

**DRINKING WATER SCARCITY FACED BY THE  
PEOPLE OF KOTTAPURAM, VIZHINJAM: ISSUES  
AND CHALLENGES**

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## ABSTRACT

As we approach the next century, more than a quarter of the world's population or a third of the population in developing countries live in regions that will experience severe water scarcity. This research study concentrates on the toiling and struggling people of the area are faced due to improper management of drinking water. Water scarcity arises in situations where there is insufficient water to simultaneously support both human and ecosystem water needs. Most often this arises as a result of a basic lack of water, but it may also result from a lack of suitable infrastructure to provide access to what might otherwise be considered ample available water resources, which is referred to as economic water scarcity. Physical water scarcity may occur as a result of both natural phenomena as well as from human influences.

The research found that the lack of basic amenities, high population density and poor sanitation are the acute problem in the area which indirectly results in drinking water scarcity. As a social problem, Sanitation and water availability are crucially important to human health and well being, and their indispensable role as engine to the regional development. Kottapuram is a municipal ward in the coast of Vizhinjam, Trivandrum, Kerala. For many decades people of Kottapuram is suffering from proper drinking water issues, lot many initiatives were taken by the government and the church diocese for solving the issue, though there are no alternatives. The people depend on private lobbies for drinking water and extract water from wells and ponds to satisfy their daily amenities.

Today a big corporate project is being done on the coast of Vizhinjam by the Adani Group, a Multinational conglomerate company, where the water for the group directly provided without any problems but still the toiling masses of the Kottapuram region who most of them are belonging to the fishermen community suffers the ignorance of basic right of good drinking water. The present study was an attempt to find out the issues faced by the people on improper drinking water facility in Kottapuram, Vizhinjam. Secondly it tried to understand how drinking water scarcity affects the common people of Kottapuram, Vizhinjam. The study also tried to understand the measures taken by government and local bodies to improve the situations and to understand the challenges faced by the people due to improper drinking water.

# CHAPTER 1

## INTRODUCTION

Drinking water scarcity in India is an ongoing water crisis in India that affects nearly 1 million people each year. In addition to affecting the huge rural and urban population, the water scarcity in India also extensively affects the ecosystem and agriculture. India has only 4% of the world's fresh water resources despite a population of over 1.3 billion people. In addition to the disproportionate availability of freshwater, water scarcity in India also results from drying up of rivers and their reservoirs in the summer months, right before the onset of the monsoons throughout the country. The crisis has especially worsened in the recent years due to climate change which results in delayed monsoons, consequently drying out reservoirs in several regions. Other factors attributed to the shortage of water in India are a lack of proper infrastructure and government oversight and unchecked water pollution.

The acute buck shortage of water for daily needs has prompted many government and non-government organizations to take stringent measures to combat the problem. The Government of India has launched multiple schemes and programs, including the formation buck of an entire 'Jal Shakti' Ministry to deal with the problem. The government has also insisted on techniques such as rainwater harvesting, water conservation and more efficient irrigation. Agriculture alone is responsible for 80% of the country's water usage. Government records show that in 1980, just 1% of India's rural areas had access to safe, usable water. By 2013, that had increased to 30%, but the majority of rural India continues to live without proper access to safe drinking A Water Aid report in 2016 ranked India among the worst countries in the world for the number of people without safe water. An estimated 76 million people in India have no access to a safe water supply, and the situation is only getting more serious. The Asian Development Bank has forecast that by 2030, India will have a water deficit of 50 per cent. The Union Ministry of Water Resources has estimated the country's current water requirements to be around 1100 billion cubic meters per year, which is estimated to be around 1200 billion cubic meters for the year 2025 and 1447 billion cubic meters for the year 2050. (Karanvir, 2018) With a projected population growth of 1.4 billion people by 2050, the total available water resources would barely match the total safe drinking water; a basic amenity has become a luxury in many Indian households, especially in semi-urban and rural areas. Official figures show that each day,

approximately 500 million liters of wastewater from industrial sources is dumped into the Ganga. The Yamuna similarly receives 850 million gallons of sewage every day from Delhi alone. For those who are dependent on groundwater sources, the presence of arsenic in the eastern belt in the Ganga-Brahmaputra region poses equally dangerous threats.er requirement of the country. Data collected from the Ministry of Drinking Water and Sanitation states that 45,053 villages had access to piped water and hand pumps by the end of 2016-17, accounting for 64.19 per cent of India. Almost 19,000 villages across the country still do not receive regular water supply. (DuttaSaptarshi, 2017, “76 Million Don’t Have Safe Drinking Water: India’s Looming Water Crisis”).

The World Health Organization (WHO) states that an individual requires around 25 liters of water daily for meeting his/her basic hygiene and food needs. The rest is used for non-potable purposes like mopping and cleaning. This indicates that for most of the non-potable uses, a quality lower than drinking water is required. Thus, for economic efficiency and environmental sustainability, water must be treated and supplied according to usage. To top this, are issues of leakage losses, water pricing and metering of water. Lack of proper maintenance of existing infrastructure causes further losses of almost 40 per cent of piped water in urban areas. Looking at the current situation, there is a need for a paradigm shift. We urgently require a transition from this 'supply-and-supply-more water' provision to measures which lead towards improving water use efficiency, reducing leakages, recharging/restoring local water bodies as well as applying for higher tariffs and ownership by various stakeholders. (MahreenMatto, June 2019)

For the past few years, a group of people residing in Kottapuram, Vizhinjam are awaiting a solution for their drinking water scarcity. As they are denied access to the most important basic amenities, they are forced to purchase water from private sources for cooking and drinking. Acute water scarcity is a perennial issue for the residents here. Close to the place where the State’s multi-crore developmental showpiece Vizhinjam International seaport and container transshipment terminal project is taking shape, hapless residents are running helter-skelter with pots and buckets to fetch a pot of water. Just a few meters away from the project site, one could see women waiting endlessly with pots for water tankers to arrive. Residents of these places have to wait for two to three days to get a few pots of water supplied by the Revenue authorities. When the crisis becomes very acute, the residents travel to places such as Chappath,

Mukkolainauto rickshaws to fetch water. Almost Thirty years have passed since agitations were launched demanding proper water supply to the region. The Karichal water supply scheme was the first scheme the government implemented to address the grievance. But the people blocked the pumping after it was found that the water was polluted. The subsequent VellayaniKayal-Vizhinjam scheme also shared the same fate.

Most of the wells and bore wells in the Kottapuram area have gone too much polluted due to the unwanted sediments of sewage waste. The situation was much different in previous times but over the years the situation got worsen. The example of Kottapuram, Vizhinjam shows that the provision of safe drinking water still remains an unachieved goal, especially in rural areas, with the most severe adverse effects on the health and development of the rural poor. However, In India we only utilize half of the available surface and groundwater. Augmentation of availability and control of water pollution are necessary to meet the drinking water needs of rural areas.

Drinking water as a fundamental right should serve as a stern warning to the politician-bureaucrat nexus that have in recent years turned a blind eye to the growing pollution of Indian rivers. That the court too has sided with the people, and should help in initiating a debate on a crucial issue that has serious implications for the continued health and well-being of most citizens. India is facing a dire water crisis, even the NITI Aayog (2018) acknowledged this in a report which was published in June last year. The water crisis is likely to get worse. A 2006 report titled “India’s Turbulent Water Future” had also predicted this. It becomes imperative to take stock of our institutions and to ask if they are capable taking us out of this crisis, especially when they are likely at the root of this crisis. The government and the NITI Aayog, in the June 2018 report, by not pointing the finger at our water institutes as the root of our crisis, seem happy to manage our water resources with organizations that were created in British era. In the last seven decades, the objectives and goals of water resources development have become vastly different. For example, building dams and canal irrigation was seen as a necessity when India was riddled with prospects of widespread famine, agricultural yields and irrigation development was low. In 1945, India had less than 350 dams compared to 5,700 dams today. As lifestyles have consistently changed and the demand for water has increased sharply, water conflicts between competing users have increased (Ramachandraiah, 2001).



Water quality declined across India's rivers and aquifers and continued to decline post passage of Water Pollution Act, 1974 and setting up of Central and State Pollution Control Boards, which are also essentially modeled on centralized, non-participatory Central Water Commission. This calls for definitive institutional reforms. Most reforms to the CWC were not implemented, suggestions by the Mihir Shah Committee were also rejected (Parsai 2016). The Central Ground Water Authority (CGWA), set up under the Supreme Court's orders to regulate groundwater, was given the status of a licensing body, resulting in the creation of an institutional vacuum in managing the multidisciplinary challenges of water sector (SANDRP 2018).

The main objective of the study is to assess knowledge and information for providing safe drinking water in the remotest part of our country. There are many studies and articles regarding this subject. The proposed study has make use of these journals and articles in order to gather information. This study solely concentrated on the people of Kottapuram, Vizhinjam, Trivandrum, as still now struggle for proper drinking water facilities.

#### **STATEMENT OF THE PROBLEM**

Faced with acute drinking water shortage, the people of Kottapuram, Vizhinjam are being forced to purchase water from private agencies at Rupees 9-10 a pot. Still, there is only assurance regarding water supply. Officials can only cite technical hitches when asked why water is not being made available to Kottapuram, Vizhinjam which is populated by over 10610 people according 2011-2021 censuses. Most of the families face acute difficulties due to the drinking water scarcity in Kottapuram. Most of the people in the area are fisherman and daily wage laborers, their economic conditions are too bad to pay for water every day.

Many drinking water projects have been said to be installed on the occasion of the beginning times of Vizhinjam port by the Kerala Government, which is still upheld due. The water they receive from pipelines is only used for cleaning purposes, which is not good for drinking. 5,000 liters of water is supplied to each ward once in three days, the situation is such that 4,000 liters are made available once in nine days. Pure drinking water crisis has been disrupting lives of the people of Kottapuram for many years and the situation is getting worse day by day. Pipelines were drawn in many areas of Kottapuram years before, but it still puts a question mark on the implementation of water supply. The people of Kottapuram hesitate to consume the water from

pipelines due to rustiness of pipelines. The people of Kottapuram completely rely on the water provided by private lobbies which is taken from lakes and other public wells. During summer people of Kottapuram may have to travel 5-6 Kilometers for water for their basic needs. The present study was an attempt to find out the issues faced by the people on improper drinking water facility in Kottapuram, Vizhinjam. Secondly it tried to understand how drinking water scarcity affects the common people of Kottapuram, Vizhinjam. The study also tried to understand the measures taken by government and local bodies to improve the situations and to understand the challenges faced by the people due to improper drinking water.

### **SIGNIFICANCE OF THE STUDY**

Even though the developmental activities of Vizhinjam sea port are on the rise, the acute shortage of drinking water facilities is still a threat in Kottapuram. Water scarcity in India is mainly due to human made causes like throwing of wastes into water bodies and improper drainage system which made water not safe to drink, the apt reason exist in Kottapuram too. Hence to study about drinking water scarcity in Vizhinjam is a relevant subject. The measures undertaken by the government and other agencies are also an important aspect to be studied. The social, economic, psychological and physical problems of the people of Kottapuram are needed to be studied.

In the present context many various private agencies supply drinking water per pot for Rupees 9-10 in various areas of Kottapuram, the fisherman community find it hard to do this on a daily basis. This study can lead to the formulation of new policies.

## CHAPTER II

### REVIEW OF LITERATURE

It is now widely accepted that water scarcity and the lack of safe drinking water are the most serious challenges of the twenty-first century. Water the most vital element for life is becoming perilously scarce. At present, one-third of the world's population lives in water-stressed countries and, by 2025, this figure is expected to rise to two-thirds. Water scarcity has also the potential to become a major destabilizing force among neighboring countries, particularly in regions with ethnic, territorial or religious tension. In addition to water scarcity, water quality continues to be a major threat to human health and well-being. At present, over 1 billion people lack access to clean water, nearly all of them in developing countries. Unsafe water is the primary cause for the vast majority of diarrheal diseases and is a leading killer of children under the age of five, accounting for over 2 million child deaths per year. Waterborne diseases also inflict significant economic burden through the loss of productivity in the workforce and through increasing national health care costs.

#### **Drinking Water Scarcity**

Socioeconomic characteristics such as gender, age, education, occupation, and income level affect how they perceive the effect of drinking water scarcity on their life and livelihood. Socioeconomic conditions also contribute to increasing or reducing vulnerability and enabling or preventing individuals to take certain adaptive measures during crisis periods. With constant media attention directed at the impending energy crisis and the search for sustainable solutions, a potentially more threatening issue looms in the background. Every year, millions of people die from a lack of clean, fresh drinking water. Beyond a few scientific journals and United Nations summit publications, major media outlets choose to ignore these staggering figures, focusing their scientific reporting instead on the impending obsolescence of fossil fuels. Water is an essential, life-giving force; its scarcity demands our attention. Even with the coordinated efforts of all nations, future water scarcity may result in a health and financial crisis of unparalleled magnitude.

Because water is a contributing element to nearly every bodily function, the human body cannot survive for more than a few days without it. From waste disposal to the healthy functioning of

the immune system, the body demands safe freshwater for survival. As used in this comment, fresh denotes desalinated water, sufficient suggests an adequate amount of water for personal needs, and both clean and safe refer to water free from harmful contaminants. Though arguably one of the greatest threats ever to the survival of our planet, nations remain unresponsive, and those who seek to raise awareness of the problem are called doomsayers. Water-related diseases, most commonly attributed to water scarcity, have taken more children's lives in the last ten years than the combined deaths of those lost in armed combat worldwide over the last sixty years. Yet water conservation policies rarely extend beyond reducing the frequency of watering lawns or washing cars.

Current access to an abundance of water has permitted the western world to turn a deaf ear to the impending crisis. But the escalating issues associated with water scarcity increasing prevalence of water-related illnesses, famine, and eventual fatalities will prevent this area of the world from maintaining its apathy. Our ecological system constantly replenishes its water supply through its cycle of evaporation and precipitation, yet over eighteen percentage of the world's six billion people lack access to clean freshwater. The human rights abuses involved in the perpetuation of ignorance surrounding such a dire circumstance is beyond the scope of this comment perhaps the human psyche fails to comprehend broad suffering hence the common reluctance to interfere in past situations of widespread human rights violations. Regardless, the more critical question is, "What can we do now?" This comment seeks to provide global policy suggestions to defeat this immediate worldwide tragedy.

An examination of water consumption data over the past century illuminates a clear trend of abuse. In the last four decades, worldwide water use has doubled to more than 1,700 litres per person per day. Water consumption essentially grows by a factor of two every twenty years. This rate is twice that of global population increases, suggesting that mere increase in population is not a sufficient explanation for the problem. Expansion of Western and modernizing influences are at the root of this discrepancy between consumption and population growth: while societal advances such as greater accessibility to indoor plumbing are partially to blame, the growing industrial demands for water put the most pressure on water resources. Industrial consumption of water accounts for more than ninety percentage of total human water use, effectively limiting the supply available for domestic use. By 2025, industrial water use will be more than 200% greater

than 1995 levels. Within industrial applications, agricultural is the largest consumer of water, totalling seventy percentage of all human water use. (Elliot Curry, 2010)

The current trend among third world farmers of catering to Western influences (abandoning crops like lentils) and adopting water intensive crops (including biofuel crops like corn) further exacerbates the effects of water use. Along with increased water consumption, the shift in production often leads not only to financial misfortune for the third world farmer, but also the disappearance of a number of species of plant and animal food sources. Statistics of water consumption abuse, such as those cited above, are skewed by the actions of the largest consumers such as the United States, and fail to properly show that a significant portion of the world community still collects water from sources outside the home (including wells, ponds, and rivers). The water consumption of these individuals is dependent upon the distance from the water source to their homes.

The World Health Organization (WHO) recommends a minimum water intake of between two and four and a half litres per person, depending on climate and activity the WHO also suggests that two additional litres of water are needed for food preparation. With a combined total volume of 332 cubic miles, the water sources of the world are one of the most abundant natural resources, making the notion of water scarcity even more confounding. However, of that massive volume of water, only two percent is salt-free, and only one-third of that two percent is available for human use (the rest is trapped in glaciers). Without implementing costly desalination technology, the world's potable water supply is extremely limited.

The effects of a limited supply of freshwater are already present hot stains, large areas of disappearing water reserves, are cropping up all over the world. Although the Middle East and Northern Africa receive the most attention with regard to waterscarcity, parts of China, nearly two dozen other countries in Africa, and even the United States, suffer from water scarcity. Though current calculations suggest over one billion people worldwide lack access to a safe water supply, the difficulties of collecting data suggest this figure is an underestimate. Without intervention, the situation will continue to deteriorate. By 2025, as much as two-thirds of the world's population will be living in conditions of serious water shortage and one-third will be living in conditions of absolute water scarcity. By 2050, the number of those living in conditions of absolute water scarcity will balloon to fifty percent.

Factors contributing to drinking water scarcity include: lack of adequate sanitation, industrial pollution, disparity in distribution, climate change, and a rising population.

### *1.Sanitation*

A lack of adequate sanitation is the most prominent of the five contributing causes, but the attention it receives rarely translates into remedial action. In 2000, contributing members of the UN drafted the Millennium Development Goals, the most intensive efforts to date. Aimed at ensuring that the proportion of people without access to safe drinking water and basic sanitation is halved by 2015, the Millennium Development Goals focused primarily on access to water. Unfortunately, current estimates suggest that unless efforts are greatly accelerated, the goal will be missed by over seven hundred million people; factoring in this deficit and the expected population growth, nearly 2.5 billion people, mostly the poor, will be left unaddressed.

The tight correlation between sanitation and drinking water scarcity (human excreta contaminates water sources and makes them unsafe) suggests that any proposed solution to water scarcity must first account for improving sanitation. There are currently 2.5 billion people without access to adequate sanitation of those, 1.2 billion continue to practice open defecation, while four in ten defecate in fields used for food production. As long as basic sanitation eludes so many people, offering contaminate-free water to the global population will be impossible. But the mutuality of these two issues complicates any solutions: just as water scarcity cannot be combated without addressing sanitation, sanitation networks cannot be implemented without water supply schemes. Sanitation, and therefore water scarcity, will only be improved through funding and public works projects.

Prior to the Millennium Development Goals, international efforts included the UN declaration of the 1980s as the International Water Supply and Sanitation Decade. The initiative was a strong global movement to provide indoor plumbing and latrines to the neediest communities. Human waste is the most common contaminate of clean water; by providing well-functioning latrines, the UN's International Water Supply and Sanitation Decade represented a significant step toward clean water. From 1970 to 2004, due in large part to the efforts of the UN's International Water Supply and Sanitation Decade initiative, one out of every three people in the world gained access to toilets.

Efforts to address global sanitation are confounded on myriad fronts. On the international level, the political motivation seems present, but the solutions lack the vigour and coordination necessary to effectuate any sufficient change. In the UN confusion impedes progress as multiple agencies are responsible for sanitation, resulting in no single agency taking the lead. The common problem in the international community seems to be a surplus of conference activity and a deficit of action. Efforts among national governments fare no better. Where progress has been made, the national policies are fragmented and tend to lack the necessary commitment. Individuals without sanitation disproportionately reside in developing, poor nations, even absent crippling financial impediments, those individuals often lack the political clout to effect any change.

## ***2. Industrial Pollution***

Industrial pollution also poses a serious threat to water supplies. As with the lack of sanitation, the effects of industrial pollution have been found to disproportionately affect those of a certain income and race. But industrial pollution presents its own distinct set of challenges, most notably accounting for the staggering number of pollutants circulating in our water sources. Inadequate or lax environmental policies are the most commonly cited causes of pollution. In China alone, over twenty-five billion tons of unfiltered pollutants were dumped into the waterways in a single year. Though larger nations are most notorious for poor pollution regulation, the issue permeates the policies of the majority of third world nations as well. Most often, the third world nations are ill-equipped to design and implement adequate regulations controlling wastewater and pollution, either because of a lack of oversight or funding. There are countless examples of contaminated water being used for irrigation or being dumped directly into municipal water sources. (E Curry, 2010)

Perhaps the greatest threat stems from deficient regulations controlling the amount of pesticides used in agriculture. To feed an exponentially expanding population, pesticide use has grown by six hundred percent in the last fifty years. When applied to soil, pesticides have a tendency to seep into surrounding water supplies; without proper regulations controlling their use and application, pesticides can taint entire water sources indefinitely. Far more concerning, because of the diffuse nature of the ecological water cycle, one nation's lax internal pollution regulations can have a worldwide effect.

In nations with established water treatment policies, the concerns are no less daunting. Gaps in coverage and improper wastewater treatment are the most common issues. In the United States, for example, pockets of poor coverage exist across the nation; one in five citizens consume untreated water. Even when treated, the concentrated waste stripped from the effluent wastewater, often referred to as sludge, can pollute entire water sources if disposed of improperly.

The health consequences of poor sanitation and pollution are enormous. Water and sanitation-related diseases combine to kill a staggering 1.6 million people each year; 25,000 of those deaths occur from mere consumption of contaminated water. In Bangladesh alone, anywhere from twenty-five percent to sixty percent of the population faces the risk of consuming arsenic in the drinking water.

Children are the most susceptible to illness. Sanitation and water-related diseases account for up to twenty-five percent of all deaths of children under the age of five thus, every eight seconds a child dies from drinking contaminated water. Diarrhoea, the cause of the majority of these deaths, is responsible for more deaths than HIV, TB, or malaria. The World Health Organization has estimated that “88 per cent of diarrheal disease is caused by unsafe water and sanitation.

In spite of the insurmountable challenges, the incentive for action is immense: improvements to water supplies and sanitation networks are estimated to result in a seventeen percent reduction in annual cases of diarrhoea. Each dollar invested in sanitation is expected to lead to a seven dollar reduction in health care costs implementing universal sanitation at an initial cost of ninety-five billion dollars would ultimately result in savings of \$660 billion.

### ***3. Disparity in Distribution and Climate Change***

The natural inequitable distribution of water sources further contributes to water scarcity. If rain fell in an even pattern, the freshwater pool covering the globe would be eighty centimetres deep, and would be sufficient to meet the demands of the global population. Unfortunately many countries simply do not have access to the water. Water importation plans have been discussed, but the costs involved limit the feasibility of any sort of large-scale implementation. Unpredictable weather patterns, which often induce droughts, only worsen conditions in water-scarce countries. The effects of global warming, while increasing the



precipitation in areas less affected by water scarcity, continue to reduce rainfall in areas already in need. Dry areas will continue to face the brunt of the long-term effects of global warming, but no nation will be immune. Estimates suggest that climate change will lead to a twenty percent increase in water scarcity across the globe.

The deleterious effects of climate change will also extend to water quality. Water temperatures will rise, which will cause pollution concentrations to increase. Food production will also be affected, “exposing an additional 75-125 million people to the threat of hunger. While there are few alternatives for addressing this issue without implementing wide-scale emissions legislation, water-stressed nations can make great strides by reducing industrial consumption and focusing on meeting the consumption needs of private individuals.

The final component contributing to water scarcity is the growing population. Each year the world’s population increases by eighty-five million people. By 2100, the population will reach ten billion. Supplying the water necessary for the survival of the entire population will jeopardize water resources around the world.

As the population grows, ensuring all individuals have access to water supplies is another concern. The continuing urbanization trend around the world presents serious difficulties. From 1950-1985, the population “living in urban areas doubled, and urban services have not kept up. While forty-eight percentage of the population currently lives in urban areas, this percentage is expected to rise to sixty percentages by 2030. Expansion of water and sanitation infrastructure in urban areas is expensive, and there is a general tendency for governments to avoid addressing these kinds of costly issues. It is estimated that at least a trillion dollars is needed to update the water systems in the United States alone. ((E Curry, 2010)

#### ***4. Food Production***

Population increase necessarily requires increased food production. To supply one person with 2800 calories per day, one thousand cubic meters of water are needed. It is estimated that within thirty years, a fourteen percentage increase in freshwater will be needed to supply the expected twenty percentage growth in irrigated land. A total transformation of agricultural practices will also have to accompany the growth. Unmanaged agricultural systems (the earth’s natural growth absent human involvement) can only feed approximately five hundred million people. The

agricultural tactics implemented today feed more than six billion people: Between 1900 and 1950, the world's irrigated land area almost doubled to 94 million hectare [from 1950 to 1990] the area expanded by over 150 million hectare. Further adaptations will be required to feed the ten billion people expected by 2100; consequences of those adaptations will be numerous.

The effects of factory farming and flood irrigation have already taken their toll on many nations' water supplies. For example, the increase in irrigation in Russia has led to a sixty-six percentage drop in volume in the Aral Sea. To keep up with demand, poorer farmers will be forced to "overexploit" their land and water supplies.

### ***5. Foreign Policy***

The growing population will also influence the foreign policy strategies adopted by nations throughout the world. Control of water sources will become an increasing form of leverage; because most sources extend beyond a single nation's borders, disputes over control of riparian rights will escalate. In these situations, the management of water sources mirrors the prisoner's dilemma game. Cooperation around sustainable uses of a water source shared between nations would ensure long-term continual use, but this strategy would impose costs on both nations. Rather than cooperating and assuming the costs together, the expected outcome is for both nations to defect. The Middle East and Northern Africa have already erupted in conflict over water sources; as water scarcity becomes more prevalent, these conflicts will only intensify. The wars of the next century will be about water.

### **People affected by Drinking Water Scarcity**

Water scarcity will have the worst impact on those groups least able to handle its effects. Eighty percent of those without access to adequate water sources are the rural poor, and that lack of access perpetuates the cycle of poverty. The poor pay more than their wealthier counterparts for adequate drinking water, further exacerbating their direct economic situation. In addition, poor people are less able to cope with the negative health consequences of poor water and sanitation. Illness prevents participation in income generating activity or attendance at school, and often further frustrates any possibility of advancement. Even minor changes, like providing adequate drinking water and sanitation at schools, improves attendance rates and reduces dropout rates.

The other demographic group most affected by water scarcity is women. Nearly seventy percent of those “living in extreme poverty are women” and women perform 80% of water-related work, i.e., collecting and transporting. Collecting water is a very dangerous obligation women are not only exposed to contaminated water sources, but they also face risks of injury and violence as they journey to and from collection sites. Carrying buckets of water, often miles at a time, also takes a physical toll on women’s bodies.

Despite these many grim statistics and warnings, there is reason for hope. If distributed appropriately, enough safe freshwater exists to satisfy the personal and domestic needs of the global population. The difficulty lies in forming policies that will reflect a worldwide consensus. Regardless of which approach is taken, any solution must address the three following areas: rainwater must remain in local watersheds, underground water cannot be extracted at a rate beyond the replenishment rate, and pollution of water sources cannot continue.

Experts disagree as to whether privatization of water resources or establishing a human right to water is the appropriate course of action. While the two are not mutually exclusive, the tenets of privatization often conflict with those of supporting a global right to water. Capitalism is the motivation behind privatization, but is also one of the contributing factors to water scarcity. The recognition of the right to safe freshwater is difficult to reconcile with capitalism. (E Curry · 2010)

### **Privatization of drinking water resources**

Privatization of water resources first gained momentum in 1987 after the World Bank, attempting to fix the supply in Manila, focused on the city’s water infrastructure. The outcome was disastrous (despite repair attempts, water loss was as high as 64%), but the profits caused privatization to spread. In Argentina, Buenos Aires soon privatized its water supply, followed by parts of Bolivia, Poland, Chile, and England. Although only ten percent of the world’s water supplies (serving seven percent of the population) have been privatized, the accumulated profits are immense. The water supply industry is a one trillion-dollar business. Corporations involved in the industry amass over two-hundred billion dollars in yearly profits.

However, there are very high initial costs associated with entering the water industry, most notably related to the development of infrastructure and transportation. This begs the question: if

a corporation assumes the financial risk associated with a water infrastructure project, is the corporation not entitled to a suitable return? Substantial initial costs also serve as a barrier of entry into the market. Further, the large amount of capital necessary to embark on a water infrastructure project causes the water industry to be highly susceptible to monopolistic control.

Only a handful of companies actually participate in the water industry; seventy percent of the market is controlled by two French corporations, ONDEO and Vivendi. Water privatization is so deeply entrenched in the water industry that it is growing increasingly difficult for government to secure loans for water projects from organizations like the World Bank without some sort of private participation. Once corporations are included in projects, they often operate on a concession basis they require exclusive control of the water supply infrastructure. (E Curry, 2010)

#### Advantages of Privatization

Support for privatization stems from financially over-burdened governments in the developing world often being ill-equipped to implement the adequate improvements to their water and sanitation infrastructures. Even those with adequate financial resources often lack the political will to assume so much risk. Privatization allows governments that have failed to provide adequate water to award contracts to corporations, effectively shifting the risk and financial burden. Municipalities are under the greatest amount of pressure to recover the cost of public works projects developing and maintaining water infrastructure is capital-intensive and slow to recover costs.

There is a huge incentive for risk-averse governments to defer or transfer this obligation to private firms. Additionally, supporters claim privatization would promote conservation and improve efficiency of resources. Placing a high enough price on the resource will ensure only the most vital of applications are implemented. Under free market principles, ownership of water rights will lead to the creation of a sort of equilibrium price suitable to the needs and desires of all entities within the market.

#### Disadvantages of Privatization

There is an inherent assumption among supporters of privatization that governments are poorly managed and cannot provide clean freshwater in an efficient manner. These supporters suggest

that competition in the industry will lead to more efficient management than the public sector can offer. The real-world evidence contradicts this assumption. Not only do free market principles ignore the transaction costs, but privatized systems often charge more, leaving those who cannot afford the increase without service. In Bolivia, privatization increased water prices by thirty-five percent, and in the UK, by 106%. In both countries, the increase in rates was accompanied by a loss of service among large portions of the population.

Beyond imposing higher rates, corporations are also inclined to maximize profits by “cherry picking” customers. There is a general tendency to focus on serving urban areas (where a concentrated population density allows for easier implementation and lower costs) while neglecting the diffuse populace in rural areas. The poor are also commonly denied service outright.

The inherent problems associated with privatization stem from the drive to maximize profits. Corporations cannot remain competitive by following the ideals necessary to eradicate water scarcity: granting all members of the global community access to safe freshwater is often not cost effective. Because corporations are profit-driven, they have less concern for “the environmental impact of providing water, whether the water is provided in a sustainable manner or the associated costs for third parties. Privatization requires active government supervision in order to be facilitated in an equitable and effective manner. Many nations, especially in the developing world, are unwilling to assume that role.

Financial inequities are inherent to any market system. Due to disparities in wealth or access, some individuals are placed in more fortunate positions. Over time, instead of countering these disparities, the market nurtures them. Unlike other commodities, like wheat or oil, water is essential for survival, and it does not have any substitutes. Limited or non-existent access to grain or oil, while potentially devastating, is not life threatening. The traditional economic principles applied to other commodities are not applicable to water. Those unable to afford the market’s price for water would be left to die.

The ideals of capitalism do not support the necessary steps for combating water scarcity. Thus, privatization will likely never serve as a solution. (E Curry, 2010)

## **Right to Clean Freshwater**

The first step in forming a solution to water scarcity is the recognition of the human right to water. Without treaties or covenants in place defining and regulating water use and obligations, private organizations have assumed an ever-increasing role both in ownership and distribution of the resource. The lack of any government foresight has led to the rise in privatization over the past few decades. Often diametrically opposed to the ideals of privatization, the human right to water entitles everyone to sufficient, safe, acceptable, physically accessible, and affordable water for personal and domestic uses.

The right to safe freshwater, like all other human rights, is derived from a basic acknowledgment of the dignity of all human beings. This dignity, first mentioned in the Universal Declaration of Human Rights (“UDHR”), stands as the minimum definition of what it means to be human in any morally tolerable form of society. Lack or denial of access to clean freshwater, essentially the bedrock of survival, does not meet this minimum standard of dignity, nor is it morally tolerable. A UN covenant recognizing the human right to water will not solve water scarcity by itself, but it will establish the framework necessary for implementing any solution. A human right to water would place human survival at the top of the hierarchy of water allocation, thereby ensuring that industrial applications do not take precedence and that those who disrupt access to clean freshwater are held accountable.

The statement of the right would provide a specific allocation of water per person per day (a minimum of 20 litres), and would establish clean freshwater as a legal entitlement of every man, woman, and child, thereby elevating water to a level above that of a traditional commodity (such as wheat or oil). Because government would be monitored and forced to comply with the associated legal obligations, the right would also create the political will to serve those typically ignored. Further, an official statement of such a right would draw international attention to scarcity issues, and would grant individuals the ability to hold their governments accountable for any water service-related issues. (E Curry, 2010)

### **Concerns**

It is important to recognize that establishing the right to water does not ease the burden of forming practical policies. Another concern is whether the adequate legal framework is in place

to enforce the right in any given country. Many countries are unfamiliar with international law or uncomfortable hearing cases involving social rights and ordering specific remedies. Of the nations that have drafted the right to water into their constitutions or legislation, many fall short of realizing and protecting the right for their citizens.

South Africa first recognized the right to water in its Reconstruction and Development Plan in 2001; it ensured adequate access in its Free Basic Water policy, which guarantees every person twenty-five litres of water per day. Unfortunately, large discrepancies in coverage exist around the country on average wealthy, mostly white South Africans use 600 litres per person per day, poor and largely black residents. The African Charter serves as another example of exceptional foresight, but poor implementation. Nonetheless, despite some tribulations, recognition of the right to water is the best opportunity to thwart scarcity and its effects: Bolivia and Uruguay have both included the right in their constitutions, and have improved access for large portions of their populations. (E Curry, 2010)

#### Progression of Right

Movement toward UN recognition of the right to clean freshwater began in 1946, when the World Health Organization adopted its constitution, declaring that the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being. The next successive stride occurred with the adoption of the UDHR in 1948. Reiterating much of the same language and ideals espoused in the World Health Organization's constitution, the UDHR included the right to a standard of living adequate for health and well-being for himself and of his family including food. The right to water was not addressed in either document, and it is speculated that many of the issues involving water scarcity stem from this omission.

The next great step in recognition took place with the UN's adoption of the International Covenant on Economic, Social and Cultural Rights ("ICESCR") in 1966. Aimed at protecting the basic rights of individuals, the ICESCR established the right of everyone to the enjoyment of the highest attainable standard of physical and mental health. Unfortunately, this covenant not only failed to recognize the right to water, it also lacked an accompanying committee to enforce its regulations.

The creation of the Committee on Economic, Social and Cultural Rights (“CESCR”) in 1985 rectified this enforcement problem. Composed of a small body of elected experts, the CESCR is responsible for monitoring the adherence of states parties to the principles listed in the ICESCR. The CESCR requires reports about implementation from all states parties “within two years of accepting the Covenant and thereafter every five years. The CESCR also has the responsibility to issue General Comments about potential improvements and upcoming issues related to states parties implementation of the ICESCR. Although the CESCR’s General Comments are merely authoritative interpretations” of the ICESCR, the issues addressed serve as a sort of barometer of the international sentiment.

The CESCR’s efforts have produced the greatest strides toward the realization of the right to water. In 2000, the CESCR adopted General Comment 14, which, though neither authoritative nor included in the ICESCR, addressed the general right to health and articulated a right to all the elements which determine good health, notably clean drinking water. (E Curry, 2010)

#### General Comment 15

The CESCR’s most recent evolution of an articulation of a right to water comes in the form of General Comment 15, adopted in 2002. Like its predecessor, General Comment 15 is not authoritative, but it serves as the most progressive interpretation of the ICESCR with respect to water rights. It is the first instance of a UN body specifically suggesting that the right to water is essential to the realization of the rights enumerated in the ICESCR.

“Water is required for a range of different purposes to realize many of the Covenant rights. Water is necessary to produce food (right to adequate food) and ensure environmental hygiene (right to health). Water is essential for securing livelihoods (right to gain a living by work)”

General Comment 15 suggests that since the word including preceded the list of rights mentioned in the ICESCR, those rights were not intended to be exhaustive. Under this rational interpretation, since the right to water is a natural extension of that right listed in the ICESCR, recognition of the right to water is as essential as all others mentioned.

General Comment 15 stands as the model for any future freestanding covenant or addendum to the ICESCR regarding water rights. It focuses on three particular areas: availability, quality, and



accessibility. In context, availability indicates that the water supply for each person must be sufficient and continuous for personal and domestic uses; quality suggests that the water required for each personal or domestic use must be safe; and accessibility means that water and water facilities and services have to be accessible to everyone without discrimination. General Comment 15 further defines accessibility by addressing physical accessibility, requiring that water sources be within a safe distance, and “economic accessibility, requiring that water supplies be affordable. The right to water does not force countries to provide the resource for free, but it does mandate that water be affordable and priced at a point that aids in conservation. Some experts suggest staggering the price of water, thereby placing a greater burden on commercial industry to fund water infrastructure projects, but General Comment 15 neglects to address this issue. A corollary to both features of accessibility is General Comment 15’s prohibition against any discrimination to providing access to water sources. General Comment 15 focuses on providing access to groups who have been marginalized in the past, namely the poor and women, and providing them with a role in the water policy decision-making processes.

The most important feature of General Comment 15 is its awareness and articulation of both freedoms and entitlements: freedoms entailing the right to access water sources and be free from interference, and entitlements suggesting the equal opportunity for people to enjoy the right to water. Both are vital to the welfare of a population and both accordingly need to be integrated into any eventual right to water.

General Comment 15 does not offer much guidance regarding the implementation of the right to water, but if the language were to be adopted into the covenant, governments will be required to act in an expeditious and effective manner. As soon as States parties acknowledged the right, they would be required to immediately meet nine core responsibilities. Of the nine, the most critical are:

- To ensure access to the minimum essential amount of water, that is sufficient and safe for personal and domestic uses to prevent disease.
- To ensure the right of access to water and water facilities and services on a non-discriminatory basis.
- To ensure physical access to water facilities or services that provide sufficient, safe and regular water.

- To ensure equitable distribution of all available water facilities and Services.
- To take measures to prevent, treat and control diseases linked to water, in particular ensuring access to adequate sanitation.

The first core responsibility includes providing a sufficient amount of water to ward off dehydration. While the core responsibilities focus on immediate obligations, states parties are also faced with the long-term responsibilities usually associated with a human right covenant: the obligation to respect, the obligation to protect, and the obligation to fulfil. The obligation to respect entails refraining from any action or policy that interferes with the right; the obligation to protect refers to states parties preventing outside groups from interfering with the right; finally, the obligation to fulfil refers to states parties adopting all necessary measures to realize implementation of the right. The obligation to fulfil can be further dissected into the obligations to facilitate, promote, and provide. These obligations, respectively, require states to adopt all necessary measures for realization of the right, promulgate the appropriate legislation concerning sanitation and hygiene, and ensure access for all groups of people. (E Curry, 2010)

#### Enforcement

Enforcement of the right presents a separate set of issues. If General Comment 15's interpretation were to be adopted by the UN, only states parties to the ICESCR will be held responsible for implementation. If a state-party fails to take the appropriate steps for implementation, it will be allowed the opportunity to defend the omission, unless it involves a violation of a core obligation. Even in circumstances of deliberate retrogressive measures, states parties are still granted the opportunity to justify their positions by making a showing that the maximum available resources have been used and that the measures finally taken were only taken after a careful consideration of all alternatives. Unfortunately, the methods of enforcement are not as stringent as needed to ensure universal adherence to the ICESCR.

Punishment of states parties who choose not to conform includes a committee report of the infraction along with comments on options for future improvement. Despite the mild penalties, the enforcement actions would at least provide some incentive for governments to conform and recognize the right.

The most important element of enforcement is the ability for individual citizens to bring complaints against states parties to international bodies. Quite often, states parties are ill-equipped to adjudicate human rights abuses. An international body with experience in these matters serves as the only means of establishing any sort of remedy. Although the UN rejected communications and complaints from individuals in the past, in December of 2008 it adopted an Optional Protocol to the ICESCR. The Optional Protocol allows the CESCR to hear and consider individual communications. This is not to suggest that the CESCR will rectify every, or even any, ICESCR abuse committed by states parties, but it stands as a first step. If the right to water were to be recognized, this provision would allow the committee to hear water-related complaints from the neglected individuals so often ignored in their own countries.

For the meantime these mechanisms of enforcement are sufficient. In the long run, however, they are ill-equipped to ensure the protection of every person's right to clean freshwater. If General Comment 15 were to be adopted into the ICESCR, new sets of protocols and "legally binding instruments both at the national and international levels would need to be established to ensure that violations by states parties are infrequent.

General Comment 15 stands as the model embodiment of what we can hope for in an established right to water, and, although it serves only as an authoritative statement, its influence is widespread. Since General Comment 15's adoption in 2002, seventeen countries have altered their constitutions or laws to conform to the ideals of valuing water as a right of every member of the global community.

The recognition of the right to water does not solve looming water scarcity, nor does it allay current suffering. However, recognition of the right would place the issue of scarcity and human need at the forefront of discussion in international fora. If recognized and implemented into the ICESCR, or established as its own freestanding covenant, an official statement of the right to water would force states parties to provide access to water resources and make the necessary policy changes to ensure that access would not be disrupted. Governments would be held accountable for their actions and would be responsible for adapting their policies to include the goals of conservation and citizen access. Water scarcity will not be solved through policy decisions or binding treaties alone, but will require the coordinated efforts of the entire global

population. The recognition of the right to water by the UN would be a building block to initiate the chain of decisions necessary to prevent the dire effects of water scarcity. (E Curry, 2010)

### **Overcoming future fresh-water scarcity in India**

Water, which is available on the surface as well as underneath the earth, is the fundamental resource that doesn't have any substitute for its numerous applications such as drinking, irrigation, domestic uses, generation of hydroelectricity, and industrial uses. According to the United States Geological Survey (USGS), nearly 97% of water is present in the oceans, which are saline in nature and the remaining 3% of water is fresh. The fresh-water is distributed amongst icecaps and glaciers in Arctic and Antarctic region (68.7%), surface water (0.3%) and ground water (30.1%). Out of surface water, 87% is contained in lakes and rest in rivers and swamps, which means that only 1% of total water found on earth is usable by human beings. Water being the foundation of life, the scarcity of it is currently affecting one fifth of the world's population and a quarter of world population face shortage of technology to retrieve fresh-water from rivers and ponds. (S Manju, N Sagar - Renewable and Sustainable Energy Reviews, 2017)

This scarcity of water is a serious problem which is an after effect of increase in population and development in industrial and agricultural sectors. The United Nations World Water Development Report released in 2015 forecasts that there will be 40% shortage of drinking water in the world by 2030, which is only 14 years from now. This projected water shortage and scarcity can be overcome by sustainable use of water along with suitable techniques for treating waste water as well as obtaining fresh water. In order to add fresh-water stocks to that existing presently, the only possible way is to purify the highly saline ocean waters that comprises 97% of the total water present in this earth. Coming to India, it is forecasted that it will rank 40th in the world by 2040 in terms of water scarcity. However, the presence of a long coastline in India measuring 7517 km gives an added advantage to use the desalination technique to overcome the projected water scarcity. The concentration of salt in fresh-water and seawater varies from 500 ppm (ppm) to 35,000 ppm. According to the World Health Organization (WHO) report, excess concentration of chloride levels of about 0.25 kg/m<sup>3</sup> and sodium levels of 0.20 kg/m<sup>3</sup> in drinking water results in detectable taste in water. In order to increase the freshwater quantity to meet their basic needs, humans have practiced various forms of purification technologies on sea and brackish waters since long. This process, which is called as desalination, is an attractive way

to tackle the water shortage problem, as it is the only inexhaustible source of water available in the globe.

The process of desalination (to separate minerals from sea water) requires sufficient quantities of energy mainly supplied from conventional fuels and hence becomes costlier compared to obtaining surface and ground water by various methods. Installation of a desalination plant in developing countries is challenging because of huge costs involved towards initial investments, its operation and maintenance. The Middle East countries have abundant conventional fuel resources and hence the local government encourages desalination technology. It is well known that 70% of world's desalination plants are located in the Middle East region. The more desalination is used, the costlier the process becomes as it requires higher energy for separating the salts. The huge consumption of energy in desalination results in greater emission of greenhouse gases, a concern for environmental pollution. An estimate shows that to produce 1 m<sup>3</sup> of fresh-water from sea water, the plant consumes 3–10 kWh of energy where as a conventional drinking water plant consumes 1 kWh/m<sup>3</sup>. In spite of the drawbacks associated with desalination plants, which are mentioned above, it is a sustainable solution to the global fresh-water shortage.

### **Drinking water trends and future challenges in India**

The exponential increase in population has led to stress in water resources in the country, which is mainly a man-made problem. The main source of fresh-water supply to the country is from the surface and ground water. During monsoons, India gets nearly 75% of total annual rainfall of which 48% represents surface water. The whole of India receives less than 4000 billion cubic meters (bcm) of rainfall annually, which also includes snowfall. The annual average rainfall varies across the states with 544.8 mm in north western parts to more than 2072.8 mm in north eastern part of the country. In addition to the rapid increase in population, the climate change also introduces additional-stress to the hydrological cycle and alters the water resources systems. The over exploitation of water resources, and increased pollution has led to scarcity of fresh-water resources across the country. According to Central Water Commission's (CWC) annual report (2013–2014), the water resource potential of the country is estimated to be 1869 bcm considering both surface and ground water.

In India, ground water is the main source of water in rural and urban areas which is replenished from precipitation and river drainage. A report published by the Central Ground Water Board (CGWB) on November 2014 describes about the ground water level in India based on a survey of 14,904 wells. It was found by CGWB that 20% wells were showing water level less than 2 m below ground level (m bgl), 39% showed depth range of 2–5 m bgl, 26% showed water level in the range of 5–10 m bgl, 11% showed 10–20 m bgl, 3% in the range of 20–40 m bgl and 1% more than 40 m bgl.

In India, ground water contributes, 85% for drinking, 60% for agriculture and 50% for urban requirements. The estimated total utilizable water in the country is about 1123 bcm of which, surface water constitutes 690 bcm and ground water constitutes 433 bcm. By the year 2050, there will be an estimated necessity of 1450 bcm water, which would create a deficiency of 327 bcm of water for the population of India by 2050. Due to population rise and developments in India, nearly 688 bcm of water was utilized for irrigation in 2010 and 1072 bcm of water will be utilized in 2050. According to a new report by World Resource Institute (WRI), the most populous countries, China, India, and the United States of America (USA), are presently under high water stress of 40–80%. Examined the groundwater depletion rate, which was estimated to be  $54 \pm 9$  Gt/yr over the period April 2002 to June 2008, this large ground water decrease was attributed to the imbalance between exploitation and replenishment, as a result, excessive lowering of the ground water table has made pumping more expensive and many wells have insufficient water to meet the necessity of the people. India occupies 16% of world population and 4% of world renewable water resources. As there is constraint in water resources, its per capita availability also reduces with population growth.

In 2001, when the population increased to 1027 million, the per capita water availability reduced drastically to 1820 m<sup>3</sup>/year. By 2050, the per capita water availability will further reduce to 1140 m<sup>3</sup>/year and the population would be 1640 million. If the water availability in India is less than 1700 m<sup>3</sup>/capita/year, the country's situation can be categorized as water stressed and if it is less than 1000 m<sup>3</sup>/capita/year, the situation is water scarce., the Indian government must initiate programs to be prepared for solving the future water crisis as national priority in order to overcome the depleting water resources. 54% of India faces high to extremely high water stress.

Among these states, Gujarat suffers extremely high water stress greater than 90%. (S Manju, N Sagar - Renewable and Sustainable Energy Reviews, 2017)

The other regions like eastern side of Maharashtra, Karnataka, northern as well as southern side of Kerala and Andhra Pradesh are struggling with high water stress that ranges between 40% and 80%. High to extreme high water stress is reported in various areas of Tamil Nadu. The problems of water scarcity in these coastal states are due to lower ground water availability, poor river water and the presence of large number of industries. Due to the increasing demand of fresh-water and at the same time finding a way to reduce greenhouse gas emissions from conventional sources, scientists are developing RE based desalination technologies to obtain fresh water from saline water, which is in plenty. Hence, in order to overcome the water stress, desalination is an efficient technology to wipe out scarcity of fresh-water in India and help the population to meet their basic necessities in coastal as well as land locked areas.

### **Drinking Water as a Fundamental Right**

In the first week of December 2000 the Supreme Court that access to clean drinking water is a fundamental right as enunciated in the right to life under Article 21 of the Constitution of India. The apex court's ruling was given while setting aside the permission given by the government of Andhra Pradesh to Surana Oils and Derivatives in 1997 to set up an industry within the catchment area of Himayat and Osman Sagar which are the two major sources of drinking water to the twin cities of Hyderabad and Secunderabad. The Supreme Court found fault with the state government for giving instructions to the State Pollution Control Board to formulate new norms to this industry. It is also unfortunate that the industry won the case in AP High Court despite all the scientific evidence against it. (C Ramachandraiah - EPW, 2001)

This industry releases highly toxic effluents that would have flowed into these water bodies and poisoned them causing irreparable damage to health of citizens of the twin cities. The nature of topography is highly permeable in that area. The Industries Department of AP permitted that industry violating an existing government order that no polluting industry should be set up within 10 km radius of the water bodies. Even without obtaining the necessary No Objection Certificate from the State Pollution Control Board, this industry has gone ahead with the construction in the vicinity of the water bodies. This is another instance of how the political leaders occupying

power talk big about environment these days in the state while actually contributing to the destruction of water bodies. It may be recalled that the unprecedented flooding of Hyderabad city in August 2000 due to 24 cm of rainfall in 24 hours was mainly because of encroachment and disappearance of hundreds of water bodies and water courses.

#### 1. Pollution of Water Bodies

The concept of water bodies should incorporate rivers and groundwater as well since most of the non-drinking water requirements are met by groundwater. It is an unfortunate story in India that most of the rivers flowing through cities are polluted beyond acceptable norms and they resemble gutters and sewers. And the groundwater in their vicinity has been contaminated to such an extent that rural people dependent on them are suffering from multiple ailments. Release of untreated sewage and effluents is the single most reason for this situation.

The sad story of Patancheru and Jeedimetla industrial areas in Hyderabad are some of the glaring examples of destruction of groundwater and soils due to release of untreated industrial effluents. The corrupt politician-industrialist-bureaucrat nexus has played havoc with peoples' lives. The government seems to be intent on further destroying the Musiriver by constructing an 18-km long pipeline from Patancheru to dump the effluents into the river. Once the groundwater aquifers are contaminated, it takes hundreds of years to bring them back to normalcy. That is why preventive measures are always less costly and more beneficial in the long run. If the government shows some sincerity and ruthlessly enforces even the existing norms of effluent treatment by industrialists, a lot of pain can be avoided to people in and around Hyderabad. But many of the owners of polluting industries are also political leaders and they do not want to invest in treatment. If some money is invested in treating all the domestic sewage and effluents before being released into Musi, lakhs of people downstream need not undergo so much suffering like now. In this context, protection of HussainSagar as a freshwater lake assumes significance since the groundwater around this lake is also polluted. But the priorities of the AP government seem to be different. (C Ramachandraiah - EPW, 2001)

Big plans are being chalked out for projecting Hyderabad as a 'global' and the 'most happening city' but there is little concern for the fluoride-affected in Nalgonda, Musi-affected areas in Rangareddy, and drought-affected villages in Mahabubnagar districts that are all in the city's



hinterland. These are also among the highly backward districts in Andhra Pradesh. India's capital city of Delhi uses much of Yamuna's water and what is let into the latter during its 22 km stretch in the city is huge quantity of untreated sewage making it practically a 'dead river'. Studies by the Central Pollution Control Board had revealed that in 12 major rivers that spread across different parts of the country, the water quality did not meet the desired norms for some or all the parameters of dissolved oxygen, total coliform count and biochemical oxygen demand at several locations along their courses.

The river Gomti, which has a very good quality of water while entering into Lucknow city, turns into a highly polluted river within a short stretch of 6-7 km. The water quality of river Tapi has deteriorated due to discharges of trade effluents and domestic sewage from Surat city. A 65-km stretch of the river Patalganga in Maharashtra has been identified as critically polluted. Instances of destruction of water bodies by untreated industrial effluents and domestic sewage abound in India. It was estimated that majority of the polluting units (57 per cent) are in the public sector (state or central) while the remaining 43 per cent are in private sector. The state in India thus comes out as the leading polluter of water resources. It was brought out by the ministry of environment (Government Of India) in 1997 that out of the 2,901 large polluting industrial units that were discharging effluents into water bodies, only 841(29 per cent) had adequate treatment facilities.

The availability of adequate quantity of clean water is an essential element in the quality of life. Millions of people in India do not have access to safe water. It has been estimated that out of the 37 diseases responsible for most deaths in developing countries, 21 are related to water and sanitation. About 1.5 million children under the age of five are estimated to be dying in India each year due to such diseases. It is also estimated that about 200 million person-days are lost annually due to such ailments. It is the poor and weaker sections who bear the brunt of these diseases and suffer loss of earnings. In a hugely populated country like China, with its high density in the east, the prevalence of water-borne diseases is very less since most of the residents have access to safe water. During the International Drinking Water Supply and Sanitation Decade (1981-91) in India, 100 per cent of urban population were to be covered by water supply and 80 per cent by sanitation by 1991. During the mid-decade review in 1985, however, the objectives were lowered to 90 per cent and 50 per cent, respectively, in the name of 'resource

constraints'. In 1991, water supply coverage was estimated to be 83.63 per cent, i e, an increase of only 10 percentage points over 1981.(C Ramachandraiah - EPW, 2001)

Setting targets in five-year plan documents, revising them and setting new deadlines at the end of the plan period with extended deadlines has become a common practice over the years. The Eighth Five-Year Plan (1992-97) has set a target of achieving 100 per cent coverage of population by safe drinking water by the turn of the century. The specified standards were 125 litres per capita per day (lpcd) for urban areas where piped water and underground sewerage system are available; 70 lpcd for urban areas with piped water supply but without underground sewerage system; and 40 lpcd for towns with spot sources/stand posts. At the end of Eighth Plan (1997), the approach paper to the Ninth Plan (1997-2002) claims that "85 per cent of urban population have access to safe water" and admits that "the access is still inadequate in slums and poorer localities". Between 1991 and 1997, the coverage has increased only by less than two percentage points. As has been the practice over the years, it is claimed that during this plan period, efforts will be made to provide access to safe drinking water facility to the entire population in urban and rural areas in the next five years.

The National Commission on Urbanisation (1988) recommended that a per capita supply of 90-100 litres per day is needed to lead a hygienic existence and this level of supply must be ensured to all citizens. In the stratified Indian social system, access to resources, including water, has been associated with caste and wealth. In India, having access to and consuming more water is considered a feudal privilege, an upper caste usurpation of a natural resource. The distribution of water in urban areas is extremely inequitable, unjust and biased against the poor. Most of the urban services have been monopolised by the rich and upper middle class in India because of the nature of the state and its relationship with society, which has developed since independence.

The pricing of water in India is working to the advantage of upper middle classes and richer people. People who consume huge quantities of municipal water do not pay as much. Further, they use municipal water for gardening and washing vehicles while millions of poor spend hours in fetching and filling water that barely suffice to meet minimum needs. India's capital city is a classic case of inequity in distribution as well as high subsidy involved in water supply for Delhi's elite and middle classes. In the municipal corporation of Delhi (MCD), the water supply was 180 lpcd, whereas it was 350 lpcd in New Delhi municipal committee (NDMC) area. South

Delhi area consumes maximum water within MCD area. It was estimated that the average recovery is Rs 0.65 per cubic metre as against the production cost of Rs 1.55 though this service is supposed to be operated on a “no profit-no-loss” basis as per the Delhi Municipal Corporation Act, 1957. It may be noted that South Delhi is a posh and upper middle class area and the NDMC is an exclusive zone for the political elite.(C Ramachandraiah - EPW, 2001)

The domestic water tariff in Delhi is the lowest as compared to other major cities in India. In Hyderabad, the existing water tariff seems to benefit more of the higher end consumers. The low user charges do not show significant progressivity with increasing consumption. We do not have a water policy that promotes equity, encourages conservation and penalises wastage so that water availability could be increased in slum areas. Water leakages in big cities of India, including Delhi and Hyderabad, accounts for 35-40 per cent. Minimising this leakage would provide water to many more people without much additional investment. In cities like Beijing and Singapore only about 7 per cent of the water is lost.

#### Right to Water and Water Business

When people protest to protect their drinking water sources, they are met with brute force. Police killed three farmers in Falla village in Jamnagar district of Gujarat in December 1999 when they protested against water being taken from Kankavati dam to meet the needs of Jamnagar town ignoring local rural demands.(C Ramachandraiah –EPW, 2001)Two farmers were killed in Prakasam district of Andhra Pradesh in February 2000 when they protested against commercial salt farming by an NRI. Groundwater in 14 villages would have been contaminated by saline intrusion due to this farming. Still the NRI got permission. These movements also signify that people will resist when they are denied access to their own resources by an insensitive bureaucracy and political elite. The competing demands for water by different sectors, viz, urban, rural, drinking, irrigation, industry, etc., and water-related conflicts are expected to rise in future. When political heavy weights are involved in such agitations very little force is used as compared to poor villagers and common people.

The growing business of drinking water is a disturbing trend that has fast emerged in recent years in India. Many big domestic and international companies are entering into this business as India is considered a huge market for water. In a series of seminars/workshops mostly sponsored by

foreign funding agencies, there has been increasing stress on treating water as an 'economic good'. But the issue of differential pricing and equity in distribution are not found on the main agenda of such gatherings. In a country where millions of poor go to bed with half-empty stomachs and an uncertain tomorrow, a bottle of this water is costlier than a litre of toned milk. It was observed that every year, 20-30 per cent more Indians agree to pay for safe drinking water which is good enough a reason to enter into water business.

The political parties and governments appear to be encouraging this trend oblivious of their constitutional responsibility to provide clean drinking water to citizens. The Water Boards do precious little to reinforce people's confidence in the quality of water that they supply. In addition, the enormous quantity of non-biodegradable waste that is generated in the form of 'use and throw' plastic bottles and glasses is posing insurmountable problems to local bodies that are already finding it difficult to provide basic amenities.

There are several fundamental rights to citizens in the Constitution. The ultimate result is their protection and implementation. The lacunae in this regard are leading to erosion of people's confidence in institutions. The present judgment should help in at least generating a debate on this crucial issue that has serious implications for health and well-being of people. Unless people come forward to protect their water bodies and demand access to safe drinking water for all, there is a danger of the state withdrawing from this sector (making water business a fait accompli) and allow big companies and the market to dictate terms. In this country with vast water resources and traditional water harvesting and storing systems, it will be a great tragedy if the vast masses in rural and urban areas are forced to depend on bottled water as the only reliable source for drinking. (C Ramachandraiah – EPW, 2001)

### **Water Scarcity Induced Migration**

Most people assume that migrants and refugees are pushed to leave their homes because of violence and political conflict. While that is often the case, climate change and global water shortages play a much larger role in human migration than most realize. The UN's 2016 World Water Development Report estimated that by 2050, around 200 million people could be displaced as a result of desertification, sea level rise and increased extreme weather events. (Maxim Pasik, 2019)

The impacts of water scarcity on food security can force people to migrate in search of countries with more water. This factor is often associated with other aspects, such as political stability, governance, economic strength and job opportunities. Hence, water is both a push and a pull factor for migration, while migration can be seen as an adaptation strategy to preserve a household's security, which, if denied or prevented, heightens environmental vulnerability and human insecurity. Here is no denying that our planet is suffering from climate change, and that it affects us all. However, the most affected are always those living in more vulnerable areas – locations with arid or semi-arid climates, such as Africa and the Middle East. Every year, thousands of people are forced to leave their homes as a direct consequence of climate-related impediments to drinking water and food production.

An estimated \$260 billion is lost globally each year due to the lack of fresh water and sanitation. When agriculture is affected by water shortages, the economic and social consequences are enormous. Drought in agriculture leads to food shortages and increases the price of basic products. When food is lacking, women feed their husbands and children first. Their empty stomachs affect their health and reproductive capabilities. Additionally, women are generally in charge of water collection. Instead of working for an income, they spend hours walking to distant water resources. In Ethiopia, girls are prevented from going to school to help collect water. Researchers at the George Washington University in Washington, DC, estimate that at least 17 million women and girls in Africa collect water every day. Children mostly girls are out very late at night or as early as 4am in search of water. Meanwhile, 30% of jobs in the industry sector and 10% of jobs in the services sector are heavily dependent on water.

With the changing climate leading to increased drought, flooding and water pollution, there is a higher risk of conflicts related to water use, poverty and migration. Countries facing increased water insecurity need a true transformation based on water-related governance. All the rivers across Vietnam, for example, could potentially provide an abundant supply of water. However, due to inadequate physical infrastructure and financial capacity, this resource cannot be properly utilized. Mexico City is also suffering from heavy rainfalls and flooding, but due to a similar lack of infrastructure more than 40% of the water is lost. In this vacuum, trail-blazing technologies can create a source of fresh, clean drinking water for vulnerable citizens while significantly

improving the quality of life and providing an opportunity to break the cycle of poverty.(Maxim Pasik, 2019)

### **Water as the new oil**

The basic problem in the quantity of water is the world is finite but demand in the quantity of water in the world infinite but demand is everywhere on the rise. As oil was in the 20th century, the key resource, a focus of tension, even conflict, so water will be of the 21<sup>st</sup> century, as states, countries, and industries compete over the ever-more-precious resource. So we need to figure out how to use water more sensibly as well as sustainably. Even we do not think twice when we turn on the water for a shower, a drink or to clean hands. We all enjoy access to clean, fresh water for years without a single worry; unfortunately, this is likely to change in the coming future. Scholars claim that water is the new oil because both are finite resources that serve as the basis for conflicts. In the 20th century, the world's most important resource was undoubtedly oil. As we move towards the future, water will likely replace oil as the most valued resource simply because it is fundamental to the survival of humanity and we do not have enough to secure our future generation. Eventually, humanity will likely run out of fresh water. If humanity fails to limit population growth, wars will inevitably be fought for access to freshwater just like they were fought over oil in the 20th century.<sup>7</sup> Engineers broadly agree that humanity will eventually figure out how to fuel vehicles with a substance other than oil. Yet humanity will probably not figure out how to survive without fresh water. Politicians, economists, scientists, demographers agree that access to clean and freshwater will soon become humanity's most important challenge. This is precisely why water will be treated like oil was in the 20th century.

Ensuring the supply of safe drinking water is a constitutional provision under Article 47 of the Constitution. Although water is a state subject, the union government is responsible for setting drinking water quality standards. Water quality issues have emerged as a major concern over the last four decades, starting with the enactment of the Water (Prevention and Control of Pollution) Act, 1974. In the national development plans, water quality was not emphasised upon till the end of the Sixth Five-Year Plan. The first national initiative for providing safe drinking water was taken up in the Seventh Plan period and the National Drinking Water Mission (NDWM) was launched in 1986. The main aim of NDWM was to improve the performance and cost effectiveness of the on-going drinking water supply programmes and policies, and to make

sure that an adequate quantity of drinking water of an acceptable standard quality is made available to the people at large. The national water policies (NWP) of 1987, 2002 and 2012 in India emphasized that both surface water and groundwater should be monitored for quality, and phased programme should be undertaken for improvements in water quality (GoI 1987, 2002, 2012). While access to drinking water in India has increased over the past decade, the adverse impact of unsafe water on health continues.

There has been change in water usage, i.e., from surface water to groundwater, which has controlled microbiological problems, but some other problems like fluorosis and arsenic contamination have increased. Excess iron is the main problem in eastern India. Around 37.7 million people in India are affected by water-related diseases every year, out of which 1.5 million children die of diarrhoea alone. Thus, it shows that the investment in the water supply and sanitation (WSS) sector has not depicted commensurate health benefits.

There is no doubt that the projects and schemes undertaken in the past ('major/medium' irrigation and multi-purpose projects, minor irrigation schemes based on surface water and groundwater, etc.) have contributed (along with other factors) to an increase in food-production, added to hydropower capacity, provided water for domestic, municipal and industrial uses, and (to some extent) helped in flood-moderation. However, there have been many problems, weaknesses and failures, and these need to be recognised. This section will therefore be necessarily concerned with negative aspects.

A complaint often heard is: "Water is a state subject; the central government cannot do much; water should have been in the Concurrent list, and should now be brought into it by amending the Constitution." This is a complex question that cannot be discussed in detail. It is indeed possible to argue that the entries relating to 'water' in the Constitution are flawed. If the Constitution-makers had anticipated some of the perceptions and concerns that became current later, perhaps they would have drafted a different set of entries. However, this is mere speculation: we have to go by the text of the Constitution as it exists. Even if we feel that amendments to put 'water' in the Concurrent list are desirable, such amendments would be enormously difficult to put through: they go counter to the trend towards greater decentralisation and federalism. The central government has in fact failed to play even the role it could have

played on the basis of the existing provisions. Much can be done without wasting time and energies on pursuing the chimera of restructuring the constitutional entries relating to water.

### **Objectives for the Future**

Policies and plans for the future must be guided by a vision of the kind of world that we would like to see. A copy of a brief statement of that nature presented by this writer at the request of the organisers at one of the seminars and workshops held in preparation for the Hague Forum is reproduced as an Annexe to this paper. Keeping that in mind, our objectives for the future can be enumerated as follows:

- Ensure access to safe drinking water to all.
- Ensure adequate availability of water for agriculture, industry, urban centres (with due regard for efficiency, economy and equity).
- Find appropriate answers for drought-prone areas, arid zones.
- Foster consciousness of scarcity, promote conservation, minimise waste.
- Improve and maintain water quality; control pollution, protect water sources.
- Protect and preserve natural environment/ecological system. Preserve integrity of rivers, maintain river regime.
- Ensure equity – between groups, between generations, between species.
- In particular, reduce burden on women and give them a voice in water planning and management.
- Minimise conflicts and hardships and provide means of resolution/redress, helps people to cope with floods and minimise damage.



## **CHAPTER III METHODOLOGY**

**TITLE: DRINKING WATER SCARCITY FACED BY THE PEOPLE OF  
KOTTAPURAM, VIZHINJAM: ISSUES AND CHALLENGES**

### **OBJECTIVES**

#### **General Objective**

- To find out the issues faced by the people on improper drinking water facility in Kottapuram, Vizhinjam.

#### **Specific Objectives**

- To understand how drinking water scarcity affects the common people of Kottapuram, Vizhinjam.
- To understand the measures taken by government and local bodies to improve the situations.
- To understand the challenges faced by the people due to improper drinking water.

### **RESEARCH DESIGN**

The study follows quantitative method. Survey design is used in this study.

### **SOURCE OF DATA**

Primary data is collected from the people of Kottapuram, Vizhinjam and secondary data was collected from the newspapers, articles and journals.

### **PILOT STUDY**

Before going to the actual study pilot study has been conducted among the people of Kottapuram to find out the feasibility of the study.

## **CONCEPTUALIZATION**

### Scarcity

Conceptual Definition: Scarcity is the limited availability of a commodity, which may be in demand in the market or by the commons. Scarcity also includes an individual's lack of resources to buy commodities.

Operational definition: Here scarcity defines the lack of drinking water for the people in Vizhinjam.

### Technical hitches

Conceptual Definition: a temporary problem or difficulty, especially one caused by a machine or a piece of equipment.

Operational definition: Here technical hitches define the flaws initiated by the officials for generating drinking water for the people of Vizhinjam.

### House hold

Conceptual Definition: a house and its occupants regarded as a unit.

Operational definition: Here household define the common occupants of Kottapuram, Vizhinjam.

## **AREA AND POPULATION OF THE STUDY**

The data for the present study was collected from the people of Kottapuram, Vizhinjam. The population of the study includes all the people in Kottapuram, Vizhinjam.

## **UNIT OF THE STUDY**

Each individual in Kottapuram, Vizhinjam constitute the unit of the study.

## **SAMPLING**

Sampling was done using convenience sampling method.

### **SAMPLE SIZE**

A total of 60 respondents formed the sample of the study.

### **TOOL OF DATA COLLECTION**

A semi structured interview schedule was used for collecting data.

### **PRETEST**

The tool was pretested before the actual data collection to understand the flaws if any in the constructed tool.

### **DATA ANALYSIS**

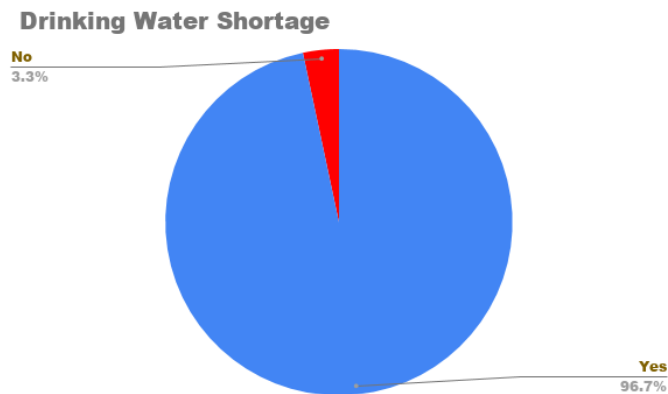
Analysis was done quantitatively. A descriptive statistical analysis stating the characteristics and attributes of the sample was done.

## CHAPTER IV

### DATA ANALYSIS AND INTERPRETATION

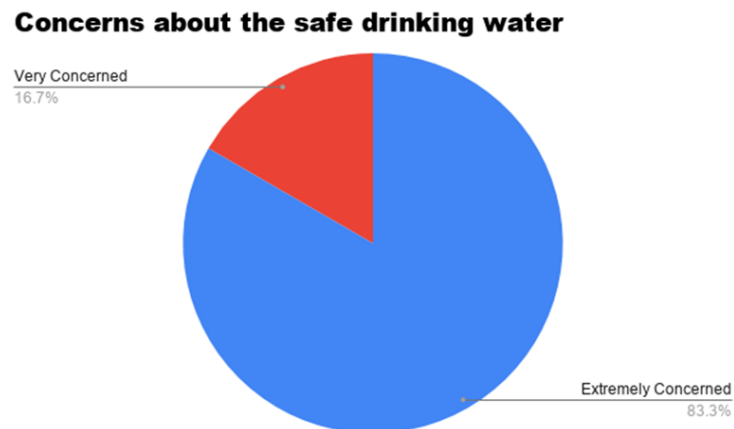
The analysis and interpretation of the collected data forms the integral part of any research activity. Analysis involves the conversion of collected, raw data into a more organized form so that one can easily get access to the data and reach out the information from it. The quantitative data are presented using the different statistical tools that include frequency tables, graphs and charts for the ease of its analysis. The purpose of analysis was to derive out the useful information from the mass of figures that are collected using the structured questionnaire.

**Figure No 4.1. Drinking Water Shortage**



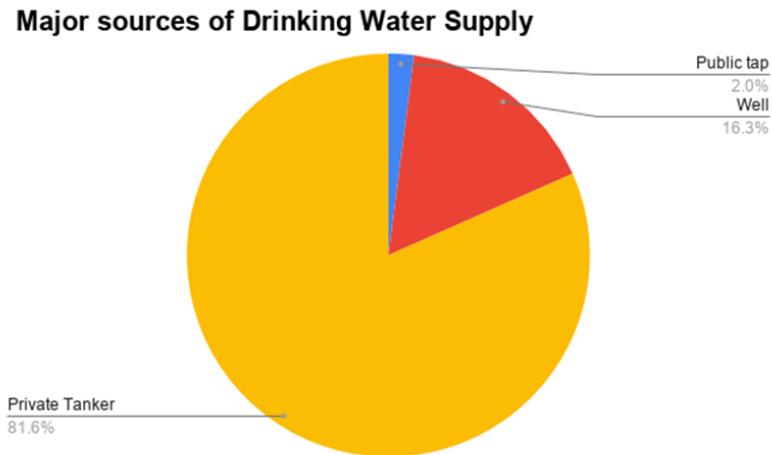
The above figure shows the acute drinking water shortage experienced by the people of Kottapuram, Vizhinjam. Among them 96.7% said Yes and 3% No.

**Figure No 4.2: Concerns About Safe Drinking Water**



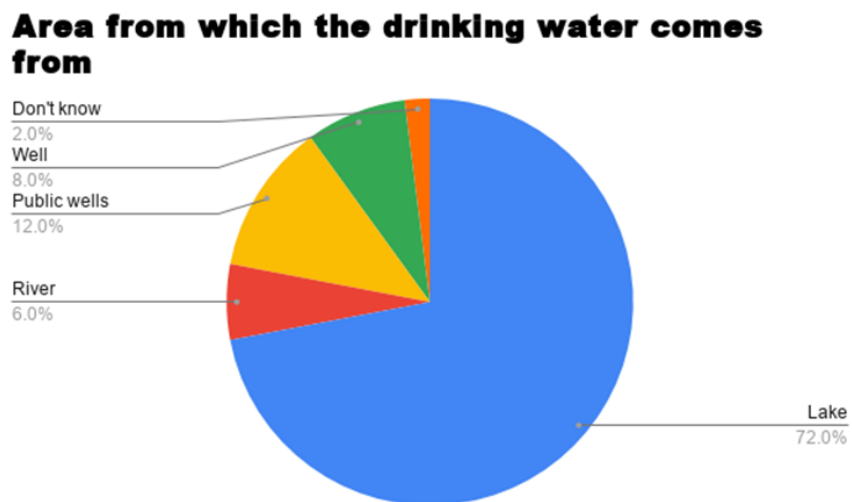
The above figure shows the concerns regarding proper drinking water in the Kottapuram area; it is to know whether the people are extremely, very or moderately concerned. 83% are extremely concerned and 16% are very concerned.

**Figure No 4.3: Major Sources of Drinking Water Supply**



The above figure shows the major sources of drinking water supply in Kottapuram, Vizhinjam, here the 81.6% people depend on private water tankers for safe drinking water and 16% depend on wells and the 2% depends upon public taps.

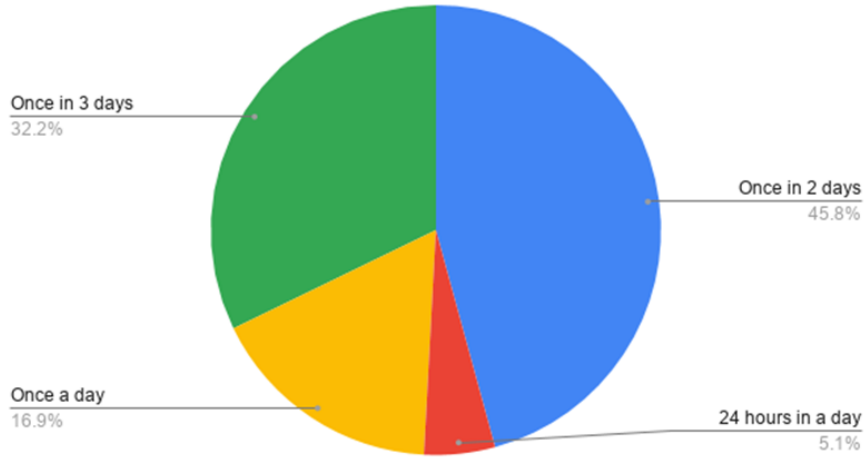
**Figure No 4.4: Area from Which the Drinking Water Comes**



The above figure shows the areas from which the drinking water comes from, 72% of the people responded that water is taken from lakes, 12% responded with public wells, 8% responded with wells, 6% responded with river, and 2% don't know from where the water comes from.

**Figure No 4.5: Supply of Drinking Water in Kottapuram**

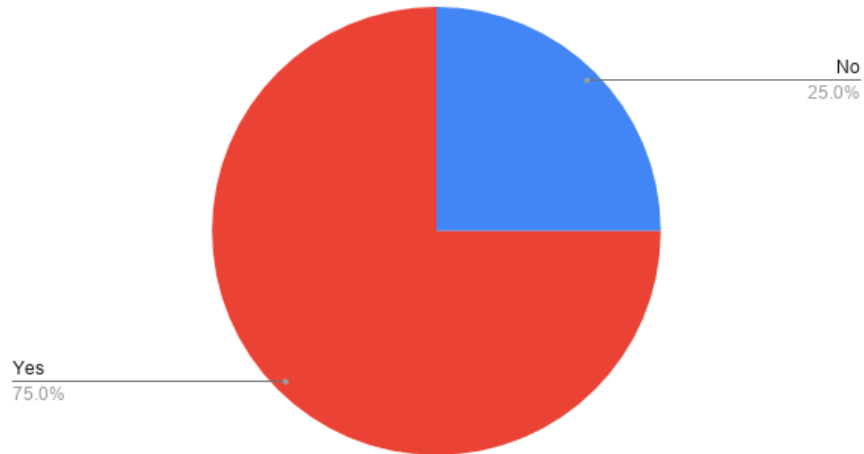
**Supply of drinking water in Kottapuram**



The above figure shows the supply of drinking water in Kottapuram area, 5.1% people receive water 24 hours in a day, 45.8% receive once in 2 days, 16.9% receive once a day, and 32.2% receive once in 3 days.

**Figure No 4.6: Water Sufficient For The Needs**

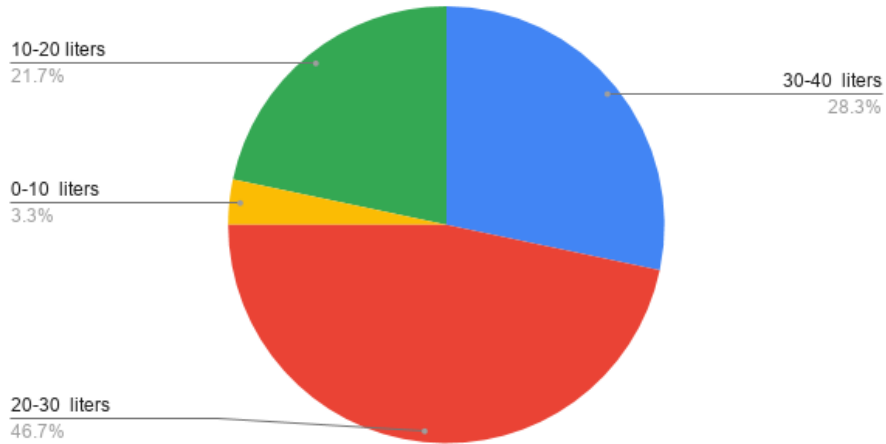
**Water sufficient for the needs**



The above figure shows the does the water receive by the satisfy their needs, 75% are satisfied by the water they receive for their daily requirements, 25% are not happy by the water they receive for daily requirements.

**Figure No 4.7: Quantity of Drinking Water Requires For Consuming**

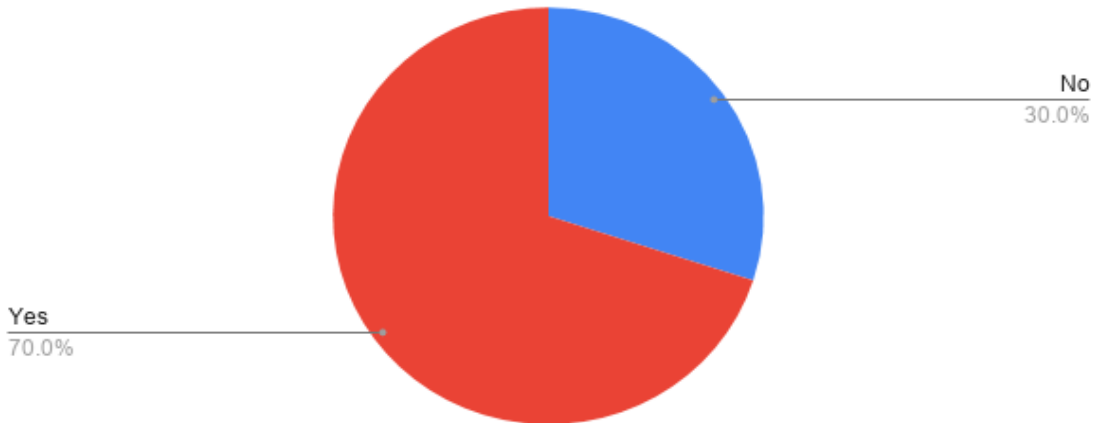
**Quantity of drinking water requires for consuming**



The above figure shows the quantity of drinking water consumed by each families of Kottapuram, here about 3.3% consume 0-10 liters of water per day, 21.7% of population requires 10-20 liters, 46.7% requires 20-30 liters, and 28.3 requires 30-40 liters of water.

**Figure No 4.8: Pipeline Connection by KWA**

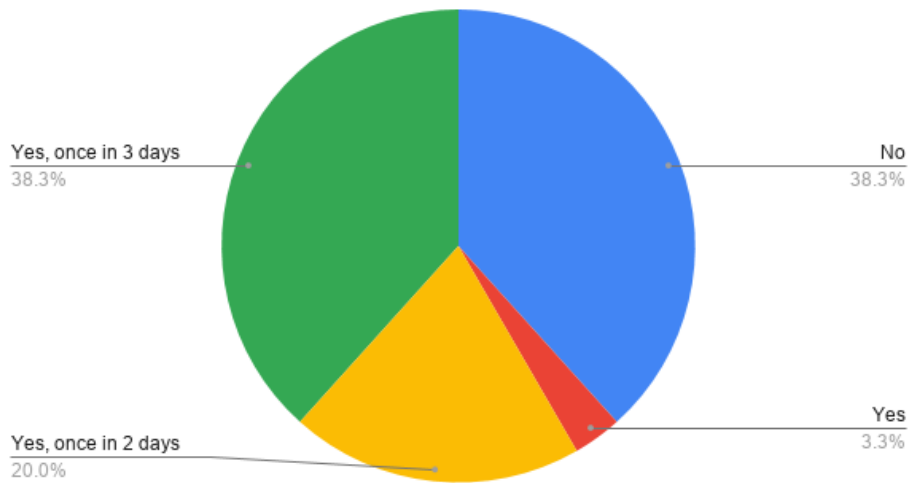
**Pipeline connection by KWA**



The above figure shows the pipeline connection in each household of Kottapuram, 70% of the population has the connection and 30% doesn't have.

**Figure No 4.9: Availability of Water in Pipelines of KWA**

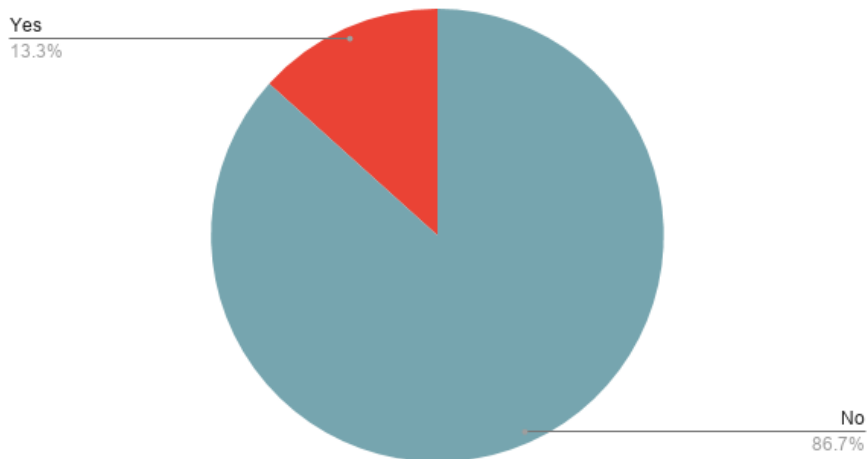
**Availability of water in pipelines of KWA**



The above figure shows the availability of drinking water in the pipelines of Kerala Water Authority (KWA). 3.3% of the households get water from the pipelines, 38.3% gets once in 3 days, 20% gets once in 2 days and 38.3% doesn't get at all.

**Figure No 4.10: Health Issues Regarding Safe Drinking Water**

**Health issues regarding safe drinking water**

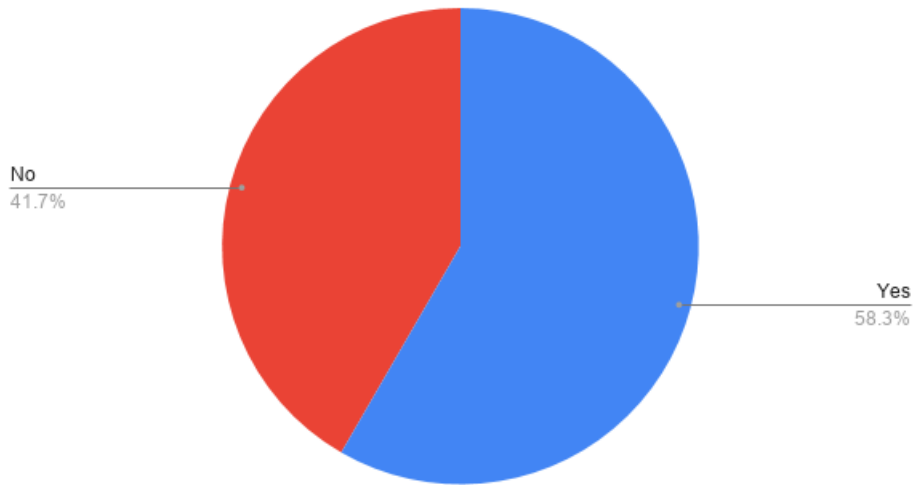




The above figure shows the health issues regarding safe drinking water 13.3% does have health issues and 86.7% doesn't have any problem.

**Figure No 4.11: Decrease in Drinking Water Sources**

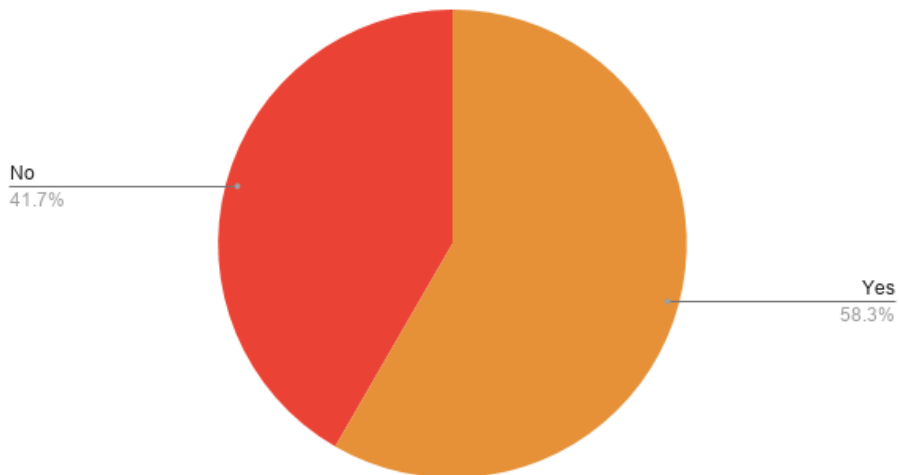
**Decrease in drinking water sources**



The above figure shows the decrease in drinking water sources in Kottapuram, 58.3% agreed with there is decrease and 41.7% disagreed with decrease in water sources.

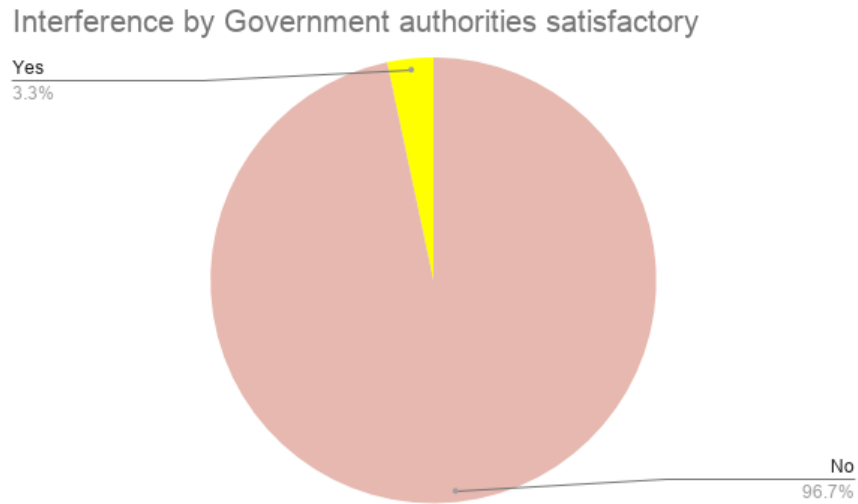
**Figure No 4.12: Interference by Government Authorities**

**Interference by Government authorities**



The above figure shows if there was any interference by the government regarding drinking water scarcity, 58.3% agreed that the government interfered, and 41.7% said there was no interference by the government.

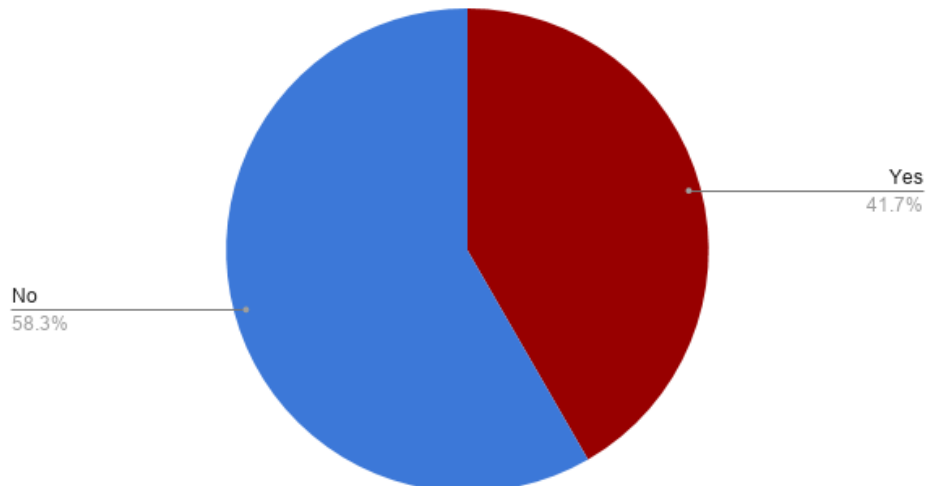
**Figure No 4.13: Interference by Government Authorities Satisfactory**



The above figure shows if the interference by the government satisfactory, 96.7% said it wasn't satisfactory, 3.3% said it was satisfactory.

**Figure No 4.14: Interference by the KWA (Kerala Water Authority)**

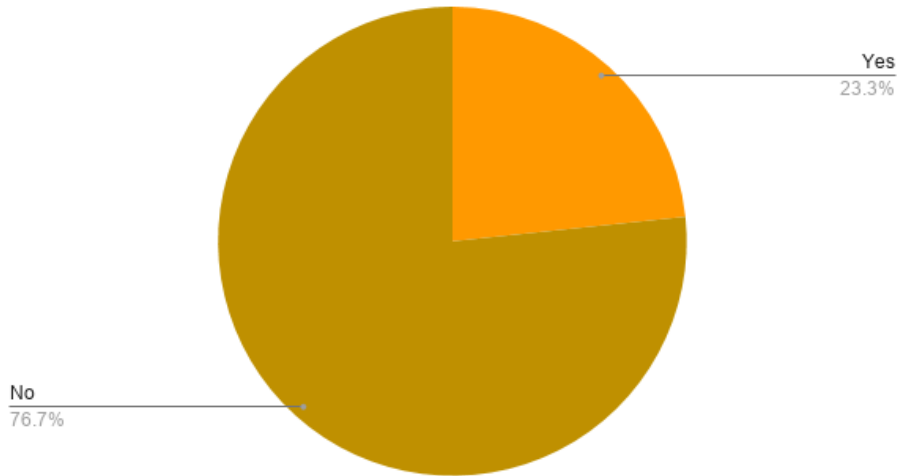
**Interference by the KWA(Kerala Water Authority)**



The above figure shows that if there was any interference by the KWA regarding drinking water shortage, 41.7% said yes and 58.3% said no.

**Figure No 4.15: Protest Conducted by the people of Kottapuram**

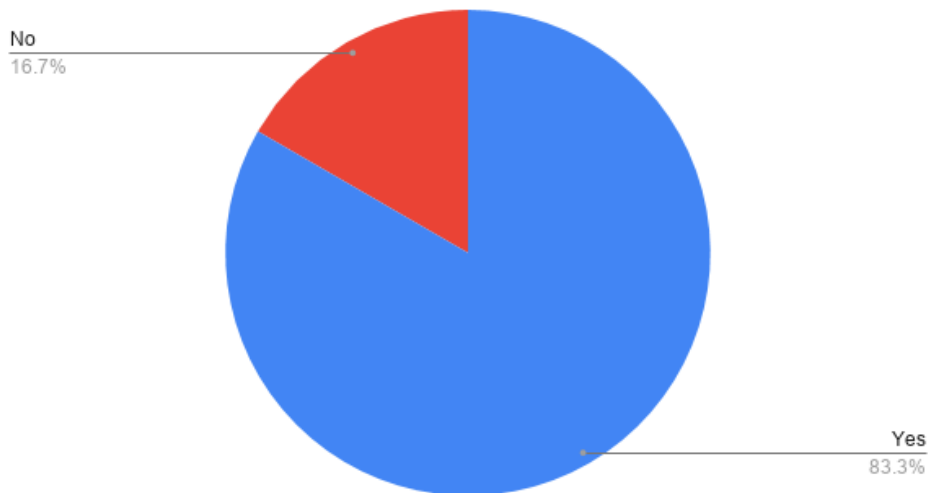
**Protest conducted by the people of Kottapuram**



The above figure shows that whether the protest conducted by the people of Kottapuram regarding proper drinking water was any useful, 23.3% said yes and 76.7% said no that it wasn't useful.

**Figure No 4.16: Interference of the Church Dioceses**

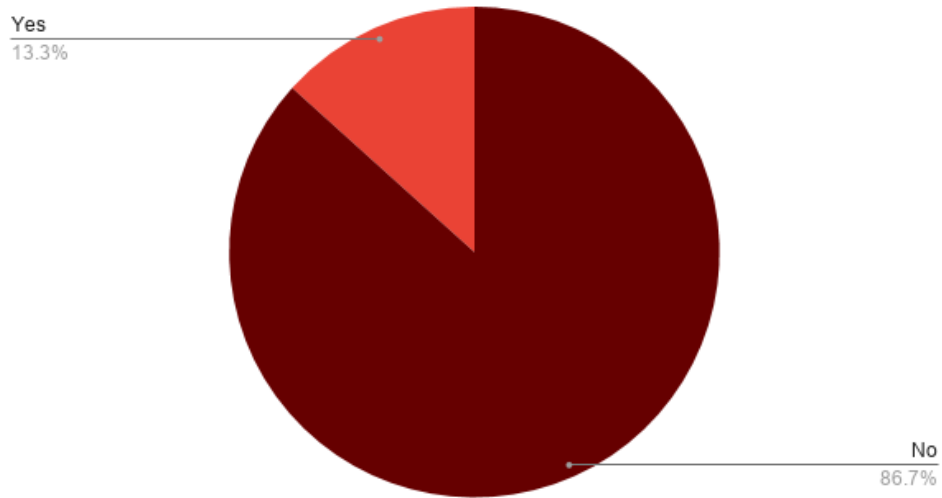
**Interference of the Church dioceses**



The above figure shows the their interference of the Church dioceses in solving water scarcity, 83.3% said they interfered in the crisis and 16.7% said they didn't.

**Figure No 4.17: Interference of Church Dioceses Effective**

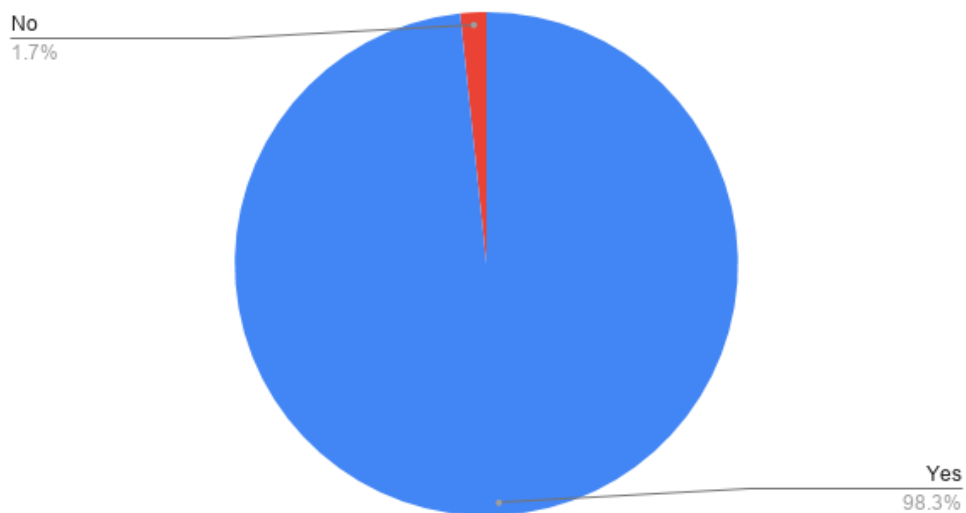
**Interference of Church dioceses effective**



The above figure shows whether the interference of the church dioceses in solving water scarcity effective, 13.3% agreed that it was effective and almost 86.7% said that it wasn't effective.

**Figure No 4.18: Lack of Drinking Water for Fishermen/Women**

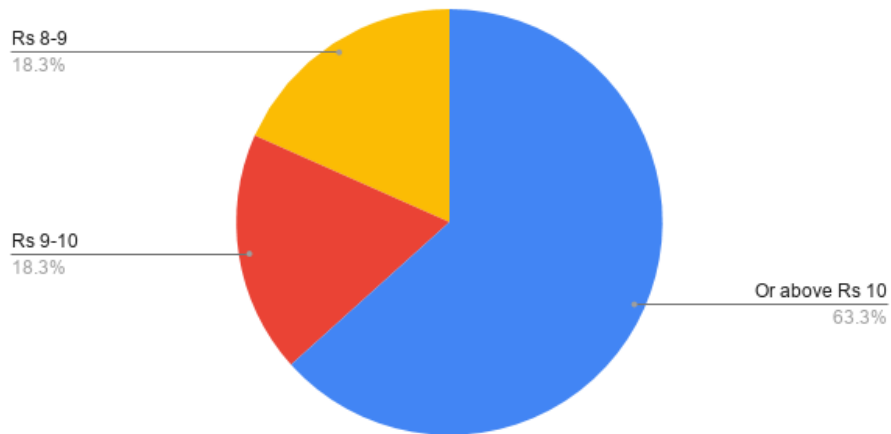
**Lack of drinking water for fishermen/women**



The above figure shows the whether there is are difficulties faced by working fishermen/women due to lack of drinking water, 98.3% of the working households agreed that there sre difficulties and 1.7% said there are no difficulties.

**Figure No 4.19: Amount paid by the Fishermen of Kottapuram**

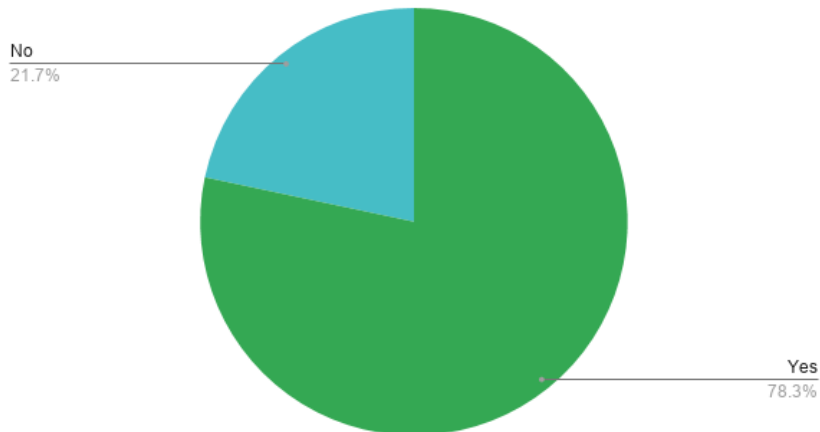
**Amount paid by the fishermen of Kottapuram for a pot of drinking water**



The above figure shows the number of amount paid by the fishermen of Kottapuram for a pot of drinking water from the private tanker lobbies. 18.3% spend almost Rs 8-10 for a pot of drinking water, 63.3% spend above Rs 10 for a pot of safe drinking water.

**Figure No 4.20: Boiling the Water Before Consuming**

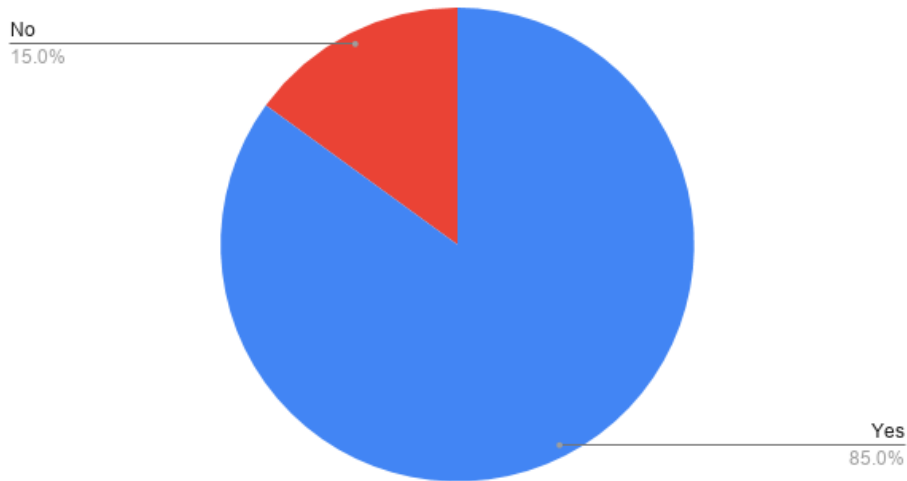
**Boiling the water before consuming**



The above figure shows whether the people of Kottapuram boil the water before drinking, 78.3% boil before drinking and 21.7% doesn't boil.

**Figure No 4.21: Involvement of Government Representatives**

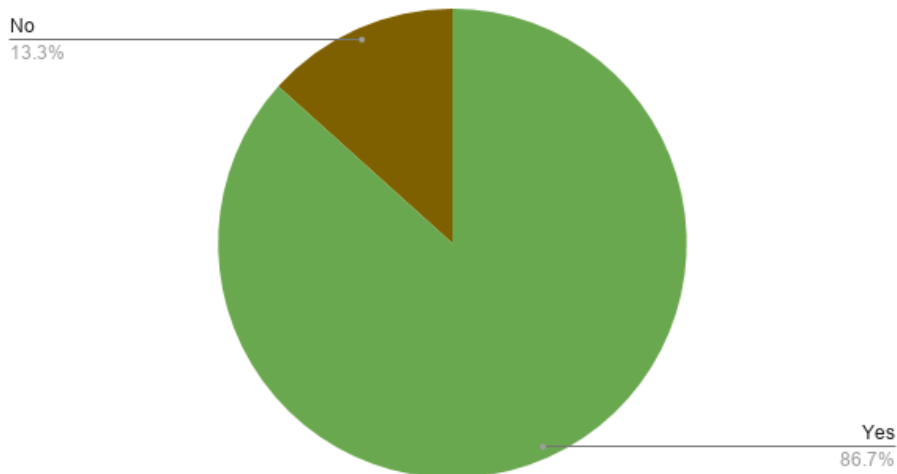
**Involvement of government representatives**



The above figure shows the involvement of government representatives while addressing the lack of awareness regarding safe drinking water, 85% people agreed that there was involvement and 15% said there wasn't any involvement.

**Figure No 4.22: Interference of ASHA/Welfare Workers**

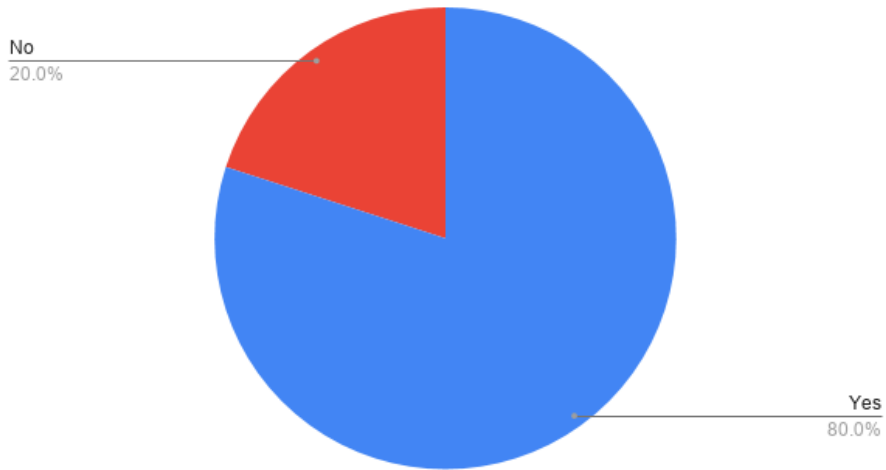
**Interference of ASHA Workers and welfare workers**



The above figure shows the interference of ASHA Workers and welfare workers on providing safe drinking water were any useful, 86.7% said it was useful and 13.3% said it was not useful.

**Figure No 4.23: Contaminated Water Bodies**

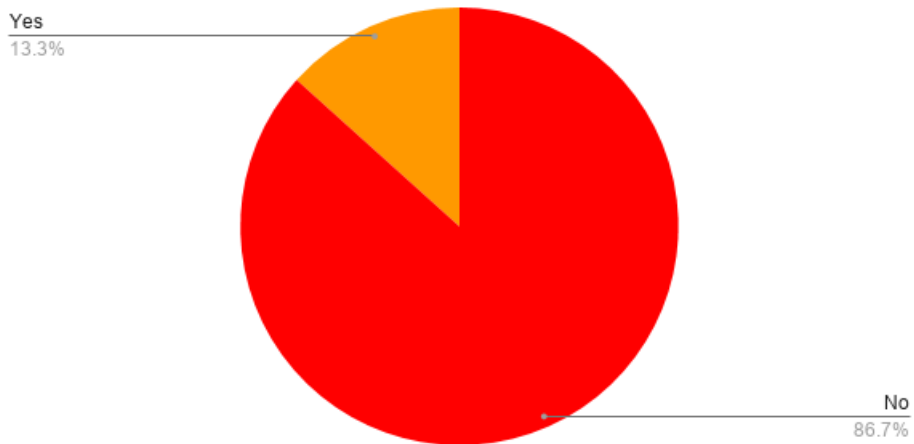
**Contaminated water bodies**



The above figure shows whether the water available in near water bodies contaminated, 80% people claims that the water bodies in Kottapuram are contaminated, while 20% says it is not contaminated.

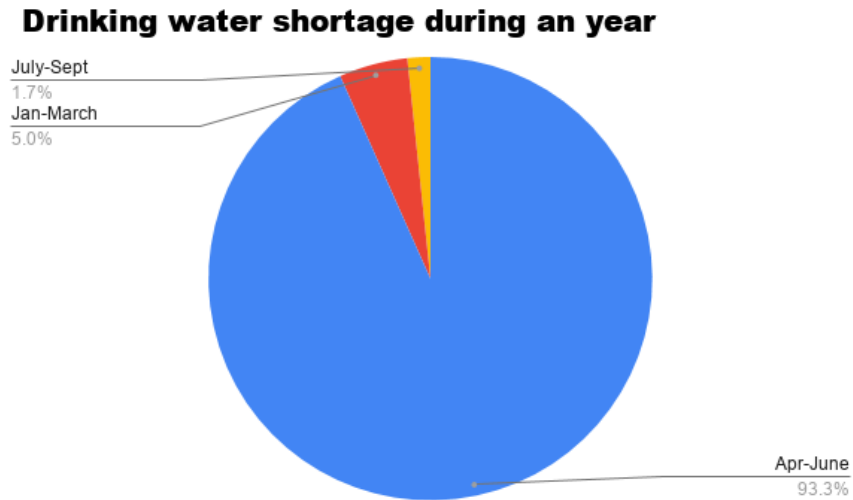
**Figure No 4.24: Interference by Government Local Bodies**

**Interference by the government local bodies to clean up the contaminated water bodies**



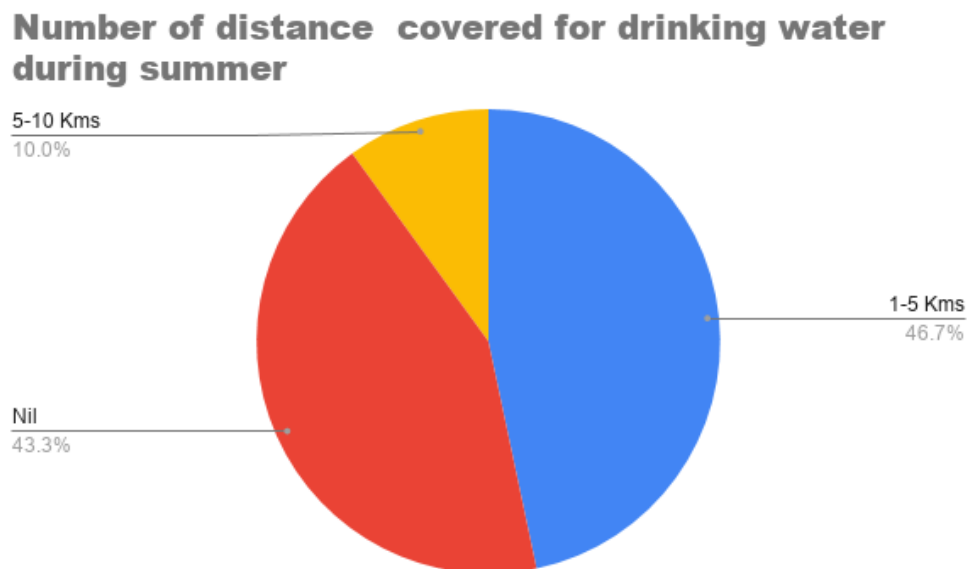
The above figure shows the interference by the local bodies to clean up the contaminated water bodies, 13.3% said yes and 86.7% said no.

**Figure No 4.25: Drinking Water Shortage In An Year**



The above figure shows the drinking water shortage faced by the people in Kottapuram during an year, 93.3% claims April-June have less availability of water, 5% says Jan-March and the less 1.7% says it's July-September.

**Figure No 4.26: Number of Distance Covered For Drinking Water in Summer**

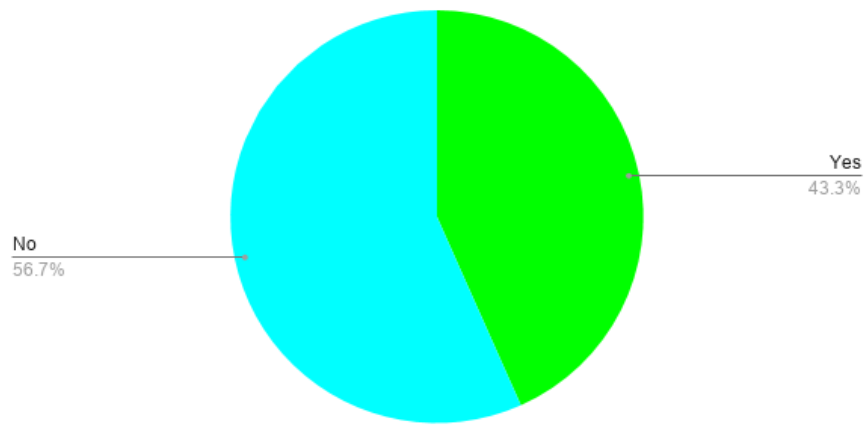




The above figure shows the number of distance one have to cover for drinking water during the summer, 46.7% have to travel 1-5 kms for drinking water, the other 43.3% says they don't have to travel for drinking water, while the 10% says they have to cover 5-10 kms for drinking water during the summer.

**Figure No 4.27: Drinking Water Provided by Private Lobbies**

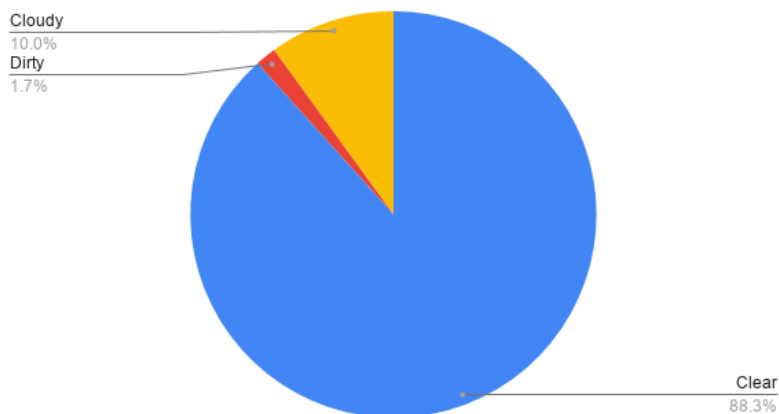
**Satisfied with drinking water provided by private lobbies**



The above figure shows the whether the people of Kottapuram are satisfied with the drinking water services provided by private lobbies, 43.3% says they are happy with the services by private lobbies, the other 56.7% says they are not satisfied with the services.

**Figure No 4.28: Colour of the Water**

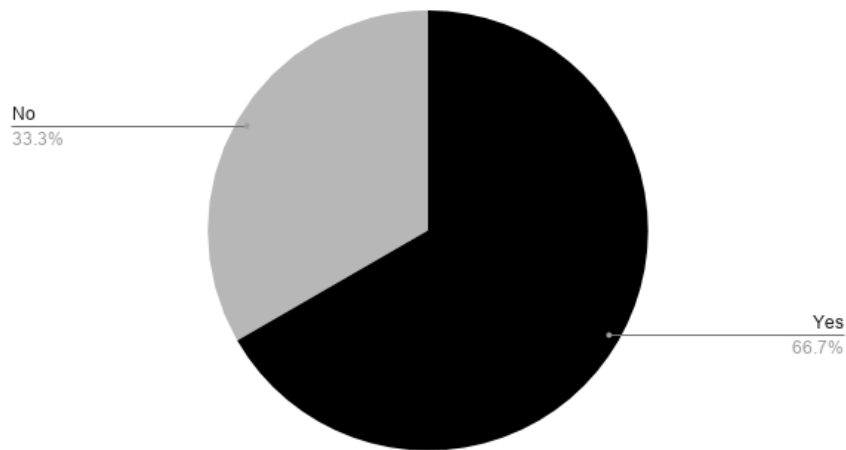
**Colour of the water**



The above figure shows that how the water looks like which is provided by private lobbies, 88.3% says it's very clear, 10% says the water seems dirty and the 1.7% says the water is dirty.

**Figure No 4.29: The Quantity of Water**

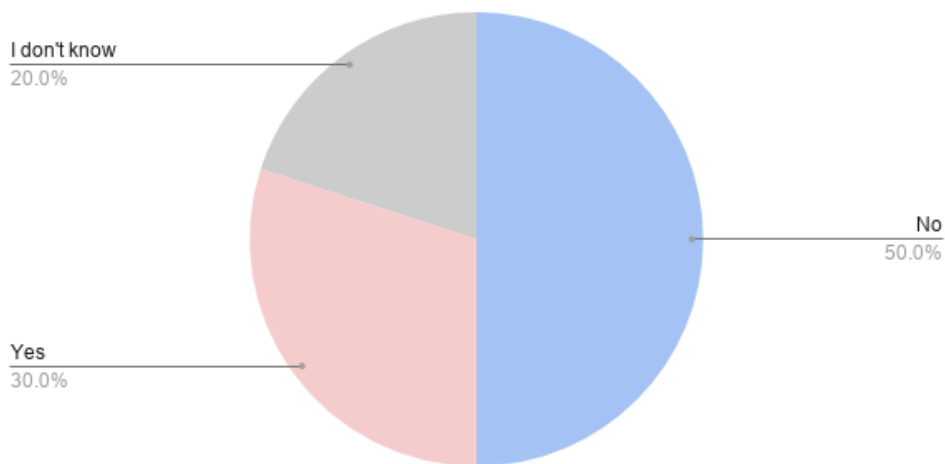
**The quantity of water is adequate**



The above figure shows whether the quantity of water received by the people of Kottapuramis adequate for consumption, 66.7% says it is adequate and 33.3% says it is not adequate.

**Figure No 4.30: Government's Role on Receiving Drinking Water From Private Lobbies**

**Government's role on receiving drinking water from private lobbies**



The above figure shows whether the government authorities discourages receiving drinking water from private lobbies, 30% says government is against the private lobbies, 50% says the government is not against receiving water from private lobbies and the 20% does not have an answer regarding this.

## CHAPTER V

### MAJOR FINDINGS CONCLUSION AND SUGGESTIONS

This study on The Drinking Water Scarcity Faced by The People of Kottapuram, Vizhinjam concentrates on the toiling and struggling people of the area due to improper management of drinking water. The study was approached quantitatively and a self-administered questionnaire was used to collect information from 60 respondents of Kottapuram, Vizhinjam. The major findings are below.

#### MAJOR FINDINGS

The people of Kottapuram are suffering of drinking water scarcity for decades now, the elected government officials also turned a blind eye to them, lot of protest were conducted for an effective involvement, still they are abundant. Amidst the corona pandemic the situation has become far worse for them, many oaths were made for a solution but nothing became in practice. There are old pipelines from KWA (Kerala Water Authority), the lines were stranded without water for so long, but recently freshwater were provided through the lines but the people were uncomfortable with it because the water lines were too old and they fear there will be mixing of toxic elements in the fresh water.

Currently they depend on private lobbies for drinking water, which are carried through trucks in large tanks, the people pay almost Rs 9-10 for a pot of water. Even though they take water for consumption most of them still have no idea from where the water is taken and pumped to them. During the summer private tankers won't be bringing water due to shortage, so the natives of Kottapuram may have to travel 5 to 10 Kms searching water in the near water bodies like Chappath, Veleyanietc., people even take taxis to get to these places that is the kind of issues they are facing.

Wells are dug for water in many of the places of Kottapuram but after the interference of health workers during their scientific research they found out that the water are getting contaminated with sanitary wastes, these sanitary lines dug up in the ground due to leakage get caught up with the water wells, thus it has been marked not good for human consumption.

## **CONCLUSION**

Even though the developmental activities of Vizhinjam sea port are on the rise, the acute shortage of drinking water facilities is still a threat in Kottapuram. Globally, water use has increased rapidly in recent years due to population growth and increased per capita consumption. Most of the increase is in the developing countries. 70% of water use is for agriculture, 22% is for industry and 8% for domestic purposes, although there is considerable regional variation. Water is not scarce globally, but it often is on a continental or national scale. It is estimated that 31% of the global population will live in a water scarce country (having less than 1000 m<sup>3</sup> of fresh water per person per year) by 2025.

Water is often unsafe to drink because of pollution. This varies with continent and locally between cities and rural environments. Water shortages have been the cause of major international disputes. The growing global recognition among citizens, governments, and civil society that water is a precious and fragile resource is a hopeful sign. Fresh drinking water is a finite and limited resource on Earth and, increasingly, much of it is polluted, by both pathogenic microbes and chemical contaminants. Human demand for freshwater is increasing; in particular, water is required to irrigate crops to feed the rapidly expanding human population. The change and awareness must be start from us and should be shared with everyone.

## **SUGGESTIONS**

- Effective measures should be taken by government authorities in order to solve the drinking water crisis.
- Alternatives regarding the wastage of water should be made.
- Proper sanitation facilities should be done to avoid polluting the fresh water.
- Handling of the distribution of water by private lobbies should be banned.
- Awareness regarding safe consumption of water should be conducted once in a month.

## REFERENCES

“Acute water shortage in Vizhinjam”, Jan 8, 2012, The Indian Express, <https://www.newindianexpress.com/cities/thiruvananthapuram/2012/jan/08/acute-water-shortage-in-vizhinjam-328159.html>

“Vizhinjam natives face drinking water scarcity”, 2019, <https://tv.mathrubhumi.com/en/news/kerala/vizhinjam-natives-face-drinking-water-scarcity-1.14644>

Bhullar A S, BediKaurJasdeep, Ghuman R S, Jun, 26, 2020, “ Health and Economic impact of unsafe drinking water, A Study of Ludhiana”, <https://www.epw.in/journal/2015/2/commentary/health-and-economic-impact-unsafe-drinking-water.html>

Chakkaravarthy, D. N., & Balakrishnan, T. (2019). Water scarcity-Challenging the future. *International Journal of Agriculture, Environment and Biotechnology*, 12(3), 187-193.

George, R. M. (2016). Bore Wells Vs. Open Wells: Water Crisis and Sustainable Alternatives in Kerala. *Journal of Management & Public Policy*, 7(2).

Gogoi, B. J. (2019). Water scarcity: a major concern for citizens. *International Journal of Civil Engineering and Technology*, 10(6), 43-53.

Impact, c. u. e. (2013). vizhinjam international multipurpose sea port project.

Iyer R Ramaswamy, Dec 15, 2016, “ Water- charting a course for the future -1”, <https://www.epw.in/journal/2001/13/special-articles/water-charting-course-future-i.html>

Jacob, N., Babu, D. S., & Shivanna, K. (2009). Radon as an indicator of submarine groundwater discharge in coastal regions. *Current Science*, 1313-1320.

Jalihal, P., & Kathioli, S. (2009). Utilization of ocean energy for producing drinking water. *Global Status and Critical Developments in Ocean Energy*, 41.

Keller, A. A., Sakthivadivel, R., & Seckler, D. W. (2000). *Water scarcity and the role of storage in development* (Vol. 39). IWMI.

Kurien, J. (1985). Technical assistance projects and socio-economic change: Norwegian intervention in Kerala's fisheries development. *Economic and Political Weekly*, A70-A88.

Lijimol, A. (2016). *Household water treatment and safe storage practices and measured drinking water quality in a water stressed area of Thiruvananthapuram Corporation, Kerala* (Doctoral dissertation, SCTIMST).

Lijimol, A. (2016). *Household water treatment and safe storage practices and measured drinking water quality in a water stressed area of Thiruvananthapuram Corporation, Kerala* (Doctoral dissertation, SCTIMST).

Mishra, V., Thirumalai, K., Jain, S., & Aadhar, S. (2021). Unprecedented drought in South India and recent water scarcity. *Environmental Research Letters*.

Narayan, S. renewable energy based desalination to address water scarcity in coastal areas of kozhikode.

Pasik Maxim, Jun 4, 2019, "How water scarcity triggers the refugee crisis- and what tech can do to solve it", <https://www.weforum.org/agenda/2019/06/water-scarcity-refugee-crisis-tech-solve-it/>

Phadke, R. (2002). Assessing water scarcity and watershed development in Maharashtra, India: a case study of the Baliraja Memorial Dam. *Science, technology, & human values*, 27(2), 236-261.

Ramachandraiah C, Dec 6, 2016, "Drinking water as a fundamental right", <https://www.epw.in/journal/2001/08/commentary/drinking-water-fundamental-right.html>

Rana, Mamta and Guleria, Vishal (2018): Water Scarcity in India: A Threat to Sustainable Management of Water. *ESSENCE Int. J. Env. Rehab. Conserv.* IX (1): 35—44. [https://essence-journal.com/wp-content/uploads/Volume\\_IX/December\\_2018/Water-Scarcity-in-India-A-Threat-to-Sustainable-Management-of-Water.pdf](https://essence-journal.com/wp-content/uploads/Volume_IX/December_2018/Water-Scarcity-in-India-A-Threat-to-Sustainable-Management-of-Water.pdf)

Rao, S. M., & Mamatha, P. (2004). Water quality in sustainable water management. *Current science*, 942-947.

Meenu.V. (2013). an assessment of health and sanitation facilities in vizhinjam coastal panchayat of kerala state by using gis. *Innovare Journal of Education*, 1(2), 1-5. Retrieved from <https://innovareacademics.in/journals/index.php/ijoe/article/view/238>

Vijayalekshmi, M., SURENDRAN, S. K., & MANI, M. (2013). Identifying appropriate sanitation for near-coastal communities in Vizhinjam (Kerala, India) adopting the sanitation-approach framework. *Waterlines*, 58-73.



## QUESTIONNAIRE

### **DRINKING WATER SCARCITY FACED BY THE PEOPLE OF KOTTAPURAM, VIZHINJAM: ISSUES AND CHALLENGES**

1. Are you experiencing drinking water shortages in your area?

Yes

No

2. How concerned are you about the safe drinking water in your area?

Extremely Concerned

Very Concerned

Moderately Concerned

3. What are your major sources of drinking water supply?

Well

Public tap

Pipeline

Private Tanker

4. Where does water in your area come from?

Lake

River

Other:

5. How is the supply of drinking water in your area?

24 hours in a day

Once a day

Once in 2 days

Once in 3 days

6. Is this frequency sufficient for your needs?

Yes

No

7. What is the quantity of drinking water you consume at home (in liters)?

0-10

10-20.

20-30

30-40

8. Is there any pipeline connection by KWA?

Yes

No

9. Is the water regularly available in pipelines of KWA?

Yes, once in 2 days

Yes, once in 3 days

No

10. Is there Health issues regarding safe drinking water?

No

Yes

11. Is there any decrease in drinking water sources in Kottapuram, Vizhinjam?

Yes

No

12. Was there any interference by Government authorities?

Yes

No

13. Does the interference by Government authorities satisfactory?

Yes

No

14. Was there any interference by the KWA(Kerala Water Authority)?

Yes

No

15. Does the protest conducted by the people of Kottapuram where any useful?

Yes

No

16. Was there interference of the Church dioceses in solving water scarcity?

Yes

No

17. Does the interference of Church dioceses in solving water scarcity useful?

Yes

No

18. Does the working fishermen/women face difficulties due to lack of drinking water?

Yes

No

19. Number of amount paid by the fishermen of Kottapuram for a pot of drinking water?

Rs 8-9

Rs 9-10

Or above Rs 10

20. Do you boil the water before drinking?

Yes

No

21. Does the government representatives address the lack of awareness regarding safe drinking water?

Yes

No

22. Does the Interference of ASHA Workers and welfare workers on providing safe drinking water useful?

Yes

No

23. Is the water available in near water bodies contaminated?

Yes

No

24. Was there any interference by the government local bodies to clean up the contaminated water bodies?

Yes

No

25. During which part of the year you face large shortage of drinking water?

Jan-March

Apr-June

July-Sept

Oct-Dec

26. Number of distance you have to cover for drinking water during summer?

1-5 Kms

5-10 Kms

Nil

27. Are you satisfied with the drinking water services provided by private lobbies?

Yes

No

28. Generally how does the water look like?

Clear

Cloudy

Dirty

29. Is the quantity of water you receive adequate?

Yes

No

30. Does the Government authorities discourage receiving drinking water from private lobbies?

Yes

No

I don't know