OBSERVATION OF PRESENT WATER QUALITY OF WASA IN NORTH ZONE (UTTARA, SECTOR -10) OF DHAKA CITY

A Project and Thesis submitted in partial fulfillment of the requirements for the award of Degree of
Bachelor of Science in Civil Engineering

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Certification

This is to certify that this project and thesis entitled "Observation of present water quality of WASA in the north zone (Uttara, sector -10) of Dhaka city" is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the department of Civil engineering under the faculty of engineering of daffodil international university in partial fulfillment of the requirements for the degree of bachelor of science in civil engineering. The presentation of the work was held on 21 January 2021.

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List of Abbreviations

WASA	Water Supply and Sewerage Authority
DWASA	Dhaka Water Supply and Sewerage Authority
DO	Dissolved Oxygen
BOD	Biochemical oxygen demand
WHO	World Health Organization
ECR97	Environment Conservation Rules 1997
NGO	Non-governmental organizations
EC	Electrical conductivity
DI	Deionization
PCBs	Polychlorinated biphenyls
PAHs	Polycyclic aromatic hydrocarbons
BWDB	Bangladesh Water Development Board
TIB	Transparency International Bangladesh
EQ	Equalization

List of Symbols

uS/cm	micromhos/cm
mS/m	milliSiemens/m
dS/m	deciSiemens/m
mg/L	milligrams per litre
NTU	Nephelometric Turbidity Unit
°C	degrees Celsius
H20	Water
CO2	Carbon dioxide

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ABSTRACT

Dhaka is the capital city of Bangladesh. Set beside the Buriganga river, it's at the center of country, trade, and culture. The people of Dhaka city directly depend on the WASA water supply daily. This investigation finding the present water quality of WASA in the north zone (Uttara, sector -10) of Dhaka city, Bangladesh. Using Questionnaires survey from one hundred local people and fifteen Stakeholders and gather all the data and analysis. Also, samples laboratory test with current situation observing then analysis all the data together and compare with world health organization (WHO) and Bangladesh Standards for Drinking Water (ECR 97) data. Using the analysis method it found WASA are properly not capable to get human satisfaction. People are very confused about water quality, and also laboratory observation showing that there have a large number of differences from standard data to sample data, specifically DO (dissolve oxygen) and BOD (biochemical oxygen demand) values are unexpected. It's harmful to human health, WASA need to more care about water quality and focuses on water physical, biological, and chemical parameter, and also supply system and human satisfaction

Keywords - survey, Laboratory test, Data and Satisfaction Analysis, Quality maintain.

CHAPTER 1

INTRODUCTION

1.1 GENERAL

Bangladesh is the 95th largest country by area, at the same time 8th most populous country in the world. Dhaka is the capital of Bangladesh, is the most populated city situated in central Bangladesh along the Buriganga river. The city lies on the lower reaches of the Ganges Delta and covers a total area of 306.38 square kilometers. The Greater Dhaka Area includes Dhaka and the municipalities have a total population of 19.84 million, and the city has shown population growth of about 4.2% annually. If this population growth remains steady, in 2020 and 2030 we will have around 21 million and 27 million occupants respectively. One of the main reasons behind this uncontrolled population growth is the inward migration from rural areas which is creating unprecedented socio-economic challenges. From the early sixties, the industrial revolution started to spring up slowly in Bangladesh and the development of new industries throughout the country, specifically around Dhaka city is continuing. That Dhaka city is expanding unsystematically with an annual rate of 3.5% to accommodate the huge population influx of more than seven million people. There are two-way peoples are collect their water first one is the personal and second world is publicly and in the public part have some government organization, non-government organization and sometimes NGO. Dhaka is the capital of Bangladesh and it's located in the center of Bangladesh, and the Water Supply and Sewerage Authority (WASA) Deal with user demand for water, Dhaka WASA was established in 1963 as an independent agency with the responsibility to supply water and sewage to Dhaka, On 16 March 2019, Parliamentary Standing Committee on Estimate recommended that the government of Bangladesh split Dhaka WASA into two different bodies along with North and South Dhaka, and now water Supply and Sewerage Authority (WASA) works in all the major cities in Bangladesh. The water supply in Dhaka is less than the water demand and 25% of people of Dhaka city have no direct access to potable water.

The water demand is more than 0.73 km3 per year whereas, the authority can supply only 0.51 km3 per year and the water quality is on a dangerous level as well. The daily water demand of Dhaka city is around 2.50E+09 to 3.00E+09 liter for 17 million residents of which 78% is supplied by extracting groundwater while the remaining 22% is supplied after treating the water of the surrounding rivers. Four surface water treatment plants,

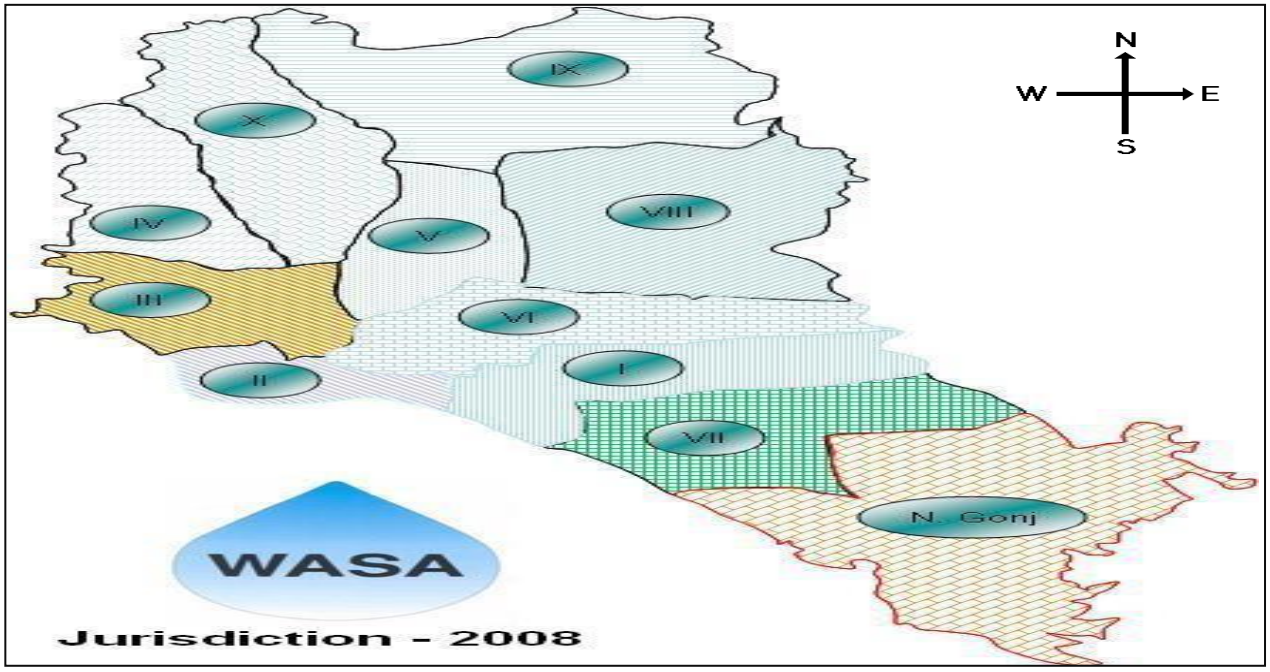
A previous study showed that the water demand of Dhaka city will rise to a very high extent over the next 20 years which would be a major challenge to meet the water demand in the 4 future using the available sources. Although there is enough water in the Dhaka peripheral river network, the water cannot be considered as a good source due to rapid urbanization, industrialization, and excessive population growth. A study found that 50-60% of total waste is from industrial sources and the other 40-50% is from a domestic source. Several researchers have studied the water quality parameters of different rivers around the world though there are very few studies in Bangladesh, the water quality of the upper and lower reaches of the Shitalakhya and the Dhaleswari is least polluted and can be used for water treatment, the water quality sampling points and presented information spatially on the existing level of water quality parameters.

1.2 Water Distribution system:

A water distribution system is a hydraulic infrastructure that conveys water from the source to the consumers; it consists of elements such as pipes, valves, pumps, tanks, and reservoirs. The most important consideration in designing and operating a water distribution system is to satisfy consumer demands under a range of quantity and quality considerations during the entire lifetime for the expected loading conditions. Also, a water distribution system must be able to accommodate abnormal conditions such as breaks in pipes, mechanical failure of pipes, valves, and control systems, power outages, malfunction of storage facilities, and inaccurate demand projections. The possibility of occurrence of each of these deficiencies should be examined to determine the overall performance and thereby the reliability of the system. In general, reliability is defined as the probability that the system performs successfully within specified limits for a given period in a specified environment.

1.3 Water Supply System in Dhaka City:

WASA was established in 1963, its work for water supply and sewerage line. WASA today a walk all the major city in Bangladesh, let's talk about Dhaka WASA divided their zone in the major sector, zone 1 to 10 and narayanganj zone, and every John they have is a zonal office and Zonal office control for all the Drone internal works, and they have a central office and it communicates all the zonal office for better service.

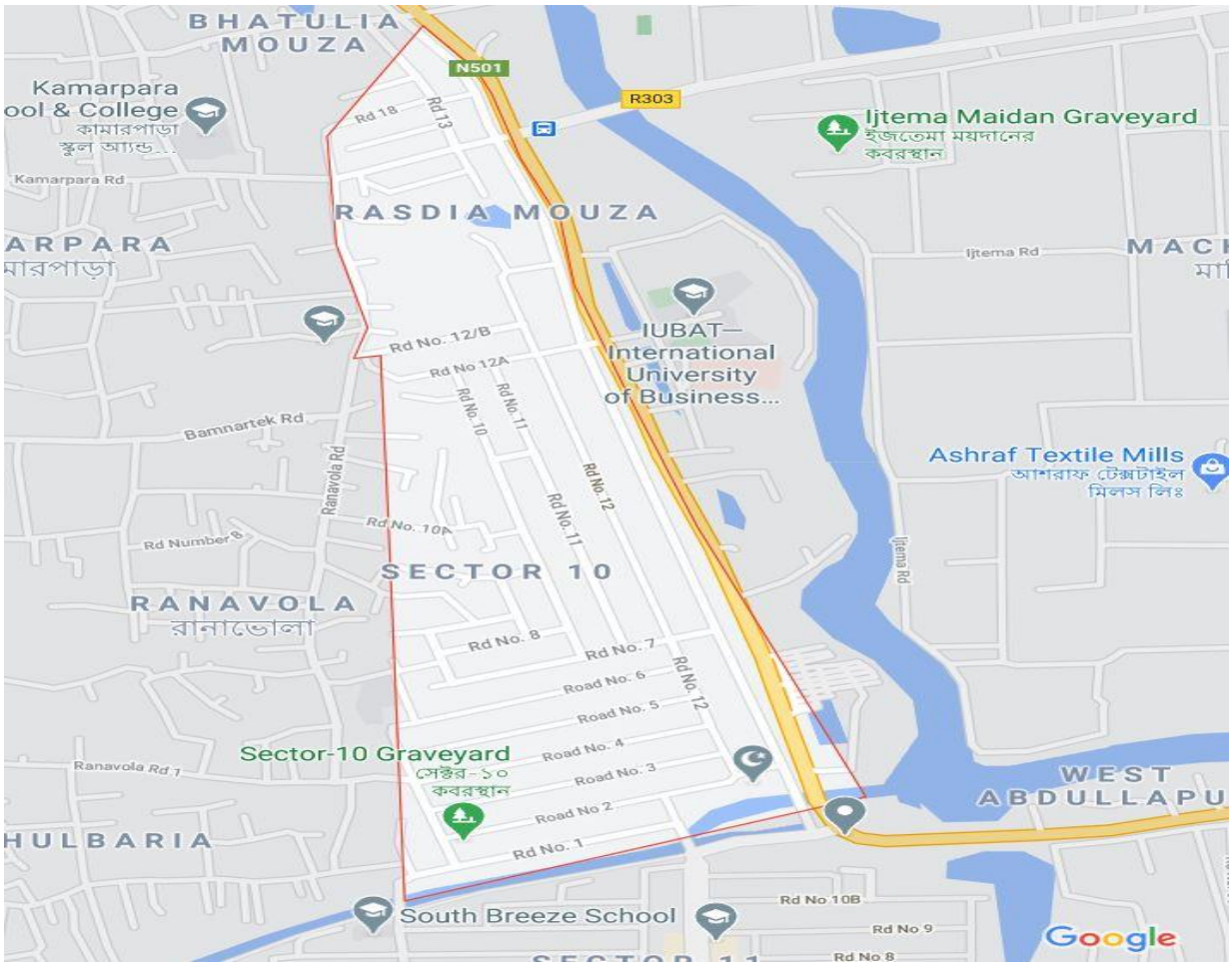


Sl #	Name of Zone	Pump No.	Length of Pipe (km)
1.	Zone – I	65	509.00
2.	Zone-II	50	180.00
3.	Zone-III	89	299.45
4.	Zone - IV	83	501.00
5.	Zone- V	54	280.00
6.	Zone- VI	93	480.52
7.	Zone – VII	36	192.23

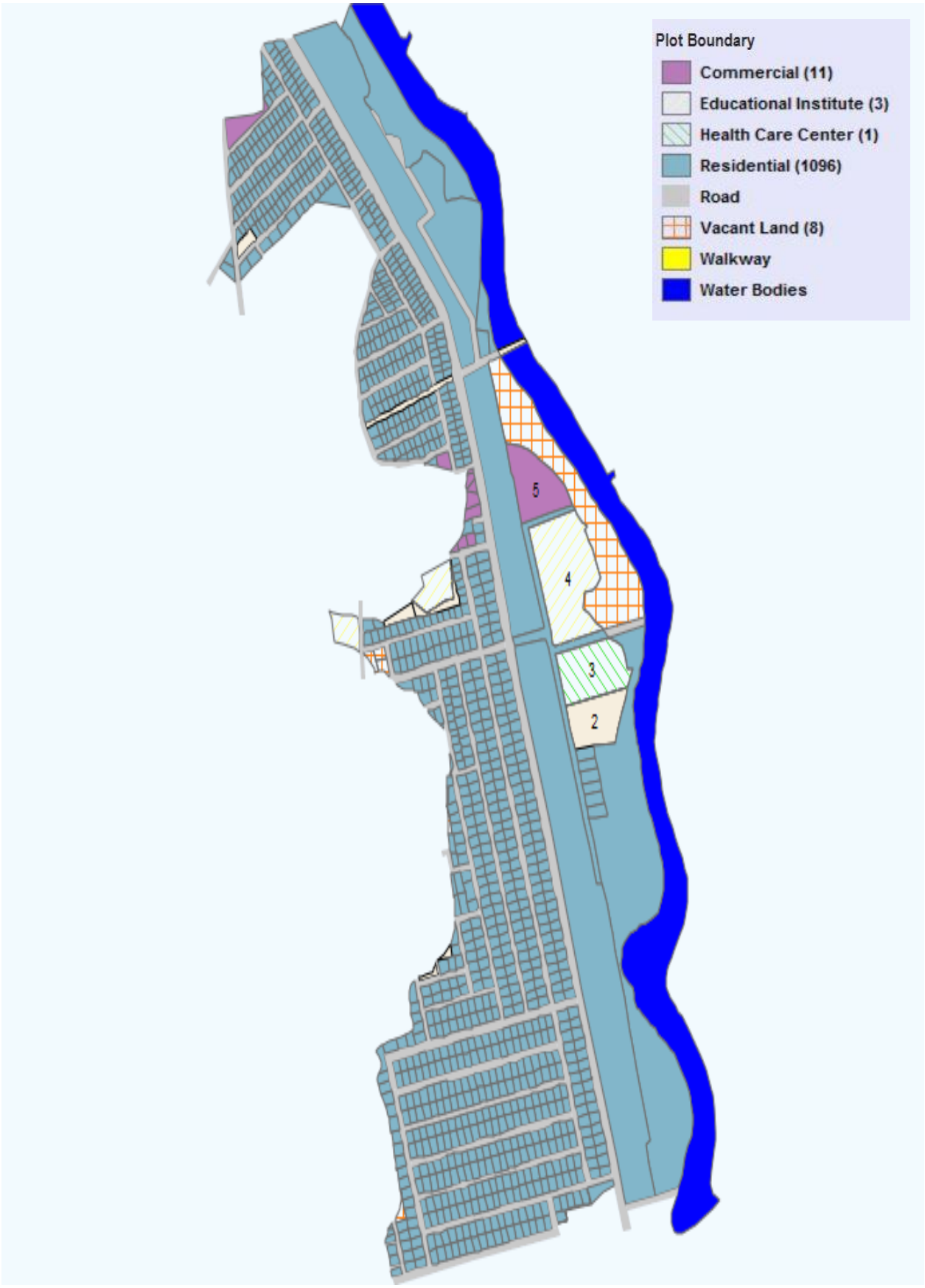
8.	Zone – VIII	46	187.22
9.	Zone – IX	45	301.50
10.	Zone- X	60	229.64
11.	Zone- XI	24	301.00
	Total	645	3,461.56

1.4 Study area

Uttara sector 10 in under Uttara residential model town (Phase 1st) follow up by Dhaka north city corporation, It's a newly developed residential area which is organized by Dhaka City Corporation, they get all the modern facilities like water supply sewerage line, electrical line, organized transposition line, gas line, all the major residential facilities. But day by day increasing this area population and its direct effect in all the facilities and water is one of them.



Sector 10, Uttara, Dhaka (Gmap)



Sector 10, Uttara, Dhaka (Area defend map)

1.5 OBJECTIVE

This study majorly focuses on these topics specifically which is showing below.

- To observe the water quality parameters and suitability for human health by a laboratory test.
- To find out the possible ways or solutions for improving the water quality Literature Review

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION:

If any human lives their life safe and hygienically they need safe water, safe food, and lots of things. All of them safe water is a most important element. Without safe water, the human cannot maintain their life activities. Which people live in city area Bangladesh most of them depend on WASA for safe-water. This chapter focused on the importance of water, classification of water, parameters of water quality, turbidity, temperature, test and odor, electrical conductivity (EC), ph, dissolved oxygen (DO), biochemical oxygen demand(BOD), groundwater depletion, and water crisis in Dhaka city, major issues of Dhaka WASA, the water treatment process of Dhaka WASA.

2.2 Importance of water:

Water is the most value able nature things in the environment. Without water, we can't live a single day. Water is essential to maintain drinking, agriculture, household, food preparation, personal hygiene, livestock purpose. Humans can't survive without drinking pure water. Many things will come to a halt without pure water. People use normal water for drinking and everyday use. Nowadays people can't do anything's pure water. We can purify water in many ways such as deionization (DI), reverse osmosis, carbon filtering, microfiltration, ultrafiltration, ultraviolet, oxidation, or electro-deionization. Purified water has a significant number of uses, especially in science and engineering laboratories and industries, and is produced in a range of purities. But this purified water may contain harmful contaminants that are not safe for drinking. Providing safe drinking water to the inhabitants is one of the major public health priorities for our Government because it is related to human health. The approximately human body is made by 70% of water. Water is also important for biological

processes and essential for the growth and maintenance of our body which is also a critical component of the metabolic process and many bodily solutes are served as a solvent. The earth consists of only 2.5% freshwater among which 98.8% is in ice and groundwater, and rivers, lakes and the atmosphere contains 0.3% of all freshwater. We can source water in many ways such as pond, lake, river, groundwater. We mainly use groundwater.

2.3 Classification Of water:

Based on its source, water can be divided into groundwater and surface water. Both types of water can be exposed to contamination risks from agricultural, industrial, and domestic activities, which may include many types of pollutants such as heavy metals, pesticides, fertilizers, hazardous chemicals, and oils. Water quality can be classified into four types potable water, palatable water, contaminated (polluted) water, and infected water.

The most common scientific definitions of these types of water quality are as follows:

1. Potable water: It is safe to drink, pleasant to taste, and usable for domestic purposes. Water Quality - Science, Assessments and Policy

2. Palatable water: It is esthetically pleasing; it considers the presence of chemicals that do not cause a threat to human health.

3. Contaminated (polluted) water: It is that water containing unwanted physical, chemical, biological, or radiological substances, and it is unfit for drinking or domestic use.

4. Infected water: It is contaminated with the pathogenic organism.

2.4 Parameters of water quality

- **Physical parameters**
- **Chemical parameters**
- **Biological parameters**

2.5 Turbidity

Turbidity is the cloudiness of water. It is a measure of the ability of light to pass through water. It is caused by suspended material such as clay, silt, organic material, plankton, and other particulate materials in water.

Turbidity in drinking water is esthetically unacceptable, which makes the water look unappetizing. The impact of turbidity can be summarized in the following points:

It can increase the cost of water treatment for various uses.

The particulates can provide hiding places for harmful microorganisms and thereby shield them from the disinfection process.

Suspended materials can clog or damage fish gills, decreasing their resistance to diseases, reducing their growth rates, affecting egg and larval maturing, and affecting the efficiency of the fish catching method.

Suspended particles provide adsorption media for heavy metals such as mercury, chromium, lead, cadmium, and many hazardous organic pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and many pesticides.

The amount of available food is reduced because higher turbidity raises water temperatures. After all, suspended particles absorb more solar heat. Consequently, the concentration of the dissolved oxygen (DO) can be decreased since warm water carries less dissolved oxygen than cold water.

Turbidity is measured by an instrument called nephelometric turbid-meter, which expresses turbidity in terms of NTU or TU. A TU is equivalent to 1 mg/L of silica in suspension.

Turbidity of more than 5 NTU can be visible to the average person while turbidity in muddy water, exceeds 100 NTU. Groundwater normally has very low turbidity because of the natural filtration that occurs as the water penetrates through the soil.

2.6 Temperature

Palatability, viscosity, solubility, odors, and chemical reactions are influenced by temperature. Thereby, the sedimentation and chlorination processes and biological oxygen demand (BOD) are temperature-dependent. It also affects the biosorption process of the dissolved heavy metals in water. Most people find water at temperatures of 20–30°C (Bangladesh) most palatable.

2.7 Taste and odor

Taste and odor in water can be caused by foreign matter such as organic materials, inorganic compounds, or dissolved gasses. These materials may come from natural, domestic, or agricultural sources.

2.8 Electrical conductivity (EC)

The electrical conductivity (EC) of water is a measure of the ability of a solution to carry or conduct an electrical current. Since the electrical current is carried by ions in solution, the conductivity increases as the concentration of ions increases. Therefore, it is one of the main parameters used to determine the suitability of water for irrigation and firefighting.

2.8.1 Units of its measurement are as follows:

• U.S. units = micromhos/cm
• S.I. units = milliSiemens/m (mS/m) or dS/m (deciSiemens/m)
where (mS/m) = 10 umho/cm (1000µS/cm = 1 dS/m).
Pure water is not a good conductor of electricity.
The typical conductivity of water is as follows:
•Ultra-pure water: 5.5×10^{-6}S/m;
•Drinking water: 0.005–0.05 S/m;

• Seawater: 5 S/m.

The electrical conductivity can be used to estimate the TDS value of water as follows.

2.9 pH

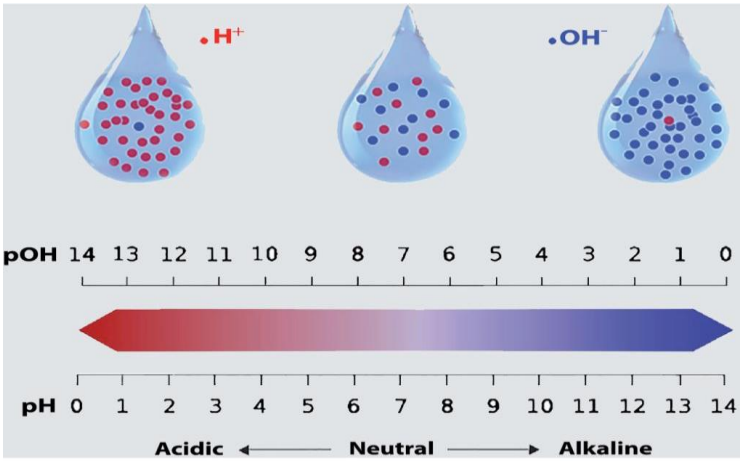
pH is one of the most important parameters of water quality. It is defined as the negative logarithm of the hydrogen ion concentration. It is a dimensionless number indicating the strength of an acidic or a basic solution.PH of the water is a measure of how acidic/basic water is. Acidic

water contains extra hydrogen ions (H+) and basic water contains extra hydroxyl

(OH−) ions.

As shown in Figure, pH ranges from 0 to 14, with 7 being neutral. A pH of less than 7 indicates acidity, whereas a pH of greater than 7 indicates a base solution. Pure water is neutral, with a pH close to 7.0 at 25°C. Normal rainfall has a pH of approximately 5.6 (slightly acidic) owing to atmospheric carbon dioxide gas. Safe ranges of pH for drinking water are from 6.5 to 8.5 for domestic use and living organism's need.

A change of 1 unit on a pH scale represents a 10-fold change in the pH, so that water with a pH of 7 is 10 times more acidic than water with a pH of 8, and water with a pH of 5 is 100 times more acidic than water with a pH of 7. There are two methods available for the determination of pH: electrometric and colorimetric methods.



Excessively high and low pH's can be detrimental to the use of water. A high pH makes the taste bitter and decreases the effectiveness of the chlorine disinfection, thereby causing the need for additional chlorine. The amount of oxygen in water increases as pH rises. Low-pH water will corrode or dissolve metals and other substances.

Pollution can modify the pH of water, which can damage animals and plants that live in the water.

2.9.1 The effects of pH on animals and plants can be summarized as follows:

•Most aquatic animals and plants have adapted to life in water with a specific pH and may suffer from even a slight change.

• Even moderately acidic water (low pH) can decrease the number of hatched fish eggs, irritate fish and aquatic insect gills, and damage membranes.

•Water with very low or high pH is fatal. A pH below 4 or above 10 will kill most fish, and very few animals can endure water with a pH below 3 or above 11.

• Amphibians are extremely endangered by low pH because their skin is very sensitive to contaminants. Some scientists believe that the current decrease in amphibian population throughout the globe may be due to low pH levels induced by acid rain.

2.9.2 The effects of pH on other chemicals in water can be summarized as follows:

• Heavy metals such as cadmium, lead, and chromium dissolves more easily in highly acidic water (lower pH). This is important because many heavy metals become much more toxic when dissolved in water.

• A change in the pH can change the forms of some chemicals in the water. Therefore, it may affect aquatic plants and animals. For instance, ammonia is relatively harmless to fish in

neutral or acidic water. However, as the water becomes more alkaline (the pH increases), ammonia becomes progressively more poisonous to these same organisms.

2.10 Dissolved oxygen

Dissolved oxygen (DO) is considered to be one of the most important parameters of water quality in streams, rivers, and lakes. It is a key test of water pollution. The higher concentration of dissolved oxygen, the better the water quality.

Oxygen is slightly soluble in water and very sensitive to temperature. For example, the saturation concentration at 20°C is about 9 mg/L and at 0°C is 14.6 mg/L.

The actual amount of dissolved oxygen varies depending on the pressure, temperature, and salinity of the water. Dissolved oxygen has no direct effect on public health, but drinking water with very little or no oxygen tastes unpalatable to some people.

There are three main methods used for measuring dissolved oxygen concentrations: the colorimetric method—quick and inexpensive, the Winkler titration method—traditional method, and the electrometric method.

2.11 Biochemical oxygen demand (BOD)

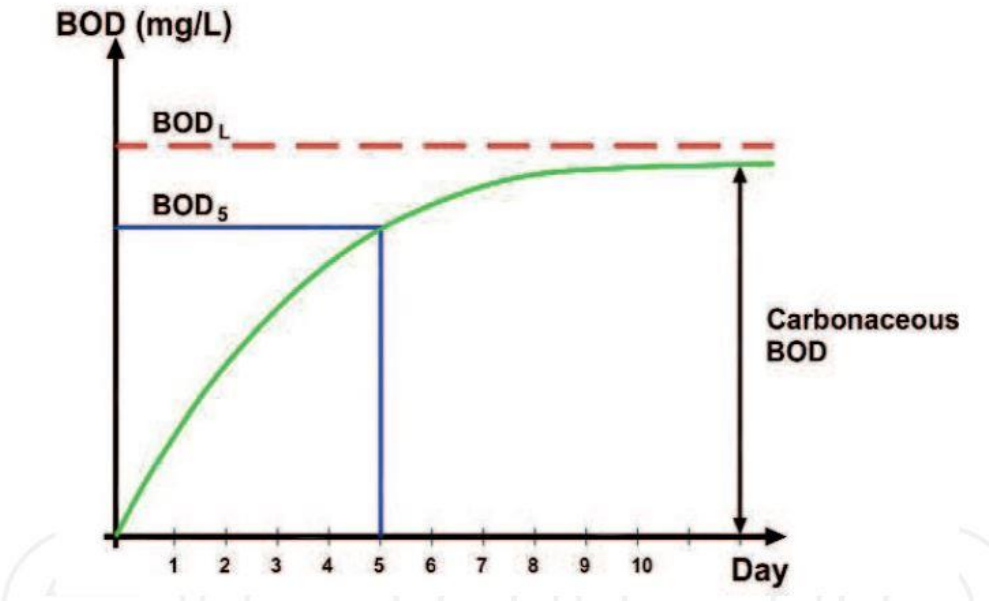
Bacteria and other microorganisms use organic substances for food. As they metabolize organic material, they consume oxygen. The organics are broken down into simpler compounds, such as CO2and H2O, and the microbes use the energy released for growth and reproduction.

When this process occurs in water, the oxygen consumed in the DO in the water. If oxygen is not continuously replaced by natural or artificial means in the water, the DO concentration will reduce as the microbes decompose the organic materials. This need for oxygen is called the biochemical oxygen demand (BOD). The more organic material there is in the water, the

higher the BOD used by the microbes will be. BOD is used as a measure of the power of sewage; strong sewage has a high BOD and weak sewage has low BOD.

The complete decomposition of organic material by microorganisms takes time, usually 20 d or more under ordinary circumstances. The quantity of oxygen used in a specified volume of water to fully decompose or stabilize all biodegradable organic substances is called the ultimate BOD or BODL.

BOD is a function of time. At time = 0, no oxygen will have been consumed and the BOD = 0. As each day goes by, oxygen is used by the microbes, and the BOD increases. Ultimately, the BOD-L is reached and the organic materials are completely decomposed.



BOD curve

2.11.1 A graph of the BOD versus time is illustrated as in Figure.

This is called the BOD curve, which can be expressed mathematically by the following equation:

$$BODt = B\,ODL \times (1 - 10^{-kt})(10)$$

Where BODt= BOD at any time t, mg/L; BODL= ultimate BOD, mg/L; k = a constant representing the rate of the BOD reaction; t = time, d.

The value of the constant rate k depends on the temperature, the type of organic materials, and the type of microbes exerting the BOD.

2.12 Bacteria

Bacteria are considered to be single-celled plants because of their cell structure and the way they ingest food. Bacteria occur in three basic cell shapes: rod-shaped or bacillus, sphere-shaped or coccus, and spiral-shaped or spirillum. In less than 30 min, a single bacterial cell can mature and divide into two new cells.

Under favorable conditions of food supply, temperature, and pH, bacteria can reproduce so rapidly that a bacterial culture may contain 20 million cells per milliliter after just 1 day. This rapid growth of visible colonies of bacteria on a suitable nutrient medium makes it possible to detect and count the number of bacteria in water.

There are several distinctions among the various species of bacteria. One distinction depends on how they metabolize their food. Bacteria that require oxygen for their metabolism are called aerobic bacteria, while those live only in an oxygen-free environment are called anaerobic bacteria. Some species called facultative bacteria can live in either the absence or the presence of oxygen.

At low temperatures, bacteria grow and reproduce slowly. As the temperature increases, the rate of growth and reproduction doubles in every additional 10°C (up to the optimum

temperature for the species).The majority of the species of bacteria having an optimal temperature of about 35°C.

A lot of dangerous waterborne diseases are caused by bacteria, namely, typhoid and paratyphoid fever, leptospirosis, tularemia, shigellosis, and cholera. Sometimes, the absence of good sanitary practices results in gastroenteritis outbreaks of one or more of those diseases.

2.13 Ground Water Depletion and Water Crisis in Dhaka city:

The surface and subsurface geologic formations under Dhaka city are not favorable for replenishment and storage of groundwater against heavy withdrawal. The records of the groundwater level observed by the Bangladesh Water Development Board (BWDB) for the year 1995 to 1999 indicate that the rate of annual declinations of groundwater level in Green road area was 2.70 m, 2.41 m, and 2.52 m, respectively in the year 1997, 1998 and 1999. The depth of the groundwater table from the ground surface was 38.12 m in 1999. At Shewrapara, the annual declinations of groundwater level were 2.86 m, 2.06 m, and 1.01 m during 1997, 1998, and 1999, respectively. Up to 1998, the average yearly declination of groundwater table within the city varied from 1.00 m to 2.50 m and that outside the city varied 0.30 m to 0.50 m. Groundwater depths in Mohammedpur, Cantonment, Lalbagh, and Dhanmondi were 20.76m, 22.95 m, 26.92 m, 33.17 m, respectively in 1980 while at the end of 2002 it went down to 28.95 m, 36.44 m, 38.73 m, and 41.38 m, respectively.

A study conducted on changes in the groundwater Regime of Dhaka City refers that, the natural pattern of groundwater flow at the southern end of the Madhupur Tract has been much disturbed by intensive groundwater development for the water supply of Dhaka since the early 1970s (Ahmed,2010). Large-scale groundwater abstraction has resulted in an extensive cone of depression centered on the city, over large parts of which the aquifer has become unconfined. Drawdown has increased by approximately 0.75 m per year since the late 1970s at the Motijheel observation well,

2.14 Major issues of Dhaka WASA:

Dhaka, one of the most densely populated cities in the world. The water provided by Dhaka's utility service, Dhaka Water and Sewerage Authority (Dhaka Wasa), has come under fresh scrutiny following a report lambasting the agency's service and water quality. Five water treatment plants in the city supposedly make the water consumable. But the pipeline used to distribute the water often renders the process pointless. In their April report, Transparency International Bangladesh (TIB) said that 34.5% of Dhaka Wasa consumers complained of poor quality water throughout the year. The report went on to say that people have to burn Tk332.37 crore worth of gas every year to boil Dhaka Wasa water to make it consumable. The problem is rooted in Dhaka Wasa's distribution system more than the supplied water itself the water distribution pipelines are old, with kilometers of pipelines either rusty or broken down. According to Dhaka Wasa, the supply network lines have not seen any development since their installation in Nawabpur Road, Basabo-Gendaria, east of Jatrabari, Sayedabad, Maniknagar, Hazaribag, Nawabganj, Nilkhet-Azimpur to Buriganga, Dhaka-Narayanganj-Dhaka project, Uttarkhan, Dakshinkhan, Nikunja, Khilkhet, and Uttara Model Town.

A report says that 51.5% of all Dhaka Wasa consumers in Dhaka reported their water supply was visibly filthy, while 41.4% complained their water smelled terrible. Poor water quality all year round was reported by 34.5% of Wasa users. Water quality was reported to be the poorest in summer with 62.1%, followed by 59.6% in the monsoon, with only 7.5% complaining of poor water quality in winter.

2.15 The Water Treatment Process of DWASA:

2.15.1 Raw Water Intake

Water is drawn into the plant via the use of pumps from the river or lake through large metal grills called screens and trash racks. These block large objects such as wood, leaves, and other forms of debris from entering the treatment plant along with the water.

2.15.2 Headwork

It is at this stage the chemicals Alum or Aluminum Sulphate (a coagulant), liquid polymer (a flocculant), and chlorine (disinfectant) are first introduced. The headwork is designed to ensure rapid mixing and uniform distribution of the chemicals with the raw water. The Alum reacts rapidly with the water's alkalinity to produce a gelatinous (jelly-like) precipitate of Aluminum Hydroxide called microflow that entraps and absorbs impurities. The liquid polymer aids coagulation by enlarging the floc particles through bridging. Chlorine is sometimes added at the headworks to prevent algae growth on the wall of the flocculation and sedimentation basins.

2.15.3 Flocculation

The design of the flocculation basin facilitates the gentle, constant mixing of the micro floc formed during coagulation. This stirring promotes contact and the formation of larger and heavier floc at a faster rate.

2.15.4 Sedimentation

Sedimentation involves the removal of solids from water by gravity settling. Water flow is greatly reduced allowing the heavy floc to settle to the bottom of the basin where it is referred to as sludge. This sludge is channeled to sludge lagoons where further settling takes place. Supernatant water from the lagoons is then returned to the headwork.

2.15.5 Filtration

After leaving the sedimentation basin, the water is then filtered. This facilitates the final and complete removal of any finely divided suspended matter, plus any flock carryover that remains after the coagulation and sedimentation processes. The filtration system is a monotype constant rate gravity filter system. The filter media consist of six feet of sand. Periodic backwashing of the filters is required to remove any accumulated suspended materials.

2.15.6 Disinfection

The water leaving the filter flows to the clear well where it is disinfected and stored. Chlorine is added to the water to remove and destroy any bacteria or viruses present in the water

2.15.6 pH Adjustment

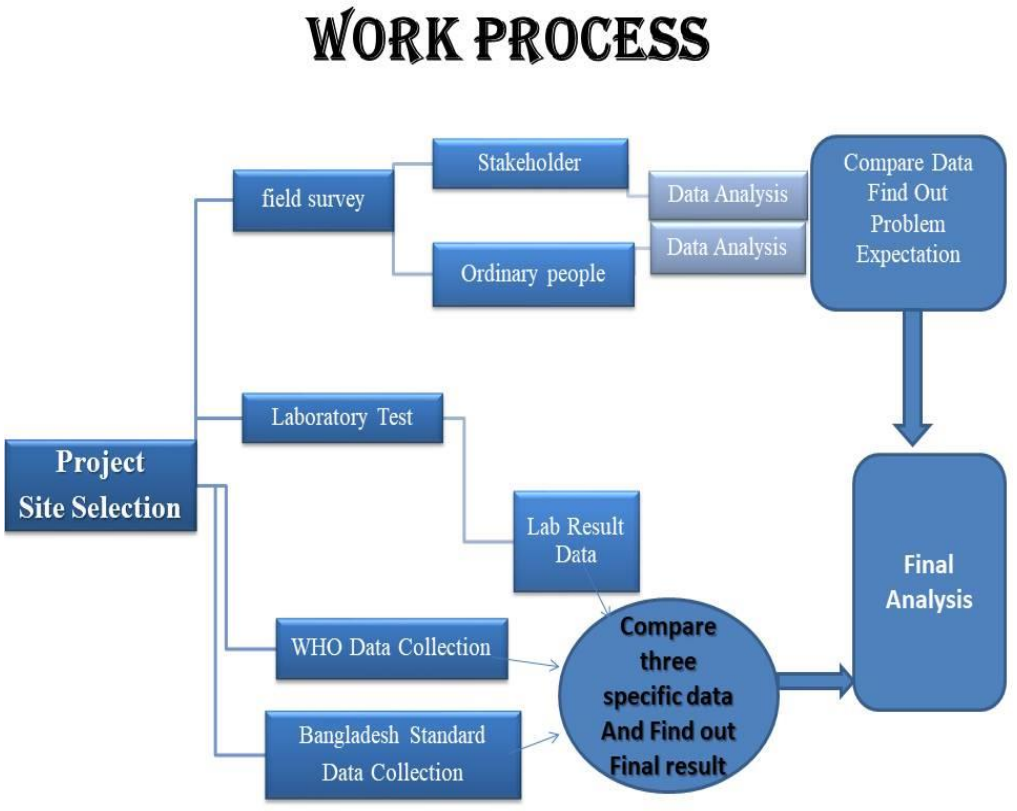
Sometimes it is necessary to add lime (Calcium Hydroxide)to the filtered water in order to maintain a pH level of 7. A sequestering agent, which offers scale and corrosion control, is also added to the water before distribution

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Bangladesh is the most densely populated country. In Bangladesh, Dhaka is the most populated and developing city therefore WASA faces many difficulties' and challenges. Nowadays WASA takes many initiates and they also include many functioning plans to solve this problem. This chapter focused on the work process, ordinary people questions survey, stakeholder questions survey, laboratory test, selected parameter of test.



Work process table

3.2 Field survey:

A field Survey is necessary to find out the real situation about the study area, we divided our survey into two-part, one of them is ordinary people, (they live in this area and they have experience) and the second one is the expert people, who have a lot of study about this topic and also they have research about this topics.

We make two different types of questions for two different categories of people and go for a physical interview door to door. We meet hundreds of ordinary people and fifteen experts and gather all the answers.

3.2.1 Ordinary people question:

That the selected question for asking local people door to door and question are showing below.

1. Are you Happy with WASA water?
2. Did you get any visible Objects in Water Last 3 Months?
3. Did you get any visible Color in Water in the Last 3 Months?
4. Do you Boil or Follow any Filtering way (WASA water) Before Drink?
5. Do you see any trouble with the water supply? According to last 3 month (approximately)
6. Do you feel Water test change suddenly or slowly?
7. Do you suffer any disease and you think it's because of WASA water? (Last one year)?
8. If I say you Ranking WASA out Of 100 Score, How much you give overall?
9. In your opinion what type of change need to do WASA for better service?

3.2.2 Stakeholder question:

That the selected question for ask stakeholder question is showing below.

1. What do you think, about the water quality of Dhaka WASA?
2. How can we improve the water quality of Dhaka WASA?
3. What type of Investment need to improve the present condition of the water supply system of Dhaka WASA?
4. Do you have any important suggestions regarding this issue?

After collection of all the data, analyze all ordinary people data together and other hand gather all the Stakeholder data and try to find out the major issue and common thing.

3.3 Laboratory test:

We select five specific sample collection points in our study area for laboratory tests. We use the Daffodil International University Civil engineering laboratory and Bangladesh Council of Scientific and Industrial Research (BCSIR) laboratory for our sample test.

3.3.1 Selected parameter of test.

The selected parameter of the test is given below.

- pH
- Conductivity
- Turbidity
- Dissolve Oxygen (DO)
- Temperature
- E.coli
- Test and odor
- Biochemical Oxygen Demand (BOD)

Selected location (Uttra sector-10)

Sample collected area

Methods used for the analysis of different parameters

No.	Parameters	Methods/Instruments
01	pH	pH meter
02	Conductivity	Conductivity meter
03	Turbidity	Titrimetric method
04	Dissolve Oxygen (DO)	Titrimetric method
05	Temperature	Thermometer
06	E.coli	Titrimetric method
07	Test and odor	Feeling
08	Biochemical Oxygen Demand (BOD)	Titrimetric method

Test name and Methods

CHAPTER 4

RESULT AND DISCURSIONS

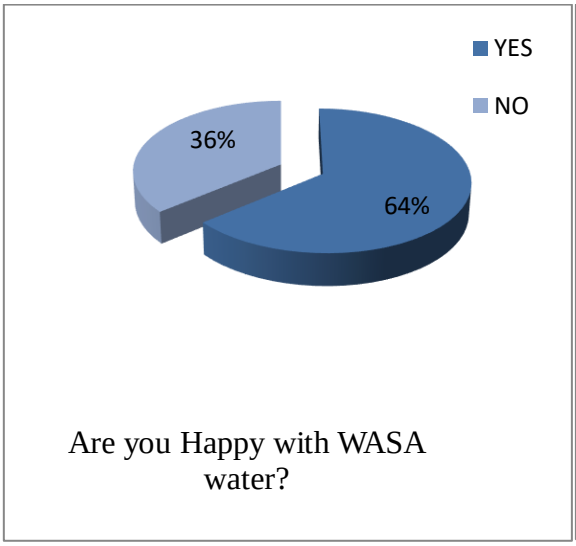
4.1 INTRODUCTION

In Bangladesh, Dhaka is the most populated and developing city. If any people live their life safe and hygienically they need safe water. Without safe water, the human cannot maintain their life activities. Day by day development of Dhaka is increasing and the population also increasing at the same time. When the population is increasing that time happened many good things and bad things. let's talk about bad things when people are increasing not only increasing population also increasing much demand these are the demand of safe food, the demand for safe water, demand of safe shelter, the demand for a good education system, etc. all of them safe water is most important elements. Most of the peoples of Bangladesh depend on WASA for safe water, therefore, WASA faces many difficulties' and challenges. Nowadays WASA takes many initiates and they also include many functioning plans to solve this problem. But the problem has not solved these problems discussed in this chapter. This chapter focused on the Questionnaire survey report, Questionnaire survey report (Stakeholder), Laboratory lest report.

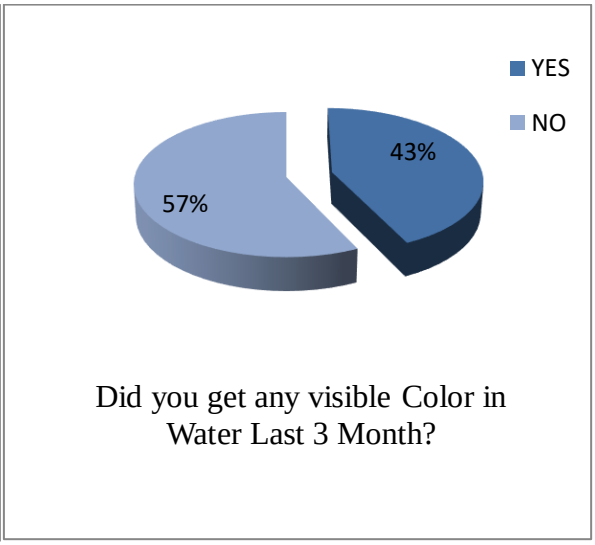
4.2 Questionnaires survey report (Ordinary people)

QN No.	Questions	Total survey on 100 no's of people/ House	
01	Are you Happy with WASA water?	Yes	No
		64%	36%
02	Did you get any visible Objects in Water Last 3 Months?	Yes	No
		31%	69%
03	Did you get any visible Color in Water in the Last 3 Months?	Yes	No
		43%	57%
04	Do you Boil or Follow any Filtering way (WASA water) Before Drink?	Yes	No
		98%	2%
05	Do you see any trouble with the water supply? According to last 3 month (approximately)	Yes	No
		19%	81%
06	Do you feel Water test change suddenly or slowly?	Yes	No
		12%	88%
07	Do you suffer any disease and you think it's because of WASA water? (Last one year)?	Yes	No
		38%	62%
08	If I say you Ranking WASA out Of 100 Score, How much you give overall?	Out of 100 marks	
		72%	
09	In your opinion what type of change need to do WASA for better service?	1. Clean water process. 2. Use more filters process. 3. Require more early maintenance. 4. Regular quality test from supply zoon. 5. More manpower.	

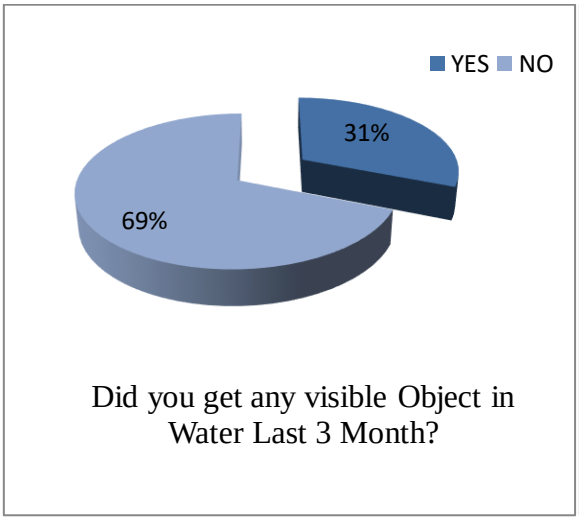
4.2.1Questionnaires survey report pie Chart (Ordinary people)



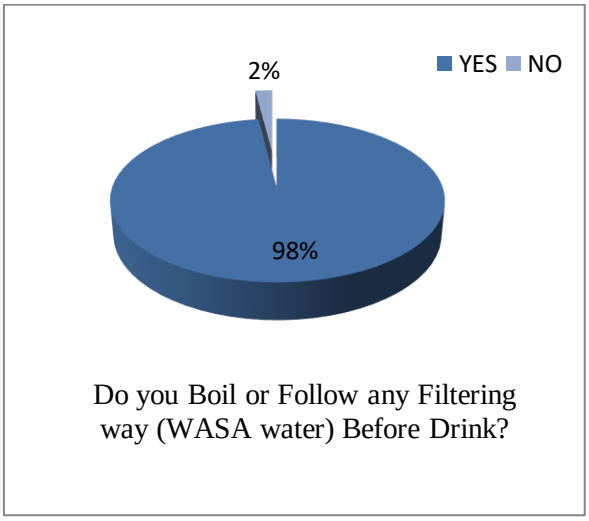
Are you Happy with WASA water?



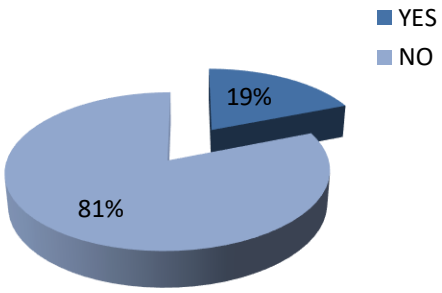
Did you get any visible Color in Water Last 3 Month?



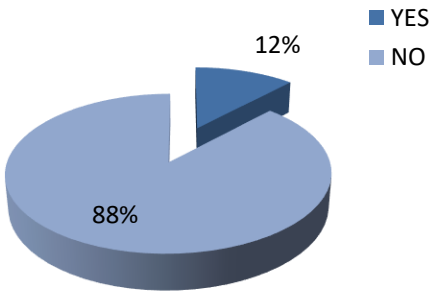
Did you get any visible Object in Water Last 3 Month?



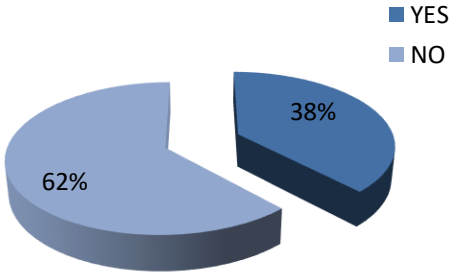
Do you Boil or Follow any Filtering way (WASA water) Before Drink?



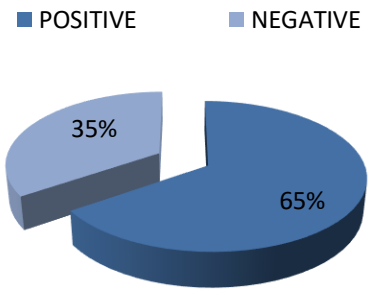
Do you see any trouble in water supply? According to last 3 month (approximately)



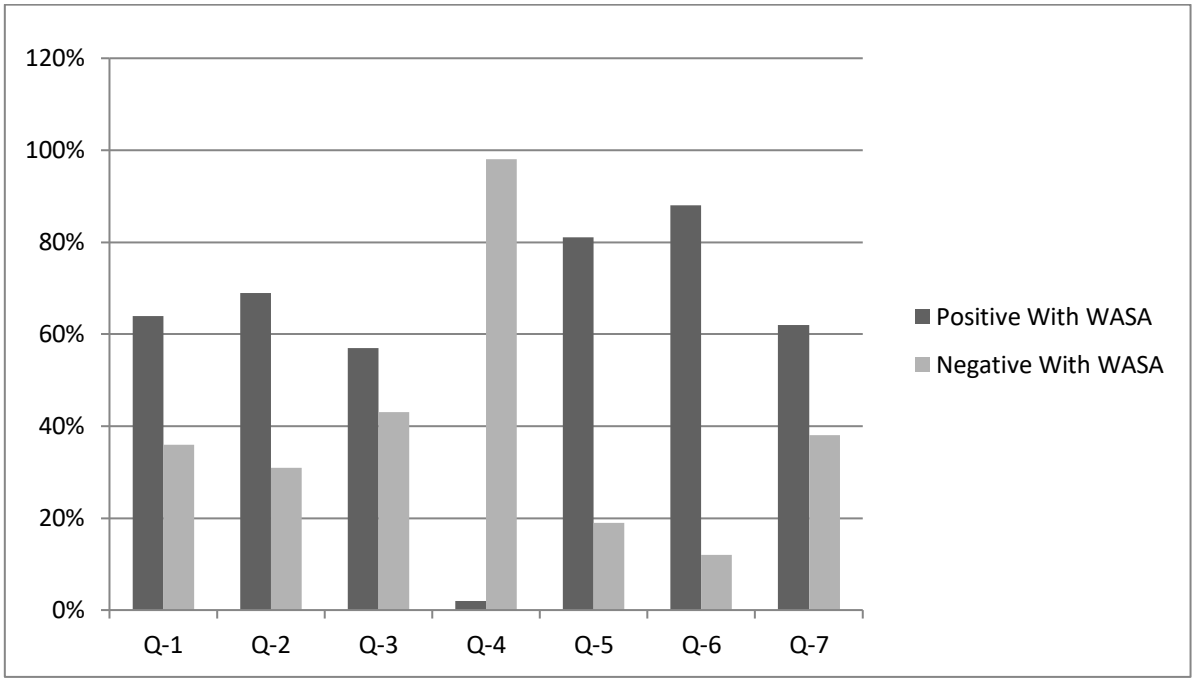
Do you feel Water test change suddenly or slowly?



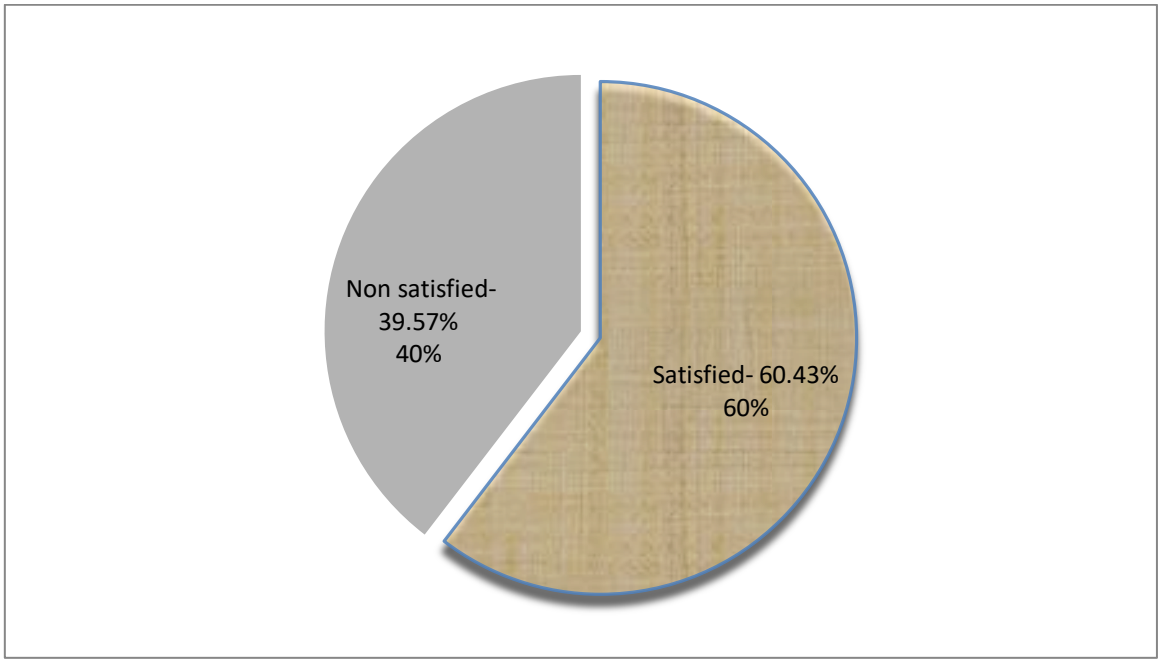
Do you suffer any disease and you think it's because of WASA water? (Last one year)?



If I say you Ranking WASA out Of 100 Score, How much you give overall?



Satisfaction level Q-1 to Q-7



Satisfaction level analysis result

- ***In your Opinion what type of change needs to do WASA for better service?**
- Clean water process.
- Use more filters process.
- Require more early maintenance.
- Regular quality test from supply zoon.
- More manpower.

4.3 Questionnaires survey report (Stakeholder):

1. What do you think, about the water quality of Dhaka WASA?

Decent, but they have some issues and they need to improve.

2. How can we improve the water quality of Dhaka WASA?

a) Treatment,
b) Distribution line improvement
c) Regular check
d) Need more public engagement

3. What type of Investment needs to improve the present condition of the water supply system of Dhaka WASA?

a) Capacity develops.
b) Build more infrastructure
c) Renewal

4. Do you have any important suggestions regarding this issue?

a) Public Awareness
b) Move to surface water use
c) Use modern technology for purifying

4.4 Laboratory lest report

Test No.	pH	Conductivity (µS/cm) Micro Siemens Per Centimeter	Turbidity (NTU) Nephelometric Turbidity Unit	Dissolve Oxygen (DO)mg/l milligrams per liter	Temperature °c	E.coli	Test and odor	Biochemical Oxygen Demand (BOD_5) mg/l - milligrams per liter
Sample 1	7.2	0.04	2.10	09.10	21.5	Absent	Good	5.7
Sample 2	7.0	0.05	3.57	08.80	20.0	Absent	Good	5.1
Sample 3	7.0	0.05	1.47	07.90	20.0	Absent	Good	4.7
Sample 4	7.1	0.04	2.14	11.00	20.5	Absent	Good	10.8
Sample 5	7.0	0.05	1.93	09.80	20.5	Absent	Good	7.9

SL.No	Water Quality Parameters	Unit	Bangladesh Standards for Drinking Water (ECR 97)	WHO Guideline Values, 1993	Water Condition of Selected Sample				
					Sample -1	Sample -2	Sample -3	Sample -4	Sample -5
1	pH	-	6.5-8.5	6.5-8.5	7.2	7.0	7.0	7.1	7.0
2	Conductivity	µS/cm	0.055	0.055	0.04	0.05	0.05	0.04	0.05
3	DO	mg/l	6.0	5.0	09.10	08.80	07.90	11.00	09.80
4	Temperature	°C	20-30	25	21.5	20.0	20.0	20.5	20.5
6	Turbidity	NTU	10	05	2.10	3.57	1.47	2.14	1.93
7	BOD_5	mg/l	5.00	5.00	5.7	5.1	4.7	10.8	7.9
8	E. coli	-	Negative	Negative	Negative	Negative	Negative	Negative	Negative
9	Test and odor	-	-	-	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

4.5 Discursion

1. From the Laboratory test result, it is seen that the quality of physicochemical parameter of selected area water is decent Condition, But DO is not so good Condition as-per standard value and also notice that BOD_5 are also similar.
2. From the survey we know that they have major Issue about water purify even they didn't trust WASA water is pure and we know 98% of people use any purification way before drink but another hand it notices overall 64% of people are happy using WASA water and WASA finally get 72% score from user feedback. And the other hand it's showing that base on questions one to seven with ordinary people answer analysis showing that around 60% satisfaction score get WASA Overall.
3. From the survey it knows that peoples get some visible object from WASA water, color change and peoples believe that they affected some disease for the reasons of WASA water.

Dhaka is a situated center in Bangladesh. Bangladesh is a developing and densely populated country .day by day population is increasing rapidly. When the population is increasing time peoples demand are increasing. This is a big challenge for authorities to fulfill their demand. A huge amount of peoples are using the water of WASA. All people use WASA water for many purposes .such as drinking, showering, cleaning cloth, etc.WASA water service area divides into ten zones. WASA mainly used groundwater for water sourcing purposes. Which people use WASA water they have many complaints about it? For this reason of research has focused on the assessment of the water quality of Dhaka WASA.WASA Water has a lot of problems, these problems increase day by day. People face many difficulties for this. In this research, something is clear which people are complaining about the water of WASA that is right. in this research we find some problem that is dissolved oxygen(**DO)** and biochemical oxygen demand (**BOD OF 5 DAYS**). Dissolved oxygen (DO) and Biochemical Oxygen Demand (BOD) are the two most important water quality parameters for the sustainability of human life. The water of WASA has been polluted to such an extent that DO and BOD is far away from the standard limit. Therefore, the water quality of WASA day by day decrees if seniors ensure good quality of water they analyze BOD and DO problem.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

- WASA needs to more care about water purification.
- The people have some vital role and WASA can organize some public awareness programs.
- For identifying the major sources of problem is that WASA needs to more capable and maintenance work, and build more infrastructure as per public demand.
- WASA can build some Lab area base or regularly collect the sample from door to door and test and maintain the quality and also collect public opinion.
- The major problem we find out that WASA didn't use any Chemical for water future influence resist Because we know that people are reserve water their tank for future use but somehow water line pipe inject by anything then there mixed lots of chemicals also bacteria, so they need to use something for the face that types of cases.
- WSAS have to maintain their pipeline properly
- WASA has to focus on the parameter of water and also maintain who water standard.
- Daily time series data of water quality parameters improve the water quality model by doing better prediction of the scenario. So, it is recommended to use daily time series data of water quality parameters instead of using water quality parameters data with large intervals.
- BOD levels must adhere to state environmental regulations
- High BOD levels can cause severe harm to wildlife and can make water unpalatable or even dangerous to human health
- High BOD can harm or kill aquatic life
- Changes in flow and loading rates can cause over or underfeeding of flocculants and coagulants. A properly sized EQ tank will help balance out your flow and loading rates. This will also help to properly size the polymer make-down feeder, keeping your initial costs down

- Using liquid chemistry allows for full automation of the process at a low cost, eliminates wetting issues and fish eyes (dissolved clumps of polymer particles), and opens up a wide range of treatment chemistries. It is also much easier to switch products when a drum or tote runs out than to wait or discard a palate of dry bag polymer.
- Ideally, you should inject the coagulant first as far upstream as possible. This would be where the wastewater comes out of the EQ tank, ahead of the transfer pump. Inject the polymer into a port in the flocculate tube. You'll need a sample tap placed ahead of the polymer injection port to check the coagulant dose for pin flock formation. Another sample port downstream of the polymer injection port checks the effectiveness of your chemicals before entry into the DAF. You can then make adjustments before the effluent comes out of the DAF.

5.2 Limitations

When this project is on processing that time some limitation makes this project difficult, these limitations are write down here:

- When this project is on processing that time is a bad time for every people because of covid-19.in this pandemic situation every people are appalled. nobody doesn't come out from the house therefore clarified information is missing in this project.
- This project needs at least five hundred ordinary people interview and also need fifty stakeholders interview. in this covid-19 situation, this is impossible to do then we take interview only a hundred ordinary people and fifteen stakeholders.
- Ordinary People have some problem with the WASA water supply but they don't want to explain it to anyone. People think if they are explained their problem to anyone they face more problem from WASA.in this situation very difficult to observe their problem and expectation.
- Bankroll is the most important thing in this project. as a student, we have some financial problems because we don't have any outside financial support so that clarified laboratory test are dues. These tests are so expensive for us.
- In this covid-19 situation, most of the labs are closed and some are open but the technician is absent.
  When a sample gives them for testing they say this test needs seven days but this test is complete in twenty-five days.
- Some tests have to do personally but we can't complete the test due to instruments and chemicals.

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Appendix

Water quality parameters of Bangladesh and WHO

Sl no	Water quality parameters	Bangladesh standards Mg/L	WHO guideline	Methods/equipment's
1	Aluminum	0.2	-	Atomic Absorption Apectrophotometer (AAS)
2	Aluminum	0.5		UV-VIS
3	Arsenic	0.05	0.01	AAS
4	Barium	0.01	0.7	AAS
5	Benzene	0.01	0.01	Gas Chromatograph
6	BOD 5 Day, 200C	0.2	-	5 days Incubation
7	Boron	1.0	-	UV-VIS
8	Cadmium	0.005	0.003	AAS
9	Calcium	75	-	AAS
10	Chloride	150-600	-	Titrimetric
11	Chlorinated Alkenes			
11.1	Carbontetrachloride	0.01	0.004	Gas Chromatograph
11.2	1.1 Dichloroethelene	0.001	0.03	Gas Chromatograph
11.3	1.2 Dichloroethelene	0.03	0.03	Gas Chromatograph
11.4	Tetrachloroethelene	0.03	0.04	Gas Chromatograph
11.5	Trichloroethelene	0.09	0.07	Gas Chromatograph
12	Pentachlorophrnol	0.03	0.009	Gas Chromatograph
12.1	2,4,6-Trichlorophenol	0.03	0.2	Gas Chromatograph
13	Chlorine (Residual)	0.2	-	Titrimetric
14	Chloroform	0.09	0.2	Gas Chromatograph
15	Chromium (Hexavelent)	0.05	-	Iron Chromatograph
16	Chromium (Total)	0.05	0.05(P)	AAS
17	COD	4	-	Closed Reflux Method
18	Coli form (Faecal)	0 CFU (N/100mL)	0	Membrane Filtration Method
19	Coli form (Total)	0 CFU (N/100mL)	0	Membrane Filtration Method
20	Color	15 Hazen	-	Colour Comparator
21	Copper	1	2	AAS
22	Cyanide	0.1	0.07	UV-VIS/Specific Ion

				Electrode
23	Detergent	0.2	-	UV-VIS
24	DO	6	-	Multimeter
25	Electric Conductivity	-us/cm	-	Multimeter
26	Fluoride	1	1.5	UV-VIS
27	Hardness as CaCO3	200-500	-	Titrimetric
28	Iodine	200-500	-	Titrimetric
29	Iron	0.3-1.0	-	AAS
30	Kjelhl Nitrogen (Total)	1	-	UV-VIS/ Digestion
31	Lead	0.05	0.01	AAS
32	Magnesium	30-35	-	AAS
33	Manganese	0.1	-	AAS
34	Mercury	0.001	0.001	Mercury Analyzer
35	Nickel	0.1	0.02(P)	AAS
36	Nitrate	10	50.0 as N	UV-VIS
37	Nitrite	<1	3.0(0.2)	UV-VIS
38	Odour	Odourless	-	Threshold Method
39	ORP (Eh)	-	-	ORP meter
40	Oil and Grease	0.01	-	Oil and Grease meter
41	pH		6.5-8.5	pH Meter
42	Phenolic Compounds	0.002	-	Gas Chromatograph
43	Phosphate	6	-	UV-VIS
44	Phosphorus	0	-	Digestion
45	Potassium	12	-	AAS
46	Radioactive Materials (Gross Alpha Activity)	0.01 Bq/L	0.5 Bq/L	-
47	Radioactive Materials (Gross Beta Activity)	0.1 Bq/L	1.0 Bq/L	-
48	Salinity	-%0	-	Multimeter
49	Selenium	0.01	0.01	AAS
50	Silver	0.02	-	AAS
51	Sodium	200	-	AAS
52	Suspended Solids	10	-	Filtration and Drying
53	Sulphide	0	-	UV-VIS
54	Sulphate	400	-	UV-VIS
55	Taste	-	-	Threshold Method
56	Total Alkalinity	-	-	Titrimetric

57	Total Dissolved Solid	1000	-	Multimeter
58	Temperature	20-30C		Thermometer
59	Tin	2	-	AAS
60	Turbidity	10 NTU	-	Turbidity meter
61	Zinc	5	-	AAS

Table 2: The safe limits of WHO and NDWQS for determining drinking water quality

parameters	**WHO limits**	**NDWQS limits**
PH	6.5–8.5	6.5–9
Conductivity (μS/cm)	-	1000
Turbidity (NTU)	5	-
TSS (mg/L)	-	25
TDS (mg/L)	1000	1000
Cu (mg/L)	2	1
Zn (mg/L)	None	3
Mg (mg/L)	none	150
Fe (mg/L)	0.3	0.3
Cd (mg/L)	0.003	0.003
Cr (mg/L)	0.05	0.05
Pb (mg/L)	0.01	0.01
As (mg/L)	0.01	0.01
Hg (mg/L)	0.006	0.001
Sn (mg/L)	-	-