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WATER POLLUTION STUDY AT CLAN JETTY, PENANG, MALAYSIA

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Abstract

As there is no sewerage facility at Clan Jetty, human waste is directly disposed of into the sea. As a place of historical interest and a tourist destination, seeing the human waste floating on the water surface and smelling the dirty water is not good for tourism. Rapid development in Penang has impacted negative environmental impact to the marine zone. Marine zone of the Penang is heavily polluted due to the activities of land reclamation and the direct sewage discharge into the sea (Sivalingam, 1984). The Water Pollution Study confirm that the most polluted area is the stretch which are the main drains leading into Clan Jetty shore. These are the drains along Lebuh Chulia, Gat Lebuh Armenian, and Gat Lebuh Melayu. The organic loads, measured in terms of BOD, COD, Oil & Grease, Suspended Solids are highest along these strips followed by the shoreline strip. The high E Coli concentrations along these strips confirmed that there is fecal contamination most probably from the partially treated sewage emanated from the septic tanks from the unsewered Lebuh Chulia and Lebuh Pantai/Pengkalan Weld enclaves. This pollution is made worse by the sewage direct disposal into the sea by the Clan Jetty community due to the non-existence of any sewerage system whatsoever.

Keywords water pollution, Clan Jetty, sewerage, BOD, Cod, SS, UNESCO

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1.0 Introduction

1.1 Clan Jetty

Among the most interesting sights in Georgetown is the Clan Jetty along Weld Quay, close to the Chulia Street. A clan is a group of close-knit families; in this case they are all of Chinese origin. Clan Jetty is a community village, consisting of houses built on stilts over the water. After the ferry terminal was built in the 1970s only six jetties remained. Five of them belong to specific clans like the Chew Jetty and the Lee Jetty with the sixth being a jetty where families with various surnames live together. When the jetties were established in the mid-19th century everybody who lived on the same jetty had the same surname because they all came from the same fishing village in China's Fujian Province. When they arrived they did not have money to buy land and so they decided to build their own villages: the jetties. The families were used to living close to the water and most men who lived on the jetties worked as fishermen or as coolies in the port.

1.2 The Origin of Clan Jetty

After Penang lost its free port status in 1974 the port became very quiet and the people who lived on the jetties had to find other ways to make a living. Many of them returned to fishing and prawn farming. Nowadays the Chew Jetty is the largest Clan Jetty and has the most active community. On the Chew Jetty about 80% of the remaining residents are still 'real' Chews. Many children of the earlier inhabitants have left the jetty to go and live in permanent houses instead of the wooden ones on the jetty. The jetties can be entered and visited from Weld Quay (Jalan Pengkalan Weld).

1.3 Clan Jetty Current Status

The UNESCO World Heritage status saved the jetties from planned demolition. The fact that the jetties now have heritage status guarantees that they will stay. Except for the houses still officially having temporary status, they are quite normal with addresses, running water and electricity. The only thing they lack is a proper sewerage system. The absence of that, combined with the general water pollution around Penang, has seriously affected the waters around the jetty, which are no longer suitable for fishing. The residents, however, have found new ways to survive: there are souvenir shops, a hairdresser, a

couple of houses offering home-stays and the boats which are now in use as water taxis. Heritage status has also resulted in an increase in cruise ships and leisure boats arriving at the renovated Swettenham

Figure 1 The study area : Clan Jetty, Penang

Pier, which results in more visitors for the jetties. One might say that UNESCO status has given the jetties a bright future.

Figure 2 Yeoh Jetty

There are a total of 213 houses at Clan Jetty taking up an area of 2500m square. Chew Jetty hosts the highest population and Tan Jetty has the lowest population, mostly because Tan Jetty predominantly houses older residents. The Clan Jetties are situated close to the Penang ferry terminal, with the entrance to the jetties located through the temple on the quayside. Maintaining its heritage value with minimal changes in its physical aspects, the area is not expected to grow in size.

1.4 Water Pollution at Clan Jetty

The waste in the area not only comes from all of the houses at the jetty, but also from the restaurants nearby the jetty. Besides, sources of oil and grease are discharged from vessels such as tank clearing, deballasting, bilges and bunkering, and leakages and disposal of engine oil from ferries and boats. Other than that, the garbage thrown by the public into the sea also affects the quality of the sea water.

Figure 3 Garbage thrown by the public into the sea

The main problem in this area is that there is no sewerage system to collect and transfer all the human waste coming from the premises. Human waste is directly disposed into the sea which negatively impacts the quality of the water, making it polluted and smelly with profuse algae and micro bacteria. Additionally, the people who live in this area commonly face a variety of health problems due to the health hazards.

Figure 4 Human waste is directly disposed into the sea

Figure 5 Human waste floating on the water surface

2.0 Literature Review

2.1 Pollutants, Factors, and Effects of Marine Pollution in Malaysia

A report on marine pollution problems in Malaysia prepared by Jothy (1976), state that the main pollutants that most likely to be disposed into the sea are silt, oil, sewage, detergents, pesticides, garbage, solid wastes, and waste from the combustion of fossil fuels. All these pollutants came from multiple human activities apart from natural causes. Human activities that causes marine pollution are forestry and land development, terrestrial and seabed excavations including trawling, domestic outfalls, pest control in agriculture and public health, deliberate and operational discharge from ships, accidental release from ships, industrial outfalls, combustion of fossil fuels, and nuclear weapons testing. Besides, the aquatic ecosystem is declining, the water and food source were contaminated which lead to health hazards of human being. Moreover, the pollution has also threatened the development of coastal agriculture such as coral reef and mangrove swamps which provide shelter and ground for feeding, spawning and nursery for many various species of fish.

2.2 Effect on Marine Communities

Warwick (2001), state that marine organisms are being affected either directly or indirectly by pollution. Which directly are by discharges of industrial and domestic wastes, indirectly are results of atmospheric pollution and global climate change.

2.3 Impacts of Coastal Reclamation

Nadzhirah et al. (2014) identified the impacts of coastal reclamation to the variables of the quality of life. Coastal reclamation had effected the communities in the aspect of job opportunity, property value, shop and malls, passive recreation, side effects, flash flood, air pollution, noise pollution, water pollution, traffic congestion and health. Based on the research and analysis that had been done, flash flood, traffic congestion and health influenced the quality of life the most. Apart from that, public health and increase of potential disease spreading is caused by loss of wetland and beaches. Reclamation showed adverse impact towards the physico-chemical environment, biological environment, and social aspects in the area and are also to be blamed for the loss of mangroves and destruction of the coral reefs (Priyandes & Majid, 2009).

3.0 Methodology

3.1 Visual Observation:

During the site visit, the physical characteristics of the waters at the study area were observed based on their water colour, odour, visible sewage and solid waste.

3.2 Data Collection and Sampling:

Samples were tested for temperature, pH value, BOD (Biochemical oxygen demand), COD (Chemical Oxygen Demand), NH^3-N (Ammoniacal nitrogen), NO^3-N (Nitrate nitrogen), Suspended Solid Test (SST), Oil & Grease, Phosphorus, E. Coli Count (by MPN Method) and Dissolved Oxygen.

Figure 6 Weld Quay Map

For the purpose of the study, 28 points were selected for water sampling. All the points are shown in Figure 7 below.

Figure 7 Sampling Points

4.0 Results

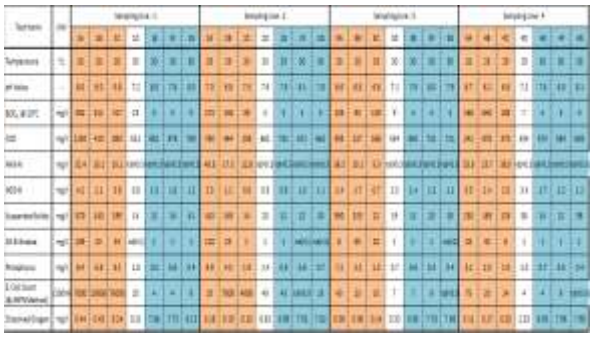

Table 1 : Sampling Results

5.0 Discussions

Figure 6 shows the two enclaves adjacent to the study area where all the premises still use septic tanks.

Water quality standards have been established to protect users from health and other adverse consequences of poor water quality. The average pH value for Clan Jetty's drain line 1, 2, 3 and 4, were 6.97, 7.51, 7.26, and 7.26 respectively. Most water bodies have pH ranges of 6 to 8. If the pH value is below 6, it has harmful effects on ecology (Lenntech, 2012). High and low pH values can kill adult fish and invertebrate life directly and can also damage developing fish. When the pH of freshwater becomes highly alkaline, the effects to marine life include death and damage to outer surfaces.

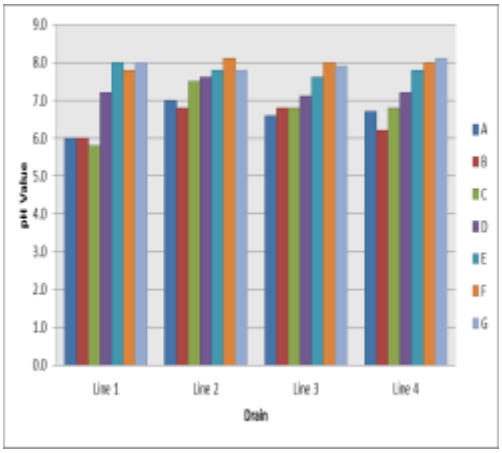

Chart 1 pH Value for Jetty Water Samples

Based on COD values for drains at the Clan Jetty it was concluded that they were too high and the water therefore is unsuitable for any type of use or activity. The COD results for Drain Line 1 were the highest, which was 790 mg/L to 1250 mg/L. The presence of high COD may indicate faecal contamination from human or organic matter from non-human sources that can restrict water use (UNDSA, 2007).

According to water classifications and uses, the lowest class of water is Class V which is unsuitable for any of the activities in or on the water. In the context of BOD, most of the samples from the drain on land (point A,B and C) have high BOD values. The highest BOD was recorded at point 4B with a value of 640 mg/L and the lowest BOD values were at points 1E, 3G, 4F and all marine water level (point D, E, F, G) in drain line 2.

According to INWQS, the lower the value of DO, the polluted the water body is. The oxygen dissolves by diffusion from the surrounding air and waste product of photosynthesis. The data analysis proved that in Clan Jetty drains; the DO value was lowest 0.08 mg/L at the point 3A, compared to the highest DO in point 1G (8.13 mg/L). The data showed that the drains water at the land area (A, B and C) were very polluted and all water at the sea (E, F and G) may have potential for living marine life because it has high DO.

Coliforms are bacteria that are always present in the digestive tracts of animals, including humans, and are found in their waste. Total Coliform includes bacteria that are found in the soil and in water that has been influenced by surface water. E. coli is the major species in the faecal Coliform group. Consequently, E. coli is considered to be the species of Coliform bacteria that is the best indicator of faecal pollution and of the possible presence of pathogens (APEC, 2012). Based on INWQS, a high presence of total Coliform and E. coli is harmful for outer body contact. All points in the study showed the presence of both types of bacteria with a maximum value at Point 1C with E. coli of 7.5 x 10^4 /100ml. This clearly shows that the study area is severely polluted with faecal matter.

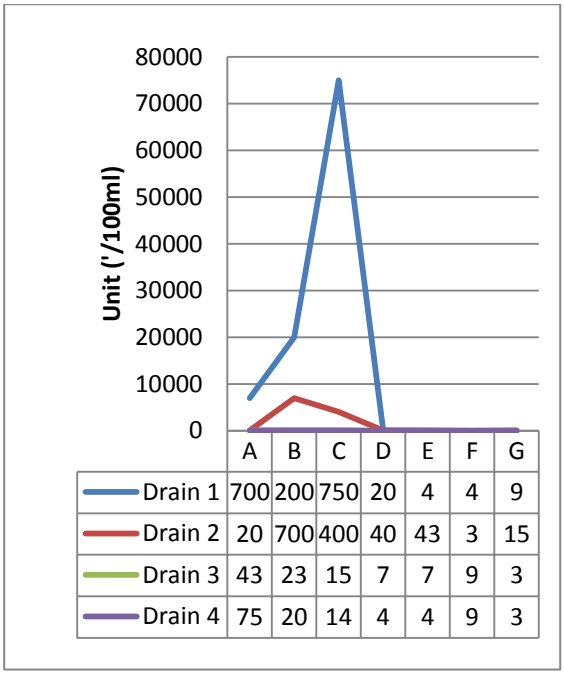

Chart 2 E. Coli Count

From the data, it shows that Drain Line 4 has the lowest average value of phosphorus which was 1.37 mg/L followed by Drain Line 3 (1.96 mg/L) and highest was in Drain Line 1 (3.66 mg/L). These values are considered high as the natural background levels for total phosphorus are generally less than 0.03 mg/L. The high concentration of phosphorus allows plants to assimilate more nitrogen before the phosphorus is depleted. Thus, when the amount of phosphorus is in abundance, elevated concentrations of nitrates will lead to algal blooms.

The value for nitrate at Point 1A was 4.2 mg/L, while in point 1G, the value was 0.4 mg/L and the standard value for nitrate is below 0.5 mg/L. Thus, these results show that the nitrate value for point 1A is unacceptable to surrounding marine life.

Below are the graphical representations of the water pollution study in Clan Jetty.

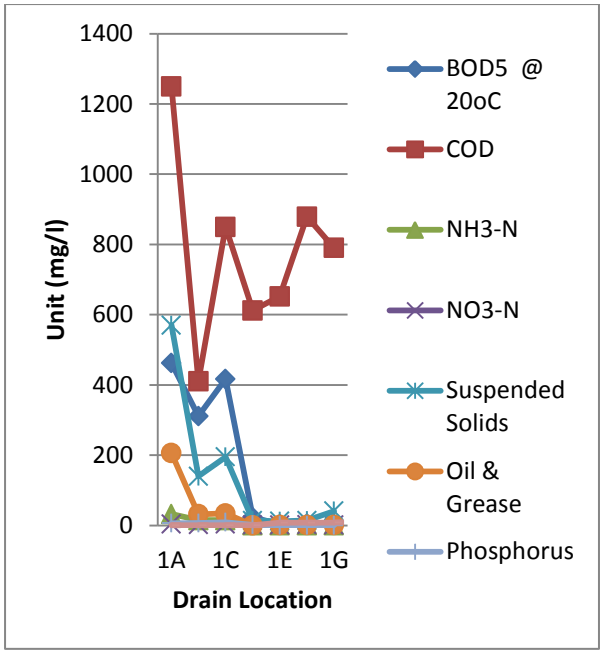

Chart 3 Data Analysis of Sampling Drain Line 1

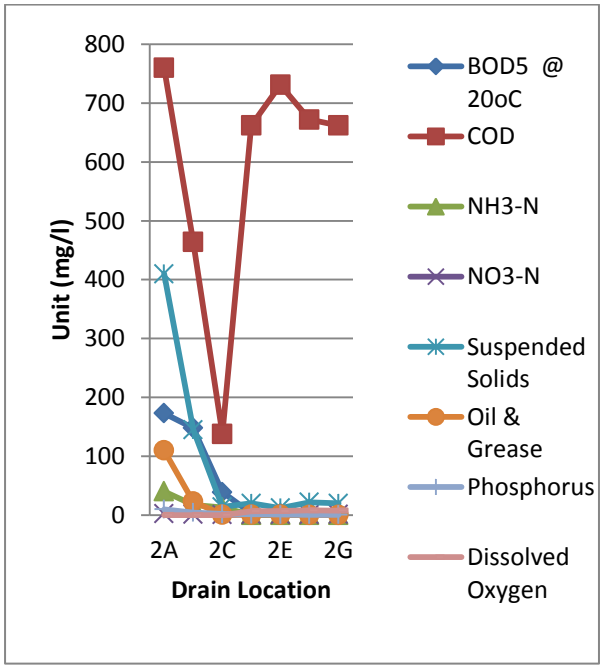

Chart 4 Data Analysis of Sampling Drain Line 2

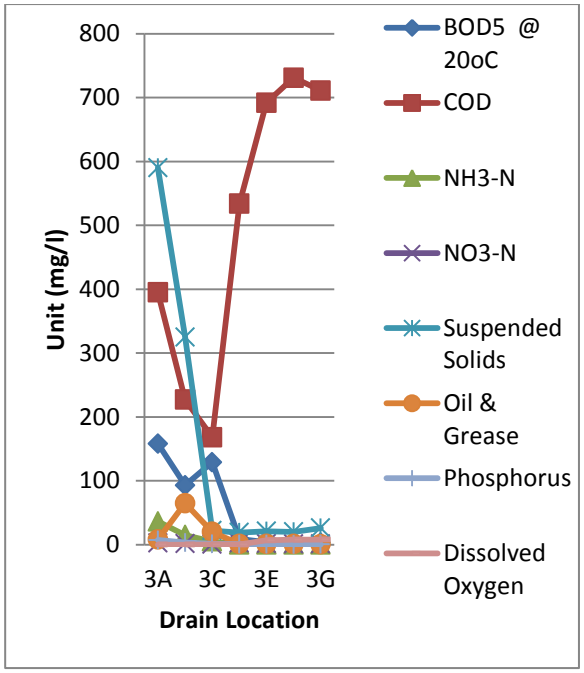

Chart 5 Data Analysis of Sampling Drain Line 3

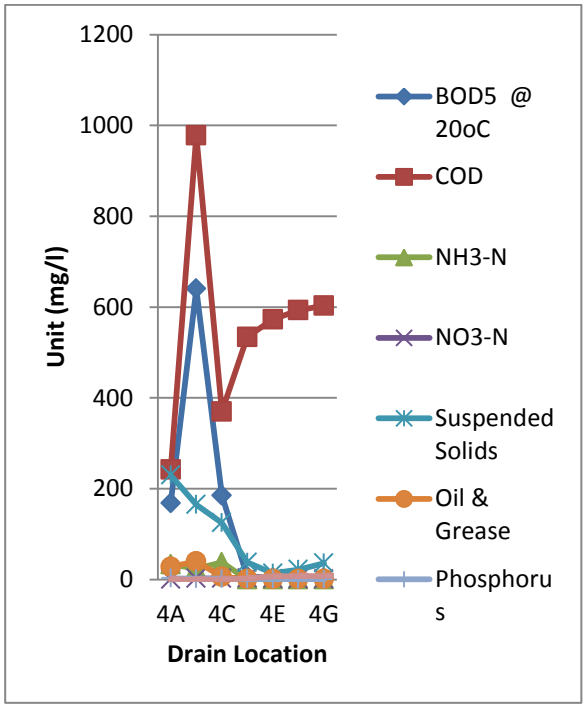

Chart 6 Data Analysis of Sampling Drain Line 4

6.0 Conclusion

The main pollutants that contributed to the problem are from the premises upstream which are still using septic tanks and also from the indiscriminate disposal of sewage in Clan Jetty itself.

In order to solve these water pollution problems at Clan Jetty, a proper sewerage system is required to be installed at the two enclaves where the premises still use septic tanks and also at the Clan Jetty settlement.

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