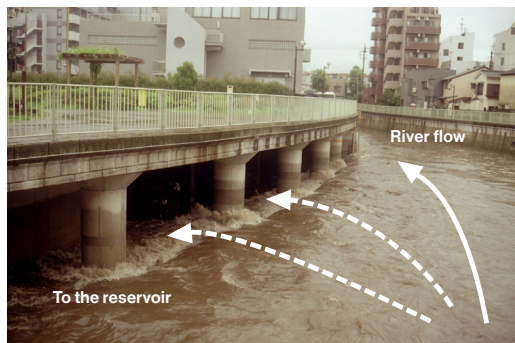


UTILIZING THE CITY'S UNDERGROUND SPACES TO PREVENT FLOOD DAMAGE

Japan employs underground spaces to ready urban areas for otherwise catastrophic flooding.



Massive underground spaces, such as this one, below the ring roads that run through major residential areas are critical elements of flood control in Tokyo.



Water from a rising river flows into an underground regulating reservoir instead of spilling over the banks of the levee.

Annual rainfall totals have been increasing worldwide in recent years, given the growing frequency of localized torrential rain, typhoons, hurricanes, and other extreme weather phenomena. Not only does the inundation of buildings and underground structures represent a danger to people living in highly developed urban areas in particular, but it also poses a grave threat to urban functions in general. Therefore, developing measures against flood damage is a pressing issue. The Japanese government considers national resilience—including disaster

Left: Shibuya is a popular spot among international tourists. Over 3 million people use the station every day. Right: New rainwater retention facilities have been constructed below the Shibuya Station area's underground commercial complexes.



prevention and mitigation, such as flood control—a central element of its policy, and is moving ahead with both public and private initiatives.

Tokyo, one of the world's foremost metropolitan areas, is making use of underground spaces in the fight against flooding. One example is the underground regulating reservoir being constructed to prevent overflow from small and medium-sized rivers. When heavy rain causes a river's water level to rise, water flows from a weir built into a revetment down into the reservoir, thus reducing the amount of water flowing downstream. So far, 28 such facilities have been constructed, collectively holding a total of 2.56 million m³ of water.

One massive reservoir has been built under a major ring road that runs around central Tokyo. When a typhoon dropped record rainfall of up to 32 mm per hour on Tokyo in 2019, the reservoir retained about 490,000 m³ of water, or 90% of its total capacity. Estimates indicate that it lowered water levels downstream by up to 1.5 m. "We have systematically developed river facilities such as this reservoir, which have helped to prevent massive flood damage," says Director ODANAKA, from the Tokyo Metropolitan Government (TMG)'s Bureau of Construction, with conviction. The reservoir is currently undergoing expansion. Eventually, it will be able to compensate for localized heavy rainfall coming down at up to 100 mm per hour.

Life-saving flood control countermeasures are also being implemented in the area around Shibuya Station, one of Tokyo's most well-known and popular sightseeing spots. Since the land around the station is slightly lower than the surrounding area, the underground malls used to be prone to flooding. However, as part of a massive redevelopment project in the area that is currently underway, a new rainwater storage facility with a capacity of 4,000 m³

was completed underneath the station's east exit, and went into operation in August 2020. It temporarily retains rainwater if the rainfall exceeds a certain amount, and the water drains out through sewer pipes when the weather returns to normal. Director OKUDA, from the TMG's Bureau of Sewerage, said, "Combined with the facility previously built underneath the station's west exit, our storage system can now hold a total of 8,000 m³ of water. Shibuya has evolved into an even safer urban area."

Many other efforts to save lives from flooding are also being made across Japan, including the construction of levees and detention basins, as well as the refinement of heavy rain forecasts. A further example of Japan's inundation prevention measures is the use of dams for hydropower and irrigation to control flooding. To prepare for this year's Olympic and Paralympic Games Tokyo 2020 and beyond, Japan is advancing the development of national land infrastructure that is resilient to natural disasters. ●

In order to prevent floods in downstream areas when heavy rain is predicted, such as during typhoons, the national and prefectural governments have established a system to discharge a certain amount of dam water in advance.

