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THE IMPACT OF COVID-19 PANDEMIC ON THE WATER DEMAND IN CALINAN POBLACION, DAVAO CITY

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APPROVAL SHEET

In partial fulfillment of the requirements in Practical Research 2, this study entitled **THE IMPACT OF COVID-19 PANDEMIC ON THE WATER DEMAND IN CALINAN POBLACION, DAVAO CITY**, prepared and submitted by Alexis Kyle Campo, Romel Erl Frits Luna, Lady Frances Licmoan, and April Krystel Peralta is hereby recommended for oral examination, approval and acceptance.

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The Researchers

ABSTRACT

This study assessed the impact of COVID-19 Pandemic on the water demand in Calinan Poblacion, Davao City. The assessment was done by comparing the water consumption of the residential and commercial consumers before and during the pandemic time. Hence, the study used the quantitative comparative approach in pursuing the investigation. From the data that were collected, it was found out that residential water demand during pre-pandemic time and pandemic time shows no significant difference. The same result was observed when the water consumption of the commercial sector before and during the pandemic period reflected no significant difference. However, the slight increase in residential water demand was observed which is opposite with the commercial water demand which shows a little decrease during pandemic. This signifies that the COVID-19 pandemic somehow affects the water consumption of the residents in Calinan Poblacion, Davao City.

Keywords: ***Residential water demand, commercial water demand, no significant difference***

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INTRODUCTION

Background of the Study

The earth is composed of about 71% of water, and within this body of water consists of about 96.5% saltwater and 3.5% freshwater (Williams, 2014). Thus, water is at the center of sustainable development and is essential for human survival. On the other hand, global water resources are recoded to reach a total of around 1.4 billion cubic kilometers. Unfortunately, only about 213,000 cubic kilometers are accessible to humans (World Water, 2019). Additionally, the annual average water footprint was reported as 1.385 million liters per person, which is equivalent to 3,800 liters daily (Water Footprint, 2021). In terms of residential water consumption, public water suppliers provided approximately 23,300 Mgal/d of water for 283 million people in single-family and multifamily dwellings in 2015 (Water Resources, 2019).

In the statement of Cooley (2020) in Portsmouth, England, it was mentioned that the residential water demand had increased by about 15% during the lockdown while the non-residential water demand had declined by 17%. Moreover, in San Francisco, California, the residential water demand also increased by about 10% while non-residential water demand declined by 32%. Therefore, it is believed that the lockdown has caused households to drastically change their typical consumption behaviors since water is generally used in order to perform daily activities across a variety of major categories, resulting in an initial sharp increase in spending, especially on essentials and food items (Abu-Bakar, Williams, & Hallett, 2021). This fundamentally became a

possible factor that affected water demand all throughout the world (Boretti & Rosa, 2019).

Moreover, it was expected that the water demand would increase even after the lifting of Enhanced Community Quarantine (ECQ) as the people adapt to the new normal. The persistent advice by the World Health Organization (WHO) and the government that frequent and thorough handwashing with soap and water, regular sanitation in households, taking baths, and washing or sanitizing belongings after work or returning home should be observed to be safe during the COVID-19 pandemic (WHO, 2020). Thus, water become even more important during this time where the world is facing the health crisis. However, it is sad to note that due to the change in water demand, an observable water interruption exists, leading to a water deficiency in some areas (Petruzzello, 2021).

Alarmingly, it has been observed that as the population grows, there is an increasing number of competing commercial demands on water resources for the communities (Boretti, 2019). As a matter of fact, some countries such as Qatar, Israel, and Lebanon continue to experience water scarcity causing the prevalent lack of access to water to execute at least the basic hand-washing techniques in the area (Tripathi, 2019). This issue becomes more alarming because the world is currently facing the COVID-19 pandemic (WHO, 2020). Further, the issue is also focused on the awareness of individuals to the vitality of water in reducing the global burden of diseases and improving the health of populations. Hence, scarcity of water in this time of pandemic imposed a massive health and economic burdens on communities around the world (Cooley, 2020) and even impacted the water demands (Guarino, 2020).

In the Philippines, inadequate and intermittent water supply in Metro Manila and in other parts of the country could incite serious health consequences (Samion, 2020). As a matter of fact, the World Health Organization is worried about the reported annual water shortages because it could worsen the situation regarding the Corona virus outbreak by making the spread more rampant or out of control. It is important for communities and health workers to have access to safe and adequate water at all times to protect them from the spread of infection (Disease Control, 2019; Macasero, 2020).

In Davao City, the second district city councilor, Danilo C. Dayanghirang (2014), confirmed that the city has undergone some kind of water crisis, not just in the second district but also in the first and third districts. Factors like the variability in climate, demographic patterns, unsustainable water-use patterns, leakage, theft, and poor management were most likely the explanations for why about 50% of the water supply in the city never reaches its designated consumers (Water Supply, 2021). In supporting to this, the Davao City Water District (2021) had issued that in Barangay Toril last March 6, 2021, there were still conflicts as regards to the low water pressure in the area. As a result, water interruptions were observed even amidst pandemic. This lack of water supply reaching every household can lead to less sanitation and allows pathogens to easily penetrate the body, hence leading to health issues (Khambete, 2019).

As a matter of fact, Davao City has recorded that detrimental water supply causes cholera, dysentery, typhoid, polio, and especially diarrhea, which are critical when not treated immediately (WHO, 2019), specifically in the areas of Buhangin District after confirming spikes of cases regarding these health issues (Diarrhea, 2015). Also, the mayor of Santo Tomas, Davao del Norte declared a diarrhea outbreak in the barangay

after the local government recorded 171 total cases with one death from drinking contaminated tap water (Colina, 2021). This proves that contaminated water and poor sanitation have a link to the transmission of diseases (WHO, 2019)

With all the data presented in the preceding paragraph, it can be noted that an increase in water demand is evident, especially at this time when the world is trying to combat the pandemic. Also, it is emphasized in the third paragraph that this increase in water demand will continue since the so-called "new normal" will now become the society's normal set-up. Therefore, data-based and informed strategic planning is critical for development planners and local government units. One of the strategies that can be implemented is to locally analyze and focus on exact figures. Therefore, the researchers found the need to present a clear picture of the water demand of the residential and commercial sectors in Calinan Poblacion, Davao City.

Statement of the Problem

The purpose of the study was to determine the impact of the pandemic on the water demand in Calinan, Davao City. Specifically, it aimed to answer the following questions:

1. What is the residential water demand in Calinan, Davao City from January to August when classified as:

    1.1 pre-pandemic time 2018-2019; and

    1.2 pandemic time 2020-2021.

2. What is the commercial water demand in Calinan, Davao City from January to August when classified as:

   2.1 pre-pandemic time 2018-2019; and

   2.2 pandemic time 2020-2021.

3. Is there a significant difference in the water demand in Calinan, Davao City during the pre-pandemic and pandemic time when classified as:

   3.1 Residential Water Demand

   3.2. Commercial Water Demand

Review of Related Literature

This section gives meaning and emphasis to the variables in the study by showing literatures related to the study. Therefore, articles, reports, and studies concerning the global pandemic affecting water demand and the impacts of pandemic to people's behavioral needs are presented.

Water Demand during COVID-19 Pandemic

The COVID-19 pandemic has imposed massive health and economic burdens on communities around the world, and no sector of society is going untouched, including the vitally important water sector. The full extent of impacts of the coronavirus pandemic on the water sector is still emerging, but one area that has come to the fore is the effect on municipal water demand (Sharifi & Khavarian-Garmsir, 2020). A data recorded by Cooley (2020) exposed that in Portsmouth, England, residential demand increased by 15 percent during the lockdown, while non-residential demand declined by 17 percent. Likewise, in San Francisco, California, residential demand increased by 10 percent, while

non-residential demand declined by 32 percent (Cooley, 2020). Also, a study of Otaki, Honda, and Ueda (2020) revealed that the difference of water consumption shows no significant difference since people are free to use water depending on their preferences. To sum up, while the pandemic increases residential water demand and non-residential water demand have decreased (Laca, 2021).

These changes are, in part, due to the simple fact that people are doing more at home during the coronavirus pandemic, like cooking, washing dishes, flushing toilets, and showering, and less in the office, at restaurants, and at the gym (WHO, 2020). Also water consumption patterns have changed since the maintenance of hygiene and disinfection of surfaces have been recommended as some of the most important actions for reducing transmission of the virus. These actions have significantly changed lifestyles, and have imposed several changes in behavior on society (Campos et al., 2021). Thus, the COVID-19 pandemic causes the residential communities to experience either a modest increase or slight decrease in water demand.

Moreover, the pandemic forced many governments around the world to implement lockdown procedures which led to a change in the regime of water demand, with repercussions on management issues. The change in people's habits and lifestyle, as well as their shelter at home, altered the traditional underlying consumption dynamics (Totaro, 2020). Precautionary measures and governmental regulations during the COVID-19 pandemic's first wave have drastically altered daily activities and hence water consumption patterns. Behavioral changes induced by COVID-19 (home office, home schooling, hygiene practices, etc.) also alter the daily patterns and total amounts of water usage (Lüdtke, Luetkemeier, Schneemann, & Liehr, 2021). This is expected because

many people had to change their working routines, organization of childcare and hygiene practices.

Residential Water Demand during Pre-pandemic and Pandemic Time

Naturally, water demand happens to change consistently (Piesse, 2020). A study conducted by Boretti and Rosa (2019) concluded that in 2018, the global water demand totaled to 4,600 km^3 and is speculated that during 2050, the demand will increase by about 20 percent to 30 percent per year due to the continuous growth of human population. However, Sonowal (2017) stated that the human population is not the only possible factor affecting the change of water demand but also factors like climate conditions, economic status, number of establishments, environmental changes, water supply systems, and the size of a city. Likewise, residential water demand tends to remain consistent only to assess the vitality of water for human survival and the usual activities performed in the household (Velayutham, 2019; Migala, 2020). However, it gradually changes if factors like environmental conditions happened (Fecht, 2019) causing the psychological change to human motivation attempting to sustain the needs for human development and this is very evident at this time that the whole world is in global health crisis (Addo, Thoms, & Parsons, 2018).

Lerner (2019) stated that the use of residential water involves both outdoor and indoor water usage. Outdoor activities include washing cars, watering plants, or managing private pools while indoor activities include showering, washing clothes and dishes, drinking, cooking, sanitation and hygiene, flushing toilets, and other household functions. Though residential water usages seem to only take a minimum water consumption, it is estimated that about 178 billion liters of water are consumed a day for

residential use (Nathanson, 2020). This indicates that residential water demand greatly influences water consumption, hence affecting freshwater supply which takes only about 3 percent of the world's total water resource (Mullen, 2021).

Basically, water serves as the foundation of life (Water, 2019) and is considered one of the immediate prevention against pathogens (Water and Nutrition, 2021). After the outbreak of the coronavirus pandemic, water demand in all aspects, residential and non-residential, changed prominently (Cooley, Gleick, Abraham, & Cai, 2020). As mentioned in the study conducted by Cooley (2020), Portsmouth, England experienced an increase of about 15 percent as regards the residential demand, specifically during the lockdown. Additionally, this drastic change in the residential water demand is because people are doing more indoor activities that use water during the pandemic such as cooking, washing dishes, flushing toilets, showering, sanitation, etc. However, it is sad to note that in the report of Gray (2021) he stated that in some countries such as India, Iraq, and some of the countries in South Africa still do not have enough water supply to attain the basic needs of the population. The situation is exacerbated by the on-going fight against the corona virus. Thus, this water scarcity in other countries (Water Scarcity, 2020), and continuous change in residential water demand (Lüdtke, Luetkemeier, Liehr, & Schneemann, 2021) overwhelmed the health systems across the world.

Pre-pandemic and During Pandemic Period and the Commercial Water Demand

Commercial refers to the service or to an establishment that allows people to gain and benefit money (Commercial, 2020), as well as used in buying and selling goods (Chen, 2021). On the other hand, Templin, Herbert, Stainaker, Horn, and Solley (2014) mentioned that commercial water usage includes water used by commercial facilities

such as hotels, motels, restaurants, office buildings, government, military facilities, hospitals, educational institutions, and retail sales stores. Additionally, they stated that commercial water used in office buildings primarily is used for sanitation, maintenance, and aesthetic appeal. Though commercial water usages seem to only take a minimum water consumption, commercial water reached approximately to 180 gallons per day (Nathanson, 2020). This indicates that commercial water demand naturally influences the water consumption due to human needs (Energy Department, 2021).

Moreover, commercial buildings are made up of many systems that rely on water (Nathanson, 2020). Due to the pandemic, multiple sectors in every community and country experienced disruption in their daily activities, especially in water-governing sectors (Balamurugan, Kasiviswanathan, Ilampooranan, & Soundharajan, 2021). Additionally, the pandemic also severely affected the global economy and financial markets due to lockdowns and for the safety of individuals during the pandemic (Pak, et al., 2020). This points out the changes in water consumption among commercial services, stating the fact that commercial water is usually consumed to give or provide interactional services to the people (Commercial Service, 2014). Thus, commercial water demand projects contractions (Services Outlook, 2020) due to the implementation of lockdowns to infrastructures and business establishments to provide safety towards the population (Atalan, 2020).

As gleaned from the data coming from other researches, commercial water demand is supposed to be the water used for or to provide services to people. Before the outbreak of the pandemic, commercial water demand was estimated to be relatively higher compared from the commercial water demand during the pandemic which

continued to decrease overtime. This results are also supported by other data suggesting that due to the implementation of lockdowns, lesser people are going from an establishment in accomplishment as regards the attainment of the needs and satisfaction of the consumers. With this, commercial water use in establishments declines thus causing the commercial water demand to continuously decrease.

Various Forms of Response to the Pandemic

Due to the COVID-19 pandemic, various businesses commenced to respond towards the demand of the citizens. It was claimed that industries are essential, which creates a lot of issues in the job functions (Renfrew, 2020). The water sector quickly adapted to maintain services, public safety, and environmental protection as the coronavirus pandemic began. Now that many institutions are re-opening, the sector is facing the question of how to return to the new normal, and what changes to keep after the pandemic ends (Fowler, 2020).

The COVID-19 pandemic has highlighted that the provision of safe water, sanitation, and hygienic conditions is essential for protecting human health during all infectious disease outbreaks (WHO, 2020). Recognizing and properly managing the linkages between water quality and food safety, hygiene in markets especially in food handling, personal hygiene and established food safety practices will reduce the likelihood that harmful pathogens will threaten the safety of the food supply (Food and Agriculture Organization, 2021). These factors were essential to both human survival and safety, even before, during, or after pandemic. Since the beginning of the COVID-19 outbreak, citizens were highly motivated in food and water consumption. Due to these

reactions, various industries globally were trying to respond for the people's safety and needs (Morgan, 2020).

Hence, a safely managed Water, Sanitation, and Hygiene (WASH) services is an essential part of preventing and protecting human health during infectious disease outbreaks, including the current COVID-19 pandemic. One of the most cost-effective strategies for increasing pandemic preparedness, especially in resource-constrained settings, is investing in core public health infrastructure, including water and sanitation systems. Good WASH and waste management practices, that are consistently applied, serve as barriers to human-to-human transmission of the COVID-19 virus in homes, communities, health care facilities, schools, and other public spaces (World Bank Group, 2020). In general, countries, states and municipalities have endeavored to implement the measures recommended by the World Health Organization, such as constant hand washing, the use of masks, routine cleaning of environments and surfaces, and the restriction or closure of schools, universities, restaurants, public transport and other places where there may be clusters of infection (WHO, 2020).

As mentioned from the data gathered from other researches, various implementation of laws and policies were executed to provide more water to every household. This is in order to ensure the safety of the population while combating the COVID-19 Pandemic. Also, various health-related organizations have suggested protocols that enables individuals to gain awareness in terms of safety and health such as washing our hands, using rubbing alcohol, taking a bath after going outside, and more. These data also showcase the importance of water in terms of protection against the pandemic.

Issues on the Accessibility and Availability of Water Supply

The WHO (2019) said water shortages affect the spread of the pathogenic organisms, such as bacteria and viruses because the lack of water will limit handwashing and compromise the cleaning and sanitation of health care facilities (Macasero, 2020). However, the WHO (2020) was also responding to the questions about the impact of water scarcity on efforts to combat an outbreak of the COVID-19 acute respiratory disease. It is important for communities and health workers to have access to safe and adequate water at all times to protect them from the spread of infections. This indicates that the lack of water would threaten infection prevention and control measures and will have an impact on health (Reduce Risk, 2020), therefore various water facilities were taking immediate actions to aid this issue (Sanitation Crisis, 2021).

Therefore, drinking water availability plays a crucial role in ensuring proper living conditions for humans and ecosystems (Nolan, 2021). Additionally, the need for water is intensified during health emergencies when the water, due to its indispensable nature, may act as a medium for microbiological contagions. The WHO (2021) pointed out that the availability of drinking water is an important condition for the safety of people. However, a statement from United Nations International Children's Emergency Fund (2020) mentioned that even in countries with adequate water resources, water scarcity is not uncommon. Further, insufficient water availability limits access to safe water for drinking and for practicing basic hygiene at home, in schools, and in other facilities. This specifies that despite water being vital for health protection (Water, 2020), several people still do not have access to water causing the rampant spread of infections (UNICEF, 2017).

Furthermore, water unavailability precludes individuals to at least perform the basic hand washing techniques as a prevention for pathogens (World Bank Group, 2020). Additionally, it was stated that countries having less access to water have higher cases of the citizens being infected by the COVID-19. However, the health measures proposed by the World Health Organization suggested that the spread of the COVID-19 virus can be minimized through frequent hand hygiene (Balacco, 2020). Moreover, the World Bank Group (2020) is working closely to ensure communities in the scarce countries to have access to fixed and portable handwashing facilities, soap or alcohol-based hand rubs, and reliable water supplies. This circumstance is anticipated to help and reduce the number of cases of COVID-19 pandemic and to allow countries to be able to acquire clean and efficient water resource.

Despite the amount of accessible water worldwide, there are still some places that do not have plenty access to clean and sufficient water source. Also, the spread of pathogens happens to be quicker especially to those areas that are unhygienic and unclean. As gleaned from the data provided by other researches, the cases of COVID-19 positive victims were relatively higher to those areas that have lesser access to water compared to areas with adequate water supply. Moreover, the need of water to some certain regions such as the areas within South Africa is still highly demanded due to the reasons of water unavailability. Although water is highly demanded, not all people have an adequate supply of drinkable water, hence it increases the water demand to an utmost level.

The Rise of New Normal

The World Health Organization declared that COVID-19 is a global pandemic, causing governments worldwide to have implemented a number of regulations and control to limit the spread of the virus (Andrews, Foulkes, & Blakemore, 2020). To control the spread of COVID-19 virus, public adherence to the rules is critical. Regulations such as social distancing and other measures persuaded individuals to the seriousness of the pandemic and that through limiting social interactions can limit the spread of the virus as well (Dezecache, Frith, & Deroy, 2020). A study by Creighton, Capistrano, Sorokowska and Sorokowski (2021) explained that one major recommendation from health organizations is through increasing the distance between individuals when interacting, often called physical or social distancing, and through limiting the frequency of interaction by prohibiting non-essential and large-scale social gatherings can protect individuals from acquiring the virus. These include the closing of public recreational activities, education, limiting people inside churches, and limiting face-to-face interactions upon buying necessities.

Moreover, due to the new executed laws, the term is often called new normal (Sick-Samuels, 2021). The government also ensured safety to the population by limiting the size of gatherings, maintaining at least 6 feet of distance between people, the shutting down of non-crucial businesses, limiting telecommunication, distanced learning, and shelter-in-place orders (Oosterhoff, Palmer, Wilson, & Shook, 2020). Although it is an unprecedented experience to the most of the population, the protection against the lethal virus depends on the strict implementation of the new measures (Andrews, Foulkes, & Blakemore, 2020).

Additionally, commercial water demand showed a sudden decrease due to the closure of most commercial establishments (Melville-Shreeve, Cotterill, & Butler, 2021). Further, due to the closure of most commercial establishments, most individuals sought ways to obtain at least the basic needs and wants (Bartik, et al., 2020) in order to ensure safety and entertainment during lockdowns (United Nations Conference on Trade and Development, 2020). Furthermore, online shopping became one of the most effective ways of marketing during the pandemic for it does not allow individuals to take the risk of interacting with each other physically, but through online platforms instead (Tymkiw, 2021). In this case, people during the pandemic had relied more on technology especially in obtaining necessities and satisfaction (Auxier, 2020). A data gathered by Ouellette (2022) showed that online shopping massively grew that nearly hit the market size of 4 trillion during 2020 and was predicted that in US alone, around 300 million more online shoppers will exist in 2023. However, due to the escalating numbers of online shoppers, the use of water to commercial establishments was reduced because of the reason that people are prohibited for physical and social interactions (Office Space, 2021; Melville-Shreeve, Cotterill, & Butler, 2021).

In a nutshell, all the recorded data coming from various researches emphasized that residential and commercial sectors used the water supply for hygiene, leisure, survival, and protection purposes. This includes bathing, washing, etc. causing more water consumption to increase. Also, the data exposed that during the pandemic, since people were encouraged to stay indoors, more water were consumed inside of the resident’s houses. This commenced the sudden increase of residential water demand to most areas worldwide.

Further, the literature provided information on various laws and policies that were executed to ensure water supply to every household to ensure the safety of the population while combating the COVID-19 Pandemic. Also, recommendations from various health-related organizations to enable individuals to gain awareness in terms of safety and health such as washing our hands, using rubbing alcohol, taking a bath after going outside, and more were included.

Furthermore, the great impact of the pandemic to the economic sectors worldwide due to the implementation of closure of non-essential establishments and lockdowns and measures like social distancing and others was also highlighted. Also, as people slowly adapting to the new normal set-up which also changed the lifestyle of many people like relying more on technology than on actual physical work and on the work from home scheme, water consumption patterns in both residential and commercial water also changes.

Theoretical Framework

The study is anchored on Maslow (1943) Hierarchy of Needs Theory. This theory states that demand is classified into five hierarchical categories, namely: basic demand, safety demand, social demand, esteem demand, and self-actualization demand. These demands progress from lower-level demand to higher-level demand and is affected by human needs and human motivation. Likewise, the theory reflects the common laws between human behavior and human needs for survival, maintenance, or for recreational activities (Pan et al., 2018).

The theory of Maslow supports the conduct of this study for it implies that due to human motivations and human needs, the demand of the population will increase. In this study, human motivation is the vitality of water in prevention against COVID-19 pandemic. Although other demands are apparent, water is highly demanded in comparison to other essentials (United States Environmental Protection Agency, 2021). Moreover, household water is a basic need that arises from daily human activities that fulfill certain demands related to survival, leisure, comfort, hygiene, convenience, and aesthetics (Dinka, 2018).

Conceptual Framework

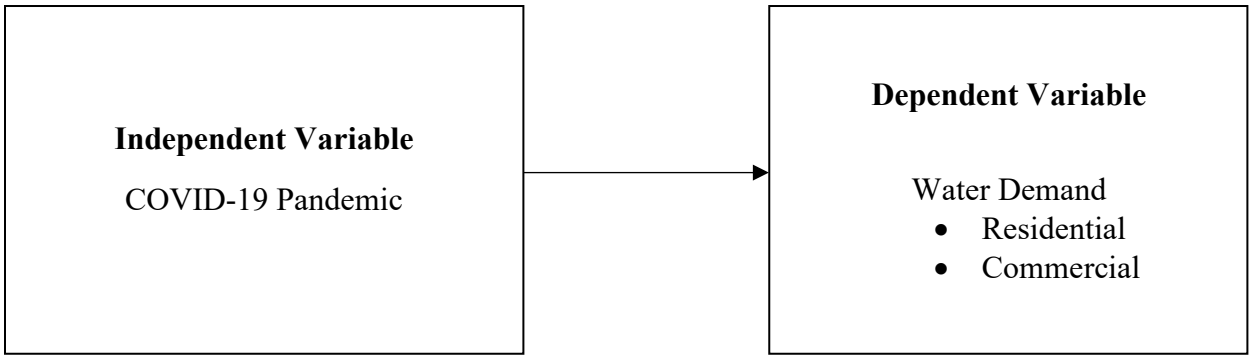

Figure 1. Conceptual Framework

The study's independent variable is the COVID-19 pandemic which is presumed to be affecting the water demand of both the residential and commercial sectors. On the other hand, the dependent variable of the study is the residential water demand and commercial water demand in Calinan Poblacion, Davao City which assumed to have been affected as the results of the global health crisis.

Significance of the Study

This study will be a significant endeavor in promoting water conservation. This study will also be beneficial to the people in Calinan Poblacion in terms of water consumption and preservation, generating strategies to prevent water shortages and encouraging water conservancy amidst a pandemic. Likewise, this research will provide evident data about the changes in water demand caused by the pandemic. By understanding the needs of the residents of the area regarding water, these people will be assured of an adequate water supply as a result of the evident data provided.

Further, this study will be helpful to the Davao City Water District in stimulating and assessing the water quantity of the Calinan Poblacion vis-à-vis the demand of the population to avoid water deficiency. Furthermore, it will provide supporting data to water governors as they advocate for water conservation among the general public. Moreover, the result of the study can be an eye opener to the commercial sectors on the vitality of water to their operations, thus conservation should be given utmost attention. This will also serve as a reference for the Water District and for future researchers about the effects of the COVID-19 pandemic on water demand.

Furthermore, the study will be significant in promoting better water consumption patterns, improved water distribution systems, enhanced production of water supplies, efficient response to the water demand of the residents. This will enlighten the people of the region, including the non-residential sectors, about the importance of water conservation amidst the pandemic. And most importantly, this research will allow the enhancement of the environment's production of water by allocating data that will enlighten the people about the salient impact of conserving daily water supply, thus

avoiding excessive consumption of the available water. Hence, the water agencies like the Davao City Water District will be able to provide a sufficient amount of safe and clean water to every household.

Scope and Limitation

The study focused on assessing the effects of the COVID-19 pandemic on the water demand specifically the residential and commercial sectors in Calinan Poblacion, Davao City. Also, two periods were compared in each category: pre-pandemic time and pandemic time. Additionally, the time stamps of the data used were during the months of January to August in the years 2018, 2019, 2020, and 2021. The pre-pandemic years were 2018 and 2019, while the pandemic time started during the years 2020 and 2021. The reason for the months being limited to January to August was to assure the balance and control of the data that were collected. Years immediately prior to or subsequently following the stated years are not included. Also, other factors like water quality, water sanitation, and water purification were excluded from the study because of the fewer opportunities for lab experimentation during the pandemic. Besides, these factors were already commonly assessed by the Davao City Water District.

Additionally, the researchers selected two categories as the basis of the study: the residential water demand and the commercial water demand in Calinan Poblacion, Davao City. This is due to the fact that residential water demand and commercial water demand detected the citizens' needs for protection during the pandemic. Other water-using sectors like agricultural and industrial water demand were not included in the study because the focus of this study was only to find the causes of water demand change due to the human motivation concerning health protection and was not focused on the other uses of water.

Further, the study is only limited to assessing the effects of the pandemic on water demand in Calinan Poblacion, Davao City and was only grounded in the effects of the pandemic on water demand. Hence, factors like climate change, population growth, and pollution were also excluded from the study.

Definition of Terms

The researchers used numerous terms with different definitions, as well as research instruments all throughout the study. The following terms were defined operationally to make this study more rational and effective:

COVID-19 refers to the lethal virus that continues to spread, mutate, and kill many people. It is assumed to be the cause of the massive changes in water demand in Calinan Poblacion, Davao City.

Water Demand refers to the quantity of water that the treatment plant must produce in order to meet all water needs in the community. In this study, it is the same with the water consumption of the residents in Calinan Poblacion, Davao City.

Residential Water Demand refers to the amount of water used within the residential areas in Calinan Poblacion, Davao City. This includes the amount of water used for household purposes.

Commercial Water Demand refers to the amount of water used within the commercial establishments in Calinan Poblacion,

	Davao City. This includes the amount of water used for services purposes.
Industrial Water Demand	refers to the amount of water used in manufacturing products such as the water used for factories, huge enterprises, and manufacturing workshops.
Pre-Pandemic Time	refers to the period of time wherein the pandemic has not yet started. It involves the years 2018 and 2019 in this study.
Pandemic Time	refers to the period of time wherein the pandemic already existed. It involves the years 2020 and 2021 in this study.
T-test	refers to the statistical tool that enables the researchers to determine whether the data gathered may or may not have any significant difference.
P-value	refers to the value that helps in determining whether or not the data has a significant difference ($p<0.05$) or the data shows no significant difference ($p>0.05$).

Chapter 2

METHODS

This chapter presents the description of the research method and procedure of the study. This presents the study's research design, research locale, data gathering procedure, and data analysis.

Research Design

A research design enables the researchers to proceed in the right direction without any deviation from the tasks. It is an overall, detailed strategy of the research process (Somasundaram, 2019). Also, it acts as the study's structure and tries to work to address all the research questions. Moreover, a comparative research design was used as the research method for this study because the researchers compared two separate records in an attempt to find its differences (Adiyia & Ashton, 2017). In this study, a quantitative comparative research design was employed. It is a research method that compares two groups in an attempt to draw a conclusion about them, as well as determine their similarities and differences (Richardson, 2018).

A comparative research design was repeated in this study since the researchers simply observed the data to clearly identify the possible differences between the compared data. Also, this type of research design is best applied when there is a feasible comparison of data and the data needed for comparison is available. This design is best at determining differences, hence it is helpful in assessing the changes of water demand as an impact of the COVID-19 pandemic in Calinan Poblacion, Davao City.

Research Locale

The conduct of this study was in the locality of Calinan Poblacion, Davao City, which is considered one of the commercial areas present in the third district of Davao City. The place is known not only because of the king of birds, the Philippine Eagle, but also of its chocolate which is considered one of the finest in the world. Additionally, Calinan is also blessed with a variety of fruits such as durian, mangosteen, rambutan, lanzones and many more (Philatlas, 2019). The researchers' target area was specifically located in the vicinity of Calinan Poblacion. Other areas outside the geological map of Calinan Poblacion were not included. For more information about the location, refer to the picture below.

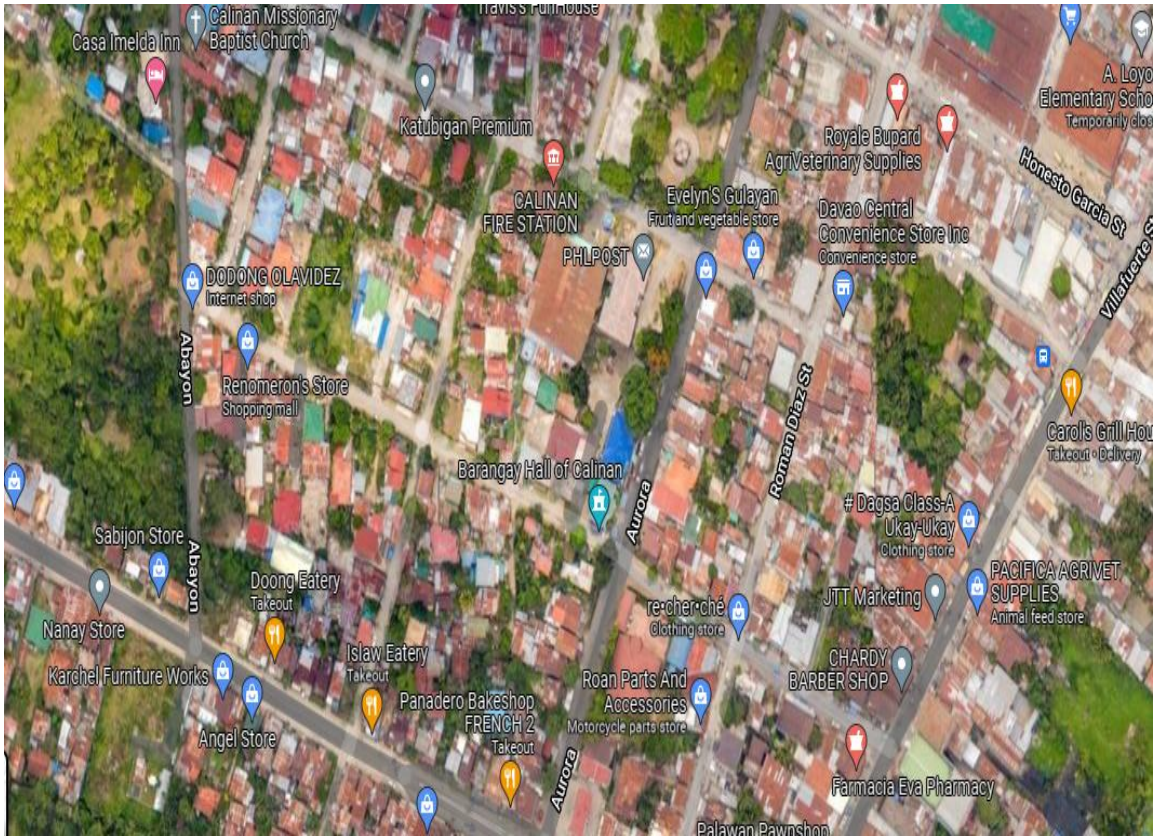

Figure 2. Calinan Poblacion, Davao City

Data Gathering Procedure

Before the onset of data gathering, permission from the school administrators on the conduct of the study was sought. A letter was sent to inform the school principal about the nature of the study. After getting the approval from the school authorities, another letter was crafted and sent to Davao City Water District (DCWD) requesting the company to furnish the statistical record of residential water demand and commercial water demand in Davao City during the pre-pandemic and pandemic periods from January to August through the use of online platforms.

Upon conducting this study, the consideration of ethics was imperative. These moral principles are able to guide the researchers to conduct a study without the intention of harming the accomplices of the study, whether intentionally or unintentionally (Singh, 2019). This also allows the researchers to create a just, responsible, and common-sense study. The organizations associated with this study were primed to ensure that the confidentiality of the data gathered is secured as there would be no different people who have access to it aside from the researchers and their research adviser. The organizations involved have the option of withdrawing their approval of the letters required to collect the data.

The researchers acquired the needed data, and the gathered data were compiled and wrapped for interpretation and analysis. The data were computed for interpretation and compared to other acquired data for statistical comparison. The impact of the COVID-19 pandemic on residential and commercial water demand during the pre-pandemic and pandemic periods was prepared for analysis and for the comparison of both records.

Data Analysis

A t-test was utilized in this study to find the difference between the effects of the COVID-19 pandemic on water demand in Calinan Poblacion, Davao City. The researchers made use of the t-test statistical test because it compared two variables present in this study, as well as it determined their differences. Moreover, as stated by Bevans (2020), a t-test is a statistical test that is used to compare the means of two groups.

On the other hand, the difference between the two sets of data gathered was acquired through the t-test statistical tool. Also, the gathered data in each category, including both residential water demand and commercial water demand, was compared as well. Likewise, there were no statistical tools employed in getting the answers to the research questions 1 and 2 since the data gathered provided the answers.

In the field of statistics, t-test was used in assessing whether there is a significant difference between two groups' means. Also, t-tests examine if two sets of normally distributed data are similar or dissimilar by comparing their standard deviations and means, respectively (Statistical Tool, 2017). In addition, higher values of the t-score indicates that a large difference exists between the two sample sets while smaller values of the t-score indicates that a more similarity exists between the two sample sets (Hayes, 2021).

All the data gathered were run through Microsoft Excel. The use of Microsoft Excel’s t-test illustrated the difference between the two sample sets. The researchers were able to determine whether the two sample sets differ or are similar after encoding the data

to Microsoft Excel. Since the results showed the difference or similarities between the sample sets, it answered the research question 3.

Chapter 3

RESULTS AND DISCUSSION

This chapter thoroughly discusses the results and findings after the data points were gathered. Further, the research questions found in the statement of the problem in Chapter 1 were answered.

Research Question 1: ***What is the residential water demand in Calinan, Davao City from January to August when classified as pre-pandemic time 2018-2019 and pandemic time 2020-2021***

Table 1. Residential Water Demand in Calinan, Davao City from 2018-2021 for the months of January to August

YEAR (January to August)	WATER CONSUMPTION (in cubic meters)	AVERAGE CONSUMPTION PER CONNECTION PER DAY (in cubic meters)
2018 (Pre-pandemic)	583,752	0.77
2019 (Pre-pandemic)	538,289	0.76
2020 (Pandemic)	544,531	0.76
2021 (Pandemic)	607,923	0.79

Table 1 shows the corresponding water consumption of the residents in Calinan, Davao City from January to August in 2018-2019 before the pandemic hit the country. Shown also in the table is the water consumption on the same months, January to August, of 2020-2021 when the country was experiencing health crisis due the COVID-19 pandemic. It can be gleaned from the table that before the pandemic, the residential water

consumption of Calinan in 2018 from January to August was 583,752 m^3, or equivalent to 0.77 m^3 per day. On the same months in 2019, the residents' water consumption was recorded to be 538,289 m^3 or equivalent to 0.76 m^3 per day.

On the other hand, the recorded water consumption in 2020 on the same months, January to August, was 544,531 m^3, or equivalent to 0.76 m^3 per day and 607,923 m^3, or equivalent to 0.79 m^3 per day in 2021. It is important to remember that in 2020-2021, various forms of community restrictions and lockdowns were in place due to the pandemic. As a consequence, a change in the residential water demand can be noted in the figures reflected in table 1. Specifically, for 2018-2019, pre-pandemic time, the average water consumption was 561,102.2 m^3 which is lower than the 576,277 m^3 in 2020-2021 during the pandemic time.

The trend in the change in water demand from the period covered in this study is clearly shown in Figure 3.

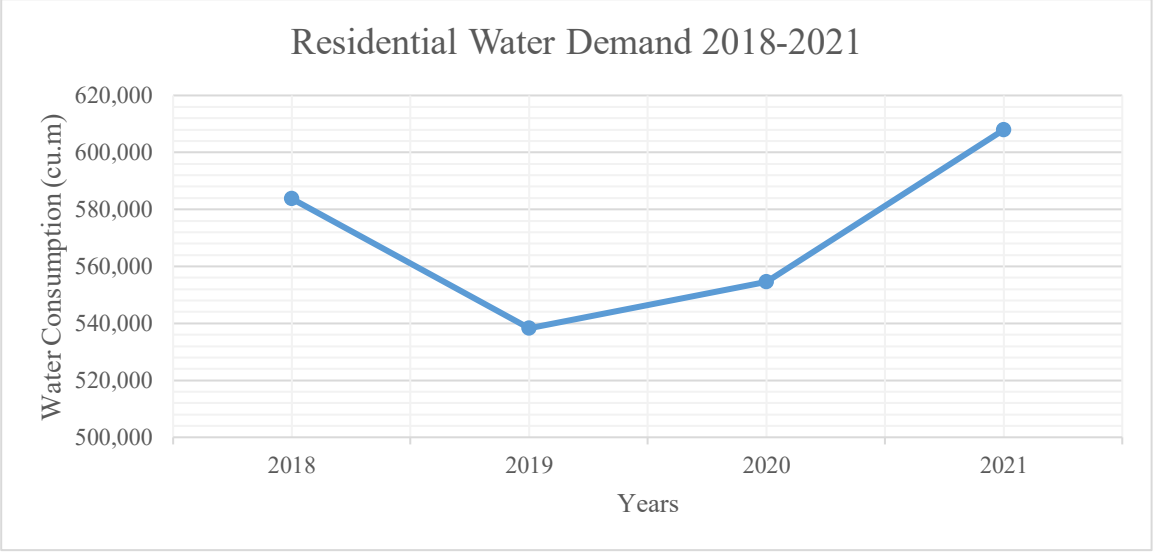

Figure 3: Residential Water Demand in 2018-2021

The graph in figure 3 illustrates a decrease in water consumption in 2018 to 2019. However, an increase was observed from 2019-2021. Further, it can be noted that the increase from 2020-2021 is higher than the increase from 2019-2020.

The observations noted above are supported by the study conducted by Sonowal (2017) stating that the decrease in residential demand is often caused by climate conditions, economic status, the number of establishments, environmental changes, water supply systems, and the size of a city. Futher, the study of Velayutham (2019) mentioned that residential water demand can also increase due to the vitality of water in regards to health, hygiene, and entertainment. Furthermore, the study of Cooley (2020) demonstrated that in Portsmouth, England, an increase of about 15% in residential demand is observable, particularly during the lockdown. This drastic change in the residential water demand is caused by people's more indoor activities than any outdoor activities due to the reasons that regulations such as social distancing and other measures are implemented to attain safety against the pandemic (Cooley, 2020; Dezecache, Frith, & Deroy, 2020).

When the World Health Organization declared that COVID-19 was a global pandemic (WHO, 2020), most governments worldwide agreed to compose a declaration of lockdown (Sick-Samuels, 2021), leading people to stay at home for safety (Oosterhoff, Palmer, Wilson, & Shook, 2020). Due to this, changes in residential water demand occurred because people were doing more indoor activities that used water during the pandemic, such as cooking, washing dishes, flushing toilets, showering, and sanitation (Cooley, 2020), as well as leisure, comfort, hygiene, convenience, and aesthetics (Pan et al., 2018). Moreover, it was suggested by the World Bank Group (2020) that water,

sanitation, and hygiene (WASH) are some of the common practices that can prevent individuals from acquiring the virus. Due to these concerns, and with adherence to the government's policies, residential water demand massively increased coming from a sudden drop, specifically in the years when the pandemic began (Fowler, 2020).

Research Question 2: ***What is the commercial water demand in Calinan, Davao City from January to August when classified as pre-pandemic time 2018-2019 and pandemic time 2020-2021***

Table 2. Commercial Water Demand in Calinan, Davao City from January to August when classified as Pre-pandemic time 2018-2019

YEAR (January to August)	WATER CONSUMPTION (in cubic meters)	AVERAGE CONSUMPTION PER CONNECTION PER DAY (in cubic meters)
2018 (Pre-Pandemic)	175,963	1.36
2019 (Pre-Pandemic)	158,558	1.24
2020 (Pandemic)	153,166	1.13
2021 (Pandemic)	149,761	1.11

Table 2 shows the corresponding amount of water consumed for commercial use in Calinan, Davao City from January to August in 2018-2019 before the pandemic hit the country. Presented in this table also is the water consumption on the same months, January to August, of 2020-2021 when the country is experiencing health crisis due the COVID-19 pandemic. It can be gleaned from the table that before the pandemic, the commercial water consumption of Calinan in 2018 was 175,963 m^3, or equivalent to 1.36

m^3 per day from January to August and 158,558 m^3, or equivalent to 1.24 m^3 per day in 2019.

On the other hand, the recorded water consumption from 2020-2021 on the same months, January to August, was 153,166 m^3, or equivalent to 1.13 m^3 per day, and 149,761 m^3, or equivalent to 1.11 m^3 per day respectively. It is important to recall that in 2020-2021, various forms of community restrictions and lockdowns were in place due to the pandemic, prohibiting consumers to have face-to-face social contact with retailers. As a consequence, a change in the commercial water demand can be noted in the figures reflected in table 2. Specifically, for 2018-2019, pre-pandemic time, the average water consumption was 167,260.5 m^3 which is lower than the 151,463.5 m^3 in 2020-2021 during the pandemic time.

The trend in the change in water demand from the period covered in this study is clearly shown in Figure 4.

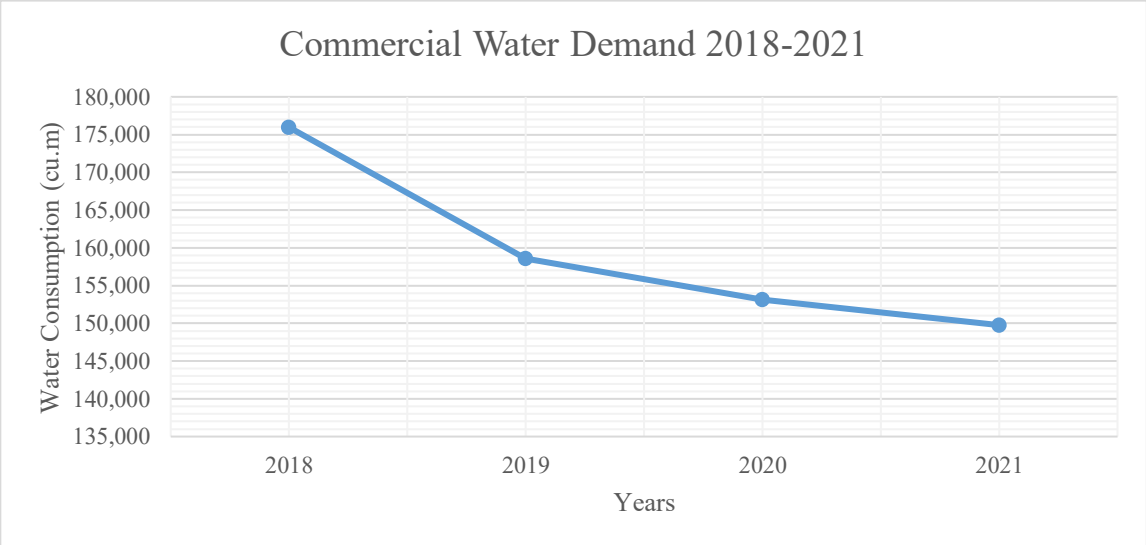

Figure 4: Commercial Water Demand in 2018-2021

The graph illustrates that from 2018 to 2019, the water consumption greatly decreased while it continued to decrease constantly until 2021. This means that the commercial water demand in Calinan Polacion, Davao City is constantly decreasing from pre-pandemic time until pandemic time.

The observations noted above are consistent with the theory proposed by Maslow (1943) stating that demand is affected by the human needs and human motivations as a result with the interaction of an individual with the environment. Although commercial refers to the services or to the establishments that allow people to gain and benefit money (Commercial, 2020), due to the closure of most non-essential commercial facilities (Melville-Shreeve, Cotterill, & Butler, 2021), the commercial water demand had decreased since the spread of the pandemic. In addition to this, the pandemic also severely affected the global economy and financial markets due to lockdowns for the safety of individuals during pandemic (Pak, et al., 2020). However, despite this concern, most individuals continued to seek for ways to obtain at least the basic needs and wants (Bartik, et al., 2020) in order to ensure safety and entertainment during lockdowns (United Nations Conference on Trade and Development, 2020).

Moreover, as a result of public adherence to the new normal (Sick-Samuels, 2021), most individuals made use of online platforms to gain entertainment, as well as spending time in online shopping (Tymkiw, 2021). In fact, a data gathered by Ouellette (2022) showed that online shopping massively grew that nearly hit the market size of 4 trillion during 2020 and was predicted that in US alone, around 300 million more online shoppers will exist in 2023. Additionally, in order to attain safety against the pandemic, the government executed actions declaring that social distancing and other measures of

prohibiting individuals from having face-to-face interactions, or by limiting social interactions in overall, can limit the spread of the virus as affirmed by Dezecache, Frith, and Deroy (2020). With this unaccustomed form of providing services, the use of commercial water had decreased as influenced by the closure of commercial establishments such as schools, universities, restaurants, and public transport (WHO, 2020).

Research Question 3: ***Is there a significant difference in the water demand in Calinan, Davao City during the pre-pandemic and pandemic time when classified as Residential Water Demand and Commercial Water Demand***

Table 3. The difference between the residential water demand during pre-pandemic and pandemic time

Residential Water Demand	**P-value**	**Commercial Water Demand**	**P-value**
Pre-pandemic Time	0.376470676	**Pre-pandemic Time**	0.132773283
Pandemic Time		**Pandemic Time**	

Table 3 reveals that there is no significant difference in the two variables involved in terms of the residential water demand of the residents in Calinan, Davao City before the pandemic and the pandemic time. With the p-value of 0.376470676 which is greater than 0.05, this means that there is no significant difference between the variables. Although the results showed no statistical difference, the graph in figure 3 made the impact of the COVID-19 pandemic obvious, providing evidence of the change in residential water demand in Calinan, Davao City.

Moreover, table 3 also reveals that there is no significant difference in the two variables involved in terms of the commercial water demand before the pandemic and the pandemic time. This is due to the p-value of 0.132773283 which is greater than 0.05 which statistically means that there is no significant difference between the variables. Although the results showed no statistical difference, the graph in figure 4 made the impact of the COVID-19 pandemic obvious, providing evidence of the change in commercial water demand in Calinan, Davao City.

The mean and the standard deviation of both residential water demand and commercial water demand after computation are clearly shown in Figure 5 and Figure 6.

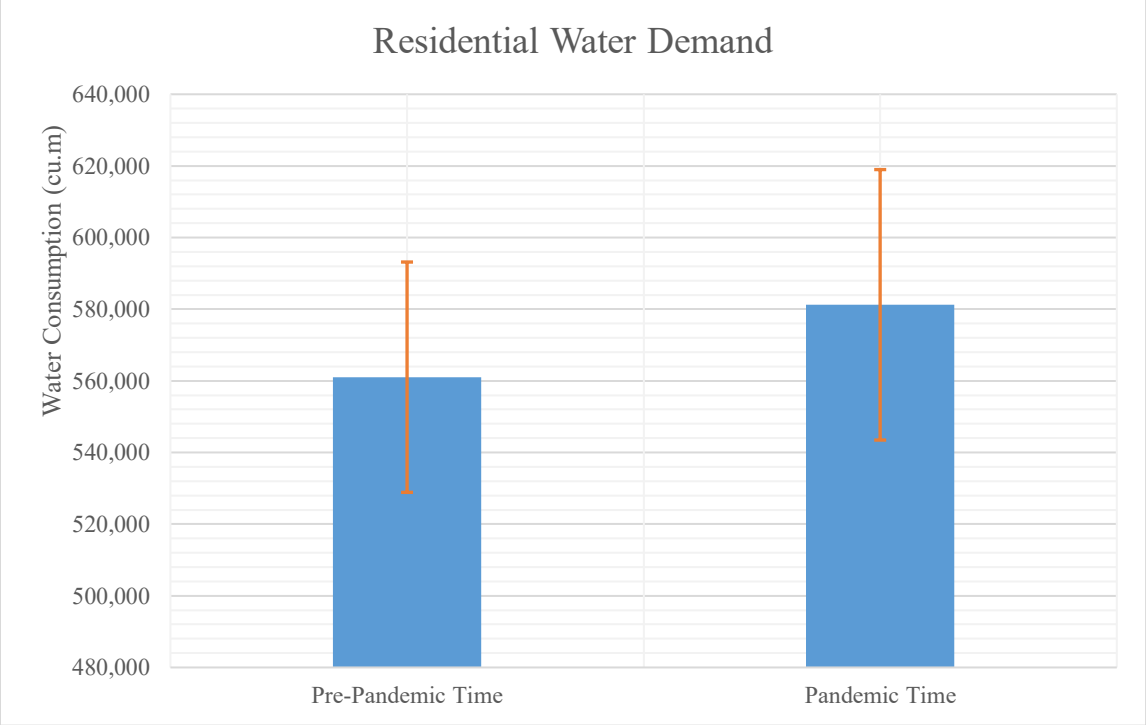

Figure 5: Mean and Standard Deviation of Residential Water Demand

The graph illustrates that the average residential water consumption during pre-pandemic time is lower in comparison with the residential water consumption during

pandemic time. In clarity, the blue-colored bar represents the mean while the orange-colored line represents the standard deviation. As shown in the illustration, height of both bar is not entirely different with each other, meaning to say that the residential water demand has no significant difference.

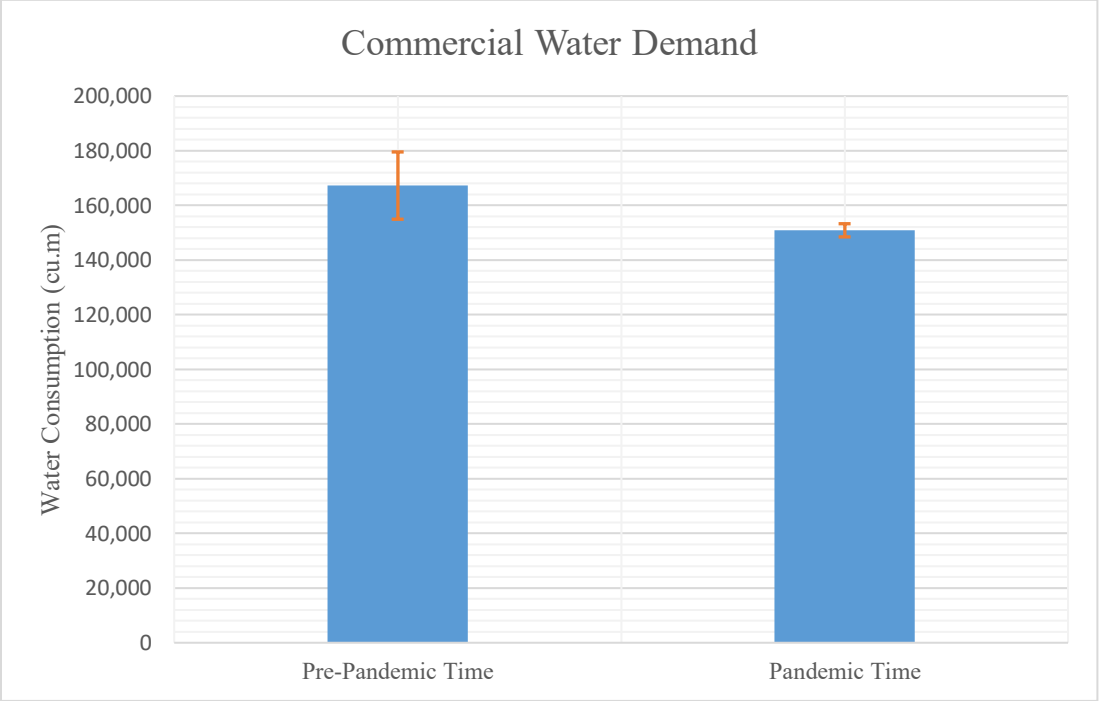

Figure 6: Mean and Standard Deviation of Commercial Water Demand

The graph illustrates that the average commercial water consumption during pre-pandemic time is higher in comparison with the commercial water consumption during pandemic time. In clarity, the blue-colored bar represents the mean while the orange-colored line represents the standard deviation. As shown in the illustration, height of both bar is not entirely different with each other, meaning to say that the commercial water demand has no significant difference.

The results gleaned above are similar to the study of Otaki, Honda, and Ueda (2020) revealing that the difference of water consumption as the results in residents' inconvenience or dissatisfaction shows no significant difference as the coding of the gathered data showed a p-value of 0.42. This is because people can freely use water depending on their needs and preferences. Likewise, during the start of the pandemic, the World Bank Group (2020) suggested that through following WASH, the residents may efficiently prevent the spread of the virus. Also, Cooley (2020) stated that during the pandemic, people used water more frequently inside residential areas and used less water in commercial areas. This explains that the human needs and preferences affecting water demand usually involved to the vitality of water in prevention against pathogens (Velayutham, 2019).

Moreover, the observations noted above are also consistent with the theory proposed by Maslow (1943) stating that demand is affected by the human needs and human motivations as a result with the interaction of an individual with the environment. Also, human preferences greatly changed due to the implementations of lockdowns (Pak, et al., 2020). Thus, this led the population to seek for other ways to attain at least the basic needs and wants (Bartik, et al., 2020) even through online shopping (Tymkiw, 2021). This explains that water demand is also depending on the decision of the people to attain safety amidst pandemic (Morgan, 2020).

Chapter 4

CONCLUSION AND RECOMMENDATIONS

The conclusions and recommendations drawn from the data analyzed in the previous chapter is found in this chapter.

Conclusion

Based on the data gathered, the total residential water demand in Calinan Poblacion, Davao City during the years 2018, 2019, 2020, and 2021 in the months of January to August is 2,284,495 m^3, having the average of 561,102.2 m^3 in 2018 and 2019, during the pre-pandemic time, and an average of 576,277 m^3 in 2020-2021, during the pandemic time. Specifically, the water consumption during pre-pandemic time had decreased from 583,752 m^3 to 538,289 m^3 while the water consumption increases from 544,531 m^3 to 607,923 m^3 when the world is facing health crisis due to the COVID 19. It can be concluded that the pandemic impacted the residential water demand in Calinan Poblacion based on the recorded data.

On the other hand, the total commercial water demand in the same area during the months of January to August was 637,448 m^3, having the average of 167,260.5 m^3 in 2018 and 2019, during the pre-pandemic time, and the average of 151,463.5 m^3 in 2020 and 2021, during the pandemic time. Thus, the figures on water demand of the commercial sector clearly showed the impact of the pandemic with a decreasing pattern. However, the statistical computations exposed a p-value of 0.376470676 of the residential water demand during pre-pandemic time and pandemic time which means it has no significant difference. Lastly, the results of the computations exposed a p-value of

0.132773283 from the commercial water demand during pre-pandemic time and pandemic time which means it has no significant difference as well.

Recommendations

Based on the results that are shown and processed into interpretation, the future researchers are recommended to gather data of the residential and commercial water demand that range from January to December in the years 2018 to 2022 to completely identify the total annual water consumption befitting in the categories. Additionally, they can expand the years of both pre-pandemic time and pandemic time to acquire a larger set of data leading to the enhancement of the accuracy of results. Secondly, since this study is only limited to Calinan Poblacion, Davao City, future researchers are recommended to conduct this study in a bigger context, which is to completely assess the water demand in whole Davao Region or even cover the whole Region XI. This is one way of maximizing available data for more accurate and effective strategies on water conservation. Another study can also be conducted including the industrial and agricultural sectors since the current study is grounded to assessing the impacts of water demand in both residential and commercial categories only to enhance the reliability of the study.

Moreover, as the results suggest there is an increase in residential water demand during pandemic time. The residents in Calinan Poblacion, Davao City are recommended to practice water conservation techniques in order to preserve water for future purposes. Therefore, an effective information drive about water conservation shall be conducted. This can be initiated by the barangay officials to make it more focused and in small-scale. Also for the DCWD, the need to craft effective programs, strategies and initiatives to

monitor water consumption to prevent exhaustion of the water source not only during this time of the pandemic.

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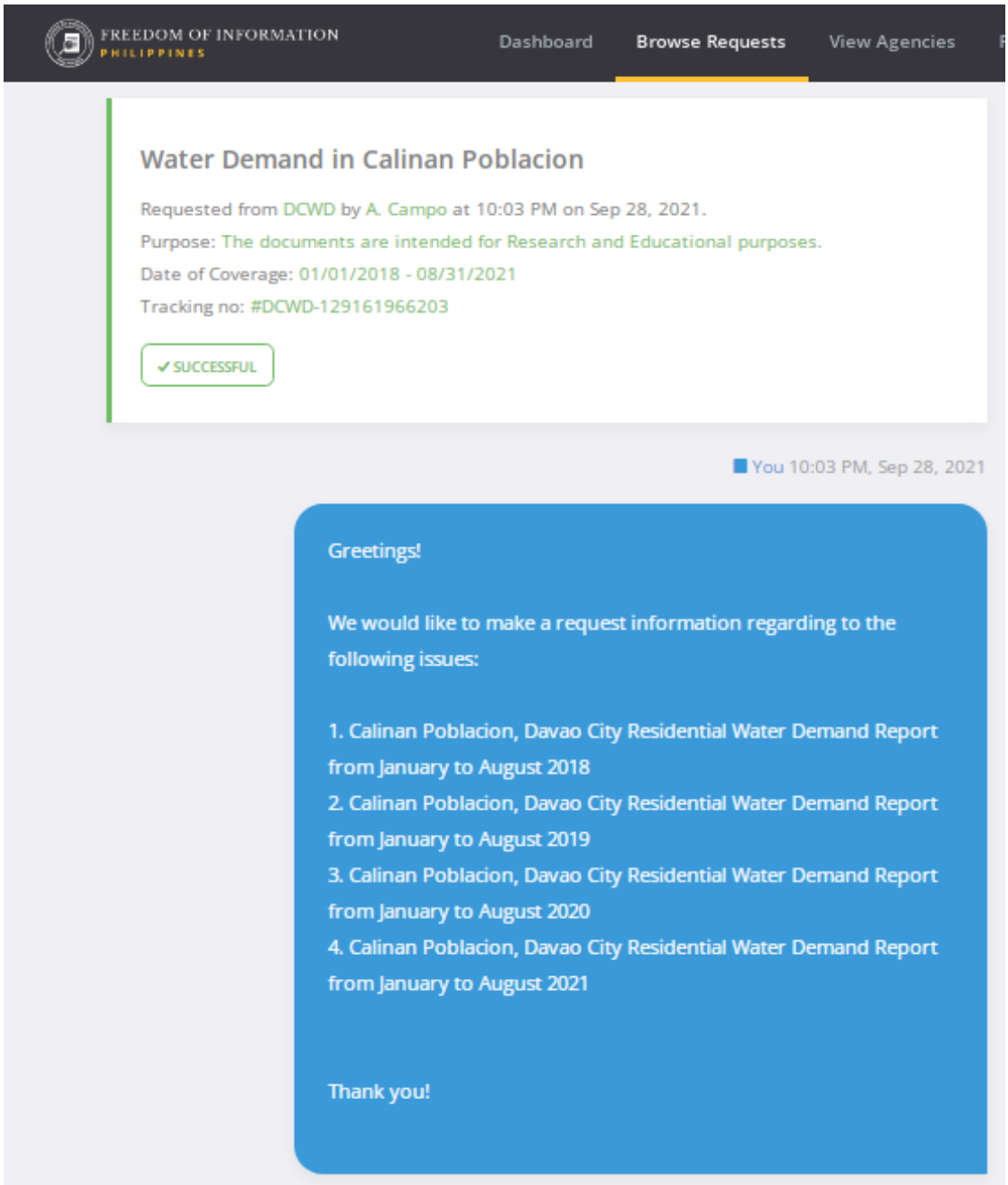
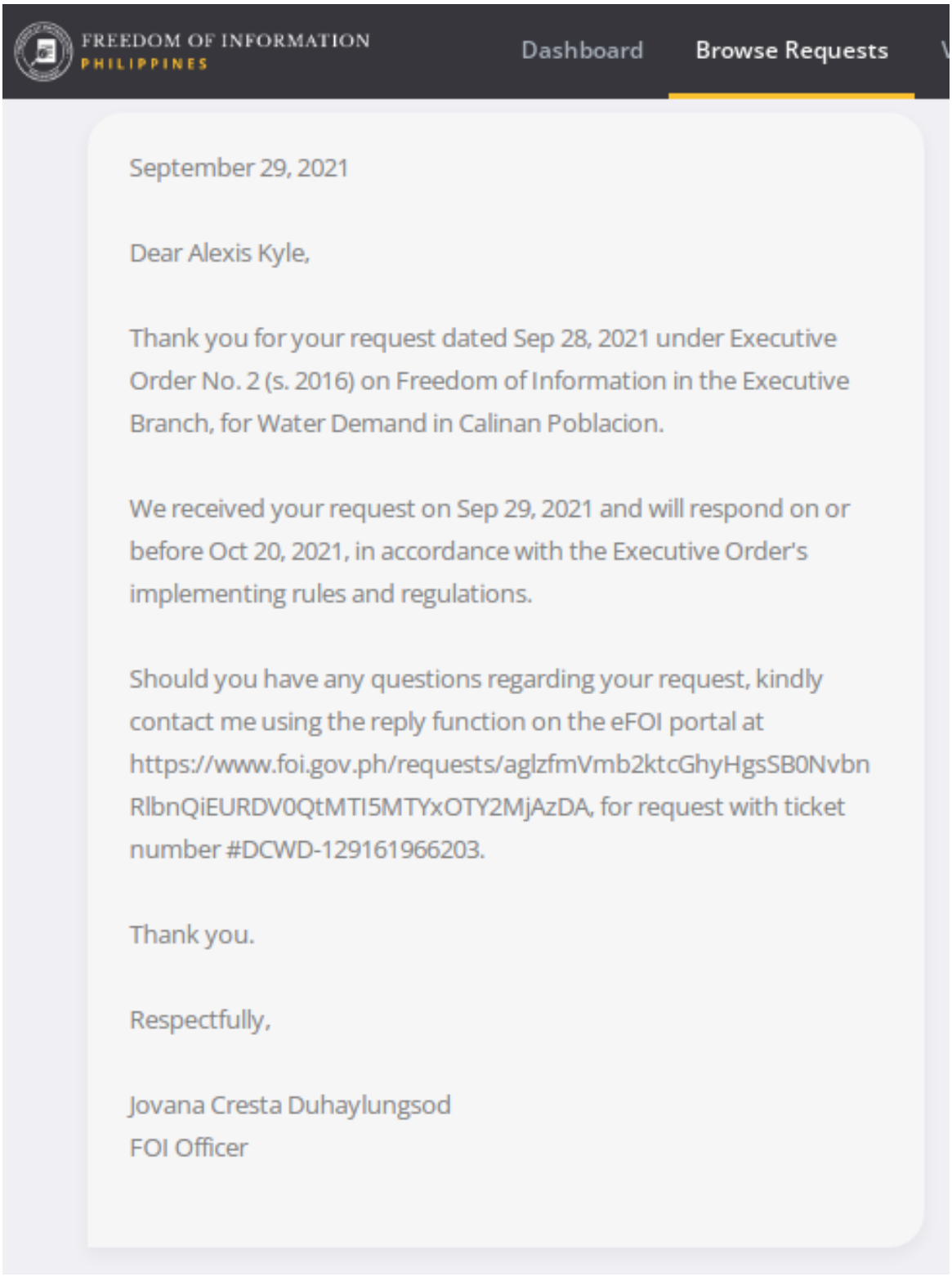
Appendix 1: Residential Water Demand Online Request

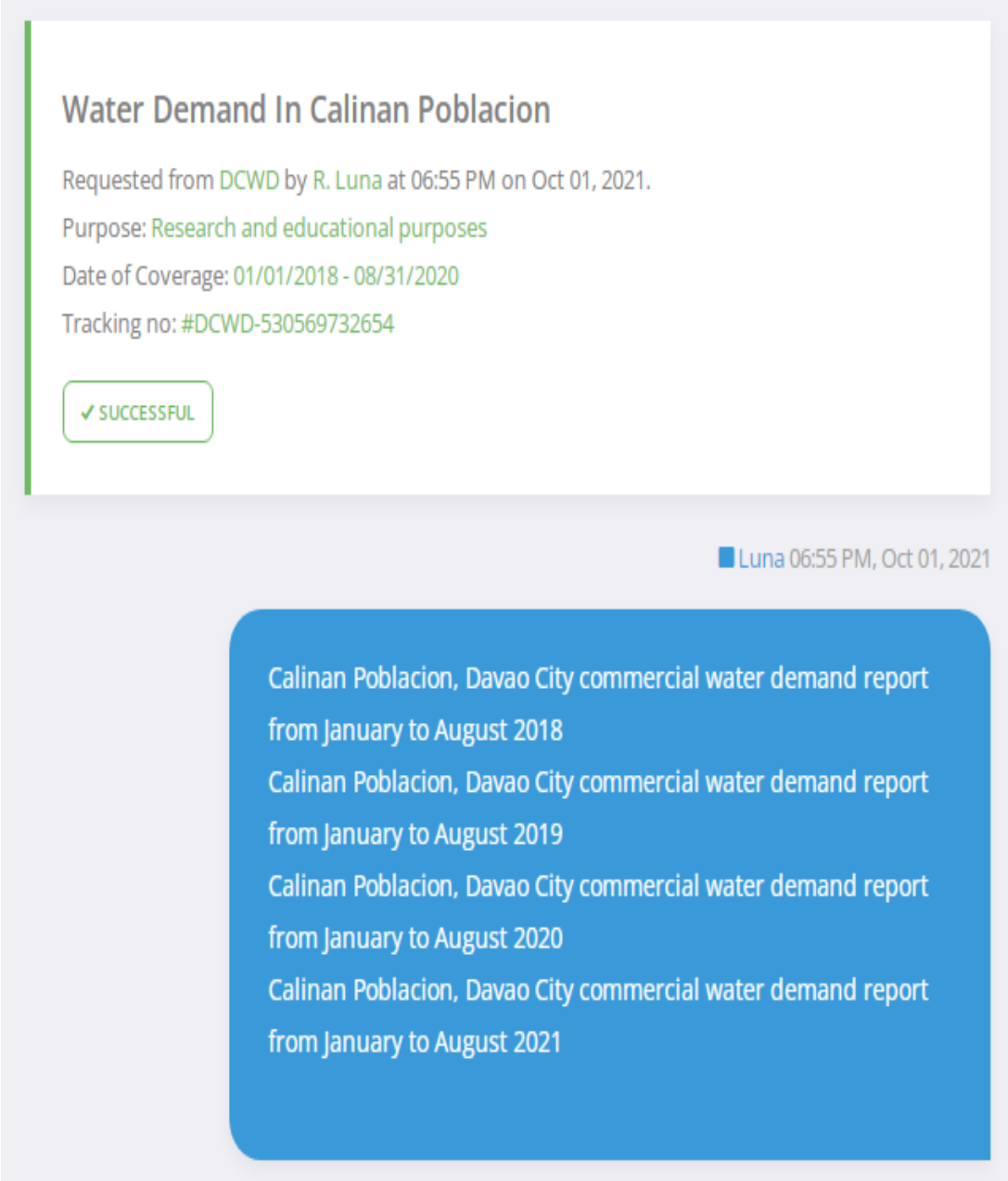
Residential Water Demand during Pre-Pandemic and Pandemic Time

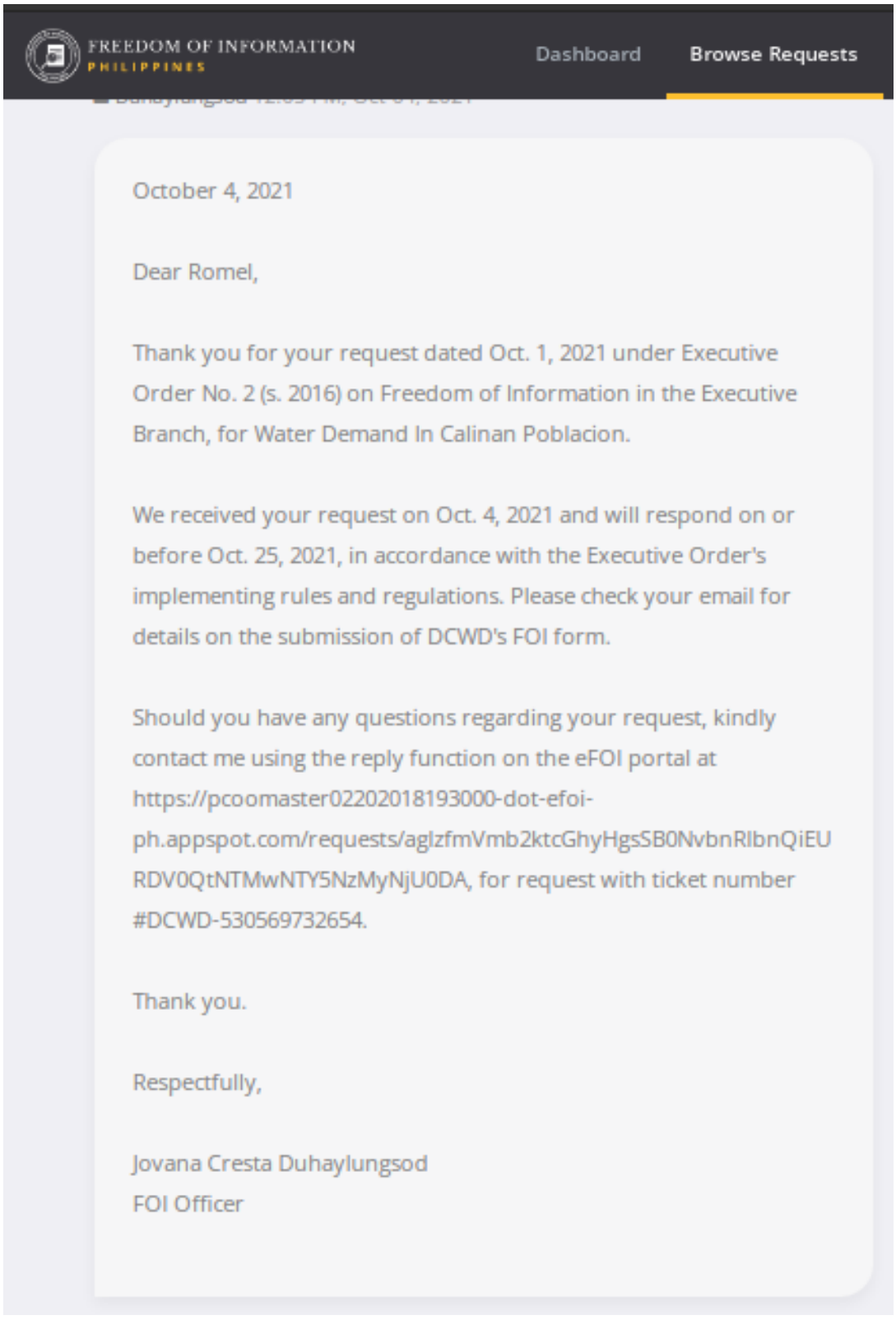



FREEDOM OF INFORMATION
PHILIPPINES
Dashboard
Browse Requests
September 29, 2021
Dear Alexis Kyle,
Thank you for your request dated Sep 28, 2021 under Executive Order No. 2 (s. 2016) on Freedom of Information in the Executive Branch, for Water Demand in Calinan Poblacion.
We received your request on Sep 29, 2021 and will respond on or before Oct 20, 2021, in accordance with the Executive Order's implementing rules and regulations.
Should you have any questions regarding your request, kindly contact me using the reply function on the eFOI portal at https://www.foi.gov.ph/requests/aglzfmVmb2ktcGhyHgsSB0NvbnRlbnQiEURDV0QtMTI5MTYxOTY2MjAzDA, for request with ticket number #DCWD-129161966203.
Thank you.
Respectfully,
Jovana Cresta Duhaylungsod
FOI Officer

Appendix 2: Commercial Water Demand Online Request

Commercial Water Demand during Pre-Pandemic and Pandemic Time




FREEDOM OF INFORMATION
PHILIPPINES
Dashboard
Browse Requests
October 4, 2021
Dear Romel,
Thank you for your request dated Oct. 1, 2021 under Executive Order No. 2 (s. 2016) on Freedom of Information in the Executive Branch, for Water Demand In Calinan Poblacion.
We received your request on Oct. 4, 2021 and will respond on or before Oct. 25, 2021, in accordance with the Executive Order's implementing rules and regulations. Please check your email for details on the submission of DCWD's FOI form.
Should you have any questions regarding your request, kindly contact me using the reply function on the eFOI portal at https://pcoomaster02202018193000-dot-efoi-ph.appspot.com/requests/aglzfmVmb2ktcGhyHgsSB0NvbnRlbnQiEURDV0QtNTMwNTY5NzMyNjU0DA, for request with ticket number #DCWD-530569732654.
Thank you.
Respectfully,
Jovana Cresta Duhaylungsod
FOI Officer

Appendix 3: Letter to the School Principal

HOLY CROSS COLLEGE OF CALINAN

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

December 3, 2021

Ma. Corazon Suñga, PhD
School Principal
Holy Cross College of Calinan

Dear Ma'am,

Greetings of peace and solidarity!

We are writing this letter to inform you that we will be conducting a research study entitled: **ASSESSING THE EFFECTS OF COVID-19 PANDEMIC AFFECTING WATER DEMAND IN CALINAN POBLACION, DAVAO CITY** as the major requirement in our Practical Research 1 and 2. The objective of our study is to compare and contrast data since pre-pandemic and pandemic period to assess the effects of COVID-19 to water demand in Calinan Poblacion, Davao City. The result of our study will be part of our contribution to the community by providing data showing the effects of COVID-19 to water demand at the area involved.

In lieu of this, we would like to ask permission to get from your office the total water consumption under the residential and commercial category of the whole Davao City in the following duration:

January – August, 2018

January – August, 2019

January – August, 2020

January – August, 2021

Confidentiality of the information obtained is assured as there will be no other individuals who have access on them except the researchers and their research adviser.

Should you wish to know more about the study, please feel free to contact:

Alexis Kyle C. Campo- 09611296276 / kalexxcampo@gmail.com

Thank you very much.

Very truly yours,

Alexis Kyle C. Campo
Researcher

April Krystel D. Peralta
Researcher

Romel Jr. Feliz Laha
Researcher

Lady Frances B. Licmoan
Researcher

Noted by:

Melina C. Gonzales EdD
Research Adviser

Approved by:

Ma. Corazon Suñga, PhD
School Principal

Complaints about this research:

The Holy Cross College of Calinan requires that all the participants are informed and if they have complaints regarding the manner in which the research is conducted, it may be given to the researcher, or if an independent person is preferred, to the Research and Publication Head, Research Office, Holy Cross College of Calinan with the following numbers: 295-0797 or 09491985644.

Appendix 4: Responses to Residential Water Demand Request

Davao City Water District Official Response: Residential Water Demand

Republic of the Philippines
DAVAO CITY WATER DISTRICT
Km. 2.5, MacArthur Highway, Matina, Davao City
Tel. Nos.: (082) 235-3293 (connecting all departments)
(082) 297-3293 (Central Information Unit / Call Center)
Fax: (082) 297-3293 (Local 441)
www.davao-water.gov.ph davaowater@yahoo.com, ogm@davao-water.gov.ph www.facebook.com/davaowater

October 4, 2021

ALEXIS KYLE C. CAMPO
FOI Requesting Party
Aurora Quezon Street, Calinan, Davao City

Dear **Mr. Campo:**

We have received your request dated September 29, 2021 under Executive Order No. 2 (s. 2016) on Freedom of Information in Executive Branch.

You specifically requested for data on the Residential Water Demand Report of Calinan Poblacion from:

1) January to August 2018;
2) January to August 2019;
3) January to August 2020; and
4) January to August 2021

We are pleased to inform you that this request has been approved. Attached herewith is the copy of all of the information requested in the format you asked for.

We hope you are satisfied with the information we have given.

Respectfully,

Digitally signed by Regalado Edwin Villaflores
Date: 2021.10.06 08:18:25 +08'00'

ENGR. EDWIN V. REGALADO
General Manager

Appendix 5: Responses to Commercial Water Demand Request

Davao City Water District Official Response: Commercial Water Demand

Republic of the Philippines
DAVAO CITY WATER DISTRICT
Km. 2.5, MacArthur Highway, Matina, Davao City
Tel. Nos.: (082) 235-3293 (connecting all departments)
(082) 297-3293 (Central Information Unit / Call Center)
Fax: (082) 297-3293 (Local 441)
www.davao-water.gov.ph davaowater@yahoo.com, ogm@davao-water.gov.ph www.facebook.com/davaowater

October 6, 2021

ROMEL ERL FRITZ L. LUNA
FOI Requesting Party
Talomo River, Calinan, Davao City

Dear **Mr. Luna:**

We have received your request dated October 4, 2021 under Executive Order No. 2 (s. 2016) on Freedom of Information in Executive Branch.

You specifically requested for data on the Commercial Water Demand Report of Calinan Poblacion from:

1) January to August 2018;
2) January to August 2019;
3) January to August 2020; and
4) January to August 2021

We are pleased to inform you that this request has been approved. Attached herewith is the copy of all of the information requested in the format you asked for.

We hope you are satisfied with the information we have given.

Respectfully,

Digitally signed by Regalado Edwin Villaflores
Date: 2021.10.07 10:57:44 +08'00'

ENGR. EDWIN V. REGALADO
General Manager

Appendix 6: Data Samples

Sample #1: Residential Water Demand

Certified True Copy produced through
Freedom of Information Request

FOI – 092921 – 01
Alexis Kyle C. Campo

Residential Billed Consumption of Brgy. Calinan Poblacion, Calinan District
January to August 2018 to 2021

YEAR (January to August)	CONSUMPTION (in cubic meters)	AVERAGE CONSUMPTION PER CONNECTION PER DAY (in cubic meters)
2018	583,752	0.77
2019	538,289	0.76
2020	554,531	0.76
2021	607,923	0.79

Source: Davao City Water District

Sample #2: Commercial Water Demand

Certified True Copy produced through
Freedom of Information Request

FOI – 100421 – 02
Romel Luna

Commercial Billed Consumption of Brgy. Calinan Poblacion, Calinan District
January to August 2018 to 2021

YEAR (January to August)	CONSUMPTION (in cubic meters)	AVERAGE CONSUMPTION PER CONNECTION PER DAY (in cubic meters)
2018	175,963	1.36
2019	158,558	1.24
2020	153,166	1.13
2021	149,761	1.11

Source: Davao City Water District

Appendix 7a: Coding 1

Residential Water Demand Computations

	Residential Water Demand	
	Pre-Pandemic Time	**Pandemic Time**
	583,752	554,531
	538,289	607,923
P-value =	0.376470676	

t-Test: Paired Two Sample for Means		
Residential Water Demand		
	Variable 1	*Variable 2*
Mean	561020.5	581227
Variance	1033442185	1425352832
Observations	2	2
Pearson Correlation	-1	
Hypothesized Mean Difference	0	
df	1	
t Stat	-0.408810885	
P(T<=t) one-tail	0.376470676	
t Critical one-tail	6.313751515	
P(T<=t) two-tail	0.752941353	
t Critical two-tail	12.70620474	

Appendix 7b: Coding 2

Commercial Water Demand

	Commercial Water Demand	
	Pre-Pandemic Time	**Pandemic Time**
	175,963	153,166
	158,558	149,761
P-value =	0.132773283	

t-Test: Paired Two Sample for Means		
Commercial Water Demand		
	Variable 1	*Variable 2*
Mean	167260.5	151463.5
Variance	151467012.5	5797012.5
Observations	2	2
Pearson Correlation	1	
Hypothesized Mean Difference	0	
df	1	
t Stat	2.256714286	
P(T<=t) one-tail	0.132773283	
t Critical one-tail	6.313751515	
P(T<=t) two-tail	0.265546567	
t Critical two-tail	12.70620474	

Appendix 8: Editor's Certificate

Holy Cross College of Calinan
Davao- Bukidnon Highway, Calinan Poblacion, Davao City
RESEARCH AND PUBLICATION OFFICE

CERTIFICATION

This is to certify that the research paper of Alexis Kyle C. Campo, entitled THE IMPACT OF COVID-19 PANDEMIC ON THE WATER DEMAND IN CALINAN POBLACION, DAVAO CITY has undergone the editing process and been approved by the undersigned.

This certification is issued upon the request by the researcher on July 21, 2022.

_____
Editor

CURRICULUM VITAE

PERSONAL DATA

Name: Alexis Kyle C. Campo

Age: 17 years old

Date of Birth: May 10, 2004

Place of Birth: Davao City

Address: Aurora Quezon Street, Calinan, Davao City

Civil Status: Single

Citizenship: Filipino

Religion: Non-Catholic

Sex: Male

Father's name: Emeterio Campo Jr. **Occupation:** Farmer

Mother's name: Pedilin Campo **Occupation:** Self-employed

EDUCATIONAL BACKGROUND

SCHOOL	Year Graduated
Elementary: Holy Cross College of Calinan	2016
Junior High: Holy Cross College of Calinan	2020
Senior High: Holy Cross College of Calinan	2022

CURRICULUM VITAE

PERSONAL DATA

Name: Romel Erl Fritz L. Luna

Age: 17 years old

Date of Birth: February 22, 2004

Place of Birth: Isaac T. Robillo Hospital Calinan

Address: Purok 1 Talomo River, Calinan District, Davao City

Civil Status: Single

Citizenship: Filipino

Religion: Episcopal

Sex: Male

Father's name: Romeo Luna **Occupation:** Soldier

Mother's name: Ferly Luna **Occupation:** N/A

EDUCATIONAL BACKGROUND

SCHOOL	Year Graduated
Elementary: Amigo School of Calinan Inc.	2016
Junior High: Holy Cross College of Calinan	2020
Senior High: Holy Cross College of Calinan	2022

CURRICULUM VITAE

PERSONAL DATA

Name:	Lady Francess Cassandra Rodryn Angelica B. Licmoan	
Age:	18 years old	
Date of Birth:	November 10, 2003	
Place of Birth:	Davao City	
Address:	Ecoland, Emerald Street, Davao City	
Civil Status:	Single	
Citizenship:	Filipino	
Religion:	Roman Catholic	
Sex:	Female	
Father's name:	-	**Occupation:** -
Mother's name:	Pynk Licmoan	**Occupation:** Self-employed

EDUCATIONAL BACKGROUND

SCHOOL	Year Graduated
Elementary: Philippine Women's College of Davao	2016
Junior High: Grace Mission Academy of Davao, Inc.	2020
Senior High: Holy Cross College of Calinan	2022

CURRICULUM VITAE

PERSONAL DATA

Name: April Krystel D. Peralta

Age: 16 years old

Date of Birth: April 11, 2005

Place of Birth: Davao City

Address: Biao Guianga Tugbok District, Davao City

Civil Status: Single

Citizenship: Filipino

Religion: Roman Catholic

Sex: Female

Father's name: Felisardo Peralta **Occupation:** Driver

Mother's name: Evelyn Peralta **Occupation:** Housewife

EDUCATIONAL BACKGROUND

SCHOOL	Year Graduated
Elementary: Biao Guianga Elementary School	2015
Junior High: Holy Cross College of Calinan	2020
Senior High: Holy Cross College of Calinan	2022