

The Water and Waste Challenges in Darjeeling: A Geographical Approach

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ABSTRACT

The urban water and waste crisis has a global face and the crisis is generally conditioned by a combination of factors including unplanned urbanization, mismanagement of water resources, ill management of solid waste, deforestation, climate change, inadequate infrastructure and over-tourism in the case of Darjeeling town. The mounting garbage and acute water crisis in the Himalayan towns are accelerating at an unprecedented rate. Darjeeling is no exception; it needs sustainable waste and water management to retain its pristine geographical space. The mounting population pressure on the limited land manifests in the environment in different ways. To address these pertinent issues the present study aims to look into the situational analysis in Darjeeling municipality and seeks to put forth suggestions through the empirical lens. The study revealed that the water problem is stimulated by the decade-old pipe water lines laid during the British era, the mismanagement, and the faulty distribution system. On the other hand, the study found the low waste awareness among the surveyed households and the reckless waste habits threatening the very existence of Darjeeling as a tourist destination. The study stresses the need for a paradigm shift in the mindset of the people by taking the responsibility to manage their waste. Darjeeling receives one of the highest rainfalls in the state of West Bengal. In this context, rainwater harvesting and reviving the dying springs through the setting up of Dhara Vikas (spring shed management) committees would trigger the pioneering steps. However, no suggestion can materialize unless there is a positive policy intervention on the part of the government. Governance is the fundamental and final link that can usher transformation to any booming urban space.

Keywords: Solid waste, Rainwater harvesting, Mismanagement, Water vendor, Perception.

Introduction:

The problem of water and waste particularly in the hill towns is influenced by the mismanagement of available resources as well as the adverse topographical characteristics and unplanned urban expansion. The current existing infrastructure is often outdated and unable to cope with the increased demand. The unequal access to water supply and sanitation services is often related to socio-economic disparities. Access to safe water remains a vexing issue for the urban poor living at the grassroot level. In the absence of proper services, households depend on multiple sources of water. This range from procuring water from private players or some form of provisioning that is difficult to access such as water tankers by public utilities (WaterAid, 2017).

Study Area: Darjeeling Municipality, the headquarters of Darjeeling district is situated on a Y-shaped ridge with its base at Jalapahar and Katapahar in the south with the arm of Y protruding towards North West. It is one of the oldest Municipalities located between 26°31' N latitude and 87°50' E longitudes. Founded by the British in 1850 for twenty thousand population, it covers an area of 7.43 sq km with a population of 118,805

(Census 2011) and a massive population density of 15,990 people per square kilometer stressing the grossly inadequate resources and infrastructure.

Objectives:

The present study tries to identify the following objectives.

1. To study the water and waste challenges of Darjeeling Municipality.
2. To highlight the perception of the people on water and waste issues.

Methodology: The research is based on empirical findings to study the waste and water issues at the household level. It uses the available literature on solid waste and water. The field survey for primary data collection is done through personal interviews and observation methods. The study makes use of semi-structured questionnaires.

Sample size determination: As per Yamane (1967) the sample households in the study area are ascertained by the following formula at 95% confidence level and $P=.05$ level of precision or sampling error.

$$n = \frac{N}{1 + N(e)^2}$$

Where,

n=Sample size

N= Total Households (21782)

e=Level of precision/Sampling error (0.05)

Applying this formula, the sample size of households is **393**

Each household at the ward level represents the urban spatial unit. However, the complete enumeration at the ward level is not possible given the time constraint. Hence, a simple random sampling without replacement was used to identify the households at the ward level. This sampling method is useful as each household has an equal probability of getting selected to get a representative sample.

Statement of the problem: Darjeeling has evolved as a service centre serving almost 1.20 lakh people but failed to build proper infrastructure to manage its growing waste and water issues. What further cripples the situation is the apathy of the people, the institutional debilities, and the lack of research in this field. The inadequate governance, lack of political will, and quirky political situation have impaired the implementation process (Tamang, 2020). The water resource of Darjeeling has been severely stressed and strained in the last decade by rapid urbanization, deforestation, drying up of sources of water, and, finally, a huge amount of construction activity taking place in a hectic place. The current water distribution system dates to the British regime which was meant for just twenty thousand populations during the early twentieth century. The town has not seen any major upgrades to the water distribution system after that. Moreover, the insurmountable pressure of tourists during peak seasons has led to numerous constructions, further piling up the load on the already fragile ecosystem.

Burgeoning population (Darjeeling Municipality)							
1941	1951	1961	1971	1981	1991	2001	2011
27224	33605	40651	42873	57603	73062	107191	1,20414
Source: Census							

According to the municipal records, Darjeeling generates an average of 35 tonnes of waste. This doubles in the peak tourist season. The transportation is done in a very crude form. The final resting place of the town's unasserted garbage/ legacy waste as some prefer to call it, is the dumping chute situated in ward no 18. In the absence of a scientific landfill, the garbage is simply pushed down the chute with the help of a backhoe loader. The accumulated garbage often catches fire in the dry season emitting methane that engulfs the entire Darjeeling town. The unscientific means of waste disposal, partial collection, open burning, and indiscriminate dumping ails the waste management process. Because of the hilly terrain, the waste once thrown down the hill becomes difficult to retrieve. Achieving economies of scale for the recycling and retrieving of materials can pose a significant challenge due to the cost and difficulties of transport and relatively low volumes of recyclable. Poor perception of the locals as waste is not perceived as a threat. If the local community fails to conceive it then any sophisticated system is bound to perish (Tamang & Lama, 2019).

Solid Waste Dilemma: The problem of municipal solid waste has been a draining perennial problem of Darjeeling municipality. The managerial side too has a lot of glitches and the entire management process defeats the concept of waste management. It is perfectly reflected in the study. The study found that in the surveyed households almost 25% avail of waste collection services from the municipality or private agency.

Source segregation is virtually non-existent in the study area though it has been mandated (Solid Waste Management Rules 2016) but there is no compliance. The very first step in the management process is overlooked as out of the three hundred ninety-three surveyed households almost 79 % of households do not segregate waste. Sadly 21 % of households segregated waste finds a place in the non-segregated waste vehicle proving it insanely futile. The very first step nullifies the waste segregation process, ultimately having a negative ripple effect on the rest of the processes.

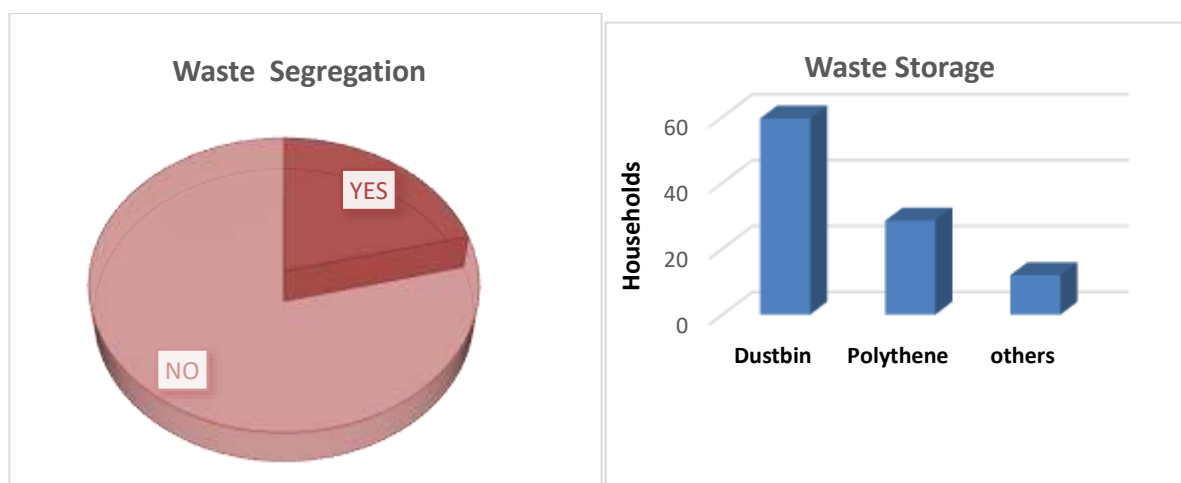


Fig No1: Waste Segregation

Fig No2: Waste Storage

Storage of waste: The waste is stored in dustbins (74%) or plastic bags (10%) and the rest (16%) cited other methods of storage. Few reported waste not stored as it directly gets into the nearby jhora/stream of any undesignated sites. The use of plastic bags/ garbage bags that is non-biodegradable as a method of storing causes environmental pollution. This has resulted in the large number of proliferation of undesignated sites in and around the prime location of Darjeeling.

The frequency of waste collection is not satisfactory as 31 % of the respondents said that the waste is collected daily. Contrary to this almost 24 % said there is no fixed day. 26% of the respondents had no idea implying that they did not place much importance on it. 18 % response was once a week. The inaccessible wards below or above the main arterial roads cannot make use of the service providers making their waste either the jhoras or the undesignated sites

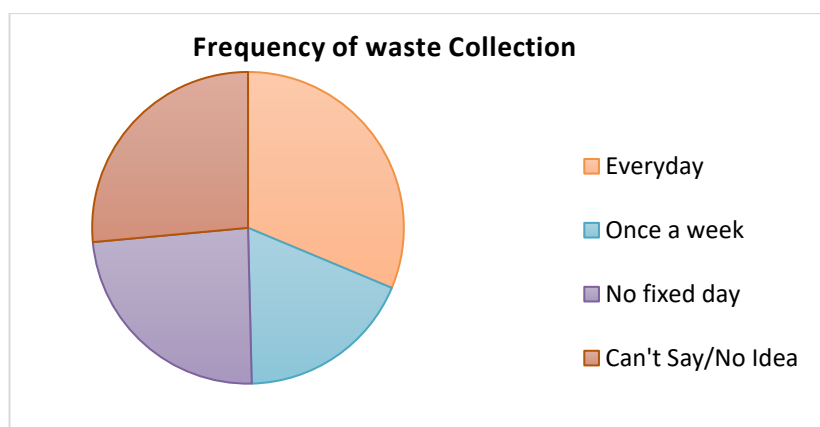


Fig No 3: Frequency of Waste Collection

To the question of the reason for poor waste management, 29 % seemed dissatisfied with the functioning of the municipality, and 15% cited unplanned urbanization coupled with rapid population surge (17%). One of the brighter sides was slowly the concept of managing the waste and owning up the waste was felt by 39% as they cited a lack of awareness and the need to proper waste workshops and sensitization was felt. As far as shouldering the responsibility 23% felt the municipality should be responsible while 22 % stated it to be the resident's responsibility while the rest felt the coordination between the two should go a long way for keeping the area clean.

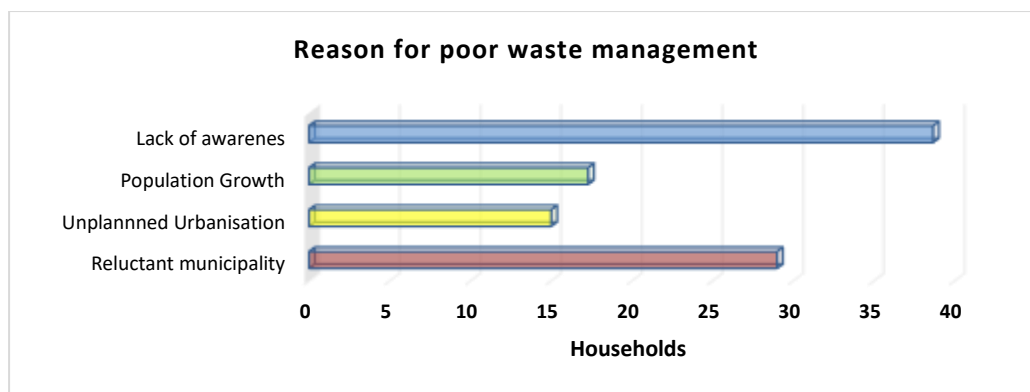


Fig No 4: Reason for poor waste management

The perception and awareness of the residents play a pivotal role in availing of waste service which in turn is conditioned by the willingness to pay. It is the informed and aware residents who make the waste management system work. The study revealed that 61 % were willing to pay for the service which reflects that the residents felt the need for a sustained system. This is one of the most vital drivers of change. Still, 39% were unwilling as they felt the additional burden. Of the 140 households who were willing to pay, 33% were willing to pay more than Rs 50 for better management and felt the need for cleanliness to draw tourists as well as to sustain the aesthetic of the place. They were eager to assist the civic body to make Darjeeling a better and cleaner place. On the contrary 67% opined the rise in the service fee shall not make the management better instead increases their economic burden.

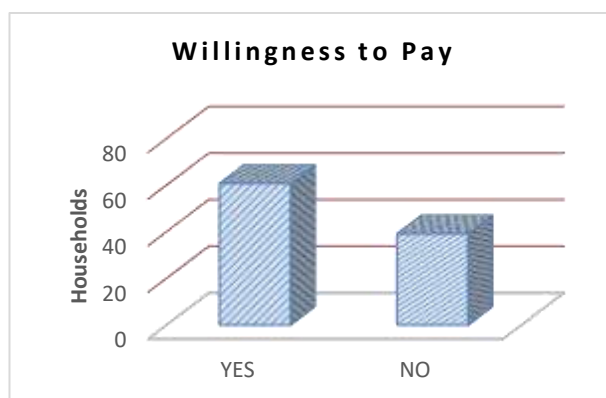


Fig No5: Willingness to pay

Water Woes in Darjeeling Municipality: The problem of scarcity of water especially in the hill towns is influenced by the mismanagement of available water resources as well as due to the adverse topographical characteristics and unplanned urban expansion (TERI, 2018). The current existing infrastructure is often outdated and unable to cope with the increased demand. The unequal access to water supply and sanitation services is often related to socio-economic disparities. Water has always remained a focal point in Darjeeling municipality. The town is dependent on the twin reservoirs of Sinchel i.e. North Lake and South Lake situated at an altitude of 7,444.50 sq. ft above sea level with a total holding capacity of 20 million gallons and 135 million gallons respectively. These lakes were constructed in the years 1910 and 1930 by the first municipal engineer of Darjeeling Sir Thos Kenay. In 1984, an additional reservoir Sindhap was built to preserve the excess water from these reservoirs, which due to its faulty structure and construction is only functioning and restoring 50% of its full capacity. The water from these reservoirs is filtered at the Jorebunglow water filtering center and stored at Rockville Water Tank, St. Paul Water Tank, and Mahakal Water Tank from where it is distributed to the wards of Darjeeling Municipality (Rasaily, 2014).

Major Sources of Water in Darjeeling Town	
Intake Of Water	Capacity (Gallons/ Day)
Reservoir of Sinchel lakes (North)	3,36,000
Reservoir of Sinchellakes(South)	75,000
Springs from Rambi catchment area	1,50,000
Boxi Jhora	12,000
Laldhiki, Bhyaguldharma, Bhotedhara, Giridhara Springs	20,000
Total	6,17,000
Source: Source: Rasaily, 2014	

Source of water: In the surveyed households, 38 % relied on tap water connections at specific points from the municipality. The duration and frequency of water differed among the different wards. The official data from the municipality and the ground-level reality do not complement each other. The rest of the households bought water from the water vendors and relied on natural spring waters scattered in and around the different points in the town (Chhetri & Tamang, 2019). About 14 % of the households bought water from the sources located at different places in the town. Some of the surveyed households were staying in rented units and were provided water by the owners. It is a staggering fact that 19% of the surveyed households bought water from water vendors even during the monsoons. During the dry spell, the price of water from the vendor varies as per the distance from the source of the water. For example, the amount near the town is Rs. 500 per 1000 liter while it is Rs. 800 in the Singamari area which is far from the centre of the town. The greater the distance, the higher the rate per liter. Wards 28, 30, 31, and 29 are the water stress areas as they bank heavily on these private vendors which gives rise to water mafias who exploit the rates since the sources are in Wards 1,2,3,4,5.

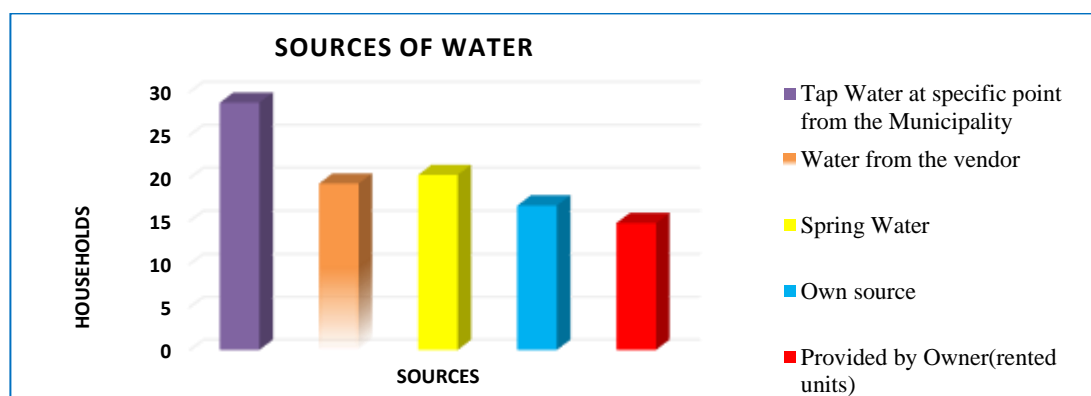


Fig.No. 6: Sources of Water

Types of the spring: The springs play a major role in the water distribution system and are an integral part of the natural source of water. There are more than hundreds of natural springs located haphazardly over the town, lying adjacent to the *jhoras* (Chhetri, Tamang, 2019). These affect the discharging capacity of the springs, especially during the monsoon when the *jhoras* swell with the overflow of the excessive rainwater. Some of the well-known springs are Lal Dhiki, Bhote Dhara, Jail Dhara, Victoria Falls Dhara, Navin Gram Dhara, Krishna Villa Dhara, Nimki Dara Dhara, Merry Villa Dhara, etc. which are perennial, with low discharge during the winter seasons. These springs also play a vital role in decentralizing the water supply system and are a huge relief to wards facing the shortage in the town. These natural springs vary in terms of water availability, accessibility, and ownership thereby promoting varied instances of decentralization which in recent times has proved to be the most feasible model of water management system in many parts of the town (Chhetri, Tamang, 2019).

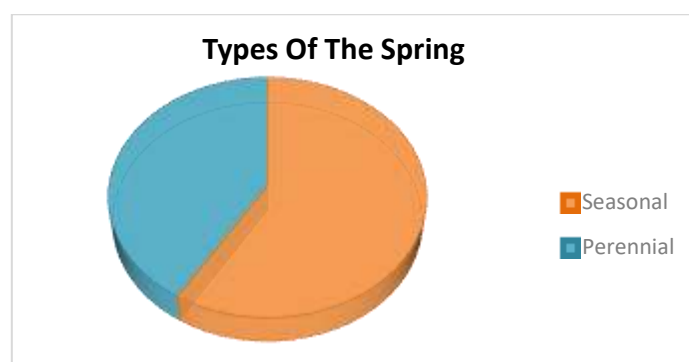


Fig No.7: Types of the Spring

Distance between the residence and spring: The distance between the springs (*dhara* in local language) and homes acts as an important indicator of the real situation of water crisis. Generally, the springs are located at a considerable distance from the households. It is a sad reality that to get access to five liters of water the residents must queue up for a significant time, sometimes longer than an hour. This situation prolongs with the onset of the dry season when the volume of water discharge becomes grim. This increases the time and the dependency too as most of the springs dry up during the dry season.

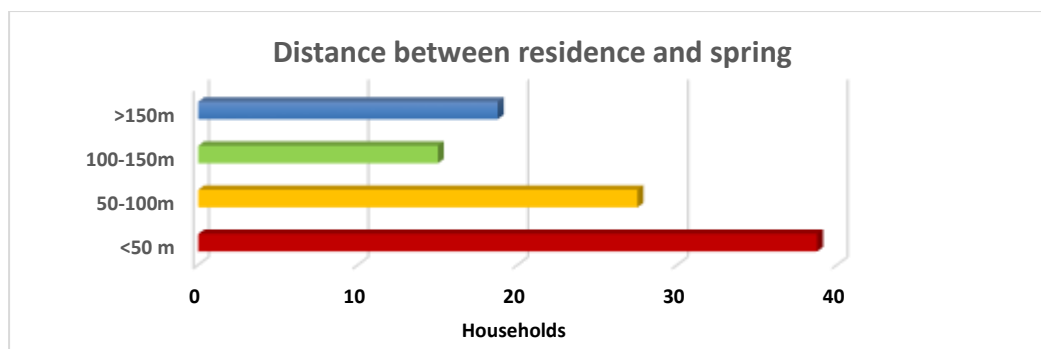


Fig No.8: Distance between residence and spring

Distance between the residence and source of personal piped water connection: The households located in the fringe area are dependent on the owners of the private water sources. These private water sources, sometimes are located outside the purview of the municipality and are at higher altitudes inside the private properties. The distance plays a pivotal role in this context. Generally, the rate varies from Rs. 500 to Rs. 1500 per month depending upon the distance and the amount required by the households. In some cases the maintenance of the pipelines is also vested with the vendors, empowering them who charge Rs. 3000 to 4000 per household. The pipelines congesting the drainage lines of the town are generally private water connections mentioned above.

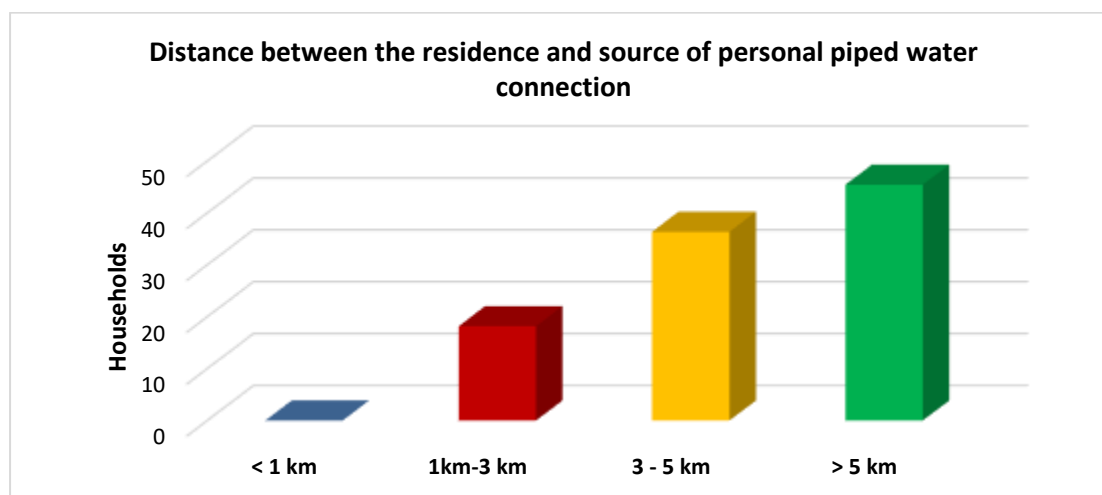


Fig No.9 Distance between the residence and source of personal piped water connection

Specific problems of the households: Around 29% of the households are devoid of municipal water connection. The supply network does not cover the whole municipal area due to the locational and geological constraints (38%) of the town. The main supply lines were constructed during the British regime for only ten thousand people centered around the main five km radius around the town. The town has outgrown this area. The area has a meager rise of 7.43 sq km but the service area to cater to the needs of the burgeoning population (118,805 persons) and households (21782) as recorded in the Census 2011 is the cause of concern. As per the research, no new water pipes have yet been installed by the municipality to connect the newly added housing areas (Koner, Samantha, 2021).

The quantity of water provided by the municipality is not adequate. Almost 47 % of the surveyed households had grievances regarding the unequal and less water distribution. They were devoid of direct water connection. The non-provision of rainwater harvesting techniques (10%) proved to be one of the major challenges. The construction of a large-scale storage facility is beyond the reach of the common people and calls for technical assistance. The dry spurt from December until the arrival of the monsoon leads to the low water level and drying up of the seasonal water sources further increases the burden of water problems (11%). The major problem with the fair water distribution in the Darjeeling municipality is due to a system of corrupt and illegal water transfer by the water valve men under the patronage of their political connections (Koner, Samanta, 2021). The main reason behind the skewed distribution of water can be attributed to financial and political power (Shaha, Badigera, 2015). The authorities pay a deaf ear to the rising water mafia and are incapable of controlling them (Koner, K. Samanta, G. 2021). The variations in the socio-economic conditions further add to the already skewed distribution.

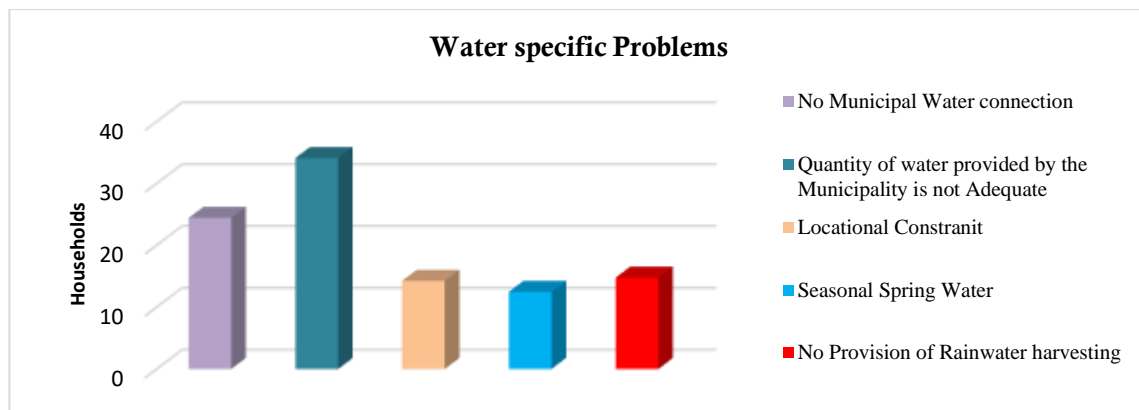


Fig No.10 Water-Specific Problems

The major problem faced by households dependent upon spring water is the drying up of the water source or the decrease in the amount of water discharge during the dry season due to rapid urbanization, and deforestation in the catchment area, (Wallace, C.D et al, 2015). The rapid construction taking place in the limited space has significantly reduced the groundwater recharge because of the concretization of the catchment areas. There is a huge amount of runoff leading to a drastic fall in the infiltration process.

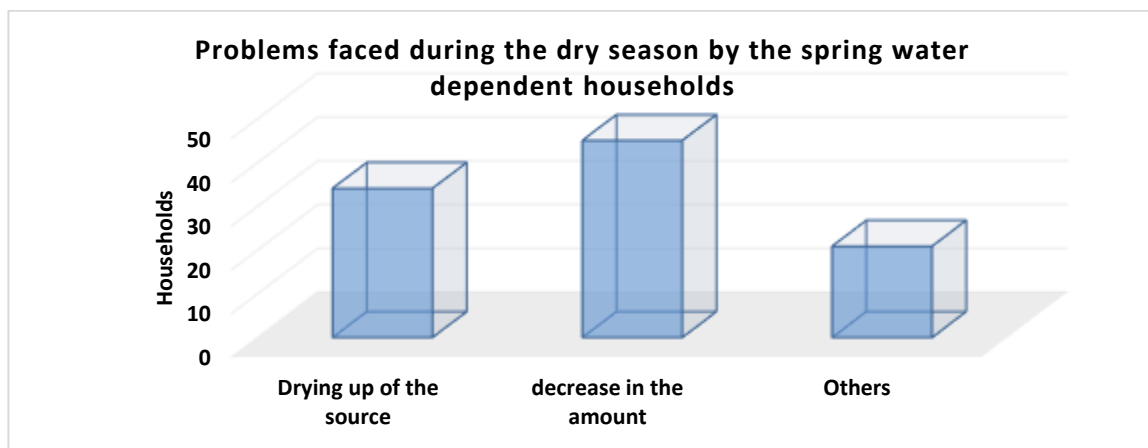


Fig No.11. Problems faced during the dry season by the spring water-dependent population

Darjeeling falls in the highest rainfall zone but ironically suffers from acute water shortage during the dry spell. The water shortage in the town can be mitigated to a certain extent with the use of rainwater harvesting techniques. To elicit the understanding of basic rainwater harvesting the residents were asked whether they had any idea on rainwater harvesting. 35% practiced the basic rooftop rainwater harvesting. However, these households denied having a sound knowledge of scientific rainwater harvesting.

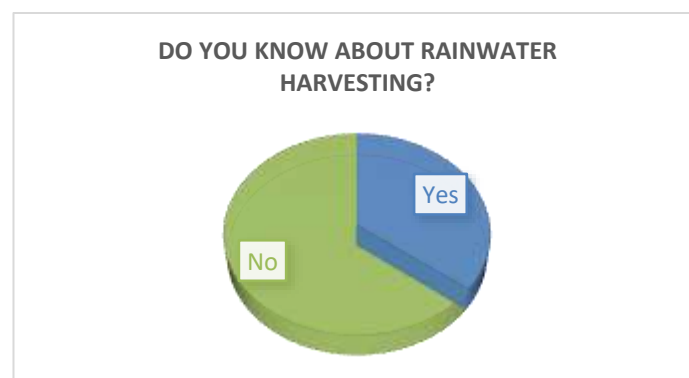


Fig No.12. Concept of rainwater harvesting

Major Findings:

- The residents place insufficient drinking water and traffic snarl above the solid waste issues.
- The waste burden increases with the floating population of 50,000 or more tourist per day virtually paralyzing the waste service which adds to proliferation of waste pockets.
- The visible eyesore of the littered garbage threatens the appeal of Darjeeling as a tourist hub.

- The water provided is grossly insufficient. Almost half of the households depend on spring water which is seasonal.
- The absence of rainwater harvesting ails the system in the dry season.
- The presence of water mafias and illegal tapping mars the availability of water resulting into an unequal distribution.
- The availability of water is monopolized by the creamy layer of the society with high purchasing power.
- The unchecked growth of urbanization compromises the already exhausted natural spring sources. The depletion of these natural resources in the wake of insufficient groundwater recharge will be unimaginable for the municipality to handle the consequences.
- The illegal tapping of the water pipes at different points also poses a huge problem for the water distribution network. Most of the connecting pipelines are vandalized at various places from where the water is illegally tapped.
- The inadequate service delivery on the part of the ULB and the reluctance of the residents to recognize the magnitude of the solid waste pollution.
- The lack of mountain-centric policies hinders the developmental plans before their execution.
- Lack of stringent rules and absence of polluters pay principle.
- The decade-old pipe system with no proper maintenance system and the clogging of the drainage lines and jhoras with the quagmire of the pipelines poses a health risk to the masses.

Finding the Way Forward

- The success stories of waste management begins with source segregation into biodegradation and non-degradable, easing the burden of the final dump site.
- Composting at the community and ward level.
- Making of an informed and responsible community and a pro-active governance.
- Involvement of stakeholders from civil society, NGOs, and locals in the decision-making to pool indigenous knowledge into modern technology.
- Practice of Rainwater harvesting as Darjeeling receives one of the highest rainfall.
- Reviving the dying springs through the setting up of Dhara Vikas committees.
- Stringent rules and regulations, bye-laws for the defaulters to be put in place.
- Sensitizing the locals with workshops and awareness programme.
- The water supply system needs to check and push for the equitable distribution of water resources to its inhabitants irrespective of their socio-economic strata. The Municipality needs to upgrade the existing water pipeline with a new and advanced pipeline incorporating the maximum use of resources and the proper geological study.
- The awareness and the technicalities involving rainwater harvesting is the need of the hour. The provision for the proper rainwater harvesting technique based on the geological study of the region will pave a new way to the water shortage problem in the town.
- There should be strict laws against corruption and misuse of water.
- Research and studies to bolster the management process.
- Despite being the most visible of all pollution Solid Waste Management does not attract the importance that it should.

Conclusion:

Water and waste management requires a paradigm shift in the way we think, locate, plan, design and sincerely execute to make system work. It calls for an immediate policy intervention with a mountain perspective involving the local stake holders, civil society and individual household. The waste and water issues need proactive treatment that is environment-friendly, cost-effective, socially acceptable, and committed residents who act as synergies of change committed to protect the very existence of Darjeeling as a tourist hub and to safeguard its fragile ecosystem.

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PLATES (Solid Waste)



Unattended Waste at the DHR Site



Informal recycling at the dump chute



Toxic fumes engulfing Darjeeling



The mountain of legacy waste.

PLATES (Water)



The Lal Dhiki Dhara (Major source in the heart of Darjeeling)



Queue in the dharas



The Waste and the water



The Waste and the water