Drinking Water Facility in Kalyani Municipality and its Sustainable Management: A Study in Urban Geography

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ABSTRACT

The demand of urban water supply service is increasing rapidly as globalization accelerates economic development and brings improvements in living. Provision of reliable and safe water supply to urban area is an essential urban amenities for overall economic and social development. Kalyani municipality is a high population concentration area so timely and regular supply of water is considered necessssary. The supply of safe drinking water is essential for maintenance of good health quality of urban dwellers. This paper emphasis on the source of drinking water, house connection, time of getting water, quality of water and pumps, Composite concentration of drinking water facilities, Density of pipe length, water pollution, problems and problems related prospects. For fulfill the objectives of this paper both primary and secondary data have been used. Primary data and information are collected from the urban dwellers and municipal authorities. Secondary data and information are collected through Census of India, municipality website & various journal and papers. To fulfill the objectives of this study some statistical techniques and QGIS software has been used. So here are some solutions to overcome this situation.

Keywords: House Connection, Pipe Length, Water Supply, Z score

1. INTRODUCTION

The seriousness of the challenges associated with urban water supply and sanitation in Bengal cities have been recognized in recent times. The first national effort to invest in the urban water and sanitation sector commenced in the 1970s. The problems of the urban water and sanitation sector in West Bengal are complex and need efforts for development of drinking water supply (Kumar, et al., 2014). This paper attempts to highlight various water supplying mode and their composite concentration of different wards, multidimensional nature of the challenge, existing policies and their implementation. A water supply system or water supply network is a system of engineered hydrologic and hydraulic components which provide water supply (Kumar, et.al, 2014) .Water is one of the three basic amenities of man. So, the urgency of clean and iron free water supply is essential because most the disease (cholera, typhoid, and gastro enteric fevers) are caused by iron contaminated water.

2. STUDY AREA

Location of any place of the earth surface is mainly two types that are Absolute location & Relative location. Absolute location describes the location of a place based on a fixed point on Earth. The most common way is to identify the location using coordinates such as Latitude and Longitude. The study area of Kalyani lies between $22^0 58'30$ north and $88^0 26'04$ E longitude. Kalyani is a city and municipality in the Indian state of west Bengal. It is located around 50 kilometers from Kolkata – the capital of west Bengal, forming the northern most boundary of Kolkata metropolitan area. Kalyani is the administrative headquarters of Kalyani subdivision, a part of Nadia district situated on the banks of Hooghly River, the city spread over an area of 29.14 square kilometers. According to the 2011 census, Kalyani had a population of 100,620.
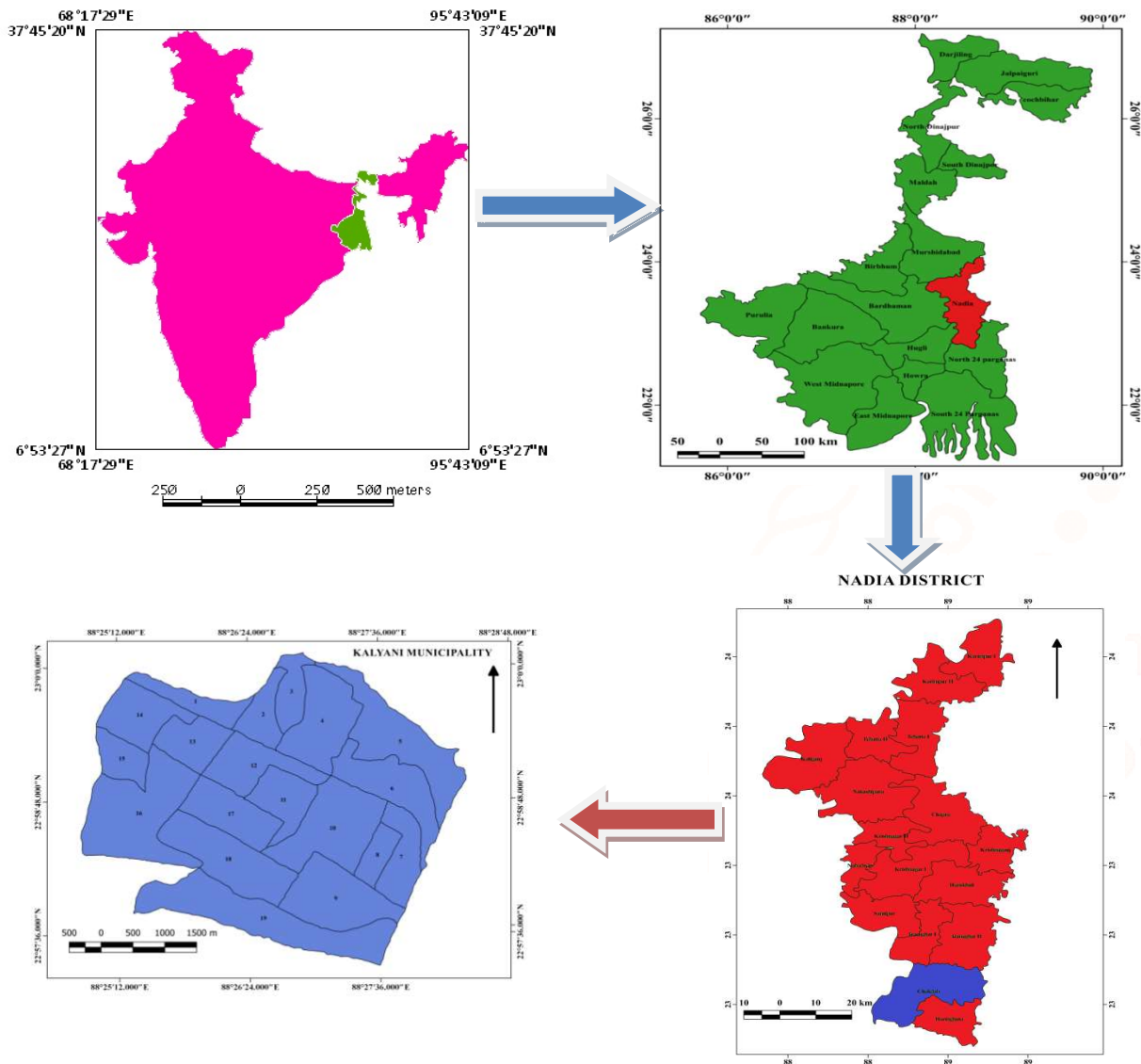
Location of Study Area

Figure 1: Location of study Area

3. OBJECTIVES

1. To know the overall water supply system of kalyani municipality
2. To know the Household water facilities.
3. To access the quality of drinking water that is provided to the people of Kalyani Municipality
4. Also examine the ward wise water facilities of municipality
5. To identify the drinking water related problem and prospects.
6. To have knowledge about the government steps and action to improve the quality of drinking water to the urban dwellers

4. DATABASE

This paper has been prepared mainly based on the secondary data i.e. collected from the census of India and the Kalyani Municipality authorities and website. Besides this, a perception study is done in some wards to know the quality and problems of drinking water i.e. supplied to the urban dwellers of Kalyani Municipality

5. METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. A major part of analysis in this paper is presented by descriptive and quantitative method. To analyze the temporal

development of drinking water condition in Kalyani Municipality, different techniques and diagram are used, e.g. simple bar diagram. to prepare the location map and showing the concentration of drinking water facilities in different wards QGIS software has been used.(Choropleth map).

5.1. Z-SCORE

A Z-score is a numerical measurement of a value's relationship to the mean in a group of values. If a Z-score is 0, it represents the score is identical to the mean score. Z-scores may also be positive or negative, with a positive value indicating the score is above the mean and a negative score indicating it is below the mean.

$$Z\ score = \frac{x-\ mean}{S.D}$$

In this paper for showing the composite concentration of drinking water facilities of different wards Z score techniques has been used. Z-scores are expressed in terms of standard deviations from their means.

RESULT AND DISCURSION

6. BACKGROUND

In the initial period of Kalyani Municipality, the water supply as well as drinking water was not well developed. Drinking water as provided to the urban dwellers by road taps, deep tube wells, tube wells. There was few water tanks and number of house connection was very few in respect to the total number of households in Kalyani Municipality. In 2001, there was only about 8400 house connection of water pipe line in Kalyani Municipality. As Kalyani municipality is under the KMDA region, water supply was rapidly developing with time. The surface water supply scheme was started in 2007 newly and it had gotten a new life. Thereafter its development is continuing and its present condition is very well than previous. Now the municipality has provided about 70% house connection and about 95% people of Kalyani Municipality get the drinking water facility.

7. SOURCES OF DRINKING WATER

From the initial stage of Kalyani Municipality (1995) drinking water supply to the urban dwellers was not developed. There were only few water tanks. Drinking water was mainly provided to the urban dwellers by deep tube wells, tube wells and some road taps.

After that the condition, way and capacity of water supply was gradually developing. Being a part of KMDA, surface water supply scheme to urban dwellers was taken from 2007. From the beginning of the scheme there ware few water tank and pumps (e.g. Central park, Buddha park, near industrial belt, near stadium) and thereafter its development is continuing. In 2017, there are 11 water tanks that supply drinking water timely to the urban dwellers of Kalyani municipality. The present sources of drinking water is mentioned by the table &pie diagram

Table 1: Sources of Drinking Water

Sl no	Source of Water	Percentage
1	Tap water	50
2	Hand pump	25
3	Well	12
4	Tube well	13

Sources: Kalyani Municipality, 2016
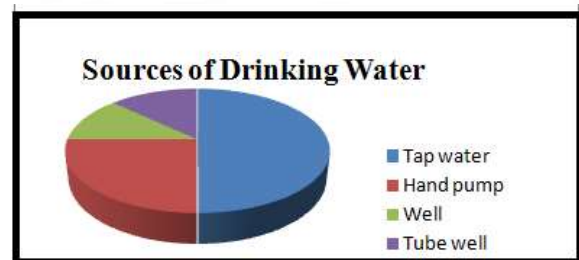
7. URBAN WATER SUPPLY IN KALYANI MUNICIPALITY

This section provides an analysis of the current situation of urban water supply in kalyani municipality. It presents this analysis in three parts: household, Infrastructure of water supply, composite concentration of drinking water facilities, pipe length density, water distribution and Pragmatic solution problems and prospect, and water sources.

7.1. HOUSEHOLD ARRANGEMENTS AND ACCESS:

Nearly 70 per cent households have access to tap water, out of which 90 per cent have access to treated

tap water. Thus, nearly 10 per cent of urban households have no access to public supply, and have to depend on other sources of water. This condition mainly sees in slum oriented ward.

7.2. FINANCING OF INFRASTRUCTURE FOR WATER SUPPLY:

Lack of finance in the urban water supply system is one of the biggest challenges in Indian urban water supply system. In West Bengal, most of urban local bodies/municipalities have to depend on the state government to get investment in water supply system (Bedi, 2015). They do not have enough sources for revenue generation to maintain water supply infrastructure.

8. CAPACITY OF WATER TANK

Table 2: Capacity of Water Tank

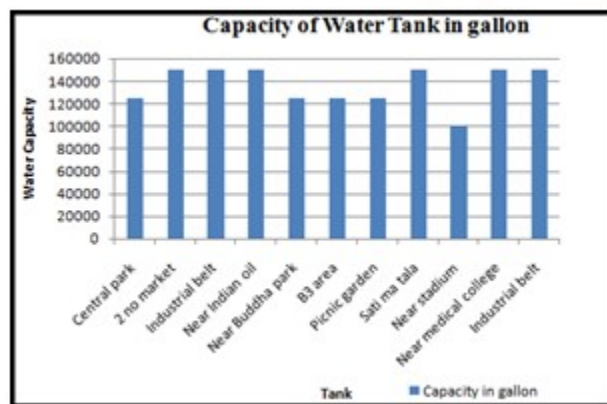| Sl. No.	Location of the tank	Capacity in gallon
1	Central park	125000
2	2 no market	150000
3	Industrial belt	150000
4	Near Indian oil	150000
5	Near Buddha park	125000
6	B3 area	125000
7	Picnic garden	125000
8	Sati ma tala	150000
9	Near stadium	100000
10	Near medical college	150000
11	Industrial belt	150000

Source: Kalyani Municipality

Figure 3: Capacity of Water Tank

Table 3: Composite Z – Score of Water Facility in Kalyani Municipality in 2001

Ward	Z score of street tap	Z score of pipe length	Z score of house connection	Composite Z score
1	-1.2	-1.68858	-0.596518	-1.15666
2	0.882539683	-1.0681	10.606966	22.88666
3	0.38730158	-0.196745	-0.75222188	-0.186666

4	0.387301587	0.380177	-0.565398	0.06666
5	0.704761905	-0.22603	0.6861023	0.38
6	0.06984127	3.61	0.3704485	1.35
7	-0.247619048	-0.181952	-0.087471	-0.166666
8	-0.56507965	-1.054733	-0.46981284	-0.69
9	0.704761905	1.711538	0.61430222	0.6
10	1.0222222	1.755917	0.4371359	1.066666
11	0.387301587	0.0695266	-0.03412172	0.136666
12	-0.247619048	0.794378	-0.02300716	-0.113
13	-0.882539683	0.069526	-0.94107055	-0.58666
14	-0.882539683	-0.536982	-0.56317521	-0.656666
15	-1.2	-1.39497	-0.34797548	0.97666
16	0.06984127	0.513313	-0.4342462	0.04666
17	-0.565079365	-0.98076	-0.08524874	-0.54
18	-0.247619048	-0.47781	-1.24116391	-0.65
19	3.2444	0.98669	0.988418619	1.7333

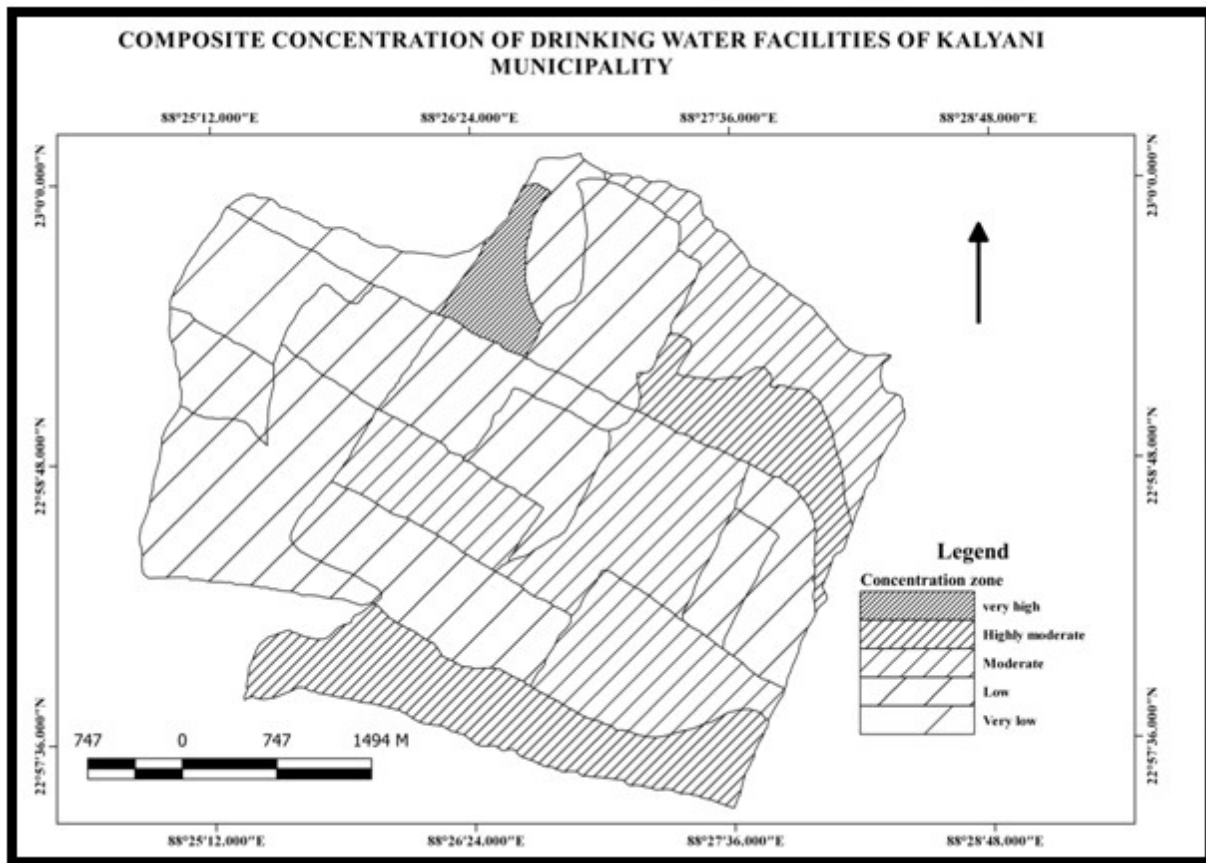**Source: Kalyani Municipality**

Figure: 4 Composite Concentration of Drinking Water Facility.

Only single criteria are not suitable for measuring the concentration of drinking water facility. So for measuring the actual concentration of drinking water facilities composite Z score method is used. Z score are away to compare results from a test to a normal population. Results from test or surveys have thousands of possible

results and units. However those results can often seem meaningless. With the help of Z score method total 19 wards of kalyani municipality is divided into five zones that is very high moderate low and very low.

Table 4: Composite Z – Score of Water Facility 2011

| Ward	Z score of street tap 2001	Z score of household connection 2001	Z score of pipe lenth 2001	Composite z score of three units of 2001
1	-1.2222600	0.3464146936	-1.292993	-0.72133333
2	-1.56506849	-0.6914054014	-1.006369	-1.08333333
3	-0.88013698	-0.4814278473	-0.592356	-0.65
4	-0.53767123	-0.0687133444	0.7133757	0.04
5	0.8321917808	3.6746796032	1.286624	1.92666666
6	0.4897260273	0.2860763159	1.54140127	0.7666666
7	0.1472602739	0.000241659	0.6178343	0.25
8	0.1952054794	-0.4017811889	-0.592356	-0.2666666
9	0.4897260273	-0.2449014070	0.585987	0.273333
10	1.1746575342	0.0085197789	2.5286624	1.23
11	0.4897260273	-0.1628412135	0.29936305	0.20333
12	-0.53767123	-0.0638862742	-0.0828025	-0.223333
13	-0.88013698	-0.6262399536	-0.4012738	-0.633333
14	-0.53767123	0.5153621509	-0.7197452	-0.24333
15	1.85958904	0.7808510124	-1.324840	0.436666
16	0.14726027	-0.283517968	-0.050955	-0.063333
17	1.2226027397	-0.621412883	-1.0063694	0.22
18	0.1952054794	-1.118601115	-0.687898	-0.08
19	2.2020547945	-0.935172447	0.2356687	0.5
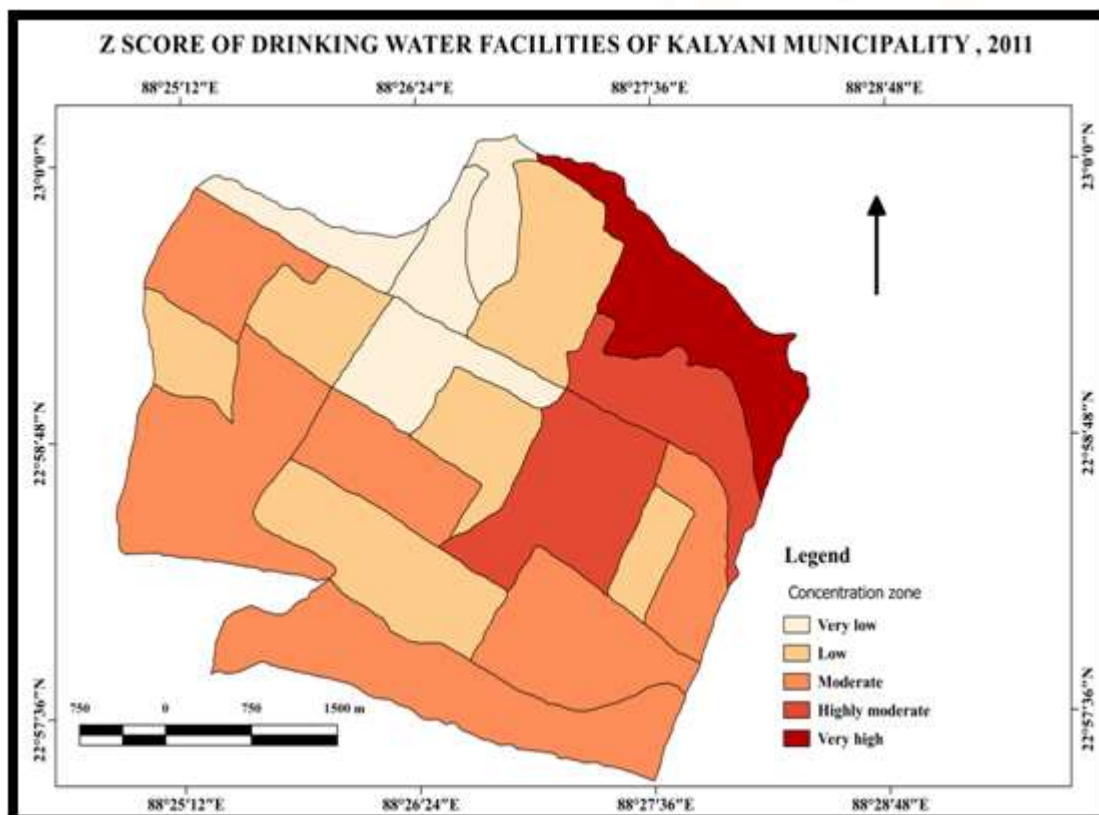
Figure 5

This map shows the composite concentration of drinking water facilities of 2011 in kalyani municipality. Number of household and percentage of households by access to water supply from 2001 to 2011 was increased. The map illustrates that there was a gradual increase from 2001 to 2011 in the percentage of households with access to 'improved' drinking water. In 2011 the number of tap water household connection and Number Street tap ware increased. So, composite concentration was also increased which indicated that better and improved water facilities. If we compare with two map we see that low drinking water facilities wards are become change to Medium water facilities zone. And medium water facilities zone changed to High water facilities zone

9. TIME OF GETTING WATER

Kalyani Municipality is providing three times water supply in a day from its initial stage of tap supply and house connected supply. Times are 6:00 am to 10:00 am, 12:00 pm to 2:00 pm and 5:30 pm to 9:00 pm. But in previous the quality of provided water was not out of danger (arsenic rate high) and the water supply system disturbed frequently. At present water is free from this type of problems

10. WATER SOURCES AT HOUSEHOLD LEVEL

With the help of fifty household's survey, we said that 65% households used water from household tap connections and community stand posts 22% households use hand pumps, 2% use dug wells and 11% use their own source. It is observed that45% households had individual household tap connections, 40% households used public water sources within 500m distance, 5%households use public sources located at distance of more than 500m and 10% households had their own water source at homes.

11. CAUSES OF WATER POLLUTION IN KALYANI

Water quality problems are caused by the pollution of surface water and/or groundwater. Water quality is affected by both point and non-point sources of pollution. These include sewage discharge, discharge from industries, run-off from agricultural fields, urban run-offs, and percolation of the chemical substances into the ground water. Water quality is also affected by floods, and lack of awareness among urban dwellers

12. BIGGEST CONCERNS OF URBAN WATER SUPPLY

One of the biggest concerns of urban water supply in Kalyani municipality, is the contamination of water and, and the consequent impact on health. There are multiple routes of transmission of pathogens, and hence contamination.. Leaking pipes is another concern issue which causes the water pollution and contamination of water. it is likely that water supplied by public sources is less contaminated. Finally, a large number of households are directly dependent on groundwater, or Shallow tube well which is iron contaminated

13. SOLUTIONS FOR EFFICIENT URBAN WATER SUPPLY

We know there are many techniques to increase the availability and better management of the resources in the urban areas like

13.1. RAIN WATER HARVESTING:
For potable water supply in urban areas, water harvesting is mandatory compulsory for all building or household. Also water is stored in tank built inside house basement and after appropriate treatment used to drink when required.(Chilton,1999) This technique is being adopted, encouraged and promoted in many cities in west Bengal. Rain water harvesting is an efficient, promising and sustainable way to increase and supplement the availability of underground and surface scarce water resources in areas where the people are facing the problem of shortage of potable water supply .

13.2. CONSERVATION OF SUPPLIED WATER: It is also an important strategy to improve efficiency of water supply system (Shah, 2016) In large urban settlements, a large fraction of supplies potable water is used for landscape and plant irrigation. Also the water demand increases in dry season when there is need for more irrigation like playground, golf course, parks etc.

14. PROBLEMS

The problems of people with drinking water are-
1. Water supply in the slum areas and marginal areas and out growth is poor.
2. 100% house connection is even not completed.
3. 3. Equitable distribution of water supply is also major problem as only prestigious people have access to potable water supply and poor people does not receive minimum clean water requirement.
4. Aging of the water supply infrastructure is also a big problem
5. Dirty particles emit with water then water is not drinkable.
6. Water tanks and pump station are not reformed timely.
7. Maximum drains are open, not covered in the slum, marginal and out growth areas and from these open drains many diseases are appeared suddenly e.g. Dengue, Typhoid, Jaundice etc

15. CONCLUSION

The status of water supply in Kalyani can be considered as good in terms of coverage at the habitations and in terms of service at the households. However, it can be argued that there is tremendous scope for improvement. Water supply and sanitation is a State responsibility under the Indian Constitution. So the state govt and Kalyani municipal authority should take some initiatives for solve these drinking water related problem and prospect.

16. ACKNOWLEDGEMENT

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