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A FUNDAMENTAL STUDY IN THE CHARACTERISTICS OF WATER QUALITY FOR IMPROVEMENT IN THE URBAN CLOSED WATER BODY

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Abstract

The historic site, Edo Castle outer moat is a precious place that has one of the few water and greenery in Tokyo urban areas. However, the outer moat water quality is exceed the environmental standards of water quality by the Ministry of the Environment. Moreover, offensive odors emitting from decomposition processes of blue-green algae. Because of the existing special sewage system in the area, the water quality become deterioration. When the rainfall amount more than the capacity of treatment, a lot of untreated wastewater is released into the outer moat. It is important issue that the place with such a problem in the urban area. In order to grasp the actual state of the water environment in the outer moat, continuous field observation of the main water quality items is carried out and each of the observation results is reviewed. By the observation of Chlorophyll-a (Chl-a), T-N, T-P and COD, we revealed the seasonal variation of each water quality item near 1 year. The concentration of T-N and T-P are showed from 0.2 to 9.7mg L^{-1} and 0.27 to 2.68mg L^{-1} respectively. In addition, a modified ecosystem model applied in the study to simulate the water quality of the outer moat. The results are confirmed to present the reproducibility of the model and the effect of pollution load from the sewer network of vicinity of the catchment area.

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1. Introduction

Inflow-outflow is inactive in closed water body such as lakes and pounds. And, due to the characteristics, Nutrients such as nitrogen and phosphorus are easily accumulated, that causes eutrophication problems.

The study area, Edo Castle Outer Moat (hereinafter referred to as Outer Moat), is an artificial channel that was excavated to prevent enemy from invasion about 400 years ago, and then it was used as a navigation channel and an entertainment place. Currently, the Outer Moat becomes less and is defined as a historical site in 1956 [1]. Thus, the Outer Moat is important spatially and historically. However, the water quality of the Outer Moat becomes increasingly worse that exceed the Environmental Quality Standards by Ministry of the Environment because of the existence of special sewage system within the area, and pollutants are accumulated at the bottom without outflow in that the Outer Moat is enclosed. While emitting offensive odors due to decomposition processes, blue-green algae outbreaks affected by the resident time and eluted nutrients cause problems. In order to improve water quality of the Outer Moat effectively, it is necessary to understand the water pollution mechanism, but that is difficult because the water pollution mechanism which includes hydrological, hydraulic issues and ecosystem. Based on above reasons, this study is focused on the effect of elution from sediment and inflow of sewage on water quality of the Outer Moat through continuous on-site observations and experiments. In addition, the dissolved oxygen (DO) concentration is investigated because it is an important chemical and biological factor in water. However, field observation is inadequate to know all the material cycle, therefore, ecosystem model is also required. Firstly, the repeatability of this ecosystem model is tested.

2. Description of study area and Observation method

2.1. Description of study area

Fig. 1 shows the catchment area of sewage and observation point in the Outer Moat. The Outer Moat is divided into three parts and flows into the downstream river (Kandagawa River). The length and elevation differences between A site and C site are about 1.3km and 12m, respectively. According to field observations and literatures, there are 18 outlets into the Outer Moat, among which 10 outlets are from combined sewer system [2]. This study focuses on site A because it owns the largest catchment area of sewage.
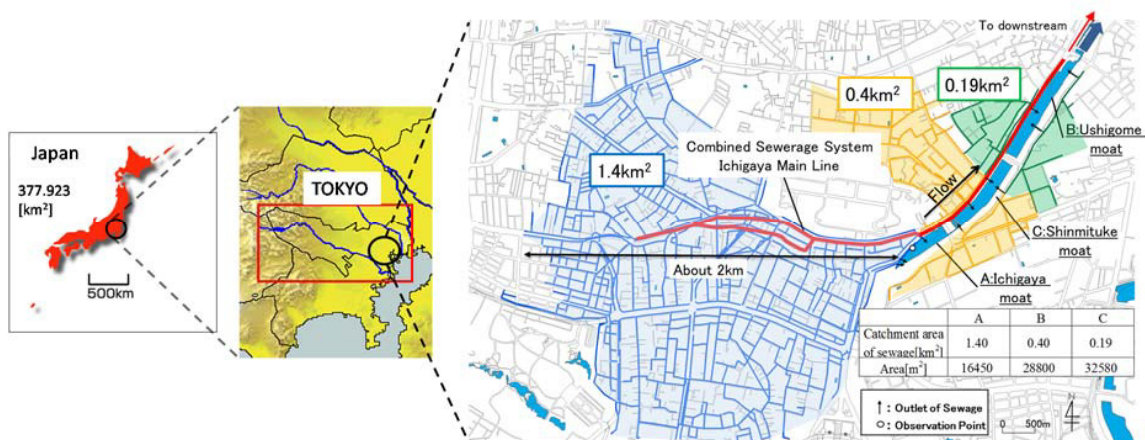

Fig. 1. Topography of Edo Castle Outer Moat which consists of Ichigaya moat (A), Shinmituke moat (B), Ushigome moat (C). And each the catchment area of sewage. Stations represent the monitoring and observation points.