Estimation of Combined Sewer Overflow Volume from Outfall Chambers in Tokyo 23 wards

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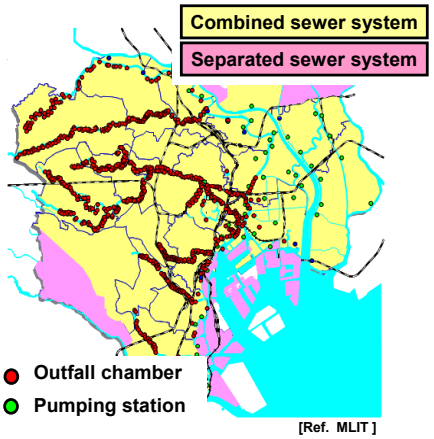
1 Background

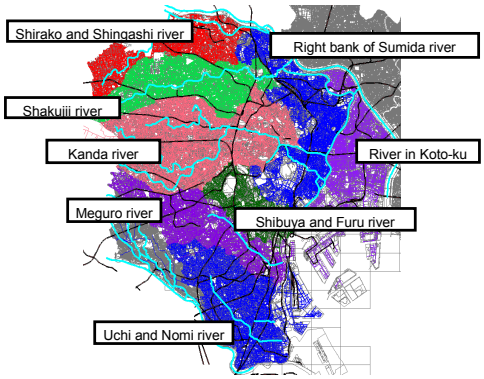
- In receiving waters, there is concern about impact on aquatic ecosystem and hygiene issue with water activities by combined sewer overflow (CSO).
- In Tokyo, there are about 800 discharge opening points and CSO is generated about 30 times a year.
- It is required the effective improvements about reduction in frequency of CSO, but overflows situation from outfall chambers is not fully-comprehended.
- In order to reduce the amount of CSO effectively, it is expected to carry out the countermeasures considering the CSO from outfall chambers as well as pumping stations.
- To estimate the occurrence of CSO from outfall chambers and pumping stations, runoff analysis with model simulation was applied for Tokyo 23 wards.
- To quantitatively calculate the volume of CSO from outfall chambers and pumping stations.



[Ref. MLIT]

2 Materials and methods

Study Area



Drainage area	Area (ha)	The number of outfall chamber	The number of pumping station
Kanda river	9,438	334	1
Shakujii river	4,812	154	0
Right bank of Sumida river	5,744	94	20
Shibuya and Furu river	2,678	81	1
Meguro river	4,824	66	2
Shirako and Shingashi river	3,481	62	5
Uchi and Nomi river	9,900	27	6
Rivers in Koto-ku	5,261	10	9
Total	46,138	828	44

[SEMIS data in 2009]

Rainfall data

- Rainfall distribution condition was considered using rainfall data by 56 precipitation stations.
  - 10-11 November, 2007
    Total precipitation: 17-55 mm
    Intensity: 1-9 mm/5 min
- Uniform rainfall data at Chuo precipitation station.
  - 30-31 May, 2007
    Total precipitation: 22 mm, Intensity: 2 mm/5 min
  - 4-7 September, 2007
    Total precipitation: 140 mm, Intensity: 5 mm/5 min
  - 10-11 November, 2007
    Total precipitation: 30 mm, Intensity: 3 mm/5 min

Surface data

Pervious	Impervious
Railway, Pervious blank space, Green zoon, Agricultural land ⇒ Horton model	Roof, Road, water surface, Impervious blank space ⇒ PR model

Runoff analysis

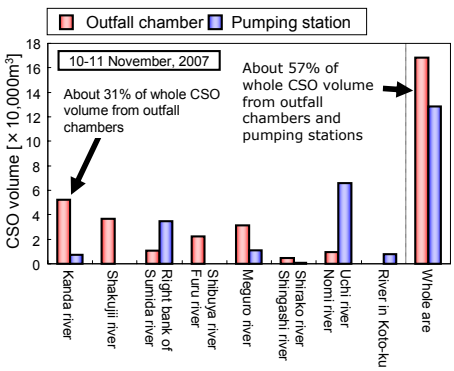
- Distributed model, InfoWorks CS (Version 10.0)
  - Infiltration capacity

	Initial infiltration rate [mm/hr]	Final infiltration rate [mm/hr]	Decay constant [1/hr]
Railway, Pervious blank space	10	1	1.8
Green zoon, Agricultural land	50	2.5	1.8

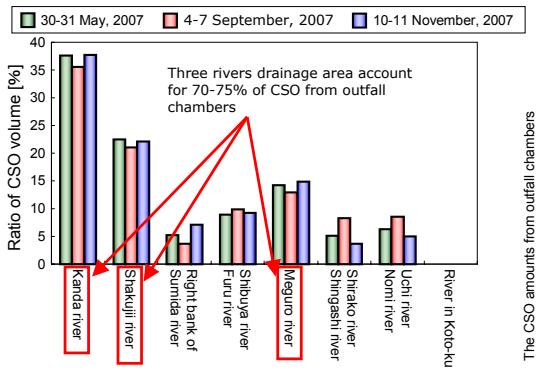
  - Initial loss
    Road, Impervious blank space ⇒ 2 mm
    Railway, Pervious blank space, Green zoon, Agricultural land ⇒ 6 mm

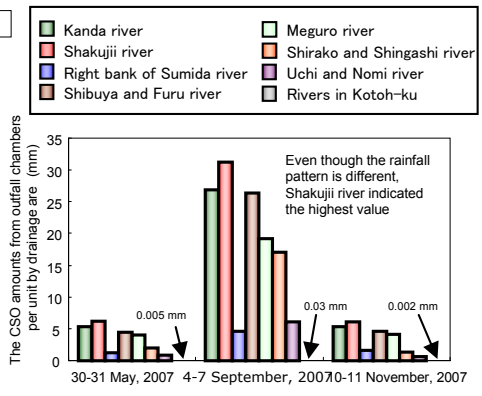
3 Results and discussions

Distributed rainfall condition



Uniform rainfall condition





4 Conclusion

- The results of simulation about the CSO from outfall chambers in rainfall event on 10-11 November, 2007, estimated that about 1.68 million m^3 CSO was discharged from 480 outfall chambers. Since this value constitutes about 57% of whole CSO (2.97 million m^3) including discharge from pumping station, it suggested that it is impossible to ignore the amout of CSO from outfall chambers.
- The results of runoff analyses using spatially-uniform rainfall data (Chuo precipitation station) showed that three rivers drainage area, Kanda, shakujii and Meguro river, accounted for 70-75% of CSO from outfall chambers under 3 different rainfall pattern.
- The results of comparing the CSO amount from outfall chambers per unit by drainage area suggested that it is effective to carry out muasure for outfall chambers in Shakujii river drainage area.