POLLUTION EVALUATION IN STREAMS USING WATER QUALITY INDICES – A CASE SUDY FROM SAIGON BASIN

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ABSTRACT

Saigon river is one of the basin of Dong Nai river system, derived from Tay Ninh, flowing through Binh Phuoc, Binh Duong and flow into Dong Nai rivers. The Saigon river is an important role in the process of social economic development of the provinces in the basin. As the water supply for daily life, agriculture, aquaculture and industrial development activities. In the research work recently, scientists have identified the Saigon river water is contaminated, surface water quality does not meet the requirements of water plants. Water supply for the city are threatened.

There are many solutions to improve river water quality has been launched. However, the current measures have not achieved desired effect. Saigon river water quality is increasingly polluted. The management and use of data collected on environmental quality in the decision-making, policy formulation is still inadequate.

Partitioning of water quality are important issues not only in environmental management, but also the importance of planning to use water resources properly and safely, building orientation pollution control, protection aquatic environment. To help prevent a possible crisis of drinking water and gradually overcome, improve and protect water resources, the need to build tools to manage water resources in the Saigon River. Indicators of water quality and water quality partition is tool for assessing pollution levels in each river section for the purpose of planning the rational use of surface water sources and construction-oriented pollution control, environmental protection water, thereby building measures to control water pollution better, this is a very necessary and urgent task..

This paper presents updated results in the construction of the partition map for the quality of the Saigon River, which provide appropriate evaluation of the regional water quality objectives for different uses in each region for for water supply, tourism, fisheries and water management. The GIS and remote sensing methods used to solve the target is in place.

1 INTRODUCTION

Saigon river is one of the basin of Dong Nai river system, connected to the Dong Nai river system through Rach Chiec river. The Saigon River is in an important role for the economic region of the South East. The water resource are used for the production and living activities of the people in Ho Chi Minh city, Binh Duong and Tay Ninh were taken from Saigon river. In the research works recently, the scientists have shown that Saigon river is polluted, the water quality does not meet the requirements of the water plant. Water supply for Ho Chi Minh city are threatened.

There are many solutions to improve river water quality has been launched such as the legal documents together with rational remedies: environmental protection act, water resources

protection act, the standard system of wastewater treatment…, set up the Committee on environmental protection watershed, committee watershed management, application of economic instruments such as discharge charges, fund environmental protection, construction monitoring programs, environmental monitoring watersheds, etc... However, the current measures have not achieved desired effect. The management and use of data on environmental quality in the decision-making, policy formulation is still inadequate, and especially the lack of community participation, a key factor in the development of program of environmental protection in river basins.

Partitioning of water quality are important issues not only in environmental management, defined region is water type A_1, A_2, B_1 or B_2 following QCVN 08:2008/BTNMT for surface water quality; which region has reached surface water quality class I (unpolluted), which region has reached surface water quality class IV (polluted), but also the importance of planning to use water resources in a reasonable and safety, building orientation pollution control, protection of water environment.

To help prevent the risk of water crisis as well as step by step improve and protect water resources, the need to build tools to manage water resources in Saigon river. Water quality index and partitioning of surface water quality is a tool for assessing river pollution for planning purposes rational use of surface water and construction-oriented for pollution control and protection of water environment. Since then, construction of measures to control water pollution better, this is a very necessary and urgent.

2 OBJECTIVE AND METHODOLOGY

2.1 Objective

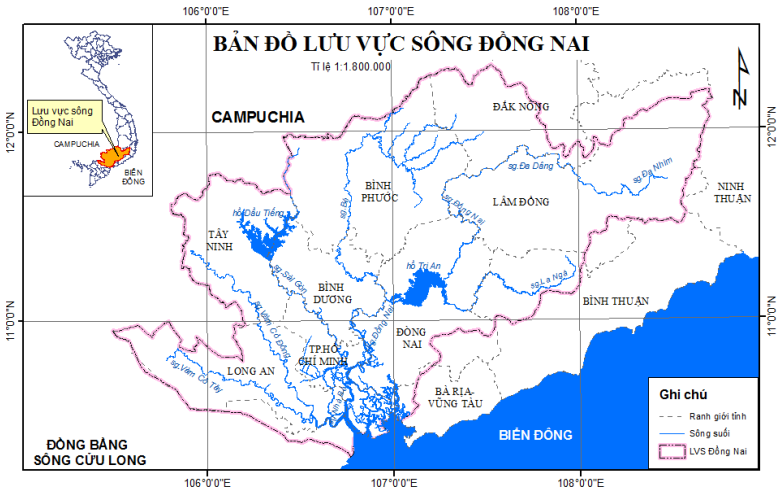

Figure 1. Sai Gon – Dong Nai river basin

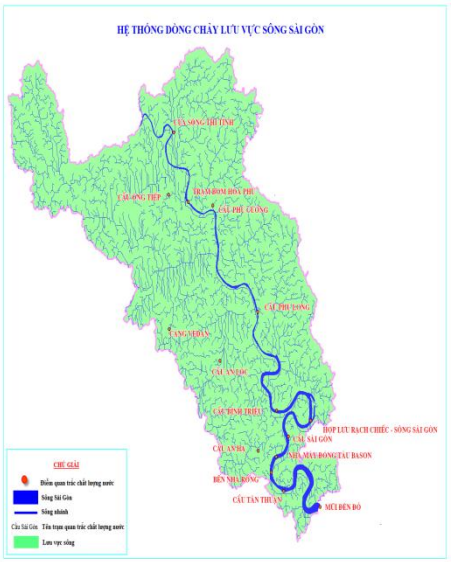

Figure 2. Sai Gon river basin

The Saigon river is heavily polluted by industrial activities, daily life activities, agriculture and forestry... Water upstream from Ben Suc bridge to Dau Tieng are strictly protected to provide water for downstream. From Ben Suc bridge to Den Do fork, the management is still inadequate so it lack of effective. Water quality has a sign of pollution for many years and this

situation tends to deterioration. Hence the need to build tools to manage water resources of Saigon river. Indicators and partition of water quality is a tool for assessing pollution levels in river sectors serving different purposes, thereby building measures to control water pollution better. The river basin management using information technology tools that demonstrates the superiority in the management: convenient, fast, easy and accurate.

The objective of this research is to develop partition map of water quality of Saigon river using WQI method. Based on that, assesses the appropriate level of the target areas for different uses: water supply services, tourism, fisheries and water management - apply to the Saigon river basin [2] – [4]

2.2 Methodology

To assess the quality of surface water, canal, pond, ocean, people often rely on the analysis of water parameters separately, and then compare them with each parameter value limits specified in the standards or national standards or international standards. How "traditional" it is and it is difficult to conclude the water quality of a river (or river sector) satisfactory for this purpose, but does not meet the requirements for any other purpose.That leads to the difficulty of partitioning and classifying river water quality, difficult to make decisions about the possibility of exploiting the river (or river sector) for a purpose or some other use.

To overcome these difficulties, there should be a system of indices for quantifying the quality of water, ie water quality by performing an agreed scale, capable of describing the combined effects of multiple composition in water resources and the importance of water quality parameters for one certain purpose use.

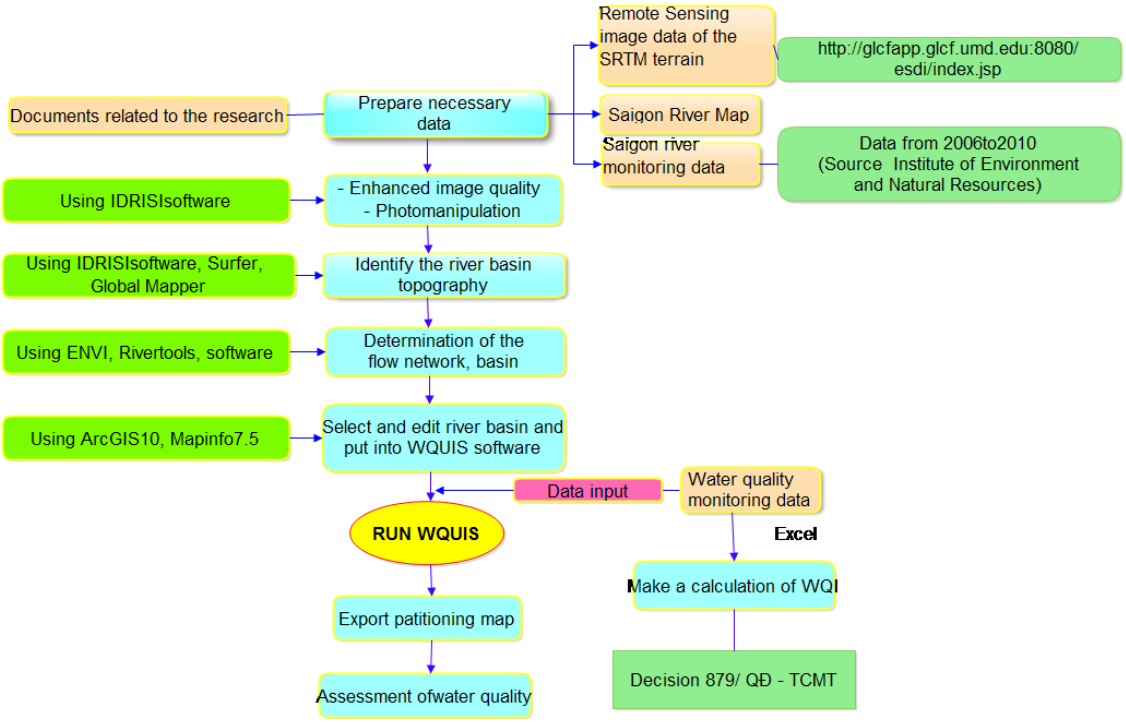

Figure 3. Content and methodology

2.2.1 Map and monitoring data processing

This process consists of two steps: data preparation and processing necessary maps. The selected data are: SRTM Remote Sensing, GIS maps Saigon river, monitoring data of Saigon river. Map processing steps include: application software IDRISI image manipulation and enhancement of images, using IDRISI software, Surfer determine topography basin, using ENVI software, rivertools determine flow and river basins, using ArcGIS 10 to select, edit river basin and put it in WQUIS software (Figure 3).

2.2.2 The method of construction and calculating WQI index

Ten parameters of surface water is used to calculate the water quality index (WQI), including DO, temperature, BOD5, COD, N-NH4, P-PO4 , TSS, độ đục, total Coliform, pH. WQI index was calculated for parameters BOD5, COD, N-NH4, P-PO4, TSS, turbidity, total coliforms by the formula as follows:

$$WQI_{SI} = \frac{q_i - q_{i+1}}{BP_{i+1} - BP_i}\left(BP_{i+1} - C_p\right) + q_{i+1} \quad (1)$$

Where: BPI: the lower limit of the concentration value monitoring parameters are correspond to i; BPI +1: concentration limits on the values of the parameters monitored are specified in the table 3:10 corresponds to i +1; qi: WQI values in the table i have to correspond to the value of BPI; qi +1: WQI value at i +1 given in the table corresponds to the value of BPI + 1; Cp: value of observed parameters taken into account.

After calculated WQI for each parameter mentioned above, the WQI was calculated by the following formula applies:

$$WQI = \frac{WQI_{pH}}{100}\left[\frac{1}{5}\sum_{a=1}^{5} WQI_a \times \frac{1}{2}\sum_{b=1}^{2} WQI_b \times WQI_c\right]^{1/3} \quad (2)$$

Where: WQI_a: WQI value calculated for 05 parameters: DO, BOD_5, COD, $N\text{-}NH_4$, $P\text{-}PO_4$; WQI_b: WQI value calculated for 02 parameters: TSS, turbidity; WQI_c: WQI value calculated for total coliform parameters; WQI_{pH}: WQI value calculated for pH parameters. [1]

2.2.3 WQUIS software

This tool was developed by the authors for mapping indicators of environmental quality. Based on the index is calculated from the observation point, the software will compile maps of environmental quality index, the more of monitoring sites, the more accuracy of the map will be higher. The main tasks: enter monitoring data by location and by time, digitized the river sections to be calculated, automatic mapping partitioning pollution, reporting and statistics.

3 RESULTS AND DISCUSSION

Saigon river water quality was contaminated from the medium level (yellow) to severe level (red), tend to improve in recent years by increasing the number of monitoring stations and close monitoring of authorities. According to monitoring data, the Saigon river water quality pollution mainly organic matter and microorganisms. WQUIS result of Saigon river water quality as follows: in 2006, Estuary the water from Thi Tinh estuary to Phu Cuong bridge only to

use for transportation purposes, the water quality from Binh Trieu Bridge to Saigon bridge are contaminated ; in 2007, water quality are seriously polluted need for timely handling measures; in 2008, the water quality are seriously polluted, the more downstream tends to reduce pollution; in 2009, the quality water is heavily contaminated, the more downstream tends to reduce pollution and still require treatment measures; in 2010, the water quality is quite good and can be used for irrigation purposes, but the sector from the Bason shipyard to Nha Rong Wharf signs seriously polluted.

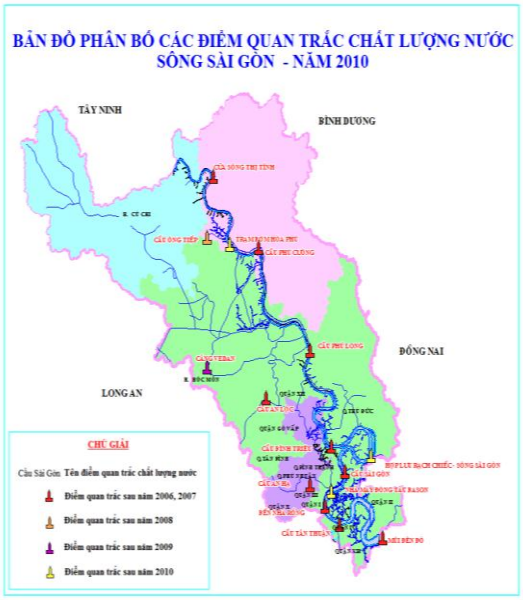

Figure 4. The monitoring position on Saigon river

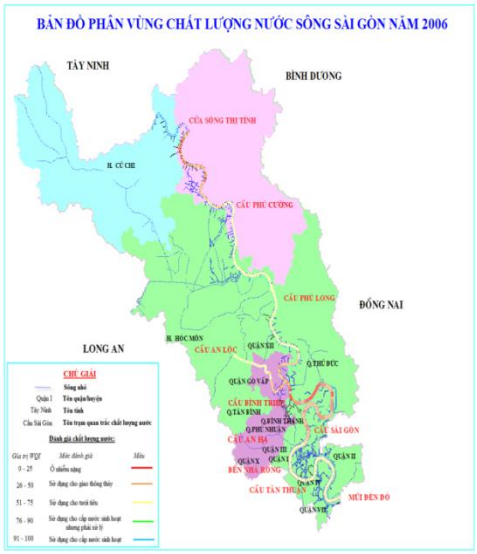

Figure 5. Partition Map of water quality in 2006 - Saigon river

Figure 6. Partition Map of water quality in 2007 - Saigon river

Figure 7. Partition Map of water quality in 2008 - Saigon river

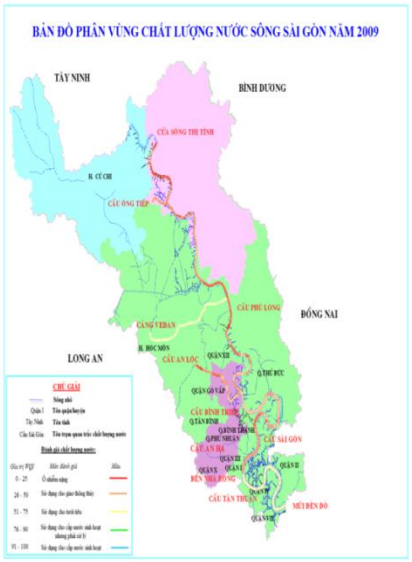

Figure 8. Partition Map of water quality in 2009 - Saigon river

Figure 9. Partition Map of water quality in 2010 - Saigon river

4 CONCLUSION

Currently, Saigon river basin is under pressure of population growth, urbanization and economic development. So the river water is easily contaminated. Polluted in Saigon river will cause major damage such as impact on human health, affecting water supplies: water input should not meet the standard have to invest in high cost for water treatment; affecting the environment: changing habitat of the organism, social and economic. The number of industrial parks in the Southeast compared with nearly half of the country. It will generate many environmental problems such as pollution caused by urban development, transportation, industrial activities, population growth ... To ensure the sustainable development objectives, and facilitate the managers in the review of projects, planning social-economic development of areas that lack of affect on the environmental, having full information on the status of environmental quality is essential.

The main result of this paper is to introduce a water quality assessment of the Saigon river basin over the years. On that basis, should apply the proposed information technology and tools WQUIS for partitioning water quality.

5 REFERENCES

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