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Abstract

Provision of basic services such as portable water and sanitation are vital for health and wellbeing of the society. The growing intensity of use of water in urban environment due to increasing urbanization and rapidly growing population has posed significant challenges for efficient water supply and conservation in many developing countries. Darjeeling town alike most of these developing countries struggle for the improved access of water for urban population. The urban dwellers in Darjeeling Town struggles for the improved access of water due to increasing urban population. The daily uncertainty and anxiety over the access to water has been a common sight to the people in urban Darjeeling hills. The rapidly growing urban population associated with the increasing demand for water has led to striking challenges in the management practice of water resources. Consequently, a huge imbalance has generated between the demand and supply of water in the town. The present study therefore attempts to explore the existing situation of water resource and discuss the issues and challenges around the management of water resource in the urban landscape of Darjeeling hills.

Household survey, focus group discussion and participant observation methods were used for collecting the data. The study revealed that the gradual introduction of developmental activities, faulty construction plans relating to water, political intrusion, poor governance system and lack of public awareness are some of the prominent factors for insufficient water supply and creating a situation of scarcity in Darjeeling.


Introduction

Water is the basic element that plays a significant role in our everyday life. All the dimensions of security in life like food and economic securities largely depend on water resources. Thus, the crucial importance of water in every aspect of the world makes it an essential component for international, national and local security. Still, a large number of human beings lack access to clean and safe drinking water. The problem of water shortage is predominantly experienced in the cities and towns, as due to rapid urbanization, especially in the developing countries as more and more people are trying to live in urban areas than in rural areas. Therefore, there has been a constant problem regarding the availability of safe drinking water to the onslaught inhabitants in urban areas. The share of the urban population in India has risen from 27.81 percent in 2001 to 31.16 percent in 2011 (Census of India 2011), which has led to the striking challenge in the management practice of water resources. Consequently, many local governments fail to provide their people with such basic needs of life, and access to clean and safe water relative to human demand has become one of the serious challenges faced by the people in the present times.

The Himalayas in the Indian context are perceived as an inexhaustable freshwater source. They are often referred to as natural ‘water towers’, highlighting their importance as a prominent water source for the arid and semi-arid lowlands however, with little reference to water security in the mountains themselves. Only a small fraction of the streamflow is stored and consumed by the communities living in these mountains (Rinan 2018). There are issues of springs drying up in many parts of the mountain due to lack of adequate recycle owing to changing rainfall pattern and catchment degradation. On the other hand, increasing demand of water with the increasing population has added stress on water resource. The hill town of Darjeeling has no exception in this matter. Further, the hill towns of Darjeeling have continuous floating population consisting of tourist visiting the place due to its scenic natural significance and pleasant climatic condition. This further increases the demand of water. The increasing gap between the demand and supply of water for human consumption due to the rapidly increasing urban population, has become a serious issue in Darjeeling. Everyday uncertainty and anxiety over access to safe and clean water is the common sight to the people in urban Darjeeling hills. Besides, the subsequent failure of the planned effort made by the municipal water supply...
infrastructures and the government’s inability to provide sufficient water to this hill station has made the problem more complex.

Darjeeling Town: An Overview

The Himalayan town of Darjeeling is situated on the lower part of Darjeeling–Jalapahar ridge in the Siwalik Himalaya, located between 26° 31′ and 27°31′ North latitude and 87° 59′ and 88°53′ East Longitude (Dozey 2011). The region is located at an average elevation of 6,982 ft. (2128 m) in the Darjeeling district (Gorkhaland Territorial Administration region)1 of West Bengal state. The name Darjeeling came from the Tibetan word where “dorje” meaning thunderbolt and “ling” is a space or land, hence Darjeeling means the land of thunderbolt. Due to its scenic natural beauty with snow-clad mountains, tea gardens and pleasant climatic conditions Darjeeling is popularly known as the “Queen of hills”.

Darjeeling Municipal Town represents one of the oldest municipalities in India established by the British in 1850. The town covers an area of 10.75 sq. km and comprises of 32 municipal wards with a total population of 1, 20,414 people (Census of India 2011). The town is also an administrative headquarters of the district and is the largest among all the hill towns situated in the district. The town receives an average annual rainfall of about 309.3 cm ranging amongst the highest in India. The average temperature in the town ranges between 16˚ C – 17˚C during summer months and 5˚C to 6˚C during winter season. Further, the growth and development of hill town of Darjeeling was different from that of plains counterpart as, these towns were predominantly built up by the British as sanitarium to relieve the British rulers from the heat of plains, predominantly selected for their own comfort and needs whereas the cities of plains have multi-functional values.

Location of Study Area

Objective

The major objectives of the study include:

i) To assess the public water supply provision in Darjeeling town.

ii) To identify the existing problems related to inadequate water supply in Darjeeling town.

Materials and Methods

The participation in everyday living in the Darjeeling being indigenous triggered the curiosity to investigate the unsolved issues of the water scarcity in Darjeeling hill towns. The paper attempts to comprehend the public water supply provision in Darjeeling town and identify some of the prominent problems faced while making urban water resource management in Darjeeling Municipal town. The study adopted mixed methodological framework. Primary and Secondary data source were used to generate information for the study.

The secondary data for the study was collected from the published and unpublished government documents such as: Annual reports of Darjeeling Municipality, Reports of Public Health Engineering Department, Reports of the Forest Department, District Statistical Handbooks 2010, 2011 and District Census Handbooks 2011. Further, additional

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1Gorkha Territorial Administration is a semi-autonomous administrative body formed in August 2012 for Darjeeling hills of West Bengal State.
<table>
<thead>
<tr>
<th>Objectives</th>
<th>Methods</th>
<th>Sources</th>
<th>Targeted Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To assess the public water supply provision in Darjeeling Town.</td>
<td>Structured Interviews (questionnaire survey)</td>
<td>Households</td>
<td>Locals</td>
</tr>
<tr>
<td></td>
<td>In-depth interviews</td>
<td>Households and Institutions</td>
<td>Locals/Officials (PHED/Darjeeling municipality)</td>
</tr>
<tr>
<td>2. To identify the existing problems related to inadequate water supply in Darjeeling Town.</td>
<td>Structured Interviews (questionnaire survey with open ended questions)</td>
<td>Households</td>
<td>Locals</td>
</tr>
<tr>
<td></td>
<td>In-depth interviews</td>
<td>Households and Institutions</td>
<td>Locals/Officials (PHED/Darjeeling municipality)</td>
</tr>
<tr>
<td></td>
<td>Participatory observation</td>
<td>Direct observation/walk and talk interview</td>
<td></td>
</tr>
</tbody>
</table>

Information regarding the water resources of the region was also collected through different academic literatures, newspaper reports, etc.

**Design of Primary Data**

The primary data was collected through various sources. The methods and sources for collecting the data was based on the objectives of the study. The household survey was conducted using a structured schedule in order to obtain individuals views and people’s perception of water use and the management of water resources. An in-depth interview was conducted with the officials of Darjeeling Municipality, Waterworks Department Darjeeling Municipality and Public Health Engineering Department (PHED). They are chiefly associated with the operation and maintenance of water supply in the town. Semi-structured interviews were also conducted primarily to comprehend the ideas related to water resources from the supplier’s point of view. Both the structured and semi-structured method was carried out visiting the households. The questionnaire survey was needed to quantify number of phenomena. Thus, the semi-structured interviews were based on the open-ended questions depending on the interviewee and the response of the respondent. It was very necessary to observe a wide range of area and people to understand how the problem of water scarcity is connected with the seasonality and the socio-economic status of the people. Moreover, it was important to understand what role does the institutions are playing regarding the issues related to water crisis. Therefore, direct observation was made staying in the different locations in the area.

Analysis of the data collected is theoretically descriptive, with the empirical evaluation of relevant statistical data. The data collected from the filed study was summarized and analyzed using relevant statistical techniques while the data generated through interview and discussion were analyzed in a qualitative (descriptive) manner.

**Water Resources in Darjeeling**

Springs and streams are the major sources of drinking water in Darjeeling hills. The region of Darjeeling Himalaya is mainly characterized by high hills and deep valleys, and due to the higher relief and steeper gradient of the area, groundwater comes out as seepages and springs whenever the land surface intersects the local groundwater table (Guha et al. 2009). Therefore, the region of Darjeeling has a good number of perennial and semi perennial water bodies in the form of hilly springs. Hence, the water supply in the town largely depends upon these natural springs. Darjeeling hill is also mainly characterized as a high rainfall area with the region receiving an average annual rainfall of approximately 309.2 cm which is the highest amongst the rates of annual rainfall in India. Therefore, natural precipitation is the primary source through which these springs are recharged. It is important to note that rainy season is the predominant season in Darjeeling which occurs twice in a year, once after the summer from mid-May to late-October and another in the winter which lasts from early-November to early-April (Shah 2015). July is the wettest month with the maximum number of rainy days.

Some of the major sources that facilitate drinking water supply in Darjeeling town are discussed below:

1. **Sinchel Catchment Area:** Springs and rivulets in the Sinchel range located at about 10.5 km southeast of Darjeeling town is the major source of water in the town. Hence, Sinchel wildlife sanctuary located at an elevation of 7,000 to 8,000 ft. (2134 to 2438 meter) above the sea level is the chief water harvesting area for the Municipal Water Supply (MWS) in Darjeeling. This sanctuary covers an area of 3,860 hectares out of which the catchment area covers 1,060 hectares (Rasaily 2014). At present 26 numbers of springs emerge from the northern and the southern part of Sinchel range. Water from these springs are collected in an arrestor tank and fed to the masonry conduit line (which is about 8 km in length) that brings water on gravity to the storage reservoir namely North Sinchel lake and South Sinchel lake. These two lakes are of vital importance for municipal water supply in the town. The North Sinchel lake was constructed in 1910 and is located at an altitude of 7,444.50 ft above the sea level. The lake has a capacity of holding 20 million gallons of water. The South Sinchel lake was constructed in 1932 with has a capacity of holding 13.5 million gallons of water (Darjeeling Municipality Report 2012). These lakes were constructed during the colonial period for providing water to the small number of population (about 10,000 people) that thrived in the region during that period of time.
ii. Sindhap Lake: It is another important source that provides water to the town. This lake was constructed by the Public Health Engineering Department (PHED) in the year 1978 to cope with the problem of water shortage in the town. Water in this lake is pumped from Bangla Khola and Khong Khola located in the close proximity of the lake and also from the springs located in the vicinity of the lake. It helps to provide additional water to the twin Sinchel lake during the dry period when the volume of water in the lake decreases. Therefore, this lake is usually operated only during the dry season. Sindhap lake is also located in the Sinchel range which has the capacity of holding 15 million gallons of water, but due to the poor quality of reservoir and several leakages, Sindhap lake fails to provide a satisfactory result. As per the municipality report, the lake in the present time can store only 50 percent of the water of its actual capacity.

iii. Khong Khola: This is a small perennial river located near the town of Darjeeling. During the dry season when the yields of springs are not sufficient to fill up the lakes to meet the demand of the people in the town, water is often pumped from Khong Khola to the lake. According to the Municipality Report (2010), about 75,000 gallons of water is pumped per day from the Khong Khola to Sinchel Lake mainly during the dry period.

iv. Rambi Catchment Area: Apart from the three lakes located in the Sinchel catchment area, water from the Rambi catchment area is the other important source through which water is supplied to the town. It is located about 20 km away from the town. Rambi catchment area consists of streams like Rambi Khola, Kalikhola and other eleven number of natural springs through which water is provided to the town during dry seasons. About 70 to 80 gallons of water is pumped per day to the town from this area. Thus, the Rambi catchment area is known as the other major lifeline for Sinchel for the people of Darjeeling that helps with additional water supply to the people.

v. Natural Springs located within the Municipal Area: Apart from the formal water supplied by the municipality through the pipe supply system, natural springs located within the town are the other major sources of water. There are more than 65 numbers of natural springs available within the Darjeeling municipal area. Although these perennial springs are located within the municipal boundaries yet, they do not fall within the purview of the municipality. Most of these springs are maintained and managed by the local communities, i.e., Samaj located within the close boundary of springs. Further, the religious and social group also plays an important role in the management of these springs. These natural springs at an average serve about 20,000 gallons of water per day (Rasaily 2014). Some of the springs located within the municipal area are listed below:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Spring</th>
<th>Elevation</th>
<th>Sl. No</th>
<th>Spring</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bhote Dhara</td>
<td>1897m</td>
<td>14</td>
<td>Lal Dikhi</td>
<td>2035 m</td>
</tr>
<tr>
<td>2</td>
<td>Haridas Hatta</td>
<td>1947m</td>
<td>15</td>
<td>Giri Dhara</td>
<td>2006 m</td>
</tr>
<tr>
<td>3</td>
<td>Muldara</td>
<td>1911m</td>
<td>16</td>
<td>Police Dhara</td>
<td>1869 m</td>
</tr>
<tr>
<td>4</td>
<td>Jail Dhara</td>
<td>1908m</td>
<td>17</td>
<td>Dhara Gown</td>
<td>2055 m</td>
</tr>
<tr>
<td>5</td>
<td>Vineeta Gram Dhara</td>
<td>2157m</td>
<td>18</td>
<td>Naag Dhara</td>
<td>1918 m</td>
</tr>
<tr>
<td>6</td>
<td>Pul Dhara</td>
<td>1973m</td>
<td>19</td>
<td>Krishna Villa Dhara</td>
<td>2091 m</td>
</tr>
<tr>
<td>7</td>
<td>Nayabasti Dhara</td>
<td>1798m</td>
<td>20</td>
<td>Nimki Dara Dhara</td>
<td>2046 m</td>
</tr>
<tr>
<td>8</td>
<td>Victoria Falls Dhara</td>
<td>1984m</td>
<td>21</td>
<td>Rani Hitti</td>
<td>1977 m</td>
</tr>
<tr>
<td>9</td>
<td>Khalashidhura Dhara</td>
<td>2151m</td>
<td>22</td>
<td>Ghum Dhara</td>
<td>2246 m</td>
</tr>
<tr>
<td>10</td>
<td>Sunar Busty Dhara</td>
<td>2157m</td>
<td>23</td>
<td>Lebong Dhara</td>
<td>1800 m</td>
</tr>
<tr>
<td>11</td>
<td>Navin Gram Dhara</td>
<td>1911m</td>
<td>24</td>
<td>Jwarbusty Dhara</td>
<td>2064 m</td>
</tr>
<tr>
<td>12</td>
<td>Redrose Dhara</td>
<td>2081m</td>
<td>25</td>
<td>Rani Hitti 2</td>
<td>1984 m</td>
</tr>
<tr>
<td>13.</td>
<td>Kholi Ghar</td>
<td>1911 m</td>
<td>26</td>
<td>Merry Villa Dhara</td>
<td>2091 m</td>
</tr>
</tbody>
</table>

Source: Compilation from the Field Survey

Existing Water Supply and Distribution Network System
The existing water supply system of Darjeeling town was commissioned during the colonial period (1910-1915) and is entirely dependent upon the natural springs from the catchment area of Sinchel forest and wildlife sanctuary. At present 26 natural springs from the Sinchel range serves as the major source for municipal water supply in the town. Water from these springs (26 in number) is tapped and collected in an arrestor tank that drains water through the masonry conduit line extending around 8 km covering all the springs. According to the municipality report, the average discharge of water through the open conduit during the dry season is 14,000 gallons per hour i.e. 3.36 lakh gallon per day and during the non-lean period the average discharge through the open conduit is 80,000 gallons per hour or 9.2 lakh gallons per day (Darjeeling Municipality Report 2012).

Water from these conduit lines then flows down to the open reservoirs (Sinchel lake). The entire system of water supply from the collection, transmission, and distribution is done through gravity due to the high altitude and steep slope of the land. There are three storage lakes: North lake (storage capacity of 20 MG); South lake (storage capacity of 13.5 MG); and Sindhap lake (Storage Capacity of 15 MG). However, due to seepage and leakage, the third lake (Sinchel lake) can hold only 50 percent of water of its actual capacity. From these storage reservoirs, water is then directly discharged to the filter house located at Jorebonglow for
purification where filtration of water is done through five pressure filters each having the capacity to filter 16,000 gallons of water per hour (Darjeeling Municipality Report 2010). From the filter house water is fed into St. Paul’s and the Rockville tank through the main pipelines that have the capacity of holding 56,651 gallons and 58,012 gallons of water respectively. From these reservoirs, water is then distributed over the town either directly through the reservoirs or through the subsidiary tanks distributed at different places of the town.

The existing water distribution system was originally constructed during the colonial period to meet the demand of about 10,000 population living in the town during that period. However, the population of the town at present time has increased to 1,20,414 in 2011 and with the beginning of tourist season the total population will be added by another 25 to 30 thousand of floating population, for which water must be provided. However, the town till today depends upon the two reservoirs and the old distribution system constructed for 10,000 people. According to Darjeeling municipality record, the demand for water is 15 lakh gallons but the availability of water for the public is just 5 lakh gallons. Hence, there is a wide gap between the demand and supply of water in the town.

Fig 1: Water distribution network of Darjeeling municipal town

26 no. of springs from Sinchel Range

Through open conduit channel

Sinchel Lake North: Capacity 20 MG
Sinchel Lake South: Capacity 13 MG

Jorebonglow Filter House

Rambi Catchment Area

St. Paul Storage Reservoir

Rock Vail Storage Reservoir

Distribution in the Municipal Area

Source: Constructed by author based on data acquired from, Darjeeling Municipality Report (2012)

Table 2: Calculation of average water demand and supply in the town

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Gallons/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total water storage capacity of reservoir (N. Sinchel lake, S. Sinchel Lake, Sindhap lake)</td>
<td>4.75 million gallons</td>
</tr>
<tr>
<td>Water production per day</td>
<td>8,50,000 gallons/day</td>
</tr>
<tr>
<td>Wastage (25 percent)</td>
<td>2,12,500 gallons/day</td>
</tr>
<tr>
<td>Net water available</td>
<td>6,37,500 gallons/day</td>
</tr>
<tr>
<td>Fixed supply (Army, Hospital, St. Paul School)</td>
<td>11,000 gallons/day</td>
</tr>
<tr>
<td>Water available for public</td>
<td>5,27500 gallons/day</td>
</tr>
<tr>
<td>Total demand of water</td>
<td>3,564,000 gallons/day</td>
</tr>
<tr>
<td>Total water available</td>
<td>5,27500 gallons/day</td>
</tr>
<tr>
<td>Total deficit</td>
<td>3,036,500 gallons/day</td>
</tr>
</tbody>
</table>


Result and Discussion

Issues and Challenges on Water Resource Management in Darjeeling Town

Despite the prominent natural endowment of the region and having its location on the high average rainfall region with an abundant number of springs, the availability of freshwater is in short supply in Darjeeling town. Irregular and insufficient access to water is one of the persistent challenges faced by the residents in the town. Insufficient and unreliable supply of water by the Municipality Water Supply Infrastructure in the town have compelled the people to look into the alternative sources so as to ensure that there is enough water at least for drinking purpose. Hence, buying
of water from the private vendors have been the common practice of people in the town. Due to high paucity of water, selling of water has become a profitable business in the town today. Water vendors are commonly seen in the area operating without any legal framework and this water business has provided employment opportunities to many unemployed youths of the town as this has become one of the easiest modes of earning.

Some of the prominent factors responsible for the scarcity of water in the towns are discussed below.

i. **Rapid population growth**: Darjeeling has experienced unprecedented growth in population and extensive urbanization of the town. The trend of urban concentration in the town reveals that the population of the town has increased from 19,005 in 1911 to 57,603 in 1981 and 1, 20,414 in 2011 and the growth rate of population in the town has increased from 12.30 percent in 1991 to 34 percent in 1981 and 49.9 percent in 2001. Apart from the natural increase in population, rural to urban migration has encouraged an increase in the population of the town and there is a growing gap between the demand and supply of water. Thus, the physical and demographic growth of the town has posed a challenge for sustained water supply to the residents. This has also led to severe challenges upon the municipal water supply system to accommodate with efficient water supply service. As a result, people in Darjeeling experiences severe water problems even during the rainy season.

ii. **Old distribution system**: About 95 percent of the distribution pipelines and valves in the town were laid during the colonial period (1910-15). Very little maintenance work has been taken up since then. However, most of the repair and restoration work has been done on a temporary basis only. The network has not been maintained properly from the time of installation excluding some patchwork projects only as a result large volume of water is wasted from the leakages of pipelines adversely affecting water supply. In some places, the cases are also seen where the broken pipes get mixed with the damaged sewerage lines running through the town leading to severe contamination of water.

iii. **Illegal tapping of water**: In addition to the old distribution system, which lowers the actual production of water supply, illegal tapping of water has further reduced and degraded the amount of water supply. It is the bitter truth of Darjeeling town that most of the connecting pipelines are seen to be vandalized at various places from where the water is illegally tapped. Valves are often seen to be broken due to illegal tapping mainly during the nighttime.

iv. **Shortage of storage tanks and reservoirs**: Darjeeling has umpteen number of water resource in the form of springs and streams located within the town and its immediate surroundings but due to an insufficient number of storage reservoirs, a large volume of water is wasted every day. According to the municipal report, 26 springs are tapped in the Sinchel catchment area for public water supply. However, during the rainy season, the collection of water from 8 springs becomes sufficient to fill up the existing reservoirs and the rest of the water has to be drained off into the nearby jhoras due to the limited capacity of reservoirs. Similarly, there are several numbers of springs located within the town but the absence of storage facility leads to heavy loss of water.

Further, the absence of a water treatment facility is the other major factor adding up to water scarcity in Darjeeling. Large volume of wastewater runs through sewerage pipes, jhoras, roadside drains every day, recycle and reuse of such water would have been helpful in checking the situation of scarcity but the absence of facilities like recycling and reuse of wastewater has resulted to contamination of water and wastage of water in long run.

Table 3: Storage and distribution reservoirs in Darjeeling

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Storage reservoir</th>
<th>Capacity (in million gallon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North Sinchel lake</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>South Sinchel lake</td>
<td>13.5</td>
</tr>
<tr>
<td>3</td>
<td>Sindhap lake</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>48.5</td>
</tr>
<tr>
<td></td>
<td>Distribution tank</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>St. Paul Storage tank</td>
<td>2,35,812</td>
</tr>
<tr>
<td>2</td>
<td>Rock Vail tank</td>
<td>56,651</td>
</tr>
<tr>
<td>3</td>
<td>Rock Vail Masonry tank</td>
<td>58,012</td>
</tr>
</tbody>
</table>

Source: Darjeeling Municipality, 2014

v. **Deforestation**: The absence of proper planning such as land use planning or town planning has inspired unplanned growth of the town with haphazard constructions. This has encouraged illegal felling of trees in the region. The inflow of water from the springs of the Sinchel range has been gradually decreasing at an alarming rate, due to the massive felling of trees in and around the sources. Rasaily (2014) in relation to this stated, out of 3,860 hectares of the total area approximately 770 hectares (18 percent) of the area was completely deforested in 1984 and it was further increased to about 50 percent by 1986. The degradation of Sinchel natural resource has a great impact on water harvesting capacity and water supply to Darjeeling. The rapid deforestation has led to denudation of the hills and resulting to decrease in...
in the town are discussed in the next section.

- **Limited institutional capacity:** The shortage of skilled manpower is one of the critical issues faced by the Darjeeling municipality. This is, in fact, one of the major limiting factors for attaining the desired service provision in the town. In addition to its inadequate equipment facilities and insufficient materials have added more problems in the proper management of water. Further, the municipality also suffers from a lack of long-term vision, strategy, and proper action plan to facilitate an efficient management system. These are some of the major constraints rendering proper management of water resources at the municipal level.

- **Inadequate budget:** Delivery of water supply requires a high level of investment. The existing amount generated by the municipality is not sufficient to meet the required demand thus lack of sufficient funding has limited the quantity and quality of water supplied at the municipal level in Darjeeling. It is mainly due to lack of adequate fund several leakages are observed within the pipelines and left unchecked even when the scarcity is acute. Lack of effective funding has seriously hampered the management system. Further several projects concerning water management have been left incomplete in the town due to the insufficiency of funds. Similarly, chlorination of drinking water in the filter house has been stopped in recent time and filtration of water is done simply by adding bleaching powder, which is not adequate for proper filtration of water.

- **Absence of community participation in decision-making:** The decision-making process in terms of water management at the municipal level in Darjeeling is typically centralized and bureaucratic in nature. The participation of local people in the decision-making process relating to water management is almost absent or non-existent. Public participation in decision making is restricted until electing the representatives of ward councilors. The decisions are generally made by the people who own the majority in election hence, the public opinion and suggestions are usually not entertained. This is the other major challenge relating to the proper management of water resources.

**Suggestions for better Management of Water Resource Darjeeling Town**

Recognizing water as a vital necessity for life, its management and conservation plays a crucial role in enabling the sustainable urban environment. Following interim suggestions may be considered productive for efficient and sustainable management of water in Darjeeling:

- There is a need for repair and renovation work for the improvement of an old and complicated water distribution system to make a uniform supply system.
- A large volume of water is wasted through drains, jhoras and springs due to lack of proper harvesting system. Encouragement of rainwater harvesting and waste water treatment plants would lead to proper conservation of water.
- In the case of Darjeeling, the development of plans and policies has always been in favor of those who own the power hence, the management strategy implemented for water resources will not be sustainable as sustainable management of water resources depends upon the interest and participation of the citizen in a system. However, the involvement of the community and community-based organizations in the decision-making process will help to bring the issues in people’s hands and make them aware of the issues. This will help to make the system transparent and efficient.
- Development of long-term proper plan keeping in view the rational utilization, protection, conservation and management of water resources based on community need and enforcement of strict laws against illegal connection and misuse of water.
- The presence of responsive bureaucracy is of vital importance. However, in many cases, the plans and decisions made by the previous boards are often not followed or completely quashed with the changing political situation. Thus, bureaucrats ought to play an active role ensuring that the previous projects and plans are not abandoned or affected by the prevailing political situation.
- Optimization of the budgetary aspects of public utility services to maintain its service levels. The existing unsatisfying tax collection on utility services can be improved by imposing strict penalties for late payments.
- It is essential to organize an awareness program in every ward by municipality to educate the mass about the causes of degradation, depletion, and pollution of water resource and resultant threat and inspire the society about the importance of preservation, restoration and rational use of their source.

**Conclusion**

It can be analyzed from the above discussion that the region of Darjeeling has umpteen water resource in the form of rivers, streams, jhoras and natural springs located within the town and its immediate surroundings. However, in spite of being located in such a volumetrically water rich region, the town experiences acute water scarcity. The water resources in the Darjeeling has been severely stressed due to numerous detrimental anthropogenic activities that has disrupted the natural water recharging system and resulted in drying-up water sources. Further, absence of proper
management has added the problem to the situation of water scarcity, due to which a huge imbalance has generated between the demand and supply of water in the town. With the passage of time the entire structure of the town has been changed with high raised building and haphazard construction of towns. Hence, the age-old distribution system has failed to cater the demand of rising population of the town. Further, lack of public awareness is also the other crucial reason leading to water scarcity in Darjeeling for instance, most of the connecting pipes along the roads are sometimes seen to be convincingly vandalized, from where people illegally tap water, not realizing that this will ultimately lead to more water scarcity. The pipes are sometimes left cut or broken for a long time without anyone caring to join them again, due to which large gallons of water gets wasted, causing further shortage in the long run. Furthermore, we also notice water overflowing from the water tanks of the houses. Scientific and long-term proper planning is therefore needed for the proper management and maintenance of the available water resource in the region.

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