

## **WATER SUPPLY SYSTEM AND RELATED PROBLEMS- A CASE STUDY DARJEELING TOWN**

Sarmistha Das

Assistant Professor, Department of Geography

Krishnagar Govt. College, Krishnagar, Nadia

e- mail- [sarmi\\_15@rediffmail.com](mailto:sarmi_15@rediffmail.com)

Water is an essential element of nature on the earth for all living organisms. During last century, man has exploited this resource very fast through various activities resulting water scarcity areas of the world. And in the hills, where there is no alternate source like tubewell, dugwells as available on the plains. The study area Darjeeling Town depends on the water supply from Senchal Lake which is fed by natural springs. Out of 30 springs 24 springs are continued to exist. Thus, people of Darjeeling are facing acute water crisis. Rich people are now spending to collect water while poors are queuing in a serpentine line or walking a long distance to collect a jerry can full of water. Hoteliers are paying 600 to 1000 bucks for 2000 litres water. Therefore, the study attempts to identify the problems faced by the people. The reasons behind the grave situation are clearly identified. Various cartographic techniques and statistical application is used to analyse the data. The study also suggests different steps to mitigate the problem. No proper rainwater harvest plan has been taken yet. The implementation of water supply projects and the roof top rainwater harvesting will be needed as viable and cost effective method.

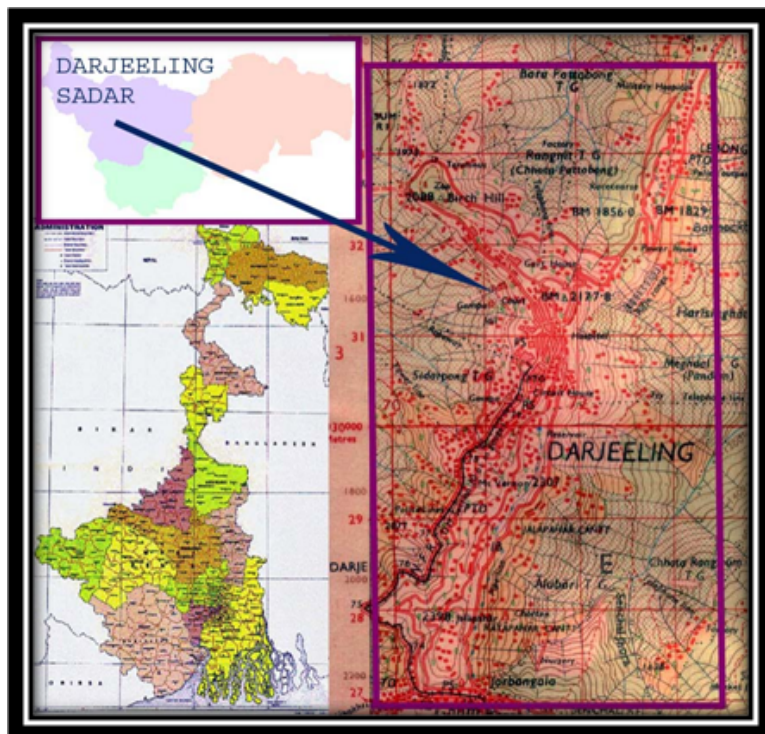
Key words: Water, Hills, Deforestation, Crisis, Rainwater Harvesting

### **Introduction**

Water is an essential natural resource on the earth for all living organisms including mankind for their development and survival . Environmental processes of biosphere are also regulated by water. Evidence of importance of water is found in the form of human settlements near water. Availability of water leads to the development of human civilization. But during last century, man has exploited this resource very fast through various activities. As a result many water scarcity areas of the world have been detected as hot spots of water crisis resulting in danger to renewable and non- renewable sources of fresh water. The development and exploitation of water resources of an area plays a vital role in its socio- economic growth also. Assessment of water crisis is made on the basis of per capita per year availability of water. If per capita per year

availability of water in a country is less than 1000 cubic metres per year, such areas are considered to be suffering from water crisis.

### The Study Area



Darjeeling–The Queen of Himalaya is located in the Northern extreme of West Bengal. It is bounded in the north by Sikkim, west by Nepal, and east by Bhutan. Darjeeling Hill area has 3 sub-division viz. Darjeeling Sadar, Kalimpong, Kurseong. My study area Darjeeling town lie in Darjeeling Sadar.

Darjeeling Town is the district headquarter lies between 27°N and 27°03'N latitudes and 88°E and 88°16'E longitudes. The word Darjeeling is the combination of

Tibetan words “Dorje” means ‘Thunderbolt’ and ‘Ling’ means ‘Place’, i.e. ‘The Place of Thunderbolt’. This town is located in Siwalik Himalaya on the lower part of Darjeeling-Jalapahar-Range. This range extends northwards from Ghoom at first rise abruptly to the height of 2366m at Chowrasta of Darjeeling town and again rising to 2149m at Observatory hill. The average elevation is 2134m. Darjeeling Jalapahar range is Y shaped with the base rising at Katapahar and Jalapahar. Two arms diverge to the north of Observatory hill. North- Eastern arm dip suddenly and ends in the Lebong Spur while North- Western arm ends in the valley near Tukavar Tea Estate.

Darjeeling is blessed with cool and bracing temperate climate, is a welcome respite during hot summer months. It has five distinct seasons- Spring, Summer, Monsoon, Autumn and Winter. Summers are mild with maximum temperature 14.8degree Celsius and minimum 8.5 degree Celsius. In winter average temperature is 5-7 degree Celsius with maximum temperature 6.1 degree Celsius minimum 1.5 degree Celsius. Occasionally the temp drops below freezing point and snowfall is rare. Rain falls during monsoon months from June to September and annual recorded rainfall is 320mm. Intense torrential rains often cause landslide.

The area of Darjeeling Town is 10.57sq.km and population is 118805(census 2011) and population density is 586/sqkm.

## Objective

The objectives of the study are

1. To assess the existing water supply system.
2. To examine how people of Darjeeling are facing water crisis.
3. To find out the reasons behind water crisis.
4. To suggest the probable mitigation method by sustainable water resource development and management using present infrastructure and technique as well as other traditional methods.

## Methodology

In the present paper 78A/8 topographical map has been used, Geo-referenced and vectorised to prepare base map. Map of Senchal Lake along with natural jhoras is stitched to show the existing water supply of Darjeeling Town. Relevant data and information relating to population has been collected for the census years 1901-2001. This has been manipulated statistically, analysed thoroughly and presented with suitable cartographic techniques.

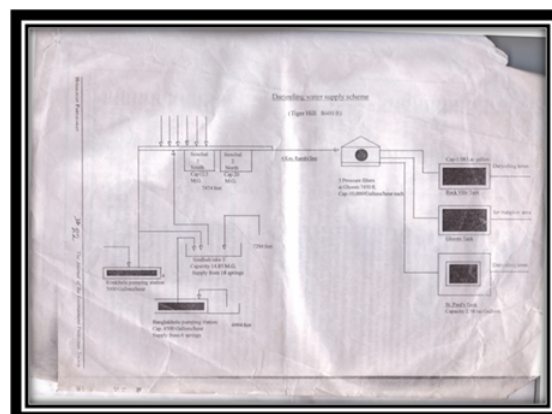
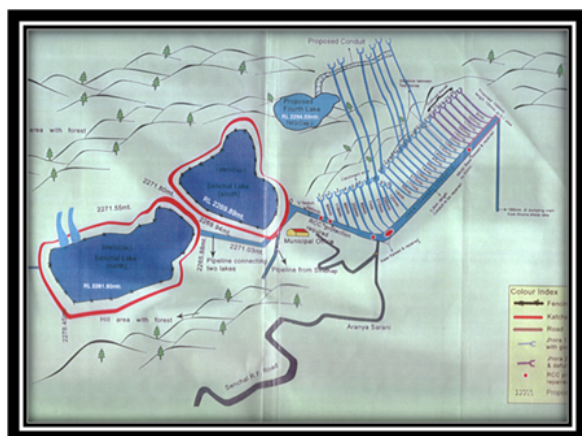
## Historical Background

According to O. Malley the district Darjeeling was created in 19<sup>th</sup> century by the British Indian Govt. On 1<sup>st</sup> February 1835, by a deed grant by the king of Sikkim, Darjeeling was ceded to the East India Company. Then the population was only 100 people. With the establishment of sanatorium for ailing British soldiers, purchase of land by Europeans for residential purpose, opening of barracks, and bazaar population grew up to 10,000 in next 50 years. When the Tea Gardens were being open out (1873), and communication developed with construction of Hill Cart Road and Darjeeling Himalayan Railways, population grew up to 16924 in 1901. After that partition of Bengal, success in tea plantation, introduction tourism, timber and immigrants from neighboring countries almost doubled the population (33605) in 1951 and in 2001 the city recorded population of about 107197 where area remain same that is 10.57sq.km.

**Existing Water Supply System** After air, water is important aspect to human life. And in hills where there is no alternate source like tube wells, dug wells as available on the plains, the town almost wholly depends on the supply from Senchal Lakes which is 10 km S.E. from the town. The water supply system of Darjeeling town was commissioned during the British period and is entirely dependent on 26 nos. of natural springs from the catchment area of Senchal Forest and wild life sanctuary. The water from springs are collected in an Arrestor tank and fed to the masonry conduit line (about 8 km in length) which brings water on gravity to twin Senchal Lakes. South Lake was constructed 1910 with water storage capacity of 13 million gallon and North lake constructed in 1932 with capacity of 20 million gallon. Water is then transported

through large water mains to reservoirs established at St. Paul Tank capacity being 235812 gallons and that of Rock Ville Tank being 56651 gallons. From these main reservoirs at two places water is distributed over the town through subsidiary tanks located at various places and also directly through distribution mains of various diameters. There are about 19 nos. of distribution mains of each from Rock Ville and St. Paul tank.

Darjeeling Municipality was set up in 1850. Then town had a population of 20000. The infrastructure and the amenities were planned and installed accordingly. But as the population increases, there is a gap between demand and supply of water, so in 1978, PHE department planned and in 1981 built another lake ie. Sindhap lake with capacity of 15 million gallon. A number of water supply installations like Kong khola station, Rambi water line, Bokshi jhora and Bangla Khola were added but this could not cope up with the rapid rise of population as a result of which the hue and cry for drinking water specially during dry period (December to May) has remained a constant feature for the last two decades or so.



## Water Consumption and problem facing by the people

As per UN Standard, 20 gallon is the ideal supply of water for per head per day. As per 2001 census for 107197 population, present demand of water is 2.14 million gallon but the present supply of water from Senchal lake in lean period (Oct- Apr) is 0.50 Mg and other season is 1.81 MG which cannot fulfill the demand of water any more. So scarcity of water remains. That is why the people of Darjeeling has to face a critical situation. People are queuing in a serpentine lane to collect a jerry can full water. Rich people are now spending to collect water while poor's are having contaminated water or living without water. Hoteliers are paying 600 to 1000 bucks for 2000 litres of water. Tourists are now avoiding the Queen of Hills and diverting their destination.

## CAUSES

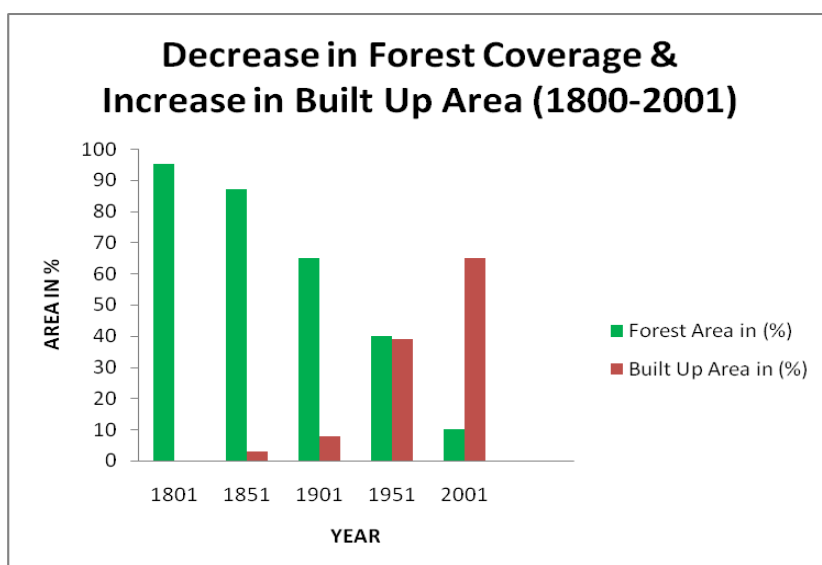
The reasons behind this water crisis in Darjeeling Town are as follows:

❑ **Problems in the storage of water and loss of water due to leakage**

Earlier there were 30 natural springs, but now reduced to 24, in the catchment area. They feed the lakes through masonry conduits and the water is pumped up to the town from Jorbunglow filter house, which is at a distance of 2.5 kms from the lakes. The total quantum of water gives a discharge of about 54,000 litres per hour around early March. After a few showers, it increases to about 1,12,500 liters per hour. Darjeeling Municipality revealed that not less than 6,75,000 litres of water is lost everyday due to 9 Km. long feeder line Senchal lakes to the town. If by preparing the main feeder line, transmission losses can be reduced then the deficit will be limited to 2.7 million litres per day.

❑ **Deforestation**

Since independence, in a desperate manner as much as possible the land had been acquired and extensive area under forest cover was gradually encroached upon. But rapid rise in population has made the problems more complex. For urbanization, demand for timber has increased resulting rapid deforestation.

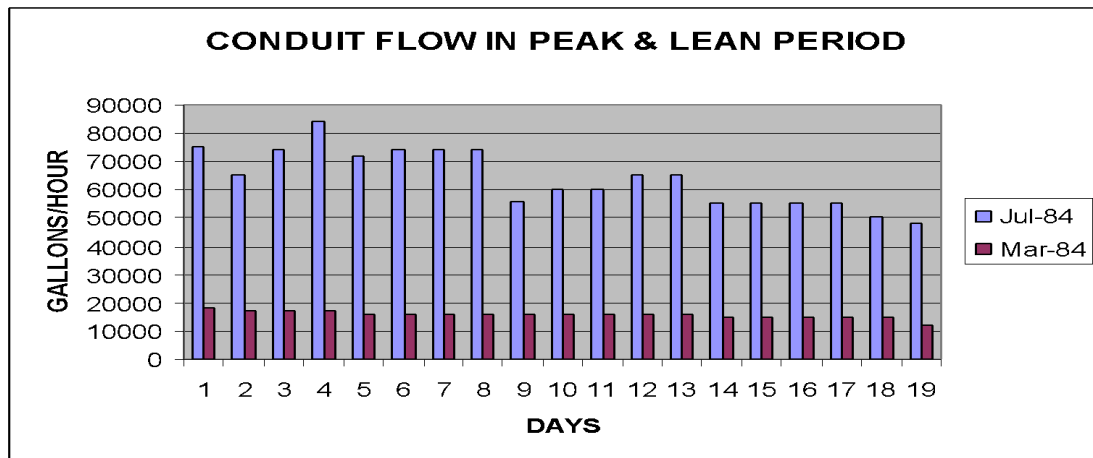


Forests act as Natural Sponge. Due to reckless felling of trees near the catchment area water cannot be stored and unable to supply water in lean period. Denudation of hills resulting in the increase in the surface run off and decreases in percolation. This percolation is essential for later release of underground water in the dry season. The denudation of the hills has also resulted in a decrease of rainfall during non monsoon months for which conduit discharge shows a downward trend.

❑ **Drying up of Jhoras**

Deforestation is the root cause of drying up of jhoras. While during the monsoon when nature blesses the Senchal catchment area with huge downpours, only 8 out of 26 jhoras feeding the lakes are kept alive, the rest are cut off. Deforestation also aggravates the

scope of landslide in this region. As Sanchal R. F. is unstable in character, construction of more reservoir will be in high risk condition.



#### □ **Faulty Distribution Network**

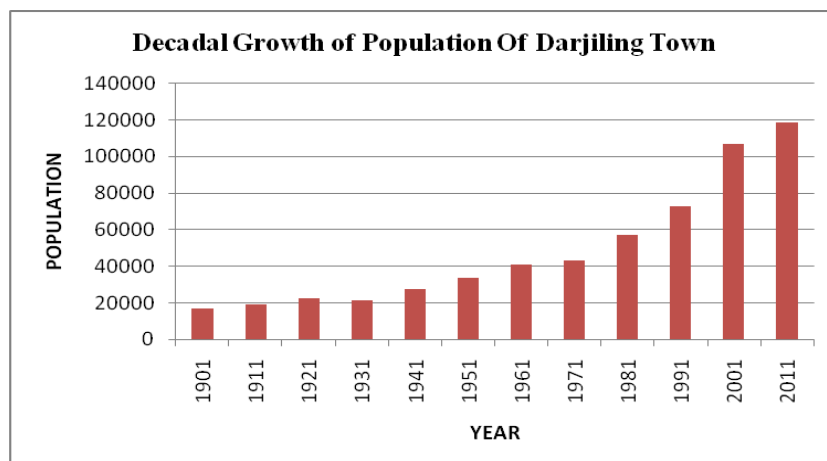
The entire water distribution network is run by different operating valves near the main tanks at St. Paul's a Rockville, and also at many places in the town. Most of these valves are very old as a result of which there are perennial leakages and unequal distribution. The town would not get water if some of these valves are not operated in a synchronized manner by different valve men at different places and thus are prone to human error resulting in unequal or faulty distribution. On the top of all these illegal tapping and unscientific connections have added more problems to the existing problematic distribution system.

#### □ **High growth of population**

As per 2011 census the Darjeeling town with an area 10.57 sq. km has a population of 118805. Every year the town has an additional floating population of 20500 – 30000 (average) mainly consisting of tourists.

Darjeeling has been significant growth in its population during the last century, especially since 1970's. Decadal growth rates reached as high as 45% in 1990s far above the state and district averages. The colonial town had been designed for a mere population of 10,000 but later subsequent population growth has created extensive infrastructural and environmental problems.





### FUTURE PLAN:

- 1) Feasibility for pumping water from Rungdung River, Rangeet River, Balason River etc.

Out of above proposals pumping of water from Rungdung River has been sanctioned by the Govt. of West Bengal and the scheme is being executed by the PHE department of DGAHC.



- ◆ On the 19<sup>th</sup> Feb, 2006 Hon'ble Chief Minister of West Bengal laid the foundation stone of 2 M.G.D. capacity DWSPS.
- ◆ PHE Dept. of Govt. of W.B. has formulated this project at a cost of Rs.49.16crore.

- ◆ Completion period of 3 years.
- ◆ 1.75 lakh population (2032) will be benefited.
- ◆ Major components of work: Augmentation of existing water source (repairing of Conduit & Jhoras.)
- ◆ Drawl of water from intake point of river Balason (1<sup>st</sup> stage of pumping & lifting at an altitude of 782mtr)
- ◆ Lifting water from 2<sup>nd</sup> stage by pumping to Senchal lake at an altitude of 686mtr.
- ◆ Distribution line from Senchal lake to St. Paul & Rock Vill reservoirs after necessary water treatment by filtration disinfections at Sindhap & boosting by pump as well as by gravity flow.

## **REMEDIAL MEASURES**

In the said circumstances, Darjeeling Municipality is of the opinion of carrying out for improvement the following measures for improvement of Water Supply to Darjeeling Town.

### **Short Term Measures**

- 1) Vegetative cover of the catchment area in Senchal Wildlife Sanctuary must be restored and felling of trees at Senchal Catchment area should be stopped.
- 2) Massive afforestation drive at the Senchal Catchment Area should be taken with quick growing varieties of trees and plants.
- 3) Planting suitable trees and bushes around the source regions of all the jhoras will get the steady flow of water even in dry period.
- 4) Complete changes of all the leaking valves and other leakages including replacement of the damaged old pipe lines.
- 5) Main feeder line must be repaired to check leakage.
- 6) Augmenting the water supply other Jhoras like Boxi Jhoras(near Hill Cart Road), and Giridhara should be taken into account.
- 7) To improve distribution network small reservoir should be constructed at different wards of Darjeeling Town and house connections will be given from them.

### **Long Term Measures**

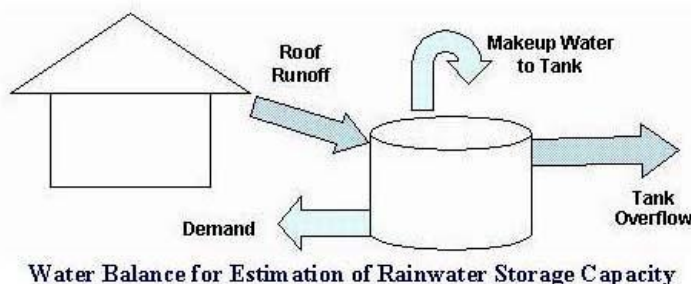
- 1) Feasibility for pumping water from Rungdung, Rangit River, Balasun River etc.
- 2) Alternative feeder Mains via Hill cart Road.
- 3) Construction of large storage reservoirs at suitable places.



- 4) Exploration of all natural springs.
- 5) Separation in supply of potable water for other uses.

## SUGGESTIONS

- 1) Rain Water Harvesting: The Roof-Top rain water harvesting system should be in practice and need to be popularized to the people of Darjeeling as a viable and cost-effective method to harness rainwater and use it in lean period.



Apart from this method some Traditional Rain Water harvesting may be followed.

- ✓ **BAMBOO DRIP IRRIGATION** : This 200 year old system is used by tribal farmers of Khasi and Jaintia Hills to drip irrigate their black pepper cultivation.

In this system bamboo pipes are used for tapping of stream and spring water. Bamboos of varying diameters are used for laying the channels. About a 3<sup>rd</sup> of the outer casing in length and internodes of bamboo pipes have to be removed. Other components are small pipes and channels of varying sizes used for diversion and distribution of water from the main channel. About 18-20 litres of water entering the bamboo pipe system per minute gets transported over several hundred metres, and finally gets reduced to 20-80 drops per minute at the site of plant.

- ✓ **KUL**: kuls are water channels found in precipitous mountain areas in Spiti Valley of Himachal Pradesh. The Kul is lined with rocks to keep it from becoming clogged. These channels carry water from glaciers to villages.
- ✓ **ZABO** : Means impounding run-off. Zabo is practised in Nagaland, in high ridge area. The rain falls on a hilltop, as the water runs off along the slope, it passes through various terraces. The water collected in pond like structures in the middle terraces.

## 2) Other Water Harvesting Technique

- **FOG COLLECTION** : The organised collection of dew through natural process is an ancient practice. In Mid 1980s meteorological service of Canada began construction deploying large fog collection devices in Quebec. This simple tool consisted of a large

piece of canvas ( nowadays using mesh ) stretched between 2 wooden poles held by the wires with a long trough underneath. Water would condense out of the fog into the canvas coalesce into droplets and slide down into drip off the bottom of the canvas and into the collecting trough below.

- This method was 1<sup>st</sup> used in Central Chile followed by Yemen, Guatemala, Haiti and Nepal.



Source:  
[www.google.co.in](http://www.google.co.in)

**CONCLUSION:** The water crisis of Darjeeling town as well as Darjeeling Hill equally face the problem. With the negligence of the authorities and ignorance of the common man, it can take the shape of a major crisis in the year to come. However in situation can look up thorough extensive research, creation of social awareness, sincere co-operation of people and judicial implementation of regulations. However in view of the increasing population and tourists in Darjeeling on the one hand and high cost of implementation and maintenance of water supply projects, roof top rain water harvesting should be introduced properly and massively with other traditional methods. If one can properly manage to conserve this amount of water through rain water harvesting there will be no shortage of water in future. Now for conservation of water, awareness has to be developed in a massive scale. This will not only save the water but also huge amount of money which are spent for constituting dams, water supply projects.

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