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# GIS-BASED APPROACH OF MAPPING WATER POLLUTANT CONCENTRATION OF SG. GALING, KUANTAN

MOHAMAD SYAZWAN BIN MOHD LATIF

Diploma in Civil Engineering

UNIVERSITI MALAYSIA PAHANG
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# GIS-BASED ON APPROACH FOR MAPPING OF WATER POLLUTANT CONCENTRATION ALONG THE SG.GALING,KUANTAN

MOHAMAD SYAZWAN BIN MOHD LATIF

Thesis submitted in fulfillment of the
requirements for the award of the Diploma in
Civil Engineering Technology

Faculty of Civil Engineering Technology
UNIVERSITI MALAYSIA PAHANG

JANUARY 2023
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## ACKNOWLEDGEMENTS

Assalamualaikum and hello, first and foremost, I want to praise and thank Allah SWT for all of the opportunities, knowledge, guidance, and grace He provided me over this research period. My heartfelt gratitude and appreciation go to my supervisor, Dr Syarifuddin Bin Misbari, for his encouragement, motivation, direction, and counsel during my studies and research. I appreciate the time and effort expended in presenting the theory and practical knowledge of GIS for mapping water pollutant concentrations along the Sg. Galing, Kuantan. May Allah swt reward and bless him and his family. Many thanks to my friends for their assistance and support during the run fieldwork in Sg. Galing, Kuantan.

Not to mention the environmental engineering personnel at the Faculty of Civil Technology for your assistance and cooperation during the data collection process. I am grateful for their efforts and contributions to completing the research. Finally, my heartfelt gratitude goes to my parents for their encouragement and prayers. Thank you also to my sisters for their valuable time and support when I needed it. This project would not have been accomplished without their presence and support, and I am grateful for the love, drive, and all they offered me.
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## ABSTRAK

Pencemaran air terhasil daripada bahan berbahaya yang terbina dalam komposisinya, menjadikan air itu toksik dan tidak boleh digunakan kepada manusia dan haiwan. Kemerosotan dalam air ini juga menyebabkan kesan negatif pada persekitaran. Terdapat banyak perkara yang kita lakukan mempunyai kesan ke atas kehebatan air di persekitaran kita. Pemikiran tidak bertanggungjawab rangkaian untuk membuang sampah ke dalam sungai telah mencetuskan sungai tercemar dengan sampah sarap. Contohnya, pembuangan sampah secara terbuka dan penebangan hutan boleh menyebabkan sungai tercemar. Dan, boleh dikatakan, kita semua membuat sumbangan kepada masalah ini melalui panggilan untuk kertas dan kayu yang dibuat dari semak. mana-mana contoh lain ialah air sisa kumbahan. Kumbahan yang dibuang ke dalam sungai boleh mendatangkan bahaya kesihatan yang teruk bagi orang yang mandi atau berenang di dalamnya. Pencemaran air telah membunuh beribu-ribu dan menelan belanja berbilion-bilion, namun kami sama sekali tidak tahu ia akan berlaku kepada kami rakyat yang bertuah. Apa yang kita patut akui ialah bahan pencemar merosakkan persekitaran tempat kita bergantung. Jadi cara kita untuk mengatasi masalah ini adalah dengan mengurangkan penggunaan plastik, guna semula dan kitar semula. Cara ini dapat membendung masalah pencemaran sediment disebabkan oleh pembuangan sampah sarap ke dalam sungai .
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## ABSTRACT

Water pollution results from harmful substances built into its composition, making the water toxic and unusable for humans and animals. This degradation in water also causes negative effects on the environment. There are many things we do that have an impact on the greatness of water in our environment. The irresponsible thinking of the network to throw garbage into the river has caused the river to be polluted with garbage. For example, open dumping and deforestation can cause rivers to be polluted. And, arguably, we all make a contribution to this problem by calling for paper and wood made from the bush. any other example is sewage waste water. Sewage dumped into the river can pose a serious health hazard to people who bathe or swim in it. Water pollution has killed thousands and cost billions, yet we had absolutely no idea it would happen to us lucky citizens. What we should acknowledge is that pollutants damage the environment we depend on. So our way to overcome this problem is to reduce the use of plastic, reuse and recycle. This way can curb the problem of sediment pollution caused by the dumping of rubbish into the river.
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## LIST OF SYMBOLS

1) KM = Kilometre
2) M = Meter
3) MM = Milimiter
4) $m^2$ = Meter per square
5) % = Percentage
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## LIST OF ABBREVIATIONS

GIS Geographic Information System
R.S Remote Sensing
TSS Total Suspended Solid
BOD Biochemical Oxygen Demand
DO Dissolved Oxygen
WQI Water Quality Index
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## LIST OF APPENDICES
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# CHAPTER 1

# INTRODUCTION

## 1.1.1 RIVER IN KUANTAN,PAHANG

Currently, Kuantan has many rivers that are quite wide and long. Among them are Sungai Pandan, Sungai Sepat, Sungai Galing, Sungai Penur, Sungai Air Hitam and Sungai Kuantan. The river that has a larger width and length is Sungai Kuantan. This is because Sungai Kuantan is the main river in Kuantan. For our group, we chose Sg. Galing as our test site to get sediment samples.

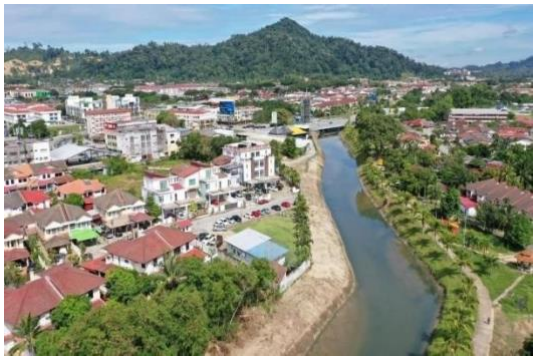

Figure 1.1 : Sg Galing ,Kuantan,Pahang (Kuan Lee,2010)

## 1.1.2 INTRODUCTION WATER POLLUTANT OF SG . GALING

As we know, water pollutant is a pollution that can have a negative impact on life. In this chapter, we will know about the state of water pollutant in Sg. Galing ini. Water pollutant can be categorized into three types namely oil pollutant, chemical pollutant and sediment pollutant. This chapter will discuss more about sediment pollutant. We will be able to know if Sg. Galing is polluted with this sediment pollutant at the same time can find a good step to overcome this problem. So, to obtain sediment samples from Sg. This time, sophisticated software will be used to help obtain this sample. The software that will be used is Geographic Information System (GIS) and Remote Sensing.. This chapter will also explain the steps we will take to obtain sediment samples from Sg. Galing.
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## 1.2 BACKGROUND OF STUDY

Many water pollutants have been produced as a result of industrial waste and other sources. Water pollution clearly occurs in urban areas where industrialization has occurred in certain areas. Traditional methods of monitoring water quality along long rivers are inefficient and time-consuming. Consequently, a technology-based approach is required. With the help of GIS, this project aims to map the concentration of water pollutants along Sg. Galing, Kuantan. The types of sediment pollutants that flow into Sg. Galing is the focus of this study. To determine whether a place is highly polluted, the interpolation of high, medium and low pollution concentrations will be categorized along the river. Spatial analysis of the drone images and examination of the filed data will be analyzed using a GIS system to determine the sources of pollution responsible for the map patterns. This can also affect human well-being because polluted water reduces the population of marine life and may contain diseases that are dangerous for human consumption. The maps and analysis produced from this study can help decision makers and local authorities to prepare immediate mitigation actions to prevent further pollution into the Sg water system. Galing, in line with SDG 11: Sustainable cities and communities; and SDG 14: Life under water.

Figure 2.1 : Example of picture at Sg . Galing (Ahmad,2011)
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## 1.3 PROBLEM STATEMENT

This study focuses on the sediment pollutant that causes water pollution in Sg. Galing. There are many development activities near Sg. Galing that potentially bring various sources of sedimentation along the river. Over the years, the water condition of Sg. Galing is not stable, and highly exposed to pollution. Sometimes, the water is dirty due to the deposits of wood, stone and glass fragments. In addition, all aquatic life and plants in the water will be threatened by the waste materials of this development activity.

All types of water pollution have effects and are dangerous to humans and other species if it is too serious. For example, fragments of solid materials such as stone, glass and wood can result in unhealthy water conditions for life. In addition, river dredging is increasingly active in our country, the purpose of which is to ensure safe navigable waterways and to control floods from happening. The result of dredging is sediment, which is solid material that settles on the bottom of rivers and seas. Each type of sediment is different depending on the area and depth of the dredging location. River dredging is becoming more significant because it contributes directly to the country's economic development. River dredging has a positive and negative impact on the environment. Positive impacts include improving infrastructure and reducing the risk of flooding. From a negative point of view, it contributes to the pollution of water quality, destroys life in the disposal area and damages its aesthetics.

Various strategies to reduce the negative impact of river dredging process are taken by developed countries. Japan, for example, widely reuses dredging sediment. In Malaysia, this method is still less practiced, instead the sediment is disposed of either offshore or on land. Some waste from dredging is just placed near the dredging site without detailed planning for recycling or reuse. This shows that there is still less effort towards encouraging the reuse of river and sea dredging waste. From the results of past research, there is some clear evidence showing that the use of dredging sediment contributes some positive effects to the construction industry.This is clear where the use of dredged sediment in brick making is proven to be able to meet the needs of building material suppliers.However, dredging sediment must be treated before use to avoid any impact on users. In addition, the issue related to the increase in the price of sand is being discussed more and more..Sand is one of the important raw materials in the construction industry that is widely used in the manufacture of bricks and concrete.The high demand for sand causes illegal mining companies to grow like mushrooms until the destruction of nature.Alternatively, the use of this sand can be reduced by replacing it with waste material that can still be potentially used.

Without proper research method and appropriate technology, the situation would be critical, aligned with the hectic and continuous industrialization at its vicinity.
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Furthermore, this incident will continue because there is no law imposed on the perpetrators who do it. Therefore, spatial science technology is effectively helps in decision making by the local agency to do mitigation action and ensure water security for many economic sectors and the people live in Kuantan.


Figure 1.3 : The diagram shows the effects of water pollutants on the environment (David,2012)

Figure 1.4 : Examples of river dredging activities to obtain sediment (Ah Juan,2009)
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## 1.4 OBJECTIVE

The aims of this study are as follow:

i. To identify water pollutant from sediment – based pollutants in Sg. Galing using GIS .
ii. To generate database of water quality in Sg.Galing

## 1.5 SCOPE AND LIMITATION

The scope of this study has been determined to ensure that the focus of the study is on certain areas only. The study area is only involved in the city of Kuantan, which is Sg. Galing. So, when you have obtained all the necessary information, it is necessary that the current database of WQI and the mapping of Sg Galing needs to be updated using GIS technology. Therefore, when all the information has been updated on the GIS software, we should be able to classify, predict and provide solutions to overcome water pollution in Sg. Cool

## 1.6 SIGNIFICANT OF STUDY

The importance of this study is that the gathered data on Sg Galing's water quality may be compared to Malaysia's Water Quality Index (WQI) and the National Water Quality Standard (NWQS). Class I water is in its natural state and does not require treatment, Class II water is good for recreation but requires conventional treatment before use, and Class III water requires conventional treatment before use. Then there's Class III water, which must be thoroughly treated before it can be utilised. Only Class IV river water is suitable for irrigation, whereas Class V river water is too contaminated to be reused. We can assess the availability of water by categorising its water quality classes.
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Figure 1. : SDG 11 data and requirement for entire world (PS Vatara,2012)

Figure 1. illustrates data from around the world that is related to the achievement of SDG 11.

Aside from that, this research is in line with SDG 11 (Sustainable Cities and Communities), which aims to improve urban planning, management, and development, resulting in more accessible, safe, resilient, and sustainable urban places around the world. Because of the action that will be taken against those who contribute pollution to the Galing River, this research will aid in the attainment of the SDG 11 goals, since data collecting will aid in pinpointing where the source of pollutant originates.


Figure 1. : SDG 14 Conserve and sustainably for sustainable development (Maher Nasser,2012)
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Finally, the importance of this study is to protect the Galing River's ecosystem and aquatic life from pollution. This was in line with SDG 14. (Life below water). As we all know, there are aquatic life in the river; if the river water becomes contaminated as a result of human activity, these aquatic life will be threatened and will impair their habitat environment. We, as an intelligent species, should conserve and cohabit with these aquatic creatures, and we must preserve their natural habitat to prevent any aquatic species from extinction.

## 1.7 SUMMARY

Overall, this chapter explains the background, problem statement, objectives and expected results about water pollution in Sg. Cool. From this chapter, we can find out the negative effects on humans and natural life that will happen if this pollution problem is not dealt with at an early stage. In addition, we can also find out the positive effects resulting from the dredging of this sediment to the construction industry. There are steps that can be taken to deal with the negative effects. Therefore, we as responsible human beings should take steps and create the best way to overcome this pollution problem. If this issue can be dealt with in a healthy way, we can protect ourselves and other lives from dangerous threats such as water pollution that can affect health. The technology that exists today can help people deal with this pollution problem in order to be able to prevent everything related to pollution and create a friendly life in this world
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# CHAPTER 2

# LITERATURE REVIEW

## 2.1 INTRODUCTION

As an introduction to this chapter ,this chapter focused on aspects of water pollution , including how it affects the ecosystem ,marine life, and human beings . This chapter also discuss the different kinds of pollution that occur in the global environment by considering various types of water pollution that happen most frequently in the water channels such as chemical,sedimentary and oil contamination. Sediment pollutant which contributes to water pollutant will throughly covered in this chapter . In fact,the impact of sediment contamination on marine life ,humans and the environment is discussed in details . As a result ,two main spatial technology namely Geographic Information System (GIS) and Remote Sensing can be used in this study where many relevant applications using these technologies have been presented in this chapter .The implementation of these technologies on reducing the hazard of water contamination along the Sg.Galing is also explained in this chapter . This chapter also justify the advantages and disadvantages of geospatial technology water pollutant .
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## 2.2 TYPES OF WATER POLLUTANT

In this modernized era, there are various types of water pollutants that exist as a result of human activities and activities that are not responsible for the environment. Human actions that are not responsible for the environment have caused rivers in the world to be polluted with various impurities such as oil, garbage and chemicals. This dirt is what causes our rivers to be polluted. As 98% of water comes from rivers (Chan, 2012), rivers' pollution is a real problem with more and more rivers being polluted. Continuous river pollution will further deplete water supplies. It will have significant consequences on the national agenda to become a fully developed nation unless important measures are taken to enhance our river water quality. Organic and inorganic pollutants are mainly discharged from industrial effluents and sewage into the water bodies.


Figure 2.1 : Type of water pollutant in Malaysia(Farid Adha ,2015)

Water pollutants can be classified as organic, inorganic, thermoluminescent, microbiotemorphic, sedimentary, organic and non-biological. Among the three types of water pollutant that have the highest rate are sediment pollutant, oil pollutant and chemical pollutant. Of these three types of water pollutants, this chapter will explain a little more in detail about sediment pollutants. As is well known, the current river pollution is caused by the dumping of toxic waste into the river by irresponsible factories. Garbage disposal and logging activities are also the cause of the pollution of this river. Spillage of oil waste from the factory is also the cause of the pollution of this river.
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Figure 2.2: Rubbish, toxic and organic wastes, as well as effluents that wind up in our waterways. (TheStar, 2020)

From diagram 2.2 above, it shows the river pollution that is happening in Malaysia which is getting worse because it is ignored by irresponsible parties. The picture shows a river filled with garbage and oil on the surface of the river. The pollution that occurs in the picture is sediment pollutant, oil pollutant and chemical pollutant. Garbage that is thrown into the river will cause the river water to become dirty and smelly as well as cause river pollution. Factories located near the river will dump toxic waste into the river which causes the river to be polluted with chemicals.

## 2.3 THE IMPACT OF WATER QUALITY IN MALAYSIA

During this time, river water in Malaysia can be said to be of poor quality as it is polluted with various dirt, chemicals and oil pollution. This is due to the selfish and irresponsible human attitude towards the environment. Water quality in Malaysia is a major concern, as is water access in general. Lakes and reservoirs serve as water resources for domestic, commercial, agricultural, hydroelectric, nautical, and recreational uses. (Mohd Faizal Abu Jalil. (2011). analysis of contamination from point and non-point sources). According to the Department of Environment (DoE) (2017), Malaysia had 579 rivers in 2008, up from 477 in 2019 (NSTP, 2019). Surprisingly, the water quality of the river has deteriorated and is more difficult to use than before. Our rivers are threatened by both point and non-point sources of pollution. Sulfuric acid or gray water from sewage treatment plants, agribusiness, manufacturing, commercial and residential buildings, and pig farms are the main sources of pollution (Daud, 2010). All these statements are facts that may be relevant to the water pollution situation in Malaysia.
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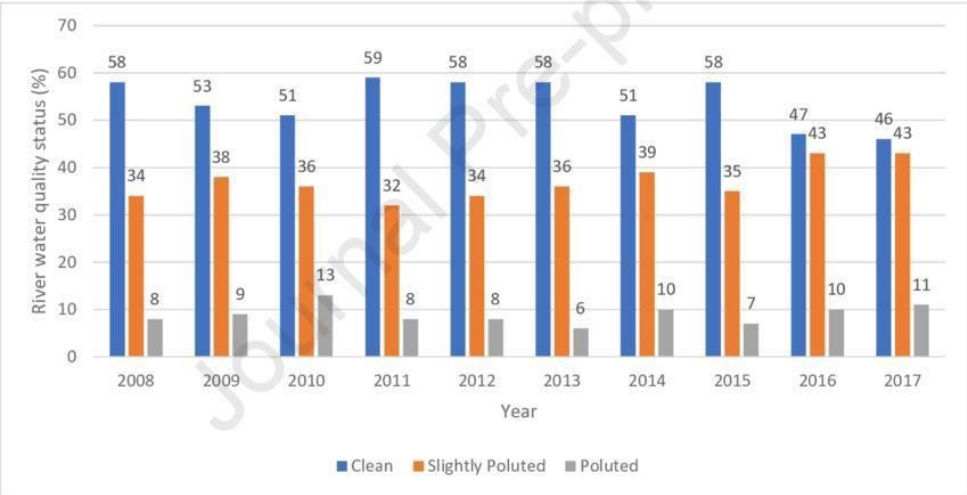


Figure 2.3 : River water quality status from 2008 – 2017

From figure 2.3 above, it shows that Data in 2016 and 2017 has shown that most Malaysian river water quality is in Class II and Class III Water Quality Index. The implementation of the Movement Control Order (MCO) has limited business activities, human movement and anthropogenic activities. The sudden decline in human activity has directly affected the quality of river water. (Chai Lee Goi, 2019). So, in 2016 and 2017 it shows that the quality of river water is affected due to the reduction of human activities which is not good for the river in Malaysia.

## 2.4 THE CAUSE OF WATER POLLUTANT

The pollution of this river is caused by various things, including garbage disposal, building construction work, toxic waste disposal, oil spills, and deforestation. These things all produce sediment, oil, and chemical pollutants, which harm the river. Oil pollutant caused by oil spills as a result of shipping, fishing and other activities. This oil spill can cause the water to become dirty and have a negative impact on the sustainability of the river ecosystem. Sediment pollutants are caused by garbage disposal activities, construction activities and open deforestation. These three activities can cause the surface of the water to be filled with solid waste as a result of the remaining debris. While chemical pollutants are caused by the illegal dumping of toxic waste into the river. The toxic waste that is thrown into the river will cause the river water to be polluted with the chemicals contained in the toxic waste.
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Figure 2.4 : Open deforestation activities at Ipoh,Perak ( Farid Hakim,2014)


Figure 2.5 : Disposal of rubbish into the river in Sungai Seri Medan (Kumar,2012)

From figure 2.4 and 2.5 over, it shows that the factors that beget river pollution. Lots of rubbish floating on the face of the river. This will beget the river water to come dirty when all the domestic waste is thrown into the river. Deforestation causes face water runoff to do and bring ground and slush into the river.


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Figure 2.6 : The condition of the river following an oil spill (Astro Awani, 2017).

Figure 2.7 : The state of the river after being hit by toxic waste( Astro Awani,2017)

### 2.5.1 DEFINITON OF OIL POLLUTANT

Oil pollution is one type of sea pollution that can be caused by tanker operations (ballast water), ship repair and maintenance (docking), loading and unloading terminals in the middle of the sea, bilge water (waste water, oil, and lubricants from process machinery), ship dumping, and tanker accidents/collisions. The term "oil pollutants" refers to the negative pollution effects of oil spills on the environment and living organisms, including humans, as a result of the environmental release of various organic compounds that make up crude oil and oil distillates, which primarily include various individual hydrocarbons.

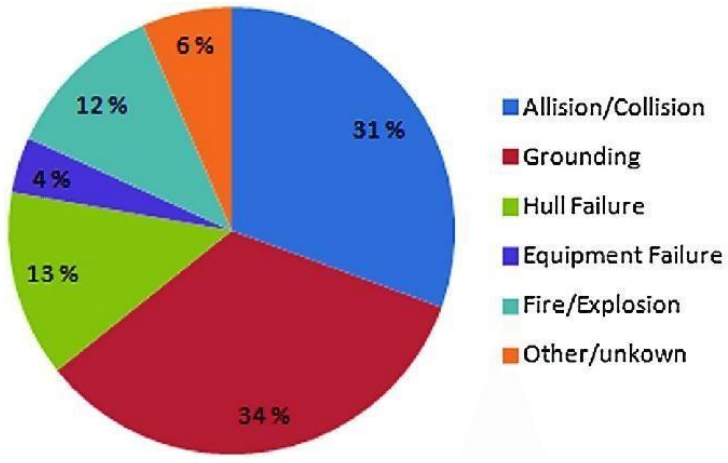


Figure 2.8: Volume of oil spilled per cause of accidents in European Seas for accidents above 7 tonnes per spills (Roben T.Bie,2014)
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Figure 2.9 : The oil spill in Borneo caused the river to be polluted (Kate Walton)

Referring to diagram 2.8 above, it shows that 34% of oil spills in European seas are caused by vessel grounding accidents. “One of the best known grounding-related oil spill accidents is that of the Sea Empress in 1996, which ran aground in the entrance to Milford Haven, in the southwestern United Kingdom”.(Roben T.Bie,2014) .The oil spill that occurred in Borneo is depicted in diagram 2.9 above. “Five fishermen have lost their lives, the Irrawaddy dolphin population is in decline, at least 162 fishermen have lost their jobs, 17,000 hectares of mangroves are in jeopardy, and crab farms worth billions of Rupiah have been destroyed. "(Fen, 2008). Humans and aquatic life are negatively impacted by this spill's effects.

### 2.5.2 EFFECTS OF OIL POLLUTANT TO RIVER

This water pollution has a variety of negative effects on aquatic life and humans. The river ecosystem's ability to survive will be negatively impacted by the water pollution this oil spill has caused. Oil spills will contaminate drinking water sources by mixing with water, killing and poisoning river life. In addition to obstructing photosynthesis in plants growing on the river's surface, floating oil on the water's surface will prevent sunlight from penetrating the water.

The identified effect is that aquatic life that is sensitive to the environment becomes toxic due to oil waste. Next, it will upset the food chain, which is crucial for fish and other river life. The oil spill will poison the aquatic life that resides in the river. This will hurt and damage their reproductive system. Animals that eat residual oil will experience poisoning and cause death. Some marine life cannot survive in low oxygen conditions. This causes the fish to not be able to live well, and can lead to them being put into an extremely dangerous situation where they are more at risk of starving to death.
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Figure 2.10 : Animals that died as a result of an oil spill in Sungai Terus (Lee Chew Lin, 2012)

### 2.5.3 DEFINITON OF CHEMICAL POLLUTANT

Chemical pollution is defined as the presence or increase in our environment of chemical pollutants that do not naturally exist there or are found in amounts higher than their natural background values. Most of the chemicals that pollute the environment are man-made, resulting from various activities in which toxic chemicals are used for various purposes.

Figure 2.11 : The disposal of toxic waste from the factory into the river that occurred in Sungai Dayung (Kim Wei, 2015)
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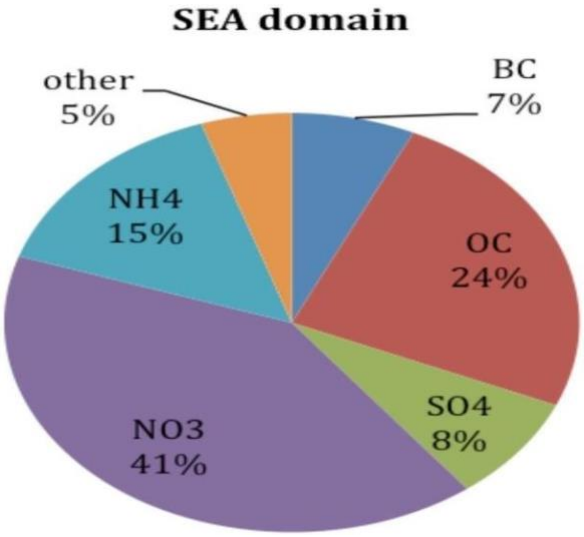


Figure 2.12 : Pie chart of the mean chemical components of PM 2.5 in Reference Scenario averaged over 2006 and 2008 in the SEA domain (Hesiang Hi Li,2015)

Referring to figure 2.12, it shows that "Aerosols emitted from fossil fuel burning can cause air quality and human health issues. In this sensitivity study, we examine the impact of fossil fuel aerosols on air quality in Southeast Asia under five different hypothetical fuel consumption scenarios. "(Hesiang Hi Li,2015) .Chemical pollution is mostly the result of human activities such as the production, processing, storage, and disposal of chemicals. These take occurs in industrial settings and processes such coal power plants, oil refineries, building sites, mining and smelting operations, transportation, agricultural pesticide and insecticide use, as well as everyday domestic tasks. River pollution that occurs from the discharge of waste from factories. Usually, this happens because of the actions of irresponsible parties or individuals who only think about their own rice cooker without thinking about the impact on the rivers in Malaysia. Usually, waste from factories built near the river bank will be flowed directly into the river to dispose of the waste in an easier way. Cost savings for waste disposal can be done when this waste flows into the river. The attitude of the factory operators involved can be likened to a deer in a bush, releasing its own shoots. The adverse effects, chemicals and toxic waste will pollute the river and at the same time will lower the quality of the water and aquatic life is no longer suitable for living in the river. With this, the bad impact that is happening to the river now is due to the discharge of factory waste.

### 2.5.4 EFFECTS OF CHEMICAL POLLUTANT TO RIVER

Among the effects that can be expressed for this chemical pollutant on the environment and humans is that the material that is thrown in the river will reduce the oxygen content in the water. Humans can also get diseases or serious health problems if they drink or use the contaminated water. The effect on water quality is that toxic substances dumped into the river will affect the food cycle by affecting and poisoning the living things in the lake river such as weeds, birds, fish and other living things. Toxic materials mixed with river water will directly
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affect the quality of drinking water. This will have a negative impact on health such as the presence of excessive nitrates in drinking water which will result in blood poisoning for small babies and cancer for adults. These polluting chemicals will also reduce the dissolved oxygen content. Processes produced by industry, especially the food processing industry, are usually rich in inorganic nutrients such as nitrogen, phosphorus and potassium in addition to dissolved organic compounds. Therefore, these nutrients cause the risk of pollution being disposed of indirectly in rivers or lakes and creating eutrophication conditions. Dissolved organic compounds reduce the total dissolved oxygen content (BOD).

Figure 2.13 : The condition of Sungai Kim after being polluted with chemicals (Dr Ammar, 2019)

Diagram 2.13 above shows the state of the Kim river that was polluted with chemicals in 2019."Around 5,000 people have become victims of chemical pollution around Pasir Gudang over the past few weeks. The pollution is due to the dumping of chemical waste in Sungai Kim Kim by nearby factories without following standard procedures." (Dr Ammar, 2019). From the situation that happened in the Kim River, it shows that this chemical pollutant is very dangerous and threatens human life. Chemicals dissolved in river water cause river water to become poisonous to humans.
```

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## 2.5.5 DEFINITON OF SEDIMENT POLLUTANT

Our environment is negatively affected by sediment pollution over time. Sediment pollution is a significant problem for rivers, streams and other bodies of water, according to the "United States Environmental Protection Agency. When water transports sediment through downstream runoff, sediment pollution occurs. The damage from these sediment pollution flows is in the billions of dollars."(Ah sian , 2014) Sediment pollutant is also solid material waste resulting from various activities carried out by irresponsible humans. Among them is that throwing rubbish into the river can result in the surface of the river being filled with rubbish. Illegal deforestation activities also result in the occurrence of this sediment pollutant. This is because soil erosion from deforestation activities causes the river near the forest to be polluted. Next, building or house construction activities can also result in sediment pollutant. This is because fragments of stone or wood fragments from these activities that are thrown into the river can cause the river to be filled with solid waste that can harm life like humans and aquatic life.


Figure 2.14 : The condition of the Juru river that is polluted with garbage causes sediment pollutant (Audrey Dermawan, 2022)

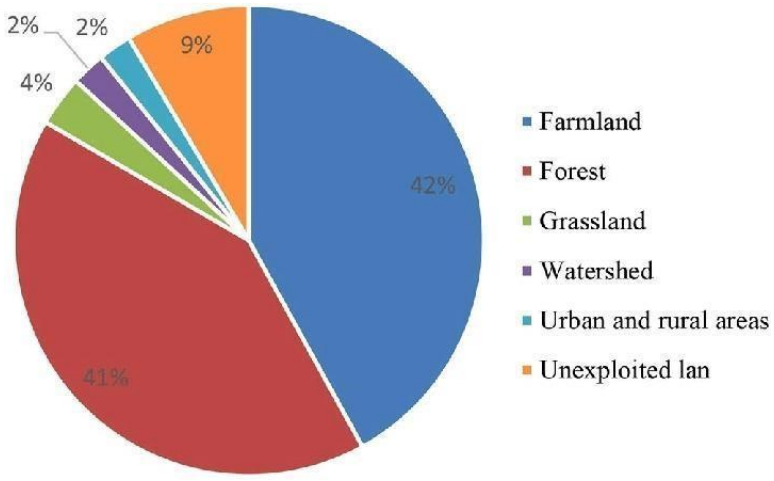
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Figure 2.15 : Pie chart showing the proportion of different land uses.(Yan Liu,2020)

Based on diagram 2.14 above, it shows Sungai Juru filled with garbage from nearby industrial areas. This is caused by dumping too much garbage into the river at the same time causing the river to be polluted with garbage. According to Professor Dr Nor Azazi Zakaria, who is the director of the river research center of the Universiti Sains Malaysia (USM) engineering campus and the urban drainage research centre," the public must be empowered to carry out campaigns like the One State One River plan, and feel like they own the river that." (Professor Dr Nor Azazi, 2022). While based on diagram 2.15 above, it shows that Pollution from non-point sources has become one of the greatest threats to water quality in agricultural areas, with nitrogen, phosphorus, and sediments standing out as the primary pollutants since the use and occupation of the land are directly related to the nature of the substances transported in the runoff. (Zhenyao et al, 2014).

### 2.5.6 EFFECTS OF SEDIMENT POLLUTANT TO RIVER

Sediment pollution also occurs due to building construction works in urban areas. The construction of buildings for the purpose of building residential houses, factories or business premises has resulted in the occurrence of land. Soil erosion that occurs continuously causes mud flow when there is heavy rain which then the erosion materials before being deposited into the river. This causes the river water to change color to cloudy and yellowish in addition to causing the river bed to become shallower.

At the same time, sediment pollution also occurs when there is widespread deforestation without control by the authorities. Most of the forests that are the source of clean water supply to rivers are cut down for logging activities or turned into agricultural areas, residential areas or as industrial areas. As a result of the destruction of these green areas, the supply of water to the rivers is decreasing and affecting water resources for public use. Soil erosion will also occur and be deposited in nearby rivers when it rains. As a result, the river water will be polluted and turn cloudy.

Next, the effect of sediment pollution from garbage disposal is that the river water becomes dirty and filled with garbage. Adding to the complexity of the situation, many traders and workshop operators throw the remains of unused goods into the drain before being carried to the river by the flow of rainwater. As a result, the river water changes color to deep black and is filled with garbage and layers of oil so that it emits an unpleasant stench. This polluted river water is not suitable for use and is not even safe to drink. This results in the problem of lack of clean water supply for our daily use.
```

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Figure 2.16 : Grading along Maryville Pike in Knoxville pumped sediment into a nearby stream and on to the Tennessee River (Tennesse Lookut,2013)

Based on figure 2.16 above, it shows that the condition of the river in Knoxville is polluted with pollutant deposits. The situation can be harmful to the aquatic life that lives in the river. When there is sediment in the water, sunlight cannot penetrate the water to allow natural vegetation to grow. In addition, through sedimentation, cloudy water prevents animals from being able to see food and therefore disrupts the food chain, causing a decrease in the life of organisms and fish populations.

### 2.6.1 TECHNOLOGY IN COMBATING WATER POLLUTANT / TECHNOLOGICAL BASED APPROACH

In our study, there are two technologies that are usually used to deal with the increasing water pollution problem. The technology is Geographic Information System (GIS) and Remote Sensing (R.S). The application of this technology is used to identify suspended matter, turbidity and dissolved organic matter in water. Not only that, this technology is also a sophisticated and modern technology that can deal with pollution problems that occur in a certain place .
```

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## 2.6.2 GEOGRAPHIC INFORMATION SYSTEM (GIS) APPLICATION FOR WATER POLLUTANT


Figure 2.17 : Function of Geographic Information System (JKR BIM,2006)

One of the methods is to use technology systems such as the use of Geographical Information System (GIS). The use of this technology system is able to monitor and prevent the crime of raw water pollution so that the same issue does not happen again and again. Mapping and buffer analysis (buffer analysis) This Geographical Information System (GIS) can be used to map development along the river which is likely to channel their waste into the river as well as contaminate the water of the river. Through this GIS mapping and analysis, illegal development can also be identified and mapped. In addition, by using this method, any development developed in the river reserve can be identified.

This method of buffer analysis (buffer analysis) can also map the surrounding development according to a certain distance (for example a radius of 5km, 10km, 15km or more than a radius of 15km). Mapping the results of this analysis is able to identify the development or type of land use around the river that has the potential to pose a threat and pollute the water of the river. GIS methods and technology like this need to be utilized because it is able to deal with the issue of interrupted water supply that often plagues the people. Every time the people are plagued with the issue of cut off water supply which is like becoming their "monthly activity or event".

It is appropriate that this monthly activity or event of water supply interruption be dealt with more intelligently and using technology such as GIS. Let this issue be dealt with by preventing and not treating (prevention is better than cure). The prevention of environmental crimes such as raw water pollution needs to be dealt with comprehensively and not just solving it according to specific cases only .
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### 2.6.3 REMOTE SENSING (R.S) APPLICATION FOR WATER POLLUTANT MONITORING

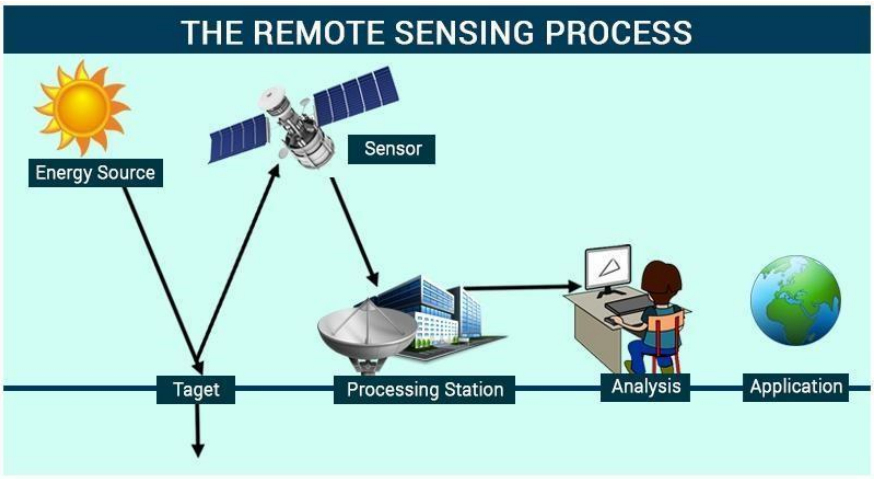


Figure 2.18 : Function of Remote Sensing (Ju's ,2005)

One of the methods is to use technology systems such as the use of Geographical Information System (GIS). The use of this technology system is able to monitor and prevent the crime of raw water pollution so that the same issue does not happen again and again. Mapping and buffer analysis (buffer analysis) This Geographical Information System (GIS) can be used to map development along the river which is likely to channel their waste into the river as well as contaminate the water of the river. Through this GIS mapping and analysis, illegal development can also be identified and mapped. In addition, by using this method, any development developed in the river reserve can be identified.

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```

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### 2.6.4 ADVANTAGES AND DISADVANTAGES OF GIS

There are several advantages and disadvantages in the use of GIS (Heywood et al., 2002). AdvantageGIS can help in improving organizational integration; allows users to view,understand, question, interpret, and visualize data in many ways and express itwith relationships, patterns, and trends, in the form of maps, globes, reports, and charts; provide answers to questions and solve problems by looking at data quickly and easily;help to be integrated into every enterprise information system framework; and provide more job opportunities.
However, the weakness in using GIS is that GIS equipment willrequire relatively expensive costs; data is required in large amounts for prior inputperform any analysis; failure to initiate or maintain additional efforts tofully implement GIS (for example adding data from the earth's surface into GIS),but it is possible that the great hope is still there; and when the data is displayed in the scalewhich is greater, technical errors in geography are likely to occur due tonatural enhancement of bimu face shape in the round.

## 2.7 SUMMARY OF THIS CHAPTER

Overall, this chapter explains the causes and effects of water pollution in Sg. Galing is the place of our survey. From this chapter, we can know the negative effects on humans and natural life that will happen if this pollution problem is not dealt with at an early stage. Therefore, we as responsible human beings must take steps and create distractions the best way to cure this pollution problem. If this issue can be dealt with healthily, we can protect ourselves including other lives from the threat of danger such as water pollution which can result in health being affected. The technology that exists today can help humans to deal with this pollution problem in order to be able to prevent everything related to pollution as well as create a friendly life in this world.
```

```

# CHAPTER 3

# METHODOLOGY

## 3.1 INTRODUCTION

This study's data gathering methodology, which focuses on achieving the goals of this project, is discussed in detail. This chapter is to achieve the objective of obtaining turbidity, conductivity, PH levels, temperature, BOD levels of the Sg. Galing, Kuantan.The information we have collected is sufficient for us to subsequently receive lab results. Figure 8 displays the study's flowchart. This chapter also discusses the physical design elements that must be taken into account in order to address the pollution issue in Sg. Galing. The collected data will be tested according to the type of pollution that occurs in the river. Next, we use satellite image technology to get the position of Sg. Galing. In addition, this chapter explains the collection of data that will be recorded in the GIS software. The end of this chapter discusses the outcome of water pollution mapping of Sg. Galing and its database.
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```

### 3.2 Flowchart Of Sediment-based Concenration Mapping Of Sg.Galing

Figure 3.1 shows a flowchart about our study in Sg. Galing.Mapping and classification in the water quality index (WQI) in Sg. Galing starts from Preparation of apparatus and equipment needed for the fieldwork. The preparation of equipment and apparatus is necessary to test water samples to identify turbidity, temperature, PH levels and conductivity of river water in Sg. Galing at risk of being affected by water pollution . The next process in this research is to surveyed the state of the parameters in Sg. Galing and marked the polluted area in Google Earth Pro to take samples. For the next location, we chose a location that is more focused on more industries such as in the factory area to get a better assessment of the condition of the river affected by pollution. We started our study from upstream to downstream. After that, we used the Google Earth Pro application to mark the area where the river was polluted so that it would be easier for us to take samples. Among the samples that our group was able to collect were oil, chemical and sediment samples. The purpose of this study is also to identify the cause of this sediment pollution. Surveys and determined locations will be processed in satellite images through machine learning methods and the following water samples will be measured using WQI standards. For the last step, all data collected will be entered into GIS software for evaluation.
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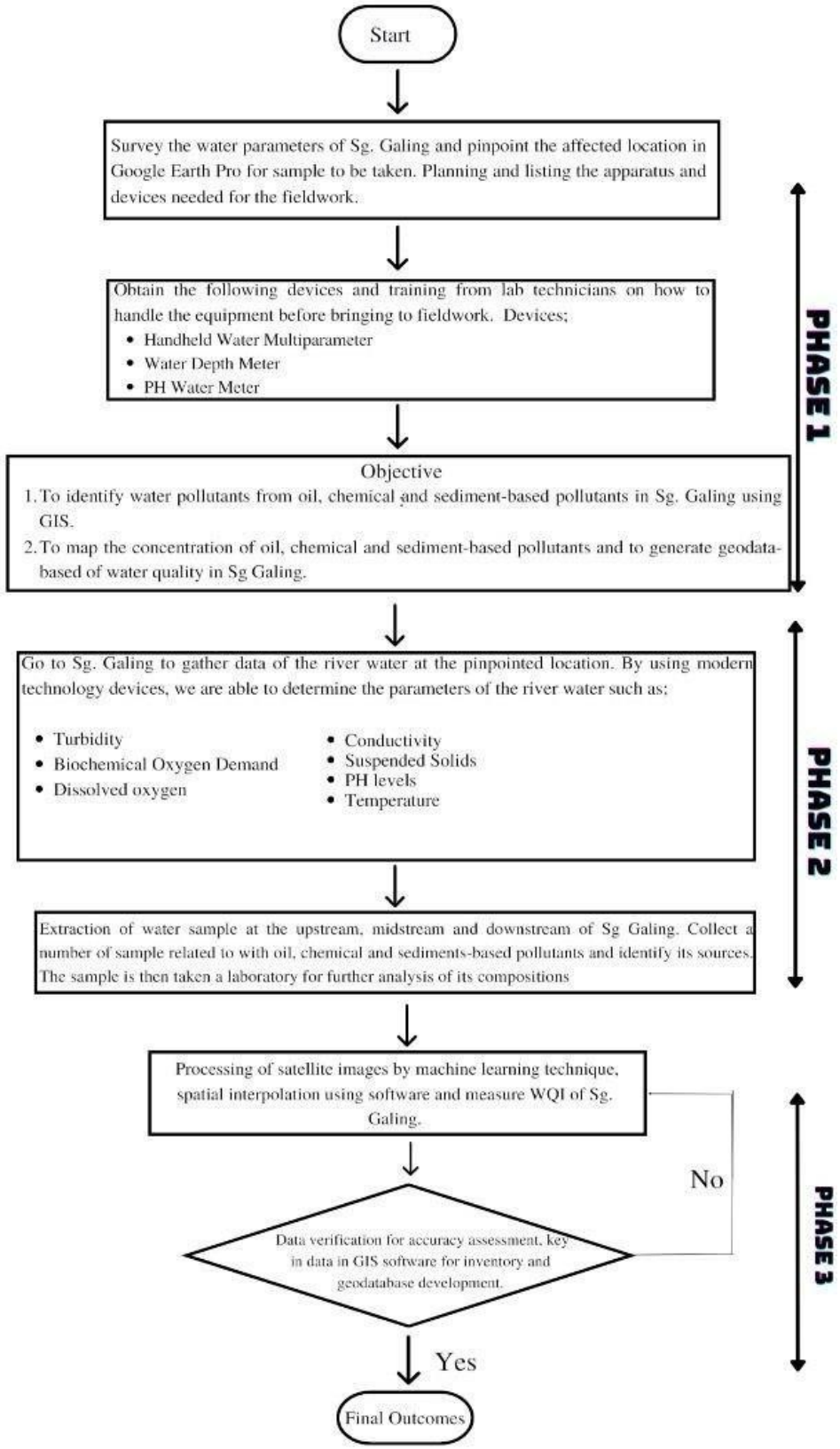


Figure 3.1 : Flowchart of Sediment based concentration mapping og Sg.Galing
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### 3.3 Field data collection

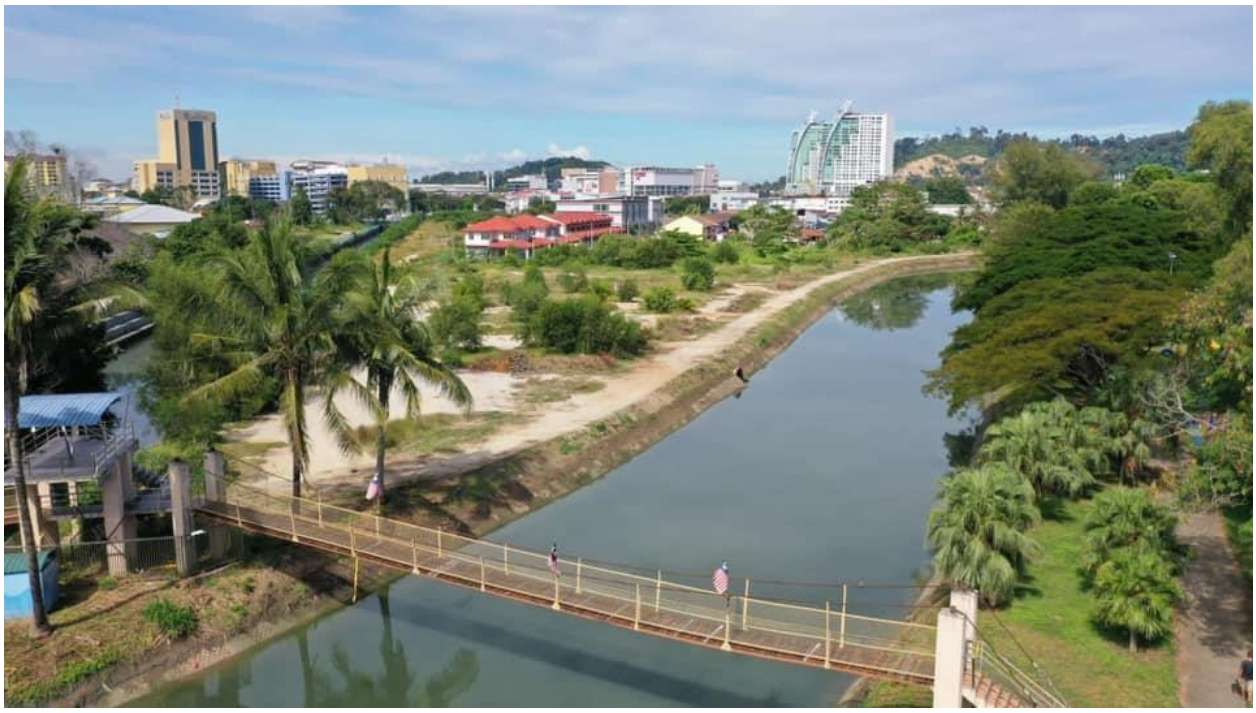

Figure 3.2 : Sg.Galing River (Ahmad,2012)

This field work was carried out in Sg. Galing, Kuantan using the in situ water quality sampling method with a water quality instrument. With the help of equipment to identify water quality, our group is able to classify and analyze the condition of water in Sg. Galing from different locations.

The water quality equipment we use for this survey in Sg. Galing is from FTKA 1000PB103(M) - 170800040001 PH meter, FTKA 1000-PB103(M) - 1305000100001 Handheld Multiparameter and a water depth meter. This sensor instrument equipment is placed in the river and the monitor will show data according to water quality such as temperature, PH levels, conductivity and Biochemical Oxygen Demand (BOD).
```

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| | | |
|---|---|---|
|  |  |  |
| Figure 3.3 Multiparameter Handheld | Figure 3.4 Water depth meter | Figure 3.5 PH meter |
```

```

## 3.4 Physical Parameter Of Water Quality

### 3.4.1 Turbidity

Turbidity is the turbidity or haziness of a fluid caused by individual particles (suspended solids) that are normally invisible to the naked eye, similar to smoke in the air. Turbidity measurement is a key test of water quality. Turbidity is a metric used to assess a liquid's relative clarity. It is a measurement of the amount of light scattered by the components of water when light is shone through a water sample. It is an optical property of water. The turbidity increases with the intensity of scattered light. Clay, silt, extremely minute inorganic and organic materials, algae, dissolved colored organic compounds, plankton, and other microscopic organisms are some of the substances that make water turbid.

| No | Turbidity level | TSM (NTU) |
|---|---|---|
| 1 | Fairly turbid | 15 - 25 |
| 2 | Rather turbid | 25 – 35 |
| 3 | Turbid | 35 – 50 |
| 4 | Very turbid | 50 |

Figure 3.6 : Water turbidity level (Zulfilqah,2010)

### 3.4.2 Temperature

Water temperature is important as it is an important quality of environmental parameter. It is important to measure the water temperature. In this way, we can see the properties of the water, including its chemical, biological and physical properties and possible health effects. Aquatic species are impacted by temperature in many different ways. The majority of aquatic species have bodies that are constantly changing in temperature and are identical to the water they are in.The majority of aquatic species are acclimated to a restricted range of temperatures, and they perish when that range is exceeded or diminished. Temperature affects their metabolism, reproduction and emergence. Temperature also affects the rate of photosynthesis Aquatic plants that form the basis of aquatic food webs. contaminants are the higher the temperature, the stronger the toxicity.
```

```

### 3.4.3 Conductivity

Conductivity is a measure of water's ability to conduct electricity. Dissolved salts and other inorganic chemicals conduct electricity, so the higher the salt concentration, the higher the electrical conductivity . A conductor is a material that offers little resistance to the flow of electrical current or heat energy. Materials are divided into metals, semiconductors, and insulators. Conductivity is useful as a general measure of water quality. Each water body tends to have a relatively constant range of conductivity that, once established, can be used as a baseline for comparison with regular conductivity measurements. Significant changes in conductivity could then be an indicator that a discharge or some other source of pollution has entered the aquatic resource. There are many factors that affect the EC of water, the most important of which is water temperature. In most cases, the higher the temperature, the higher the electrical conductivity.
```

```

### 3.4.4 PH level

PH is one of the main factors that need to be considered when it comes to water quality. PH is a measure of how acidic/alkaline water is. The range is 0 to 14, with 7 being neutral. A pH below 7 indicates acidity and a pH above 7 indicates base. pH is actually a measure of the relative amounts of free hydrogen and hydroxyl ions in water. Water with many free hydrogen ions is acidic and water with many free hydroxyl ions is basic. pH is an important indicator of chemical changes in water, as pH can be affected by chemicals in the water.

Your body tries to maintain a constant neutral state around pH 7, so drinking acidic or basic solutions does not change the pH of your plasma. However, high pH levels in water can indicate the presence of contaminants and unwanted chemicals, which can be harmful to your health. Even if the PH is above 8.5, the water is probably safe, but if you notice skin problems it is recommended to acidify the water. The US Environmental Protection Agency and the World Health Organization recommend that the pH range of tap water meant for drinking should be maintained between 6.5-9.5 according to new research … (Blogger, 2022)

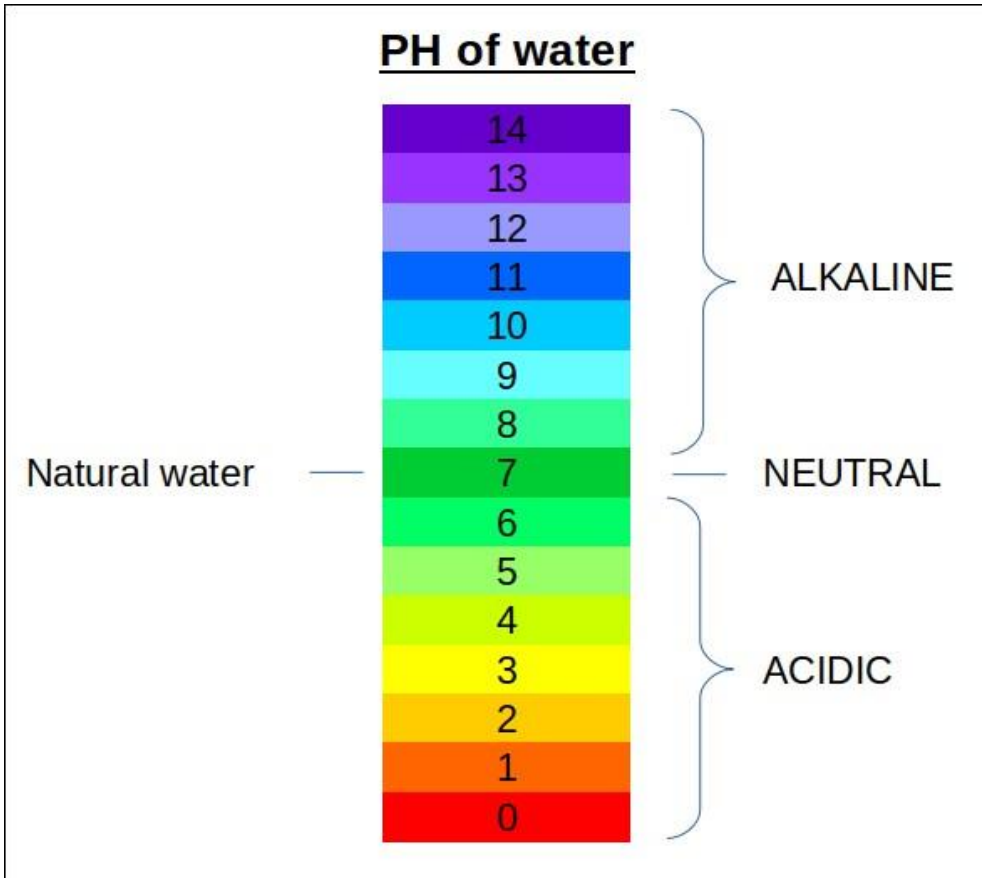


Figure 3.7 : The different Ph level for waters (Hsoon,2014)
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# CHAPTER 4

# RESULTS AND DISCUSSION

## 4.1 INTRODUCTION

In this chapter, the overall analysis will be discussed and the output will be interpreted in the Geographic Information System (GIS) software that we use in this fieldwork.All the results we get based on this fieldwork will be keyed in right in Microsoft excel first to get an average result.The decision that we key in on the GIS is to get an overview of the form of pollutant sediment in Sg. Galing, Kuantan. The data acquired during the fieldwork revealed the types of pollutants defined as sediment-based, oil-based, and chemical pollutants, indicating that the primary purpose of this study was satisfied. A concentration map of chemical-based pollutants along the Galing River is also shown in this chapter as a result of GIS software mapping. The second purpose of the study was then achieved because the chemical-based pollutant concentration map was completed.
```

```

### 4.2.1 DATA AND RESULT BASED ON WATER POLLUTANT

All the data and results we get based on the fieldwork we do will be keyed in right in Microsoft excel. To get pollutant sediment results, a Total Suspended Solid (TSS) test was done to get results at each point that we have obtained based on fieldwork in Sg. Galing. TSS tests are performed on samples at each point to obtain the highest and lowest concentration levels in the area. A tool called Handheld Multiparameter has been used to obtain the necessary readings to obtain Total Suspended Solid readings. All the readings we take will be keyed into Microsoft Excel in order to get the average of the highest and lowest concentration readings.

### 4.2.2 RESULT AT EACH POINT BASED ON SEDIMENT POLLUTANT

| No | Lat | Long | Sediment |
|---|---|---|---|
| 1 | 314909 | 424217 | 96.2 |
| 2 | 314902 | 424180 | 111.15 |
| 3 | 315024 | 424213 | 67.6 |
| 4 | 314619 | 423809 | 89.2 |
| 5 | 315310.4 | 422134.9 | 1306.5 |
| 6 | 315293.5 | 422143.5 | 1722.5 |
| 7 | 315294.9 | 422125.7 | 1891.5 |
| 8 | 315260.6 | 422115.7 | 1722.6 |
| 9 | 315280.8 | 422129.1 | 1722.5 |
| 10 | 315218.8 | 422108.9 | 884 |
| 11 | 315175.7 | 422101.1 | 864.5 |
| 12 | 315206 | 422161 | 708.5 |
| 13 | 315137.1 | 422187.6 | 995.5 |
| 14 | 315133 | 422094.3 | 890.5 |
| 15 | 314726.8 | 422959.7 | 95.55 |
| 16 | 314744.8 | 422896.1 | 2704 |
| 17 | 314763.1 | 422814.4 | 3516.5 |
| 18 | 314710.8 | 423041.3 | 5597 |
| 19 | 314706.2 | 423074.4 | 669.5 |
| 20 | 314902 | 425259 | 66.3 |
| 21 | 314898 | 425285 | 68.9 |
| 22 | 315470 | 421874 | 78.90 |
| 23 | 315488 | 421845 | 65.88 |
| 24 | 315496 | 421811 | 68.32 |
| 25 | 315616 | 421578 | 3201.10 |
| 26 | 315639 | 421556 | 2982.30 |
| 27 | 315702 | 421409 | 3154.60 |
| 28 | 315709 | 421382 | 1205.20 |
```

```

| | | | |
|---|---|---|---|
| 29 | 315693 | 421375 | 492.00 |
| 30 | 315702 | 421353 | 524.60 |
| 31 | 314942 | 424788 | 368.50 |

Figure 4.1 : Table showing results and results of Total Suspended Solid (TSS) test

To get all the information listed in the table above, we all did fieldwork in Sg. Cool Table 4.1 shows 31 points that have been taken during fieldwork in Sg. Galing. During fieldwork, the Water Handheld Multiparameter is a tool used to obtain temperature, pH and more readings. With the readings that can be taken from this device, results for Total Suspended Solids can be obtained. The purpose of this Total Suspended Solid test is to test the reading level for sediment. The reading rate obtained has a different reading rate according to point in each place. From the data, it can be seen that the point has the highest concentration, the lowest concentration and an equal concentration. This is because the point we took during the fieldwork in Sg. Galing was in a different place. For example, there are points that are close to housing, manufacturing and industrial areas. From the data, it shows that the highest concentration is in manufacturing and industrial areas. This is because rivers that are close to residential areas are easily exposed to pollution such as dumping garbage into the river.

While for the latitude and longitude at each point, we use the facilities available on our Smartphone to get the longitude and latitude at each of our points. The purpose is to facilitate our fieldwork when trying to get samples in the same place. The samples we take at each point will be tested in the lab to get a Total Suspended Solid (TSS) reading. This Total Suspended Solid experiment was conducted to test the sediment material present in the water sample. The table above shows that the highest concentration for the sediment sample is at point 17 which is 3516.5 mg/L. While the lowest concentration is at point 23 which is 65.88 mg/L. Most of the readings collected are in the range of 500 - 2500 mg/L.
```

```

## 4.3 WATER QUALITY CLASSIFICATION BASED ON WATER QUALITY INDEX (WQI)

**DOE Water Quality Classification Based On Water Quality Index**

| SUB INDEX & WATER QUALITY INDEX | INDEX RANGE | | |
|---|---|---|---|
| | CLEAN | SLIGHTLY POLLUTED | POLLUTED |
| Biochemical Oxygen Demand(BOD) | 91 - 100 | 80 - 90 | 0 - 79 |
| Ammoniacal Nitrogen(NH3-N) | 92 - 100 | 71 - 91 | 0 - 70 |
| Suspended Solids(SS) | 76 - 100 | 70 - 75 | 0 - 69 |
| Water Quality Index(WQI) | 81 - 100 | 60 - 80 | 0 - 59 |

Sourse : EQR2006

Figure 4.2 : Water Quality Classification Based On Water Quality Index (HM Nazir,2016)

Water Quality Index (WQI) is computed based on six main parameters which are Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammonia Nitrogen (AN), Acidic and Alkaline (pH), Dissolved Oxygen (DO) and Total Suspended Solids (TSS). "Water quality can be classified into four types which is potable water, palatable water, contaminated (polluted) water, and infected water" (Nayla Hassan Omer,2019).

| Parameter | Class I | Class II | Class III | Class IV | Class V |
|---|---|---|---|---|---|
| Ammoniacal Nitrogen | < 0.3 | 0.3 – 0.9 | 0.9 – 1.6 | 1.6 – 2.3 | 2.3 – 3.0 |
| BOD | < 2.0 | 2 – 6.5 | 6.5 – 11 | 11 – 15.5 | 15.5 – 20 |
| Turbidity | < 10 | 10 – 30 | 30 – 50 | 50 – 70 | 70 – 100 |
| Dissolved Oxygen | > 7.0 | 7.0 – 6.0 | 6.0 – 5.0 | 5.0 – 4.0 | 4.0 – 2.0 |
| TP | < 0.15 | 0.15 – 0.5 | 0.5 – 0.8 | 0.8 – 1.2 | 1.2 – 1.5 |
| Total Suspended Solids | < 50 | 50 – 160 | 160 – 270 | 270 – 380 | 380 – 500 |
| Water Quality Index | > 93.2 | 72.1 – 93.2 | 47.4 – 72.1 | 22.9 – 47.4 | < 22.9 |

Figure 4.3 : Water Quality Index Classification ( A.Idris ,2008)

Figure 4.3 above shows the type of Water Quality Index class based on the water pollutant we study.So for the Water Quality Index (WQI) class based on the three types of water pollutants that we study is class III. We were able to classify it as class III after we calculated the average from each test we did, namely Dissolved Oxygen (DO), Total Suspended Solid (TSS), PH and Conductivity. We use the Water Quality Index (WQI) formula by entering the average value for all the tests we do. From this formula we can classify why class III. We got the formula from the Environmental Engineering textbook. Figure 4.4 below shows the formula used to get the class type.
```

```

## WQI FORMULA AND CALCULATION

### FORMULA

$$WQI = (0.22 * SIDO) + (0.19 * SIBOD) + (0.16 * SICOD) + (0.15 * SIAN) + (0.16 * SISS) + (0.12 * SIpH)$$

where;

SIDO = Subindex DO (% saturation)
SIBOD = Subindex BOD
SICOD = Subindex COD
SIAN = Subindex $NH_3$-N
SISS = Subindex SS
SIpH = Subindex pH
$0 \leq WQI \leq 100$

Figure 4.4 : The formula of Water Quality Index Classification ( James Ston,2014)

## 4.4 INTERPOLATION MAP USING GEOGRAPHIC INFORMATION SYSTEM (GIS)

Interpolation map was done by using Geographic Information System (GIS) to know the position of the highest and lowest concentration. All explanations will be explained according to color in each area. The way we use this GIS software is to transfer the pollutant sediment reading file at each point from Microsoft Excel to this GIS software. By transferring the file, we can form according to the shape of Sg. Galing as shown on the map. Figure 4.5 below shows mapping based on water pollutant concentration in Sg. Galing, Kuantan. This mapping is made using GIS software. From this mapping, it shows various colors that have their own functions. For the cyan color, it shows the area we went to get water pollutant samples. We first plot in Google Earth to make our work easier. The blue color shows the area of Sg. Galing, Kuantan which has a length of 7.7 kilometers and an area of 22.65 km. The further explanation will be explained in the next title.
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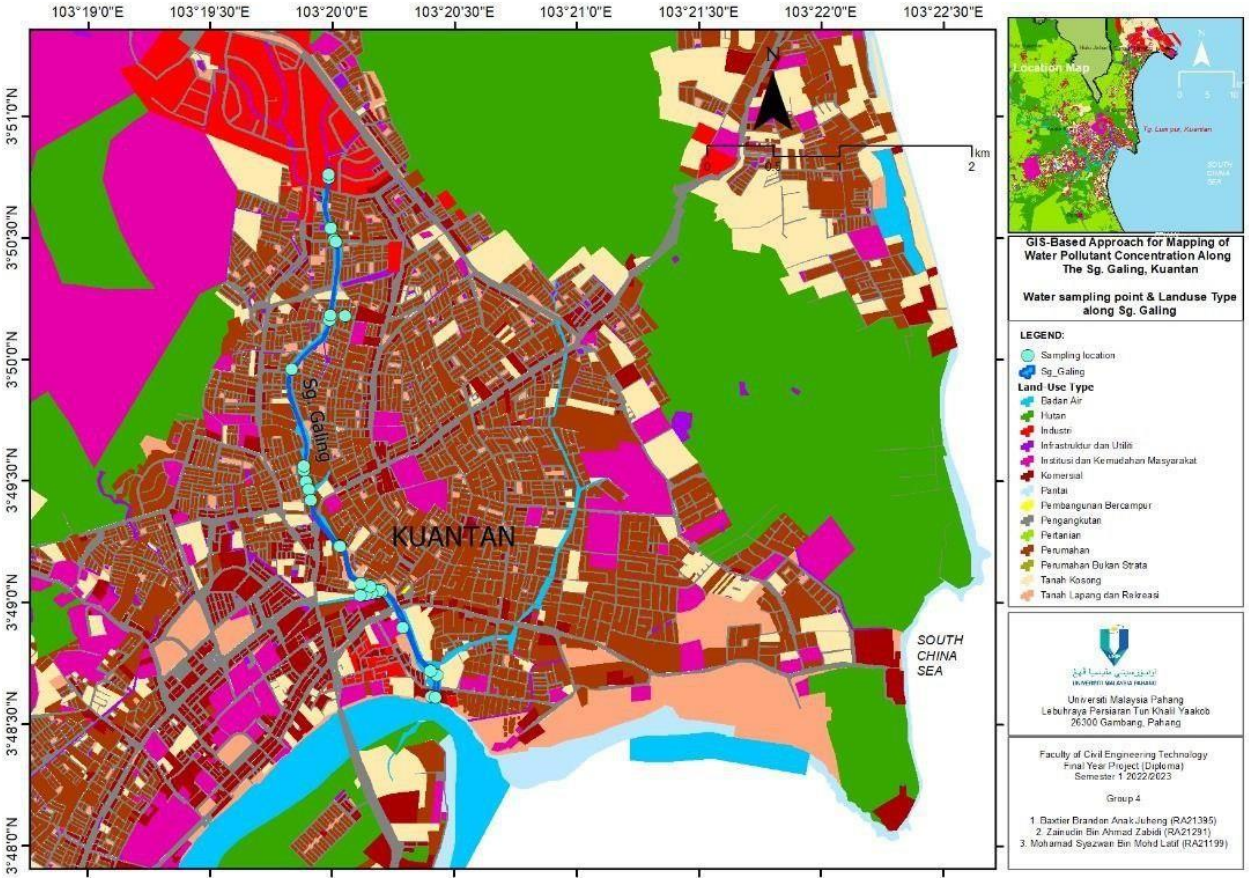

Figure 4.5 : GIS based Mapping of Water Pollutant concentration along the Sg.Galing,Kuantan

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### 4.4.1 INTERPOLATION MAP BEFORE AND AFTER RUSTER CLIP USING GEOGRAPHIC INFORMATION SYSTEM (GIS)

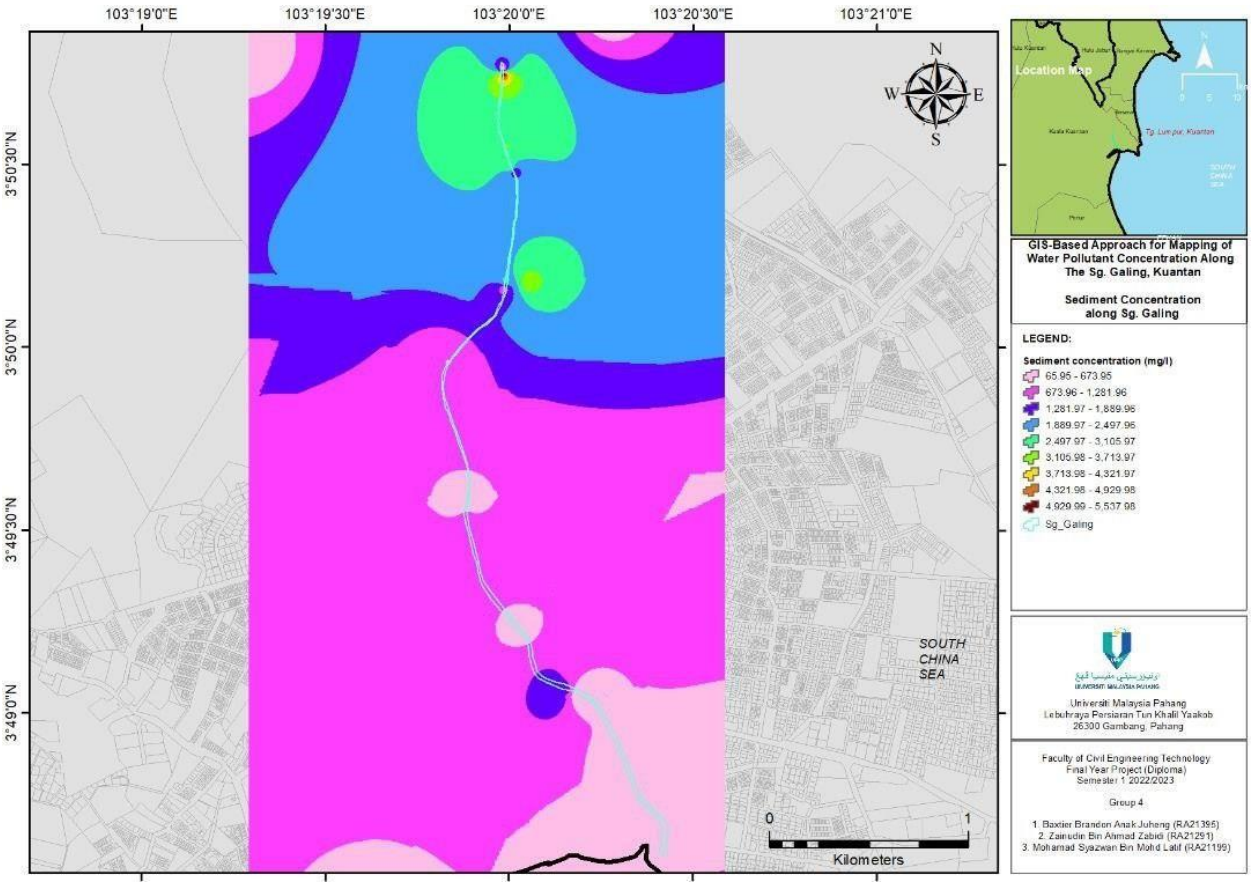


Figure 4.6 : Interpolation map before ruster clip

Figure 4.6 above shows the interpolation map before ruster clip. In the diagram, different colors are shown in each area. Our purpose in using this GIS software is to make it easier to find out which locations have the highest and lowest concentration levels. But we need to cut the shape of the rectangle to the shape of the river so that it will be easier to see it.
```

```


Figure 4.7 : Interpolation map after ruster clip

In figure 4.7 above, it shows the interpolation map after the ruster clip. In the figure, it can be stated that the highest concentration is blue. While the lowest concentration is red. The highest concentration reading rate is 5537.98 mg/L while the highest concentration reading rate is red. From the map, the blue color that has the highest concentration is in residential and manufacturing areas. The area is Jalan Hj Ahmad which is a residential area. The red color that has the lowest concentration indicates urban areas.
```

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## 4.6 DISCUSSION BASED FROM THIS RESULT

This chapter presents the findings of sediment-based contaminant concentration mapping. An interpolation map built with GIS software was used to detect the concentration at each geographical point along the Galing River, from upstream to downstream. The concentration of sediment material is concentrated upstream, as seen in Figure 4.7, as indicated by the blue color, since the upstream is located in a residential area, which may contribute a large amount of sediment-based pollutants into the River. Although the river downstream has a low concentration of sediment-based pollutants, shown in red, this is due to the river downstream being located in an urban area, where sediment materials are not commonly used in daily life activities.

Based on the results shown in the GIS software, we can know that the residential area has the highest level of concentration due to excessive waste disposal. This waste disposal contributes the most pollution to Sg. Galing. From the readings stated in table 4.1, we can see the result of sediment concentration after conducting the Total Suspended Solid (TSS) experiment. In this table, each reading for concentration for each sample has been stated to make it easier to identify the highest and lowest concentration levels. Therefore, with the ease of software such as Microsoft Excel and GIS software this is very helpful in our fieldwork about water pollutants in Sg. Galing.

## 4.7 ACCURACY OF WATER POLLUTANT AT SG.GALING

Sediment is the most common form of water pollution. Sediment is small fragments of soil, rock or other solid particles that are washed or blown from land into water. Sediment pollution can also occur from development activities, deforestation and river dredging. The sediment pollution seen in Sg. Galing, Kuantan is caused by landfill and river dredging. The downstream river surface is filled with a large amount of garbage. The water in the river, which used to be clean, has become dirty and smelly with this garbage. This garbage disposal occurs because the people sitting in the area do not think about the negative effects that occur when the garbage is filled with garbage. You can take this for granted. They are also taking the simple step of dumping their garbage in the river to save money.

River dredging taking place in Sg. Garing, Kuantan aims to expand the river basin and increase the depth of the river to prevent flooding. However, this activity can result in negative side effects. For example, dredging this river would result in the remnants of the excavated soil flowing into the river. This makes the river dirty and muddy. River water becomes turbid and river creatures die. The picture below is proof that garbage disposal and river dredging are the cause of sediment pollutant in Sg. Galing, Kuantan.
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Figure 4.8 : River dredging activities in Sg. Galing, Kuantan

Figure 4.8 shows the river dredging that took place in Sg. Galing, Kuantan. The dredging has caused Sg. Galing to be polluted with the remains of the river soil.

Figure 4.9 : Garbage that pollutes Sg. Galing, Kuantan

Diagram 4.9 shows Sg. Galing, Kuantan which is polluted with garbage. This garbage will cause the river water to become dirty. Areas that are polluted with a lot of garbage are mostly in residential are
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# CHAPTER 5

# CONCLUSION

## 5.1 CONCLUSION

To summarize, we succeeded identify and map concentration of each pollutant involved in this investigation, and the end result of the mapping sediment based material the concentration along the Galing River is shown above. From the final results we received, we were able to classify the pollutants we studied, which are sediment, oil and chemicals, can be classified in class III. We use formulas found on Google for our calculations. The GIS software we use is very helpful in our study of water pollutants in Sg. Galing. As a result, the Sg. Galing geodatabase has been updated, which can help analyze better problems and finding solutions to water pollution.

Based on our study about water pollutants in Sg. Galing, the pollution that occurs in Sg. Galing, which is sediment, oil and chemicals, we can find out after we do the research. The three pollutions can be known through the convenience of multiparameter handheld devices. Through the tool, we can find out the reading of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), and Ph water at each point. With the reading, we can find the point that has the highest and lowest concentration. We used Geographic Information System (GIS) software to form a river in Sg. Galing as shown in figure 4.7. Therefore, the use of Geographic Information System (GIS) software is very helpful in our study of water pollutants in Sg. Galing, Kuantan.
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## 5.3 APPENDIX A (PROGRESS OF FIELDWORK)

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| 1)<br>  <br>We took river water readings at our first point which was in a residential area using multiparameter handheld devices. | 2)<br>  <br>We continue with our fieldwork by taking the next point in the middle of the river at city of Kuantan. |
| 3)<br>  <br>At the last point, we took the river point which is behind the mercedez car shop in Kuantan. | 4)<br>  <br>We were able to complete 31 points for our fieldwork within a day with the guidance of our group advisor, Sir Syarifuddin. |
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## 5.4 APPENDIX B (APPARATUS USE FOR FIELDWORK)

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| **1) HANDHELD MULTIPARAMETER**<br>  |
| **2) WATER DEPTH**<br>  |
| **3) PH METER**<br>  |
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