of these elements is optional and at the discretion of the owner and manager of the water supply system.

9.3.2 case B: fountains connected to treated natural water sources

In order to meet the health criteria for drinking water distributed from natural sources, installing drinking water treatment systems is mandatory.

Nevertheless, the regulation does not define which treatment system is to be used in order to meet the quality objectives. Therefore, the treatment system used will depend on the conditions of the raw water and the selection of the technology used for purification.

According to the methodology proposed in this guide, using groundwater abstractions without microbiological contamination or, potentially, with a very low levels of contamination, is recommended, rejecting those sources that have chemical issues (for which treatment is available but the cost and complex maintenance requirements are prohibitive for the cases in question). The general treatment scheme is explained below, detailing the processes that would need to be implemented in order to treat only the water that will be consumed and leave the rest untreated and free flowing.



① Roughing Filters → ② Decanting → ③ Filtration → ④ Disinfection

- Roughing filters ① are used to eliminate course solid particles or sand carried by the water by means of retention components such as gravel filters or solid particle traps that are located in the spring box.
- Decanting ② is the removal of settleable solids using gravity when the velocity of the water is decreased by means of chambers or the spring box itself.
- Filtration ③ is the removal of the remaining particles by means of a porous medium that retains the solids and allows the fluid to pass through.

  In addition to the particulate filters, an activated carbon filter can be installed to absorb any organic compounds and metal oxides present in the water.

  Proper filtration significantly increases the effectiveness of the disinfection process.
- Disinfection[25] ④ is used to destroy and inactivate pathogenic microorganisms by means of chemical and/or physical processes. The most common processes used are chlorination and ultraviolet radiation, respectively.

  In order for disinfection to be effective, the microorganisms must come into contact with or be exposed to the disinfectant. In the case of chlorination, the minimum contact time is 30 minutes, while normal exposures for ultraviolet radiation are mere seconds. In other words, in the former, it is necessary to provide a tank in which the chlorinated water can be stored for the required time. In the latter case, it is possible to expose the flowing water to radiation continuously at the same time as it is dispensed.

  Moreover, using a chemical disinfectant continuously for the distribution of free-flowing water (and, thus, exceeding the demand) involves the release of a large quantity of sodium hypochlorite into the environment in a way that is unnecessary and, in part, avoidable.

  On the other hand, the simplicity of the ultraviolet radiation disinfection method allows it to be installed at the point where water is dispensed to consumers[26].

25 Disinfection does not necessarily imply the destruction of all living organisms present in the water; a process known as sterilisation.

26 This eliminates the possibility of recontamination and the need for a residual chemical disinfectant from being present in the water. Maintaining a small concentration of residual disinfectant ensures that the water has been properly disinfected and guarantees its effectiveness in preventing any further contamination in storage tanks or distribution networks.

Thus, the drinking water treatment system recommended by the Life Water Way project seems to be the most appropriate as it proposes treating only the water required for human consumption and leaves the water not intended for this purpose untreated, which would continue to flow from the pipes of the current natural sources. Additionally, by using a physical disinfection system, releasing biocides into the environment would be avoided.

"Croas Fountain". Betanzos

10 pilot network

10.1 objective

The purpose of this section is to provide details on the following goals:

- Disseminate the actions needed to implement the Life Water Way methodology in order to provide water intended for human consumption by means of public drinking fountains, based on the water supply alternatives available in the pilot network built within the framework of this demonstration project.
- Assess the total cost of the civil works, equipment and maintenance needed to provide a safe water supply, in accordance with the health regulations concerning water intended for human consumption.

Therefore, the general goal will be to allow local city councils and other competent bodies to evaluate if the proposal is reasonable, appropriate and comparable to other similar initiatives.

10.2 description of the pilot drinking fountain network

The pilot drinking fountain network along the English Way of the Saint James Way has been designed with the goal of offering pilgrims a safe micro-supply point so that they can fill a half-litre water bottle at regular intervals, approximately every 6 kilometres.

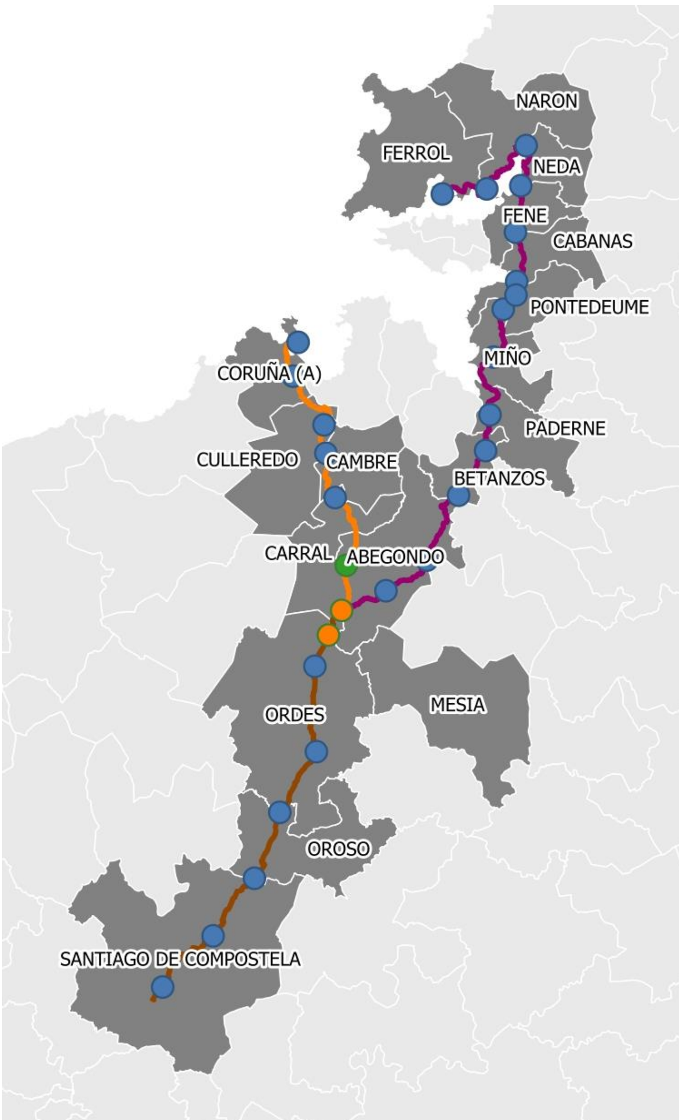
For this reason, 28 micro-supply points have been constructed with a uniform and recognisable design for the entire network. There are three possible alternatives depending on the source of the water:

- Case A – water supply network. There is the possibility of connecting the drinking fountain to a municipal water supply network.
- Case B1 – natural sources from an existing catchment. The previous option is not possible, and the extension of the municipal water supply network is not feasible.

However, there is the possibility of creating a treated natural water source from an existing groundwater abstraction point.

- Case B2 – natural sources from a new catchment. If neither of the two previous options is possible, the solution would then be to assess the possibility of building a new catchment to provide a treated natural water source.

The following map shows the sections, locations and types of the fountains that comprise the Life Water Way network. The blue dots represent the 25 fountains connected to municipal water supply networks (Case A), the 2 orange dots are the fountains that make use of existing groundwater catchments (Case B1), and the green dot shows the one new catchment (Case B2) in a location in which drinking water was not available.



10.3 proposed solution

The Life Water Way project has created an "ad hoc" drinking fountain model with a uniform and recognisable design for the Saint James Way. There are three different possible configurations that correspond to the different technical conditions for the three types of drinking fountains:

TYPE OF FOUNTAIN	LIFE WATER WAY SOLUTION
Case A – municipal water supply network	Option (3): MUNICIPAL WATER SUPPLY NETWORK
Case B1 – natural source from an existing catchment	Option (1): SPRINGS/UNPRESSURISED WELLS sufficient to ensure water supply.
Case B2 – natural source from a new catchment	Option (2): SPRINGS/PRESSURISED WELLS sufficient to ensure water supply.

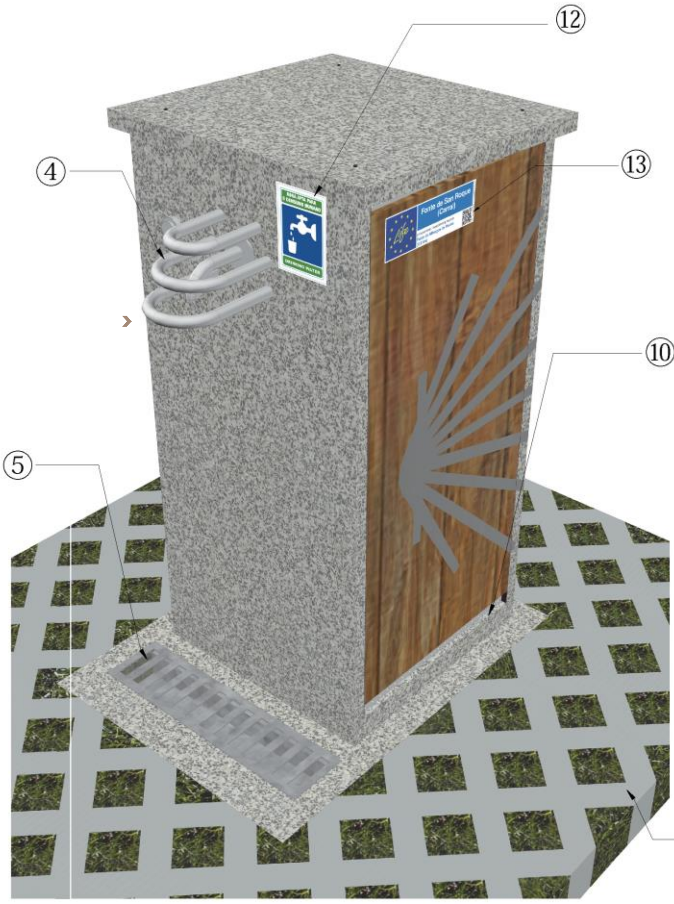
Image of the "Cruz de Beira Fountain" (Abegondo), an example of Case B2 – natural source from a new catchment

Annex 01 "Design and implementation of a prototype for the treatment and dispensing of water intended for human consumption from natural water sources" contains details regarding the equipment used in the three possible alternatives (see Section 4 of the document).

Additionally, the following sections summarise the main characteristics of the external design of the drinking fountain and the treatment solution for natural water sources.

10.3.1 Accessible design

Public drinking fountains must have a simple operating mechanism that facilitates the use of water, especially by children and/or individuals with reduced mobility. Based on this premise, the main aspects that have been taken into consideration in the design of an accessible drinking fountain suitable for filling water bottles that is in line with the values of the Saint James Way are detailed below (see the diagram):



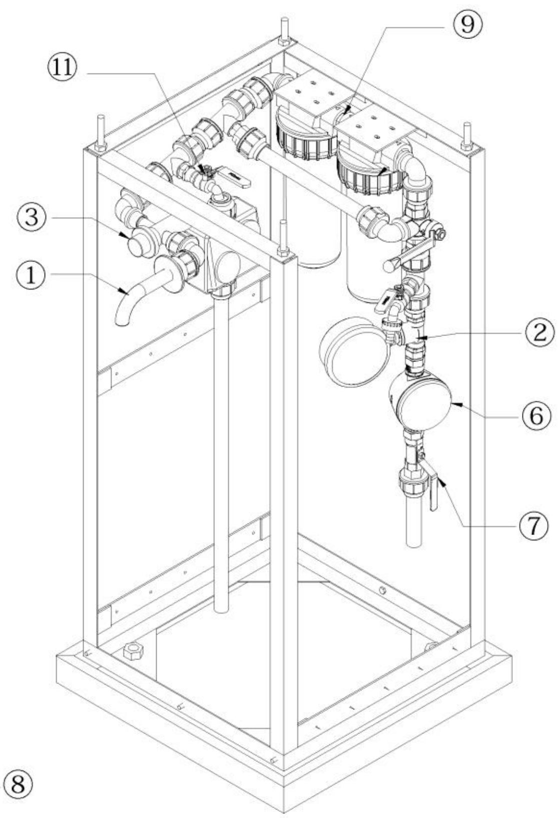


Image of the dispensing point and drinking fountain operational diagram for Case A.

The **spout/tap** ① with a vertical flow perpendicular to the ground has been installed at a height of between 0.80 and 0.90 metres. The water stream must be capable of filling narrow-mouthed bottles, so the inside diameter of the spout has been set at 16 mm. A **water pressure regulator** ② has been installed to ensure a constant flow of 6 litres/minute with minimum splashing.

- The fountain's spout/tap is fitted with a stainless-steel **guard** ④ to prevent contact with the user's hands and/or mouth since, for hygienic reasons, the design implemented is only intended to be used for filling containers and not for drinking directly from the spout.
- It is equipped with a water flow control timer ③, with a user-friendly operating mechanism, in order to optimise and economise water consumption. In Case A, this mechanism is manual[27], and can be operated by one hand with a force of not more than 20-22 N. For Cases B1 and B2, there is a digital button that can be activated with one finger.
- There is a wastewater **collection system** ⑤ that prevents it from accumulating. The drain grate is flush with the ground and the gap distance is limited[28] to 2 cm.
- There is a **meter** ⑥ to measure the distributed water flow and a **shut-off valve** which allows the water from the tap to be turned off ⑦.
- The fountains must be accessible to **wheelchair users**, with a clear height of 70 cm and a maximum depth of 40 cm. Furthermore, a space 1.5 metres in diameter around in the area surrounding the fountain must be **free of any obstacles** (see the diagram below).
- A **distinctive pavement** ⑧ has also been installed in order for visually impaired individuals to be able to locate and identify the fountain easily.
- Th structure of the fountain has been adapted to the system to be included inside the fountain to dispense water. The minimal installation (Case A) requires a water

27 To avoid contact between the user and the fountain, a non-manual operating system is advisable.

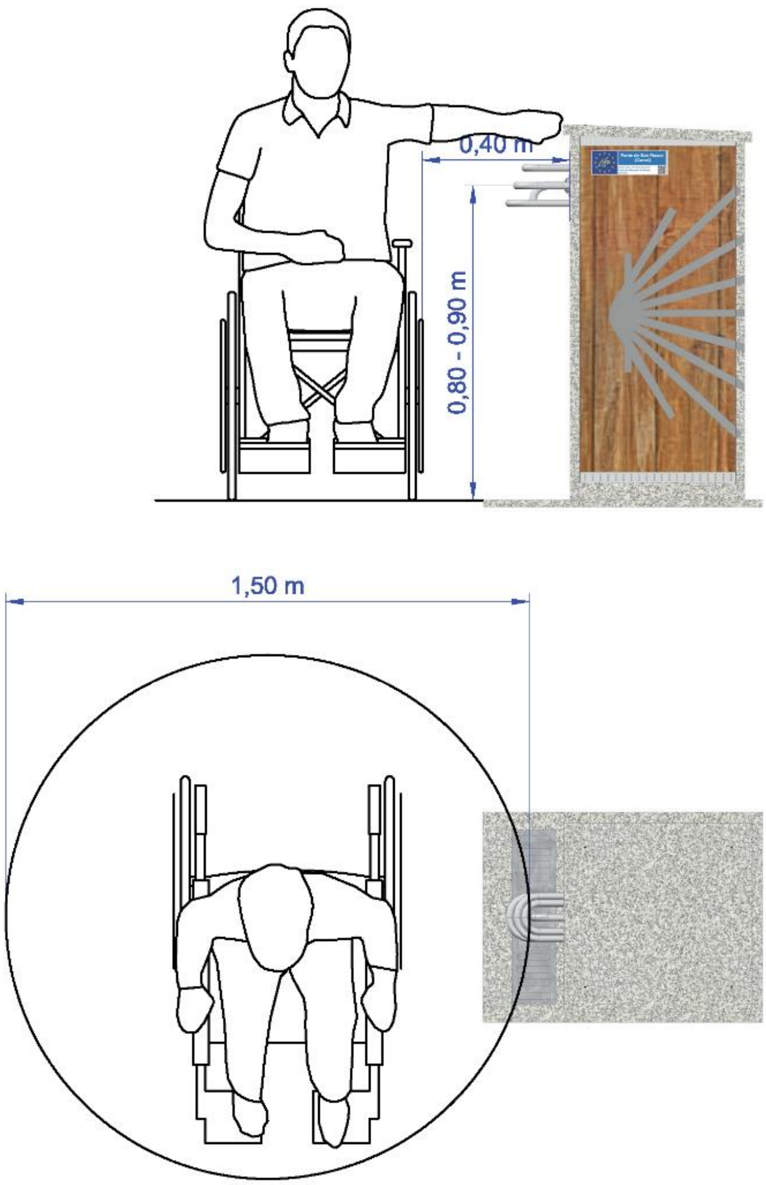
28 In order to avoid trekking poles, heels, crutches or even children play from becoming stuck.

inlet and outlet, with an optional **filtration system** ⑨ that improves the organoleptic quality of the water.

- The fountains are also equipped with a **water renewal device** ⑪ and a **ventilation system** ⑩ that renews the air inside the fountain.
- The **materials used in the construction** of the fountain (natural brown granite, stainless steel, and natural wood panels on a high-density Bakelite body) are resistant to vandalism, corrosion and easy-to-clean so that the levels of hygiene and safety needed for the proper functioning of the fountain can be easily maintained.
- The **materials and fittings that are in contact with water** do not transmit any substances or properties to the water that contaminate or degrade its quality or pose a risk to human health[29]. Furthermore, they are easy-to-clean, disinfect and easily replaced.
- The **health information signage**[30] **is in both Galician and English** ⑫ based on the results of the most recent control analysis. Moreover, there is a consumer information system in place that provides information regarding the most recent control analysis carried out and can be accessed by means of a **QR code** ⑬.

29 Construction products must comply with Article 14 of Royal Decree 140/2003, Regulation (EU) No. 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down the harmonised conditions for the marketing of construction products and repealing Council Directive 89/196/EEC of the Council, and Commission Decision 2002/359/EC of 13 May on the procedure for attesting the conformity of construction products in contact with water intended for human consumption.

30 Where foreign users are expected, the signage should also be provided in English.

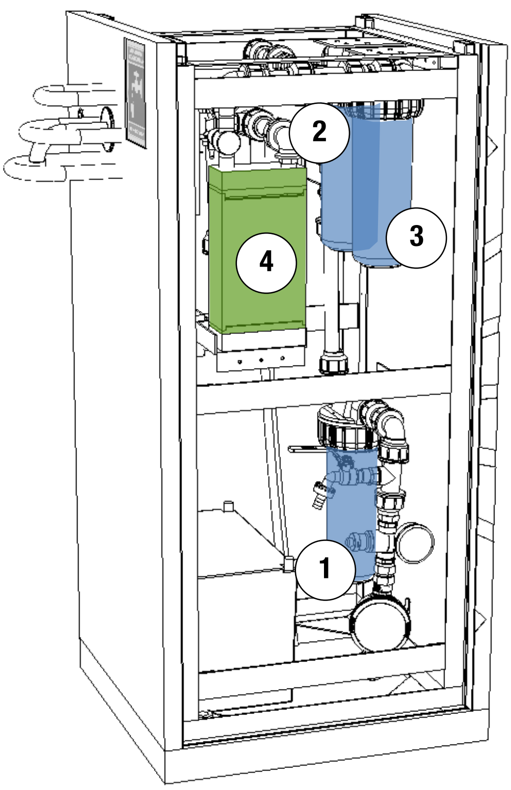


Fountain access for individuals with reduced mobility.

10.3.2 water treatment of natural water sources

The UV-C germicide provides chemical-free microbiological disinfection through UV-C radiation. It is designed to rapidly dispense drinking water with minimal wait time (0.5 litres in 5 seconds). Its UV-C LED technology means that it can be switched on only when treating water, so it is energy efficient and does not consume much power. It can be powered by two 10w solar panels. Moreover, the equipment regularly sends information regarding its use, alerts and autonomy to a web platform. In this way, the manager is aware of its operation status remotely at all times, and the amount maintenance tasks required is reduced.

The fountain's operation is divided into two stages. Following the flow of the water to be treated, it first passes through the **filtering stage**; three cartridge filters of 100 microns ①, 10 microns ② and activated carbon ③ are responsible for capturing the solid particles (sand, organic material, etc.). The water then passes to the **UV-C germicide** ④, in which the water circulates inside the device and microbiological disinfection occurs. Finally, the water flows directly from the germicide device through the dispenser spout.



The main characteristics of the treatment equipment are as follows:

- Instant treatment flow rate: 6 litres/minute
- Operating limits: 1 bar maximum pressure
- Maximum turbidity of water to be treated: 1 NTU
- Maximum pollutant load: *Escherichia coli (25 MPN/100 ml), Enterococci (10 CFU/100 ml), Clostridium perfringens (40 CFU/100 ml), Total coliforms (200 MPN/100 ml) and Aerobes at 22°C (1,300 CFU/ml).*

10.3.3 installation requirements

The following is a summary of the main requirements to be met by the locations for the installation of the proposed fountains.

TYPE OF FOUNTAIN	REQUIREMENT
Case A – municipal water supply network fountain	In the case of locations where controlled water supply networks are available, the only requirement is that the pressure at the connection point is stable and greater than 1 bar.
Case B1 – natural source from an existing catchment	The catchment must comply with the requirements established by the basin organisation and the health authority with regards to the granting of a concession for water intended for human consumption. Furthermore, the water must be analysed in order to ensure its suitability for microbiological disinfection treatment. (See Section 10.3.2).
Case B2 – natural source from a new catchment	The main requirement is that groundwater can be found in the vicinity of the location planned for the rest area. If so, the new catchment must comply with the above-mentioned requirements for the Case B1.

10.4 investment: technical studies, civil works and equipment

10.4.1 work units

Based on the Life Water Way experience, a study has been carried out of all the actions needed for the installation of the drinking fountains in the pilot network.

From these results, (**31**) work units have been created and are presented in the following tables, with their price estimate per fountain and broken down according to their purpose: (1) technical studies (2) catchment, (3) dispensing point and (4) drainage system.

(1) TECHNICAL STUDIES

code	unit	designation (type of fountain to be used in)	price (€)
LWW01	u	**Catchment feasibility study (Cases B1 and B2).** Studies to determine the feasibility of the catchment and prepare the necessary documentation for the water concession: - Identification and pressure analysis. - Hydrogeological survey to determine the location of new catchments and, in the case of existing catchments, assess the groundwater quantity and quality. - Study assessing the suitability of the collected water for microbiological disinfection treatment, according to the technical conditions of the of the designed equipment. - Preparing the documentation needed to process the health report on water for human consumption in catchments not included in the RD140/2003. - Determining the catchment protection measures to be included in the construction project, including the establishment of the source protection perimeter. - Two visits to the catchment location are included	1,680.00
LWW02	u	**Water Quality Analysis (Cases B1 and B2).** Sampling and analytical assessment of the parameters included in Part A of Annex II "*parameters to be determined in the granting or novation of water concessions",* including travel to the site for laboratory personnel to collect samples. The analytical methods used must be accredited by the UNE-EN ISO/IEC 17025 Standard.	1,635.00
LWW03	u	**Preparation of the civil works project (Cases A, B1 and B2).** Drafting of the complete technical project for the execution and installation of drinking fountains located in rest areas, including the processing of sector authorisations[31].	1,440.00

31 For Case A drinking fountains, the quantity corresponds to one quarter of the work unit.

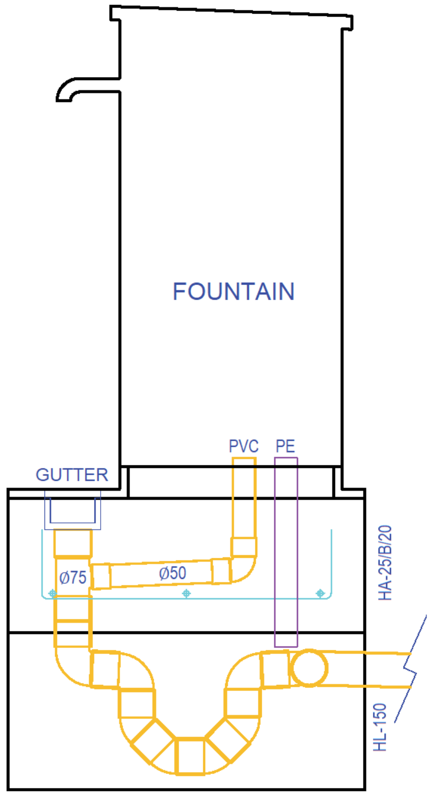
(2) WATER CATCHMENT

code	unit	designation (type of fountain to be used in)	price (€)
LWW04	u	**Construction of a well for water supply (Case B2).** Construction of a well to supply water intended for human consumption (up to 60 m deep) with a sanitary sealing of the vadose zone with cement mortar and bentonite (up to 18 m deep), an inner 316l stainless steel pipe of ø 4", covered in gravel and a PVC casing that is 160 mm in diameter. Transport and installation of the equipment is included.	5,584.72
LWW05	u	**Repair of a spring collection box (Case B1).** - Excavation of the external surfaces. - Repair and treating of the exterior surfaces with a liquid polyurethane membrane, a 55/60 g/m^2 reinforcement mesh and a food-safe epoxy resin. - Tiling of the interior surfaces with porcelain stoneware tiles. - Drainage filter installation in stainless steel with a Ø250 mm and a blind plug. - Placement of a 30 cm high 3/6 mm pebble gravel layer at the bottom of the box. - Installation of a protective stainless steel well cap (60 cm X 60 cm) with a fastener and padlock. -Installation of PVC water drainage system (Ø 110 mm) and a stainless-steel mesh filter (Ø 110 mm) in the existing pipe. - Cleaning and disinfection of the existing pipes to the location of the fountain is included.	1,964.44
LWW06	u	**Well protection measures (Case B2).** Construction of a well protection box with two pre-cast concrete rings (Ø 125 mm and 55 cm high) sealed with cement in the joints and topped with a concrete cover (Ø 125 mm diameter) with an opening that is 45 cm and 58 cm high; placed on a square polished concrete slab (1.25 cm wide and 25 cm thick) with an internal slope of 5%; exterior surfaces treated with green rubber paint; a stainless steel cover with a ventilation system; a PVC drain (Ø 90 mm); pre-installation of the water outlet to the dispensing point; water inlet with two double-layer corrugated pipes (Ø 50 mm) and parapet sanitary seal.	1,540.36

(2) WATER CATCHMENT

code	unit	designation (type of fountain to be used in)	price (€)
LWW07	u	**Installation of the pumping equipment in the well. (Case B2).** Electrical installation and pumping equipment for the well comprised of a 700 W, stainless-steel pump with a flow rate of 360l/hour at a manometric height of 70 m, including a control and safety sub-panel, frequency inverter, controller, pump supply hoses and a controlling sensor with stainless steel ball floats.	3,163.96
LWW08	u	**Low voltage electrical connection (Case B2).** Low voltage electrical connection (10 A – 2.3 kW).	854.70
LWW09	m	**Underground conduits and pumping equipment wiring (Case B2).** Underground conduits for electrical wiring consisting of 3x6 mm2 flexible RZ1-K (AS) Cu cables made from class 5 conductors, operating voltage 0.6/1 kV, XLPE insulation, no flame propagation, (UNE-EN 60332-1-2), fire resistant (UNE-EN 60332-3-24), halogen free (UNE-EN 50267-2-1), low smoke emission (UNE-EN 50267-2) and low toxic fumes emissions (UNE-EN 50267-2-2); for conduit installations according to the Low Voltage Electric Regulations, fully installed. Measured length executed.	13.84
LWW10	m	**PE Ø25 mm conduits in unpaved ground (Cases B1 and B2).** Water supply conduits with low-density polyethylene pipes (Ø 25 mm outside, 10 ATM maximum pressure NTE/ISA-2, AENOR quality certificate, homologated; installation for burying in a trench according to NTE/IFA-13, PG-3 and PTAA, including excavation, granular material base, pipe connection joints and backfill.	10.00

(3) DISPENSING POINT

code	unit	designation	price (€)
LWW11	u	**Construction of a base on unpaved ground (Case A).** - Excavation and pouring of a blinding concrete layer for a Ø 75 mm PVC trap. - Construction of a reinforced concrete foundation (80 x 60 x 30 cm), fitted with a corrugated PE sleeve (Ø 50 mm), a gutter with a cast iron grating and PVC pipes and fittings (Ø 75 and 50 mm). - Cladding made of 12- and 20-mm thick slabs of bush-hammered natural brown granite.  	258.08
LWW12	u	**Construction of a base on unpaved ground (Cases B1 and B2).** - Excavation and pouring of a blinding concrete layer for a Ø 75 mm PVC trap. - Construction of a reinforced concrete foundation (800 x 600 x 300 mm), fitted with 5 corrugated PE sleeves (2 – Ø 32 mm and 3 – Ø 50 mm) for raw water intake and electricity, and a drainage system comprised of a gutter with a cast iron grating and PVC pipes and fittings (Ø 75 and 50 mm). - Cladding made of 12- and 20-mm thick slabs of bush-hammered natural brown granite.	334.32
LWW13	u	**Turf block pavers (140x160x10 cm) (Cases A, B1 and B2).** Precast concrete turf block pavers (140x160x10 cm) for pedestrian traffic areas, laid over existing pavement, including compaction and filling of the holes with topsoil, made flush, and final cleaning.	200.81

(3) DISPENSING POINT

code	unit	designation	price (€)
LWW14	u	**Installation of the drinking fountain (Cases A, B1 and B2).** Installation of the drinking fountain with a lifting crane, secured to the base by means of four stainless steel threaded rods.	104.07
LWW15	u	**Supply and assembly of the casing (Case A).** - Internal structure and two filter holders in 316L stainless steel. - Front, rear and top covers with bush-hammered natural brown granite cladding. - Side cladding made of wood veneer panels on a high-density Bakelite body. - Methacrylate signage and the Saint James Way logo in stainless steel. - Wall-mounted, 151 mm spout with a satin-finish 316L stainless steel guard and a timed mechanical push button.	1,562.95
LWW16	u	**Supply and assembly of the casing (Cases B1 and B2).** - Internal structure, three filter holders and one reactor holder in 316L stainless steel. - Front, rear and top covers with bush-hammered natural brown granite cladders. - Side cladding made of wood veneer panels on a high-density Bakelite body. - Methacrylate signage with the Saint James Way logo in stainless steel. - Wall-mounted, 151 mm spout with a satin-finish 316L stainless Steel and a LED push button.	1.527,46
LWW17	u	**Supply and assembly of pipes and fittings (Case A).** - PE Ø 20 mm pipe suitable for drinking water. - Pressure reducing valve. - Pressure gauge. - Sampling tap. - One-way timer. - Ultrasonic flow meter.	346.19

(3) DISPENSING POINT

code	unit	designation	price (€)
LWW18	u	**Assembly of the equipment used to guarantee pressure (Case B1).** - 0.75 litre hydro-pneumatic accumulator tank with an 8.6 bar maximum pressure. - 12V/3A pump with a 10 litre/minute maximum flow rate and a 1 bar pressure switch.	108.39
LWW19	u	**Assembly of pipes and fittings (Cases B1 and B2).** - PE Ø 20 mm pipes suitable for drinking water. - Solenoid valves. - Pressure reducing valve. - Pressure gauge. - Sampling tap. - Ultrasonic flow meter.	362.18
LWW20	U	**SIGFOX signal booster (Cases A, B1 and B2).** Installation and supply of a SIGFOX signal booster to ensure the fountains' meters receive sufficient signal. Includes identification of the most appropriate installation point so that it operates properly (poles, roofs, etc.).	219.10
LWW21	U	**SIGFOX subscription (Cases A, B1 and B2).** SIGFOX subscription fee for the first year.	17.00
LWW22	U	**SIM card purchase and subscription (Cases B1 and B2).** Purchase and subscription of a prepaid SIM card with a 10 MB credit.	8.26
LWW23	u	**Installation of the filtration stage (Case A).** Bypass installation of the following elements: - ½" Filter housing and a 10 µm filter cartridge. - ½" Filter housing and a granular activated carbon cartridge.	105.81
LWW24	u	**Installation of the filtration stage (Cases B1 and B2).** Installation of the following elements: - ½" Filter Housing and 100 µm filter cartridge. - ½" Filter housing and 10 µm filter cartridge. - ½" Filter housing and granular activated carbon cartridge.	152.67

(3) DISPENSING POINT

code	unit	designation	price (€)
LWW25	u	**Supply of the germicide (Cases B1 and B2).** Supply the germicidal equipment used to disinfect the water with UV-C LED technology. Specifications: - Instant treatment flow rate 6 litres/minute. - Operating limit: 1 bar maximum pressure. - Maximum turbidity of water to be treated: 1 NTU. - Maximum pollutant load: Escherichia coli (25 MPN/100 ml), Enterococci (10 CFU/100 ml), Clostridium perfringens (40 CFU/100 ml), Total coliforms (200 MPN/100 ml) and Aerobes at 22°C (1,300 CFU/ml).	3,100.00
LWW26	u	**Supply and assembly of communication and power (Cases B1 and B2).** Supply of the equipment for the communication and power cabinets, and installation of the cabinet once assembled at the fountain.	1,127.39
LWW27	u	**Supply and installation of the photovoltaic panel (Cases B1 and B2).** Installation of the photovoltaic panels on existing poles, pergolas or roofs to provide power to the water treatment system in fountains connected to natural springs, including a galvanised steel support, screws, cables, protections, grounding, and solar panels connected to the base.	275.59
LWW28	m	**Photovoltaic panel conduits (Casos B1 and B2).** - Excavation of trenches (25 cm wide X 75 cm high) and backfilling. - Underground conduits for the electrical cables comprised of double-walled polyethylene protective tubing with 50mm nominal diameter, guide wire and marking tape. - Electrical wiring consisting of 2x4 mm^2 flexible RZ1-K (AS) Cu cables made from class 5 conductors, operating voltage 0.6/1 kV, XLPE insulation, no flame propagation, (UNE-EN 60332-1-2), fire resistant (UNE-EN 60332-3-24), halogen free (UNE-EN 50267-2-1), low smoke emission (UNE-EN 50267-2) and low toxic fumes emissions (UNE-EN 50267-2-2); for conduit installations according to the Low Voltage Electric Regulations, fully installed.	10.54

(3) DISPENSING POINT

code	unit	designation	price (€)
LWW29	u	**Programming, start-up and verification of the fountain control equipment.** Preliminary work necessary for the assembly and configuration of: - Communication and power cabinet: installation of the datalogger and communication equipment, regulator and battery in a watertight cabinet, including the fitting of connectors and wiring for the fountain's interior and exterior buttons and power connections for the photovoltaic panels. - Pre-assembly of the electronic components and plumbing in the workshop, including a soundness and watertightness test prior to installation. - Programming the firmware of the control equipment that manages the solenoid valves and the UV-C germicide used to treat the volume of water to be supplied. For each fountain, this includes the configuration of the pre-emptive flushing of the water in the treatment stages in the event the fountain is inactive. Verification in the workshop of the functions enabled in each case. - Configuration of the real-time connection for sending data to the IoT platform used to operate and maintain the fountain. Creating alerts to detect incidents in the normal operation of the system.	2,750.00

(4) DRAINAGE SYSTEM

code	unit	designation	price (€)
LWW30	m	**PVC Ø75 mm conduits in unpaved ground (Cases A, B1 and B2).** Conduits for draining the water via PVC pipes with an external diameter of 75 mm, with bonded joints, 3 mm thick, in accordance with UNE-EN1453-1, AENOR certificate; installation for burying in a trench according to NTE/ISA-9, PG-3 and PTSP, including excavation, granular material base, pipe connection joints and backfill.	31.91
LWW31	u	**Construction of an infiltration trench (Cases A, B1 and B2).** Drainage made from slotted PVC pipes, Ø 75 mm, in an 80 cm deep trench, filled with 50 cm of filtering gravel up to a height of 20 cm above the pipe, placement of 180 g/m^2 geotextile and backfilling with dirt from the excavation up to the top of the trench, in two 15 cm layers, including tamping but not excavation, for the collection and drainage of wastewater to the subsoil, as per NTE/ASD-8.	66.36

10.4.2 investment per fountain

Applying the calculations to the prices of the work units in the previous sections, the construction cost estimate per fountain is obtained.[32].

If we apply the coefficients of 13% for General Expenses, 6% for Business Profit and 21% VAT to this estimate, we obtain the Base Tender Estimate + VAT.

The following tables show the unit costs for each type of fountain.

[32] Indirect costs have been estimated at 2%: general expenses needed for the execution of the works are not included in the direct costs incurred by the contractor: administration, organization, etc.

10.4.2.1 case A – fountain connected to water supply network

CODE	UNIT	INVESTMENT CASE A: FOUNTAIN CONNECTED TO WATER SUPPLY NETWORK	QTY	PRICE (€)	COST (€)
LWW03	u	Preparation of the civil works project	0.25	1,440.00	360.00
LWW11	u	Construction of a base on unpaved ground	1.00	258.08	258.08
LWW13	u	Precast concrete turf block pavers (140x160x10 cm)	1.00	200.81	200.81
LWW14	u	Installation of the drinking fountain	1.00	104.07	104.07
LWW15	u	Supply and assembly of the casing	1.00	1,562.95	1,562.95
LWW17	u	Supply and assembly of the piping and fittings	1.00	346.19	346.19
LWW20	u	SIGFOX signal booster	1.00	219.10	219.10
LWW21	u	SIGFOX subscription	1.00	17.00	17.00
LWW23	u	Installation of the filtration stage	1.00	105.81	105.81
LWW30	m	PVCØ75 mm conduits in unpaved ground	5.00	31.91	159.55
LWW31	u	Construction of the infiltration trench	1.00	66.36	66.36

SUBTOTAL	3,399.92
INDIRECT COSTS (2%)	68.00
CONSTRUCTION COST ESTIMATE	3,467.92
ESTIMATED CONTRACT VALUE (13% GE and 6% BP)	4,126.82
BASE TENDER ESTIMATE (VAT 21%)	**4,993.46 €**

"Campo Fountain". Abegondo

10.4.2.2 case B1 – fountain connected to a natural source from an existing catchment

CODE	UNIT	INVESTMENT CASE B1: NATURAL SOURCE FROM AN EXISTING CATCHMENT	QTY	PRICE (€)	COST (€)
LWW01	u	Catchment feasibility study	1.00	1,680.00	1,680.00
LWW02	u	Water quality analysis	1.00	1,635.00	1,635.00
LWW03	u	Preparation of the civil works project	1.00	1,440.00	1,440.00
LWW06	u	Well protection measures	1.00	1,540.36	1,540.36
LWW10	m	PE Ø25 mm conduits in unpaved ground	10.00	10.00	100.00
LWW12	u	Construction of a base on unpaved ground	1.00	334.32	334.32
LWW13	u	Precast concrete turf block pavers (140x160x10 cm)	1.00	200.81	200.81
LWW14	u	Installation of the drinking fountain	1.00	104.07	104.07
LWW16	u	Supply and assembly of the casing	1.00	1,527.46	1,527.46
LWW19	u	Assembly of the pipes and fittings	1.00	362.18	362.18
LWW20	u	SIGFOX signal booster	1.00	219.10	219.10
LWW21	u	SIGFOX subscription	1.00	17.00	17.00
LWW22	u	SIM card purchase and subscription	1.00	8.26	8.26
LWW24	u	Installation of the filtration stage	1.00	152.67	152.67
LWW25	u	Supply of the germicide	1.00	3,100.00	3,100.00
LWW26	u	Supply and assembly of the communication and power installations	1.00	1,127.39	1,127.39
LWW27	u	Supply and installation of the photovoltaic panel	1.00	275.59	275.59
LWW28	m	Photovoltaic panel conduits	20.00	10.54	210.80
LWW29	u	Programming, start-up and verification of the fountain control equipment	1.00	2,750.00	2,750.00
LWW30	m	PVC Ø75 mm conduits in unpaved ground	5.00	31.91	159.55
LWW31	u	Construction of the infiltration trench	1.00	66.36	66.36

SUBTOTAL	17,010.92
INDIRECT COSTS (2%)	340.22
CONSTRUCTION COST ESTIMATE	17,351.14
ESTIMATED CONTRACT VALUE (13% GE AND 6% BP)	20,647.85
BASE TENDER ESTIMATE (VAT 21%)	**24,983.90 €**

10.4.2.3 case B2 – fountain connected to a natural source from a new catchment

CODE	UNIT	INVESTMENT CASE B2: NATURAL SOURCE FROM A NEW CATCHMENT	QTY	PRICE (€)	COST (€)
LWW01	u	Catchment feasibility study	1.00	1,680.00	1,680.00
LWW02	u	Water quality analysis	1.00	1,635.00	1,635.00
LWW03	u	Preparation of the civil works project	1.00	1,440.00	1,440.00
LWW04	u	Construction of a well for water supply	1.00	5,584.72	5,584.72
LWW06	u	Well protection measures	1.00	1,540.36	1,540.36
LWW07	u	Installation of the well pumping equipment	1.00	3,163.96	3,163.96
LWW08	u	Low voltage electrical connection	1.00	854.70	854.70
LWW09	m	Underground conduits and pumping equipment wiring	10.00	13.84	138.40
LWW10	m	PEØ25 mm conduits in unpaved ground	10.00	10.00	100.00
LWW12	u	Construction of a base on unpaved ground	1.00	334.32	334.32
LWW13	u	Precast concrete turf block pavers (140x160x10 cm)	1.00	200.81	200.81
LWW14	u	Installation of the drinking fountain	1.00	104.07	104.07
LWW16	u	Supply and assembly of the casing	1.00	1,527.46	1,527.46
LWW19	u	Assembly of the pipes and fittings	1.00	362.18	362.18
LWW20	u	SIGFOX signal booster	1.00	219.10	219.10
LWW21	u	SIGFOX subscription	1.00	17.00	17.00
LWW22	u	SIM card purchase and subscription	1.00	8.26	8.26
LWW24	u	Installation of the filtration stage	1.00	152.67	152.67
LWW25	u	Supply of the germicide	1.00	3,100.00	3,100.00
LWW26	u	Supply and assembly of the communication and power installations	1.00	1,127.39	1,127.39
LWW27	u	Supply and installation of the photovoltaic panel	1.00	275.59	275.59
LWW28	m	Photovoltaic panel conduits	20.00	10.54	210.80
LWW29	u	Programming, start-up and verification of the fountain control equipment	1.00	2,750.00	2,750.00
LWW30	m	PVC Ø75 mm conduits in unpaved ground	5.00	31.91	159.55
LWW31	u	Construction of the infiltration trench	1.00	66.36	66.36

SUBTOTAL	26,752.70
INDIRECT COSTS (2%)	535.05
CONSTRUCTION COST ESTIMATE	27,287.75
ESTIMATED CONTRACT VALUE (13% GE and 6% BP)	32,472.43
BASE TENDER ESTIMATE (VAT 21%)	**39,291.64 €**

10.4.3 investment budget

The following table details the base tender estimate for the creation of the pilot network of fountains along the English Way of the Saint James Way.

FOUNTAIN (ID – NAME, MUNICIPALITY)	TYPE	BASE TENDER ESTIMATE (€)
01- English Way Fountain, Ferrol	Case A	4,993.46
02- Mar Fountain, Ferrol	Case A	4,993.46
03- Marcial Calvo Fountain, Narón	Case A	4,993.46
04- Conces Fountain and washbasin, Neda	Case A	4,993.46
05- Vilar do Colo Fountain, Fene	Case A	4,993.46
06- Praia Fountain, Cabanas	Case A	4,993.46
07- Mirador de Aresito Fountain, Pontedeume	Case A	4,993.46
08- Buíña Fountain, Miño	Caso A	4,993.46
09- Ponte Baxoi Fountain, Miño	Case A	4,993.46
10- Garea Square Fountain, Paderne	Case A	4,993.46
11- Caraña Fountain, Betanzos	Case A	4,993.46
12- Croas Fountain, Betanzos	Case A	4,993.46
13- Campo Fountain, Abegondo	Case A	4,993.46
14- Beche Fountain, Abegondo	Case A	4,993.46
15- Porta do Parrote Fountain, A Coruña	Caso A	4,993.46
16- Eirís Fountain, A Coruña	Case A	4.993,46
17- San Xiao Fountain, Culleredo	Case A	4,993.46
18- Adro da Igrexa de Sigrás Fountain, Cambre	Case A	4,993.46
19- Lameira Fountain, Carral	Case A	4,993.46
20- Cruz de Beira Fountain, Abegondo	Case B2	39,291.64
21- San Roque Fountain, Carral	Case B1	24,983.90

FOUNTAIN (ID – NAME, MUNICIPALITY)	TYPE	BASE TENDER ESTIMATE (€)
22- Bruma Shelter Fountain, Mesía	Case B1	24,983.90
23- Cabeza de Lobo Fountain, Ordes	Case A	4,993.46
24- Senra Fountain, Ordes	Case A	4,993.46
25- Baxoia Fountain, Oroso	Case A	4,993.46
26- Carboeiro Fountain, Oroso	Case A	4,993.46
27- Sionlla Fountain, Santiago	Case A	4,993.46
28- San Caetano Park Fountain, Santiago	Case A	4,993.46
	TOTAL	**214,095.84**

Since no expropriations were necessary, and in order for the Administration to be duly informed, the aforementioned budget amounts to the above-mentioned sum of **TWO HUNDRED FOURTEEN THOUSAND NINETY-FIVE EUROS AND EIGHTY-FOUR CENTS** (€214,095.84).

10.5 operation: maintenance and self-monitoring

10.5.1 case A: fountains connected to a controlled water supply network

As previously mentioned, in order to optimise water quality regardless of the municipal supply main network to which the fountains are connected, the fountains have been equipped with a filtration system comprised of one 10 μm cartridge and a second granular activated carbon cartridge. Using these elements is optional and will be at the discretion of the water manager.

With regards to this, it must be remembered that one of the main effects of activated carbon is dechlorination, or the removal of free chlorine from water. For this reason, if the water manager decides to use this filtration system, they must apply for a residual disinfectant exemption from the health authority[33].

[33] In accordance with Article 10 of the RD 140/2003.

In this case, the sampling tap located inside the fountain before the filters will be used to monitor the residual disinfectant, and the fountain's spout will be used for the control and organoleptic analysis.

In the "Drinking fountain self-monitoring and signage plan", the *Regional Health Department* recommends that local city councils carry out at least the following controls, in addition to appropriately signposting the fountains that are connected to a controlled public drinking water supply network:

1. Inclusion of the fountain as an additional sampling point for the water main network to which they are connected for both residual disinfectant control and to take samples in order to perform control analysis.

2. Inclusion of the fountain in the Self-monitoring and Management Protocol (SMP) for the water supply network in the "Sources" section and indicate: name, georeferencing information, status and the hygiene and health conditions of the fountain.

Apart from the recommendations indicated by the *Regional Health Department*, the following actions are proposed as additional requirements[34]:

1. **Annual inspection** (LWWMA01). Before the start of the peak season with the highest number of pilgrims (spring), a general inspection and servicing must be carried out in order to ensure the proper functioning of the fountain, replacing, if necessary, the elements that are in poor condition[35]. In any event, the following actions must be carried out:

    - Both the exterior and interior of the fountain is to be cleaned with water and a mild soap.

    - The water drainage system is to be flushed by introducing pressurised water into the trap.

[34] The code of the corresponding work unit will be included in brackets.

[35] If the fountains are disconnected during the winter months, the water must be allowed to flow generously before they are put into service in order to renew all the water in the connections and installations.

- The one-way timer battery[36] (the device that allows the water to be renewed) must be replaced, regardless of its state. Additionally, this equipment is to be replaced every 5 years.
- If the filtration system is used, the 10 µm cartridge and the active carbon cartridge are to be replaced with new cartridges, regardless of their state.
- The volume of water dispensed must be measured to ensure it is within specifications (0.5 litres/button push). If this is not the case, the water pressure regulator must be adjusted until the required flow rate is achieved.
- Finally, all changes made will be properly documented, noting the date of the inspection and the water consumption reading recorded on the meter.

2. **Quarterly control analysis** (LWWMA02). The parameters established in the "distribution network control analysis" (odour, colour, turbidity, conductivity, pH, ammonium, *Escherichia coli*, coliform bacteria, *Clostridium perfringens*, trihalomethanes, residual combined chlorine and residual free chlorine) must be measured, as well as other parameters depending on the specific characteristics of the water (Pb; Ni; Cu; Fe; Cr). The sample will be taken from the spout.
3. **Monthly inspection** (LWWMA03). The following activities will be carried out:
   - The volume of water dispensed must be measured to ensure it is within specifications (0.5 litres/button push). If this is not the case, the water pressure regulator must be adjusted until the required flow rate is achieved, respecting the technical working conditions of the equipment.
   - The spout, guard and pushbutton must be cleaned (with water and a mild soap) and disinfected (with peroxide or 70% alcohol).
   - Organoleptic (colour, odour, pH, taste and turbidity) and conductivity analysis of the water in the spout.

[36] 9V Alkaline battery

- Residual disinfectant control. If filters are used, the sampling tap located inside the fountain before the filters is to be used. Otherwise, the sample is to be taken from the water in the spout.
- The battery level must be checked on the display of the one-way timer. If the charge is low, the battery must be replaced with a new one.
- If the filtration system is used, the depletion level of the activated carbon must be checked by analysing if residual disinfectant is detected in the water taken from the spout. In this is the case, the cartridge must be replaced with a new one.
- Finally, all changes made will be properly documented, noting the date of the inspection and the water consumption reading recorded on the meter.

4. **Document management** (LWWMA04). The following services are to be carried out on a yearly basis:
    - Management of maintenance, self-monitoring and incidents reports.
    - Management of the consumption records sent remotely by the meter.
    - Management of laboratory reports, making these available to users via a QR code located at the fountain.

10.5.1.1 maintenance costs per fountain

The following table details the theoretical costs for the specific maintenance requirements described above:

CODE	UNIT	INVESTMENT CASE A: FOUNTAIN CONNECTED TO A WATER SUPPLY NETWORK	QTY	PRICE (€)	COST (€)
LWWMA01	u	Annual inspection	1.00	98.42	98.42
LWWMA02	u	Quarterly control analysis	4.00	150.00	600.00
LWWMA03	u	Monthly inspection	12.00	31.41	376.92
LWWMA04	u	Document management	1.00	209.00	209.00

SUBTOTAL	1,284.34
INDIRECT COSTS (2%)	25.69
COST ESTIMATE	1,310.03
ESTIMATED CONTRACT VALUE (13% GE AND 6% BP)	1,558.93
BASE TENDER ESTIMATE (VAT 21%)	**1,886.31 €**

10.5.1.2 Signage

"**Drinking Water**"[37] provided the analytical parameters are within the limits established in Royal Decree 140/2003 (and the values agreed upon by the Ministry of Health for Group C parameters), including radioactivity parameters.

Whenever the analytical parameters are not within the limits established in Royal Decree 140/2003 (Part A, B, or the values agreed upon by the Ministry of Health for Group C parameters) or radioactivity parameters: **immediate suspension of the water supply.**

[37] The fountain model used in the pilot network along the English Way incorporates the sign "Auga apta para o consumo humano" in Galician and its English translation "Drinking Water". This sign will remain visible as long as the results of the parameters analysed are within the limits established in the Royal Decree 140/2003. If this is not the case, the fountain's service will be suspended, activating the corresponding shut-off valve.

10.5.2 case B: fountains connected to treated natural water sources.

In the "Fountain self-monitoring and signage plan", the *Regional Health Department* recommends that local city councils carry out at least the following controls, in addition to appropriately signposting the fountains that have disinfection treatment:

1. Initial assessment of the parameters from a complete analysis (in accordance with Royal Decree 140/2003) to determine the quality of the water and to be able to rule out that the water is "unsuitable".
2. Yearly control analyses: odour, colour, turbidity, conductivity, pH, ammonium, *Escherichia coli*, coliform bacteria, nitrites, nitrates, enterococci, *Clostridium perfringens*, among other parameters depending on the specific characteristics of the water.
3. Daily residual disinfectant monitoring and recording. In this regard, it must be remembered that drinking water treatment system uses ultraviolet radiation for disinfection. For this reason, the water manager must apply for a residual disinfectant exemption from the health authority[38].
4. Records of incidents and the corrective measures implemented in the event that any parameter not within the limits established in the applicable legislation.
5. "Drinking Water" signage, providing the analytical parameters are within the limits established in Royal Decree 140/2003 (and the values agreed upon by the Ministry of Health for Group C parameters), Otherwise, it must be marked as "Not Drinking Water".
6. Where possible, the results of the most recent water analysis are to be posted via the fountain's QR code.

Apart from complying with the requirements established by the *Regional Health Department*, the following actions are proposed as additional requirements:

In accordance with Article 10 of RD 140/2003.

1. **Cleaning of the catchment.** Cleaning and disinfection of the catchment will depend on its type and the frequency on the characteristics of the aquifer. For example:

    - **Case B1** (LWWMB01). The spring box must be cleaned and disinfected every six months using a pressure washer.

    - **Case B2** (LWWMB02). Every five years, a specialised company is to be contracted to clean and disinfect the well using a compressor and the pumping equipment must be inspected.

In any case, the date on which the cleaning is carried out must be recorded.

2. **Annual inspection** (LWWMB03 y LWWMB04). Before the start of the peak season with the highest number of pilgrims (spring), a general inspection and servicing must be carried out in order to ensure the proper functioning of the fountain, replacing, if necessary, the elements that are in poor condition[39]. In any event, the following actions must be carried out:

    - Both the exterior and interior of the fountain is to be cleaned with water and a mild soap.

    - The water drainage system is to be flushed by introducing pressurised water into the trap.

    - The 100 µm, 10 µm and activated carbons are to be replaced with new cartridges, regardless of their condition.

    - The 100Ah gel battery is to be inspected. This battery will be replaced every 7 years.

    - For the Case B1 fountains, the pumping equipment is to be inspected in order to ensure the proper water pressure. This equipment will be replaced every 5 years (LWW18).

[39] If the fountains are disconnected during the Winter, before they are put into service in the spring, they will need to be serviced and the water must be allowed to Flow generously in order to renew all the water in the connections and installations.

- The volume of water dispensed must be measured to ensure it is within specifications (0.5 litres/button push). If this is not the case, the water pressure regulator must be adjusted until the required flow rate is achieved.
- The physical condition of the ultraviolet germicidal equipment is to be inspected. The microbiological disinfection parametric values of the analyses carried out during the last period evaluated are to be verified. The estimated lifespan of the equipment is 2 years (LWW25).
- Finally, all changes made will be properly documented, noting the date of the inspection and the water consumption reading recorded on the meter.

3. **Quarterly control analysis** (LWWMB05). Control analysis must be carried out[40]: odour, colour, turbidity, conductivity, pH, ammonium, *Escherichia coli*, coliform bacteria, nitrites, nitrates enterococci, *Clostridium perfringens*, among other parameters based on the specific characteristics of the water (aluminium, magnesium, arsenic, etc.). The sample will be taken from the fountain's spout[41].

4. **Five-year catchment analysis[42]** (LWWMB06). A complete analysis (in accordance with Royal Decree 140/2003) of the water from the catchment is to be carried out every 5 years. The samples will be collected from the sampling tap located inside the fountain.

5. **The biweekly inspection** (LWWMB07) will include the following:
    - The volume of the water dispensed will be measured to ensure it is within specifications (0.5 litres/button push). If this is not the case, the water pressure regulator must be adjusted until the required flow rate is achieved, respecting the technical working conditions of the equipment.

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[40] For the first two years, the ITG recommends 5 analyses per year to determine the contaminant load present in the operation of the fountain. For this purpose, the following schedule is suggested:

- 4 analyses during the peak season (March to October). 1 analysis will be carried out during each of the following months: March, May, July and September.
- 1 analysis at the end of the year in December.

[41] In the event the results of the quarterly control analysis do not fall within the established parameters, the raw water will be analysed from the sampling tap in order to verify a possible contamination of the catchment.

[42] This analysis will have already been done when the fountain was installed, but it must be repeated every five years.

- The spout, guard and pushbutton are to be cleaned (with water and a mild soap) and disinfected (with peroxide or 70% alcohol).
- Organoleptic (colour, odour, pH, taste and turbidity) and conductivity analysis.
- Finally, the results are to be properly documented, noting the date of the inspection and the water consumption reading recorded on the meter.

6. **Document management** (LWWMB08). The following services are to be carried out on a yearly basis:

   - Alert management: the manager of each of the Case B fountains will receive alerts for any incidents regarding these fountains in order to be able to resolve any malfunctions or anomalies as soon as possible.
   - Management of the maintenance, self-monitoring and incident reports.
   - Management of the consumption records sent remotely by the meter.
   - Management of the laboratory reports, making these available to users via a QR code located at the fountain.

10.5.2.1 Operating costs per fountain

The following table details the theoretical costs for the specific maintenance requirements described above for Cases B1 and B2:

CODE	UNIT	INVESTMENT CASE B1: NATURAL SOURCE FROM AN EXISTING CATCHMENT	QTY	PRICE (€)	COST (€)
LWWMB02	u	Cleaning of the source	0.20	500.00	100.00
LWWMB04	u	Annual inspection	1.00	1,728.00	1,728.00
LWWMB05	u	Quarterly control analysis	4.00	110.00	440.00
LWWMB06	u	5-year catchment analysis	0.20	750.00	150.00
LWWMB07	m	Biweekly inspection	24.00	20.31	487.44
LWWMB08	u	Document management	1.00	403.50	403.50
		SUBTOTAL			3,308.94
		INDIRECT COSTS (2%)			66.18
		COST ESTIMATE			3,375.12
		ESTIMATED CONTRACT VALUE (13% GE and 6% BP)			4,016.39
		BASE TENDER ESTIMATE (VAT 21%)			**€4,859.83**

CODE	UNIT	INVESTMENT CASE B2: NATURAL SOURCE FROM A NEW CATCHMENT	QTY	PRICE (€)	COST (€)
LWWMB02	u	Cleaning of the source	0.20	500.00	100.00
LWWMB04	u	Annual inspection	1.00	1,728.00	1,728.00
LWWMB05	u	Quarterly control analysis	4.00	110.00	440.00
LWWMB06	u	5-year catchment analysis	0.20	750.00	150.00
LWWMB07	m	Biweekly inspection	24.00	20.31	487.44
LWWMB08	u	Document management	1.00	403.50	403.50
		SUBTOTAL			3,308.94
		INDIRECT COSTS (2%)			66.18
		COST ESTIMATE			3.375.12
		ESTIMATED CONTRACT VALUE (13% GE and 6% BP)			4,016.39
		BASE TENDER ESTIMATE (VAT 21%)			**4,859.83 €**

In any case, the real cost and effectiveness of the maintenance and self-monitoring actions described above will be evaluated during one year in the tests to be carried out in the 3 "Case B" fountains of the Life Water Way pilot network along the English Way.

10.5.2.2 Signage

"**Drinking Water**", provided the analytical parameters are within the limits established in Royal Decree 140/2003 (and the values agreed upon by the Ministry of Health for Group C parameters), including radioactivity parameters.

Whenever the analytical parameters are not within the limits established in Royal Decree 140/2003 (Part A, B or the values agreed upon by the Ministry of Health for Group C parameters) or radioactivity parameters: **immediate suspension of the water supply**.

10.5.3 annual operating budget

The following table details the base tender estimate envisaged for the yearly maintenance of the pilot network.

FOUNTAIN (ID – NAME, MUNICIPALITY)	TYPE	BASE TENDER ESTIMATE (€)
01- English Way Fountain, Ferrol	Case A	1,886.31
02-Mar Fountain, Ferrol	Case A	1,886.31
03- Marcial Calvo Fountain, Narón	Case A	1,886.31
04- Conces Fountain and washbasin, Neda	Case A	1,886.31
05- Vilar do Colo Fountain, Fene	Case A	1,886.31
06- Praia Fountain, Cabanas	Case A	1,886.31
07- Mirador de Aresito Fountain, Pontedeume	Case A	1,886.31
08- Buíña Fountain, Miño	Case A	1,886.31
09- Ponte Baxoi Fountain, Miño	Case A	1,886.31
10- Garea Square Fountain, Paderne	Case A	1,886.31
11- Caraña Fountain, Betanzos	Case A	1,886.31
12- Croas Fountain, Betanzos	Case A	1,886.31
13- Campo Fountain, Abegondo	Case A	1,886.31
14- Beche Fountain, Abegondo	Case A	1,886.31
15- Porta do Parrote Fountain, A Coruña	Case A	1,886.31
16- Eirís Fountain, A Coruña	Case A	1,886.31
17- San Xiao Fountain, Culleredo	Case A	1,886.31
18- Adro da Igrexa de Sigrás Fountain, Cambre	Case A	1,886.31
19- Lameira Fountain, Carral	Case A	1,886.31
20- Cruz de Beira Fountain, Abegondo	Case B2	4,859.83
21- San Roque Fountain, Carral	Case B1	4,859.83

FOUNTAIN (ID – NAME, MUNICIPALITY)	TYPE	BASE TENDER ESTIMATE (€)
22- Bruma Shelter Fountain, Mesía	**Case B1**	**4,859.83**
23- Cabeza de Lobo Fountain, Ordes	**Case A**	**1,886.31**
24- Senra Fountain, Ordes	**Case A**	**1,886.31**
25- Baxoia Fountain, Oroso	**Case A**	**1,886.31**
26- Carboeiro Fountain, Oroso	**Case A**	**1,886.31**
27- Sionlla Fountain, Santiago	**Case A**	**1,886.31**
28- San Caetano Park Fountain, Santiago	**Case A**	**1,886.31**
	TOTAL	**61,737.24**

In order for the Administration to be duly informed, the aforementioned budget amounts to the above-mentioned sum of **SIXTY-ONE THOUSAND SEVEN HUNDRED THIRTY-SEVEN EUROS AND TWENTY-FOUR CENTS** (€61,737.24).

10.6 cost recovery

10.6.1 justification

As is well known, the Water Framework Directive introduces a new approach to water management in order to achieve its objectives that is based on a policy allowing for the recovery of costs of water-related services and provides incentives for the efficient use of water resources.

Moreover, the Regulatory Law on Local Tax Authorities states that local governments may not charge for the service of supplying water from public drinking fountains.

Taking this situation into account, the aim of this study is to define a feasible cost recovery model for the drinking water supply service via drinking fountains along European cultural and or natural routes, based on the results of the pilot network tested along the English Way of the Saint James Way.

10.6.2 methodology for identifying financial costs

Following the cost recover analysis methodology for water services, a detailed critical assessment of the costs of supplying water from public drinking fountains as opposed to those relating to bottled water consumption was carried out.

As a base for calculating the cost of the pilot network tested along the English Way, the investment and operating costs analysed in the following sections were used:

- 10.4 Investment: technical studies, civil works and equipment
- 10.5 Operation: maintenance and self-monitoring

This study evaluates the financial cost of providing the micro-supply service along the route, which is the sum of the (1) investment and (2) operating costs.

While there are several calculation alternatives, this study has opted for linking the investment costs to their potential financing (considering them as a bank loan) and determining an annual fee based on the work units of the original infrastructure projects.

In order to do this, the following procedures have been carried out:

a Identifying the various elements that comprise the studied model, reorganising the work units according to the work projects of said elements and classifying these according to the following two types of investment costs:

1. Civil construction works or the permanent elements that last longer periods of time (catchment, bases, casing, pipes, etc.) and will not need to be replaced until the end of their lifespan, which depends on the type of material and construction used.

2. The equipment (filtration stage, UV-C germicide, battery, communication equipment, pumps, etc.) that are not part of the previous group and have shorter lifespans than the permanent elements. The maintenance and replacement of this equipment at the end of their lifespans must be provided for.

element	case A	case B
catchment	(-)[44]	✓ (25 years)
micro-supply point	✓ (15 years)	✓ (15 years)
water drainage	✓ (15 years)	✓ (15 years)

Lifespans of the pilot network's civil works.

b Calculation of the current value: updating the amount based on the prices of the construction cost estimate, WITHOUT considering any possible discounts made by the provider and taking into account the date of execution and the income variation rate with the Consumer Price Index (CPI) published by the Spanish National Statistics Institute (INE)

c Calculation of the annual cost: income that balances the current value of the element throughout its lifespan[45] at an interest rate of 3%, applying the following formula.:

$$CA = VA \frac{i}{1-(1+i)-t}$$

CA: Annual Cost (€)
VA: Current Value (€)
i: Interest Rate (%)
t: Lifespan (years)

According to this methodology, the current value of the water supply system for the Egnlish Way, comprised of 28 public drinking fountains, is nearly €215,000, with a yearly investment cost of around €17,250.

item	current value	%	annual investment cost	%
Civil works	80,483.80 €	38%	5,896.80 €	34%
Equipment	133,612.04 €	62%	11,347.73 €	66%
total	**214,095.84 €**		**17,244.53 €**	

[44] As indicated in the “observations” section, the investment costs of the “source of the water” for drinking fountains that are connected to a controlled water main network are not considered.

[45] Estimated based on consultations with experts.

Furthermore, the operating costs correspond to the annual operating budget that, as previously mentioned, amounts to €61,737.24 €.

The following table summarizes the financial cost of this water supply service for the English Way, which would be around €80,000 per year.

cost	pilot network total	%
Annual investment cost	17,244.53 €	22%
Annual operating cost	61,737.24 €	78%
Annual financial cost	**78,981.77 €**	

10.6.3 cost per user[46]

In the consumption intention survey carried out among pilgrims during the first stages of this project, the results showed that 96% of these pilgrims would be willing to consume water from public drinking fountains, provided they were guaranteed to be safe[47]. For this reason, it is assumed that all the ecotourists who make the pilgrimage along the English Way will use some of the pilot network's drinking fountains.

In the case of the English Way, the number of pilgrims[48] is estimated to be 22,092 per year, with 85% starting in Ferrol (18,778) and the remaining 15% beginning their journey in A Coruña (3,314).

[46] Although it may seem obvious, it should be made clear that, while the pilot network has been primarily designed to meet the water needs of the English Way's users, it is also a suitable and accessible way to meet the local population's needs as well. However, for the cost recovery purposes, the consumption of local users of the network has not been considered.

[47] See page 9 of the *deliverable* of Action C2: "Study of alternative dispensing models that allow for cost recovery".

[48] The "Compostella" is the certificate that is given to all pilgrims who have completed the Saint James Way according to the established rules. The Pilgrims' Reception Office is located at the end of the Saint James Way and is part of the Cathedral of Santiago in the Archdiocese of Santiago de Compostela. Its purpose is to receive pilgrims who arrive in the city and have walked, cycled or travelled on horseback to the Tomb of the Apostle Saint James the Great. It is there where the final stamp of the Cathedral of Santiago is placed on the "*pilgrim's credentials*" and the traditional pilgrimage certificate, the "Compostella", is issued.

According to the official statistics from the Pilgrims' Reception Office, the number of users who made the pilgrimage along the English Way and who obtained the "Compostella" during 2019 was 15,780: 15,097 began in Ferrol, 139 from A Coruña and 544 from other starting points.

As a general rule, the Pilgrims' Reception Office estimates that 25% of the users who make the pilgrimage along one of the Saint James Way's multiple routes do not request the certificate. For this reason, they are not counted and do not appear in the aforementioned statistics.

In the case of the English Way, the percentage of unregistered users increases due to the following reason: in order to qualify for the "Compostella", a pilgrim is required to have covered the last 100 kilometres on foot or horseback or the last 200 kilometres by bicycle. As

Based on these factors, the current value of the investment to be made in the drinking fountain installations would be around €10 per pilgrim, with a yearly financial cost of €3.58.

	total per user
Current Value	9.69 €
Annual investment cost	0.78 €
Annual operating cost	2.79 €
Annual financial cost	**3.58 €**

10.6.4 recovery scheme

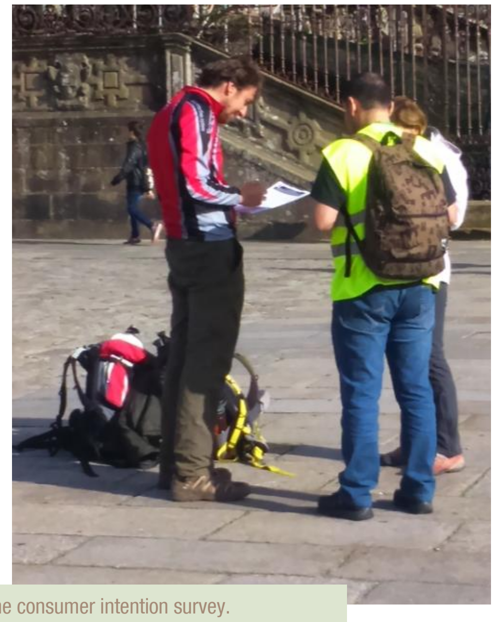
Given the need for future maintenance of the drinking fountain network and any improvements that may need to be implemented, the different cost recovery options were analysed to ensure its sustainability. In order to carry out the study of these alternatives, which, on the one hand, would allow for the service to continue, and, on the other, adapt to the preferences of the potential water consumers, a series of questionnaires were developed.

previously mentioned, the English Way is 113 km long from Ferrol and 73 from A Coruña. Nevertheless, although many are not aware, pilgrims who begin their journey in A Coruña can obtain this certificate if they meet the fulfil the following requirements:

- For those who are not residents of the city of A Coruña or the surrounding municipalities, the pilgrim must complete part of the Saint James Way in their home country or place of origin so that, when added to the English Way from A Coruña to Santiago, the total number of kilometres traversed exceeds the 100 km necessary to obtain the "Compostella". Therefore, this only applies to those European Citizens who have part of the Saint James Way in their countries. Those pilgrims who are not European citizens (from a country with part of the Saint James Way) and residents of A Coruña are not eligible to get the "Compostella" in this way.
- If the pilgrim is a resident of A Coruña or one of the surrounding municipalities, they must prove this with their Identity Card.

In conclusion, given that there is no reliable record of the actual users of the English Way, for the purposes of this study, it is assumed that the number of pilgrims who make this pilgrimage each year is 40% higher than the total registered number (considering that 35% of the users who, while eligible, do not request the "Compostella" and that 5% of users complete the Way but do not qualify for the certificate). This means that there are 22,092 pilgrims per year, with 85% starting in Ferrol (18,778) and the remaining 15% beginning in A Coruña (3,314).

These surveys were carried out both in person and online with pilgrims and other potential users from more than 18 different countries. They were structured so as to begin with general questions before gradually moving on to attempt to gather more specific information regarding the intended objective with as much detail as possible. Thus, the questionnaires began with questions on consumer habits and preferences, and then, depending on the results obtained, the questions pivoted towards defining the most appropriate method for implementing the chosen cost recovery scheme.



Images of Saint James Way pilgrims filling out the consumer intention survey.

The key result of these interviews showed that **pilgrims chose the purchase of reusable containers** as the **best cost recovery alternative** for the micro-supply service provided by the drinking fountains placed along the English Way.

In order to promote the purchase of these reusable containers ("bottles"), two actions have been launched within the framework of the LIFE Water Way project, which are to be promoted within the scope of this preliminary project:

(1) **Online bottle shop**: this allows pilgrims from all over the world (the site is available in both Spanish and English) to purchase bottles and pay by credit card. The bottles can be delivered to their homes or, alternatively, pilgrims can pick up their bottles at one of the established collection points free of charge (see the next point). Finally, this platform promotes the network of available drinking fountains and explains that the cost of the bottle (RRP €15) and the proceeds from sales will contribute to the recovery of the financial costs of the drinking fountain network.

The current shop could be customised for the different Saint James Way routes with uniquely designed bottles and product sheets to highlight the drinking fountains located along each of these routes.

LIFE WATER WAY

DRINKING FOUNTAIN | PILOT NETWORK | OBJECTIVES | SCOPE | ACTION | WATER QUALITY | NEWS | PARTNERSHIP | SHOP

STAINLESS STEEL BOTTLE 0,50 L WITH STEEL CAP

Vintage bottle decorated by Galician pinter Branda, lightweight and wide mouth, entirely stainless-steel made. No plastic in contact with water!

- 18/8 STAINLESS STEEL, FOOD SAFE
- TIGHT CLOSURE EVEN FOR CARBONATED DRINKS
- NO BPA, PHTHALATES, LEAD OR OTHER HARMFUL SUBSTANCES
- DOESN'T IMPART FLAVOURS
- NON-TOXIC EXTERIOR PAINT
- REUSABLE AND RECYCLABLE
- VERY RESISTANT
- LIGTHWEIGHT

15,00€ | 1 | ADD TO BASKET

SPECIFICATIONS

- 18/8 stainless Steel
- Tight closure
- Doesn't impart flavours
- Diameter: 7 cm. Height: 18 cm. Weight: 154 g
- Wide mouth (enough to introduce ice cubes and easy cleaning)
- No BPA, phthalates, lead or other harmful substances
- Reusable and recyclable
- Recycled carboard packaging

HOW WE SPEND THE BOTTLE COST?

With the purchase of this bottle (*) you will be contributing to the maintenance of the network, aside from reducing plastic consumption and CO2 emmissions.

(*) Not-for-profit initiative.

REDUCED PLASTIC CONSUMPTION | REDUCED CO2 EMISSIONS | MAINTENANCE OF FOUNTAINS NETWORK

DRINKING FOUNTAINS NETWORK

In the English Way to Santiago, the project Life Water Way has created a public drinking fountain network. Take advantage of it and refill your canteen, 28 points alongside its 143 km are available with potable water. !

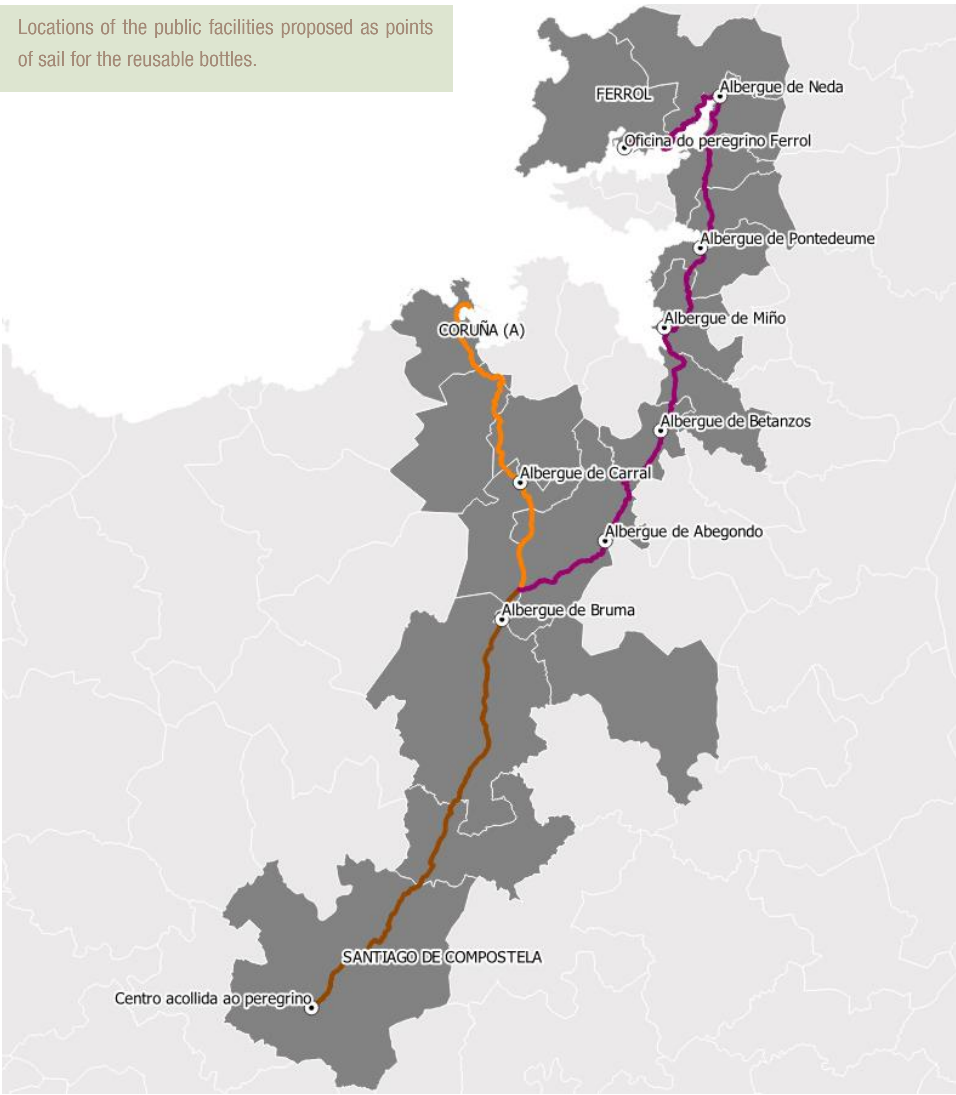
Choose local consumption!

- **Fonte da Baxoia** – Oroso
- **Fonte de Cabeza de Lobo** – Ordes
- **Fonte de San Xiao** – Culleredo
- **Fonte do Mirador de Aresito** – Pontedeume
- **Fonte de Beche** – Abegondo
- **Fonte do Campo** – Abegondo
- **Fonte da Cruz de Beira** – Abegondo

(2) **Collection points**: the proposed collection points or sites in which pilgrims can obtain their reusable bottle are those centres or facilities linked to the various Saint James Ways managed by the Xacobeo Plan or other public administration offices. Currently, the following are collaborating with the LIFE Water Way project along the English Way: 7 shelters (Neda, Pontedeume, Miño, Betanzos, Abegondo, Carral and Mesía), the Pilgrims' Office in Ferrol and the Pilgrims' Reception Office in Santiago de Compostela.

In addition to these points, other public and private facilities linked to the Way could be analysed and incorporated in the future (tourist offices, municipal markets, souvenir shops, etc.).

Locations of the public facilities proposed as points of sail for the reusable bottles.



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- Abastecimiento de Aguas. Universidad Politécnica de Cartagena.

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Life
Life water way
LIFE16 ENV/ES/000533
CONCELLO DE ABEGONDO
XUNTA DE GALICIA
CONSELLERÍA DE SANIDADE
augasdegalicia
Deputación DA CORUÑA
Mariñas Coruñesas e Terras do Mandeo Reserva de Biosfera
instituto tecnológico de galicia

The objective of the Life Water Way project is to supply the 'English Way' with drinking water, as an example of how to mitigate the environmental impacts of bottled water consumption on European nature trails and cultural routes.

This guide proposes a strategy to encourage the adaption and/or installation of drinking fountains in public spaces for reusable bottles and the recovery of natural water catchments as a micro-supply solution in areas where centralised drinking water supply networks do not reach.

Good Practice Guide for Promoting Public Drinking Fountains