

## **The Impact of Land Reclamation Project on Fisherman of Tanjung Tokong**

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DOI: <https://doi.org/10.30880/rmtb.2021.02.01.072>

Received 01 March 2021; Accepted 30 April 2021; Available online 01 June 2021

**Abstract:** Land reclamation as a development from a construction site has greatly become a part of people's attention around the world. This study explored the survey land reclamation project in Penang. As we know that the problem of land reclamation is affecting the soil structure destroy, had affected the pollution of sea area. However, during the construction process did not implemented well mitigation, resulting in damage to the soil structure, affecting the surrounding marine biota. Therefore, this study attempts to explore the effect cause by reclamation activities to fishermen and determine the action taken by the contractor to mitigate for damage caused by reclamation at Tanjung Tokong. The research was conducted in Tanjung Tokong, Penang. Quantitative and quantitative approach adopted for this research. Data collection was made by obtained effect cause by reclamation activities to fishermen through questionnaire with 40 respondents. The data was analyzed by using SPSS. For the qualitative method which through interview session and online method carry out with 3 contractors from CCCC company. The results about of the effect cause by reclamation activities to fishermen had impact to income of fisherman is majority agree with 80% and with the highest mean 4.35. Besides that, during the operation of reclamation, effectively follow up the proper planning and establishment method of reclamation will prevent the major environmental problem. As conclusion, the research objectives were achieved and implement the rock protection is importance to soil stabilization and coastal protection. This is important to mitigate the damage from the reclamation.

**Keywords:** Land reclamation, mitigation, Tanjung Tokong

## 1. Introduction

Land Reclamation activities is the process of creating new land from the ocean, lakes and riverbeds, with the aim of overcoming the scarcity of land required for development. Although reclamation will benefit to society, the process may have posed certain disadvantages to the residents in the area (Jumain *et al.*, 2018).

The purpose of land reclamation is to improve the storage capacity of a city and make a helpless choice. At present, the cities that have developed first have discovered that there is no storage space reserved in advance. Excessive reclamation will narrow the harbor make the water flow faster, and the volatility will be greater, thus affecting the navigation of ships. It destroys marine ecology and affects the life of aquatic organisms. Not only were these creatures unable to survive, but there were also numerous red tides. For areas where rainwater is directly discharged into the ocean, reclamation will extend the rainwater canal underground. Due to the insufficient inclination of the extension part, the drainage capacity of the entire rainwater channel is reduced. Pollutants accumulate in narrow ports and are difficult to wash away, thus worsening the water quality of the harbor (Koto, 2017).

### 1.1 Research Background

Land reclamation is restoring an abandoned and derelict landscape as close as possible to the original state to offer alternatives land use options. The land reclamation is given many benefits in social, economy, and environmental aspects. In the context of environmental, the land reclamation is good for human beings and good for the rest of nature (Najiha Jaffar, 2010).

In addition, land reclamation is of great significance in landscape architecture design and can improve the quality of the urban environment. The reclamation results in new investments with new job opportunities increase in the productivity of land and property values and increase the income from tourism attraction in economy aspects. In addition, in reclaiming the landscape there are some issues and problems of the development area (Najiha Jaffar, 2010). For example, in the demining area, this is a polluted area that may have a negative impact on human health and contains the remains of many construction and dangerous toxic.

### 1.2 Problem Statements

As we know that the problem of land reclamation is affecting the soil structure destroy, this will affect the pollution of sea area causing reduced fish in coastal areas. This is because the contractor did not implement well mitigation in land reclamation so that it will be caused the soil structure to destroy. Mitigating failure in land reclamation will cause trouble for Tanjung Tokong fishermen because low water quality will affect the sea biotas around the area and caused fishes deaths in coastal areas (Priyandes & Majid, 2009). The problems involved in the reclamation activities release toxic effluents and material wastes into groundwater that eventually pollute the structure of sea area and as such, it impacts on soil quality (Duo & Hu, 2018). The material used causes the water to be more acidic, and cause fish deaths in coastal areas. As a result, fishing households find it difficult to earn a living (Suriati Ghazali, 2019).

Reclamation activity has destroyed the environment and ecosystem of the Tanjung Tokong affect and alter the ecosystem of the surrounding areas. Land reclamation also changes the quality of the surrounding areas of water. This upsets the oxygen and carbon dioxide levels in the water, making it harder for fish to survive (Rahman *et al.*, 2019). Soil structural destroyed had causing the socioeconomic of fishermen in the form of fishery productivity and income level. The productivity of fish will decline, which will lead to a decrease in fishermen's fishing area and affect the income of fishermen (Jumain *et al.*, 2018).

### 1.3 Research Questions

- (i) What is the effect cause by reclamation activities to fishermen at Tanjung Tokong.
- (ii) What the action taken by the contractor to mitigate for damage caused by reclamation.

### 1.4 Research Objectives

- (i) To identify the effect cause by reclamation activities to fishermen at Tanjung Tokong.
- (ii) To determine the action taken by the contractor to mitigate for damage caused by reclamation.

### 1.5 Scope of the Study

This study was focused on the impact of land reclamation project at STP2 on fisherman of Tanjung Tokong. The respondents targeted in this study focused on the fisherman in Tanjung Tokong also included the contractor. The reason for choosing Tanjung Tokong as the location to study because land reclamation has become very popular in Penang at the same time reclamation will be causing many problems. The reclamation project has troubled fishermen and affected their livelihoods, causing that many fishermen protest the massive land reclamation in Tanjung Tokong. This is the purpose for the study.

### 1.6 Significance of the Study

This study attempts to develop research to examine the impact of land reclamation projects at Seri Tanjung Penang Phase 2 (STP2) on fishermen of Tanjung Tokong. In addition, the research paper studies that soil liquefaction, flooding, and ocean pollution are caused by reclamation projects. These factors can be causing troubled fishermen and affected their livelihoods. It also determines which factor have a significant impact on fishermen of Tanjung Tokong.

## 2. Literature Review

### 2.1 Land Reclamation

Land reclamation is the process of creating new land from the ocean or riverbed (Britannica, 2020). The purpose of land reclamation is to increase the amount of land available and suitable for economic activity in countries. Land reclamation requires a large number of constructions works, bulldozers, scrapers, excavators, continuous excavators, concrete irrigators and so on. The most common type of land reclamation is unfavorable water conditions.

### 2.2 Impact of land reclamation

#### 2.2.1 Biological impacts

The process of coastal land reclamation involves sand mining and dredging in the offshore waters, followed by backfilling. Activities carried out during reclamation have a direct impact on coastal ecosystems (Malaysia, 2018).

#### *(a) Loss of marine benthic ecosystem*

The impact of reclamation on the seabed will damage the habitats of benthic organisms. Interference with bottom sediments by dredging and filling will bury and suffocate benthic organisms and cause permanent loss of benthic organisms (Yasser, 2011). Long-term recovery of benthic ecosystem can occur only where original sediment composition is being restored.

#### *(b) Destruction of buffer zone*

These ecosystem acts as natural buffers against wave energy and minimizing the impacts of wave on coastal areas, thus protecting the coastal area from being flooded and eroded due to wave action.

Removal of the ecosystems will leave the coastal communities vulnerable to flooding and natural disaster such as tsunami (Malaysia, 2018).

*(c) Disruption of food chain*

Collapsing ecosystems cannot sustain the marine life that depends on them. Shoreline modification and reclamation will affect existing biological and non-biological factors linked to the food chain. Any change or disruption of intimate relationships between certain species can affect the balance of ecosystems (Malaysia, 2018).

*(d) Coastal water pollution*

When the bottom sediments are disturbed during reclamation projects, it causes the release of toxic chemicals including heavy metals and polychlorinated biphenyls into water column which was trapped by sea grass earlier (Malaysia, 2018). The release of toxic compounds will degrade the water quality and affect the aquatic life.

*(e) Increase in siltation and turbidity*

Dredging and extraction of aggregates from the benthic zone or the seabed is a form of disturbance that leads to increase of suspended particles in the water column (Malaysia, 2018).

## 2.2.2 Socio-economic impacts

*(a) Livelihood and fisheries*

Inshore fishermen cannot venture further beyond nautical miles out to the sea to fish hence they might lose their normal fishing ground if there is any proposed reclamation project (Malaysia, 2018). Hence, reclamation may either lead to temporary disruption of fishing activities or total loss and thus affecting local fishermen's livelihood.

*(b) Sociocultural Impacts*

Clash of cultures, values and tolerance level between locals and foreign workers may occur during the reclamation project (Malaysia, 2018). A large number of foreign workers alongside the locals could disrupt the cultural and racial balance of the area.

## 2.2.3 Physical impacts

*(a) Saltwater intrusion and alteration of groundwater system*

Land reclamation activities in coastal areas causes changes on local groundwater systems (Guo & Jiao, 2007). This will affect nearby agriculture land as the pH of the soil is altered thus making it unsuitable for plant growth, especially species that are sensitive to salinity changes.

## 2.2.4 Other impacts

*(a) Affects the quality of life of nearby residents*

Temporary increase in noise pollution and air quality is likely to occur at the site, caused by construction and reclamation processes. This gives a negative psychological and physical impact to the people around the area (Yasser, 2011).

## 2.2.5 Flooding

The land reclamation will be caused flooding. Wetlands provide a buffer zone between the sea and the land, absorbing most of the ocean's power. Land reclamation has destroyed this natural buffer zone, with potentially catastrophic consequences (Jiang Gaoming 2008). On December 26, 2004, an earthquake in the Indian Ocean triggered a series of tsunamis that killed more than 200,000 people

and left many more homeless in at least 13 countries. In Penang, at least 38 people drowned, including a baby, and more than 30 were missing after a tsunami triggered by a major Indian earthquake hit coastal areas, including beach resorts in parts of Penang (Star, 2004). The district of Balik Pulau was the hardest hit, with 15 people drowned, 43 injured and more than 30 missing. 22 people died in Batu Ferringhi's famous tourist strip, which is relatively hidden (The Star, 2004). If natural mangroves are preserved, much of the tsunami's energy will be absorbed by wetlands, reducing casualties.

### 2.3 Mitigation

Mitigation is a specific action measures, projects, activities or processes taken to reduce the long-term risks of hazards and impact to people and property (National Academies of Sciences, 1991). Implementing mitigation measures can help achieve the planned tasks and goals (National Academies of Sciences, 1991). Action to reduce vulnerability to threats and hazards is at the core of the plan and a key result of the planning process (Beyond the basics, 2016). In order for the mitigation to be effective, we need to take action immediately before the next disaster to reduce future human and financial losses. It is important to know that disasters can happen anytime, anywhere, and if we are not prepared, the consequences can be fatal.

With the rise of new technologies and new technologies and their potential use in risk assessment, management, and mitigation, seismic engineering research has made significant progress. Despite this, there is still much work to be done, especially for existing buildings, most of which are constructed without seismic regulations (Ferreira *et al.*, 2019). In order to effectively reduce the impact of reclamation, developers need to use multi-disciplinary teamwork communication and coordination to increase the possibility of implementing effective mitigation measures, such as zoning, land use practices and building regulations (Ferreira *et al.*, 2019). Mitigation measures can reduce or eliminate long-term risks and are different from the measures taken to prepare or respond to hazardous events. Mitigation activities reduce or eliminate future demand for preparedness or response resources (Jane A. Bullock *et al.*, 2013). When analyzing risks and determining mitigation measures, the planning team can also determine emergency response or operational readiness measures.

#### 2.3.1 Soil structure reforms

Soil is an important medium for salt and water transportation. Its structure directly determines the hydraulic conductivity. Capillary action is the main force driving water rise. Does the groundwater level in the capillary rise area have a significant effect on evaporation (Shiguo Xu *et al.*, 2016). Once the capillary is destroyed if a multilayered structure is designed in the land reclamation zone, the salt accumulation process will be prevented. Therefore, it is meaningful to design multilevel backfilling technology based on the mechanism of salt movement in the reclamation area (Shiguo Xu *et al.*, 2016).

#### 2.3.2 Sediment property modifications

In the reclamation areas, coastal sediments are often used to improve the physical and chemical properties of soil and build construct grassy areas due to the high content and acidity of organic matter in coastal and river areas. Sediments are rich in microorganisms, which can increase the number and structure of soil microorganisms and improve soil enzyme activity fertility and humus content (Shiguo Xu *et al.*, 2016). However, coastal sediments are rich in salt and heavy metal pollutants, and the soils are small in size and prone to hardening after dehydration. Therefore, coastal sediments need to be modified before being applied to reclaimed soil (Shiguo Xu *et al.*, 2016).

### 2.4 Project reclamation at Seri Tanjung Penang 2 in Tanjung Tokong

STP2 is the second phase of the Seri Tanjung Pinang reclamation project on penang island's northeast coast. STP2 aims to be a paradigm development (Hassan *et al.*, 2018). Its overall conceptual master plan draws on highly successful waterfront projects around the world, while respecting penang's unique environment and characteristics (Hassan *et al.*, 2018). The proposed Seri Tanjung Pinang Phase II Master Plan will be implemented in phases over 15-20 years, in line with the policies of the Federal and state governments (Eastern and Oriental 2020). STP2 will adopt urban design guidelines to create places for communities. It is envisaged that STP2 will be designed to encourage more social interaction with green Spaces and the public sector, introduce a vibrant work and seaside lifestyle, and provide a variety of housing and facilities for all segments of society. However, many fishermen oppose the reclamation project because the reclamation activities in STP2 sea area have damaged the environment and ecological system and affected the fishery production and livelihood of fishermen.

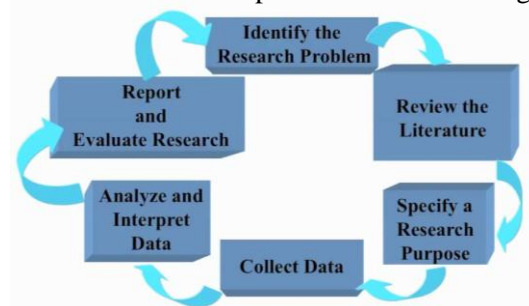
### 3. Research Methodology

#### 3.1 Research Design

In this study, quantitative method is used to collect the data from the respondent in Tanjung Tokong. The researcher used the data collected to examine the relationship between independent variables and dependent variable. The questionnaire was applied by using an on-paper survey tool for this study, and the survey item was primarily likert scale. Therefore, the questionnaire was used as an effective tool for collecting data in this study, and hypotheses supporting quantitative research were developed. The researcher's goal in conducting quantitative research is to collect primary data intended to identify the effect cause by reclamation activities to fishermen. The qualitative method is using in semi-interview session with contractor to determine the action taken by them to mitigate the damage cause by reclamation.

#### 3.2 Research Process

This research was started with finding the issue related to the impact of land reclamation project on fisherman to carry on the study. The subject areas that are related to the research have been identified. For doing this research, the information and the sources that are related to the topic has been searched and find. Second, the researcher finds the action taken by them to mitigate the issues of soil structure destruction. After that, the researcher selects the best method to conduct this study. Next, the researcher performed the method, and the then run the analysis. For the last step is to report the result and make a conclusion. The research process is shown in Figure 1 below:



**Figure 1: Flowchart of the research process**

#### 3.3 Instrumentation

The questionnaire has been developed and used as the research instrument in this study after the hypotheses were formulated. The questionnaire is one of the most popular data collection methods in management and business studies (Ghauri & Grounhaug, 2005). In this study, the questionnaire has been developed in section A, section B and section C. In section is Demographic. In section B, this

instrument will be used, and it was developed by Cho and Lee in 2015 after adoption and formulation. It was the first self-diagnostic scale for measuring the perspective of fisherman about reclamation activities with 5-point Likert-type scale. Each question has a response scale from 1 to 5 (1 = strongly disagree to 5 = strongly agree), reflecting the frequency of the symptoms. In section C is semi-interview session, using interview with contractor to determine the action taken by them to mitigate the issues of soil structure destruction.

### 3.3.1 Primary data

Primary data are information collected by a researcher specifically for a research consignment (Hox & Boeije, 2005). Primary data are original in nature and directly related to the issue or problem and current data. In this study primary data was used to achieve the second objective of study. Theory of Krecjie & Morgan (1970) was used to determine the sample of population. According to Trachoma (2006) sampling is a route of choosing units from a population of fishermen at Tanjung Tokong Penang.

### 3.4.2 Secondary data

Secondary data are data collected by a party unrelated to this study but collected at different times in the past for any other purpose (Hox & Boeije, 2005). In this study, the data of land reclamation obtained from CCCC is considered as secondary data information. China Communications Construction Company (M) Sdn. Bhd (CCCC) as the Main Contractor for Seri Tanjung Pinang Phase 2 (STP2) reclamation project. Furthermore, reference material was searched at the Tunku Tun Aminah Library, UTHM. While browsing the Tunku Tun Aminah Library website, UTHM researchers have been searching for the information of land reclamation, especially searching on the impact of land reclamation and the mitigation damage caused by reclamation.

## 3.5 Population

Population is referring to a group of people with specialized set of characteristics. In another word, population from which the sample was properly selected (Banerjee & Chaudhury, 2010). The target population is focus on the fishermen in the Tanjung Tokong and the contractor. The total population of fishermen in Penang has 6000.

### 3.5.1 Respondent

For this research a group of fishermen which is the age between 20 until 60 years old and above will be chosen as a respondent. Tanjung Tokong are selected area for this study because land reclamation has become very popular in Penang at the same time reclamation will be causing many problems to the fishermen, so that fishermen are be selected to be respondent and it this was convenience for the researcher to collect the data. A sample is select from a population in an appropriate way to reach the appropriate general conclusions (Barreiro & Albandoz, 2001). The target of respondents is comprised of different gender, age and race. This is due to assume that the sample is a good representation of the theoretical population of this study (Leong, Ooi, Chong, & Lin, 2013). The sample sizes are 40 respondents with a total population of 6000. Therefore, 40 sets of questionnaires will be distributed through the on-paper survey method. Probability sampling technique will be used in this research.

## 3.6 Analysis of Data

A well-constructed questionnaire titled “the impact of land reclamation project on fisherman in Tanjung Tokong” will be used to get the desired perspective from the respondents. Nominal and ordinal measurement analyzed by using descriptive analysis to clearly explain it mean and median among respondents. Therefore, descriptive analysis will be used in analyze the demographic data of respondents such as gender, age and ethnicity which is section A in the questionnaire. The IBM

Statistical Package for Social Sciences (SPSS) will use for the online questionnaire to analyses the data.

#### 4. Results and Discussion

The methods used for gathering data and analysis recognized as most relevant in achieving the objectives of the research, which are to identify the effect cause by reclamation activities to fishermen at Tanjung Tokong and determine the action taken by the contractor to mitigate for damage caused by reclamation. In addition, findings from the study were analyzed using of data of perception about effect cause by reclamation activities to the fishermen in a numerical form and questionnaire. For the first objective, the obtained the effect cause by reclamation activities at Tanjung Tokong type of data analysed by using SPSS and for the second objective analyzed by using interview.

##### 4.1 Research objective 1: To identify the effect cause by reclamation activities to fishermen at Tanjung Tokong.

Survey strategy was used to collect data from targeted respondents through of questionnaire tool based on purposive sampling technique. The distribution of questionnaire was administrated via using on paper survey format. There have 40 questionnaires were safely collected. A detailed overview of the demographic profiles of the respondents is presented in Table 1.

##### 4.1.1 Demographic Background

**Table 1: Demographic Data**

No	Section	Category	Frequency	Percentage (%)
1	Gender	a) Male	32	80
		b) Female	8	20
2	Age Group	a) 25-34years old	4	10
		b) 35-44years old	2	5
		c) 45-54years old	10	25
		d) 55-65years old	12	30
		e) 65 and above	12	30
3	Ethnicity	a) Malay	27	67.5
		b) Indian	8	20
		c) Chinese	5	12.5
4	Marital Status	a) Single	8	20
		b) Married	32	80
5	Income Range (RM)	a) 1001-2200	11	27.5
		b) 2201-2500	23	57.5
		c) 3501-5500	6	15

##### 4.2 Findings of the Effect Causes by Reclamation Activities at Tanjung Tokong

The Likert scale type of questionnaire was used to gain response in a form of data from the participants. The Table 2 presents the Likert scale.

**Table 2: Likert scale (Survey, 2020)**

The effect causes by reclamation activities to fishermen at Tanjung Tokong	1	2	3	4	5
Opinion of Respondents based on the scale	Strongly	Disagree	Neutral	Agree	Strongly



		Disagree								Agree		
		1		2		3		4		5		Mean
No	Question	F	%	F	%	F	%	F	%	F	%	
1	Land reclamation had damaged to natural ecosystem.	-	-	2	5	6	15	20	50	12	20	4.05
2	The reclamation project impact on the ocean food chain and the fishing	-	-	-	-	28	70	7	17.5	5	12.5	3.43

#### 4.2.1 Result

**Table 3: Summarized valid response rates data (Survey, 2020)**

	industry due to total loss of mudflats.											
3	Land reclamation activities had impact to income of fisherman.	-	-	-	-	8	20	10	25	22	55	4.35
4	Destructive of marine habitat from reclamation activities had caused the fishermen income decreased.	-	-	-	-	8	20	12	30	20	50	4.3
5	Water pollution from reclamation activities had caused the marine life decreased.	-	-	-	-	-	-	40	100	-	-	4
6	Reclamation activities give negative impacts to the ecosystem.	-	-	-	-	28	70	12	30	-	-	3.3
7	The reclamation would affect fishermen's livelihoods.	-	-	-	-	8	20	20	50	12	30	4.1
8	Reclamation project negative effects on the environment.	-	-	5	12.5	20	50	13	32.5	2	5	3.3
9	Reclamation make Penang more advanced and become a high-tech international city.	10	25	5	12.5	20	50	5	12.5	-	-	2.5
10	Reclamation of the sea has reduced the fishing area, and the sea production will be greatly reduced.	-	-	-	-	-	-	28	70	12	30	4.3
11	Fisherman support with the reclamation project in Tanjung Tokong.	18	45	12	30	10	25	-	-	-	-	1.8
12	Land reclamation affects coastal building (for example hotel, condominiums).	-	-	-	-	38	95	2	5	-	-	3.05
Overall mean												3.54

According to the Table 3 show that the highest mean with 4.35 of perception of fishermen's about the effect cause by reclamation activities had impact to income of fisherman. There have 22 respondents with 55% strongly agreed with the statement and 10 respondents with 25% agree and 8 respondents with 20% keep neutral because fishermen believe that water pollution caused by reclamation activities has led to a decrease in aquatic life, and the decrease in marine life directly affects fishermen's income. Besides that, the statement fisherman support with the reclamation project in Tanjung Tokong. There have majority of respondents with 45% strongly disagree and 12 respondents with 30% disagree with statement fisherman support with the reclamation project in Tanjung Tokong with the mean score 1.80. The overall mean is 3.54.

#### 4.3 Research Objective 2: The Action Taken by Contractor to Mitigate the Damage Caused by Reclamation.

The distribution of interview was administrated via using through the social media platform. There have three set data was safely collected with determine action taken by the contractor to mitigate for damage caused by reclamation.

##### 4.3.1 Demographic Background

**Table 4 Demographic profile of respondents (Survey, 2020)**

No	Section	Category	Frequency	Percentage (%)
1	Gender	a) Male	2	66.67

2	Age Group	b) Female	1	33.33
		a) 25-34 years old	1	33.33
		b) 35-44 years old	1	33.33
		c) 45-54 years old	1	33.33
		d) 55 and above	-	-
3	Ethnicity	a) Malay	-	-
		b) Indian	-	-
		c) Chinese	3	100
		d) Other	-	-
4	Marital status	a) Single	1	33.33
		b) Married	2	66.67
5	Education	a) Diploma	-	-
		b) Degree	3	100
		c) Master	-	-
		d) Phd	-	-
6	Income Range	a) RM2201-RM3500	-	-
		b) RM3501-RM5500	-	-
		c) RM5501-RM7000	1	33.33
		d) RM7001 and above	2	66.67

#### 4.4 Findings of The Action Taken by Contractor to Mitigate the Damage Caused by Reclamation.

Table 5 below summarized the findings related to the action taken by contractor to mitigate the damage caused by reclamation.

*(a) When the reclamation project started, the safety indicator installed in the sea area.*

All respondents agree that when the reclamation project started, the safety indicator has been installed in sea area. To ensure the reclamation project is developed safely and efficiently and optimize safety and health performance, minimize potential negative impacts on the environment.

*(b) Prevent the major environmental problems during the operation of reclamation projects.*

During the operation of reclamation, effectively follow up the proper planning and establishment method of reclamation will prevent the major environmental problem. For example, method of reclamation: The hydraulic filling method is suitable for granular fill (Designing Buildings, 2017). The filling material is excavated from the retrieving source and then pumped in through the drainage pipe at the site, usually adjusting the mixture of the filling material and water according to the particle size.

*(c) The method has the project adopted to reclaim the sea to reduce the impact of construction on water quality.*

The findings show that method of project adopted to reclaim the sea to reduce the impact of construction on water quality. A respondent answers that silt curtain control. Silt Curtains are installed around civil works in or adjacent to waterways to control the migration of suspended silt and sediment into the sea area. Respondent 2 and 3 answer with rock cofferdam and reasonable construction method.

*(d) A temporary jetty built for fishermen during the construction period of reclamation.*

All respondent which respectively provided an answer with no. This is because it is not their responsibility to build temporary jetty for fishermen during the reclamation period.

*(e) Any special subsidies provided to affected fishermen.*

The findings show that all the respondent agrees with special subsidies had provided to fishermen affected by reclamation activities in the area is determined by the state government and the Malaysian Fisheries Development Authority (LKIM).

*(f) Each boat owner will give a fisherman transformation boat funded by the state*

The findings show that respondent not sure with the statement each boat owner will give a fisherman transformation boat funded by the state, but they have presented to the Penang State Government with a cheque for ex-gratia payment to fishermen.

*(g) Contractor had establishment of a new terminal with various facilities such as storage rooms and maintenance centers.*

The findings show respondent 1 answer that only built temporary jetty at the Phase 2A3 island during construction but upon completion of project, the temporary jetty has been removed. Respondent 3 say that scheduled waste storage has built at the Setiamarine Peurnama.

*(h) Adopt a sediment spill management option to mitigate the leakage impact associated with reclamation and dredging projects.*

The findings show that all the respondents agree with Sediment spill management options can be adopted to mitigate the impact of spills associated with reclamation and dredging works. Sediment spill is unavoidable during dredging works and must be addressed. Dredging and earth handling in the aquatic environment always result in a certain sediment spill that must be managed (Solution & Spill, 2000).

*(i) The management of transportation and storage of designated waste, solid waste, chemicals, and designated waste.*

The finding show that respondent 1 answer follow the DOE guidelines and requirements. Respondent 2 answer that send designated waste, solid waste, chemicals, and designated waste to designate area. Respondent 3 say that prepare of the Scheduled Waste Plan. For example, a proper designated area in the waste generator premises, away from the manufacturing/processing area and area of employee's activities.

*(j) The plans of developer adopt to mitigate the risk of pollution and complaints in the area.*

The findings show that respondent 1 and respondent 3 not sure with the plans of developer adopts to mitigate the risk of pollution and complaints in the area. Respondent 2 answer with follow SOP. A SOP should be available at the any workplace. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations.

*(k) The function of a temporary wall with geotextile and rock protection*

The findings show that all respondent agree with temporary wall with geotextile and rock protection is to prevent pollution, prevent landslide and protection against wave action. Geotextiles allow water to pass through but resist the fine soil migration. Geotextile can erosion control, soil stabilization, coastal protection, and offshore engineering (Mitra, 2013).

*(l) Good maintenance can mitigate accidental leakage. For example, bottom door leakage in funnel/barge, no leaking pipes and connections during pumping.*

The findings show that all the respondent agree with good maintenance can mitigate accidental leakage. With increasing awareness of the fact that maintenance not only ensures high level of safety at workplaces.

*(m) The mitigation measures planned in the environmental assessment phase can greatly reduce the potential impact, but there may be changes between the environmental assessment phase and implementation, such as in the dredging method schedule and others.*

The findings show that respondent 2 and 3 answer with there have some different between environmental assessment phase and implementation. This is because in the construction phase, it must be arranged according to the actual construction method. Respondent 1 say that proper planning shall be one of the critical factors to prevent potential pollution.

**Table 5: The Action of Contractor to Mitigate Damage Caused by Reclamation**

Questions	Respondents	Answer
When the reclamation project started, the safety indicator installed in the sea area	Respondent 1 Respondent 2 Respondent 3	Yes, to ensure proper planning and implementation of reclamation projects to minimize potential negative impacts on the environment. Yes Yes, to ensure the project is developed safely and efficiently, which includes the emergency response. To prevent the injuries for emergency case for example Explosion, Oil/Chemical Spillage, Capsizing.
Prevent the major environmental problems during the operation of reclamation projects.	Respondent 1    Respondent 2 Respondent 3	a) Proper planning and establishment of the method of reclamation. b) Implementation of control measures during construction activities. c) Regular daily monitoring of the water parameter (TSS). d) Real time monitoring of the water parameter (TSS).  Install silt curtain, patrolling Effectively follow up and evaluate environmental problems arising from the operation of reclamation projects, and promptly rectify problems when problems are found
The method has the project adopted to reclaim the sea to reduce the impact of construction on water quality.	Respondent1  Respondent 2 Respondent 3	a) Selection of the method / machine / vessel. b) Silt curtain control. c) Stop work if water parameter (TSS) exceed control limit Rock cofferdam Reasonable construction method
A temporary jetty built for fishermen during the construction period of reclamation.	Respondent1 Respondent 2 Respondent 3	No No No
Any special subsidies provided to affected fishermen.	Respondent1 Respondent 2 Respondent 3	Ex-Gratia Payment to Eligible Fishermen Have Have, ex-gratia payments to fishermen
Each boat owner will give a fisherman transformation boat funded by the state	Respondent1 Respondent 2 Respondent 3	Refer to item 5 Not Sure Not sure, but we have proposed to the government to give subsidy
Contractor had establishment of a new terminal with various facilities such as storage rooms and maintenance centres.	Respondent1  Respondent 2 Respondent 3	Only temporary jetty at the Phase 2A3 island during construction. Upon completion of project, the temporary jetty have been removed. Yes Scheduled Waste storage area build at the Setiamarine Purnama
Adopt a sediment spill management option to mitigate the leakage impact associated with reclamation	Respondent1 Respondent 2 Respondent 3	Certainly Yes Yes

and dredging projects.

The management of transportation and storage of designated waste, solid waste, chemicals, and designated waste.	Respondent1	Follow DOE guidelines and requirements.
	Respondent 2	Send to designate area
	Respondent 3	Prepare of the Scheduled Waste Plan
The function of a temporary wall with geotextile and rock protection.	Respondent1	Is a containment bund and filling works to be done within the bund to prevent pollution
	Respondent 2	Prevent landslide
	Respondent 3	Protection against wave action
Good maintenance can mitigate accidental leakage. For example, bottom door leakage in funnel/barge, no leaking pipes, and connections during pumping.	Respondent1	Certainly
	Respondent 2	Yes
	Respondent 3	Sure
The mitigation measures planned in the environmental assessment phase can greatly reduce the potential impact, but there may be changes between the environmental assessment phase and implementation, such as in the dredging method schedule and others.	Respondent1	Proper planning shall be one of the critical factors to prevent potential pollution. During construction stage, the relevant control or mitigation measures have to be reviewed and adjusted from time to time suiting the actual construction method / arrangement.
	Respondent 2	Yes, Will be different when implement it
	Respondent 3	Yes, there will be some different between the environmental assessment phase and implementation.

#### 4.5 Discussions

One of the purposes of discussions is to explain the meaning of findings and why they are so important. Thus, this section concludes the results of the findings which are summarized.

The First objective of this study is to identify the effect cause by reclamation activities to fishermen at Tanjung Tokong, Penang. Findings from the study revealed that almost all fishermen oppose with land reclamation activities because it affects their income and negative effects on the environment with overall mean 3.54. Findings of this study found that almost respondent agree with land reclamation activities had impact to income of fisherman with the highest mean 4.35. This shows that there are majority fishermen oppose with land reclamation activities.

Referring to literature review, on impact of land reclamation, findings of study from previous researchers is majority respondent agree that land reclamation has caused many impacts to the natural and fishermen obtained result for this study. Although the method and location vary according to the research framework, the final result successfully analyzed the fishermen's perception on reclamation. Through obtained result for this study, we can conclude that respondent's opposition with land reclamation.

Second objective of study is to determine the action taken by the contractor to mitigate for damage caused by reclamation. Findings from the study revealed that action to mitigate for damage caused by reclamation. Sediment spill management options can be adopted to mitigate the impact of spills associated with reclamation and dredging works. Hence, mitigating measures to be established in the event of unforeseen and unacceptable impacts will be tailored to the site-specific needs.

#### 4.6 Suggestion to the researcher

A few suggestion was developed for the reference of construction stakeholder, to local authority and also fisherman related to the impact of land reclamation project.

##### *(a) Dry method*

Dry method is suitable for the filling of land source materials, especially rock, mountain, clay and other materials. In general, the dry method is applicable to foreshore sites with effective seabed soil under them. When the subsea soil is weak, mud waves will be generated in front of the fill due to displacement.

##### *(b) Sediment spill management*

Sediment spill management options can be adopted to mitigate the impact of spills associated with reclamation and dredging works. Sediment spill is unavoidable during dredging and must be treated. Each dredging project and associated sediment leakage has specific characteristics. Therefore, in the event of unforeseen and unacceptable impacts, mitigation measures will be developed according to the needs of specific locations.

##### *(c) Geographic Information System*

Remote sensing and geographic information systems (GIS) are useful tools for assessing ecosystem characteristics and functions. These techniques can be used to study land use/cover change and soil degradation in different ecological areas. These techniques can assess whether this area is suitable for land reclamation, with minimal harm to the environment. Therefore, this all can help industry or developers to make further improvements mitigate impact to environment and strategize better mitigation strategies with these appreciate information.

##### *(d) Environment*

Land reclamation can bring economic benefits to the marine ecological environment. The application of ecological compensation to the coastal development activities of reclamation and land reclamation not only considers the economic benefits brought about by reclamation, but also considers the external cost and marine ecological value of reclamation. On the other hand, appropriate compensation can be made for reclamation areas and adjacent damaged sea areas, and the original sea areas can be restored as much as possible contribute to the sustainable development of the ocean.

##### *(e) Fishermen*

The compensation for land reclamation belongs to the category of ecological damage compensation. Compensation are the stakeholders who originally enjoyed the ecosystem services of the reclaimed area. Special subsidies had provided to fishermen affected by reclamation activities in the area is determined by the state Government and the Malaysian Fisheries Development Authority (LKIM).

## 5. Conclusion

This research was conducted to identify the effect cause by reclamation activities to fishermen at Tanjung Tokong and to determine the action taken by the contractor to mitigate for damage caused by reclamation. The result about of perception about the effect cause by reclamation activities to fishermen had impact to income of fisherman is majority agree with 80% and with the highest mean

4.35 because they believe that water pollution caused by reclamation activities has led to a decrease in aquatic life, and the decrease in marine life directly affects fishermen's income. On the other hand, the researcher findings have identified the fisherman support with the reclamation project in Tanjung Tokong, they almost 75% protesting against development projects. Besides that, the action taken by the contractor to mitigate for damage caused by reclamation. During the operation of reclamation, effectively follow up the proper planning and establishment method of reclamation will prevent the major environmental problem. This is important and necessary for protection to the environmental. A temporary wall with geotextile and rock protection is to prevent Pollution, prevent landslide and protection against wave action. Therefore, it is important to mitigate the damage from the reclamation.

## Acknowledgement

The author would like to thank and highly appreciate the Department of Construction Management, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia (UTHM) who have been very supportive during the conduct of this study.

## References

- Barreiro, L. P., & Albandoz, J. P. (2001). Population and sample . Sampling techniques. Management Mathematics for European Schools.
- Banerjee, A., & Chaudhury, S. (2010). Statistics without tears: Populations and samples. *Industrial Psychiatry Journal*, 19(1), 60. <https://doi.org/10.4103/0972-6748.77642>
- Beyond the basics (2016). Develop a Mitigation Strategy.<http://mitigationguide.org/task-6/mitigation-goals/>
- Cho, S., & Lee, E. (2015). Development of a Brief Instrument to Measure Smartphone Addiction among Nursing Students. *CIN - Computers Informatics Nursing*, 33(5), 216–224. <https://doi.org/10.1097/CIN.000000000000013>.
- Duo, L., & Hu, Z. (2018). Soil quality change after reclaiming subsidence land with Yellow River sediments. *Sustainability (Switzerland)*, 10(11), 1–13. <https://doi.org/10.3390/su10114310>
- Eastern & Oriental Berhad (2020). Seri Tanjung Pinang Phase 2. <https://www.easternandoriental.com/property/seri-tanjung-pinang-phase-2/>
- Ferreira, T. M., Mendes, N., & Silva, R. (2019). Reducing the seismic vulnerability of existing buildings: Assessment and retrofit. In *Buildings* (Vol. 9, Issue 6). <https://doi.org/10.3390/BUILDINGS9060148>
- Ghuri, R. & Gronhaug, K. (2005). Research method in business studies: a practical guide. Prentice Hall.
- Guo, H. and Jiao, J.J., 2007. Impact of Coastal Land Reclamation on Ground Water Level and the Sea Water Interface. *Ground Water* 45, 362-367.
- Hassan, N. M. K. N., Kamel, N. A. M. A. N. M., Pauzi, M. F., & Teh, H. M. (2018). Construction Technology Used for the Reclamation of Seri Tanjung Pinang (Phase 2). *MATEC Web of Conferences*, 203, 1–20. <https://doi.org/10.1051/mateconf/201820301016>
- Jumain, N. A., Kamarulzaman, N. H., Latif, I. A., & Economics, B. (2018). 1 , 2 , 3. 3(03), 87–97.
- Jiang Gaoming (2008) Land reclamation: tread carefully. <https://www.chinadialogue.net/article/show/single/en/1792-Land-reclamation-tread-carefully>.
- Jane A. Bullock, George D. Haddow, and Damon P. Coppola. (2013). Mitigation, Prevention, and Preparedness. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7158272/>
- Koto, J. (2017). Preliminary Study on Impacts of Reclamation of 17 Islands in Jakarta Bay Preliminary Study on Impacts of Reclamation of 17 Islands in Jakarta Bay. *International Journal of Environmental Research & CLean Energy*, 8(1), 9–17.
- Krejcie, R. V. & Morgan, D. W. (1970). Determining sample size for researching activities. *Educational and Psychological Measurement*, 30, pp. 607-610.
- Leong, L. Y., Ooi, K. B., Chong, A. Y. L., & Lin, B. (2013). Modeling the stimulators of the behavioral intention to use mobile entertainment: Does gender really matter? *Computers in Human Behavior*, 29(5), 2109–2121. <https://doi.org/10.1016/j.chb.2013.04.004>
- Malaysia, S. A. (2018). Impacts of Coastal Reclamation to the Quality of Life. 20.
- Mitra, A. (2013). Geotextiles and its application in coastal protection and off-shore engineering. *Journal of the Textile Association*, 74(1), 5–11.



- Najiha Jaffar (2010). The Important of Land Reclamation in the Context of Landscape Architectural Design. <https://www.academia.edu/26268005>
- National Academies of Sciences (1991) A Safer Future: Reducing the Impacts of Natural Disasters. <https://www.nap.edu/read/1840/chapter/6>
- Petersmack, P., & Wilkerson. R. (2003) Land Use Affects Public Health
- Priyandes, A., & Majid, M. (2009). Impact of reclamation activities on the environment case study: reclamation in northern coast of Batam. *Jurnal Alam Bina*, 15(1), 21–34.
- Rahman, F. A., Hassan, N. A., Ismail, A., & Baharudin, B. A. (2019). Dredging impact towards marine ecosystem and fisheries activity at Penang Coastal Area. *International Journal of Recent Technology and Engineering*, 8(1), 415–421.
- Suriati Ghazali. (2019). 'No Fish , No Money': *The Livelihoods of the Malay Fishing Community in Teluk Bahang*. ii, 182–192.
- Shiguo Xu, Yi Xu, Yanzhao Fu and Qi Wang (2016) Soil Salinization and Mitigation Measures in Land Reclamation Regions. <https://www.intechopen.com/books/soil-contamination-current-consequences-and-further-solutions/soil-salinization-and-mitigation-measures-in-land-reclamation-regions>
- The Editors of Encyclopaedia Britannica(2020). Land reclamation. <https://www.britannica.com/science/land-reclamation#info-article-history>
- The Star (2004) At least 38 dead in Penang. <https://www.thestar.com.my/news/nation/2004/12/27/at-least-38-dead-in-penang>
- Yasser El Sayed Mostafa. (2011) Environmental impacts of dredging and land reclamation at Abu Qir Bay, Egypt. *Ain Shams Engineering Journal* Vol. 3, pp.1–15)