Development of AIM/Water

-Impact analysis on water use for water resources-

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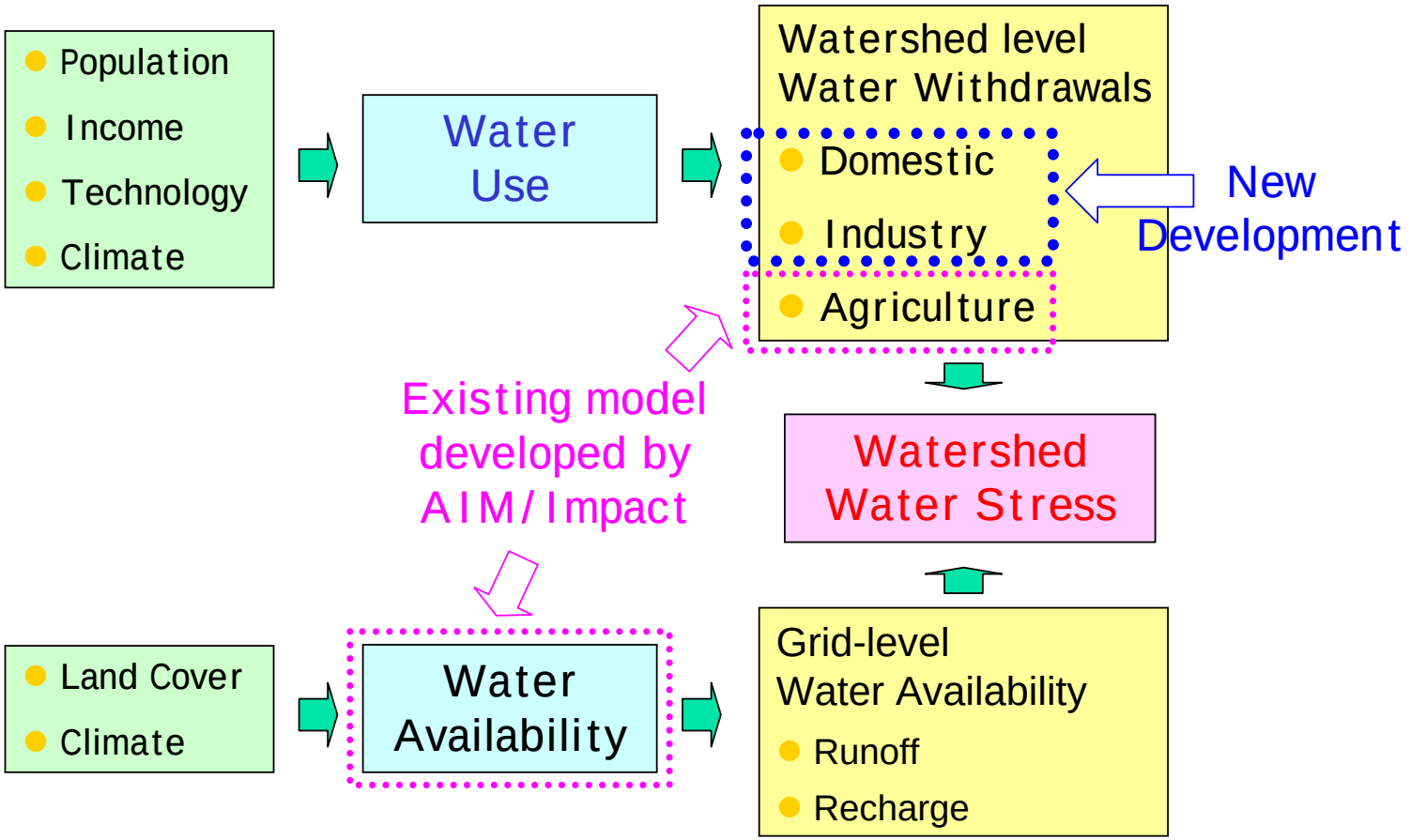
Concept of AIM/Water

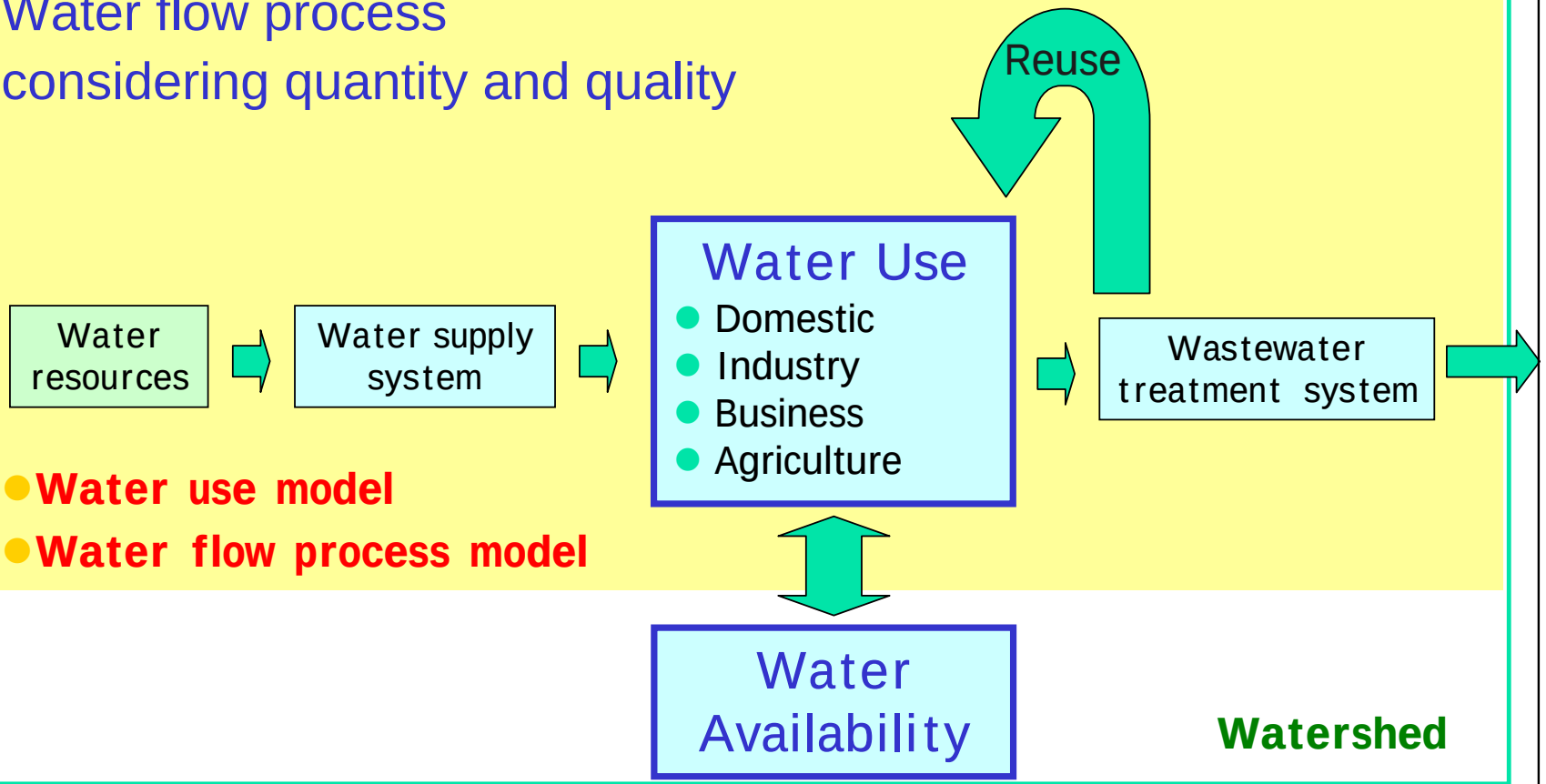
- Analysis on water resource under social, economic, life style and climate changes
  - ✓ Water balance between demand and availability
  - ✓ Evaluating effectiveness and cost benefits on environmental policy and investment
  - ✓ Scenario analysis for water resources based on social-economic factors
- AIM/Water focuses on water use
  - ✓ One part of impact models for water resources
  - ✓ Considering water quantity and quality aspects

Block diagram of impact model for water resources



Water use and flow process model

Water flow process
considering quantity and quality



- **Water use model**
- **Water flow process model**

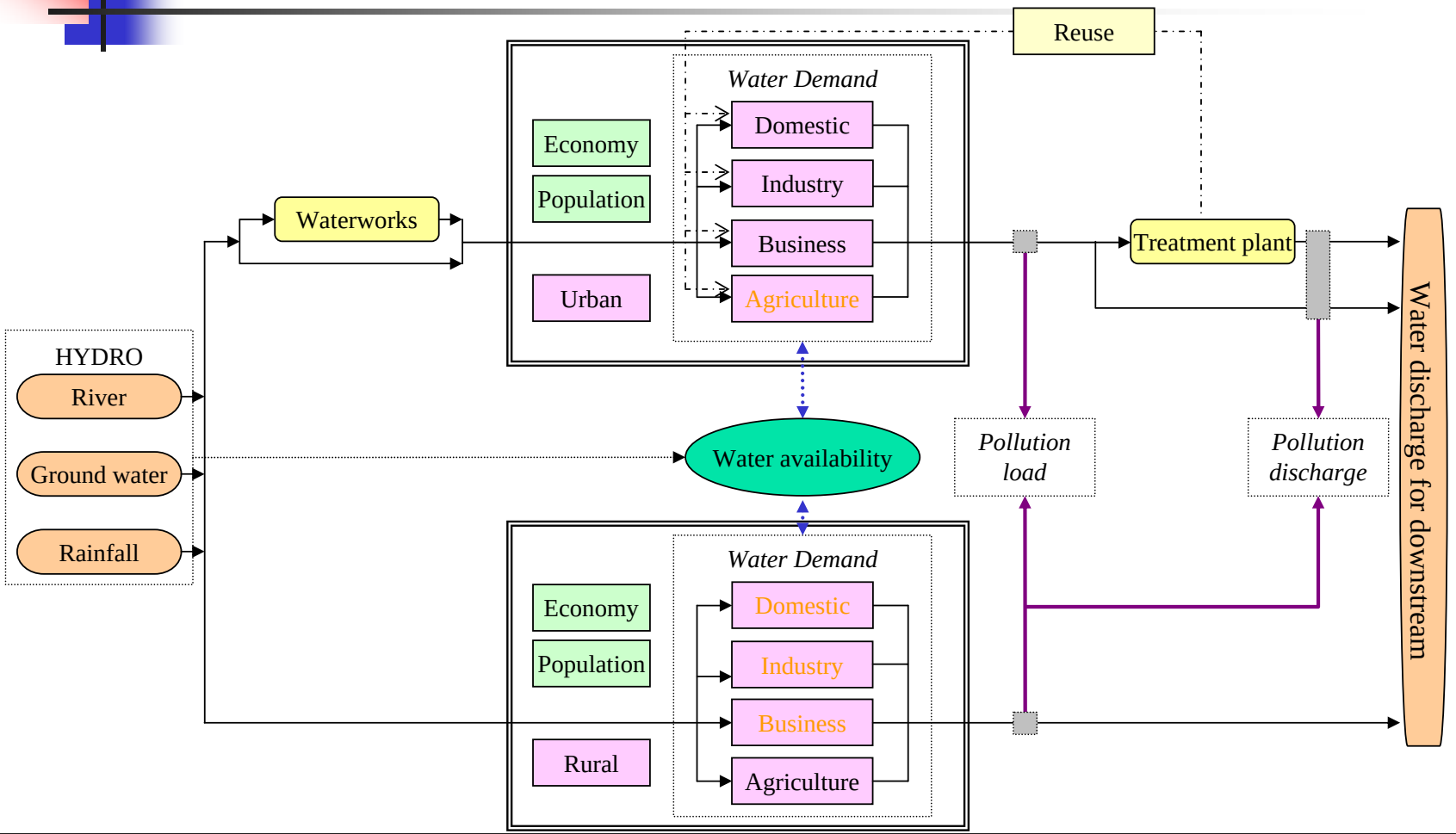
Outline of Model Development

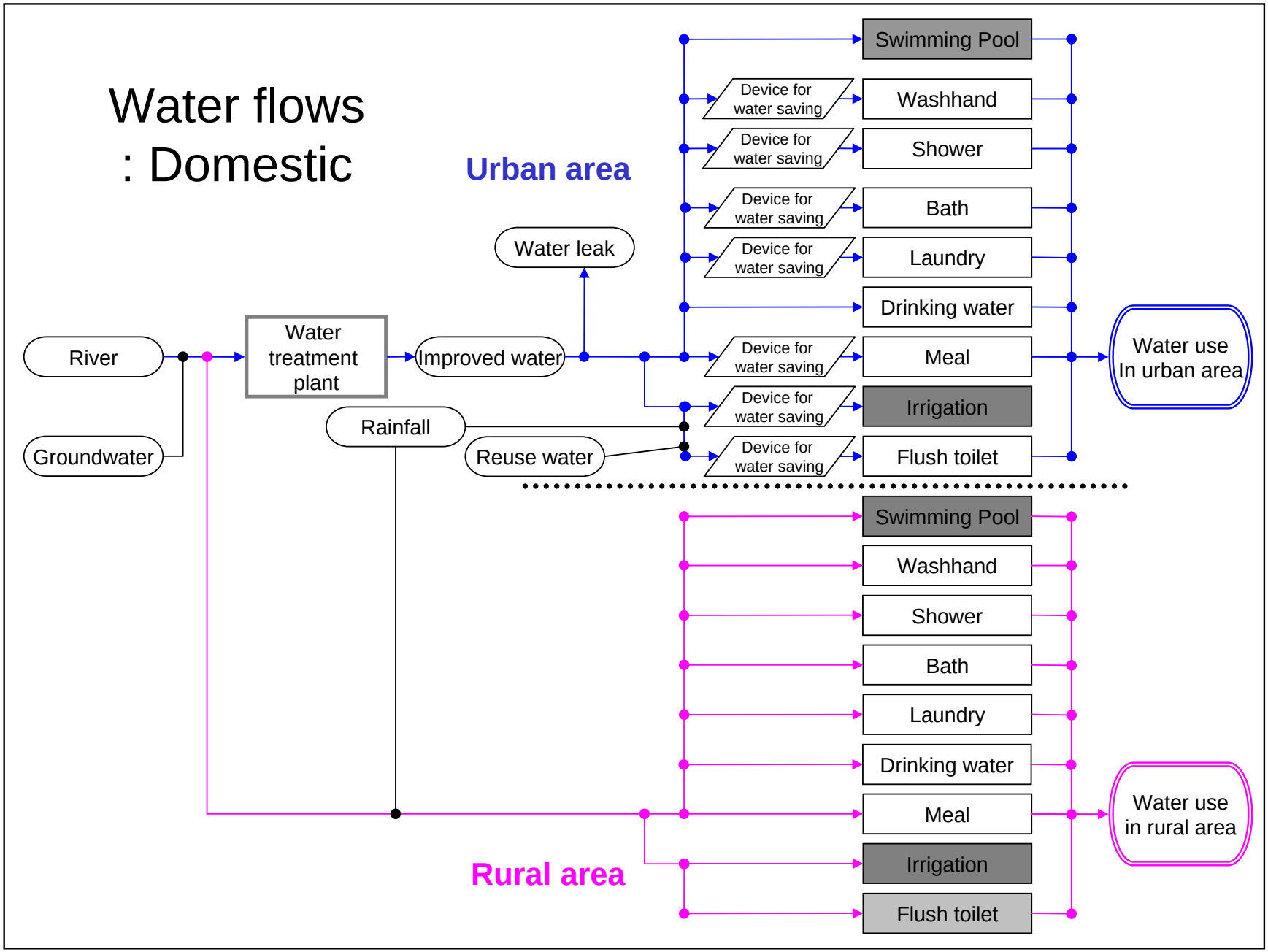
- Study area：Asia
- Level of model analysis：Watershed
  - ✓ Representing water stress distribution inside of countries
  - ✓ Modeling water quantity and quality flow between watersheds
- Watershed is divided into two areas : Urban and Rural area
- Water use model
  - ✓ Bottom-up model
  - ✓ Sectors : Domestic, Industry, Business, Agriculture
- Water flow process model
  - ✓ Water resources, water supply, water use, wastewater treatment
  - ✓ Water quantity and quality flow process, modeling wastewater reuse

Concept of Urban and Rural areas

- Differences between Urban and Rural areas
  - Population, materials and industry concentrate in urban area than rural area
  - Huge water use and pollution load are generated in urban area
  - Different water supply and sanitation systems
- Main water use in Urban area
  - ✓ Domestic, Industry, Business
- Main water use in Rural area
  - ✓ Agriculture

Water flow in a watershed



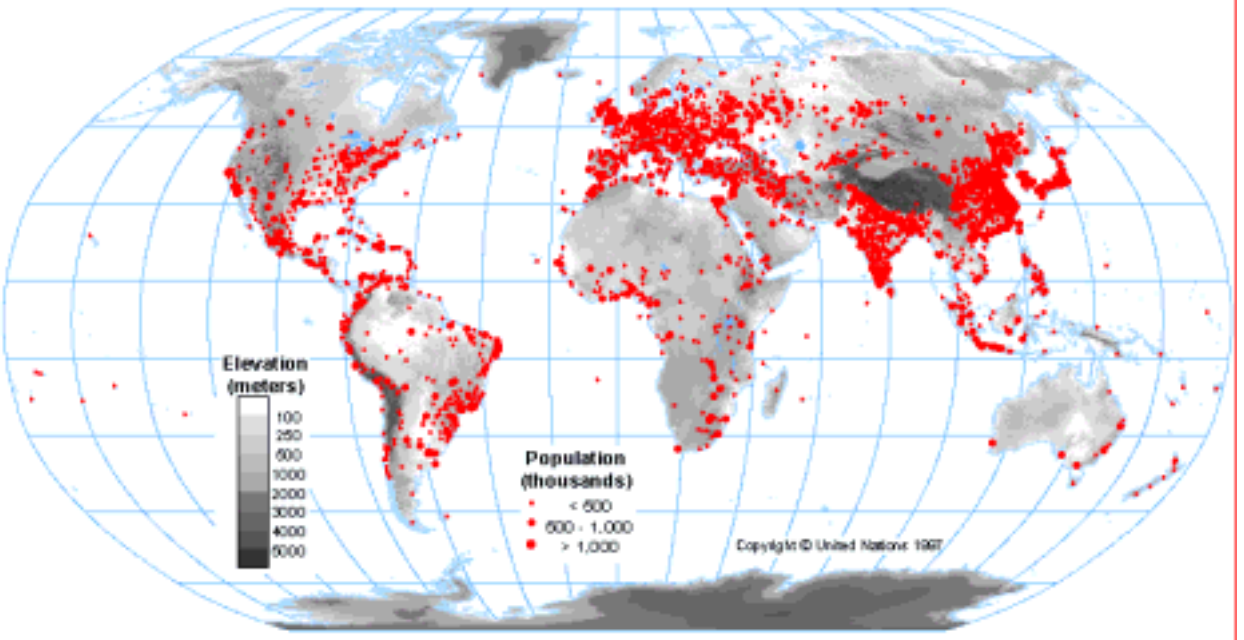

Water flows
: Domestic
Urban area
Water leak
River
Water treatment plant
Improved water
Groundwater
Rainfall
Reuse water
Swimming Pool
Device for water saving
Washhand
Shower
Bath
Laundry
Drinking water
Meal
Irrigation
Flush toilet
Water use In urban area
Rural area
Swimming Pool
Washhand
Shower
Bath
Laundry
Drinking water
Meal
Irrigation
Flush toilet
Water use in rural area

Input data

- Basic data
  - City location：UNSD, UNEP/GRID
  - Population：LandScan2000
  - Boundary of watershed：Hydro1k
  - Administrative region：UNEP/GRID
- Parameters for model analysis
  - Unit water consumption and pollutant load on each sector
  - Cost and technology information for water saving
  - Necessary water quality data for water use in each unit
  - Diffusion of water and wastewater treatment plant
  - Treatment ability by water treatment plant and wastewater treatment plant
  - Costs of construction and management by water treatment plant and wastewater treatment plant

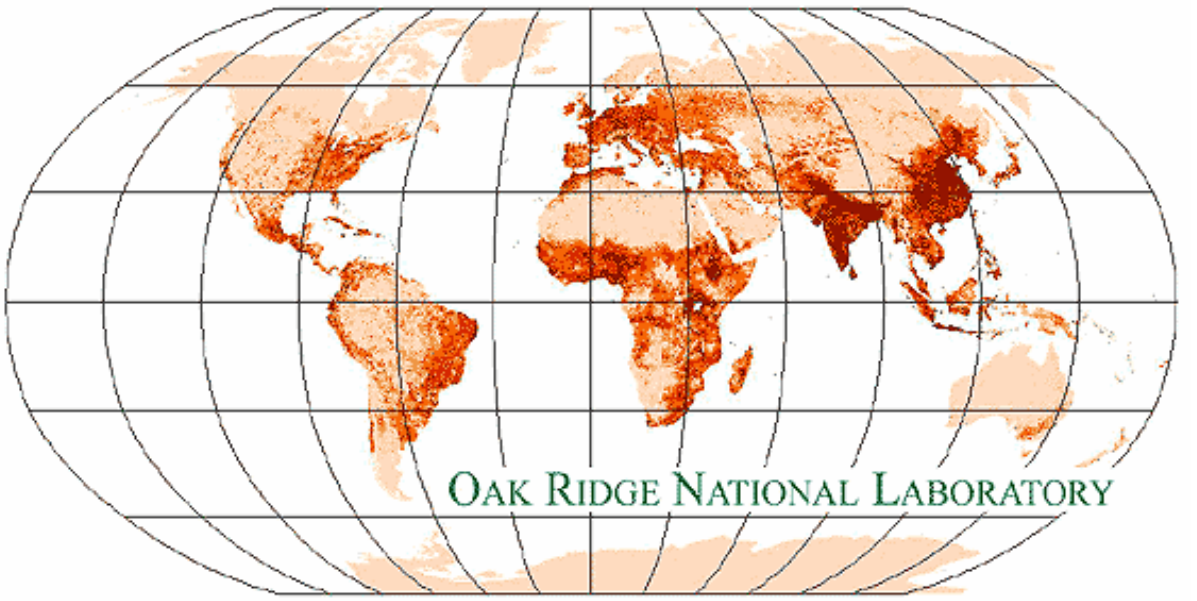
City location and population data (UNEP/GRID, UNSD)

- About 3000 cities in the world：Population of capital cities and cities of 100,000 and more inhabitants



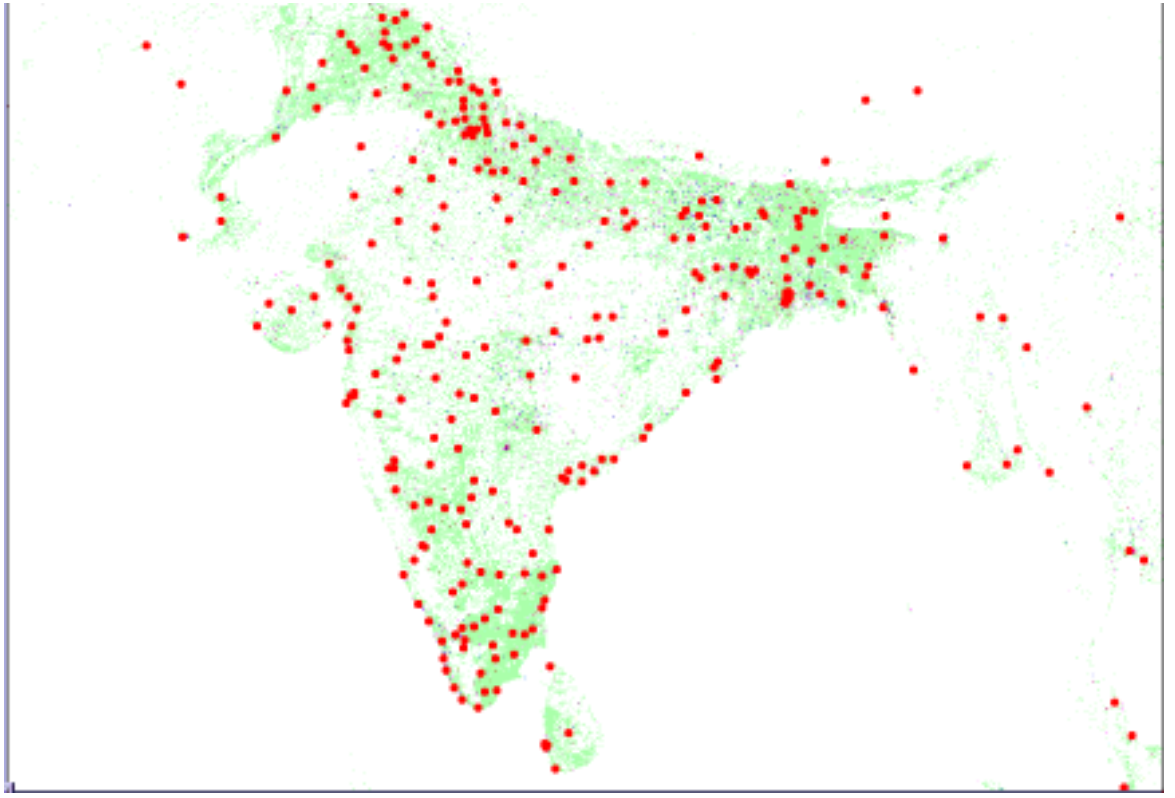
LandScan2000

- Estimated population data derived by Census data (Population), Land cover, Roads, DEM, Nighttime light data

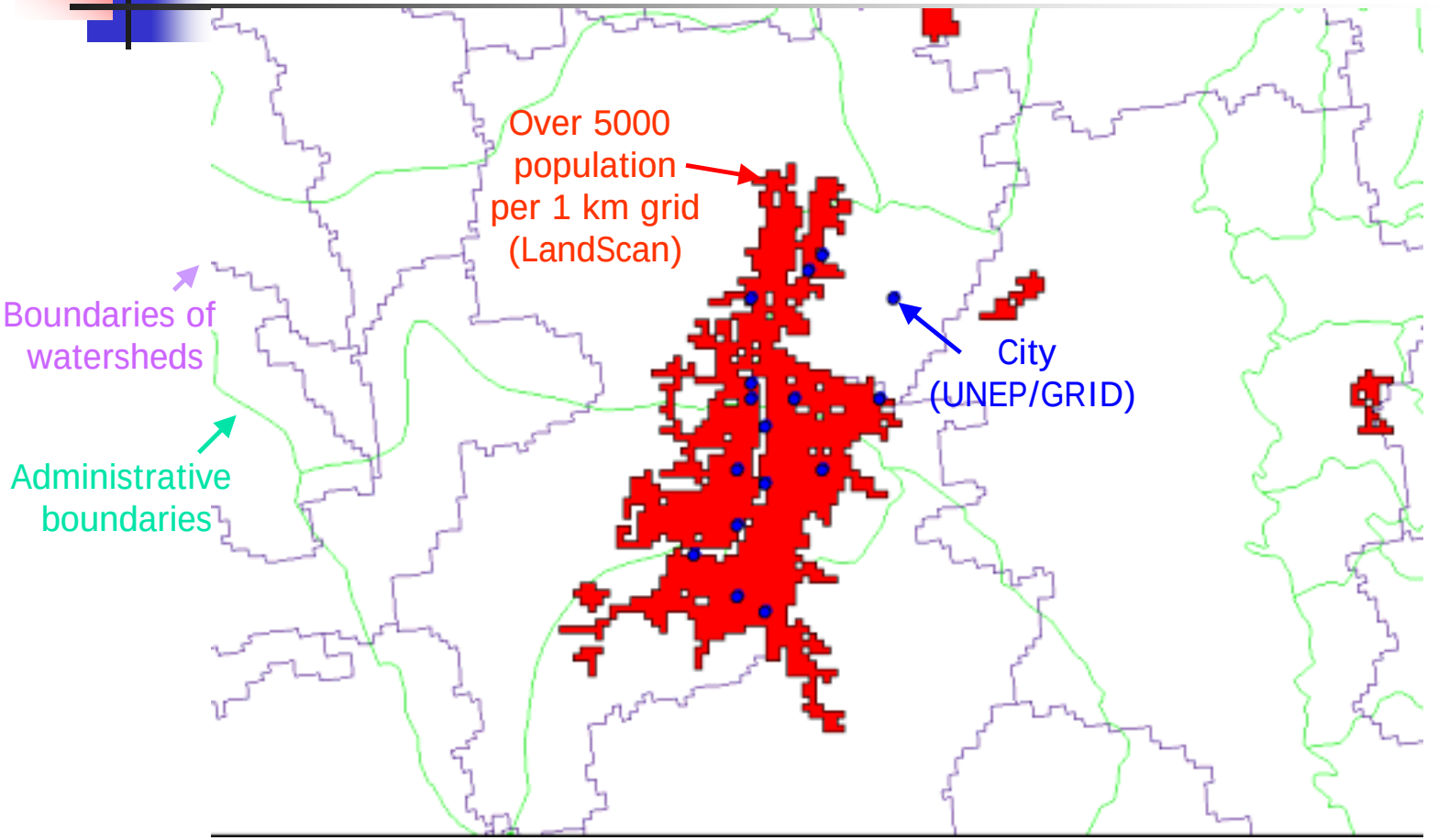


Overlaying LandScan and UNEP/GRID

- Change from rural to urban area



City, Watersheds, Administrative boundary, Population



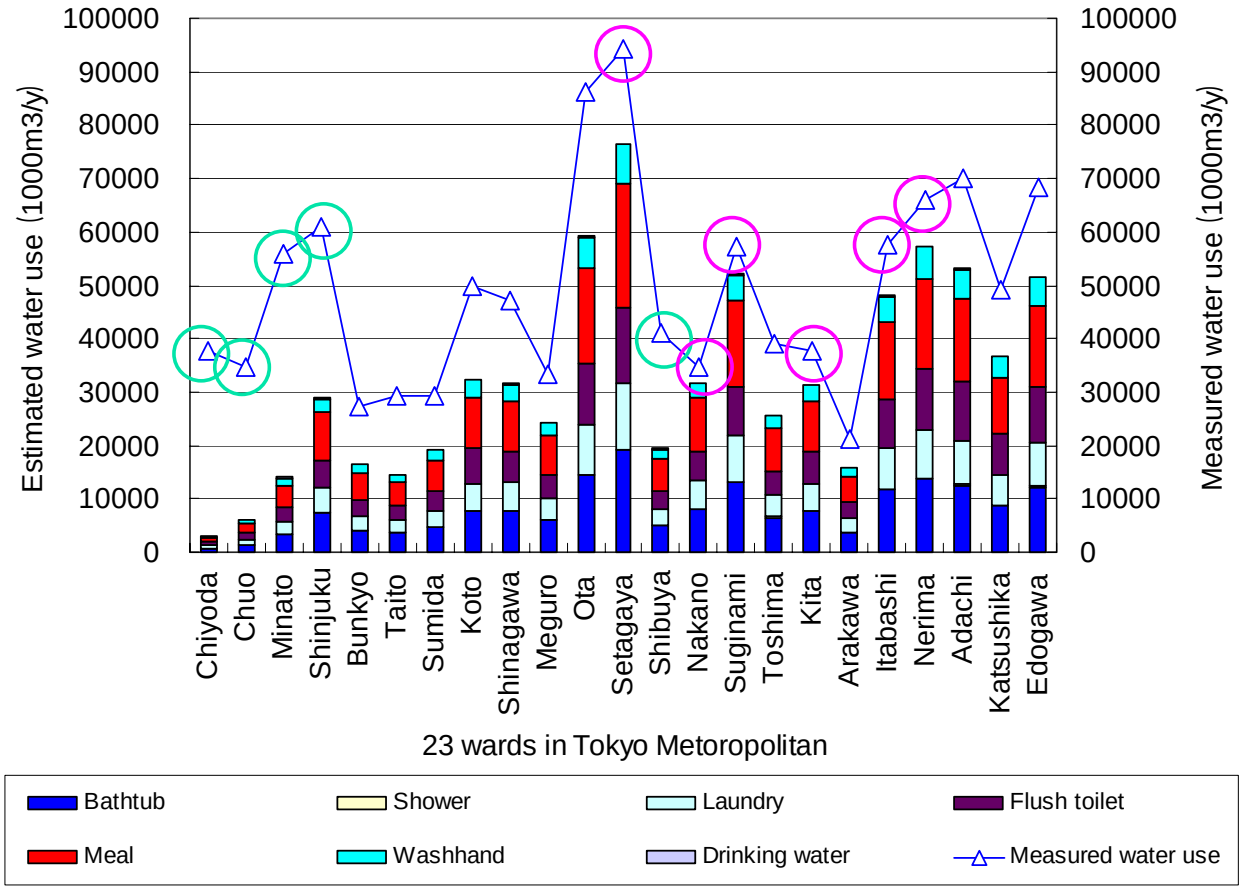
Analysis for treated water use in Tokyo 23 wards

- Tentative analysis on treated water use in 1997
  - ✓ Analysis on treated water use in domestic, industry, business
  - ✓ Statistical data is opened to the public on the Web
  - ✓ Long term series data is scarce
  - ✓ Detailed statistical analysis was carried out in 1997

Equation, unit consumption and parameters for domestic water use (JWWA, 1990)

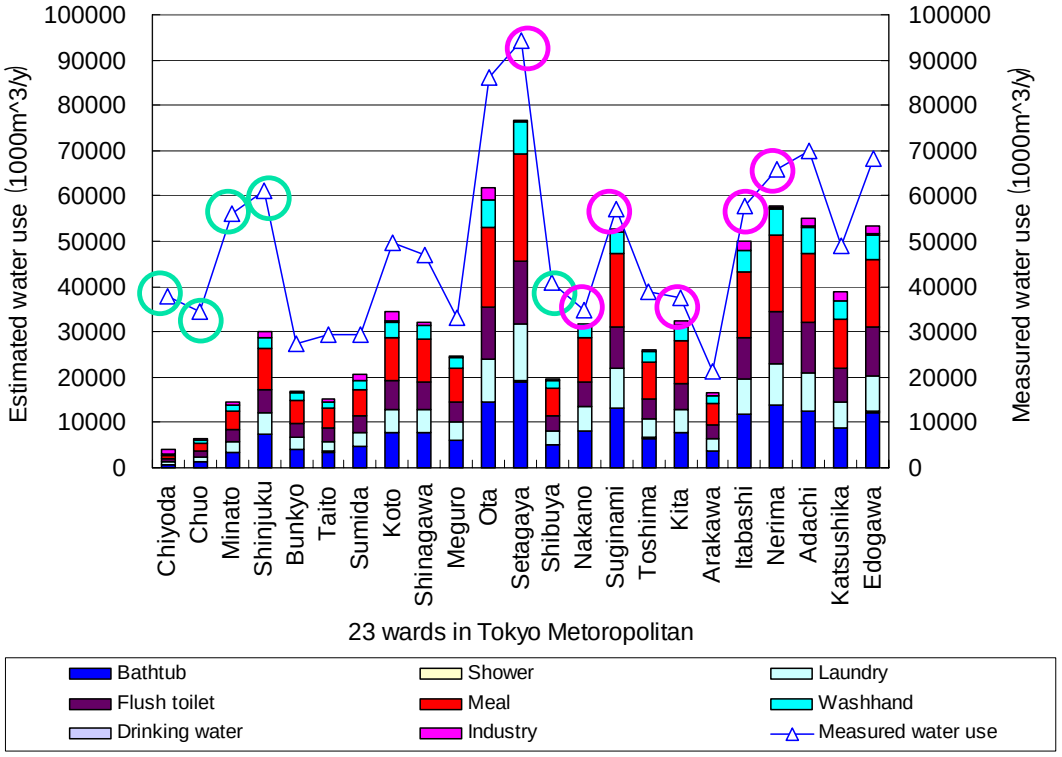
Unit [L/d]		=	Consumption	×	Diffusion of device [%]	×	Frequency [d]	×	Segment
Bath	bathtub	=	168 [L/h/d]	×	100 (bathtub)	×	0.85	×	Household [h]
	Shower	=	35 [L/p/d]	×	100 (shower)	×		×	Population [p]
Laundry		=	110 [L/h/d]	×	100 (Cloth washing machine)		0.85	×	Household [h]
Toilet		=	14 [L/p/d]	×	100 (Flush toilet)	×	3.5	×	Population [p]
Meal		=	160 [L/h/d]	×			0.85	×	Household [h]
Washhand		=	20 [L/p/d]	×			1.25	×	Population [p]
Drinking water		=	1.0 [L/p/d]	×			1.0	×	Population [p]

Result of water use for domestic in Tokyo 23 wards



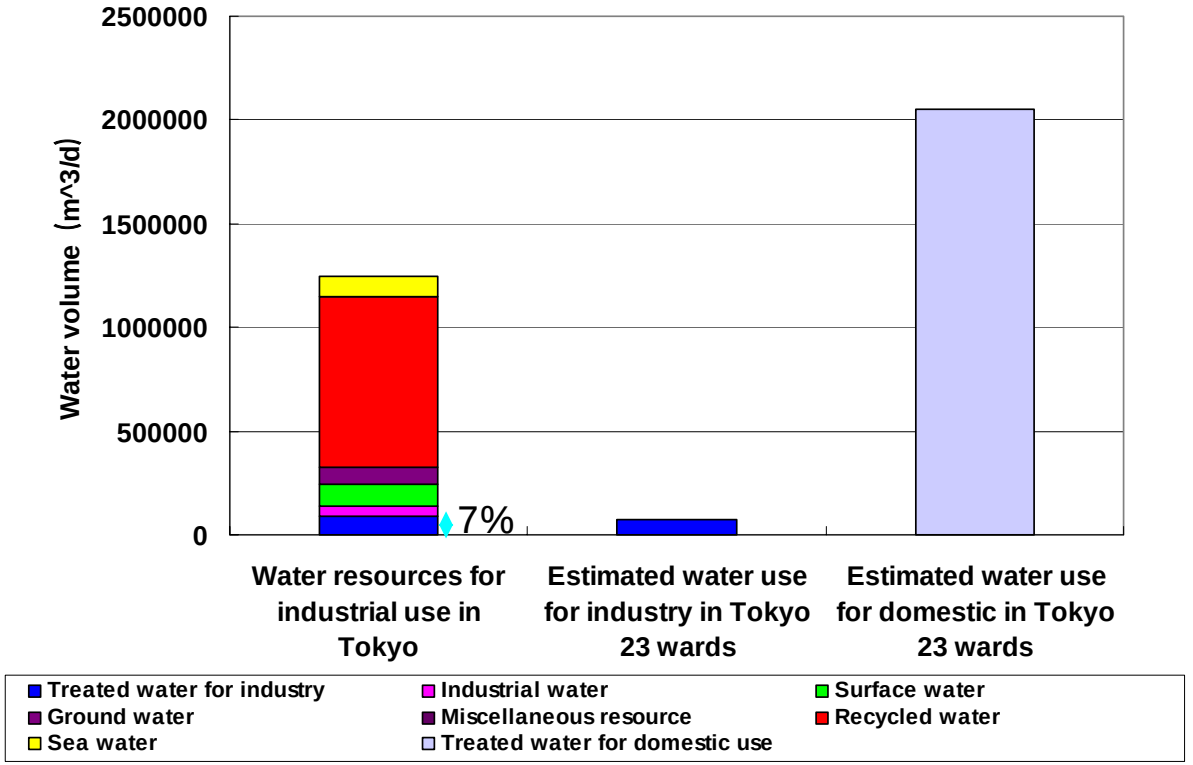
Result of water use for industry in Tokyo 23 wards

- Total treated water use for industry was allocated to each ward based on number of factories



Water resources for industrial use in Tokyo

- The proportion of treated water for industry in water resources is only 7 %

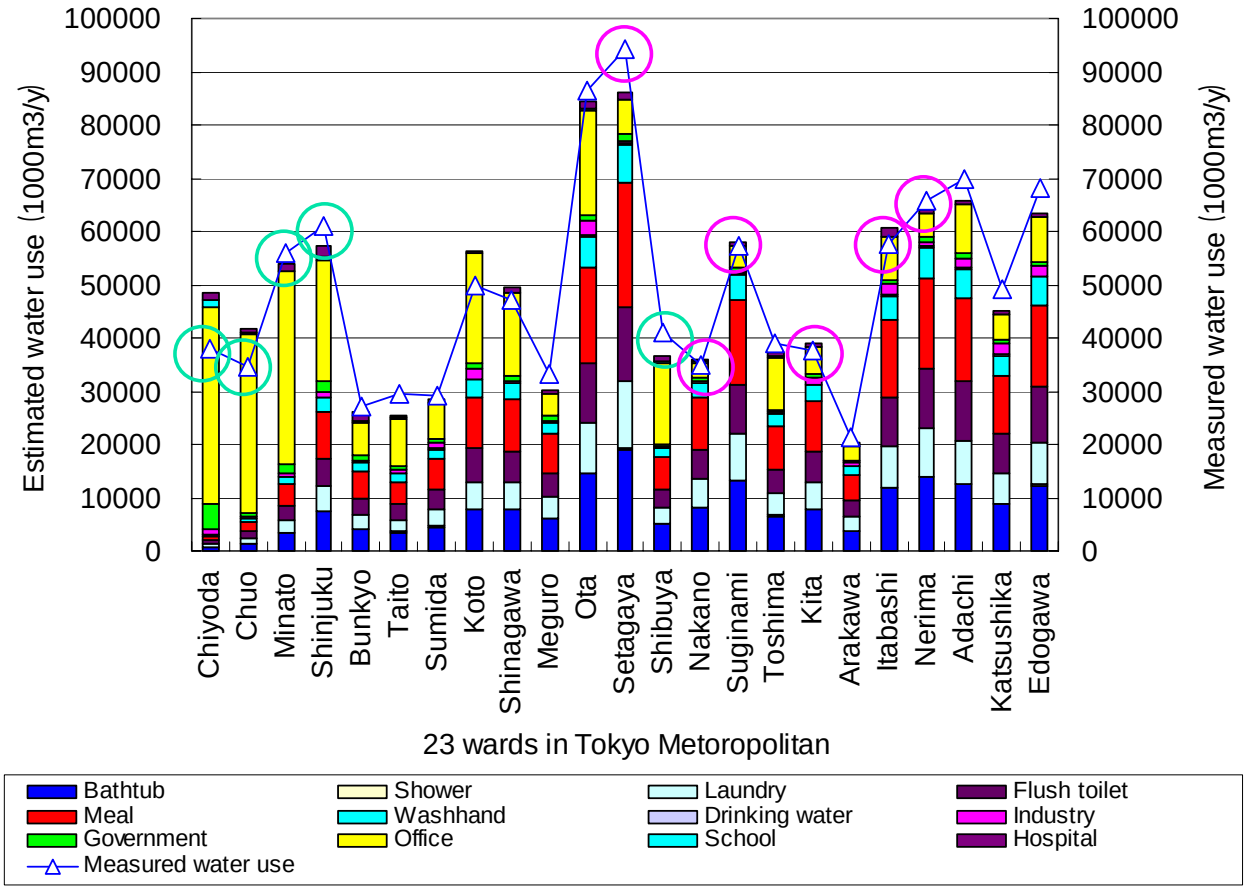


Calculation of water use for business in Tokyo 23 wards

Equation, unit consumptions for business water use (JWWA, 1990)

Unit [L/d]	=	Consumption	×	Segment
Government	=	150 [L/h/d]	×	Employee [p]
Office	=	65000 [L/ha/d]	×	Floor space [ha]
School	=	45 [L/p/d]	×	Teacher and student [p]
Hospital	=	640 [L/p/d]	×	Employee [p]

Result of water use for business in Tokyo 23 wards



Future Plan

- Input data collection for long-term period analysis
- Development of database for model parameters
- Application of water use analysis to another cities in Asia region
- Development of water flow process model
- Coupling water use model to water availability model
- Scenario analysis on environmental policy and investment strategies