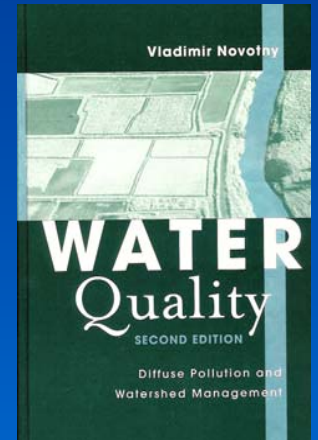
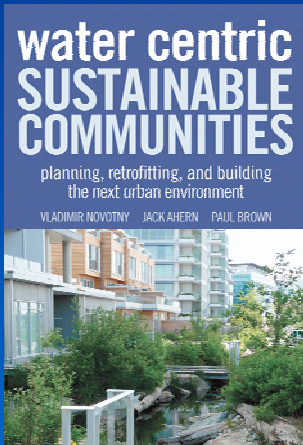


URBAN DRAINAGE AND STORMWATER MANAGEMENT IN JAPAN

© Vladimir Novotny

Supplement to Chapter 4 (*Water Centric Sustainable Communities*) and Chapter 8 (*WATER QUALITY: Diffuse Pollution and Watershed Management*)



TOKYO



TOKYO METROPOLITAN
GOVERNEMENT

SEWERAGE DEPARTMENT

Tokyo area = 543 km²

Population = 8,210,000

98 percent sewered

Annual rainfall = 1,500 mm

Average number of rainfalls = 90

SEWERAGE IN TOKYO



GOALS/HIGHLIGHTS OF THE DRAINAGE AND CSO CONTROL PROGRAMS IN TOKYO CARRIED OUT BY THE TMG-SEWERAGE DEPARTMENT

■ FLOOD CONTROL

- Provide flow capacities in urban streams for 300 mm/hr rain (3 year protection)
- Sewerage - 50 mm/hr

■ CSO CONTROL (in the initial stages)

- Detention basins at most pumping stations (basin capacities 5,000 to 20,000 m³)
- Outlet control strategy

■ INFILTRATION OF RUNOFF

- Runoff infiltration is wide spread but occasionally still meets resistance (see slide show)
- Permeable pavements and pavement blocks are being installed mostly on walkways. Coarse pavement (marginally permeable) is widely used primarily for noise control

Making Money on Sewerage

- TMG has been installing optical fiber cable in the sewers for remote control of pumping stations
 - The cables have 24 optic cables, TMG is anticipating that future capacity will be 100 optic cables par cable; however, they need only 8.
- Telephone company is interested in renting the remaining capacity
 - Cost of installation to TMG is \$1.5 / meter of the cable
 - Phone company is willing to pay \$12/meter for renting the unused transmission cable capacity.

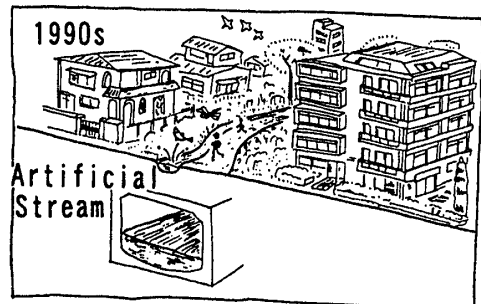
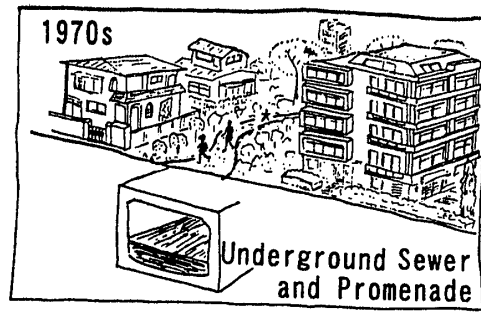
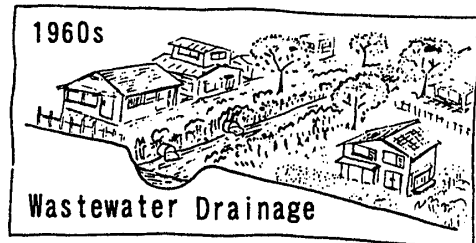
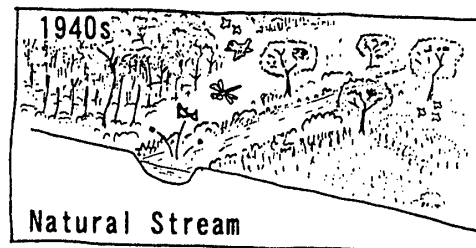
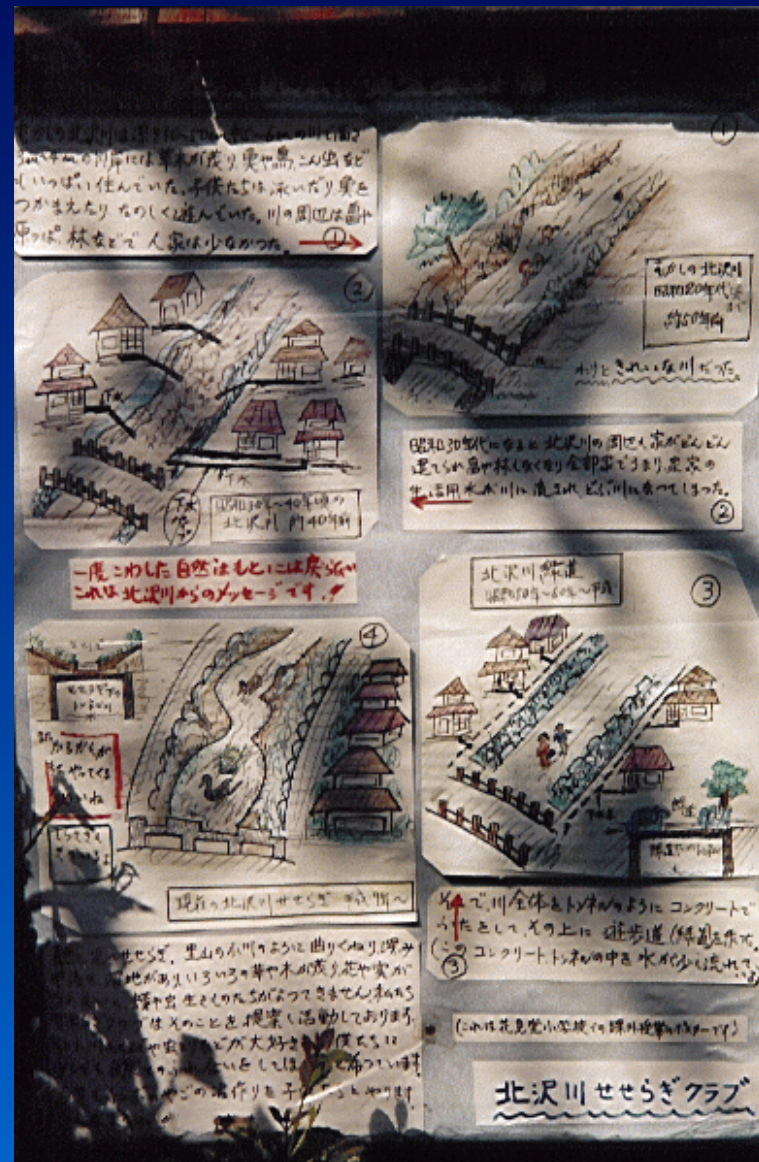


Figure 5. The history of Kitazawa Stream

KITAZAWA TWO STORIES RIVER





KITAZAWA RIVER

Watershed area = 10.5 km²

Population in the watershed
150,000

People's project

After the river was covered, mainly because of the smell of raw sewage, Tokyo Metropolitan Government answered the wishes of the population to restore the river.

Outcome = two stories river





To provide flow in the upper stream, TMG allocated about $0.02 \text{ m}^3/\text{sec}$ of highly treated (tertiary) effluent from a plant 11 km away.

The meandering channel was planted with water plants and flowers and even is stocked with fish.

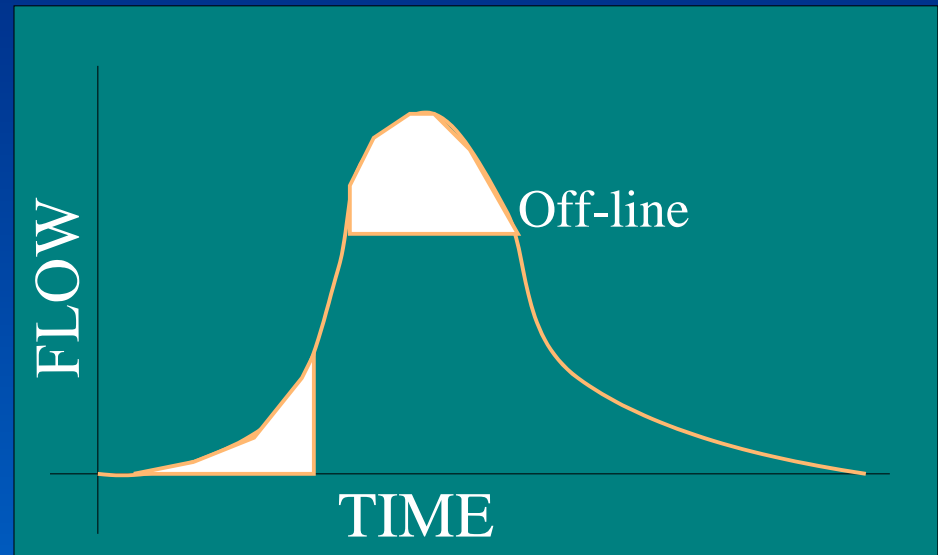


OFF-LINE STORAGE

Unlike in the US, Japanese engineers use almost exclusively off-line storage basins. Such basins have a limited water quality control benefits.

Because the urban areas in Japan are highly impervious, the present urban streams cause flooding several times per year.

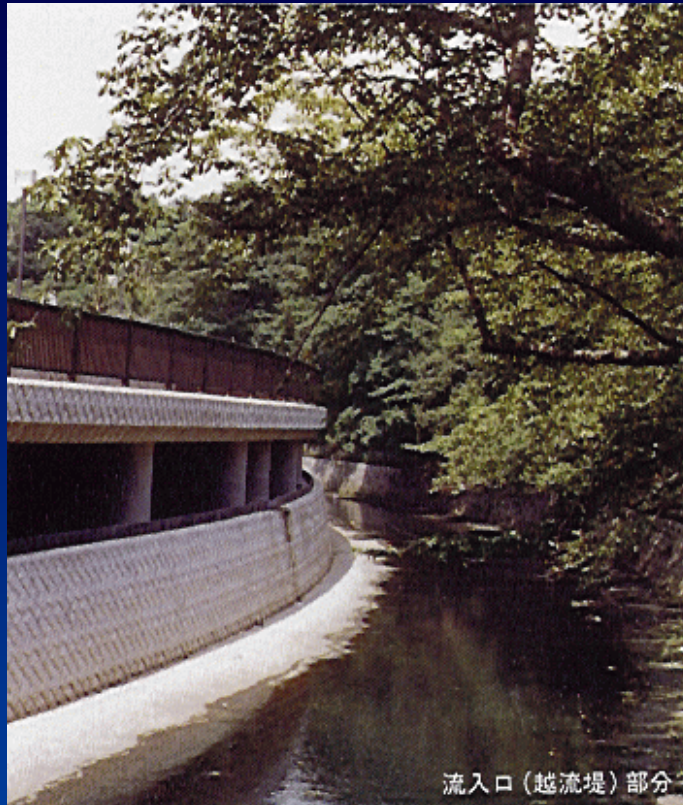
The goal of urban drainage planners in Tokyo is to provide 3 - year protection from flooding.



MYOSHOJI RIVER RESERVOIR

Two offline storage basins (one open - 30,000 m³ - the other underground - 100,000 m³). A place where storm water and living co-exist.





流入口（越流堤）部分



A side weir direct flood water from the river into a forebay storage that is needed to provide evacuation time for the people who might be in the open storage/recreation area.





Open Basin

The open basin is a playground/park setting adjacent to the condominiums.

Japanese people love streams/water. This artificial stream inside the basin recycles water inside the basin.



STORAGE IN DOWNTOWN



Surface storage (a small park near a “Water/drainage Museum-exhibit”)

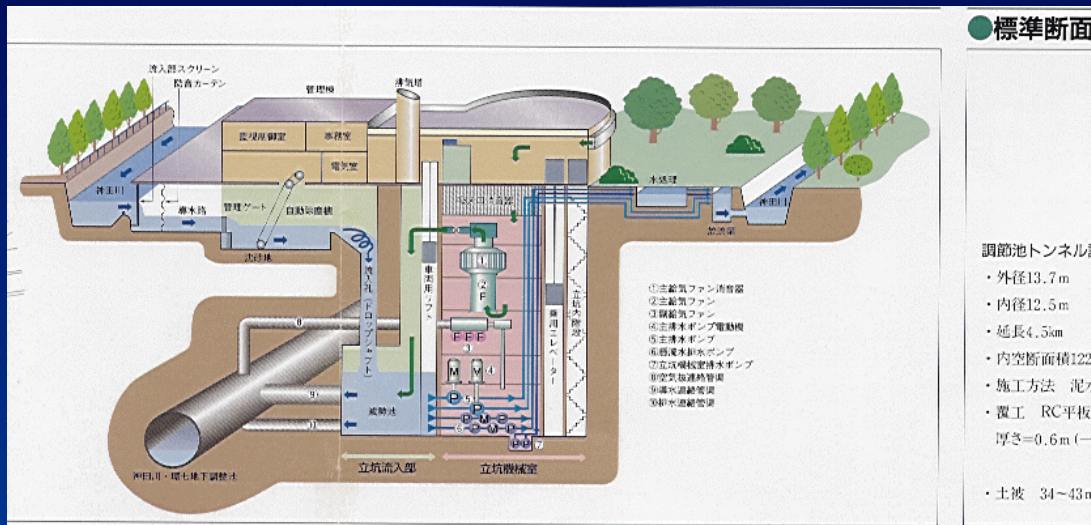
Flow energy dissipator



Underground storage

Visitors of the museum can see the basin through a glass window.
Overflow weir

UNDERGROUND RIVER



The 12 m dia “Deep Tunnel” (very similar to the one in Milwaukee or Chicago) is on average 40 meters below the surface. Its objective is to convey stormwater runoff overflow from a river. It is not designed to capture CSOs.



OFF-LINE RETENTION POND ON NEYA RIVER IN OSAKA



Off-line retention basins have minimal water quality control benefits.

Flood water overflowing Spill Levee on Sept. 3, 1989 following a heavy rainfall.



RITSUMEIKAN UNIVERSITY KYOTO - OTSU



Professor Yamada
and his students





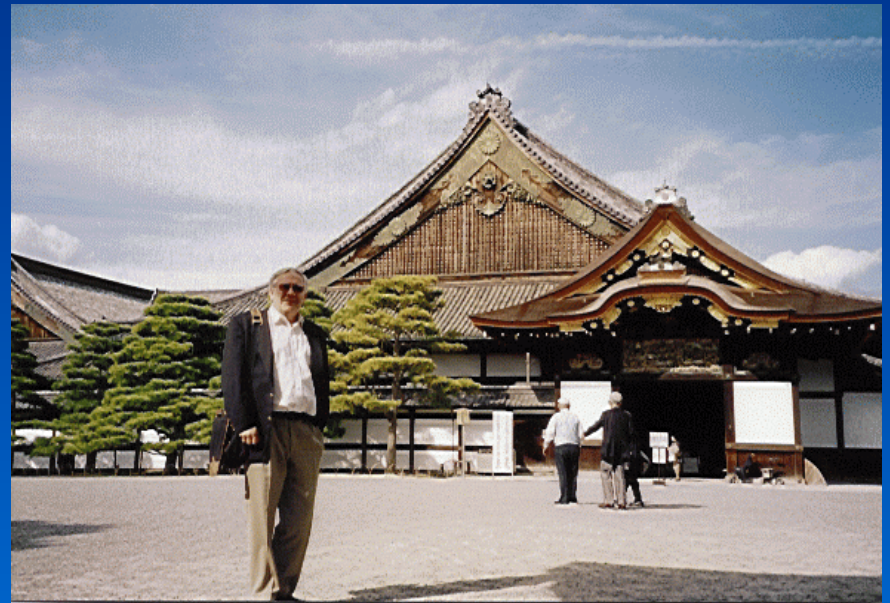
Diffuse pollution workshop at Ritsumeikan University, Kyoto
October 1999 (attendance over 100 professionals and students)



KYOTO

Ancient capital of Japan and one of the most beautiful cities (pop. 1.4 million)

Pagoda
Golden pavilion
Ninja castle





Japanese people love and enjoy water and food.

River in Kyoto, note the Stepping stone blocks that allow people to cross the river.

River flow diverted to a restaurant garden.



MORE OF KYOTO

Shrines and Ninjo Castle



OLD AND MODERN KYOTO

Old city



New modern train station with
Shinkansen (bullet train)



MOUNT FUJI





MORE MOUNT FUJI

Volcanic vents.

