



## → MEASUREMENTS AND OBSERVATIONS IN THE 21st CENTURY CONFERENCE

# CITHYD: a Citizen Science experience for hydrometric measurements in ungauged basins

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# Needs and new opportunities

- Collecting the maximum information available for using in the estimates and hydrological modeling (temporal and causal expansion of information)
- Improve the collection, exchange and use of data
- Seek the involvement of citizens as called for by the EU Water Framework Directive 2000/60 / EC and EU Flood Directive 2007/60 / EC)
- Improve prediction in ungauged basins (PUB)
- Increased measures of levels / flows, especially in small basins (poorly instrumented)
- **Wide diffusion of smartphones (with camera and sensors)**
- **Many experiences of Citizen Science for observation, data collection and data processing, even in water resources**
- **Inclusion in the Italian legislation (art. 68bis DLgs 152/2006) of the River contracts, creating activities for citizen participation and a network of authorities and citizens at basin and sub-basin level**



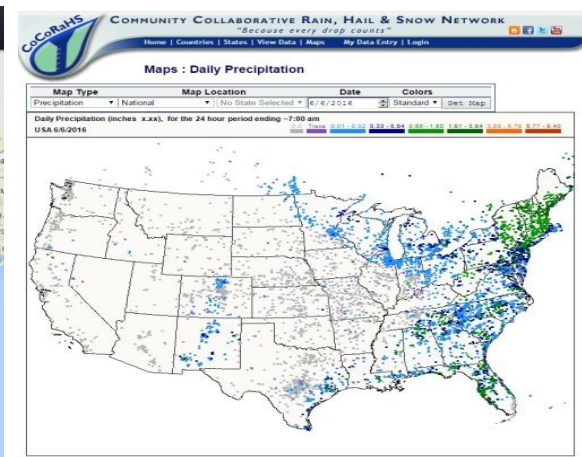
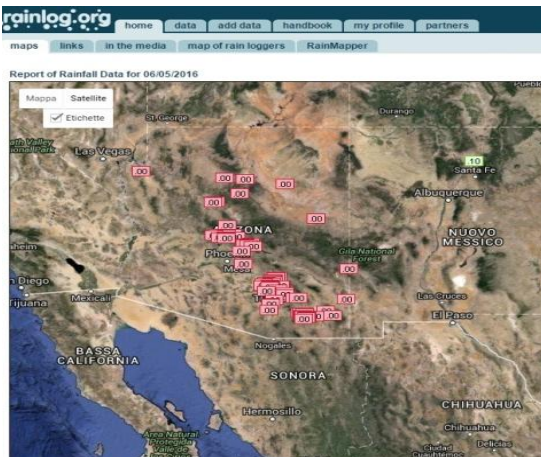
## Why CITHYD? With CITHYD we want to:



- Create an **experience of citizen science** to improve the **link between people and rivers** through the measure of river water levels matching river contracts goals.
- Create a **tool for water level data storage**, from citizen measures, completely free, downloadable and usable by anyone, now and in the future, that could be improved to receive data also from other sources (electronic hydrometric sensors , etc...)
- Improve the **knowledge on low and high flows**, also on small rivers, generally poorly monitored but often extremely critical for flood risk and DMV.



# Inspiring existing experiences



CITHYD is obviously not the first experience of Citizen Science project in hydrology in the world. There are interesting experiences with different grade of complexity, such as: *Crowd Hydrology* ([www.crowdhydrology.org](http://www.crowdhydrology.org)), *Community Collaborative Rain, Hail and Snow Network* ([www.cocorahs.org](http://www.cocorahs.org)), Cooperative rainfall monitoring network for Arizona: *Rainlog* ([www.rainlog.org](http://www.rainlog.org)), *WeSenseIt* ([www.wesenseit.eu](http://www.wesenseit.eu))

Cithyd wants to collect the largest possible number of water level measures, creating new stable measurement stations in the most simple and inexpensive way.

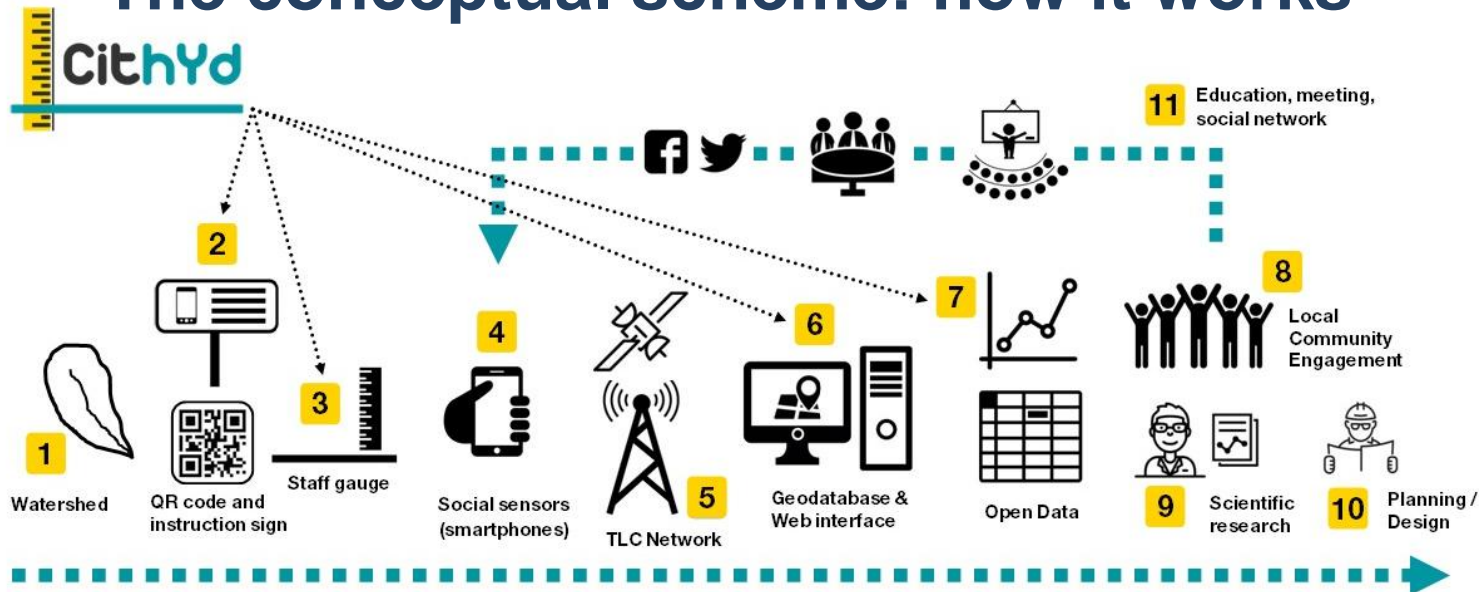
# What is CITHYD: the idea and the goals

CITHYD is an application that receives water level data, collected and sent by citizens with smartphone or tablet, in river cross sections instrumented with a staff gauge, stores the data, publishes and creates reports and graphics available for free to everyone.

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



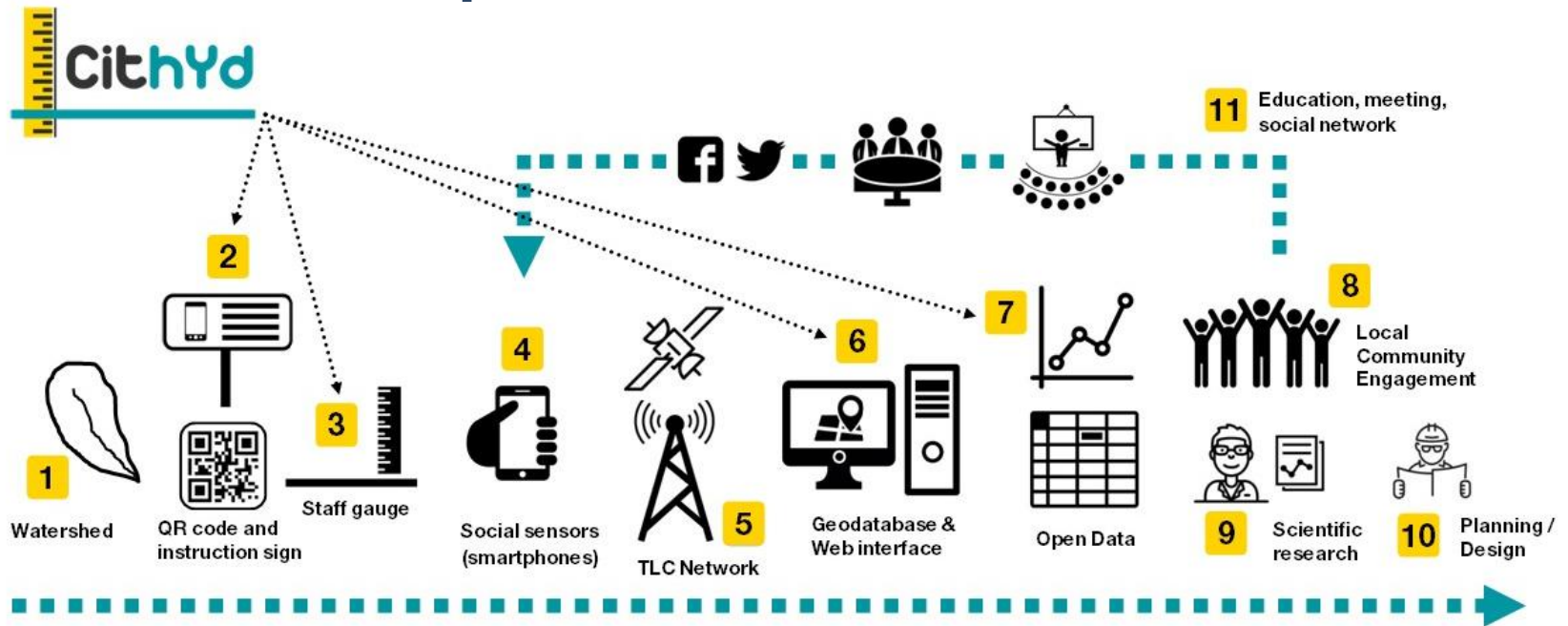
# The conceptual scheme: how it works



Near a staff gauge CITHYD (3) located on a river basin (1) the user will find an information panel containing a unique QR code (2). Scan the QR code with the smartphone camera (4) and via web (5) he will be connected to CITHYD website (6), with a user-friendly mask referred to that staff gauge, in which he can insert the water level just read. The data will be stored in a geodatabase, published 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), for free by anyone.

The data are issued according to the Italian **Open Data License version 2.0**

# The conceptual scheme: how it works



Institutions and associations, through conferences and social networks can contribute to the diffusion of the project and increase the number of citizens involved. The data can be used for scientific research, for improving information on a river, for planning and design and also as a support for the management of emergency situations in case of floods.



# What is CITHYD: the components

## Staff gauges



Every kind of staff gauge (new or existing) can become a CITHYD staff gauge

A staff gauge enters in CITHYD network simply initializing the staff gauge, on CITHYD platform, assigning a unique QR code, and installing an instruction panel with QR code near the staff gauge

## The instruction panel

**Cithyd** Che livello d'acqua leggi sull'asta?

ECCO COME PUOI CONTRIBUIRE: bastano uno smartphone e 2 minuti

- 1 Cerca l'asta graduata e leggi il livello a cui arriva l'acqua
- 2 Scatta una foto al codice QR con lo smartphone e quando si apre la pagina web...
- 3 ....Inserisci la misura del livello che hai letto ed invia

puoi subito controllare sulla mappa il dato inserito e scaricare i dati inseriti da altri partecipanti

CON IL PATROCINIO DI:

CITHYD è un servizio di Citizen Science e Smart City per raccogliere dati sui livelli idrici coinvolgendo cittadini, istituzioni e ricercatori. Più persone partecipano più è possibile accrescere la conoscenza sui fiumi e il territorio!

TUTTI POSSONO PARTECIPARE  
Per maggiori informazioni [www.cithyd.com](http://www.cithyd.com)

The instruction panel describes CITHYD experience, and gives simple instructions to take a good measure.



# What is CITHYD: the components

## QR code



The QR code will be located in two places: on the instruction panel and at the top of the staff gauge.

## Entry data mask



The data entry mask, will open automatically by pointing the camera of smartphone or tablet on QR code.

The data entry mask will ask the user to insert the water level he is reading on the staff gauge, using the scrollbar.

The staff gauge is initialized inserting the max and the min level readable on the staff gauge, so in the scrollbar you can not find values over that limits. Thanks to the scrollbar and the limits the occurrence of typographical errors is minimized.

# What is CITHYD: the components

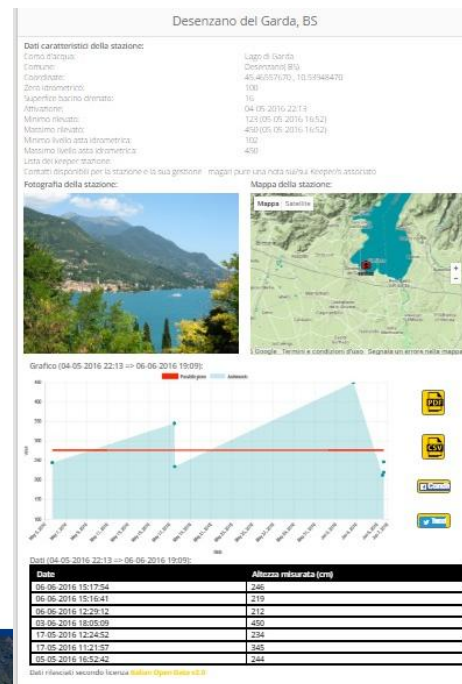
## The website

Citizen's measure becoming from CITHYD staff gauges are stored in a DB and visible by all users realtime.

Every staff gauge is georeferenced on a map in the home page of the website and has a register of the measures (text and graphic) with the characteristic data of the station. The register of the measures can be downloaded for free.



Nome	Comune (Prov)	Latitudine	Longitudine
Badia Polesine, RO	Badia Polesine(RO)	45.09608370	11.49038900
Brescello	Brescello(RE)	44.89356780	10.50387000
Castiglione Olona, Olona	Castiglione Olona(VA)	45.75515000	8.86456000
Chivasso, TO	Chivasso(TO)	45.19152140	7.88178500
Cremona	Cremona(CR)	45.13635640	9.99083070
Delta del po	Comacchio(FE)	44.95252000	12.29349000
Delta del Pò, Goro, FE	Goro(FE)	44.91314760	12.34924970
Desenzano del Garda, BS	Desenzano(BS)	45.46557670	10.53948470
Guastalla	Guastalla(RE)	44.90986880	10.65061270





## Strenghts of CITHYD

**SIMPLICITY:** Everyone with a smartphone can take a water level in two minutes following few and simple passages

**ENGAGEMENT:** Citizens can help institutions and researchers by sending data easily, improving their knowledge about rivers, hydrology and hydraulic risk. The tool can be used to improve community resilience.

**INCREASE OF RIVER DATA:** Is not a substitute of electronic hydrometric sensors but an integration (also in the same place, in order to create engagement) . Data collected during special occasions, for example floods, by trained users can be used immediately for emergency management. You can quickly and simply activate also temporary stations to collect data related to a specific use or project.

**COST:** staff gauges and signs are not expensive, especially if already provided in current projects. The use of the app is free and the data are open according to IODL 2.0. The low cost allows the activation of a great number of measurement stations, on condition of being able to involve local communities.

## Possible critical aspects (1)

**RELIABILITY OF DATA:** depends on citizens reliability and the actual checks provided are only concerning the boundary limits and the captcha test to avoid Computers and Humans Apart

### **CITHYD ANSWER:**

Assignment of one or more voluntary Keeper for each staff gauge

Engagement involving local association and public administrations

Creation of a community of registered users interested in the good quality of data

Correct location of the staff gauge to have a big number of data and isolate wrong data

Many authors shows good agreements between citizen data and electronic measurements (C. S. Lowry and M. N. Fienen 2012)

## **DURABILITY OF THE STAFF GAUGE**

### **CITHYD ANSWER:**

Installation handbook and technical specifications

Promote the identification of a Keeper for each staff gauge

Engagement involving local association and public administrations



## Possible critical aspects (2)

**DIFFICULTIES IN THE CREATION OF A CITIZEN COMMUNITY:** many citizens contribute to the experience much more you can collect data

**CITHYD ANSWER:**

Creating engagement through local association and public administrations and insertion of CITHYD in River Contracts projects or in projects involving people

Careful choice of the installation point (in order to involve citizens and make maintenance easy)

Using social media

## Current development and next steps

The test phase with selected users (citizens, researchers, professionals) is over and the final version will be ready on the website on January 2017

CITHYD has been inserted in some **River Contracts projects** in Lombardy Region and it has been used in a hydrologic- hydraulic study for model calibration inside Seveso basin (through **temporary QR codes** on existing gauges)

Is in definition phase the application of CITHYD in other projects concerning rivers and resilience and in activities organized by park authorities

**Other steps provided for next year:**

Start of training and education projects in collaboration with Institutions

Improvement of CITHYD with Validation of level data and photo storage





## Thanks for the attention

You will find Cithyd soon at [www.cithyd.com](http://www.cithyd.com) (now under construction)

Contatti: [info@cithyd.com](mailto:info@cithyd.com)



From ungauged rivers to engaged people