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Urban Lakes in Megacity Jakarta: Risk and Management Plan for Future Sustainability

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Abstract

The impact of urban development in the distinct surrounding inhabited areas on urban lakes in megacity Jakarta has been so pervasive that makes the lakes very vulnerable to environmental disturbances. High levels of disturbances to the urban lakes from urban development in the past and recent years, such as lake filling, land use change, shoreline encroachment, and garbage dump, have caused nearly 10 - 20% of urban lakes loss in megacity Jakarta. The consistency of lakes loss has been estimated from the old-Dutch map to the recent year maps indicating that the lakes continuously have been sacrificed for urban area development. In addition to the lake front destruction, siltation and the excessive macrophyte coverage have caused more than 25% of existing lakes shrinkage in area and volume and based on the lake morphology assessment, nearly 50% of lakes have been damaged. The lakes inurban village, rural village, agricultural and urban village – industrial areas are at high risk of lakefront landscape destruction, siltation/sedimentation, eutrophication and water pollution, including pathogenic bacteria and toxic pollutants contamination that can pose threat on human's health as results of untreated sewage inflow and storm water runoff to the lakes. The complexity of the problems faced by urban lakes in Jakarta requires a comprehensive management plan that is not only effective in maintaining the stability of lake ecosystem but also effective in improving urban life, such as socio-culture-economic conditions of people around the lakes. Fundamental requirement is that the urban lake should be managed according to its surrounding characteristics and conditions, and functional context.

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1. Introduction

The lakes in urban megacity Jakarta, called as "setu or situ" by the local people, are part of the watershed area of two main rivers, i.e. Ciliwung and Cisadane Rivers that flow across the interconnected regions within the megacity. Urban lake management has been the key point of the watershed management plan of those two rivers to minimize the impact of flash flooding coming from the upstream region and to overcome the water crisis in downstream of megacity Jakarta [1].Besides maintaining the surface and ground water balance, the urban lakes are also important in maintaining the urban ecosystem [2]. In addition to its major function as flood control and water supply, the lakes can also be managed as recreational, educational, fishing and even for economic purposes. Hence, the existence of urban lakes can contribute to increase the quality of life in urban centers by increasing the amenity of urban environment.

According to Schuler and Simpson, for the purposes of watershed management, the urban lakes are distinct than common natural lakes. The lakes tend to be small and shallow with a large watershed area that contains more impervious cover, such as pavement, roads and buildings and often lack of substantial vegetation cover which exert strong influence to the lake [3]. Although some lakes share this common type of urban watershed, the urban lakes in megacity have other distinct types of watershed. The urban lakes in megacity Jakarta can have mixed urban and other types of watershed, such as rural, industrial and even agricultural area. The impact of urban development in these distinct surrounding inhabited areas on urban lakes in megacity Jakarta have been so pervasive that makes the lakes very vulnerable to environmental disturbances. Land expansion is needed for housing as a result of urban development which has caused extensive lake shoreline development even reaching to the water bodies that causes serious damage to urban lakes and even disappearance of lakes due to land use change. Lakes are often used as a dumping place for garbage and collecting untreated sewer and storm water runoff. Moreover, lack of concern of the public and lack of management of the government have aggravated the damage of environmental conditions of urban lakes. Limited previous studies have reported on several urban lakes conditions in megacity Jakarta, including area shrinkage, siltation/sedimentation, eutrophication and water pollution [4,5,6]. Some lakes are reported to have been contaminated with toxic cyanobacteria and metals contamination [6,7,8]. Lake shrinkage and eutrophication or pollution problems are common in urban lakes problems found in other countries as well; however, no extensive lakes loss case reported happened, unlike the one in megacity Jakarta [2, 3, 9, 10].

Downstream area of megacity Jakarta has been facing chronic problems of severe flash floods annually from the upstream region during the wet season. In addition, the exploitation of groundwater usage and polluted surface water has caused shortage of clean water during the dry season. The lakes in urban megacity Jakarta have lost their capacity to support their function as flood control, water supply, and for other direct human uses. The negative impacts of urban water related issues can be minimized by optimizing the function of urban lakes as an impounding for local storm water runoff to control flood, to recharge and to maintain groundwater table, and to reserve in dry seasons. It is quite unfortunate that despite its pivotal role in maintaining urban water and urban ecosystem, lakes in the urban areas have received little attention.

This paper was aimed to examine the loss, shrinkage in area and environmental conditions of urban lakes according to the type of surrounding inhabited area in megacity Jakarta. It determined the risk as results of the impacts of distinct urban development to the lakes and develops management plan based on the ecosystem approach for their future sustainability according to the types of lake surrounding inhabited area in urban ecosystem and functional context. The ecosystem approach in urban lake management is a strategy for the integrated management of lake's catchment area, water body and biodiversity of flora fauna in and around the lakes and human that promotes conservation and sustainable use in an equitable way. The management involves all user groups in comprehensive management. Management on functional context is a management based on the function of the lakes according to lake's condition and socio-economic benefit to the people around the lakes.