POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

CASE STUDY OF WATER SUPPLY DISRUPTION IN TAMAN TTDI JAYA, SHAH ALAM, SELANGOR.

AINA BINTI KAMARUDDIN

(08DKA20F1066)

DEPARTMENT OF CIVIL ENGINEERING

1:2022/2023

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Laporan ini dikemukakan kepada Jabatan Kejuruteraan Awam sebagai memenuhi sebahagian syarat penganugerahan Diploma Kejuruteraan Awam

DEPARTMENT OF CIVIL ENGINEERING

1:2022/2023

AKUAN KEASLIAN DAN HAK MILIK

TAJUK PROJEK:

KAJIAN KAJIAN KES GANGGUAN BEKALAN AIR DI TAMAN TTDI JAYA

1. Saya, **AINA BINTI KAMARUDDIN (NO KP: 020721100414)** adalah pelajar
   Diploma Kejuruteraan Awam, Politeknik Sultan Salahuddin Abdul Aziz Shah, yang beralamat di **Persiaran Usahawan, Politeknik Sultan Salahuddin Abdul Aziz Shah, 40150 Shah Alam, Selangor, Malaysia**. (Selepas ini dirujuk sebagai 'Politeknik tersebut').

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AINA BINTI KAMARUDDIN)

(No. Kad Pengenalan: 020721-10-0414))

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AINA BINTI KAMARUDDIN

Di hadapan saya, JAZLINA BINTI MUHAMMAD (810628035984)

…….

sebagai Penyelia Projek pada tarikh: 15/12/2022)

ACKNOWLEDGEMENTS

First and foremost, I would like to express my special appreciation and thanks to my educators Puan Jazlina Binti Muhammad, and Puan Rabeah Adawiyah Binti Hashim, you have been a tremendous mentor for me. I would like to thank you for encouraging my case study and for allowing me to push beyond my boundaries and step out of my comfort zone. Your advice on both case study as well as on my studying journey as a student pursuing in Civil Engineering have been invaluable.

I thank my studying institution Polytechnic Sultan Salahuddin Abdul Aziz Shah for providing a whole class access dedicated solely for executing my Final Year Project assessments.

I thank TTDI Jaya residents who took part in answering a questionnaire prepared by me and my team in order to further understand the issue that took part at the main location of my case study.

I would especially like to thank to Mr. Haji Muhammad Sofi Bin Ibrahim, an engineer with former experience at Melaka Water Resource for providing detailed explanations on several topics regarding water disruptions as well as the operation systems in Selangor. I would also like to thank Mr. Muhammad Zaim Zaki, the Deputy Head of Region in Distribution department at Air Selangor Sdn. Bhd for giving thorough explanations behind the regulations, law enforcements, and overall, the construct of water operation systems for Taman TTDI Jaya area and Selangor. I give our utmost thankful regards and appreciation to both of them for giving me the chance to further educate myself regarding this important matter, the knowledge they provided holds a significant weight and contribution towards the research of my case study.

I would also like to pass my thanks and appreciation to the agency Lembaga Urus Air Selangor (LUAS) for providing me with important information that holds a valuable insight for our data analysation. Their cooperation to help us with my case study is extremely important to me.

Finally, I would like to express my deepest appreciation to my family and friends who have lend me endless help and support as well as encouragements to never give up and carry on with my case study. My father, mother, my older brother and sisters, and my close friends, I deeply appreciate them for every ounce of their support and for always being there when it gets challenging. Sincerely, from the bottom of my heart, Thank you.

ABSTRACT

Water is widely known as an essential to every living creature on this planet. The absence of clean water could lead to various short- and long-term chronic crisis. In Malaysia, Selangor is the most developed state with rapidly increasing development and ever growing numbers of population. Despite the progressive development, the state of Selangor is also known for its bizarrely high amount of water disruption cases that occurs almost every year in multiple areas. With that being said, this case study will emphasise on the water supply disruption that has become an expected occasion for the locals living in Selangor. The main location of this study will be at Taman TTDI Jaya, Shah Alam, Selangor. For resources and networking, multiple methods of online inspection have been carried out such as reading blogs, social media, news articles and other scientific readings available online. The research shows that the source of water supply disruption in Selangor comes in many factors, some of which are the water supply company's mismanagement and even the government's lack of consideration towards citizens welfare itself. The implication towards this problem will produce difficulty towards patronages and creates complicated matters. This phenomenon has changed the trajectory of people's everyday lives.

Keywords: *Water, Water supply disruption, Taman TTDI Jaya, Selangor*

ABSTRAK

Air dikenali secara meluas sebagai keperluan untuk setiap makhluk hidup di planet ini. Ketiadaan air bersih boleh menyebabkan pelbagai krisis kronik jangka pendek dan panjang. Di Malaysia, Selangor adalah negeri yang paling maju dengan pembangunan yang semakin pesat dan bilangan penduduk yang semakin meningkat. Di sebalik pembangunan yang progresif, negeri Selangor juga terkenal dengan jumlah kes gangguan air yang tinggi yang berlaku hampir setiap tahun di beberapa kawasan. Dengan itu, kajian kes ini akan memberi penekanan kepada gangguan bekalan air yang sudah dijangkakan oleh penduduk tempatan yang tinggal di Selangor. Lokasi utama kajian ini adalah di Taman TTDI Jaya, Shah Alam, Selangor. Untuk sumber dan rangkaian, pelbagai kaedah pemeriksaan dalam talian telah dijalankan seperti membaca blog, media sosial, artikel berita dan bacaan saintifik lain yang tersedia dalam talian. Penyelidikan menunjukkan punca gangguan bekalan air di Selangor berpunca daripada banyak faktor, antaranya adalah salah urus syarikat bekalan air malah kurangnya pertimbangan kerajaan terhadap kebajikan rakyat itu sendiri. Implikasi terhadap masalah ini akan menghasilkan kesukaran ke arah naungan dan mewujudkan perkara yang rumit. Fenomena ini telah mengubah trajektori kehidupan seharian manusia.

Kata kunci: *Air, Gangguan bekalan air, Taman TTDI Jaya, Selangor*

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LIST OF SHORTFORMS

TTDI	Taman Tun Dr Ismail
WTP	Water Treatment Plant
SSP1	Sungai Selangor Phase 1
SSP2	Sungai Selangor Phase 2
SSP3	Sungai Selangor Phase 3
SYABAS	*Syarikat Bekalan Air Selangor*
LUAS	*Lembaga Urus Air Selangor*
SPAN	*Suruhanjaya Perkhidmatan Air Negara*
AIPA	*Akta Perindustrian Air*
MSCL	Mild Steel Cement Line
HDPE	High Density Polyethylene
IWK	Indah Water Konsortium
SJAM	*Skim Jaminan Air Mentah*

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CHAPTER 1

INTRODUCTION

1.1 Background

Water resources is a very important element in human life, without resources sufficient water is impossible for humans to continue to survive. However, nowadays the supply of clean water sources is declining while demand for it is increasing in line with the increase in population the population of the State now. The emphasis in the industrial sector is also causing this to happen increased demand for tap water. Perhaps the question arises among us why such a situation can occur, albeit frequently, while we have abundant water resources in around us.

1.2 Problem statement

Lately, the supply for clean water has frequently been disrupted, simultaneously, the demand for clean water has been increasing on par with the increasing population. The problem arises when conflicts regarding the lack of water supply among the citizens appears. It has made daily lives harder. People must go hard way to receive clean water.

On another perspective, sectors such as businesses or development works were impacted as well, this results in a halt towards community progression. The delay on projects and profits results in major financial and time loss.

Another problem is that it affects the general health of citizens. Water is important for recovery and frequent water supply disruption the community's health will plummet thus decreasing their productivity.

1.3 Objectives

Some objectives we have discovered for the purposes of this studies are:

1. To study previous cases related to water supply disruption.
2. To determine the factors of frequent water disruption.
3. To suggest the solution for frequent water disruptions.

1.4 Scope of studies

The primary issue with the water supply disruption phenomenon is not only does it happen, but that it occurs way too frequently, especially for an area with dense population. With that being said, the research of this study will focus on the issue of water supply disruption that frequents the living communities.

In order to further attain thorough information regarding this issue, we will be studying previous water supply disruption cases that has occurred in various areas in Selangor. On the other hand, the prime area we will be focusing on is in Taman TTDI Jaya, Shah Alam, Selangor. The method of gathering intel, data, and researching will be approached in a mix method, more specifically, using the qualitative as well as quantitative researching methods.

At the end, after doing research and gathering information from the previously mentioned methods, we will further brainstorm to scan a pattern and identify the possible causes to the reoccurring water supply disruptions. Once we have gathered the bundle of information, we will attempt to suggest a possible solution to this issue using the obtained information and based on our own knowledge on civil engineering studies.

CHAPTER 2

LITERATURE STUDY

2.1 Introduction

Literature study is a study based on actual theories that are used in many fields related to the main topic such as journals, articles, books or newspapers. For this chapter, several theories about this topic in this study will be prioritised such as the background, characteristics. As we all know, Water is a critical resource. It is the backbone of human life and culture, ecological functions, and economic activities. However, in many nations the demand for water is increasing at rates which are outstripping traditional supply sources. This is leading to a crisis of water management in many locations which is acknowledged in various international declarations (United Nations 2001; 2003).

A great variety of solutions have been developed to manage shortfalls between water availability and demand. These solutions can be broadly categorized into two approaches: increasing supply based, and decreasing demand based. Supply-side solutions range from small-scale decentralized approaches including water saving household appliances, informal reuse of water, rainwater tanks, and household level wastewater treatment systems. Said innovations are discussed by Allon and Sofoulis (2006). Bigger scale centralised solutions include city-wide wastewater recycling systems and seawater desalination plants, which both are implemented in various locations around the world (see for example: Government of Western Australia 2003). Despite Australia being prone of drought, a policy escalation has only recently been to address this through sources augmentation in various major urban centres. The use of alternative water sources concurrently increased across the country. The use of recycled water in Australia is increasing, and currently accounts for 4% of total consumption (Australian Bureau of Statistics 2006), thus there is increasing potential for research on actual use of these alternative water sources. Demand-side (decreasing demand) solutions include initiatives such as increasing efficiency of appliances and water use restrictions. In Australia such restrictions are frequently imposed on households, industry, and farmers during periodic water shortages (Nancarrow et al. 2002). Restrictions are also commonplace in other countries for example in China (Rattay et al. 2006).

2.2 Water supply sources and distribution in Malaysia

The primary source of water supply in Malaysia comes from rainwater, which produces 90% of Malaysia's water supplies (EPU, 2010). Malaysia has seen an unprecedented demand on its water supplies due to fast economic expansion (Anang et al., 2019). Large amount of the supply is focused on agriculture, which consumes 62% of the total water supply, followed by industrial at 21%, and domestic at 17%. Malaysia's water consumption is predicted to exceed 20 billion m3 by 2020, with agriculture being the dominant consumer. As preparation for this, the priority should be on improving the water usage management rather than water supply management.

The demand of water in Malaysia noticeably increased starting from 1980 (8.9 billion m3) to 2000 (15.5 billion m3) in agricultural, industrial, and domestic activities. The increasing population and urbanization will also lead to aggravate the water shortage because of water demands (Chen et al., 2020).

Regardless, the rise of newer water problems such as pollution, destruction of water catchment areas, water waste, high non-revenue water (NRW), low tariffs, and a lack of public knowledge on water conservation have led to the declination of Malaysia's water supply resources (Chan, 2004). According to Lai et. al (2016), Malaysia's NRW problem is not only a technological issue, but also a matter of poor governance and management. The research proves that the public engagement when it comes to water policy is often unappreciated. Several positive stories have emerged from Malaysia's water utilities in terms of public engagement as a solution to the NRW problem.

2.3 Water disruptions in Malaysia

Being in a tropical region, Malaysia is blessed with an abundance of water supply, sourced mainly from rainwater. Water shortage is unheard of in this country. However, despite that, there are some areas with water pressure in Malaysia that faces water shortages, having difficulty getting water for mobile uses from lack of resources and lack of raw water. This can lead to water crisis. In situations like this, the demand of potable water in a region is higher than the supply of potable water, especially during dry times. To note, the state of Selangor recorded the biggest problem of water supply in Malaysia in recent years. According to a report by the Malaysian Water Association, 49.5% of all water supply problems in Malaysia were reported in Selangor. Whereas in 2017, the number increased to 62.4% (Malay Mail, 2019). Nowadays, water shortage is no longer considered a natural disaster that must be borne and accepted but instead is a human-made cause that can be dealt with and solved by humans.

According to a study by Haliza Abdul Rahman from Universiti Putra Malaysia titled *'A review on water issues in Malaysia'*, one of the reasons water disruptions continue to occur in Selangor is due to the state's very little amount of treated water storage. The water reserve margin in Selangor in 2017 was at zero percent, which was identified as one of the main factors behind the State water problem. If a pipe breaks, a water treatment plant is damaged or a sudden increase in water demand, such as during the festive season, it is very likely that certain areas in Selangor will experience water disruption.

The author also mentioned another reason behind the recurring water problem is the lack of improvement in the water supply and distribution system despite the rapid development of Selangor for several years now. Broken pipes often occur because the pipes originated when Selangor water demand was not as high as it is now, and the design were not made to deal with the rising pressure. In 2020, Selangor used more water (234 litres per capita) than the national average (209 litres per capita, the highest in Southeast Asia). Although the per capita consumption of the State of Selangor is not much different from 1998 (228 litres per capita), the population has increased significantly since then (The Malaysian Times, 2019). There is also a problem with the layout of the pipe itself. The water distribution system in Selangor follows a radial pattern. Although there are advantages to this layout, a broken pipe will at least cut off the water supply for the entire area.

2.4 History of water supply disruptions in Selangor from 2020 to 2021

It is an obvious fact known across the nation that the water disruptions issues in Selangor are increasingly becoming a problem, continually leaving millions of households high and dry for several days to even a week with notice issued only at the last-minute causing inconveniences to businesses and industries reliant on steady water supply.

The rivers that are most polluted are Sungai Semenyih and Sungai Selangor. For instance, Klang Valley is repeatedly hit by water cuts, resulting in observers once again questioning the water management agencies' efficiency.

Ranging from burst pipes to river streams being polluted with solvents, here is a list of water disruptions in the state since the start of the year:

(Choong, Jerry, "A history of water cuts in Selangor this year" *Malay Mail, 21 October 2020)*

- 7 February 2020

  57 areas in Gombak faced water disruption due to a burst pipe at the Hulu Kelang pump house. Repair works were completed by 6.30pm on the same day, with the water supply returning to normal within 24 hours.

- 17 March 2020

  Water treatment plants in Sungai Selangor (WTP) Phase 1 (SSP1), Phase 2 (SSP2), Phase 3 (SSP3) and Rantau Panjang were forced to halt operations after odour pollution was detected at the raw water intake source in Sungai Selangor. The water supply was fully restored only the next day.

- 16 April 2020

  Another round of odour pollution resulted in the Sungai Selangor Water Treatment Plant (WTP), Phase 1 (SSP1), Phase 2 (SSP2) and Phase 3 (SSP3) shutting down, affecting 1.2 million users in KL, Petaling, Klang, Shah Alam, Kuala Selangor, Hulu Selangor, Gombak and Kuala Langat. Operations resumed the following morning, with the water supply slowly restored to normal starting at noon for the next 24 hours.

- 11 June 2020

  A water pipe near Jalan Langat in Klang burst, affecting the areas of Bandar Bistari and Batu 5 and 6. Repair works were completed by 1.30pm on the same day, and water supply completely restored by 2am on June 12.

- 14 July 2020

  Almost 300 areas were affected by a scheduled water disruption due to repair and improvement works to the Sungai Selangor Phase 3 Water Treatment Plant. The works were completed on July 17 and the plant fully operation by 5pm, by which time nearly 90 per cent of those affected had their water supply resumed.

- 11 August 2020

  20 areas in Gombak faced another round of water disruption, this time due to scheduled upgrading and replacement of critical assets at the Sungai Gombak Water Treatment Plant. The water supply was fully restored by 9.30am the following day.

- 3 September 2020

  1,292 areas in the Klang Valley, Petaling, Klang/Shah Alam, Kuala Selangor, Hulu Selangor, Gombak and Kuala Langat experienced an unscheduled water supply disruption, following the halting of operations the water treatment plants in Sungai

Selangor Phases 1, 2, 3 and Rantau Panjang, due to odour pollution that was later identified to have come from a factory in Rawang. This disruption was the longest for Selangor in 2020 yet, with the supply fully restored by 9am six days later.

- 4 October 2020

  The water treatment plants in Semenyih, and Bukit Tampoi ceased operations at 4.30pm, leaving 274 areas in Petaling, Hulu Langat, Kuala Langat and Sepang without water. The cause was attributed to odour pollution said to have originated from the Nilai Industrial Estate in Negri Sembilan, which entered Sungai Semenyih from Sungai Batang Benar. Sungai Semenyih resumed operations on October 6, followed by Bukit Tampoi the following day, with water supply restored in stages within the next 24 hours.

- 20 September 2021

  In Petaling Jaya, Residents in the USJ 1 to USJ 27 area in the Petaling district are experiencing water supply disruptions and low water pressure on a Saturday (Nov 20). Air Selangor said the water disruption in these areas was due to an 'air lock' technical problem on the main distribution pipe that carries water to the Sime UEP Water Pool in Kg Kenangan in Puchong.

- 13 October 2021

  1000 areas in Klang valley experienced a four-day water supply disruption as a result of repair and maintenance works at the Sungai Selangor Phase 1 water treatment plant. Air Selangor said the works, which had been pushed down from their original schedule for 2019 and 2020, followed incidents of water pollution which had caused unscheduled large-scale disruptions to water supply. About 105 water tankers were sent to the affected areas with priority given to critical premises such as hospitals and dialysis centres. Eighteen public water taps were also provided from Oct 14 to 16 for users who require water supply during this period.

2.5 Other water issues in Malaysia

Poor water management severely causes billions of people and the environment to suffer from not being able to access water resources. If properly managed, it is possible to give everyone a sufficient equal share of these water resources. The high rate of population increase is so rapid and high that water resources can be distributed to serve everyone's needs, but not everybody's wants or greed.

Other than that, the lack of clean water, water pollution, urban flood disasters, and environmental degradation around rivers or catchment areas are some of the problems related to water problems in Malaysia. For example, the fast development in Malaysia through economic growth and land development in recent decades has had a significant impact on the environment, which contributes to the deterioration of water quality in urban river basins such as in the Klang Valley and Langat Valley. The level of pollution in the river is a significant cause of concern as it is an essential source of water supply for economic development and domestic consumption. Reports show that the downward trend from year to year has caused the problem of water pollution to become increasingly dangerous.

Moreover, the Klang valley and Langat valley had a severe shortage of clean water in early 1998 mainly due to logging and upland indirectly for housing, diesel pollution from quarries near water treatment plants in the upper Langat district, and others -other pollutants from more than 100 factories along the river. The effects exacerbate this issue it also comes from prolonged drought (El Nino phenomenon), increased non-revenue water loss and lack of resource management (Ngah & Othman, 2011)

2.6 Summary

The main objective of this study is to identify the factors and effects of water supply disruption to the community in Selangor areas as reference to local governments to plan strategies to address water problems. Most of the previous results show that the most dominant factor was due to the lack of capacity of water treatment plant while the most dominant effect was causing reproductive diseases that affect health. The water crisis is due to several factors such as climate, development activities, and so on that affect the society in economic, social, or political sectors and activities. Many methods are adopted to ensure uninterrupted water supply services, such as daily dam capacity monitoring, optimising daily drainage, cloud seeding, and encouraging water conservation by users, however this is insufficient if the community is not aware. The local community in Selangor needs to take care and protect the water supply by raising awareness and concern about water issues to maintain water sustainability. Clean water quality ensures the well-being of the community. The community also needs to be sensitive and concerned when they see leaking pipes and so on, by reporting to the authorities so that these issues can be addressed immediately.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The research methodology describes the approaches, methods, and techniques to attain the study's objectives and aims for this. The research approach makes the study more methodical and the research journey more focused on reaching the goals. This study is very suitable as the factors and effects of disruption of water supply in Taman TTDI Jaya, Shah Alam, Selangor. This chapter will describe this study's research methodology. Studies and tactics for gathering information and data using certain guidelines.

3.2 Research design

The following figure depicts the research framework and the conceptual framework. As stated in the research framework, we will research by using two data collection strategies to achieve the study findings, this is known as primary data and secondary data. Meanwhile, for the conceptual framework which depicts research of analysing the factors and effects of water supply disruption in Shah Alam Selangor, which we will obtain by using items such as questionnaire to determine which factors and effects are the most influential on water supply disruption.

3.2.1 Project Type of study

Data collection studies

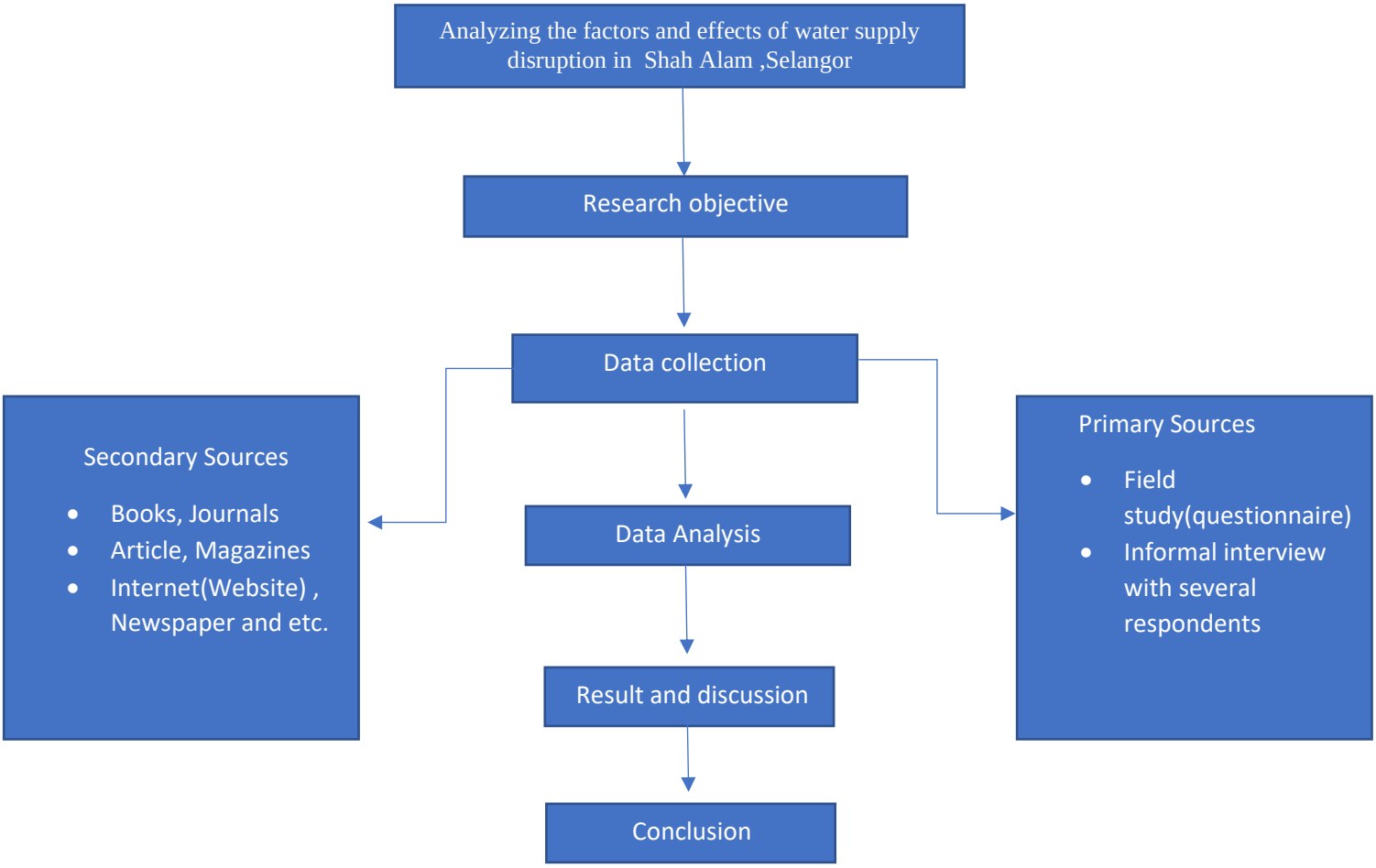

Diagram 3.2.1.1 Data collection studies

This study uses two types of data sources, namely primary data and secondary data. Primary data were obtained through a questionnaire session and qualitative method (interview) with residents from Shah Alam, Selangor Respondents will be contacted by phone and email. They are be briefed on the purpose of the study and their rights as responded. All the conversations and discussion will be recorded audio and documented. As a researcher we will select the study of respondents based on the random sampling. From this random sampling method, we will identify and select the study sample based on the opportunity and probability of the population to be the sample in this study. Respondents must be of various races, ages, educational levels, and family sizes. Therefore, a questionnaire session was conducted to obtain feedback from the respondents. This study also used secondary data. Secondary data were obtained through books, articles, journals, newspapers related to water problems and research topics.

Data Analysis Methods

This study employs two data analysis methodologies: quantitative research methods and qualitative research methods. A questionnaire session and a qualitative approach (interview) with locals were used to collect primary data. Respondents must be of various races, ages, educational levels, and family sizes. Secondary data were gathered from books, articles, journals, and newspapers on water issues and research themes. We as the researcher using record keeping which means that we also refer the already existing reliable documents and similar sources of information as the data source. This data can be used in our research based on our location to get more information about our case study. The obtained data will be examined throughout the analysis phase, and the results will be shown in the form of pie charts, bar graphs, and tables. Once we have gathered all the data and information's we needed from our methods of research, we will convert the numbers and information's in various graphics such as charts and graphs. With graphics, we will be able to dismantle and determine the information's we receive a lot easier. To sum it up, readers will be able to imagine and grasp the information's, further understanding the stories behind the collected miscellanies from our research.

3.3 Summary

To conclude this chapter, in the beginning stage, the study design, data collecting methods, techniques, and data analysis methods are made systematically in the study methodology to know the facts and information to support and describe this study more clearly. Referring to the data we obtain, problems can be identified and with that, several solutions can be made to be given as suggestions for water agencies such as SYABAS, local authorities or even the local government. In best case scenario, these agencies can retrieve ideas from our research. They will be able to conduct multiple ways to manage this reoccurring cycle of water disruptions issue, so in the future, the possibility of this issue happening will be less common.

CHAPTER 4

RESEARCH OUTCOMES AND DATA ANALYSIS

4.1 INTRODUCTION

After collecting all data and information, an analysis process is conducted to observe the outcomes from the data collection.

The results obtained in this chapter are the results obtained from questionnaires and research interviews from engineers and agency officials from Lembaga Urus Air Selangor (LUAS) and Pengurusan Air Selangor Sdn. Bhd., that have been carried out in the study area. The data resulting from the experiment in the study area is analysed in more detail to draw conclusions based on the research objectives that have been stated.

The questionnaire was conducted through Google Forms by respondents from Taman TTDI Jaya citizens. There are several aspects in the questionnaire that are the main focus which are divided into 3 sections:

1) Section A: Respondent's profile
2) Section B: Respondent's resident information
3) Section C: Water disruption issues and solutions

On the other hand, as an effort to obtain a much more intricate details and information, we have conducted several interview sessions with engineers and agency officials regarding our questions on water supply system and water supply disruptions.

4.2 Questionnaire

4.2.1 Section A: Respondent's profile

4.2.1.1 Respondent's gender

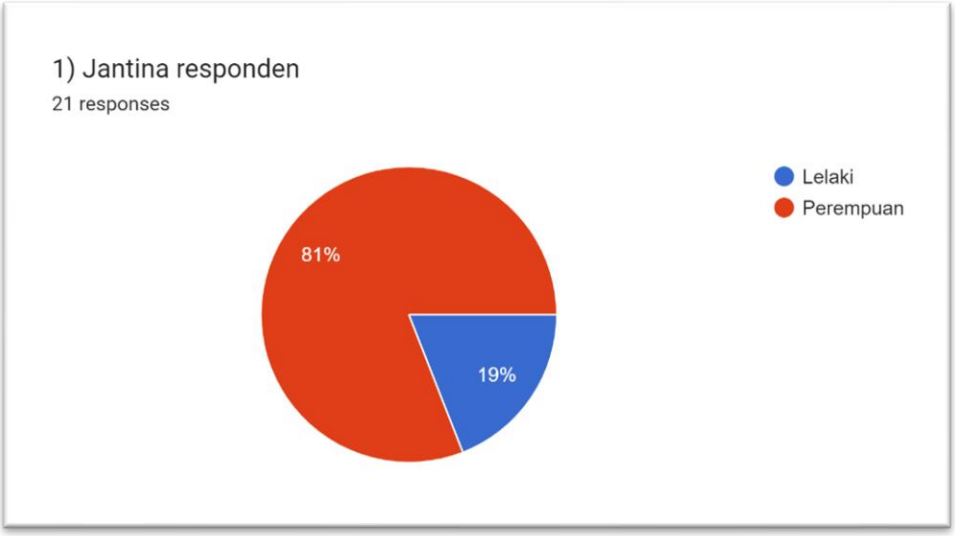

Diagram 4.2.1.1 Respondent's gender

Diagram 4.2.1.1 shows the number of TTDI Jaya citizens who responded to the study. A total of 19% of the respondents are men while 81% of the respondents are women.

4.2.1.2 Respondent's age group

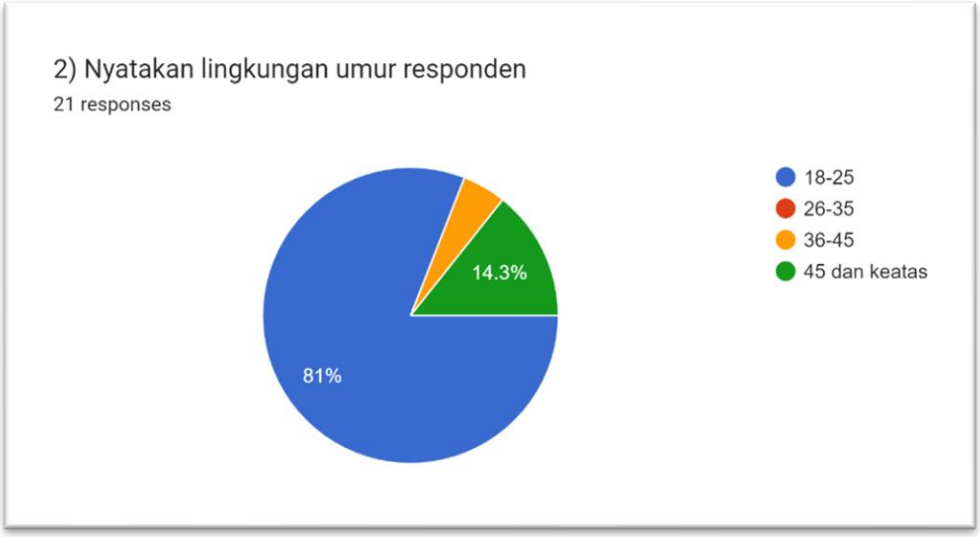

Diagram 4.2.1.2 Respondent's age group

Next, the results of the study found that a total 81% respondents of whom were between 18-25 years old, answered this questionnaire. This is because, they consist of higher education students and young adults. Most of them are citizens who live in a rented house. Next, 4.8% respondent are aged 36-45 years old. While 14.3% of respondents consisted of 45 years old and above.

4.2.1.3 Respondent's occupation

Diagram 4.2.1.3 Respondent's occupation

Diagram 4.2.1.3 shows the results of a study about the respondent's occupation. A total 76.2% of respondents are students. Next group of respondents are lecturers at 14.3% of response. Meanwhile, a total of 4.8% respondents are self-employed. Also, we receive a miscellaneous respondent who claims to be a housewife, which makes up 4.8% of the whole respondents.

4.2.2 Section B: Respondent's residence information

4.2.2.1 Resident's years of living in the area

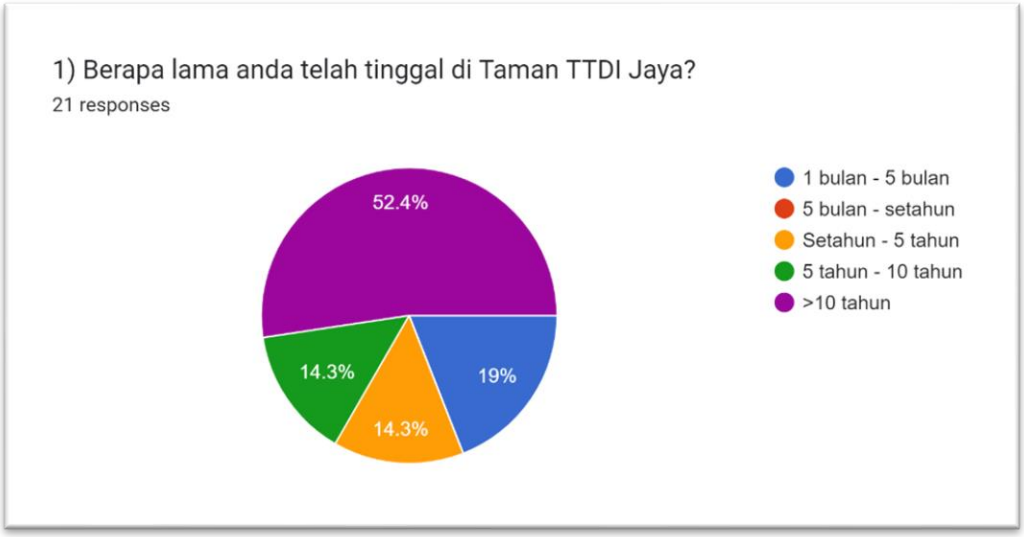

Diagram 4.2.2.1 Resident's years of living in the area

Diagram 4.2.2.1 shows the data of respondent's years of living in Taman TTDI Jaya. 19% of the respondents has been living in this area for 1 to 5 months. The next group of people consists of 14.3% of respondents has stayed for 1 to 5 years in this area. Afterwards, we have respondents who has been living in area for 5 to 10 years at 14.3%. Finally, this group has lived the longest in Taman TTDI Jaya for more than 10 years at 52.4%, this group also makes up the largest percentage of data.

4.2.2.2 Type of residence

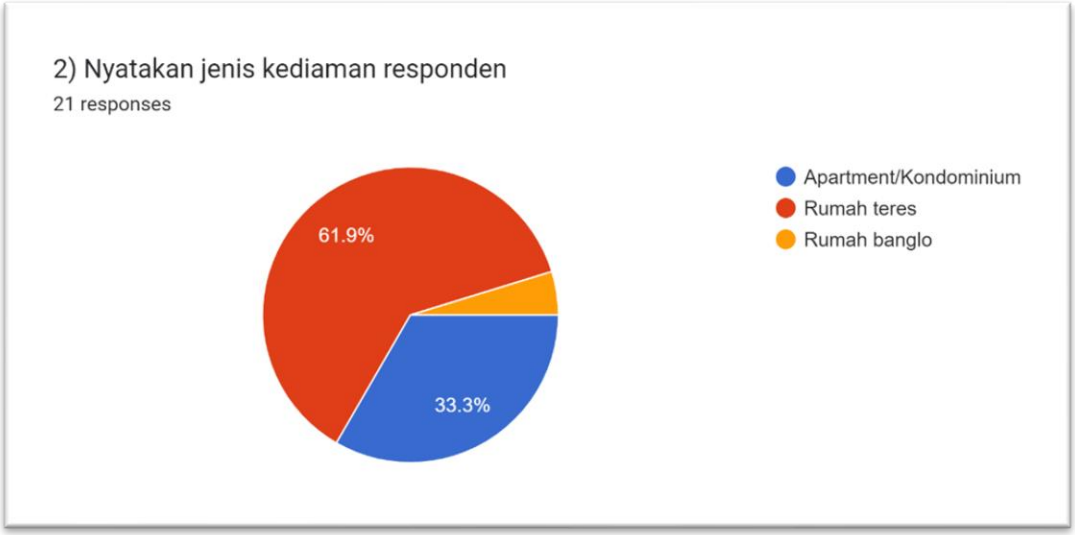

Diagram 4.2.2.2 Type of residence

Diagram 4.2.2.2 shows a diagram of the type of residency that are used by the respondents. The data obtained shows two category, which are terraced house and apartments/condominiums respectively. At 61.9%, consists of people is living in an apartment or condominium. On the other hand, about 33.3% respondents lives in a terraced house. Lastly, 4.8% of respondents lives in a bungalow house.

4.2.2.3 Respondent's water supply source

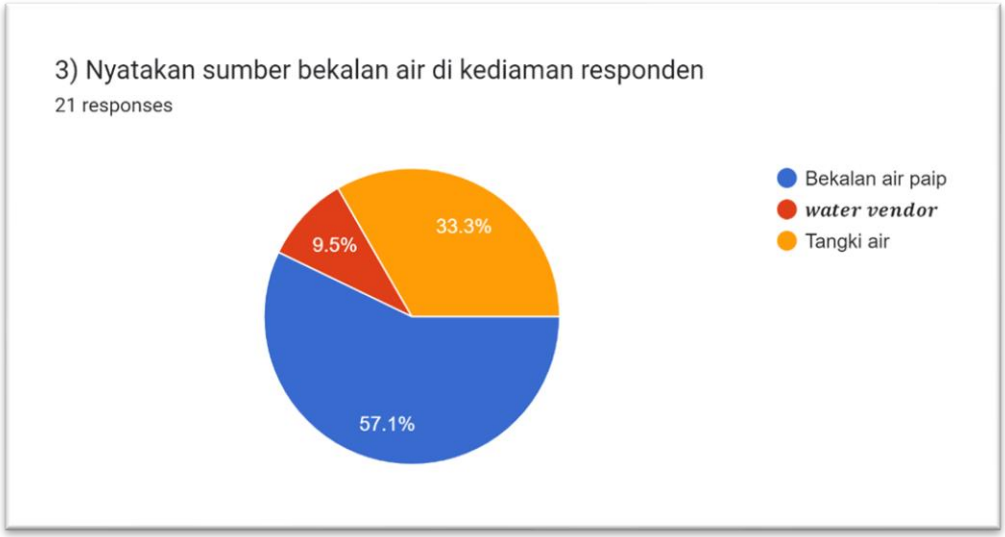

Diagram 4.2.2.3 Respondent's water supply source

Diagram 4.2.2.3 shows a pie chart of the type of water supply resources that are used by the respondents at their home. 57.1% of people uses water supply from pipes as water source. Next is the water sources supplied by water vendors, 9.5% of respondents received their water supply from this source. This is also the least used water source used by respondents. For the last group, the source is from water tank, this group is made of 33.3% respondents.

4.2.2.4 Main use of water supply in residence

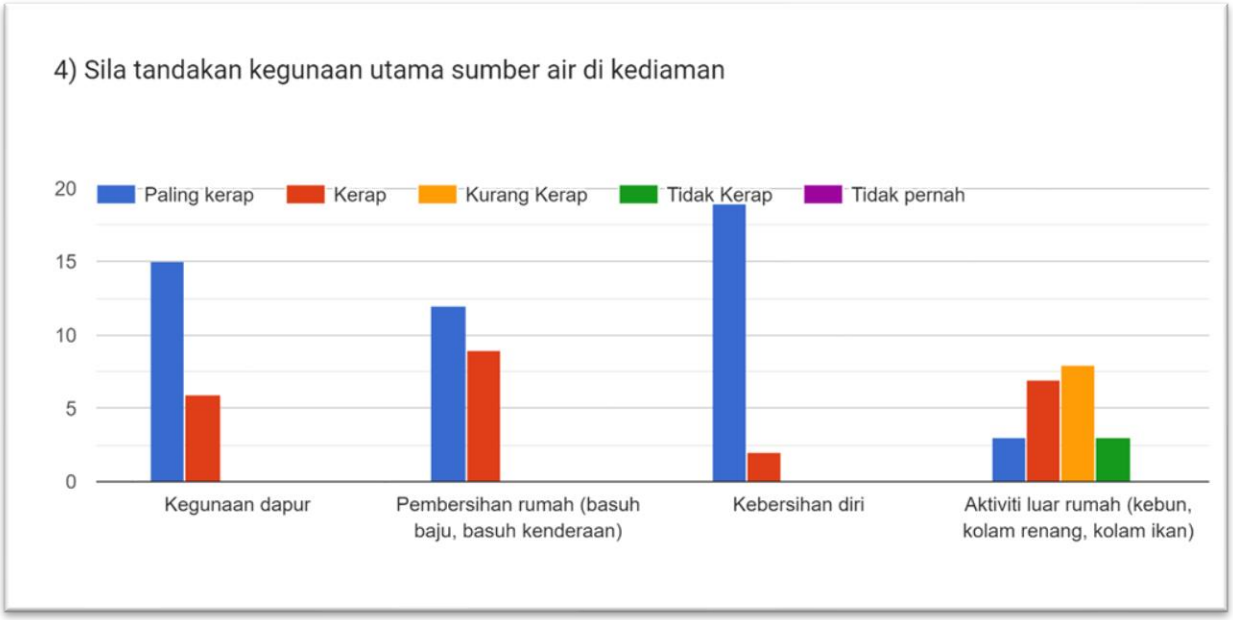

Diagram 4.2.2.4 Uses of water supply in residence

Diagram 4.2.2.4 shows a bar graph of various household use of water supply. It is divided into four main categories. The first category is kitchen use, which are highly used by the respondents with most respondents responding with very often and often. The second category is house cleaning such as cleaning vehicle or laundry use, this category also shows a high usage rate among respondents with a very often and often used. The third category is for self-hygiene use, to no one's surprise, this category also shows a a really high usage rate by respondents at very often by respondents. The final category is the use of water supply for outdoor categories, for example gardening, swimming pool or fishponds and more. This category marks the lowest usage rate by respondents, with respondents showing various rate of water supply usage for outdoor use.

4.2.3 Section C: Water supply disruption issues and solutions

4.2.3.1 Respondent's experience with water supply disruption

Diagram 4.2.3.1 Respondent's experience with water supply disruption

Diagram 4.2.3.1 shows a pie chart of the respondent's experience with water supply disruption. It is divided into two categories. The first and largest category is the respondent's agreeing to having faced a water supply disruption, about 90.5% of respondents reported with yes to having experienced water supply issues in Taman TTDI Jaya. On the other side, 9.5% of respondents have not experienced with water supply issues, making them a minority in this category.

4.2.3.2 Frequency of water supply disruption issues in Taman TTDI Jaya.

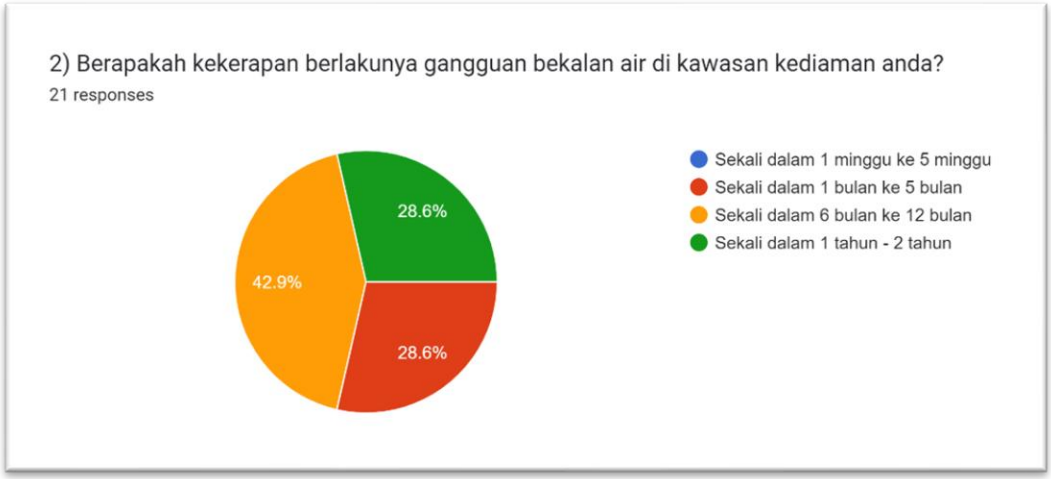

Diagram 4.2.3.2 Frequency of water supply disruption issues in Taman TTDI Jaya

Diagram 4.2.3.2 shows a pie chart of several Taman TTDI Jaya's citizens response about how frequently water supply system gets disrupted in their residence area. Unlike previous pie charts, this specific chart does not show a majority in the experience, as the results are rather divided. However, the highest number shows that water supply disruption occurs **once every six to 12 months** at 42.9%. Interestingly, the second highest number are tied between **once every one to two years** and **once every one to five months**, both at 28.6%. However, no responds show water supply disruption happening **once every one to five weeks**, at 0%.

4.2.3.3 Respondent's preparation for facing scheduled water supply disruption

Diagram 4.2.3.3 Respondent's preparation for facing scheduled water supply disruption

Diagram 4.2.3.3 shows a pie chart of respondent's act of preparation when facing a scheduled water supply disruption in their residence area. It is divided into four categories. The first category is **using a pail or big bucket to keep water supply**, at 81%. The second category is **rationing the available water supply**, at 9.5%, tied with **buying bulks of water supply**. The last category is **using disposable utensils in order to save water supply**, however, no respondents show any use of this method, at 0%.

4.2.3.4 Other water issues in Taman TTDI Jaya

Diagram 4.2.3.4 Other water issues in Taman TTDI Jaya

Diagram 4.2.3.4 shows a pie chart of other water supply issues that occurs in Taman TTDI Jaya. The first category is Unclean water at 42.9%. The second category is foul odour water at 14.3%. The last category is rusty water at 42.9%.

4.2.3.5 Causes of water supply disruption in Taman TTDI Jaya

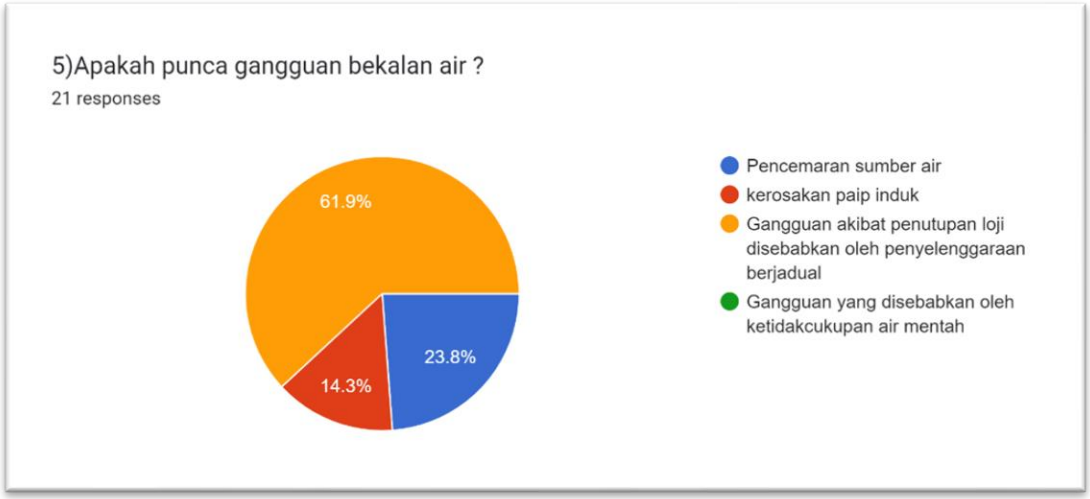

Diagram 4.2.3.5 Causes of water supply disruption in Taman TTDI Jaya

Diagram 4.2.3.5 shows a pie chart of the causes of water supply disruption in Taman TTDI Jaya as said by the citizen's response. The first category is water supply pollution at 23.8%. The second category is damage on the main pipe, at 14.3%. The third category is disruptions caused by temporary shutdown of water supply plant for scheduled maintenance work, at 61.9%, which makes up the largest category. The fourth category is disruptions caused by the lack of raw water supply, at 0%.

4.3 Interviews with engineers and agency officials

As one of the efforts to obtain information, we have conducted interview sessions with several engineers and agency officials regarding our questions on the crisis of water supply disruption that often happens in the state of Selangor. From these interviews we are able to achieve a more detailed and thorough understanding on the background and operations of the water supply systems in Selangor.

The first person we had the privilege of interviewing is Mr. Haji Muhammad Sofi Bin Ibrahim, an engineer with former experience at Melaka Water Resource. He is currently a water engineering contractor at a firm based in Shah Alam. He has provided detailed explanations on several topics regarding water disruptions as well as the operation systems in Selangor. The second person we were able to interview was Mr. Muhammad Zaim Zaki, the Deputy Head of Region in Distribution department at Air Selangor Sdn. Bhd. He has given thorough explanations behind the regulations, law enforcements, and overall, the construct of water operation systems and their operations.

4.3.1 General information and background

Taman TTDI Jaya or TTDI Jaya, which stands for Taman Tun Dr. Ismail is a major township located in Shah Alam, Selangor. The town is located about three (3) kilometres away from Shah Alam, the capital of Selangor. The town's water supply is distributed from the Air Selangor Water Treatment Plant Phase 1 (SSP1 WTP), located at Bestari Jaya, Selangor. The main source of raw water for SSP1 WTP is obtained from Sungai Selangor.

From an interview we learnt that the size of the city poses an influence towards the possibility of water supply disruption to happen. The network of water distribution system must be catered and often upgraded to be in sync with the state of population growth pattern in a city. Should the city population index increases, the network of water distribution system must also increase in order to prevent water shortages for the citizens and corporations alike. However, a bigger network of water supply distribution systems also holds a bigger burden and risk of accidents and crisis happening. A bigger network of water supply distribution system means overseeing multiple networks of distribution system for an area, thus proposing an even higher risk of accidents leading to crisis occurring.

As such, if there are occurrences of water crisis, actions must be taken immediately in order to avoid from further aggravating the already existing crisis. Several bodies of authority hold the responsibility of handling and managing water crisis including water supply disruptions. These agencies are the local state water licency, for Selangor, this is known as Selangor water works. The Selangor water works is responsible for providing the water supply

to the state of Selangor as well as other areas such as the federal territories of Kuala Lumpur and Putrajaya in Malaysia. The Selangor water works is run by Pengurusan Air Selangor Sdn Bhd (Air Selangor), formerly known as Syarikat Bekalan Air Selangor of SYABAS, a Selangor State owned company. The second agency responsible for handling water crisis in Selangor is Suruhan Perkhidmatan Air Negara or SPAN for short, they are the national regulatory body for the water and sewerage industry for Peninsular Malaysia and the Federal Territory of Labuan. This agency operates under the legal framework defined in the National Water Services Commission Act 2006 (Act 654) and the Water Services Industry Act 2006 (Act 655).

4.3.2 Factors of water supply disruption

There are several factors behind the causes of water supply disruption. One of the main causes of this crisis leads back to the main source of the water supply also known as the upstream area, which normally consists of a catchment area, a dam, and a river at the upstream area. Among the causes, pollution is the most notable and frequent cause of several water crisis. River pollution alone is the biggest contributor to the temporary shutdown of majority water distribution system in Selangor. When pollution at the main source occurs, immediate action must be taken in order to prevent the spoiled water from being distributed through the network to the consumer. The water supply will be temporarily shut down in order to perform maintenance work. Shutting down the water supply causes the available water supply to be insufficient. The state of water supply will remain as it is until the maintenance work is complete to ensure the water supply's quality is completely safe and the quantity is sufficient to be provided for the consumers.

The water service system in Malaysia overall is regulated by the government body, Ministry of Environment and Water or KASA. Under KASA there is an agency known as Suruhanjaya Perkhidmatan Air Negara (SPAN), that governs all the water operators in Malaysia. Every action and decision are subjected under Akta Perindustrian Air (AIPA) under SPAN's supervision. During water supply disruption crisis, there is no one specific agency that handles the issue. Instead, it is a joint coordinated work between various agencies and parties involved. For the state of Selangor, every water disruption cases SPAN and Lembaga Urus Air Selangor (LUAS), an agency under the state which regulates rivers in Selangor. Aside from the Department of Environment and Water, SPAN and LUAS are responsible to ensure that any necessary maintenance or improvement works are carried out to prevent any water crisis from happening. They are also responsible in making enforcement actions towards any causes of water source pollutions.

There are two types of water supply disruption. The first one is the scheduled water supply disruption, normally done for maintenance and improvement works. The second one is the unscheduled water supply disruption, which occurs because of water sources pollution, pipe bursts and cases involving third parties.

The pipe system that is established in Selangor is known as the water distribution system. It can be divided into several category of stages ranging from the main source to the consumer's meter pipe. The main distribution system, consisting of the main water source, the water plant and the water balancing reservoir systems is the primary source of water supply. The major pipes used in this stage ranges from 1000 mm, 1500 mm and 2000 mm diameter are strategically used. The pipes in these stage requires meticulous maintenance work, and rarely had cases of pipe burst in the main distribution system. From main distribution, the water supply is distributed to the reticulation pipes which distributes water from the service pools at the community areas towards the consumer's residential meter. The type of pipes used in the reticulation pipe to the meter service pipe is known as the communication pipe, a smaller polyurethane pipe or PVC, measuring at half inch or 12.7 mm. Among all the stages of pipes, the most frequently bursts pipe occurs from the reticulation to communication pipes where polyurethane pipes are used.

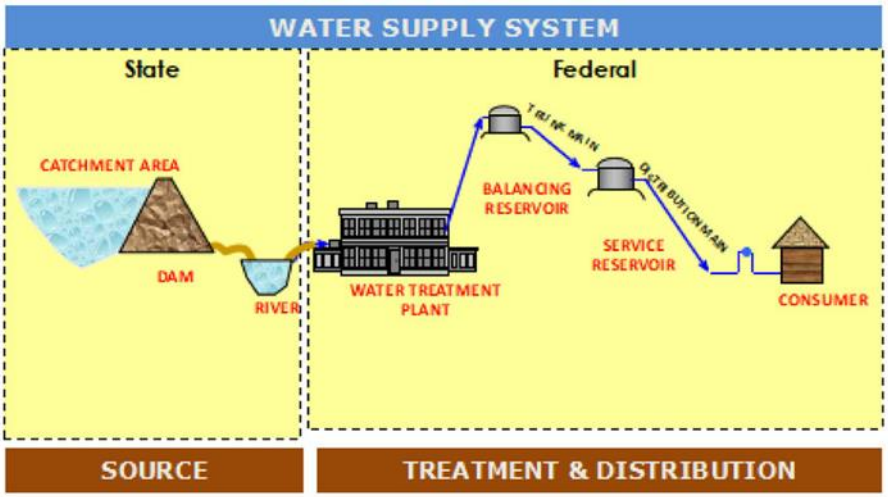

Diagram 4.3.2 The water supply system used in Selangor

In Selangor there are 30,000 km of pipes which has been implemented since the 1960s and the 1970s. Various types of pipes and sizes are used for the water supply distribution, some of which are Mild Steel Cement Line Pipes or MSCL, and Asbestos cement pipes, a commonly used pipe in the 20th century. However, asbestos cement pipe has been mostly discontinued due to health concerns and requires replacement work. About 60,000 km of asbestos cement pipes has been used for decades. A replacement work for asbestos cement pipe to newer pipes has been in the works. Every year about RM200 to RM300 millions are spent to replace those pipes, which covers about 150 km every year in a 30-year plan for pipe replacements. There is also another type of pipe known as the ductile iron pipe as well as HDPE pipe which is a poly pipe. HDPE pipes are commonly used for shore or coast areas to prevent easy corrosion. Galvanised steel pipes are also used albeit not widespread, they are mainly used for internal piping system inside construction buildings. It is not commonly used in water supply

distribution system network due to it's not long-lasting shelf life compared to other pipes like ductile iron pipes or mild steel pipes.

Pipe burst index is used to measure the rate of pipe bursts per 100 km per year. In 2017, there were 19 cases of burst pipe on average. In 2022 the cases have gone down to five (5) cases in Kuala Lumpur, Putrajaya and Selangor altogether per 30,000 km of pipe. Aside from burst pipe which uses asbestos cement pipe, a less durable, fragile and not long lasting pipe and needs immediate replacement work, there are increasing cases involving third parties because of construction work, industry, and foreign contractors who sabotages the water system assets for their own development's benefit. Non-scheduled water disruption is much harder to control because it involves third party. In cases like this, every party's cooperation is needed such as the government, the state's water agency as well as the consumers to report to the agencies if they ever encounter any leadings towards water supply disruption cases.

In regards to the type of neighbourhood residence that are affected to water supply disruption, water supply disruption does not discriminate and evenly attributes to every type of residence on the affected area. For apartment buildings, the water supply system is supported from a bulk meter, and it will distribute to the residence's houses. Poor maintenance will cause the internal pipes to experience damages and causes disruptions. However, water supply disruption doesn't affect apartment residence more or less compared to other types of residence.

For bigger cities, a bigger network of water system distribution is implemented and becomes more complex due to bigger population index. However, the size of the city is not the direct contributor to the possibilities of water supply disruption cases. Instead, the age of the city somewhat plays a part behind the causes of water supply disruption. The reason behind that is due to the age of the pipes that are used in the city's water distribution system. Old pipes that are used in a city that is decades old often faces water disruptions because of the pipe's old conditions if no pipe replacement work is carried out to the city's water distribution network.

On another note, certain non-man-made factors can also contribute to the cause of water supply disruptions. For instance, natural disasters like floods can cause water supply disruptions. When flood happens, some water treatment plant cannot operate because its systems like pumphouses and substations were drowned by floodwater, this causes failure of water processing operation. In conjunction to floods, the flooding that happened towards the end of 2021 has caused landslides and slope failure which also causes the pipes to burst and break apart, this chain of events eventually leads to water supply disruption, which has called for emergency mandatory replacement work.

4.3.3 Effects of water supply disruption

Water supply disruptions affects the community by various courses. Water supply disruption largely impacted the cost losses for the agencies, one of them being revenue loss. When water supply cannot be distributed due to disruptions, it will cause revenue loss because profits cannot be generated due to the lack of water, but more importantly, the loss that goes to the cost of pipe replacements restoration and management for consumers and works such as water tanker distribution. Water supply disruption disrupts consumer's experience and cause a significant drop of rating to agencies which generates dissatisfaction and distress from consumers, reputational loss also occurs to agencies.

For businesses and general economic growth, they are also affected in which they cannot continue or sustain regular business. Regarding development, new developments cannot survive during water disruption crisis, mainly due to the lack of sustainable business margin for a long-term period, thus preventing economic growth. For water heavy reliant sectors like commercial and industrial, who are the customers of water supply. Although in terms of numbers, the residential numbers are higher, most revenue are contributed by the biggest consumer which are commercial and industrial sectors. In a way, water supply disruption affects these sectors, which affects water agencies.

4.3.4 Emergency River pollution cases in Selangor from 2019 to 2021.

The following tables contains data of emergency cases in Selangor from the year 2019 until 2021. All information is obtained in courtesy of the agency Lembaga Urus Air Selangor (LUAS).

4.3.4.1 Emergency River cases in 2019

River	Type of pollution	Number of cases	Cause
Sungai Ampang	Turbidity	1	EKVE project
Sungai Labu	Odour	2	1)Unspecified 2)Originates from Negeri Sembilan.
Sungai Gombak	Turbidity	1	Exposed area without mitigation
Sungai Rumput	Turbidity	1	Heavy rainfall exceeding 330 NTU
Sungai Rinching	Odour	1	Odour pollution from factory
Sungai Selangor	Odour Oil	1 1 Total: 2	Odour pollution at the IWK Batang Kali sewage treatment plant. Diesel oil pollution from sand dredging pontoon leaks.
Sungai Rasa	Turbidity	3	Unspecified, most likely from heavy rainfall. (2 cases) Most likely from heavy rainfall and small-scale agricultural land work. (1 case)
Sungai Batang Kali	Odour	1	Odour pollution at the IWK Batang Kali sewage treatment plant.
Multiple locations (Sungai Beranang/Sungai Semenyih)	Odour	2	There is a solvent smell from IWK Bandar Bukit Mahkota Bangi.

Table 4.3.4.1 Emergency River case in 2019.

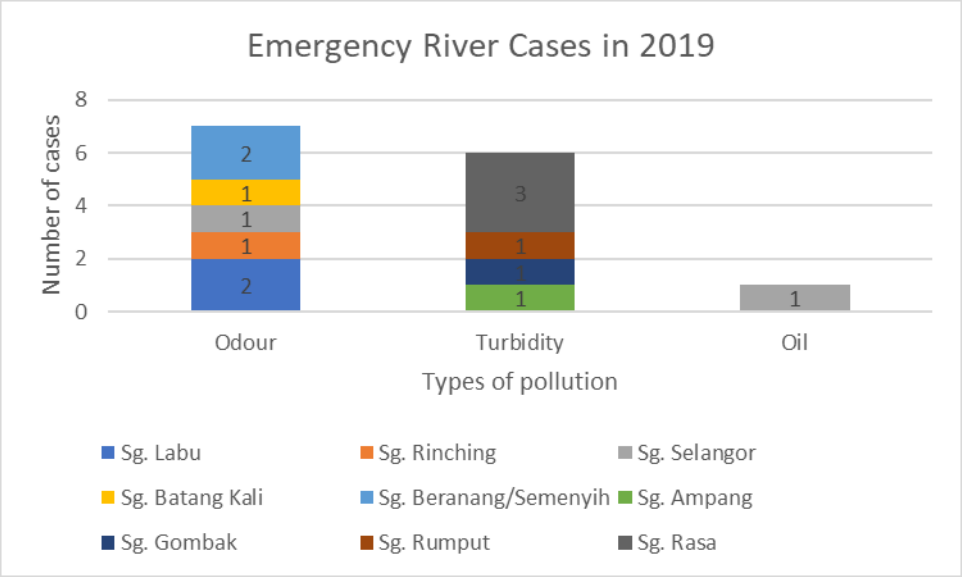

Diagram 4.3.4.1 Emergency cases in 2019

Table 4.3.4.1 and **Diagram 4.3.4.1** shows the data of emergency river cases throughout 2019. In the table it shows the most common type of pollution is odour pollution with seven (7) cases total, followed by turbidity with six (6) cases total, there is also one case caused by oil. The data also shows in 2019 there are 12 locations affected, out of all locations, Sungai Rasa has been affected three (3) times, Sungai Selangor has been affected two (2) times. There are also (2) cases in which there are multiple locations at once, these being Sungai Beranang and Sungai Semenyih.

As for the causes of the pollutions, it varies with several different causes. The causes make no specific pattern however some of them do occur on multiple occasions. These causes are construction project (EKVE project), area exposed to mitigation, odour pollutions, heavy rainfall, diesel oil pollution, a solvent smell, agricultural land work, and unspecified.

4.3.4.2 Emergency River cases in 2020

River	Type of pollution	Number of cases	Causes
Sungai Selangor	Odour	9	**Odour**– Carcass smell (Aquaculture effluent), Catfish Pond cleaning work, Effluent (Premise's heavy machinery, IWK, fishpond), Solvent from palm oil processing, fish reservoir cleaning work.
	Diesel oil	1	**Diesel oil -** Diesel pollution from factory.
	Oil spill	1	**Oil spill –** Unspecified
	Industrial effluent	1	**Industrial effluent** – Effluent from construction material factory.
		Total: 12 cases	
Sungai Gong	Odour	1	**Odour** - Factory maintaining heavy machinery.
	Solvent odour	1	**Solvent odour** – Premise maintaining heavy machinery.
		Total: 2 cases	
Sungai Sembah	Odour	1	Black coloured water flow as a result of dredging the nearby pond.
Sungai Semenyih	Oil	1	**Oil** – Scheduled oil discharge in the IWK plant.
	Black oil	2	**Black oil** – 1)Unspecified 2)Premise maintaining heavy machinery
		Total: 3 cases	

Sungai Langat	Oil spill Pond effluent Diesel oil Industrial waste	2 1 1 1 Total: 5 cases	**Oil spill –** 1)Overturned lorry incident 2)Kuala Langat Power Plant factory **Pond effluent** – Effluent suspected to originate from a fishpond in Jenderam. **Diesel oil** – Diesel oil leakage from the tank of the National Cancer Institute, Putrajaya **Industrial waste** – Foamy flow from cosmetic premise.
Sungai Bernam	Diesel oil	1	Diesel oil tanker accident at Km 389.5 south of Highway PLUS near Beranang.
Sungai Lolo	Turbidity	1	Turbidity from natural rock material.
Sungai Dusun	Turbidity	1	River deepening work.
KL Larut – Ijok water course	Diesel oil	1	Accident involving a truck carrying concrete.
Sungai Balak	Vehicle engine oil	1	Vehicle oil discharge to Sungai Balak water course.
Sungai Beranang	Diesel oil	1	Diesel oil spillage from the river maintenance contractor's excavator
Sungai Kuang	Burnt black residue	1	The plastic processing factory caught fire in Sungai Kuang.
Multiple locations (Sg. Batang Benar, Sg. Pajam, Sg.	Carcass Smell	1	From an industrial area in Nilai, Negeri Sembilan.

Beranang, Sg. Semenyih)			

Table 4.3.4.2 Emergency River cases in 2020

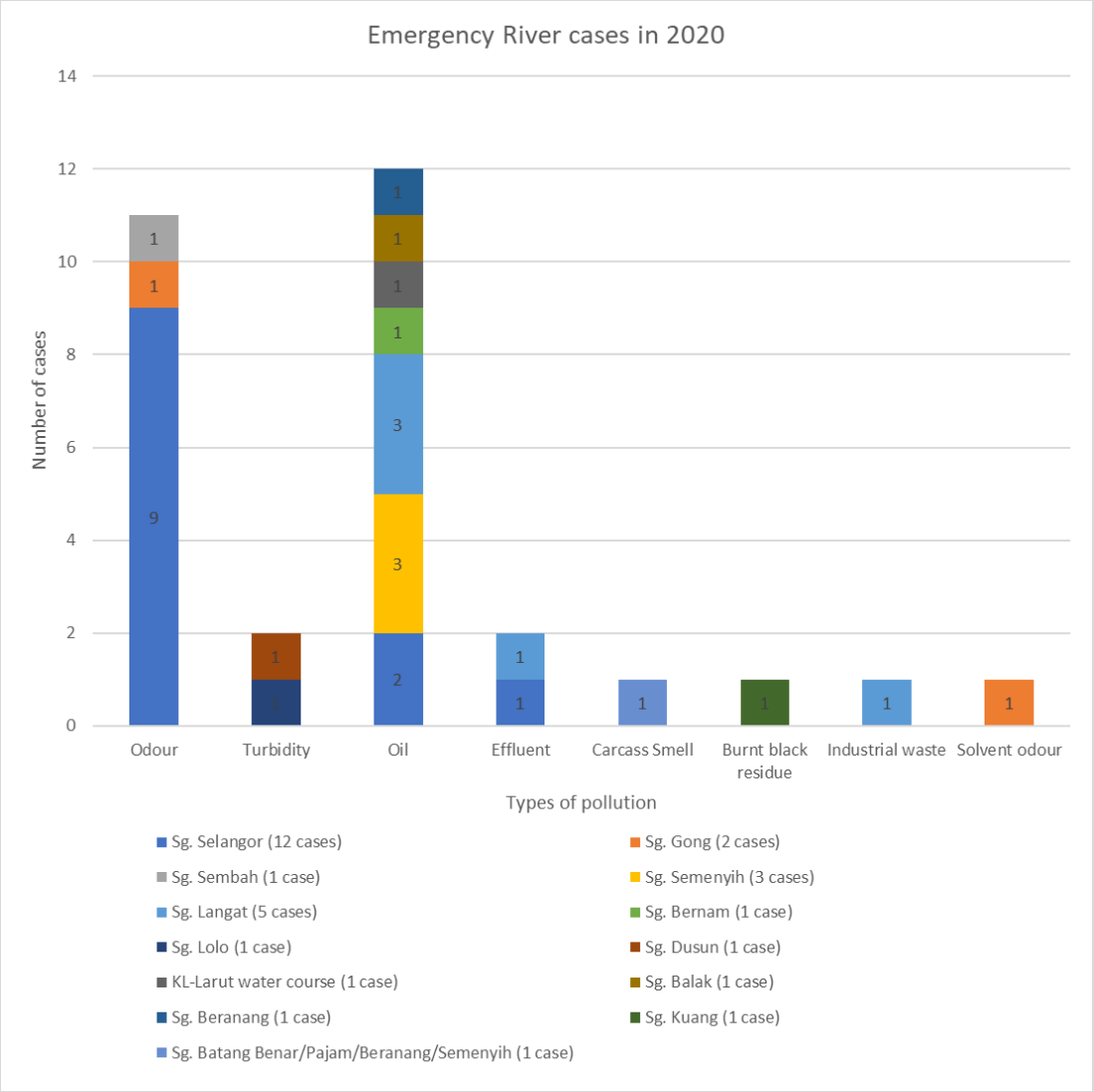

Diagram 4.3.4.2 Emergency River Cases in 2020

Table 4.3.4.2 and Diagram 4.3.4.2 shows the data of emergency river cases that occurred in the year 2020. The number of cases in 2020 has increased with 31 total cases compared to the previous year, 2019 which had 14 cases. Aside from the increased number of cases, the number of locations affected has also increased from 9 to 13 locations. The new affected locations are Sungai Gong, Sungai Sembah, Sungai Langat, Sungai Bernam, Sungai Lolo, Sungai Dusun, KL Larut-Ijok Water Course, Sungai Balak, Sungai Kuang, Sungai Batang Benar, and Sungai Pajam. The same locations that are affected in 2019 and 2020 are Sungai Selangor, Sungai Beranang, and Sungai Semenyih. On the other side, some affected

locations in 2019 records no cases in 2020, these locations are Sungai Rinching, Sungai Rasa, Sungai Labu, Sungai Gompak, Sungai Rumput, Sungai Batang Kali, Sungai Ampang, and Sungai Berang.

Aside from the rise numbers of affected locations, the type of pollution was also increased into several more categories. Recorded cases caused by odour, oils, turbidity were still present in 2020, joined by effluents, carcass smell, burnt black residue, industrial waste, and solvent odours. This time, cases caused by oil peaked with 12 cases while odour cases ha 11 cases. Turbidity cases has decreased to two (2) cases and are tied with effluent. Solvent odour, industrial waste, burnt black residue, and carcass smell has all recorded one (1) case.

The causes of emergency cases also varies but we are able to put them in several different categories, these categories are from factories, cleaning work, premises, plants, ponds, accidents, natural causes, illegal discharges, and even unspecified causes.

4.3.4.3 Emergency River cases in 2021 (Sungai Selangor basin)

River	Type of pollution	Number of cases	Causes
Sungai Gong	Chemical discharge	1	**Chemical discharge –** Smart Novus Sdn. Bhd, No 12, Jalan INR 1, Taman Industri Nautical Rawang.
	Sludge on the water surface in the culvert	1	**Sludge on the water surface in the culvert –** Unspecified and still under investigation.
	Foamy water	1	**Foamy water –** Elevated water flow caused from a foaming water and is a natural effect.
	Turbidity	1	**Turbidity –** The reservoir owned by Synergy Development Sdn Bhd in front of the Rawang toll is not well maintained and there is no grass cover on the surface to control sedimentation.
	Foamy & smelly	1	**Foamy & smelly water -** Global Plastic Resource factory fire (recycled plastic warehouse) in Sungai Bakau, Rawang.
		Total: 5	
Sungai Selangor	Turbidity	2	**1)**The turbidity in Sungai Rening is caused by land clearing activities for agricultural purposes.

			2)Caused by the spread in Sungai Selangor which is likely due to natural weather factors, heavy rain, high tides and strong river currents.
Sungai Rening	Turbidity	1	Water head and flow from the opening of land that carries out agricultural activities with direct flow to Sungai Rening by Golden Meridian Sdn. Bhd.
Sungai Ampang	Turbidity	36	Heavy rain and mud floods as a result of earthworks activities of the EKVE construction project.
Guthrie Highway	Palm oil waste spillage	1	Oil palm tanker accident with registration number NDC 4463 belonging to JASA BUMI LOGISTIC SDN. Ltd.

Table 4.3.4.3 Emergency River cases in 2021 (Sungai Selangor basin)

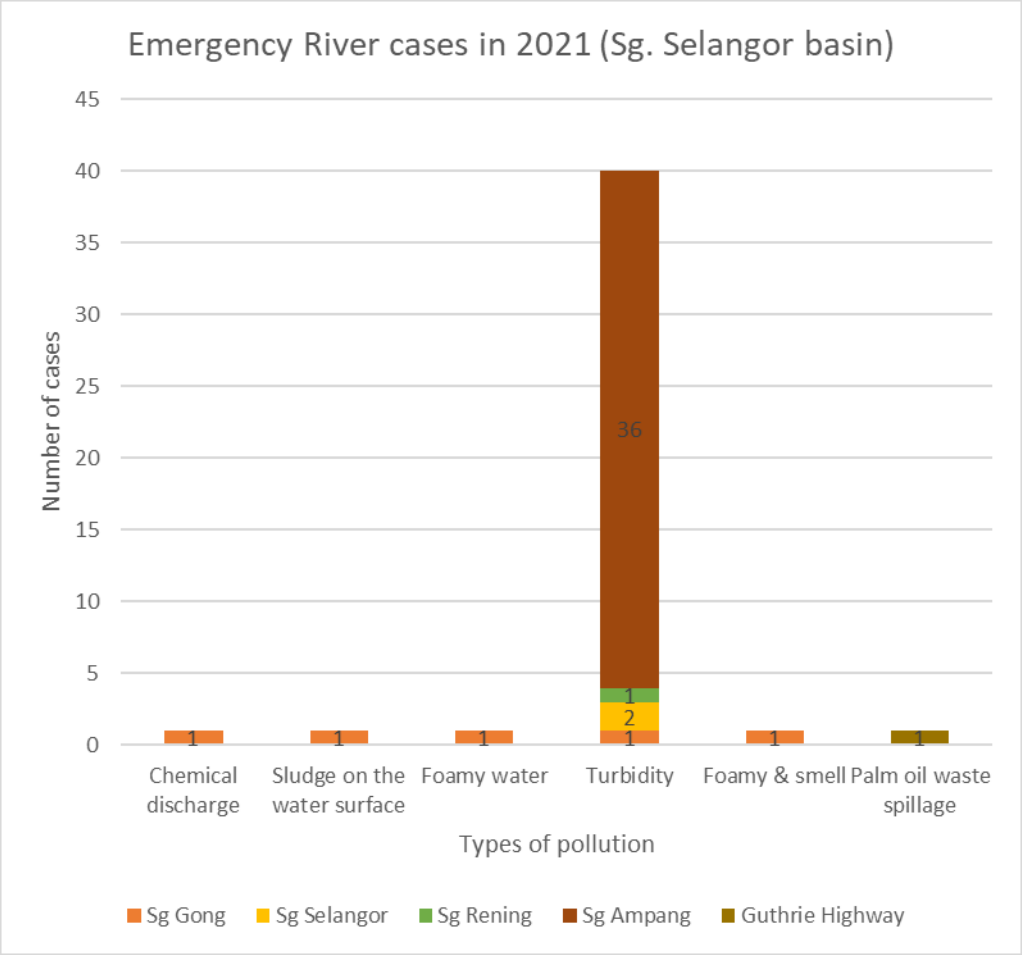

Diagram 4.3.4.3 Emergency River cases in 2021 (Sungai Selangor basin)

Table 4.3.4.3 and **diagram 4.3.4.3** shows data of emergency river cases occurring in 2021 at Sungai Selangor basin. The number of locations in this basin are lesser than those at Sungai Langat basin. However, it recorded more cases compared to the Sungai Langat basin, with 45 cases total, 36 of those cases in Sungai Ampang alone. The locations of are Sungai Gong, Sungai Selangor, Sungai Rening, Sungai Ampang, and Guthrie Highway. Among all the types of pollution, turbidity has the greatest number of cases at 40, with 36 of the cases from Sungai Ampang. The total amount of pollution types is also less than the Sungai Langat basin, with only six (6) types. The pollutions that can be found are chemical discharge, sludge on the water surface, foamy water, turbidity, foamy & smell, and palm oil waste spillage.

4.4 Emergency River cases in Sungai Selangor from 2019 to 2021

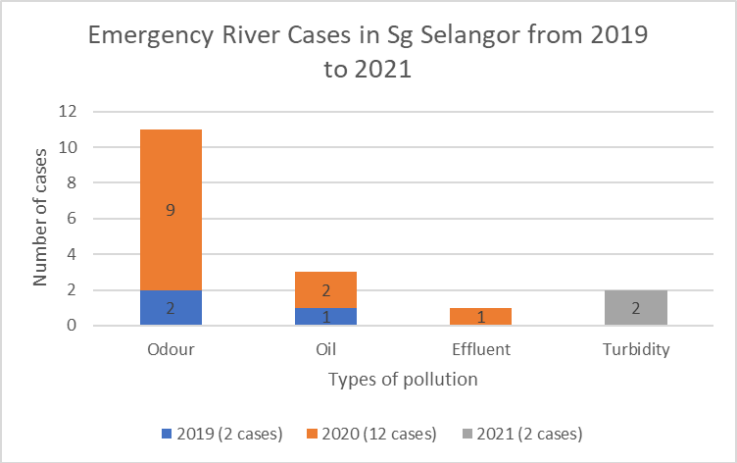

Diagram 4.4 Emergency River cases in Sungai Selangor from 2019 to 2021

Sungai Selangor has been facing several cases of pollutions coming from various types. Throughout 2019 to 2021, there had been a total of 16 pollution cases in Sungai Selangor. 2020 is the year that recorded the highest amount of pollution cases with 12 cases, while 2019 and 2021 both had two (2) cases each.

Sungai Selangor has been polluted with four (4) types of pollution. They are odour, oil, effluents, and turbidity. Among all the types of pollution, odour has the highest number of recorded cases, with two (2) cases in 2019, and nine (9) cases in 2020 alone. The second type of pollution is caused by oil with three (3) cases. The type of oil cases varies from oil pollutions, diesel oil, and oil spillage. Oil pollution occurred once (1) in 2019 and two times (2) in 2021. Following oil pollutions, turbidity has polluted Sungai Selangor two times, and it only happened in 2021. Finally, one (1) pollution case in Sungai Selangor is caused by effluents, more specifically, an industrial effluent from a construction material factory. This case occurred in the year where pollution cases peaked, 2020.

There have been multiple speculations explaining why river pollution cases in 2020 increased compared to 2019. Some sources said poor management and low maintenance work, others believe the law enforcement was not properly executed to the perpetrators. The State Government has denied the allegations of ill-intentioned or sabotages by the perpetrators towards the pollution of Sungai Selangor.

As of 2022, no cases of river pollution have occurred at Sungai Selangor. The reason behind this improvement is probably because in 2021, an initiative called SJAM was introduced by the State Government as a method to overcome the water issues that occurred in Sungai Selangor and Sungai Langat, orchestrated by Lembaga Urus Air Selangor (LUAS).

CHAPTER 5

CONCLUSION AND SUGGESTIONS

5.0 Introduction

In this chapter, all the decisions made are based from the results obtained from the data collection, analysis, and interviews conducted and the discussions in the previous chapters. Also in this chapter, related matters are related to the objectives of the study as well as the recommendations for the study conducted. In addition, conclusions have been made for this case study.

5.1 Discussion

Based on the results of our research and data analysis that we received in previous chapters, we are able to speculate the causes of

For the last 10 years, cases of water supply disruption have indeed been increased, however, it has been showing signs of declination since 2021, which is the year where the state alliance introduces a raw water security initiative. On a major scale, cases of scheduled and non-scheduled water disruption recorded has decreased to (5) cases in 2022 from 10 cases in 2021, most of which are caused by river pollutions and other related causes. In 2022 alone, only one (1) water disruption case from river pollution was recorded. The reduced number of cases shows an improvement in water supply disruption cases.

The time range between 2020 and 2021 shows higher number of recorded cases due to high cases of river pollution. Unregulated industrial works are the main culprit behind the pollution of rivers, as well as improper river supervision, and the lack of surveillance from the authorities. One of the initiatives that was introduced in the raw water security initiative includes a 24-hour surveillance at a major river basins and strategic locations nearby industrial areas such as Semenyih and Rawang, which often records cases of water disruptions. This initiative was also extended to festivities area. Another initiative is to also introduce an alternative if water disruption happens where they create waves where they will directly pump water supply from reservoirs to plants, for instance, if a river is polluted, there will be another source of water from riverbanks tanks directly to water plants, thus simultaneously performing maintenance work on the polluted river while still being able to provide water supply distribution.

On the law enforcement part, since 2020, fines have been increased to a minimum of RM200,000 compound. Recently, on September 2022, an Act for Environmental quality was amended by the Ministry of Environment comprising of a fine between RM200,000 to RM10 million fine as well as five (5) of prison sentences for being charge guilty of polluting the environment. This kind of law enforcement would deter from water supply disruptions caused by pollutions from happening, meaning that industrial sectors cannot freely exploit the environment by releasing discharge pollutants towards water sources and systems.

5.2 Suggestions

Agencies has a specialised 'Repair Respond Time' for water supply disruption cases. With this method, they have been able to reduce one (1) day and a half repair work to 24 hours. On average, repair works for water supply disruption takes for 24 hours. For bigger distribution networks, it takes longer time to do repair work due to the size and complexity of the system, because cases for bigger distribution networks occur deep in the ground, various extra works such a excavation, transferring, replacement equipment which are hard to obtain which all require longer time. In general, repairment works at main distribution system takes longer from those at reticulation and communication pipes. The repairment work hours follows a Key Performance Indicator (KPI) which dictates the maximum repairing hour for different pipe categories.

In order to prevent water supply disruption, a water control program was carried out, where they find for the source of water supply disruption. For example, an active leak detection is carried out called the leak inspectors will survey through the whole pipe systems to find a leak using the appropriate equipment. The gadgets are used to detect pipe burst before doing the replacement or repairing work. Other than that, an Artificial Intelligence system is also used to correlate the various data across data like pressure and the pipe age to pinpoint the potential for a certain pipe to burst so replacement work can be done ahead of the pipe bursting. Some instances where third party is involved, a cooperation work is done with the local authority where if a party is planning to do development or construction work that intervenes with the water distribution system, a permit must be acquired for the said party to build carry on with the original plan.

5.3 Summary

Based on the results of our research and data analysis that we received in previous chapters, we are able to speculate the major cause of water supply disruption occurrences in Taman TTDI Jaya are ultimately caused by unscheduled maintenance which happens due to the halted operation of the Air Selangor First Phase Water Treatment Plant which distributes water supply towards the area of my research. The reason of the halted operation is due to the pollution of the main raw water source for the water treatment plant, which is Sungai Selangor. The causes of the pollution varies from multiple sources, however from our research pollutions from factory is the most common denominator.

In general, it is possible to prevent water supply disruption from happening. However, it requires very high cost per capita. The economic off scale and repairment must be balanced where it must be adjusted to the current tariffs. Water tariffs plays a huge role. With the available amount of water tariffs in Selangor, it is very difficult to eradicate all water supply disruption cases. An appropriate tariff must be provided to ensure the prevention of water supply disruption.

For the state government, Inisiatif Skim Jaminan Air Mentah was released where it contains several initiatives for overall water supply improvements with various ways and perspectives such as technology, geography, and law enforcements, and other areas. For Air Selangor. Sufficient water supply storage must be ensured in regard to the growth of the population in 20 or 30 years. Constant improvement water plants must be regularly carried out and be built on development areas such as the new water treatment plant at Rasau. Pipe replacement programs where old pipes are regularly replaced with new ones, as well as old assets refurbishments where old assets are refurbished and upgraded to serve as an additional reserve margin.

SUMMARY

There is no disputing that Selangor's water supply situation is fragile. The disruptions that occurred are symptoms of the situation's tightness; as a result, medium and long-term remedies must be discovered in order to free the state from the clutches of insufficient water supplies. At the same time, proclaiming a state of crisis is not the best way to represent the precarious nature of the water supply, assuming that natural factors such as rain fall during the projected months.

If nature becomes less compassionate, the state of Selangor may face another water problem.

The growing uncertainty of surface water availability and increasing levels of water pollution and water diversions threaten to disrupt social and economic development in many areas as well as the health of ecosystems.

Many traditional practices are being refined while more recent advances are being developed further. More support needs to be given to policy options, which stress more efficient use of water resources, as well as to technical solutions on the supply side.

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APPENDICES

Appendix A	Questionnaire form
Appendix B	Permission to obtain information form
Appendix C	Gantt Chart

APPENDIX A

Questionnaire form

Soal selidik gangguan bekalan air di Taman TTDI Jaya, Shah Alam

Soal selidik ini khas untuk penduduk Taman TTDI Jaya sahaja

Sila tandakan yang berkenaan

Section A: Profail respondent

1) Jantina Responden

( ) Lelaki ( ) Perempuan

2) Nyatakan Lingkungan Umur Responden

( )18-25
( )26-35
( )36-45
( )45 dan keatas

3) Nyatakan Pekerjaan Responden

( ) Pelajar
( ) Pensyarah
( ) Staf sokongan
( ) Bekerja sendiri
( ) Other:

Section B: Maklumat Kediaman Responden

1) Berapa lama anda telah tinggal di Taman TTDI Jaya?

( )1 bulan - 5 bulan
( )5 bulan - setahun
( ) Setahun - 5 tahun
( )5 tahun - 10 tahun
( ) >10 tahun

2) Nyatakan jenis kediaman responden

( ) Apartment/Kondominium
( ) Rumah teres
( ) Rumah banglo
( ) Other:

3) Nyatakan sumber bekalan air di kediaman responden

( ) Bekalan air paip
( ) ***water vendor***
( ) Tangki air
( ) Other:

4) Sila tandakan kegunaan utama sumber air di kediaman

	Paling kerap	Kerap	Kurang kerap	Tidak kerap	Tidak pernah
Kegunaan dapur					
Pembersihan rumah (basuh baju, basuh kenderaan)					
Kebersihan diri					
Aktiviti luar rumah (kebun, kolam renang, kolam ikan)					

Section C: Masalah gangguan sumber air & penyelesaian

1) Adakah anda pernah mengalami gangguan bekalan air?

( ) Ya ( ) Tidak

2) Berapakah kekerapan berlakunya gangguan bekalan air di kawasan kediaman anda?

( ) Sekali dalam 1 minggu ke 5 minggu
( ) Sekali dalam 1 bulan ke 5 bulan
( ) Sekali dalam 6 bulan ke 12 bulan
( ) Sekali dalam 1 tahun - 2 tahun
( ) Other:

3) Apakah persiapan responden dalam menghadapi gangguan bekalan air?

( ) Menggunakan baldi atau bekas besar
( ) Mencatu bekalan air yang sedia ada
( ) Membeli bekalan air (air botol dan lain-lain)
( ) Menggunakan perkakasan dapur pakai buang
( ) Other:

4) Apakah isu bekalan air yang anda hadapi selain terputus bekalan air?

( ) Air tidak bersih
( ) Air berbau
( ) Air berkarat
( ) Other:

5) Apakah punca gangguan bekalan air?

( ) Pencemaran sumber air
( ) Kerosakan paip induk
( ) Gangguan akibat penutupan loji disebabkan oleh penyelenggaraan berjadual
( ) Gangguan yang disebabkan oleh ketidakcukupan air mentah
( ) Other:

APPENDIX B

Permission to obtain information letter

Kepada sesiapa yang berkenaan, Tuan,

KEBENARAN MENGUMPUL MAKLUMAT KAJIAN BAGI PELAJAR JABATAN KEJURUTERAAN AWAM POLIT EKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

Dengan segala hormatnya, perkara di atas adalah dirujuk.

2. Adalah dimaklumkan bahawa pelajar jabatan ini perlu mengumpulkan maklumat kajian untuk memenuhi keperluan kursus yang sedang diikuti yang merupakan salah satu syarat penganugerahan diploma.

3. Butiran kajian dan pelajar terlibat adalah seperti di lampiran.

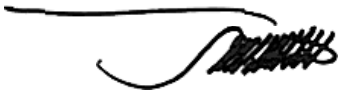
4. Sehubungan dengan itu, kerjasama dari pihak tuan amatlah diharapkan untuk membenarkan pelajar tersebut mendapatkan maklumat kajian yang berkaitan. Sekiranya terdapat sebarang pertanyaan, tuan bolehlah menghubungi pegawai seperti di lampiran.

5. Segala kerjasama dari pihak tuan amatlah dihargai dan didahului dengan ucapan ribuan terima kasih.

Sekian.

"**BERKHIDMAT UNTUK NEGARA**"

Saya yang menjalankan amanah,



(DR. HJ MOHD ZAHARI BIN ISMAIL)

Pengarah,

Politeknik Sultan Salahuddin Abdul Aziz Shah.

Ketua Pegawai Eksekutif

Pengurusan Air Selangor Petaling Jaya Jalan Templer, Pjs 51,

46050 Shah Alam, Selangor Darul Ehsan

Butiran kajian dan pelajar terlibat adalah seperti berikut.

Kursus & Kod Kursus : DCC50194 Final Year Project 2

Tajuk kajian: Case Study of Water Supply Disruption in Taman TTDI Jaya, Shah Alam, Selangor

BIL	NAMA PELAJAR	NO PENDAFTARAN	NO TELEFON
1.	Aina Binti Kamaruddin	08DKA20F1066	012-2043482
2.	Sweta A/P Nagaretnam	08DKA20F1068	011-11108933

Sekiranya terdapat sebarang pertanyaan, tuan bolehlah menghubungi penyelia projek iaitu Puan Jazlina Binti Muhammad di talian 019-3564191

APPENDIX C

GANTT CHART

MINGGU/ AKTIVITI PROJEK	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16
Registering and discussing Final year project 2 plan																
Researching the agencies																
Preparing interview questions																
Preparing letter for interview appointment																
Research for questionnaire questions																
Obtain and process interview and questionnaire data																
Preparing for progress presentation																
Progress presentation																
Preparing for final presentation																
Final presentation																
Preparing for competition																
Submitting final report																

APPENDIX D

BORANG PENDAFTARAN PROJEK

AHLI KUMPULAN			
Nama	**No. Pendaftaran**	**Kelas**	**No. Tel.**
1AINA BINTI KAMARUDDIN	08DKA20F1066	DKA5D	0122043482
2.SWETA A/P NAGARETNAM	08DKA20F1068	DKA5D	01111108933

MAKLUMAT PROJEK		
A. CADANGAN TAJUK	Case Study Of Water Supply Disruption In Taman TTDI Jaya, Shah Alam, Selangor	
B. KETERANGAN PROJEK	**1**	**Pernyataan Masalah:** (i). Frequent water disruption occurrence causes lack of water supply and conflict in daily citizens' routine (ii). Disrupts business and construction development progress, causes financial loss. Affects the general population's health, decreasing community productivity (iii). Affects the general population's health, decreasing community productivity
	2	**Objektif Projek/Kajian:** (i). To study previous cases of water supply disruption (ii). To identify the causes of frequent water disruptions. (iii). To suggest the solution for frequent water disruptions.
	3	**Skop Projek/Kajian:** 1. Studying previous cases about water supply disruptions 2. Conducting research and studies at Taman TTDI Jaya, Shah Alam area 3. Identifying causes and solution for frequent water disruptions
	4	**Lampiran Lakaran Projek dan Carta Alir Pelaksanaan Projek *(jika perlu)***
NAMA PENYELIA PROJEK	PUAN HJH JAZLINA BINTI MUHAMMAD	

TANDATANGAN PENYELIA PROJEK	
TARIKH	8/10/22