9 UDM BELGRADE
3-7 SEPTEMBER 2012

Improving Operation of Sewerage Facilities on Basis of Real-time Stormwater Information

Japan Institute of Wastewater Engineering Technology
Masataka Ikeda

METAWATER Co., Ltd.
Shinichiro Oki
Kazunori Matsumoto

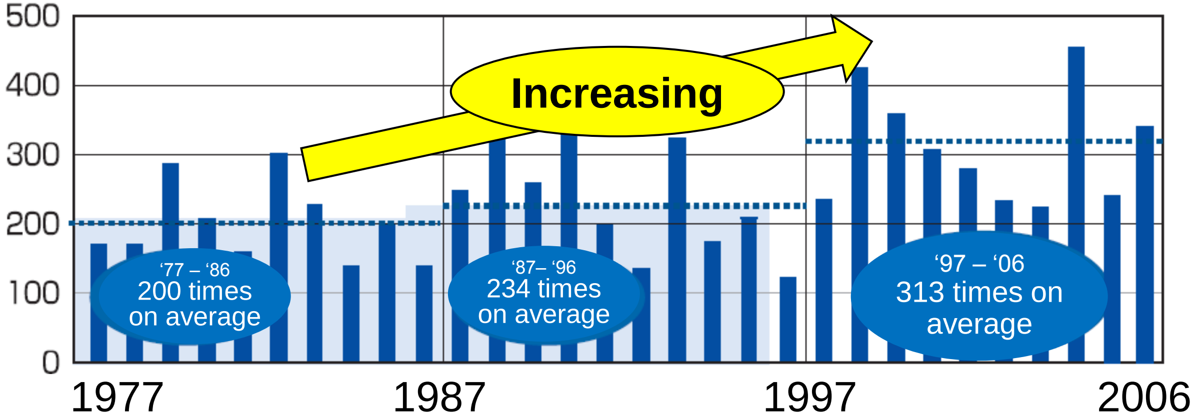
Contents

1.Rainfall Trends and Flood Damage in Japan

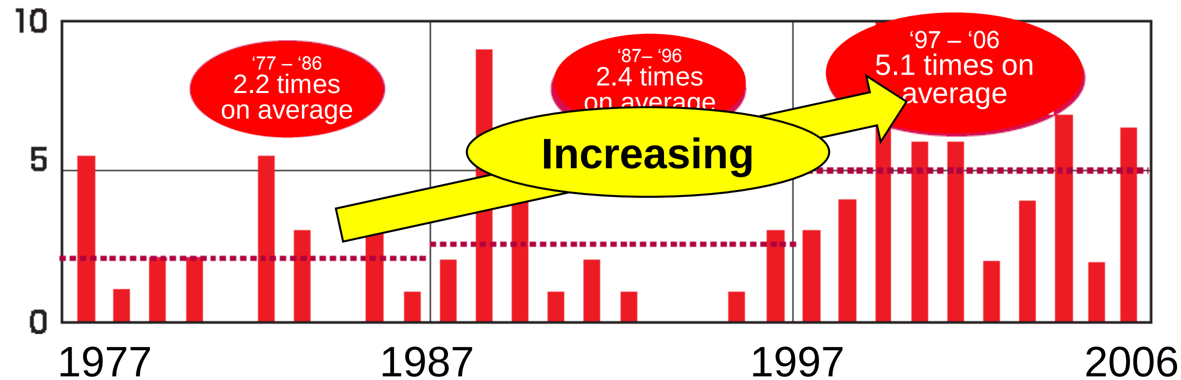
METAWATER

Rainfalls with high intensity increasing annually.

No. of occurrences of rainfall over **50mm/h**



No. of occurrences of rainfall over **100mm/h**



Flood damage increasing

Flood damage in urban areas: 120 billion yen/year (Average for 1994 - 2003)

Source: Ministry of Land, Infrastructure, Transport and Tourism

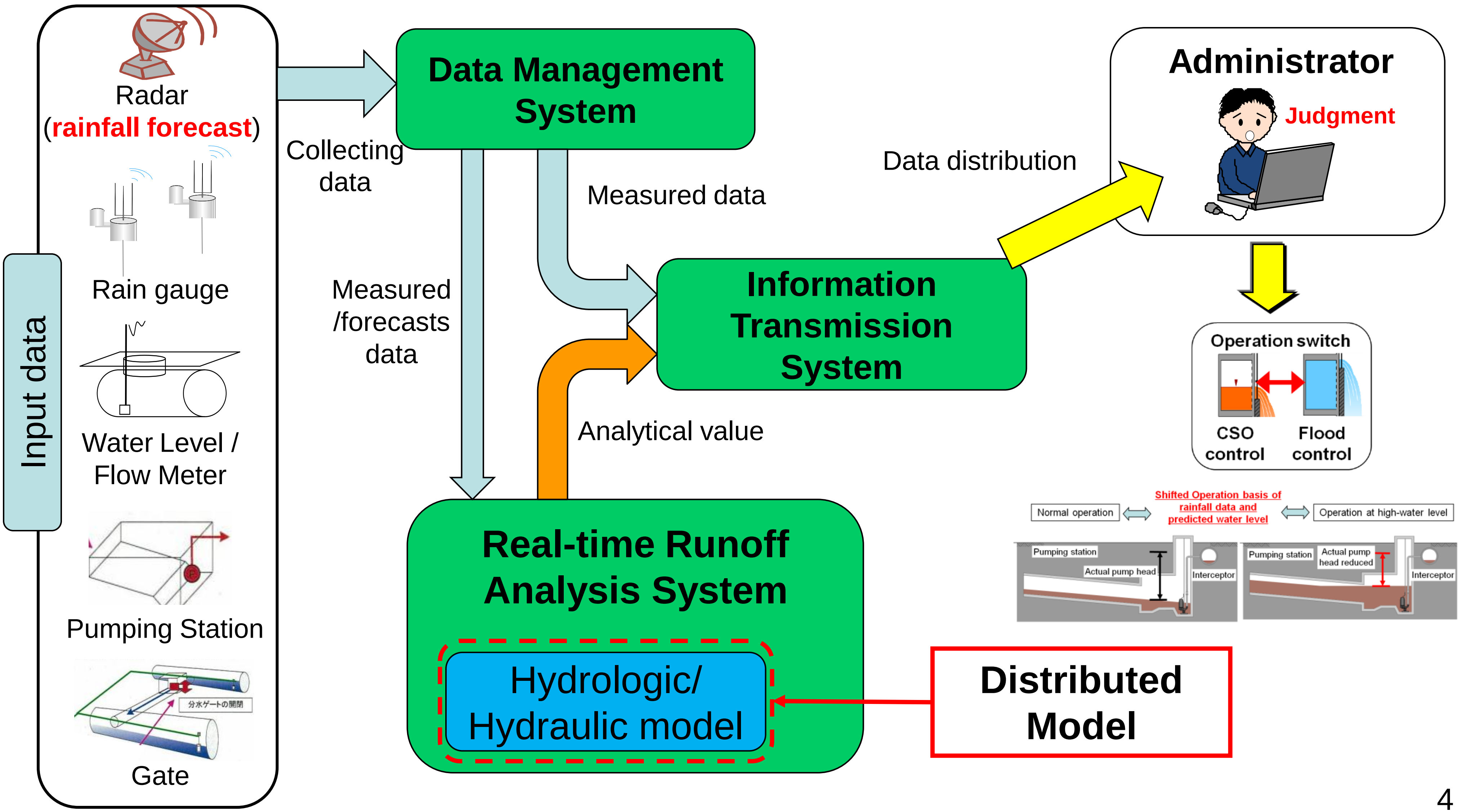
Background:
The MLIT(Ministry of Land, Infrastructure, Transport and Tourism) has shifted to a policy using public support and self-help for structural and **non-structural measures against flood**.

METAWATER and
Japan Institute of Wastewater Engineering Technology
Starting joint research for development of system for flood countermeasures

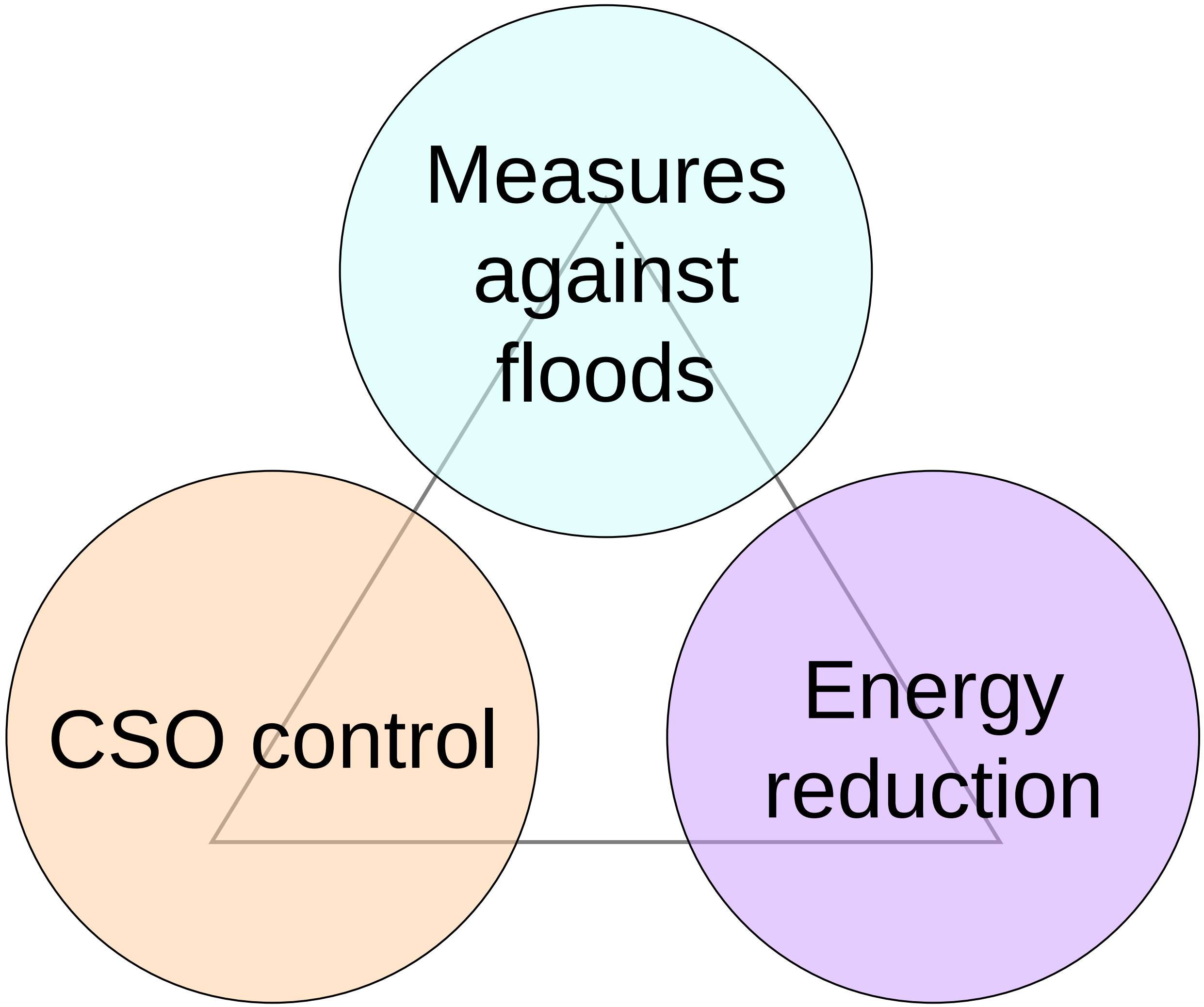
Objectives: For Administrator of urban stormwater
(1) Effective operation of facilities for CSO control and flood countermeasures
(2) Provide information to enable residents to reduce damage by themselves

3.Real-Time Urban Drainage Management System

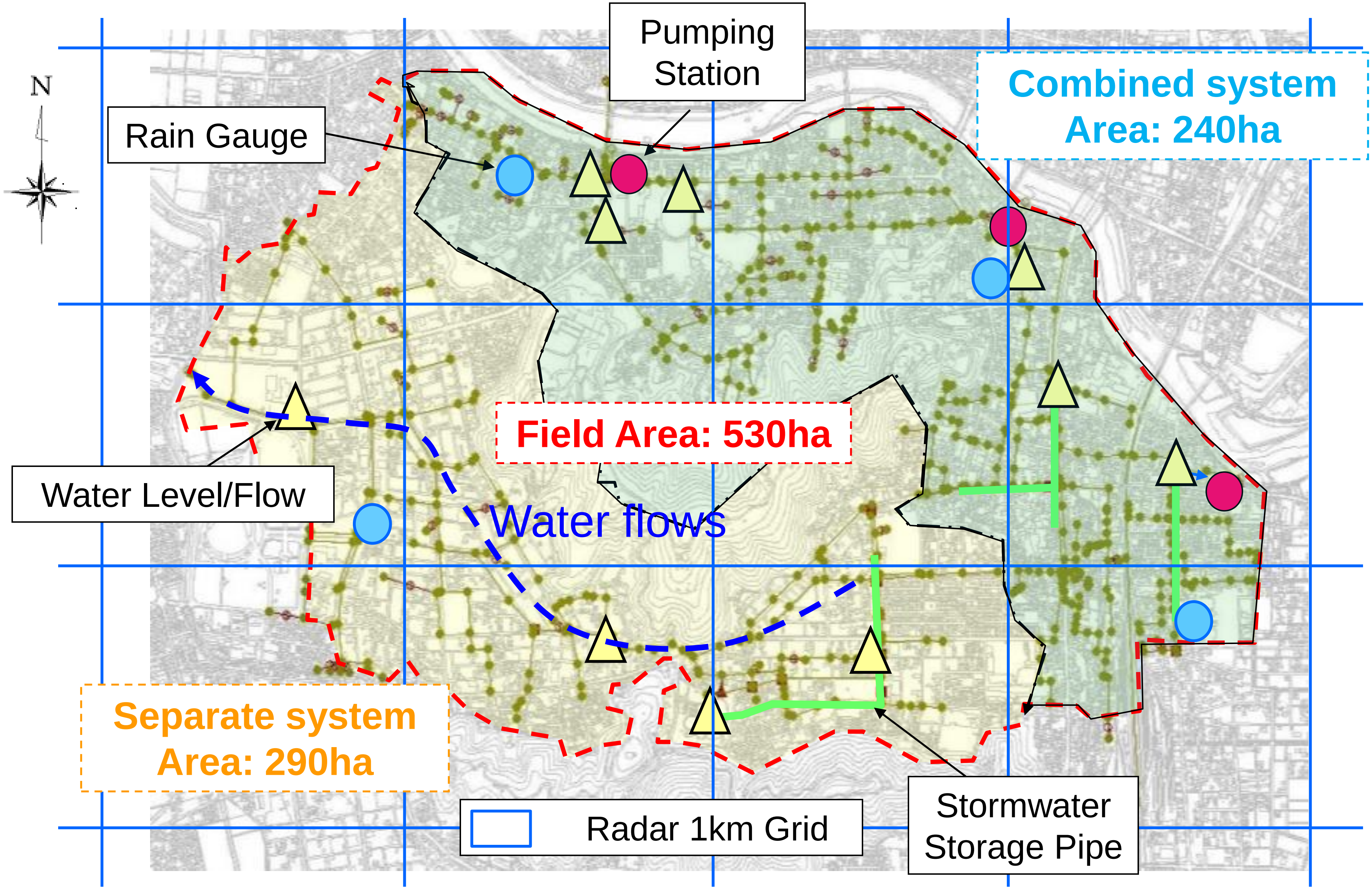
Administrator determine the operation based on the Information



Realization of efficient urban stormwater management！

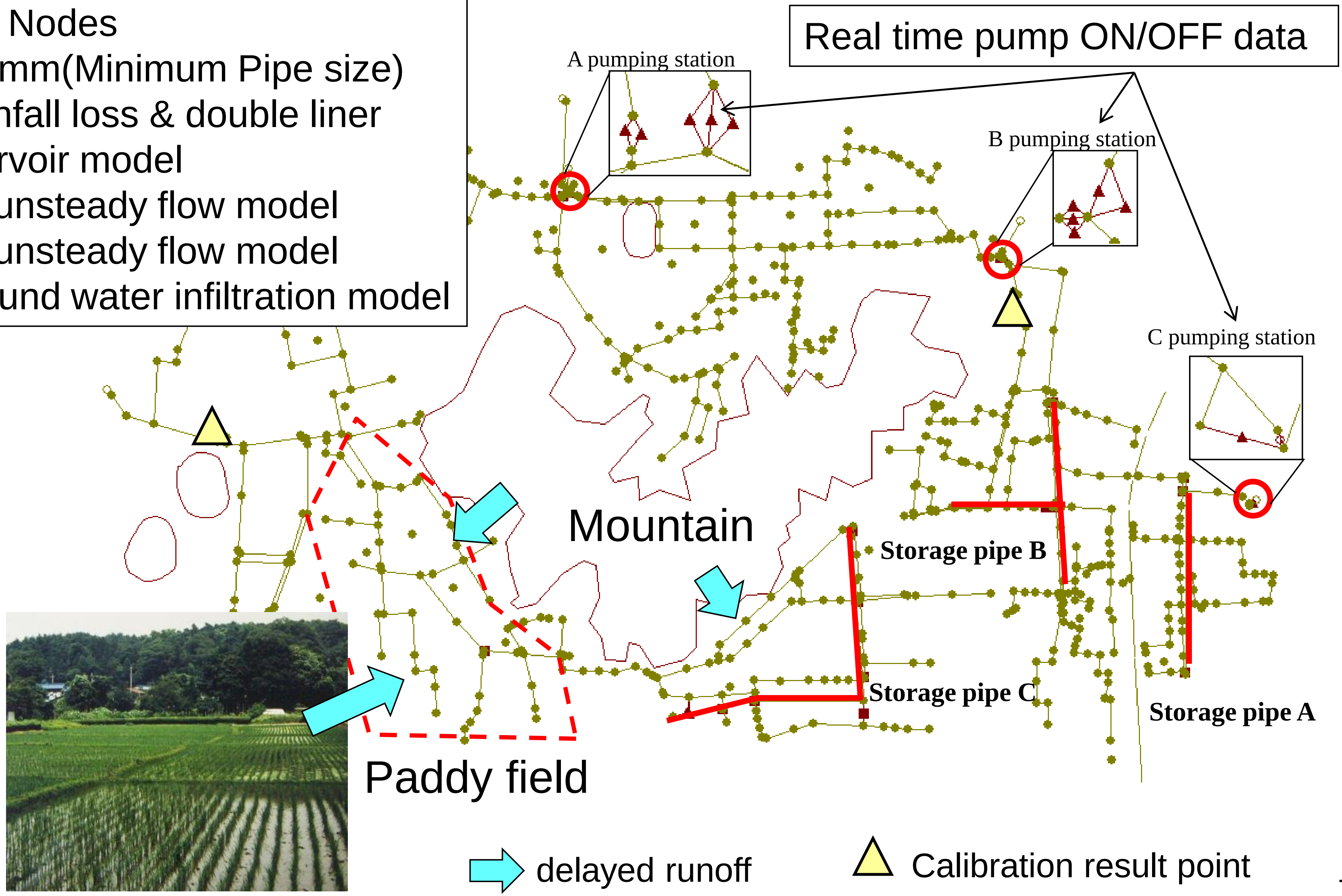


5.Case Study Area



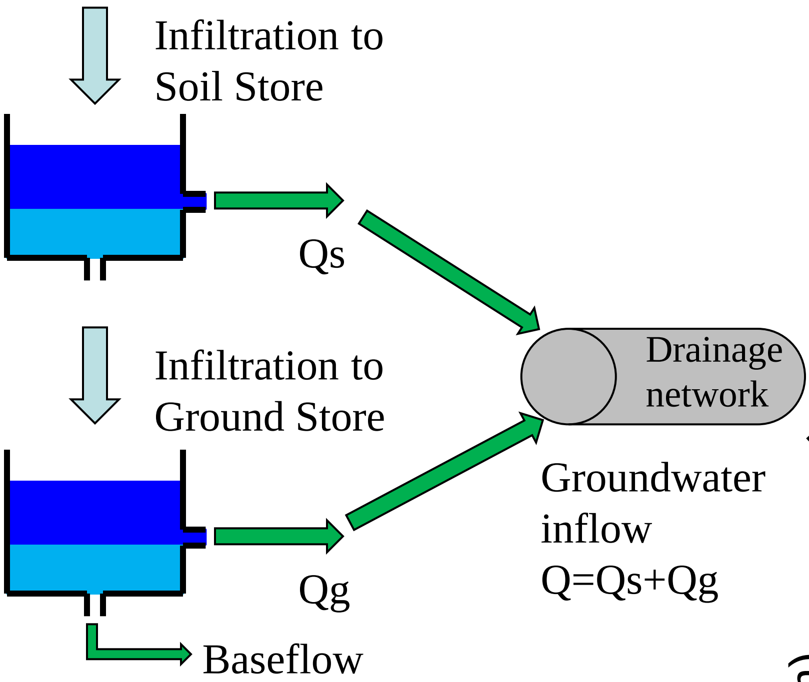
6.Modeling

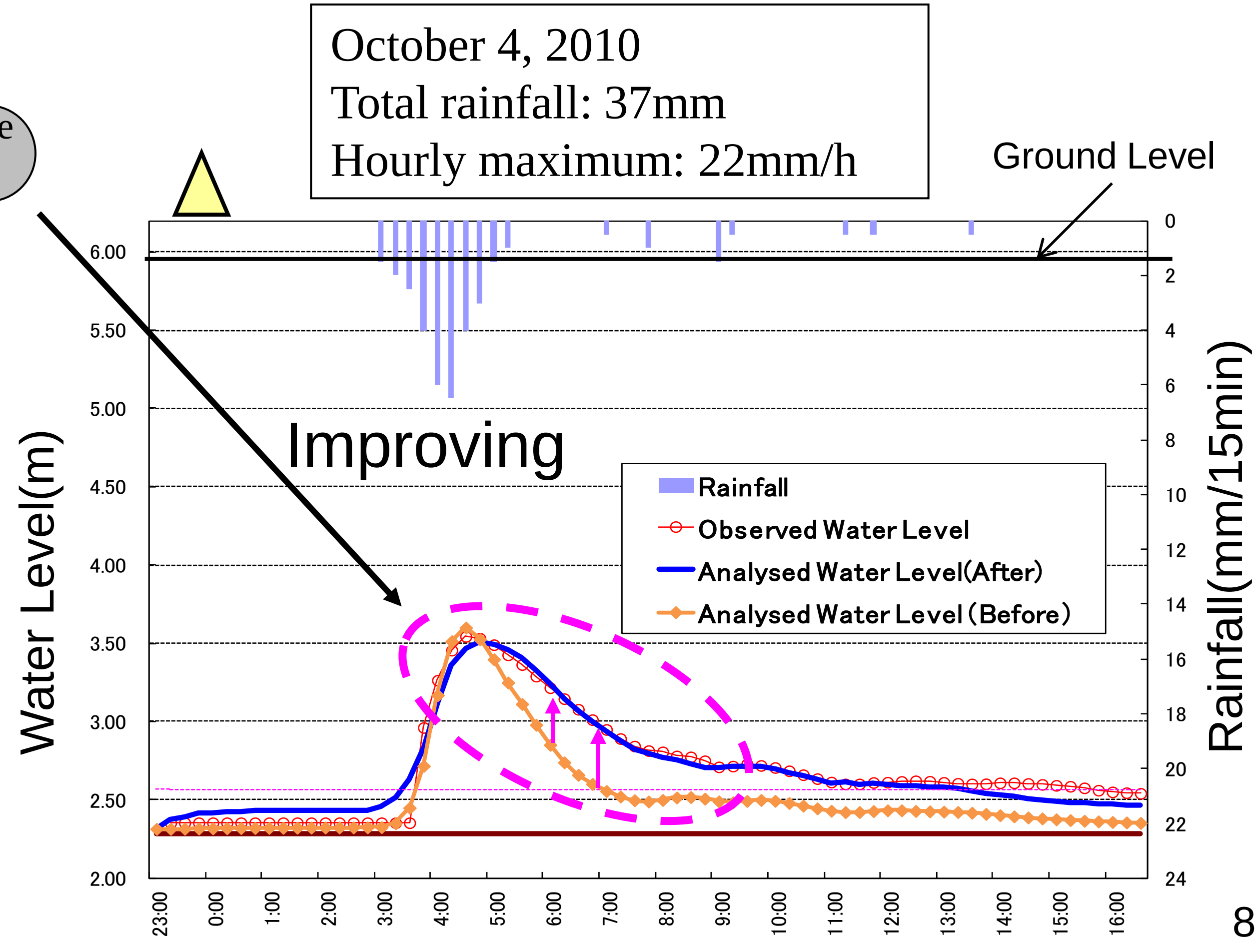
- -640 Nodes
- -250mm(Minimum Pipe size)
- -Rainfall loss & double liner reservoir model
- -1D unsteady flow model
- -2D unsteady flow model
- -Ground water infiltration model



7.Calibration result 1

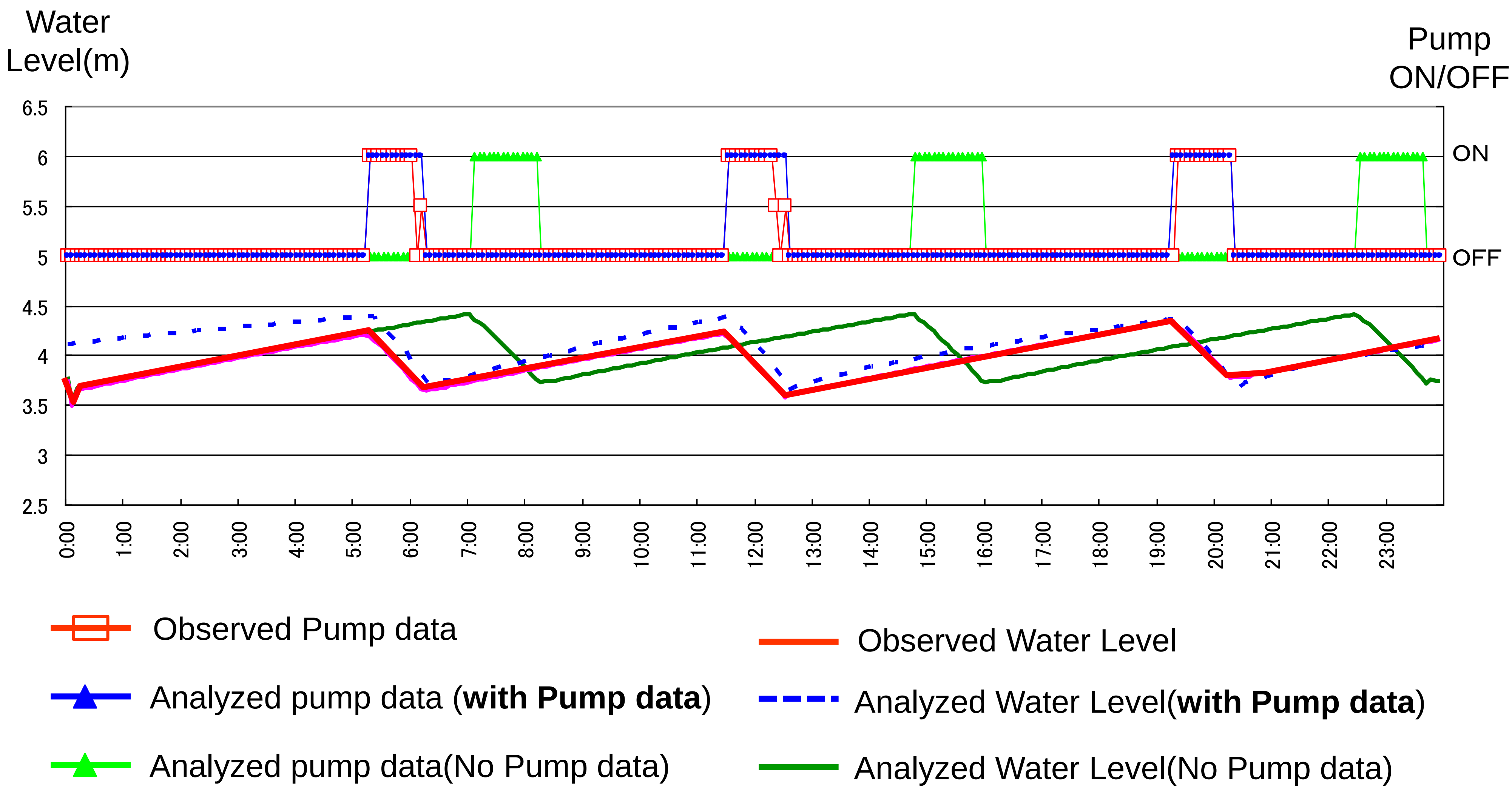
Improving the Water Level with Ground Water Infiltration Model





7.Calibration result 2

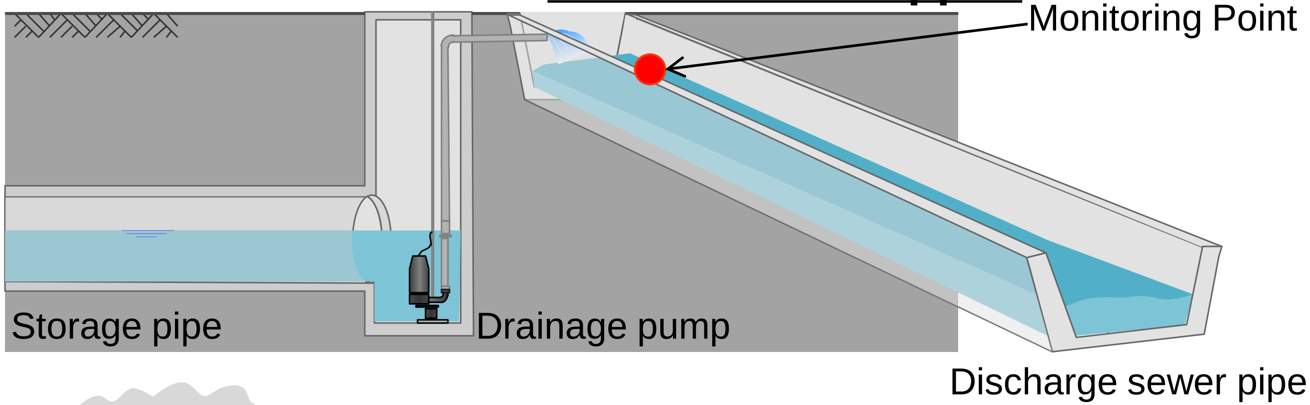
Improving the Water Level with real time pump data



Securing of the storage capacity to prepare for the next rainfall

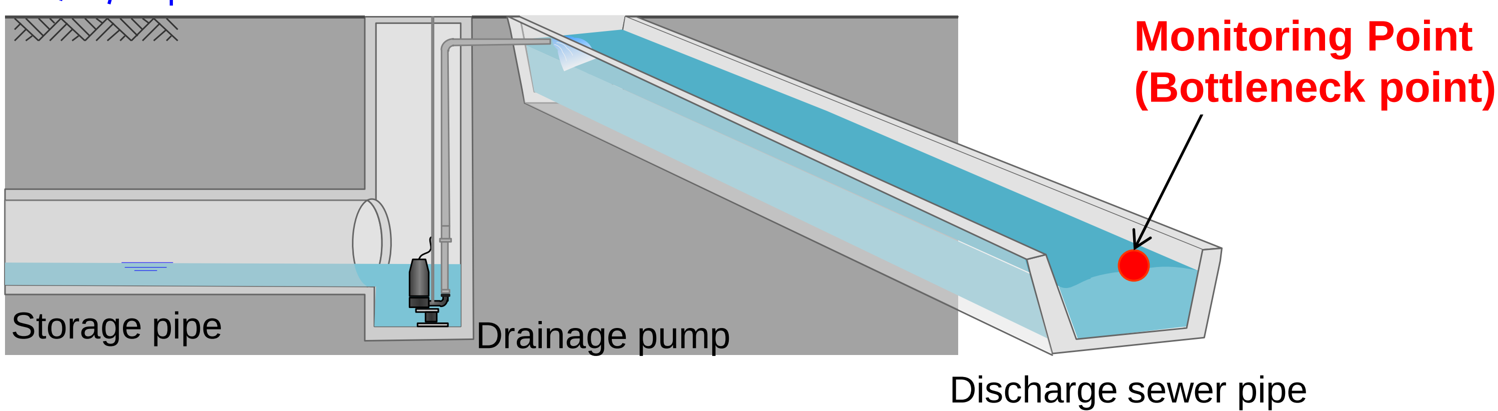
[Current]

Pump operation when the destination water level has lowered <u>after rainfall stopped</u>

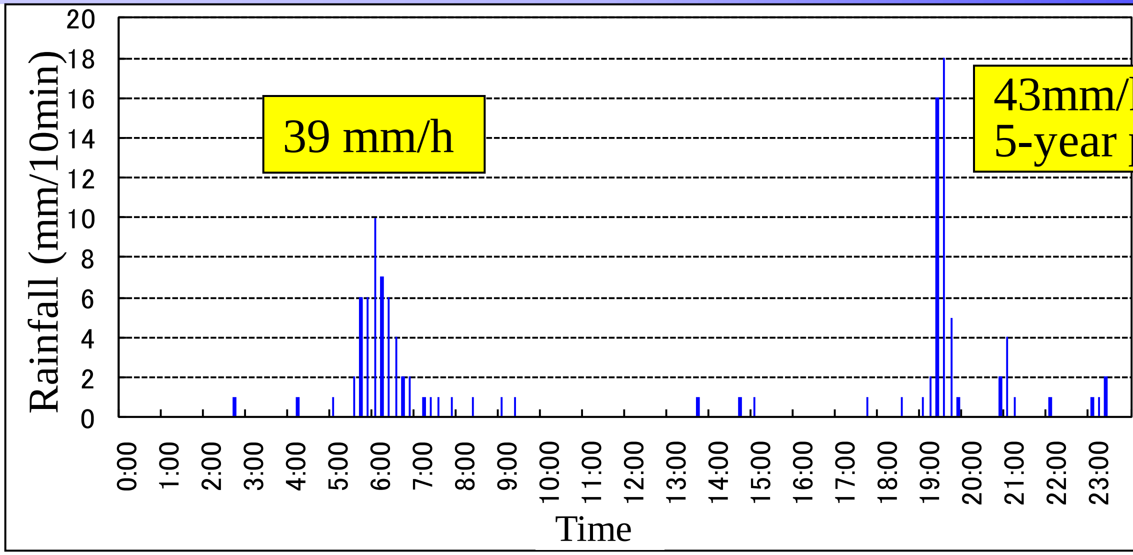


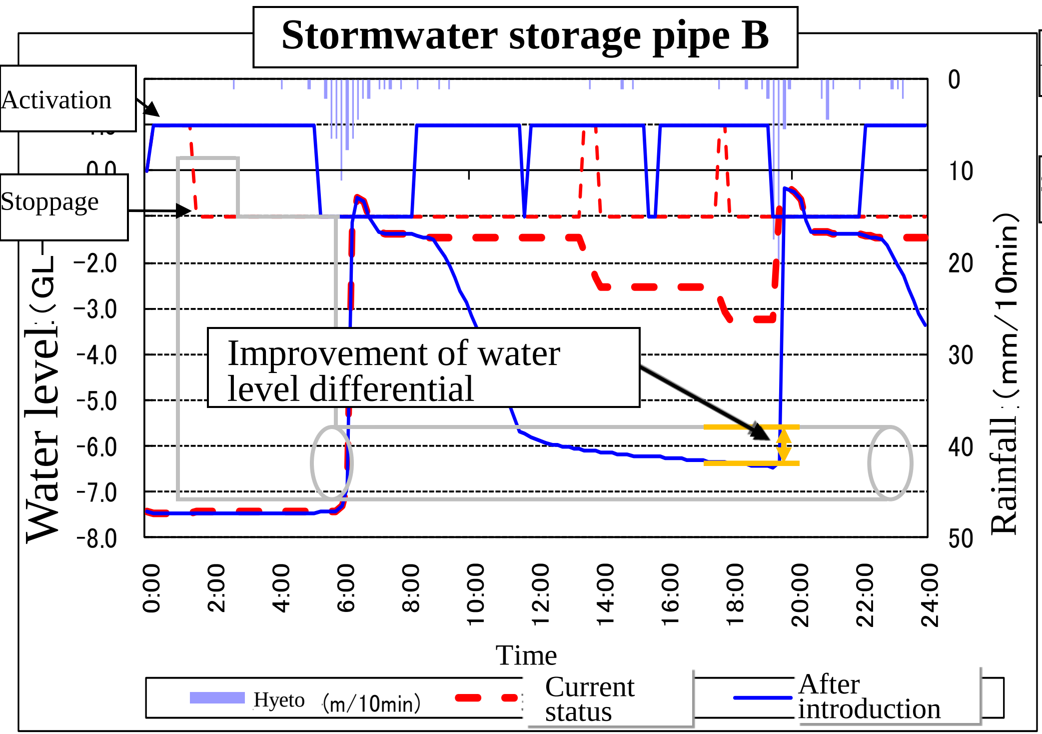
[After Introduction]

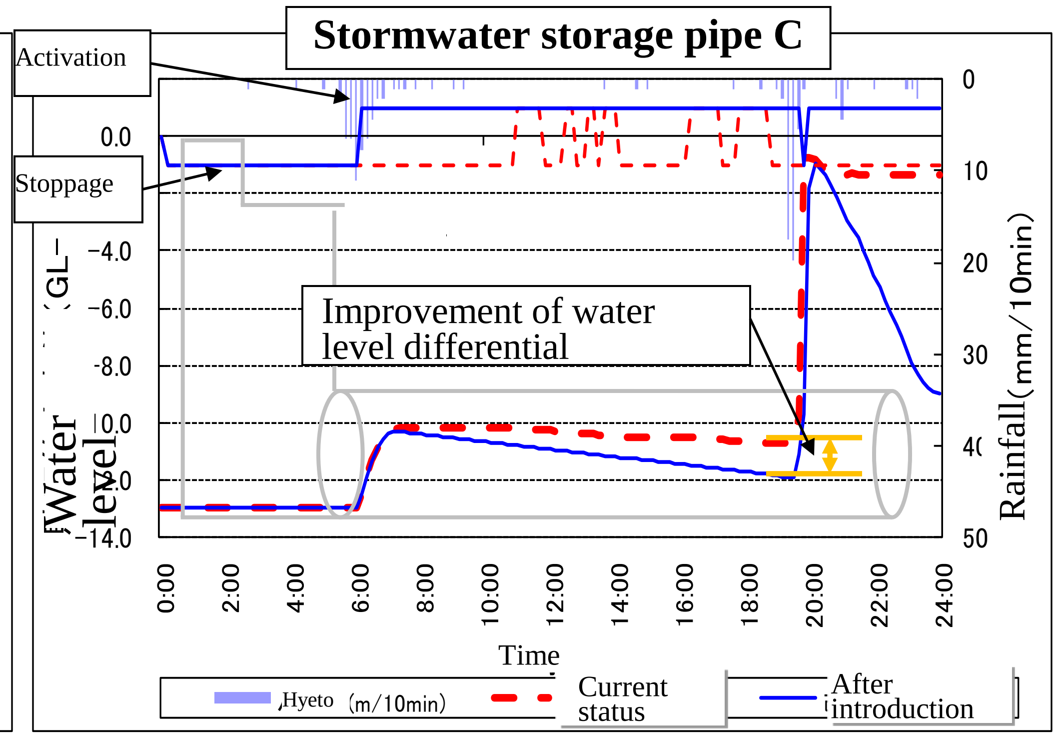
Pump operation according to the capacity of the destination water level



8.Simulation Result



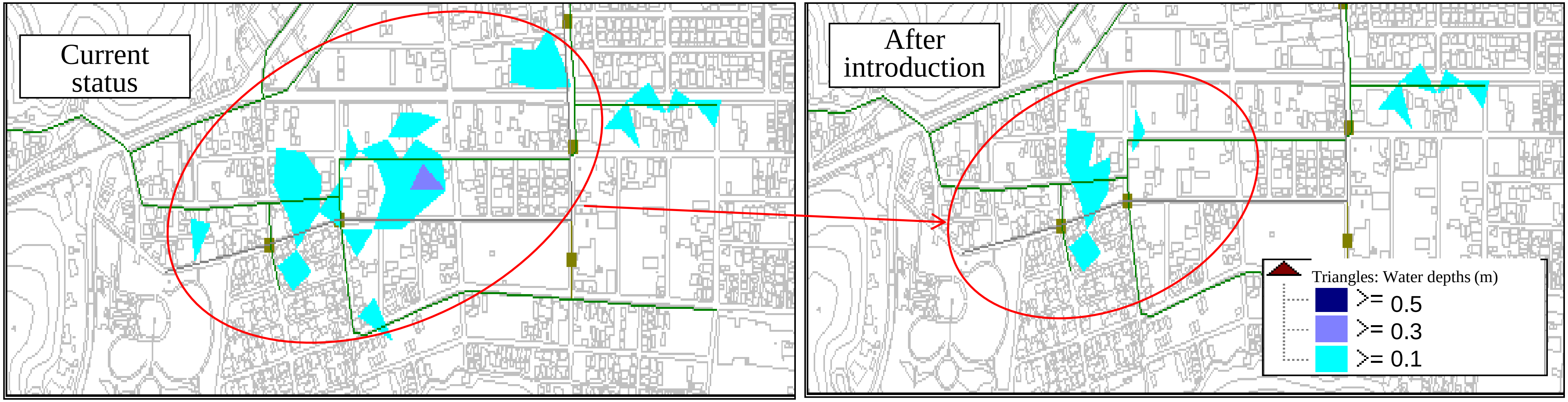




8. Improvement Effect

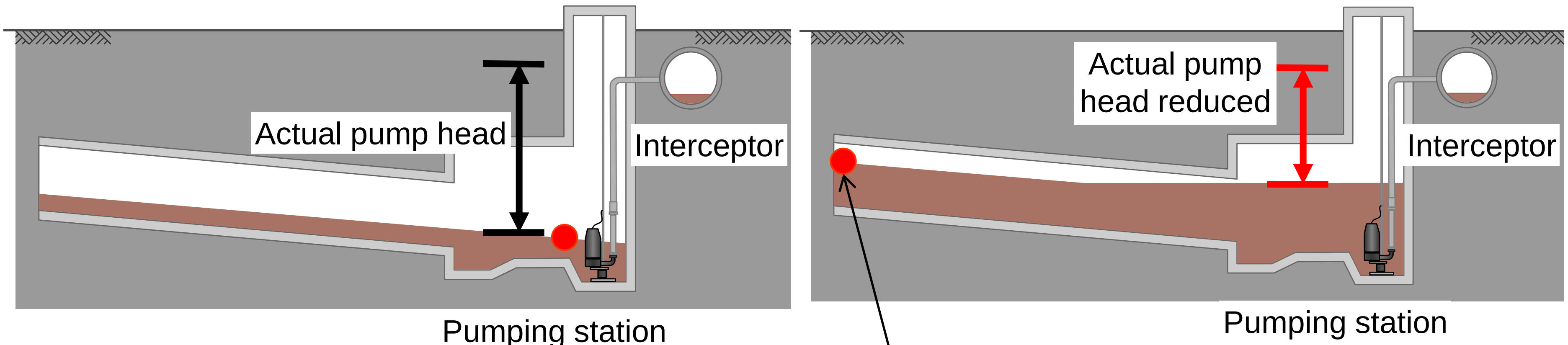
Storage Capacity were Increased
Inundation area were decreased

Storage pipe	Storage capacity(m^3)	Current status(m^3)	After introduction(m^3)	Increase (m^3)
B	1400	0	350	350
C	12700	4500	9300	4800



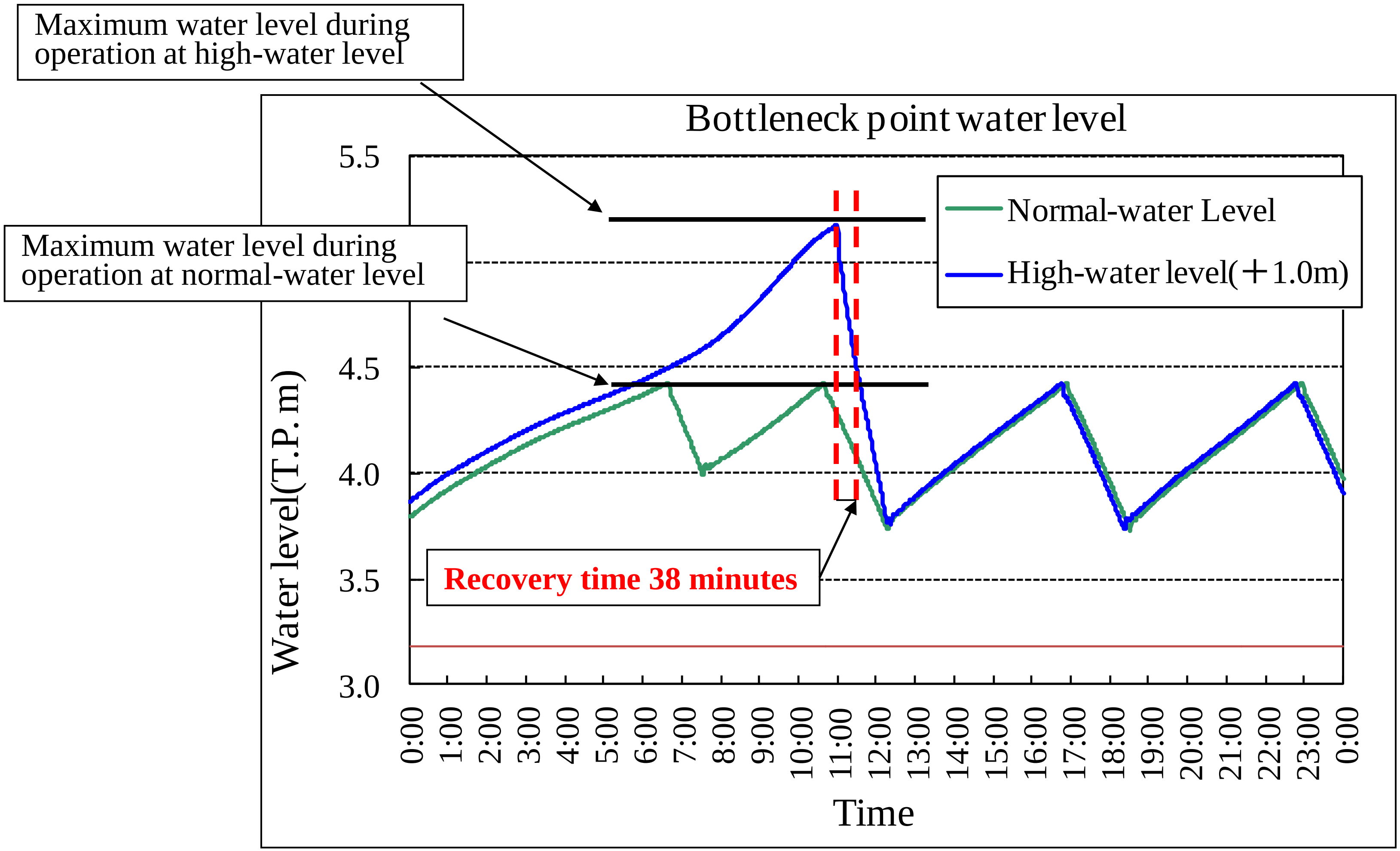
Energy conservation using intercepting pump at high-water level

Normal operation ⇔ **Shifted Operation basis of forecast rainfall data and predicted water level** ⇔ **Operation at high-water level**



Monitoring Point for Shifting Operation (Bottleneck point)

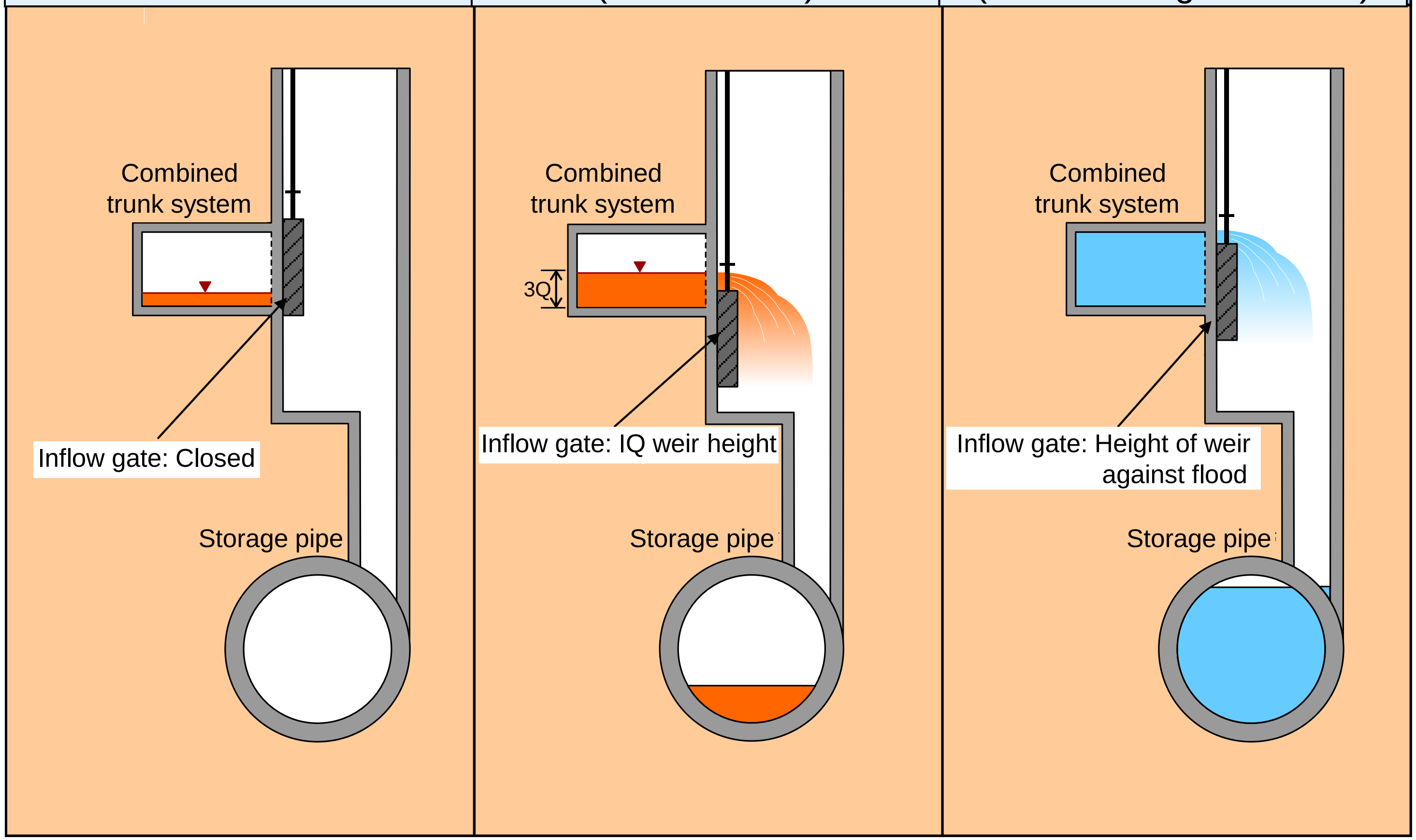
Shifted from Hi-level to Normal with <u>1hour ahead predicted water level</u>



CSO Control Effect

Storage facilities used for CSO control to cope with floods

Dry weather	Weather with light rain (CSO control)	Weather with heavy rain (measures against flood)



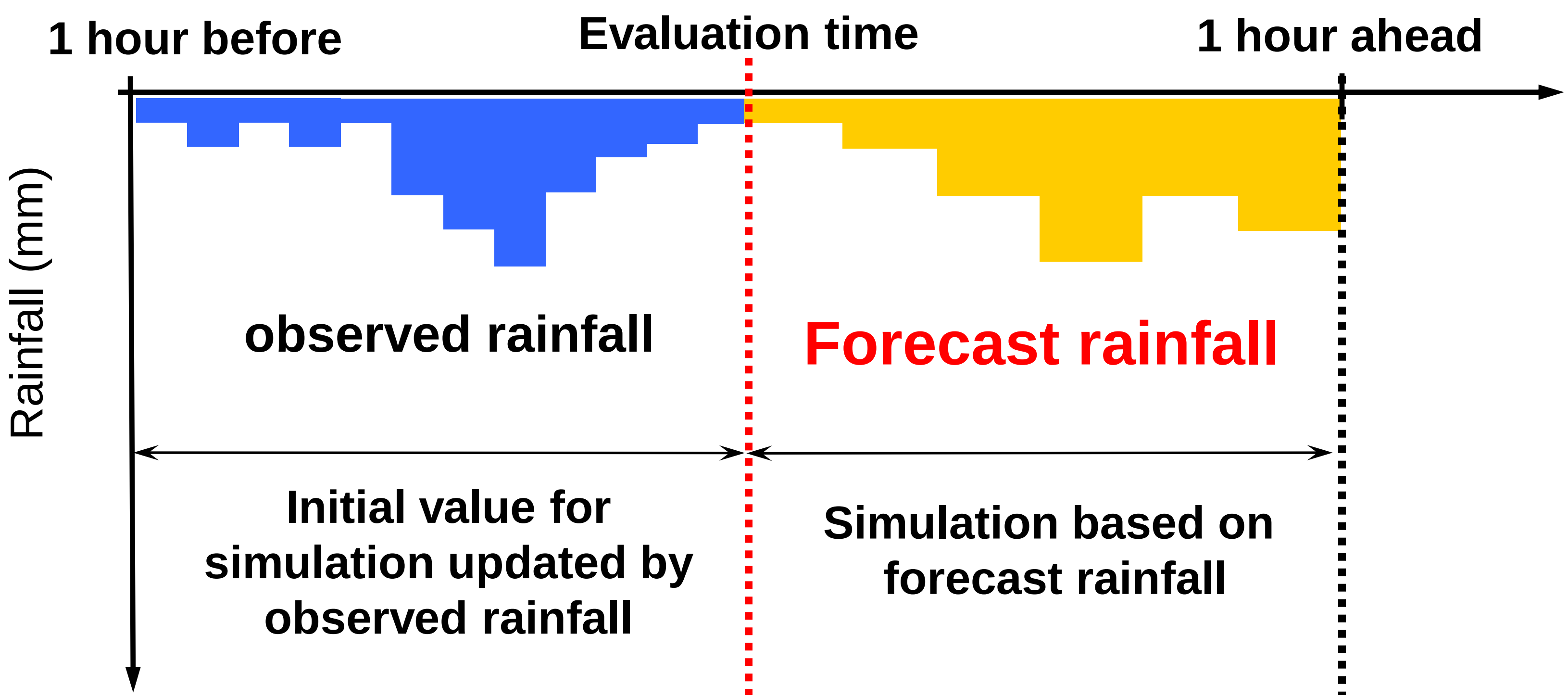
10. Cost effect

The ratio of improvement effect to cost of introduction is as high as 2.8

Item		Annual cost (thousand yen/year)	
Costs for introduction and operation (C)		**27,000** (Equipment replacement in ten years)	
Improvement effect (B)	**Flood control measures**	**64,400**	**74,700**
	CSO controls	**10,000**	
	Energy reduction	**300**	
B/C = 2.8			

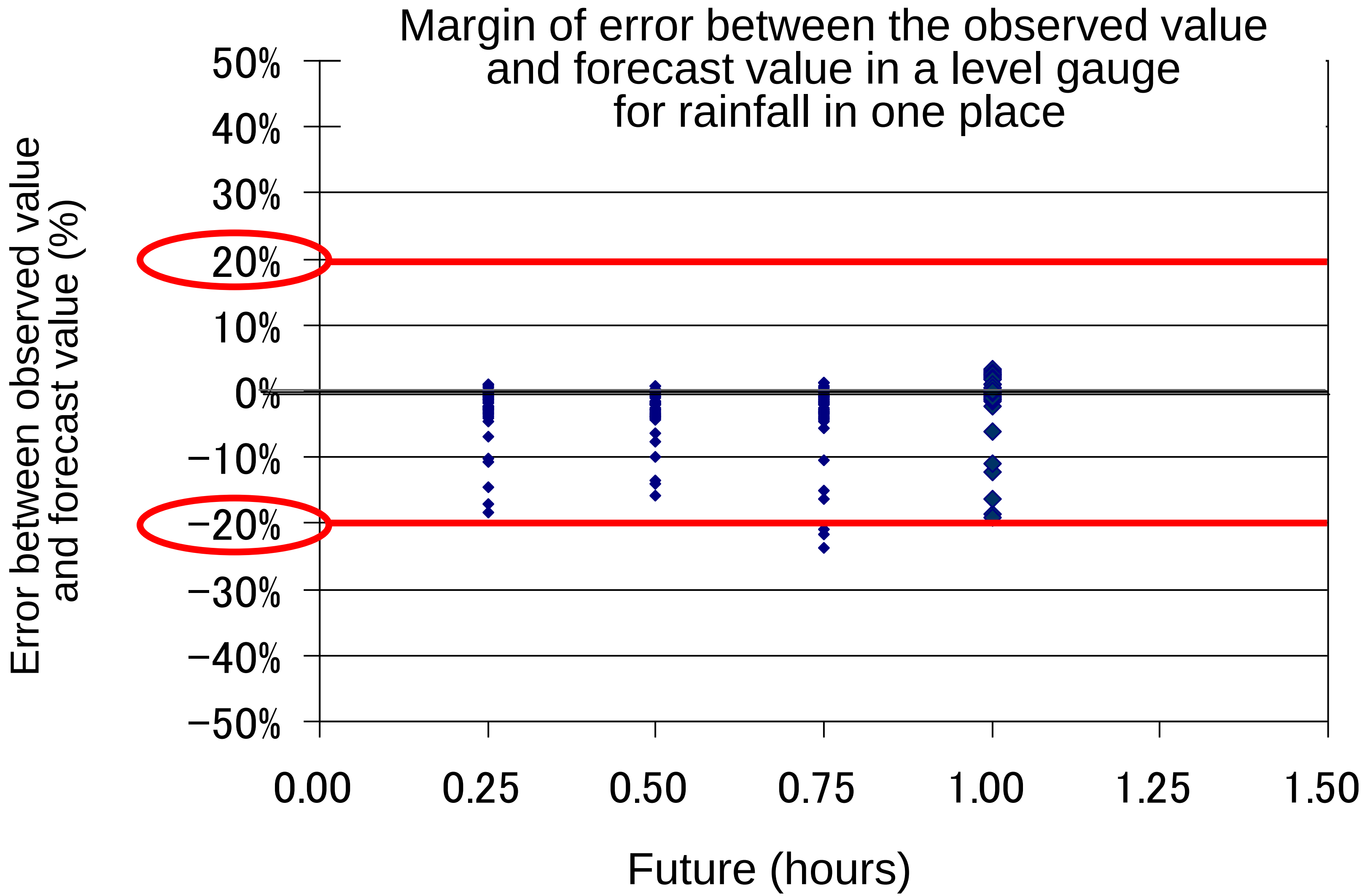
11. Accuracy of the forecast rainfall data

- We use the forecast rainfall data of the Meteorological Agency, which is **one hour ahead**
- Simulation based on Hydrologic/hydraulic model uses the **observed rainfall data and the forecast rainfall data**



11.Accuracy of forecast water level

The margin of error for forecast levels are about 20%



12.Summary and Tasks Ahead

METAWATER

Summary:

・**The effect of introduction of this system is large.**

・**The margin of error between observed water level and forecast water level is about 20%.**
This margin of error depends on the accuracy of forecast rainfall.

Tasks:

1. To raise the forecast analysis accuracy

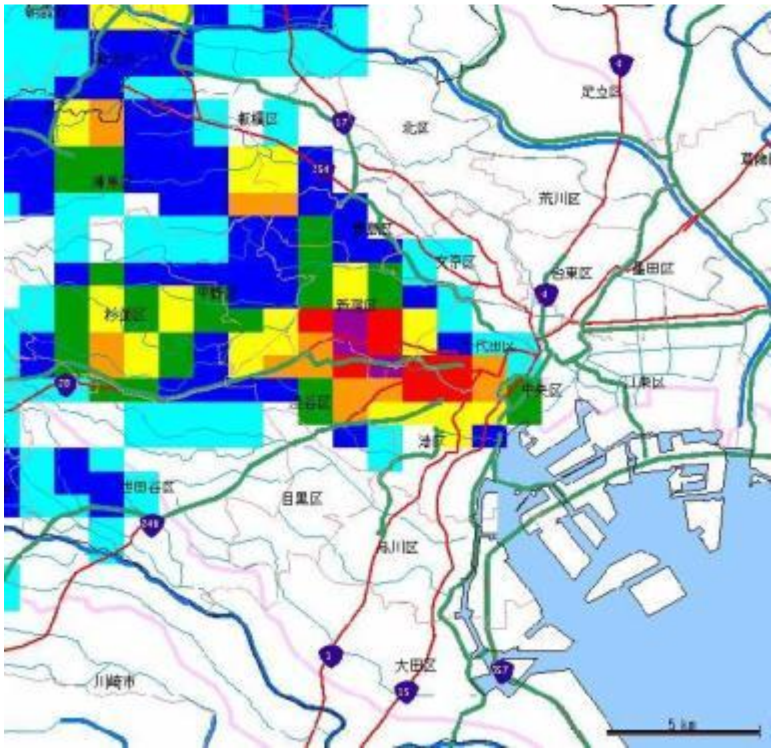
2. Positive verification of effects of introduction

12-1.About X-Band Multi-Parameter(MP) Radar

MP radar enables greater accuracy and higher frequency data distribution than existing radar

・Currently under test operation. Full-scale operation scheduled for 2013

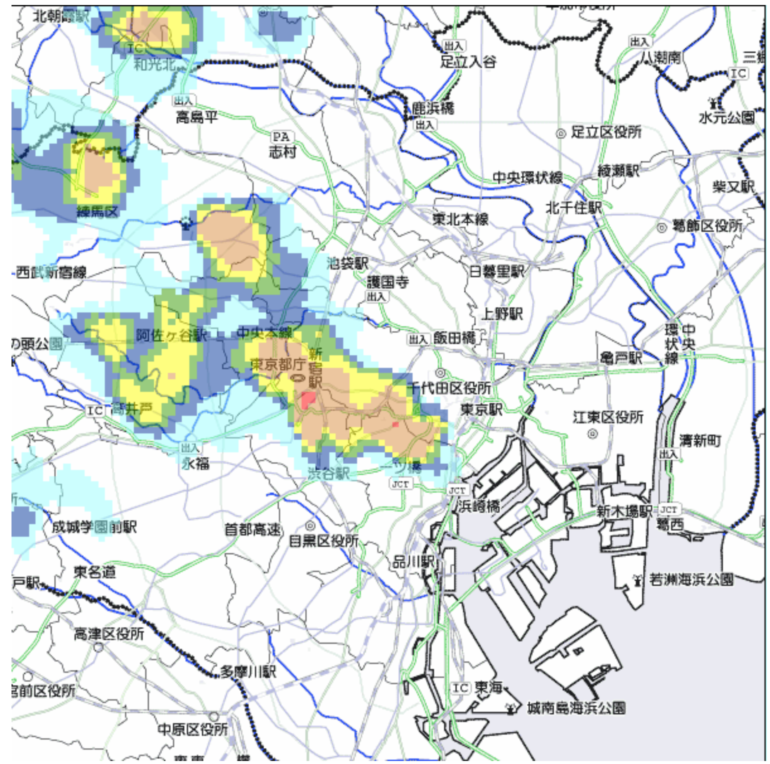
Existing Radar (C band)



Minimum observation area: 1km mesh
Observation interval: 5 min
Time lag before data distribution: 5-10 min

・High accuracy (16-fold)
・High frequency (5-fold)

MP Radar (X band)

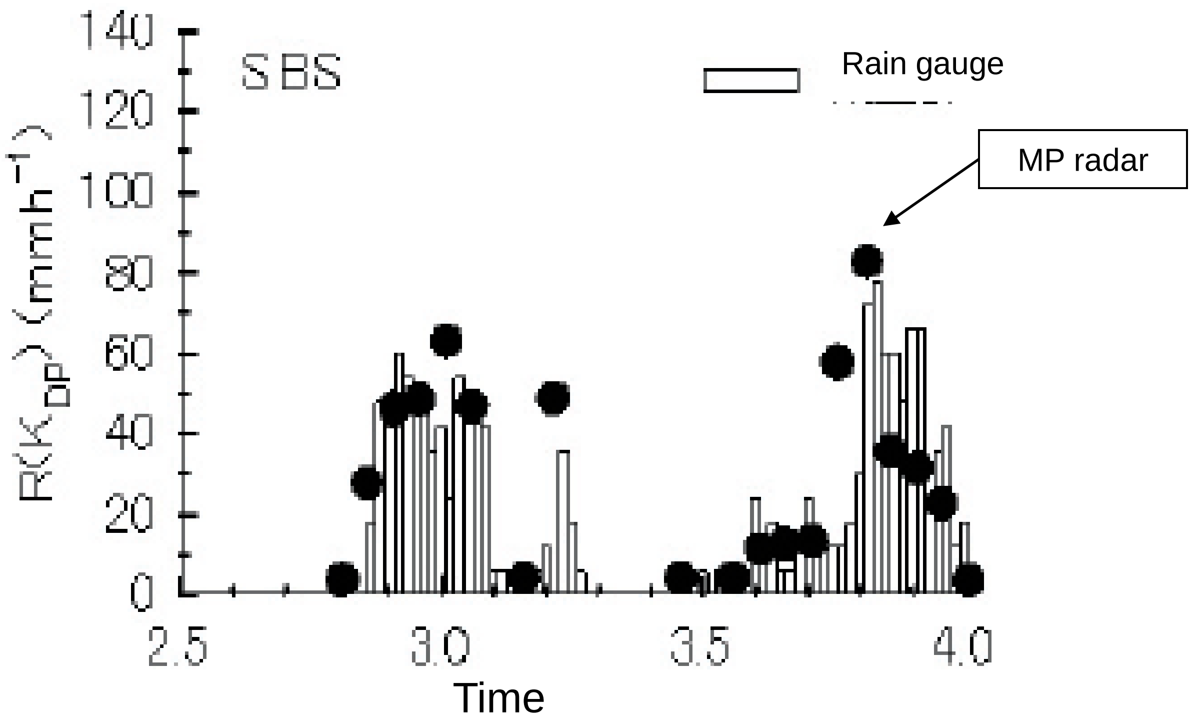


Minimum observation area: 250m mesh
Observation interval: 1 min
Time lag before data distribution :1 min

Source: MLIT Websites

Calculated values obtained with MP radar are equivalent in effect to using of densely installed rain gauges

Verification result graph of rain gauges and MP radar calculated values



Error of rainfall intensity relative to rain gauges:
Existing radar: 100% or more may occur in certain cases
MP radar: 30% or less

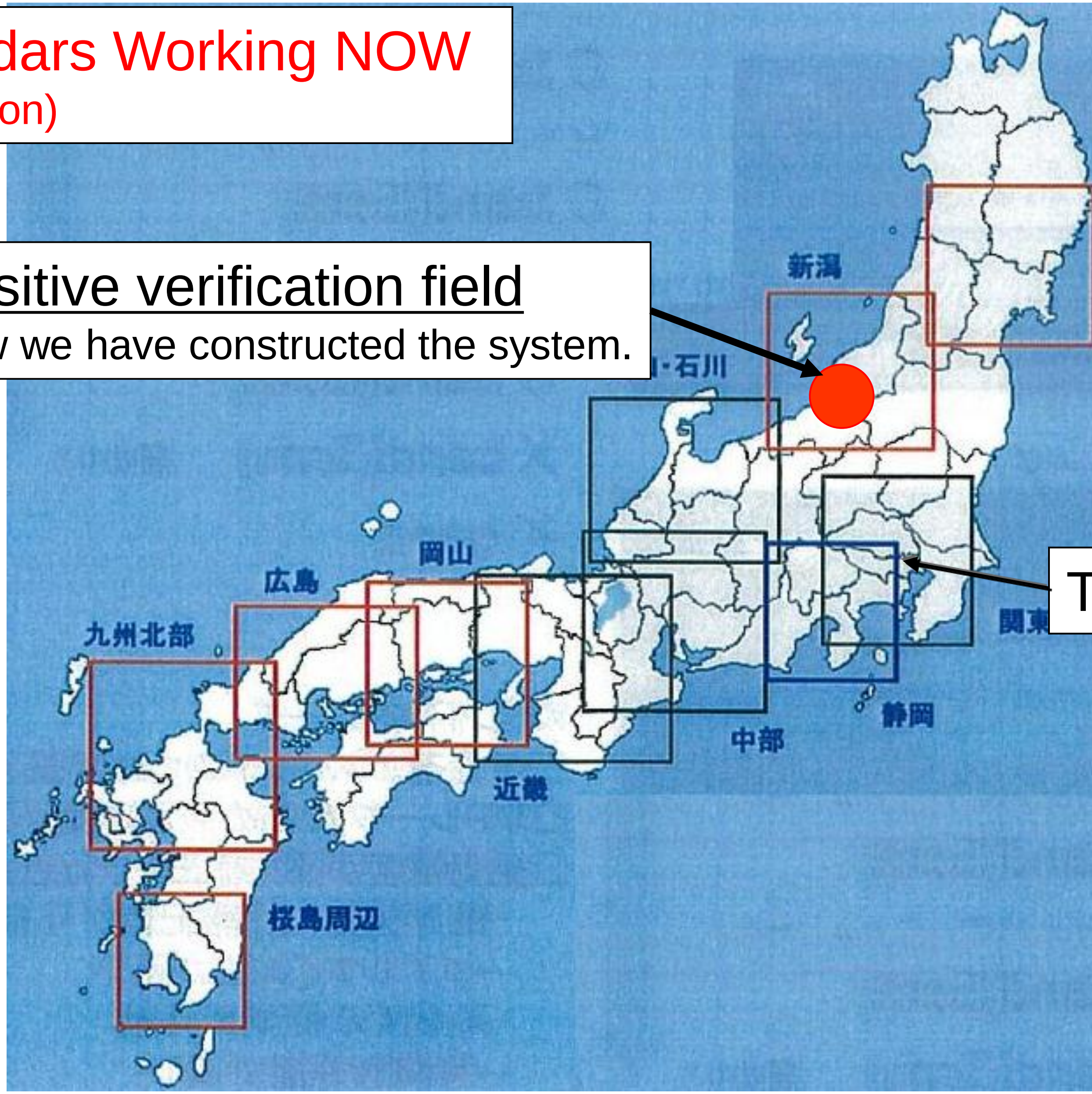
Source: National Research Institute for Earth Science and Disaster Prevention

12-2. Positive verification by using MP-radar data

27 MP-radars Working NOW
(Test Operation)

Positive verification field
Now we have constructed the system.

Tokyo



Source: MLIT

Thank you for kind attention.

Kazunori Matsumoto

International & New Business Engineering Dept.
Engineering Division

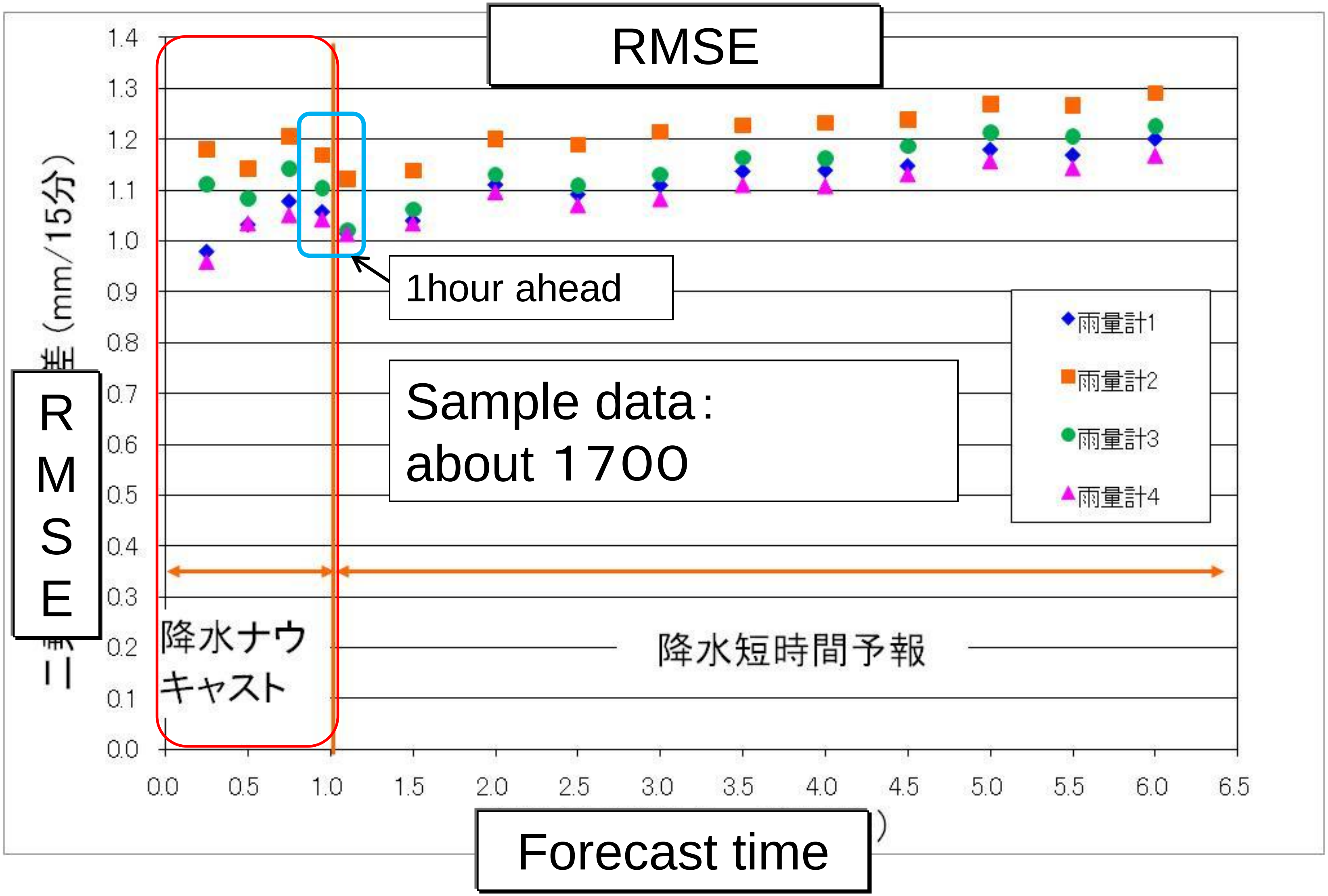
METAWATER

Phone:+81-3-6403-7513
FAX:+81-3-5401-2603
Email: matsumoto-kazunr@metawater.co.jp

Accuracy of forecast rainfall

METAWATER

Forecast rainfall data have the margin of error for actual rainfall data.

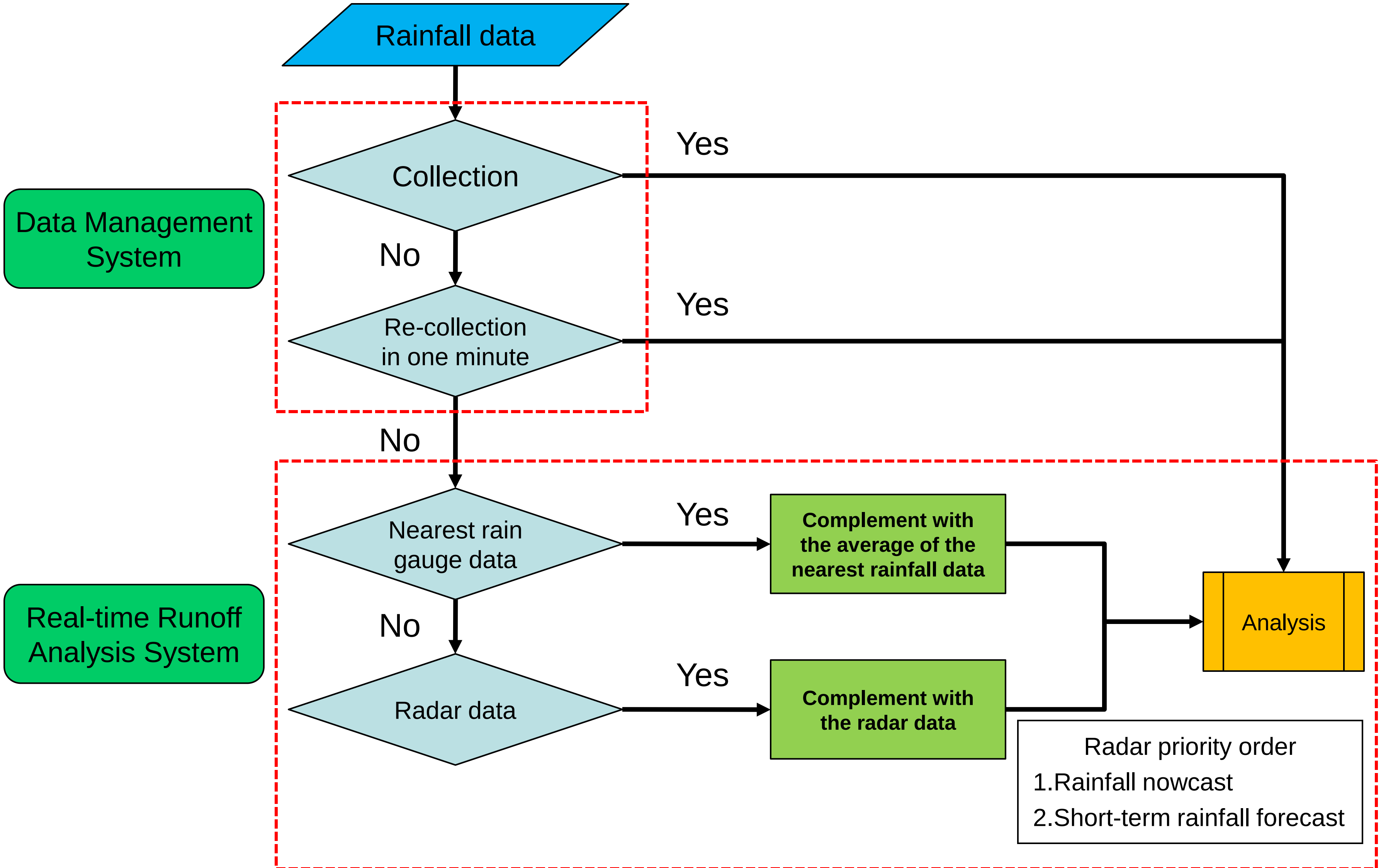


Rainfall data

■Duration　　　　　　　:2010年7月3日～10月28日 (118日間)
■Number of rainfall　　:21rainfall data
■Total（Max）　　　　:122．5mm（9月15日～16日）
■Intensity（Max）:27．5mm／h（9月16日）

		雨量計1		雨量計2		雨量計3		雨量計4	
降雨開始時刻	降雨終了時刻	総雨量 (mm)	時間最大雨量 (mm/h)	総雨量 (mm)	時間最大雨量 (mm/h)	総雨量 (mm)	時間最大雨量 (mm/h)	総雨量 (mm)	時間最大雨量 (mm/h)
2010/9/15 17:00	2010/9/16 7:40	118.5	26.0	113.5	27.5	122.5	26.5	108.0	21.5
2010/7/12 0:20	2010/7/12 12:00	38	21.5	38.5	22	37	22	32.5	20
2010/10/4 3:00	2010/10/4 13:10	36	17	35.5	14	39.5	22	37	20.5
2010/7/13 2:40	2010/7/14 5:10	60.5	23	59.5	21	59.5	20.5	56.5	18.5
2010/08/13 17:50	2010/08/14 11:00	32	17	41.5	27.5	36	19.5	30.5	14.5

Risk hedge against lost or missing rainfall observation data



About METAWATER

History

Fuji Electric Holdings, Co., Ltd.

NGK Insulators, Ltd.

Separated as a daughter company (2007)

Expert of Electric technology

Fuji Electric Water Environmental Systems

Expert of Machinery and equipment technology

NGK Water Environment Systems

April 1st, 2008 Consolidation

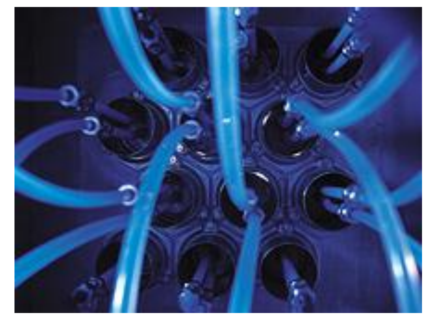
METAWATER

Outline

Capital	JPY 7.5 Bil.
Net Sales	JPY 100 Bil. (FY2009)
Employees	Approx. 1,800 (consolidated)
Location (JPN)	Tokyo (Head Office), Hino Office, Nagoya Office
(Intl.)	China, Korea, Germany, USA, Vietnam

Drinking Water Treatment

- ✓ **Ceramic membrane filtration system**
- ✓ **Ozone system**
- ✓ Rapid sand filtration system
- ✓ UV disinfection system
- ✓ Thickening/Dewatering system
- ✓ Electric equipment & Instrumentation
- ✓ Monitoring/Controlling system
- ✓ Operation & Maintenance service



THMs monitor

UV system

PLC

Environment-conscious Switchboard

Wastewater & Sludge Treatment

- ✓ **High speed CSO filtration system**
- ✓ **Electric equipment & Instrumentation**
- ✓ **Monitoring/Controlling system**
- ✓ **Operation & Maintenance service**
- ✓ Ceramic diffuser system (Bio. treat.)
- ✓ Sludge incineration/gasification system
- ✓ Advanced tech. (Membrane, Ozone, UV)
- ✓ Thickening/Dewatering system
- ✓ Sludge dryer carbonizer
- ✓ Ceramic dust filter (system)
- ✓ Phosphorus recovery system
- ✓ Power generation/storage system