Pollutant Load for Flood and Non-Flood Periods in Urban Small Tidal River

Hidehiko HAYASHI[1 *], Nobuaki KOHSAKA[1)], Yoshio ISHIZUKA[1)] and Masaru MORITA[2)]

1) SHIMIZU CORPORATION *e-mail: hide.h@shimz.co.jp 2) Civil Engineering Department, SHIBAURA INSTITUTE OF TECHNOLOGY

Introduction

Many urban small tidal rivers in Japan lack natural water sources. Besides, at the time of storm, untreated water flows into these rivers through a combined sewer system, causing pollutant load e.g. Fig. 1. This latest study aims at evaluating the characteristics of pollutant load during storm, focusing on the discharge and pollutant load.

Fig. 1 Combined sewer overflow at the Edogawabashi Brg. of Kanda River on 8th Sep. 2010

Observation site

The Shin-Ryukei Bridge located some 4.4 km upstream of the river mouth of the Kanda River.

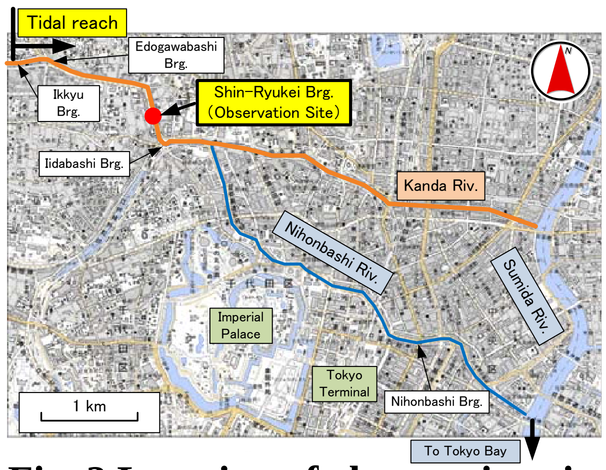

Fig. 2 Location of observation site

Conditions

The total rainfall : 102.2 mm
(The maximum rain intensity : 67.0 mm/hour)

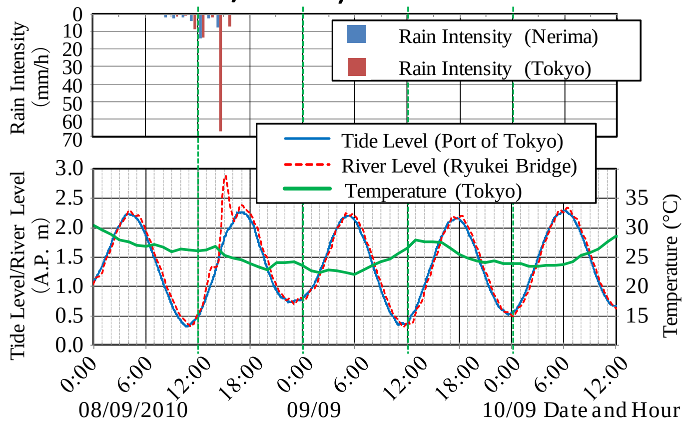

Fig. 3 Change of Rainfall, Tide Level and River Level

Results

Following the velocity increase, the salinity of the bottom layer was flushed out while the BOD, COD and SS values sharply increased.

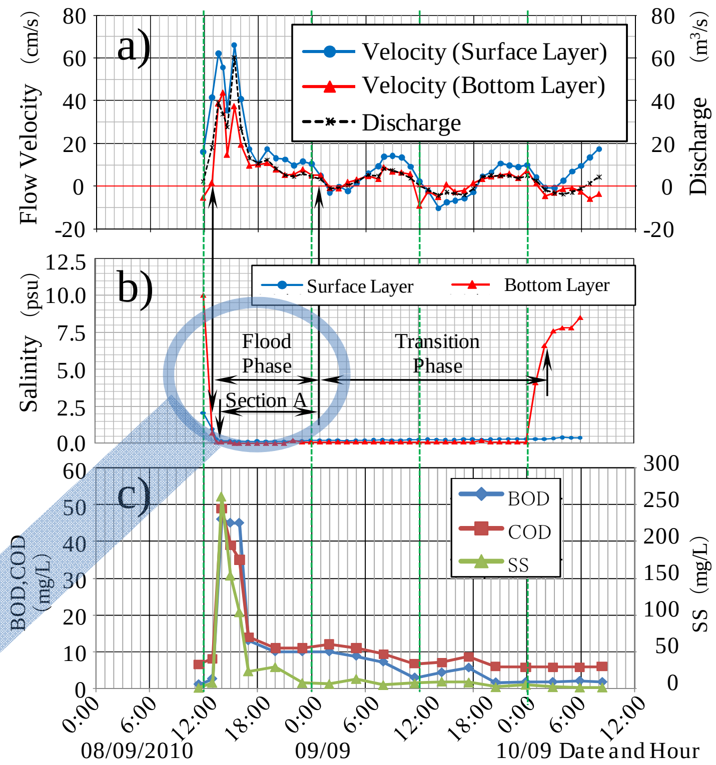

Fig. 4 Change of Velocity, Discharge, Salinity, BOD, COD and SS

Relationship between Discharge and Pollutant Load (Application of the L-Q equation)

$L = aQ^b$ where L is Pollutant Load, Q is Discharge, a and b are the coefficients. When all of the data are plotted as shown in Fig. 5-a), the coefficient of determination (R^2) is high at 0.81 with noticeable scattering in the low discharge range. In contrast, the correlation improves with the R^2 value of 0.95 when only the flood phase data are plotted as shown in Fig. 5-b).

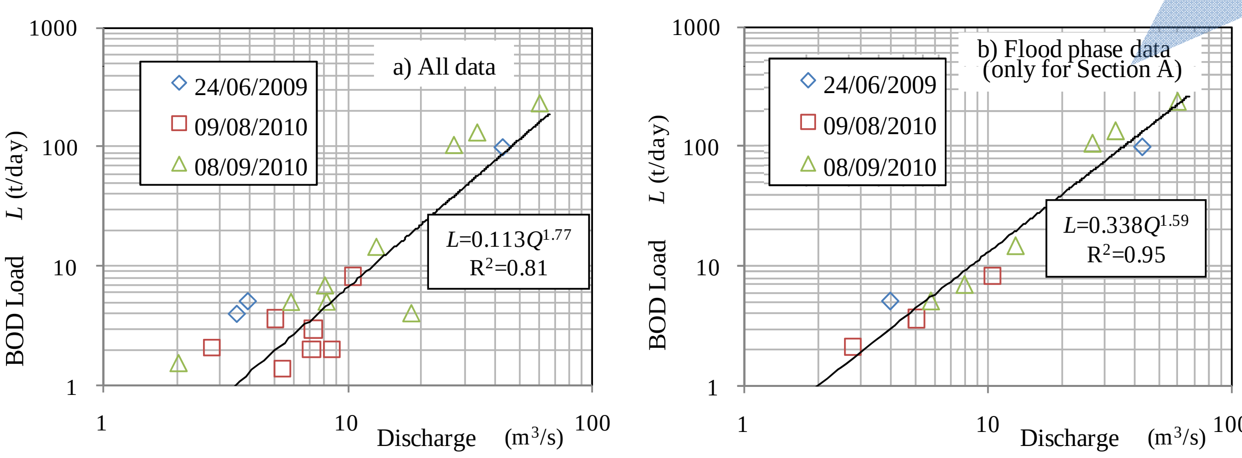

Fig. 5 Relationship between Discharge and BOD Load

Table 1 Coefficient of Determination (R^2) for the BOD, COD and SS

Water Quality Parameter	All Data			Section A Data Only		
	a	b	R^2	a	b	R^2
BOD	0.113	1.77	0.81	0.338	1.59	0.95
COD	0.415	1.36	0.94	0.345	1.54	0.96
SS	0.142	2.00	0.82	0.170	2.10	0.94

Comparison with other rivers

The value of coefficient a for the Kanda River is much larger than that for the Edo, Tama and the other rivers, indicating the likelihood of a relatively large load being experienced due to small-scale flooding.

Table 2 Coefficients (a and b) of *L-Q* Equation by River (COD)

River	Coefficient a	Coefficient b
Kanda River	0.345	1.54
Edo River[1)]	0.0663	1.35
Ara River[1)]	0.158	1.24
Tama River[1)]	0.0698	1.35
Naka River[1)]	0.314	1.12

1) Sakai A., Nihei Y., Ehara K., Usuda M., Shigeta K., Ootsuka S. (2008). Nutrient and COD loads in the Edo, Ara, Tama and Naka Rivers under flood flow conditions. In: 52th Conference on Hydraulic Engineering, JSCE, pp.1117-1122.

Conclusions

The study found a high level of L-Q correlation in the period from flushing out of the bottom water to the time when the discharge becomes zero in the flood phase.

Based on this newly confirmed L-Q correlation, the characteristics of urban small rivers where a high level of pollutant loading occurs with small-scale flooding are clearly established.

SHIBAURA INSTITUTE OF TECHNOLOGY

Today's Work, Tomorrow's Heritage SHIMIZU CORPORATION