What is spring?

A spring is a focused discharge of naturally occurring groundwater on the Earth's surface.

Fig. 1 Free flow spring

Fig. 2 Seep Spring

For creating spring inventory, following conditions need to be considered during springs mapping,

(1) Not all naturally occurring groundwater flows with diffuse discharge can be classified as springs. For example:

Seepage: *This refers to cases where a discrete discharge point cannot be determined, such as the oozing of groundwater from the banks of a river, lake, or stream, resulting in the creation of a wet and marshy area.*

Fig. 3 Water logging due to seepage

Wetlands: *In areas where the water table is near the surface, groundwater discharges diffusely, giving rise to swampy or* *marshy ecosystems that support unique plant and animal life.*

Fig. 4 Swampy wetland

(2) Spring inventory should not include ponds and artificial situations, viz. dug wells, artesian wells, and groundwater that appears in excavations.

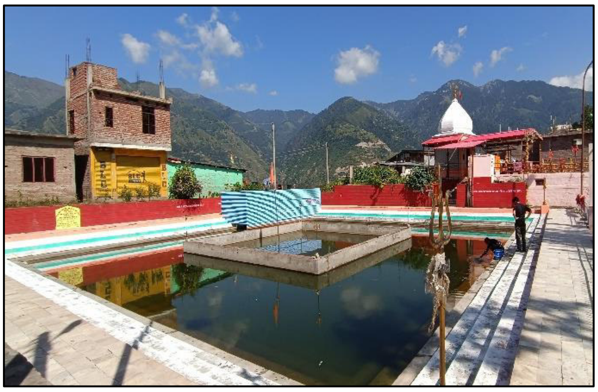

Fig. 5 Pond

Fig. 6 Dug well

Fig. 7 Artesian well

(3) Natural springs that have pipes installed at their outlets to direct/guide their flow should be included in the mapping of springs and should not be mistaken for piped water supplies.



Fig. 8 Springs with piped outlet

However, the following should be excluded:

- *Pipes connected to artificial tanks and pumping schemes.*
- *Pipes drawing water from adjoining or nearby streams, rivulets, or nallahs.*

(4) In addition to free-flowing springs, which are characterized by concentrated flow, there are small and localized groundwater seeps that occur through permeable sediments or fractures in rock, resulting in the formation of pools of water known by different names in local areas, viz. ***Naula*** in Uttarkhand, ***Baowli*** in Himachal Pradesh, and ***Bowli/Baowri*** in Jammu & Kashmir should also be covered in the spring inventory. It is important not to confuse these with other larger structures like step wells during spring mapping (e.g., Agrasen Ki Baoli in New Delhi, Rani ki Vav in Gujarat, etc.).

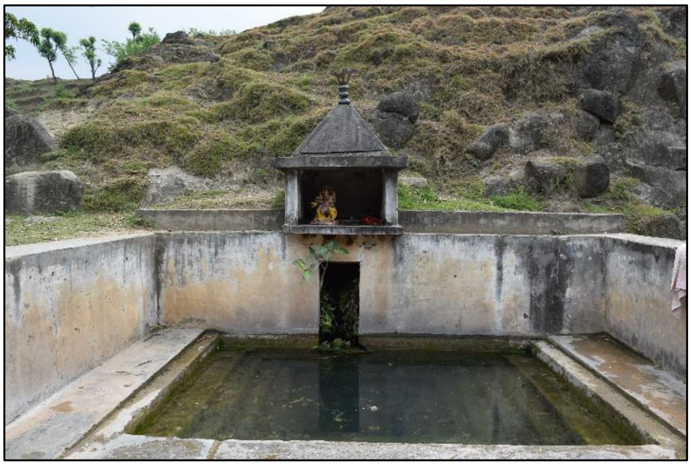

Fig. 9 Bowli/Baowri in Udhampur district of J&K

There exists a notable variation in the local nomenclature used to refer to springs across different regions of India. Consequently, it is advisable to incorporate the specific vernacular designations utilized by the local populace when conducting spring mapping exercises. A 'non-exhaustive' list of popular nomenclatures for springs in different regions of India is provided below:

Table 1 Local nomenclature of springs across different states of India

S. No.	State	Local nomenclature of spring
1	Arunachal Pradesh	Hikur by the people of Adi tribe, and Sadang by the Nyishi tribe
2	Assam	Uuh
3	Himachal Pradesh	Panihar, Nadu, Baori, Chharedu
4	Jammu and Kashmir	Chasma, Naag, Baowli
5	Karnataka	Neerina bugge, Karanji neeru, Oravu
6	Kerala	Jaladhara, Oat vellum
7	Ladhakh	Chhumik
8	Maharastra	Jara or Zara
9	Manipuri	Ephut by Meitei people
10	Meghalaya	Chimik by Garo tribes
11	Mizoram	Sih
12	Nagaland	Dzuluo in Kohima area, Azukikhi in Zunheboto area, Dzuri in Phek area, and Tchulan in Wokha area
13	Sikkim	Dhara, Umrey ko Pani (Nepali)
14	Tripura	Hathai-ni by the indigenous people, and Jharna by Bengali people
15	Uttarakhand	Naula, Panera in Kumaon region, and Dhara, Panera in Garhwal region

What is springshed?

A springshed refers to a land area within a groundwater or surface water basin that contributes groundwater to a spring. The genesis of spring water is influenced by both topography and the underlying geology, including the nature of the rock, its inclination, and its structure. It should be noted that springsheds do not necessarily lie within the same watershed due to these factors. A typical springshed encompasses three distinct zones: the recharge zone, the transition zone, and the spring outlet. Despite being geographically distant, these zones are intricately interconnected.

Spring parameters to be covered during spring census

The spring survey constitutes a laborious and time-intensive endeavour, demanding considerable effort to access remote spring locations often situated amidst challenging and rugged mountainous terrain. Thus, upon reaching these locations, it is highly recommended to undertake a comprehensive survey encompassing a wide array of parameters. The selected parameters ought to yield invaluable insights into springs and facilitate the formulation of subsequent management strategies.

To maximize the efficiency of surveyors in identifying geographically scattered and secluded springs within the remote expanse of the Indian Himalayan Region (IHR), deliberations were held with esteemed experts specializing in the field of springshed management and groundwater hydrology during the Brainstorming Workshop on the 'Development of a Standard Operating Procedure (SOP) for Springshed Management,' conducted on May 15, 2023, at the National Institute of Hydrology, Roorkee. These deliberations culminated in the finalization of the Spring Data Collection form, which would be consequently used as Spring Schedule for First Census of Springs. The following points highlight the significant aspects of data collection and their relevance to spring surveys, with the aim of ensuring a comprehensive inventory:

(1) Detail of Surveyor/Enumerator

In order to acknowledge the source of the data provider and establish accountability, it is imperative to gather comprehensive information pertaining to the surveyor. This information should encompass name of the surveyor, contact number, designation, and name of their respective department or organization.

(2) General description of spring

In this section, general information on spring such as, geo-graphic coordinates along with the altitudinal information and different administrative units (e.g., district, block, etc.) are covered. It is important to collect spring photographs while collecting the general information to understand the physical condition of spring and its vicinity. It is recommended to capture at least two photographs of spring during survey so that the clear view of spring outlet (in a close up photo – within 2 meter from spring outlet) and the information of spring along its vicinity (in a wide angle shot – about 10-20 meter from spring outlet) can be visualized.

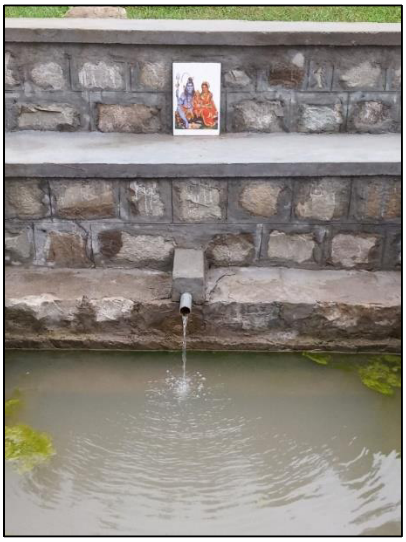

Fig. 10 Close-up shot

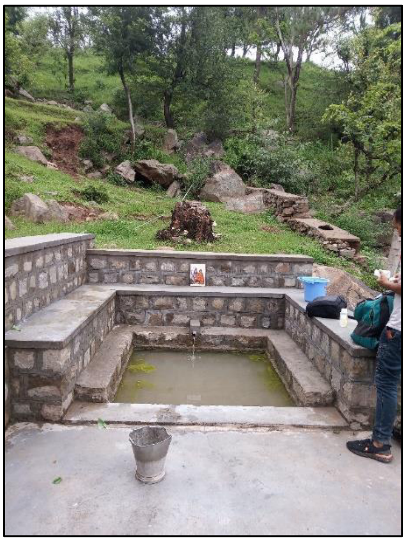

Fig. 11 Wide angle shot

Furthermore, insight on spring nature (i.e., perennial, seasonal, dried), cleanliness in and around the spring, ownership, any storage tank on spring, pipe supply from the spring, etc. should also be collected.

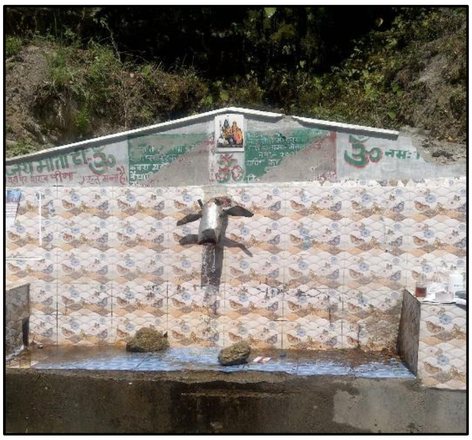

Fig. 12 Spring with storage tank

(3) General physical characteristics of spring

This section necessitates the collection of specific information regarding the general characteristics of the spring. These include the spring discharge, colour, smell, taste, insight on discharge trends over the past ten years and seasonal variability as perceived by local residents.

- ✓ The insight on seasonal variability aids in comprehending the spring's reliability as a water source throughout the year. For instance, a spring with high seasonal variability exhibits significant fluctuations in discharge magnitude across different months, whereas a spring with low seasonal variability maintains relatively consistent discharge levels throughout the year.

- ✓ It is not uncommon for a spring to possess multiple outlets. In such cases, it is necessary to measure the discharge of each outlet individually to determine the total discharge of the spring. For instance, if a spring has two outlets, the surveyor must collect data for both outlets separately. To accomplish this, a bucket of known volume or a container with graduated markings should be employed to ensure the collection of an appropriate amount of water (e.g., 1 liter, 2 liters, 5 liters, 10 liters, 20 liters, etc.), depending on the spring's discharge magnitude. The time taken to collect the water should be recorded using a stopwatch. This process should be repeated three times, and the average time taken should be recorded for each outlet.

Fig. 13 Springs with three outlet

- ✓ In the case of seep-type springs that lack free-flowing water or concentrated discharge, the known volume of water should be drawn from the accumulated pool after marking the initial water level. Subsequently, the time taken for the water level to return to the initial mark should be recorded to calculate the discharge. For example, if it takes 10 minutes for the water level to return to its initial position after withdrawing two buckets of water (say, 40 liters in total, assuming each bucket has a 20-liter capacity) from the accumulated pool, the discharge will be calculated as 4 lpm. The volume of water withdrawn should be determined based on the size of the pool.

Fig. 14 Spring discharge measurement

(4) Other information

The comprehensive assessment of springs requires the inclusion of various ancillary information that can greatly enhance the understanding of their dynamics and contribute to informed decision-making. This additional information encompasses several key aspects, such as land use and land cover, spring water usage patterns, threat perception, stressors affecting the springs, dependent communities relying on these water sources, and detailed descriptions of these dependencies. Furthermore, it is essential to gather information on any ongoing springshed management activities in the area. The incorporation of these details into the survey process significantly enriches the collected data and facilitates the analysis and interpretation of results in later stages.

Fig. 15 Interaction with local stakeholders during spring mapping

Fig. 16 Interaction with senior citizens to grasp evolution in spring flow regime over time

To ensure the accuracy and relevance of this ancillary information, surveyors must actively engage with local residents and stakeholders. Interacting with the community members allows surveyors to obtain first-hand knowledge and insights about the springs and their associated aspects. This participatory approach fosters a sense of ownership among the local stakeholders and includes their valuable perspectives in the survey. Including the views and concerns of the community members is important as they possess invaluable knowledge and observations accumulated through their interactions with the springs over time.

Engaging local residents in the data collection process not only facilitates the acquisition of ancillary information but also enhances the overall accuracy and reliability of the survey outcomes. Involving stakeholders ensures that the collected data aligns with ground realities, local customs, and practices. Moreover, involving the community members in the survey instills a sense of empowerment, as they feel recognized and heard in matters relating to the springs that directly impact their lives. Engaging with local residents during the data collection process promotes inclusivity, integrates local perspectives, and contributes to the overall accuracy and relevance of the survey findings. This collaborative approach benefits scientific research, strengthens community relationships, and empowers local stakeholders in the sustainable management of springs.