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Drinking Water Supply And Demand Management In Chennai City- A Literature Survey

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Abstract

One of the major problem in chennai metropolitan area is water scarcity which comprises water strain, water dearth and water disaster. Natural reasons and human causes may also plays a major role in water scarcity problem. This survey aims to focus on the drinking water supply and demand in chennai metropolitan city. As a result of this review paper, different author's vision towards water problem in chennai city were discussed. Study of 20 journals based on water crisis in chennai city, growing population, and ground water source, water quality of drinking water and also awareness of harvesting rain water were also discussed.

Key words: safe drinking water, supply and demand, increase in growing population, Chennai metropolitan area, awareness of harvesting rain water.

1 Introduction

Chennai city is the capital of Tamil Nadu state, is located on the coast of the Bay of Bengal at latitude 13°4" North and longitude 18°15" East. Two rivers rush through Chennai, the Cooum river in the central region and the Adayar river in the southern region. Domestic and Commercial sources were polluted these two rivers with effluent and trash.

The state government took responsibility on de-silted the Adayar river, which is much less polluted than the Cooum river [1]. Source of water distribution is mainly based on:

i. Surface water
ii. Ground water

1.1 Water supply city system:[Surface water]

In the northwest along GNT road, for about six km from the Red hills lake is situated were water is drawn for the Chennai city supply. The upper supply channel which diverts the flow at Tamaraipakkam to Cholavaram lake from there it flows to Red hills lake. This lake mainly receives its supply across the Poondi reservoir [2]. Small number of lakes are also connected in the northwest of Chennai city, were a statistical analysis report shows that for period of 39 years 95% of probability is the safe potential up to 142 mid. This is because lakes are shallow and has 43% evaporation losses.

1.2 Ground water

In early water supply source to Chennai, people we depend on shallow wells situated in their own houses and some part if people mainly depend on public wells and tanks. At that time was no source water supply during the year 1914 protected alter supply system using filtration and pumping was achieved [3].

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1.2.1 **States of ground water in Chennai basin**

The source of ground water are from the old well fields such as poondi, flood plains and kannigaipair and new well fields like panjetty, tamaraipakkam and minjur [4]. Ground water are getting polluted because of effluent and plastic trash were the intrusion of sea water that contain salty waste product spoils the groundwater where does not meet the permissible limit for drinking purpose.

2. Study Area [Hydrology]

2.1 **Climate**

Chennai metropolitian area has a hot climate, were most of hottest part is late May and early June, with maximum temperatures 38-42°c (100-107°F).And the coolest part of the year is January, with minimum temperature around 19-20°c (66-68°F) [1]. Due to cyclones and low pressure development in Bay of Bengal Chennai city receives heavy rainfall and the area is regulated with sea breeze with high humidity.

SEASON	**DURATION**
Winter	January and February
Summer	March to May
South west monsoon	June to September
North west monsoon	October to December

Table 1.1 The important season in Chennai metropolitan area

2.2 **Rainfall**

At the middle of October till December the rainfall currents sets from the north and about the earlier day of August till the middle of October, South flow parallel to coolest sets the rainfall received during south west monsoon is recorded as 760mm and during south east monsoon is 400mm [4]. The average annual rainfall for the Chennai city is about 1,300mm [1].

2.2.1 **Rain gauge stations**

Chennai city storage reservoir are:

1. Poondi -3.231TMC
2. Cholavaram-0.881TMC
3. Red hills -3.300TMC
4. Chembarambakkam-3.645TMC
5. Veeranam-1.465TMC

Ponneri, tamaraipakkam, cholavaram, redhills, vallur, anicut, thiruvottiyur, nungmbakkam, egmore, koratturtambaram, meenambakkam, kovalam, ponnamallu and chembarambakkam are the rain gauge stations in which Poondi reservoir plays an important role this is because this reservoir receives water from Krishna water and now the poondi canal capacity is 28.34 m^3/s (1000 cusecs) [1,4]. Mode of water supply to people in Chennai is through metro water pipeline connection, bore wells, and tankers. This tanker supplies water to the south part of Chennai were water storage is from chembarampakkam which has a free catchment zone area up to 77.10km^2.

2.3 **Population**

The major factor that demands the water is population. From the directorate of census operations, Chennai data have collected in which 34.2% of population living in urban centers ranks third most urbanized state in India [4]. Chennai district verified increases to 13.07% to its population compared to 1991. The initial draft data released by

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census India 2011, shows that mass of Chennai district for 2011 is 26,553 people per.sq.km [5].

2.4 **Ground water recharge structures**

To improve the ground water storage recharge structures are built. To improve the water table, a process by which ground water reservoir is amplified. Hence these structures provide good quality of ground water in the aquifers.

2.5 **Intrusion of sea water**

If the ground water level decline, sea water moves inland in which it threats the ground water. Most coastal area are dependent on local fresh water where intrusion of saline water into fresh ground water occurs commonly in coastal aquifers [4].

The southern region of Chennai is also facing threat of contamination due to constant pumping and improper management. Digging of bore wells in south Chennai area like Besant Nagar, Triplicane has already started resilient brackish water with high TDS (total dissolved solids).

3. Investigation in demand and supply of water management- Review from different authors

Water Crisis In India: Need For A Balanced Management Approach

G.C Maheshwari et al [1] analyzed, the Water related problem in India which have pointed to crisis situation. The gap between demand and supply of usage of water got increased and the reasons are:

(1) The ever- burgeoning population.

(2) The raise in per capita consumption of water.

It has been estimated that the demand increases up to 76% to 114% of the usage of water in future 2050. The 3 components which challenge the supply chain-side of present and future demand are:

(1) Creating new potential for enhancing supply

(2) Achieving equitable distribution

(3) Meeting the needs of sustainable development

And the challenges posed by demand-side solution are:

(1) Creating new technologies for reducing water demand.

(2) Bringing about changes in the societal mindset about water usage.

(3) Initiating and enforcing water-related structural reforms.

To bind the gap between demand and supply management a balanced water management approach, involving fundamental changes in policies, practices, performance, and public behavior is required [6].

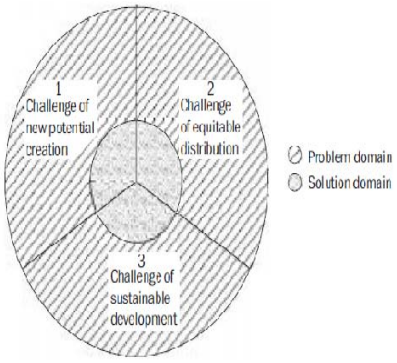

Fig 1.1 Challenges of supply chain solutions

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A Way Out of Drinking Water Crisis In Rural India

Suchismita Das et al [1](2013) analyzed that over exploitation of ground water and receding water tables resulted in water crisis in many general and rural areas which resulting in dry wells, ponds etc. Pure and safe drinking water in rural area has taken demoralizing form. Because of no pure drinking water death zone arise and only sources of water are some natural springs and water pits kilometers away from their homes. Ground water is generally pure and safe for drinking but because of overexploitation, water table is progressively getting down. Due to high usage, the groundwater quality is being corrupted with pollutants such as heavy metals, pesticides, coliform, BOD, COD etc. Rain water storage tank which has a capacity of storing 10,000 liter have built after people have moved for rain water harvesting for drinking and managing water. Rain water harvesting is used to recharge the underground water sources. This can be done with the common people's participation, man-made scarcity and the looming water calamity can be overcome [7].

Demand and Supply of Water Resource in The State Of Tamil Nadu: A Descriptive Analysis-2012

DR.A.B.Angappapillai et al [1](2012) analyzed, for India southwest monsoon is the main source of water that undergoes wide spatial and inter-annual variations related with global climate anomalies. In the coastal regions, the state receives more rainfall during north east monsoon. around 322 mm and 470 mm amount of rainfall is the normal rain that receives from south west and north east monsoon which is lower than the National normal rainfall of 1250 mm. The key environmental issues as environmental fear that are to be lectured are:

(1) Industrial Effluent Discharge
(2) Surface Water Pollution
(3) Ground Water Pollution
(4) Catchment Degradation
(5) Siltation In Rivers And Reservoirs

On implementing the Water Resources Consolidation Project from the World Bank the government of Tamil Nadu has obtained:

(1) Water Sector Reforms Project
(2) River Basin Boards
(3) Ground Water Regulation
(4). Interlinking of Rivers

From various sectors of the state economy the fast growing population has results in the urbanization and increase in demand for water. As a result this paper challenges to provide a account on the demand and supply of water in the state of Tamil Nadu culled out from various sources [8].

Water Demand Analysis of Municipal Water Supply Using EPANET Software

Arunkumar M et al [1](2011), using EPANET 2.0 software the study of the water demand analysis of Public Water Supply in Municipalities were examined. The major trade and transportation networks are provided with modern water supply networks and public water supplies all improved water supply in India. Municipal water systems includes:

(1) Collection or intake works

(2) Purification or treatment works

(3) Transmission and distribution

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EPANET is a computer program that achieves prolonged period model of hydraulic and water quality behavior within under pressured pipe networks. The movement and fate of drinking water constituents within distribution systems is designed by EPANET for improving our understanding. For improving water quality throughout a system an alternative management strategies can help assess which include:

(1) Altering source utilization within multiple source Systems

(2)Altering pumping and tank filling/emptying schedules,

(3) Use of satellite treatment, such as re-chlorination at storage tanks,

(4) Targeted pipe cleaning and replacement.

As a result, there is a critical need to find methods for saving, reusing and recycling water and to grow procedures to recover water resource management [9].

Improved Water Management Strategies for Chennai Metropolitan Area

Radhakrishnan R et al [1](2007) says that the purposes of the study is to examine the domestic water supply and demand scenario of Chennai Metropolitan Area from the year 1981 onwards to the present grade. For Chennai Metropolitan Area a better way of distribution of domestic water is suggested to reduce the gap between supply and demand for the future. For forecasting the population the geometric increase method is used for the study. The total water demand for the CMA is calculated as:

Total Water Demand = Design Population x Per Capita Demand.

Metropolitan Area is divided into 4 sectors as North sector, Central sector, South sector and West sector for the study purpose. Immediate steps to be taken for the drinking water requirement in challenge of meeting of such huge population [10].

Year	Population (Lakhs)	Demand (MLD)
2001	17	177
2005	19	191
2010	20	208
2015	23	229
2025	28	278

Table 1.2 Population and demand

Spatial Analysis of Groundwater Quality Investigation In North Chennai, Tamil Nadu, India

Ponniah Raju et al [1](2012) determined that, Chennai is a coastal city, still having leftovers of higher sea levels in the form of back waters, filled lagoons etc. Groundwater is an important factor of the water supply to the city, as the piped water supply is insufficient to meet the necessities. Chennai city gets about 1200 mm rainfall annually. The maximum rainfall receives during northeast monsoon. With the help of polyethylene bottles groundwater samples for quality analysis are collected (26 samples for both pre monsoon and post monsoon periods). From both open as well as bore wells the water samples have been collected. The groundwater feature of north Chennai has been examined using incorporation of terrain parameters (lithology, landforms, soil, drainage and rainfall) with groundwater quality parameters such as TDS, Na, Ca, Cl, Mg etc. The

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calculations of Groundwater Quality of North Chennai area are founded on WHO international standards (1971). During pre-monsoon period TDS content is beyond required limit and during post monsoon period TDS content is small in some places. This is for the reason that of addition of rainwater into the groundwater system through access. Ground water quality corrosion can be controlled by recharging groundwater through rainwater harvesting and monitoring seawater intrusion. The present study specifies that the current fresh groundwater resources have to be accurately succeeded [11].

Levels of Fluoride In Various Sources Of Drinking Water Available In Chennai – A Household Survey

Sunayana Manipal et al [1](2013) In this study on using the Ion-Selective Electrode for fluoride ion testing three types of drinking water namely Corporation water (tap water), bore water (underground water) and different brands of packaged drinking water were tested at the Tamil Nadu water supply and drainage board, Chepuk Chennai. Chennai, the capital of Tamil Nadu mostly originates its water supply from the public drinking water supply, the metro water. This supply is not sufficient to meet the water stresses and hence a majority of the population use ground water take out via pumps, as a source of drinking water and most other prefer for packaged drinking water. A house hold survey was done in Chennai city to evaluate the practice of different source of drinking water, it was valued that 50% of the people use bubble top, 20% use tap water (metro water), and while 12% of the people use ground water and 18% use combined sources. The levels of fluoride was greater only in the bubble top form of packaged drinking water when compared other sources like ground water, metro water and in bottled water. The results of this investigation have limitation such as the gathering of samples was completed only from nine locations and the samples were composed only during pre-monsoon season. Further, this study affords only starting point evidence on groundwater quality in Chennai and hence additional studies casing a larger number of samples should be done [12].

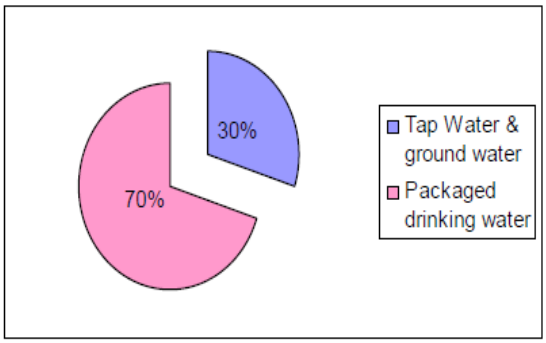

Fig 1.2 Drinking water scenario

Packaged Drinking Water Quality Characteristics At Chennai City, Tamil Nadu

Mr.J.S.Sudarsan et al [1] analyzed, People in urban zones suffer from acute drinking water scarcity. This study is directed in Chennai city to measure the physiochemical and bacteriological value of packaged water retailed in several key locations of study area. The three main source of packaged water includes bottled water, sachet and Bubble top cans are taken for quality test. Water quality is measured on the basis of calculated water quality indices. The determination of calculating WQI and matching it with standards is to measure drinking water contamination and difference of drinking water quality in different kind of packaged water on source of calculated value of water quality indices. A total of 480 samples were composed from 40 locations of study area. The samples collected on a day were

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straightaway treated for physiochemical and bacteriological analysis as per standard methods (APHA, 1998). As a result of the analysis exposes that the packaged water quality of bottled water is within the boundary and almost 97% are admirable to drink. In case of bubble top cans and sachets water quality does not meet the WHO standards. Only 80 % of sachet water and 70% of bubble top cans are with in exceptional boundary of WHO. So beforehand re-filling the bubble top cans, the sterilization to be completed accurately and bubble top cans and sachets water desires some degree of more treatment before drinking. The network was checked for discontinuous supply because CMWSSB and Avadi Municipality are not on condition that of supplying 24 hours water supply to the public. The system shows negative force when investigated for discontinuous supply [13].

Condition	Range of demand factors
Daily average in maximum month	1.10-1.50
Daily average in maximum week	1.20-1.60
Maximum daily demand	1.50-3.00
Maximum hourly demand	2.00-4.00
Minimum hourly demand	0.20-0.60
Source: Velon and joo*** (1993). Reprinted by permission of The McGraw Hill Corporation	

Table 1.3 Range of demand factor

Microbiological Analysis of Packaged Drinking Water Sold In Chennai

Kalpana devi venkatesan et al [2](2014) analyzed, The current study was calculated to judge the microbial quality of sachet and bottled drinking water sold in selling openings in Chennai. In developing countries, 80% of all diseases and over 30% of deaths are associated with poor drinking water. In this study, overall 51 samples (36 sachet and 12 bottle), be appropriate to 17 different brands were tested. It was assessed that 88% of that burden is unsafe to water supply, sanitation and hygiene. The bottled water samples tested are of improved microbiological quality when associated to that of the local brands of sachet water samples. The findings consequently proposes that these sachet water are not fit for human feeding purpose and are hazardous to health. Hence there is a need for severe and repetitive monitoring of the packaged drinking water with the view of educating their standards [14].

Class	Grade	Presumptive Count	Sachet Water		Bottled Water	
			n=36	%	n=15	%
I	Excellent	0	28	77.8	15	100
II	Satisfactory	1-3	1	2.8	-	-
III	Suspicious	4-9	3	8.3	-	-
IV	Unsatisfactory	>10	4	11.1	-	-

Table 1.4 Classification of samples for drinking water

Factors Determining Informal Tanker Water Markets In Chennai, India

Veena Srinivasan et al [1](2010) examined, Private tanker van workers means of transport for water take out from peri-urban wells to urban users. The study shows that two groundwater issues are related: depth to water and aquifer productivity. No Indian city currently has a 24/7 water supply. Even in cities where majority of the population gets water from pipe line water system, were households usually receive water for a few hours a day and it is not for sufficient needs. This article reports the problem of water establishment in Indian cities where tankers meet about 7% of the demand–supply gap. The main

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quarrel was tanker demand is driven by groundwater obtainability. The prototype considers in a dynamic manner is the connections between private wells (i.e. self-supply) and piped supply in formative the need for tanker water is useful to the case study area, Chennai, India. Chennai agonized from a severe drought in 2003 and 2004, surveyed by the heaviest rains in its recorded history in 2005. Chennai went totally dry, and the piped supply organization was blackout for almost a year, informal private tanker markets appeared in which water was bought from peri-urban farmers for urban supply, provided that an chance to study the dynamics of tanker markets. The results designate that the demand for tanker supply was produced by dearth of groundwater availability in private wells as well as unpredictable piped supply. People will only rest on on informal water markets if both piped public supply and self-supply through private wells be unsuccessful. This research suggests that integrated management of urban water resources in Indian cities must openly take version of urban groundwater [15].

Ground Water Quality Assessment in Coastal Regions of Chennai City, Tamil Nadu, India- Case Study

Annapoorani .A et al [3](2013) examined, Urbanization and industrialization have increased degradation of water quality. From 72 places 250 samples were collected in Chennai city. The important parameters were dissolved salts, pH, and electrical conductivity. Statistical analysis was prepared and done using SPSS software by using different titration methods. And using GIS software, map of study area and spatial variation were done. From 500 to 13390 ppm varies for higher values of EC and TDS were recorded. By examining only 35% of ground water samples are fresh water and which is less than 1000 ppm based on TDS. This study shows that in central part the ground water quality is safe but the Covum River or Adyar River are not safe towards the central [16].

Faecal Contamination of Drinking Water During Collection And Household Storage: The Need To Extend Protection To The Point of Use

Thomas F.Clasen et al [1](2003) summarized as, From improved sources 85 house holds of female heads getting the water, in addition parried water were collected and analyzed. At the non-improved sources, the arithmetic mean TTC load were calculated in the house hold level. To the point of consumption extend drinking water quality beyond the point of distribution is needed. They discussed the options for such extended protection, counting better collection and storing approaches and household-based water treatment. The drinking water during collection and storage in the home has long been recognized in the risk of microbiological contamination. There are thirteen towns and villages in the Kailahun District were chosen to contribute in a cross sectional study of the faecal contamination of drinking water composed and store in households. Drinking water samples were taken and analyzed from the stored water at a sum of 100 households, 5 from every sample sources during the same period. In this treatments are primarily focused on worse water sources. To ensure microbiological quality cost-effective circumstances developing or rehabilitating wells and other sources of supply and maintenance are operated [17].

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Study of Water Supply & Sanitation Practices in India Using Geographic Information Systems: Some Design &Other Considerations in a Village Setting

Srila gopal et al [8](2009) summarized as, Water in the village was originate to be microbiologically unhealthy for drinking water. Examination using straight clarifications complemented by GIS maps exposed unfortunate planning, unfortunate engineering design and shortage of regulating of the water distribution method causing possible corruption of drinking water from sewage at multiple sites. The use of GIS tools to stock statistics about a public with respect to their environment is a different way to use this tools. GIS maps have a benefit over old-style hand drawn maps since it is possible to participate environmental characteristics such as slopes and soil into a particular visual symbol by the layering method. In this study, most of the explanations made were added with GIS maps which were helpful in recognizing possible risks [18].

Evolving Urban Water and Residuals Management Paradigms: Water Reclamation And Reuse. Decentralization, And Resource Recovery:

Glen T. Daigger (2009) analyzed, Stove piping (i.e., separate management of drinking, storm, and waste water) surrounded by the urban water and resource management living must be removed. Assumption of these methods to urban water and resource management can central to additional resolutions. Water recovery and reprocess schemes can be cast-off to encounter drinkable and non-drinkable usages and can be organized in a consolidated or dispersed formation. Consolidated systems may be well-suited with drinkable reprocess and dispersed system well-suited with non-drinkable reprocess. In a dispersed system, water recovery services are situated all through the urban area. Wastewater is detached from a neighboring wastewater gathering system to meet the water demand. New methods are developing with advanced demonstration, as well as:

(1) Storm water management and rainwater harvesting.
(2) Water conservation.
(3) Water reclamation and reuse.
(4) Energy management [19].

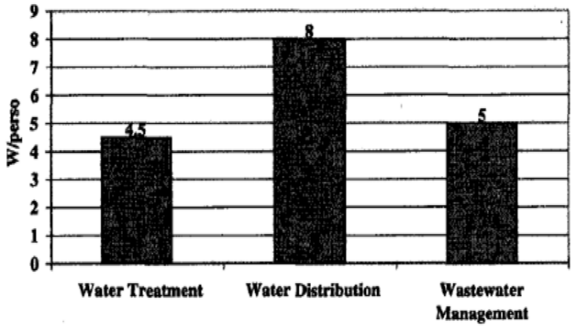

Fig 1.3 Energy requirements for water treatment

Various Options for Removal of Fluoride from Drinking Water -2013:

Neelo Razbe et al [3](2013) analyzed, Excessive fluoride concentrations have been stated in ground waters of additional than 20 urbanized and mounting countries as well as India. In this paper, a wide-ranging indication of the existing skills for fluoride elimination and benefits and boundaries of each one have been offered founded on collected works assessment and the trials directed in the workroom with numerous procedures. With the growth in industrial undertakings water bodies high fluoride concentrations in groundwater, up to more than 30 mg/L, happen broadly. Numerous selections for elimination of fluoride can be prohibited or diminished by:

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(1) Using alternate water sources.

(2) By improving the nutritional status of population at risk.

(3) By removing excess fluoride (de fluoridation).

De fluoridation of drinking water is the only possible selection to over whelm the problematic of disproportionate fluoride in drinking water, where substitute basis is not obtainable. Approaches are founded on the standard of adsorption, ion-exchange, precipitation–coagulation, membrane separation process, electrolytic de fluoridation, electro dialysis, etc. As a consequence elimination of fluoride will bring a better result in ground water were it is used for drinking drive [20].

Removal of Iron from Drinking / Ground Water by Using Agricultural Waste As Natural Adsorbents

Balaji.R et al [1](2014) summarized as, Groundwater quality problem are characteristically accompanying with great level of iron concentration in West Mugapair, Chennai. Ground water models were composed from tube wells. The physicochemical individualities was restrained for ground water. The current study agreements that motivated carbon organized from Sugarcane bagasse and Coconut coir can be cast-off very sound for elimination synthetic iron (5mg/L), ground water, double distilled water models. Since sugarcane bagasse and Coconut coir is a cultivated solid waste, easily accessible, it can be cast-off in Ground water behavior industries and wastewater behaviors. The ordinary agricultural left-over as ecologically friendly sensible for removal of iron from ground water [21].

S.NO	Parameters	Values
1	Turbidity	50
2	pH	7.1
3	Conductivity(μscm^{-1})	1309
4	Dissolved oxygen(mg/L)	8.0
5	Chloride(mg/L)	203
6	Alkalinity(mg/L)	236
7	Calcium Hardness as	178
8	$CaCO_3$(mg/L)	122
9	Magnesium Hardness as	300
10	$CaCO_3$(mg/L)	940
11	Total Hardness as $CaCO_3$(mg/L)	840
12	Total Solids(mg/L)	100
	Total Dissolved solids (mg/L)	
	Total Suspended Solids (mg/L)	

Table 1.5 Characteristics of ground water

Water Purification with Bottle Filling System:

Sagar Anant Kasrung et al [2](2013) summarized as, The procedure of water purification intricate in handling water for drinking purpose may be solids parting using physical procedures such as settling and filtration, and chemical processes such as decontamination and setting. Biological procedures are working in the handling of wastewater. Water handling methods are:

(1) Boiling

(2) Distillation

(i) Reverse Osmosis

(ii) Ultraviolet Light

The whole procedure is being measured through a PLC. The scheme thus delivers an excessive chance to implement numerous control loops considered before and regulated them with one of the most inclusive and extensively used organizer - PLC. From the outcome using this scheme it was originate that water scums are cast-off [22].

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Infiltration Galleries:-A Solution To Drinking Water Supply For Urban Areas Near Rivers:

Er. Rajvir singh jurel et al [3](2013) examined that, because of pollution and sewerage disposal in the river, the quality of water has become underprivileged and the handling cost has moved out to high. The quality of ground water is also becoming underprivileged due to pollution, interruption of brackish/saline water, and concentration of fluoride etc. The bases of drinking water stores are reservoirs, lakes, rivers which be determined on surface stream of water and tube wells which are hooked on ground water. Treatment process for drinking water supply from rivers are:

(1) Aeration
(2) Sedimentation
(3) Coagulation
(4) Flocculation
(5) Softening
(6) Filtration
(7) Disinfection
(8) Storage

In urban areas beside rivers drinking water supply is mainly reliant on river. One of the supreme appropriate solution for receiving drinking water at low rate and all over the year is facility of "Infiltration Galleries" in the river divan which will arrange for clean drinkable water endlessly even in summer. Punctured pipes will be rested below the river divan at a deepness about 5 to 10m from bed flat. These tubes will be associated to a sump-well in which drinkable water will flow under magnitude due to head of water about it. This kept water after decontamination –action will be supplied for drinking purpose. The idea of intrusion walkway is that when water clearances through the bed of river which has sand with filter, it is drinkable and even when there is unimportant surface movement in the river, there is always sub surface movement in the absorptive layers of sand underneath the bed of river, hence we get drinkable water endlessly [23].

The effect of roofing material on the quality of harvested rainwater-2010:

Carolina B. Mendez et al [1](2011) stated as, harvested rainwater is increasingly used for potable and non-potable purposes, due to decreases in the availability and quality of traditional water resources. Rainwater harvested from any of these roofing materials would need action if the user wanted to meet drinking water standards. Rainwater harvesting is undergoing a flow in fame in the United States, mainly in locations where traditional, high-quality freshwater supplies are lacking. The kind of roofing material used for the catchment can distress the quality of harvested rainwater hence six roof types: galvanized metal, cedar shake, asphalt shingle, two types of treated wood, and green are cast-off for harvested rainwater quality. Concrete tile and cool roofs seem to be noble applicants for rainwater harvesting catchments, among those three materials. The DOC concentrations in rainwater harvested from the shingle and green roofs are very high. The rainwater harvested showed lower concentrations of fecal indicator bacteria from the metal roof. Concentrations of maximum of the verified water quality limits diminished as an outcome of diverting a first-flush and a first-flush device can deliver some development in water quality [24].

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Fig 1.4 Pilot scale roof (A) concrete tile, (B) green, (C) cool

The role of satellite and decentralized strategies in water resources management:

Petros Gikas et al [1](2007) stated that, Existing and projected water scarcities and connected features have facilitated emphasis consideration on the need for water recycle. The relative advantages of satellite and decentralized wastewater management schemes for an amount of water recycle requests are obtainable and discussed in this paper. The use of satellite and decentralized methods for the management of water and wastewater can play a significant part in the upcoming of water resources management, while both water and wastewater are essential. This scheme used to diminish the demand for drinkable water, there should be chances to use the cultivated water from these services. Decentralized action plants can be used for wastewater action generated from a separate inaccessible house to a cluster of houses or to a subdivision and wastewater produced at universities campuses, or by isolated commercial, industrial and agricultural facilities. Domestic water is consumed characteristically at the district of wastewater group. A case study have been studied:

The City of Upland, located at the west end of San Bernardino County, is helped by a centralized wastewater treatment system.

(1) The town was facing two main problems: partial collection system interceptor volume and partial groundwater supply.

(2) Both difficulties were overwhelmed positively by the use of a removal type satellite system for the making of domestic water.

(3) Wastewater is dug on its way to the centralized treatment, and is focused to a satellite action system were it experiences full action.

(4) Exact problems related with the application of such schemes in current and in new improvements are inspected [25].

4 Conclusion

The study of different author's vision is based on the water supply and demand in urban and pre-urban area stated that source of water supply is mainly based on the rainfall during the monsoon season such as north-east and south-west on average amount of 1200mm annually in which maximum amount of rainfall for Chennai city is received during north-east season as recorded. From the rainfall source drinking water supply from various reservoirs like poondi, chembarampakkam, cholavaram, red hills supplies surface water for drinking and other purposes. Apart from the surface water, ground water also another main source of supply of water during draught season summer. Human health and habitant and also for all agricultural irrigation purposes is mainly based on the consuming safe drinking water as because many deadly diseases are separated due to poor/contaminated water. Water quality index on testing samples all around Chennai city shows that, testing of fluoride, total dissolved solids, magnesium, chloride, and microbial analysis relates that the ground water quality in many parts of Chennai city are free from contamination and pollutants as well as sea water intrusion. As a result of this literature survey, during monsoon season, the rain water

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harvesting will help the people in Chennai city to diminish the gap between supply and demand for nearly 40% from the all reviewed papers. So as a part of crating cognizance this paper work helps to create awareness among people on storing ground water for future demand purpose during draught season as a source of supply of water.

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