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# Estimation of CSO reduction effect utilizing of storage pipe for flood prevention

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## Back ground

- **Many storage facilities have been constructed** in the underground as a countermeasure against the flood disasters.
- However, the storage facilities are used **only several times a year**.
- Several storage facilities have started **to be used as a countermeasure against CSO**
- The most important thing is that, even if the storage facilities are used as a countermeasure against CSO, **flood prevention must be given priority** over CSO prevention.

## Objectives

- **How to decide the prevention measures** for flood disaster or CSO in their storage facilities.
- **To estimate the amount of reduction load** with using the storage facilities.

## Methods

- To achieve the purpose, we examine the usage of the storage pipe for flood prevention and CSO prevention through a case study.
- **In the case 0**, the storage pipe is **only used for flood prevention throughout the year**.
- **In the case 1**, the storage pipe is switched by movable weir for flood prevention and CSO prevention **from November to May**.
- **In case 2**, the storage pipe is used to switch **for flood prevention and CSO prevention throughout the year.**
- The annual simulation using the InfoWorks CS is conducted to estimate the CSO reduction effect by average rainfall such as **1,315mm in total rainfall volume and 87 times** in rainfall events, except for less than 1mm in total rainfall.

## Results and discussion

**Condition of switching the prevention for flooding and CSO**

- We examined the relationship **rainfall intensity and reduction in BOD** using the storage pipe for CSO prevention(Fig.3).
- As a result, the reduction in BOD is increased **less than 7 mm/hr** in rainfall intensity, after that the reductions remain on the same level.
- This result indicates that the capacity of storage pipe can only retain less than 7 mm/hr in rainfall intensity(Fig.4).
- We decided that the height of movable weir is switched from CSO prevention to flood prevention **if the rainfall intensity is forecasted over the 7mm/hr.**

**Estimation of the reduction load**

- The utilizing of storage pipe as CSO prevention makes a tiny contribution **to decrease frequency of discharge into stream**.
- The amount of primary treatment flow and discharge flow decrease. The total pollution in Case 0, Case 1 and Case 2 are 424, 398 and 385 ton/year during the wet weather period, respectively(Table 1).

## Conclusions

- In case of using the storage pipe for CSO prevention from November to May (in Case 1), the pollutant discharge rate is **reduced more than 6 %** compared to the case of using the storage for flooding prevention (in Case 0).
- In case of using the storage through the year (in Case2), the pollutant discharge rate is decreased 9 % compared to the Case 0.
- **This study has shown that the storage pipe for flooding prevention is able to use for CSO prevention.**

Table 1 BOD discharge volume during WWP (unit: ton / year)

| | Frequency | Secondary Treatment | Primary Treatment | Non-treated discharge | Stored and treatment | Total |
|---|---|---|---|---|---|---|
| Case 0 | 63 | 85 | 229 | 109 | 1 | 424 |
| Case 1 | 60 | 85 | 215 | 94 | 4 | 398 |
| Case 2 | 59 | 85 | 208 | 86 | 6 | 385 |

From June to October :40/87, More than 7mm/hr: 18/87

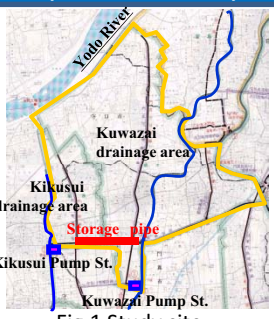


Fig.1 Study site

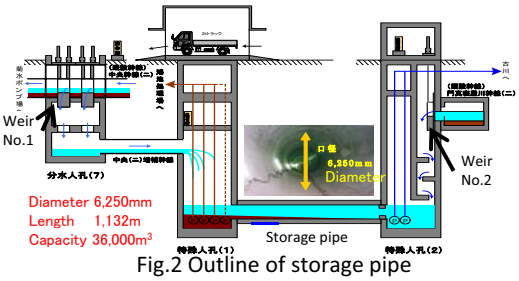


Fig.2 Outline of storage pipe

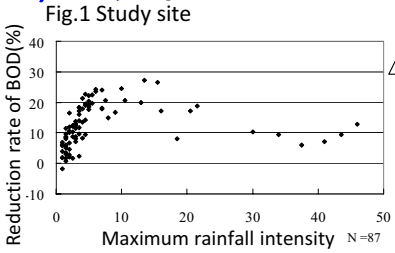


Fig.3 Relationship rainfall intensity and reduction rate in BOD

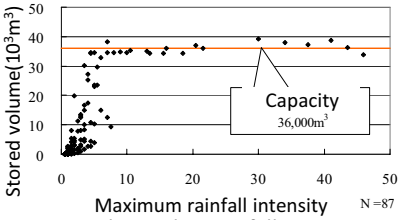


Fig.4 Relationship rainfall intensity and stored volume

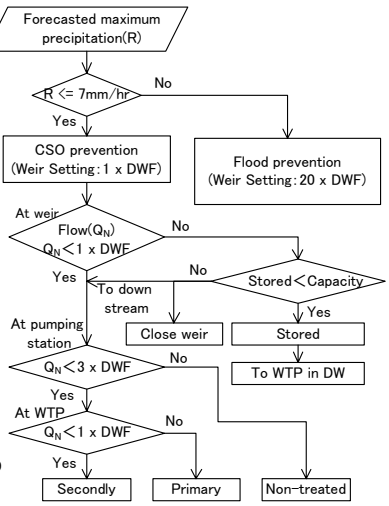


Fig.5 Method of switching for flood or CSO prevention

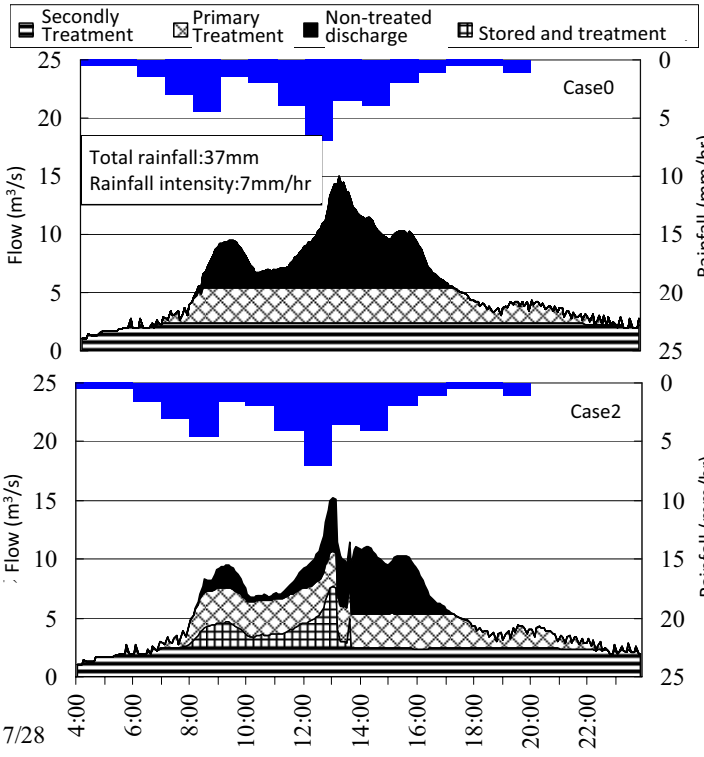


Fig.6 Discharge flow in Case0 and Case2, as an example