

## Citizen hydrology in River Contracts for water management and people engagement at basin scale

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### ABSTRACT

The EU Water Framework Directive 2000/60/EC as well as the EU Floods Directive 2007/60/EC encourage the effective public participation in order to increase public awareness of environmental issues and support for the decisions taken.

In Italy the Water Framework Directive has been transposed by Legislative Decree 152/2006, which recently received, from February 2016, the river contracts, as voluntary tools for strategic and negotiated programming at a basin and sub-basin scale.

River contracts, through public participation, pursue the protection, proper management of water resources and enhancement of river territories, together with the safeguard from the hydraulic risk, contributing to local development.

The aim of the research is the collection of water level data on rivers acquired by citizen through the application CITHYD (CITizen HYDrology), developed by the authors.

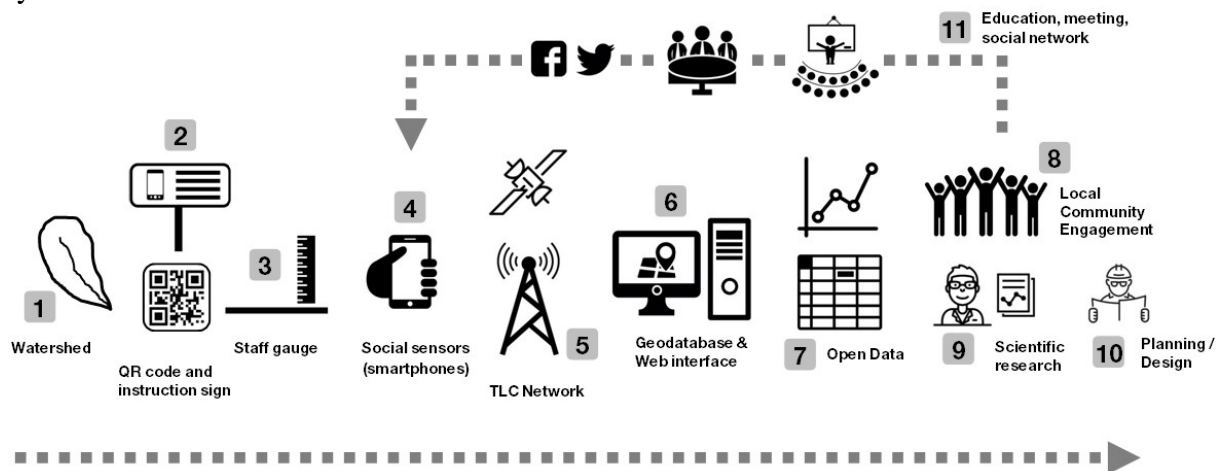
CITHYD is an application that receives water level data, collected and sent by citizens, in river cross sections instrumented with a staff gauge and an information panel with a QR code, performs simple reliability checks, stores the data, publishes and creates statistics freely available for all. The application is a useful support during emergencies, and allow to improve knowledge and water management capability. Moreover it can be an important people involvement instrument in the context of River Contracts, at virtually no cost.

In order to indentify the main features of the application, the first step of the research was focused on the analysis of various experiences of Citizen Science, mainly about water resources, (W. Buytaert et al 2014, V. Lanfranchi et al 2014, C.S. Lowry & M.N. Fienen 2012, E.A. Graham et al 2011). The goals, set in Table 1, and the solutions adopted to achieve them, concern both hydrological aspects, and functional and citizen involvement.

**Table 1.** Identified goals and design choices to get them

Goal	Description	Answer
Simplicity	Easy data collection and sending, user friendly interface, design clearness	Use of Smartphones, QR code, few fields to fill
Engagement	Crowdsourcing, awareness, community making	Dedicated website about the project and the river environment, infographics, bi-directional communication
Cost	Low or no costs for citizens and institutions	Flat telephone rates for sending data, freeware software, inexpensive field tools, possibility to use existing level gauges
Time	Quasi-Real time, short citizen's time need, no need of formal training	Easy measurement process, fast publication of data
Hydrologic data	Relevant aperiodic data for hydrologic analysis in small basins	Choice of variable useful for predictions in ungauged basins (PUB) and calibration of hydrological models
Reliability	Good measurement accuracy	Good ability to measure water level

Once set the goals and fixed ways of achieving them, the application was developed and it is now in test phase. The functioning can be summarized according to the following scheme showing the logical flow of information and the relationships between elements of the whole system.



**Figure 1.** Citizen hydrology CITHYD Model with logical flow of information and relationships between elements of the service

As mentioned before CITHYD need an information panel containing a unique QR code (2) for every staff gauge (3). Through smartphones (4) and TLC network (5) the citizen can transmit the water level seen on a staff gauge (3) existing on a river basin (1) to a geodatabase with web interface (6). The user, thanks to the QR code, immediately enters the data entry form related to that staff gauge and can insert the water level just read. Data are published almost in real time on a map and the data, inserted by all users, can be read and downloaded, as text files, tables and graphics (7). The Open Data stored in the DB can be used for scientific research (9), to improve the knowledge of the territory and as a support instrument for planning and design (10).

The Citizen Science experience supports the involvement of local communities in living and take care of the river (8) and can promote the creation of a virtuous circle in data collection through social networks, educational and communication events (11).

In the logical chain represented in figure 1, CITHYD provides rings 2, 3, 6 and 7.

Regione Lombardia - DG Environment, Energy and Sustainable Development, by Decree n. 3147 of 2015 in the context of the River Contracts "Olona Bozzente and Lura", "Seveso" and "Northern Lambro" funded the design of several river restoration actions in which CITHYD could find his natural placement. At the moment some local administrations involved in this actions are evaluating the use of CITHYD for some small catchments in their territories.

## References

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