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River Corridor Development towards Water Quality Preservation in UTM River

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ABSTRACT

UTM River water quality is decrease due to increase of human activities in land used. This research study is conducted to investigate the status of water quality and develop river corridor in UTM River. 7 sampling station are determined along UTM River, which is upstream, middle-stream, and downstream; where the water are test for 6 physico-chemical parameter namely DO, pH, BOD, COD, SS, and NH3N. The water are analysis based on APHA 2005 that divided into two categories, in-situ analysis for DO and pH, and laboratory analysis for BOD, COD, SS and NH3N. Result indicates UTM River is majority in class 1 and class 2. However, uncontrolled and unmanageable of rapid development in land used activities will possibility and probability to cause river water pollution to increase into class 3 and class 4. Therefore, the corridor concept has possibility to control and prevent from further pollution. Several suggestions could also be taken into account, namely maintenance plan, widening and deepening the river, improving existing corridor, cleaning the river, etc. Therefore, if the river corridor development could be achieved, then the UTM River are possible to be improve from continuous polluted.

Keywords : River Corridor, Physico-Chemical Parameter, In-Situ Analysis, Laboratory Analysis

I. INTRODUCTION

to River water pollution can be detected from two sources, namely point source and non-point sources pollution (Hua and Kusin, 2015). Point source pollution can be defines as 'any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory' (Hill, 1997). In other words, contamination sources through domestic sewage, animal husbandry waste, and industrial waste, are easily detected with naked eye that disposed directly into rivers. Meanwhile, non-point source pollution is defined as 'diffuse or runoff pollution that inputs and impacts occur over a wide area and are not easily attributed to a single source' (Lazarus, 1978). Possible pollutants to contribute nonpoint source pollution are animal husbandry waste, agricultural waste, forestry, rural-suburban-urban development, and so on. Both of point and nonpoint source pollution brings negative impact such as disruption of food-chains, brings death to aquatic animals, spreading disease, causing destruction of ecosystem, and so on. Hence, the source of pollutants can be reduced by controlling the land used that carried out for human activity.

According to the Department of Environment (DOE) Malaysia report in 2012, about 338 river are consider clean in 2005 had reduce until 278 in 2012, while slightly polluted river in 2005 are 166 increase until 191 in 2012, and polluted river in 2005 are 90 are also increase until 125 in 2012 (DOE, 2012). The major pollutants detected were biochemical oxygen demand (BOD), ammoniacal nitrogen (NH_3N), and suspended solid (SS); which can be attributed to inadequate treatment of sewage or effluent from

agro-based and manufacturing industries, while SS are connected with the improper earthworks and land clearing activities (DOE, 2012; Hua, 2015). This condition are no exceptional to happen in developing country like Malaysia (Hua and Zuhdi, 2014), especially in UTM River. Based on the map, most probably the river is flow across engineering and chemistry faculty, several food courts, laboratories, and football field before entering the Skudai river. Therefore, this research study is conducted to determine the status of water quality and develop river corridor towards water quality preservation of UTM River.

II. METHODOLOGY

Water samples are collected along the UTM River with 7 sampling stations is determined based on upstream river, middle-stream river, and downstream river (Figure 1). The water samples are collected using 'grab sampling' and it will be analyzed based on physic-chemical parameter namely Dissolved Oxygen (DO), acidic/basic water (pH), biological oxygen demand (BOD), chemical oxygen demand (COD), suspended solid (SS), and ammoniacal nitrogen (NH_3N). Meanwhile, analysis of physic-chemical parameter is divided into two categories, namely in-situ and laboratory analysis. In-situ analysis will involve with DO and pH, while laboratory analysis involve with BOD, COD, SS and NH_3N. Raw water sample are analysis based on APHA 2005 methods, for example BOD based APHA 5210-B, COD based APHA 5220-C, SS based APHA 2540-D, and NH_3N based 5220-C. Before collecting data for water quality assessment, site observation is carried out to determine the access of sampling area to avoid difficulties in obtaining the results.

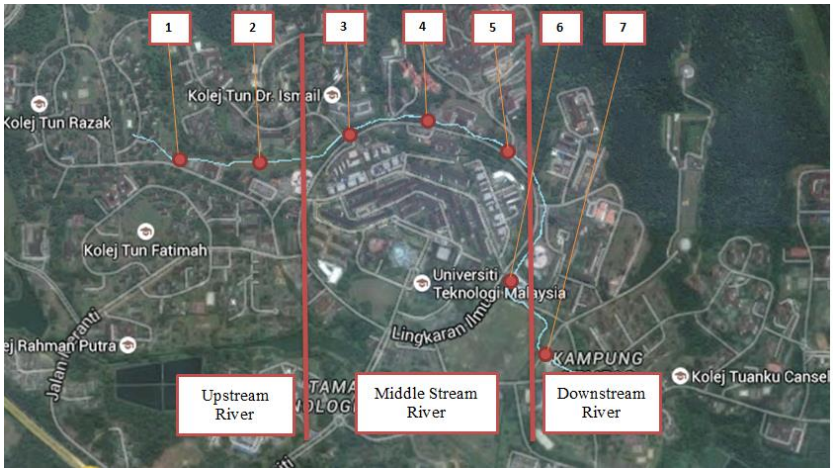

Figure 1. 7 sampling stations along UTM River.

Table 1. National Water Quality Standards for Malaysia.

Category (Unit)	Class					
	I	IIA	IIB	III	IV	V
pH (-)	> 7.0	6.0 – 7.0	6.0 – 7.0	5.0 – 6.0	< 5.0	> 5.0
SS (mg/L)	25	50	50	150	300	300
BOD (mg/L)	1	3	3	6	12	>12
COD (mg/L)	10	25	25	50	100	>100
DO (mg/L)	7	5 – 7	5 – 7	3 – 5	< 3	< 1
NH3N (mg/L)	0.1	0.3	0.3	0.9	2.7	> 2.7

(DO means Dissolved Oxygen; BOD means Biological Oxygen Demand; COD means Chemical Oxygen Demand; SS means Suspended Solid; pH means Acidic or Basic water; NH_3N means Ammoniacal Nitrogen)

Source: DOE (Malaysia) report, 2012

III. RESULTS AND DISCUSSIONS

Figure 2 indicate the analysis of UTM River water quality for DO, BOD, COD, pH, SS, and NH_3N in 7 sampling stations. According to table 1 of National Water Quality Standard for Malaysia, BOD and NH_3N parameter indicate class 2 and class 3. Continuously, DO parameter show majority water quality are in class 3, except station 5 that resulted in class 2. Next, SS parameter explained station 2 and station 5 are in class 1, while others are in class 2. Lastly, COD parameter determines station 1, station 3 and station 5 is class 2 while others are class 3; and pH parameter shows only station 5, station 6 and station 7 is class 1 while others are class 2.

According to the result shows that UTM River has possibility and probability to cause water pollution until class 3 and class 4 due to excessive and extreme land used development for human activities within the UTM River. Several land use activities are detected that carried out along UTM River, namely residential activity, agricultural activity (small scale), road and bridges construction activity, building construction activity, and sedimentation activity.

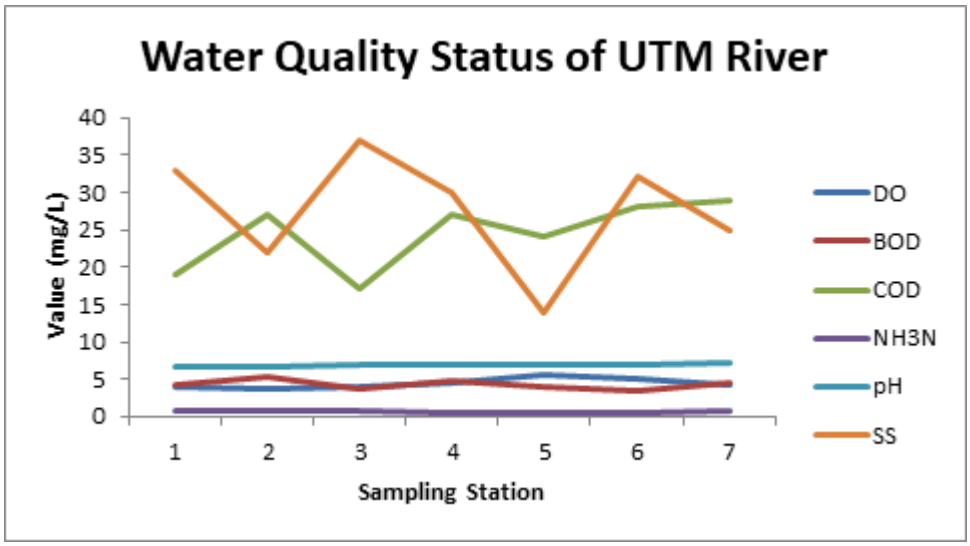

Figure 2. Water quality status of UTM River
(DO means Dissolved Oxygen; BOD means Biological Oxygen Demand; COD means Chemical Oxygen Demand;
SS means Suspended Solid; pH means Acidic or Basic water; NH_3N means Ammoniacal Nitrogen)

Conservation and Management

Evaluation of chemical and physical parameters in UTM is detected from land used activities that carry out along the corridor of UTM River, which become main impact to the river water quality. Decreasing quality green zone along the UTM campus especially several activities like construction building and business premises are need to adapt cleanliness attitude, which is needed to improve the downstream river and effort to protect and preserve existing buffer zone.

Maintain river water quality is complex and requires good knowledge of the state of the river. There are no guidelines for designers to plan this maintenance. Therefore, the best way is to identify what actions are necessary to maintain the structure and function of the river corridor. This issue can be made of an understanding of the types of threats that have

implications for the UTM and how the system reflexes against this threat. Symptoms of Sungai UTM problem has been identified and is also one of the objectives of the two in this study.

Preservation Technique in UTM River

In achieving the river corridor development objective, buffer zone is the most appropriate and suitable to be applying in UTM River. Advantages to used buffer zone concept is the existing space without having any interruption between ground and a river or stream (Figure 3 and 4), which concern on the element of ecological, environmental management, habitat diversity, and impact on fauna and aquatic ecosystems. The importance of the buffer zone is to control pollutants. Apart from buffer zone, it's also rename as trap zone, protection zone, or zone weeks to river management. The definition of a buffer zone is maintained riverfront area adjacent to the river or lake to protect water quality, fish habitat, and other natural resources (Azzamudin Arsad, 2009). Suggestion for buffer zone is by letting plants to grown by itself.

Buffer Zone Function

Buffer zones are very important requirements for breeding flora and fauna and other aquatic life. This zone can be used as a zone where natural processes are allowed to occur as the formation of the twists and turns of the river, erosion control and pollution as well as the stability of the banks. Plants such as grasses and bamboo grow naturally along rivers. Protection of the banks in the form of plants is an attractive alternative in terms of aesthetics, if the plants can be maintained. A creeping plant roots form properly bind and strengthen the banks. The grass layer is installed as bank protection will be able to withstand erosion. Revetment vegetation also will not prevent the dynamic interaction between the river and the water which is very important for the ecological network that generates aquatic life. Revetment in the form of plants will also contribute to the preservation water quality because it will encourage the life of micro-organisms which in turn will clean up the rivers from organic waste. In the long run, life will encourage micro-organism or trigger a suitable habitat for plants, animals, birds, fish and others. Apart from perfecting the aquatic habitat, vegetation along the banks also will produce the buffer zone can filter the silt, fertilizers and other pollution remains washed away into the river. Shallow riverbed silt, silt as a result of the problems arising from the absence of vegetation along river banks.

Formation of Buffer Zone

According to the Department of Irrigation and Drainage (JPS, 2008), riverside areas with reserves of mangrove forests (mangroves) additional shift of reserves required to be held for the purpose of controlling pollution. Generally, the recommended reserves is 100 meters for the development of tourism, 500 meters to 1000 meters of housing construction and for the construction industry. Replanting the river banks by natural vegetation would contribute towards the establishment of aquatic habitats and in the long term to the stability of the banks. Width of plants intended for planting along the banks is due to the width of 5-10m is most suitable for guaranteeing the stability of banks and the creation of habitats. Planting should also reflect the kinds of natural plants. The benefits from various types of vegetation can be focus to the grass and small plants. Small plants should also be planted in groups of at planting in rows to increase chances of breeding. As far as possible the width of the plants to be grown is possible that in the great river reaches up to 30 meters. Planning should also be made for the costs of preparation, care costs and other costs involved. Solid fences should be built to protect these plants.

Fixing River Reservation

With the increase in the value of land, especially in urban and suburban areas are developing rapidly, and the use of modern machinery capable of using

limited space, there is a demand for a smaller river reserves than recommended by the JPS Department. Fixing river reserves must take into account factors river channel whether it is a natural channel, a mat or a combination of both.

Table 2. Minimum width measured at the narrowest part of a section of the reserve

Category	Width for water pass between cliff	Width reservation requirements from the both side of the river banks
Natural Drains	> 40 meter	50 meter
	20 - 40 meter	40 meter
	10 - 20 meter	20 meter
	5 - 10 meter	10 meter
	< 5 meter	5 meter
Base Drains	-	minimum is 5.0 meter

The table 2 above is a minimum width measured at the narrowest part of a section of the reserve, where borders do not necessarily follow the river loop. For those who already have the river twists and turns stable, for example in the coastal basin preferably the entire width of the river meandering river reserves should be used. However, often it may not be possible to build in the area. River reserve requirements in the area of development, the municipality or in the area where the discharge of flood water does not exceed the existing banks, depending on the local situation and determined in accordance with the requirements of the design with a minimum area of 5.0 meters must be provided for maintenance work.

Table 3

Types	Reservation Zone (meter)
Agricultural	3m
Aquaculture	20m

The type of plant is important in obtaining optimal results. Some areas have a total area reserves UTM is not real. Although some have the green area it may not be effective because the green area has only grass area only. A buffer zone is perfect to have a combination of plants such as grass, shrubs and large trees, because each plant species can be affected differently. The species to be planted should be of local seeds to maximize environmental benefits. Plants also be planted as close as possible to the water's edge to add interest to the aquatic habitat. Planting should also reflect the kinds of natural plants. The benefits of various types of plants are focus to turf grass and small plants. If possible to speedy recovery methods for plant species that grow quickly are highly encouraged.

Figure 3. Corridor zone in UTM River

Figure 4. Corridor zone in general (within UTM River)

IV. CONCLUSION

Although UTM River water quality status is in class 3 and possible to change into class 4, the corridor concept has possibility to control and prevent from further pollution. Several suggestions could also be taken into account, namely maintenance plan, widening and deepening the river, improving existing corridor, cleaning the river, etc. Therefore, if the river corridor development could be achieve, then the UTM River are possible to be improve from continuous polluted.

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