[研究論文]

Japan's First Urban Water Disaster: The Great Kanto Flood of 1742

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(1) Introduction

Late in the summer of 1742, two typhoons coming in rapid succession brought massive rains to central and eastern Japan and flooding around major rivers. In central Japan, the Chikuma River flooded as it made its way through the mountains of Nagano Province. In the Kanto region, the Tone, Ara, and smaller rivers, already under pressure from an unusually long rainy season, burst their banks. Homes and farmland were flooded, river traffic was disrupted, irrigation channels were damaged, river embankments were broken, and bridges were washed away. Water surged across the Kanto Plain into the city of Edo, Japan's political capital and its

largest city, submerging the densely populated low-lying areas of the city. From beginning to end, the disaster was reported to have taken the lives of some 20,000 people, including perhaps 6,000 in Edo.

At the time of the Great Kanto Flood, water disasters had become a chronic problem in many regions of Japan. Because of their relatively short length, steep incline, and fast flow, Japanese rivers are prone to overflowing, especially during the rain and typhoon seasons of summer and early autumn. For this reason, Japanese people have long lived with floods, especially in the relatively small alluvial plains created by sediment deposits from overflowing rivers: the Kinai Plain (around Osaka-Kyoto), the Nobi Plain (west of Nagoya), the Echigo Plain (around Niigata) and, from the Edo period, the Kanto Plain. However, the scale of damage increased as a result of the burst of development that followed the establishment of the Tokugawa bakufu in 1603. In order to increase agricultural productivity and to meet the needs of a growing population, governments, merchant developers, and local communities engaged in aggressive land clearing, turning mountainsides, river valleys, and flood plains into farmland and settlements. To meet the particular demands of rice cultivation, they changed river courses and created new ones, dammed and dredged streams, and built irrigation ponds.

The effects were evident by the turn of the 18th century, with the increased incidence of flood damage, particularly in the flood plains of major rivers. Although new development was not entirely abandoned, government and community attention shifted to the more pressing problems of flood control. River work changed from

one-time modification of river courses or construction of irrigation channels to ongoing levee repair, stream diversion, and retarding basin construction aimed at mitigating water damage. Large-scale flood control works were conducted almost annually along major rivers, notably the Tone and Arakawa Rivers in the Kanto region and the Kiso, Ibi and Nagara in the Nobi Plain.

Like other floods of Japan's early modern era, the Great Kanto Flood of 1742 stemmed from a combination of physical characteristics and the human record of development during the Tokugawa, or Edo era (1603-1867). But within that general historical trend, it was distinctive. In terms of scale, it was the single most destructive flood to strike Japan in the early modern era and the first major assault on Edo, Japan's political capital and a city of some one million residents. It drew attention to the enormous river engineering achievements that had fostered the growth of Edo and the surrounding Kanto region, while at the same time warning starkly of the city's vulnerability. It thus demonstrated the risks of development and the limits of the flood control measures that had been put in place, underscoring the vulnerability of both rural and urban populations.

The Tokugawa bakufu's actions in the aftermath of the flood followed the pattern it had already developed: immediate relief for victims followed by large-scale river cleanup and embankment repairs, conducted with the help of daimyo from unaffected regions. The work was expensive, exhausting, and ultimately unsuccessful in protecting against future calamity. Floods continued to inflict damage in Edo and its surrounding villages until well into the

modern era.

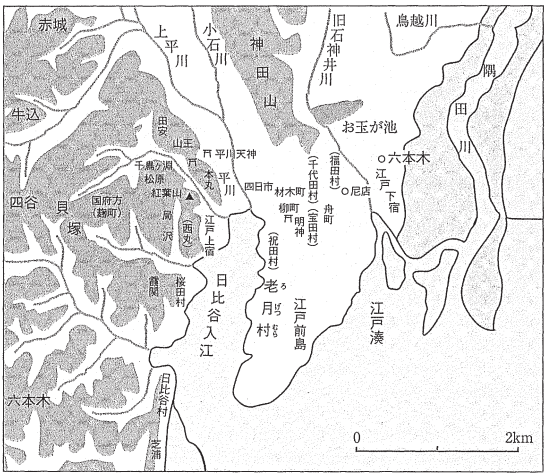
This paper aims to clarify the physical and social characteristics of the Great Kanto Flood of 1742, with a focus on its origins its and impact on Edo. It examines the urban and regional waterways development that supported Edo's emergence, the events of the flood from Osaka to Edo, and the response of the Tokugawa government. It concludes with some comments on the content and limitations of river management and flood control in Japan's largest urban area.

(2) Developing Edo Waterways in the 17th Century

Edo's particular susceptibility to floods stemmed from both its physical characteristics and the urban development policies promoted by the Tokugawa shogunal government. When Tokugawa Ieyasu established his capital in Edo in 1590, it contained little more than a dilapidated castle and a few hundred families living in the marshlands that lined Edo (now Tokyo) Bay.[1] Located on the southeastern edge of the Kanto Plain, Japan's largest lowland, Edo and its environs were crisscrossed by numerous large and small streams that meandered their way across the plain to the Pacific Ocean. Hibiya Inlet cut into the town in such a way that Edo Castle was close to the waterfront; much of the area around present-day Nihonbashi was under water (see Chart 1). To the north and east of the bay, heading towards what is now Chiba Prefecture, marshy lowlands formed the mouths of the Sumida, Tone, and Watarase rivers. Small islands interspersed, and sandbars lined both sides of the Sumida River. Mount Kanda (present-day Surugadai)

dominated the landscape. Despite the abundance of waterways, transportation networks were undeveloped, and there was no ready supply of drinking water.

Chart 1: Edo in 1590



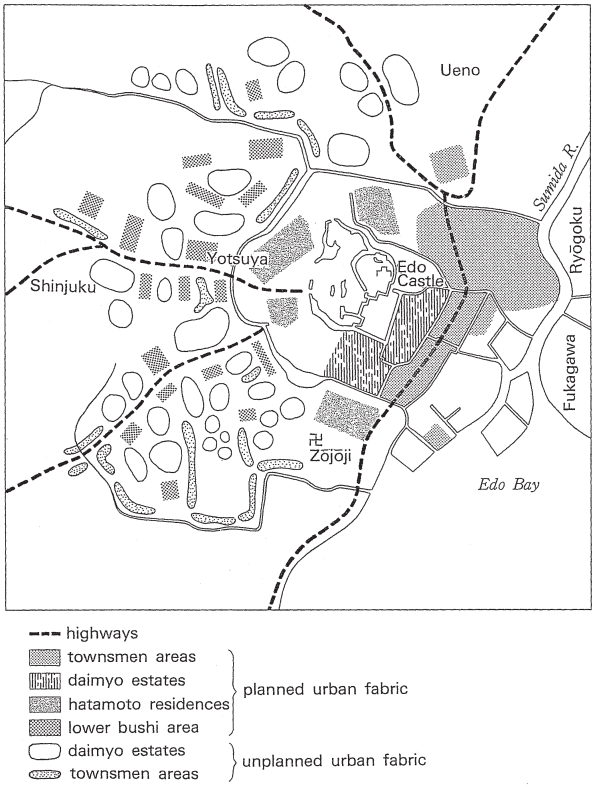
Source: Suzuki Masao 鈴木理生 , *Suupaa Bijuaru Edo・Tokyo no chiri to chimei* スーパービジュアル版 江戸・東京の地理と地名 (Nihon Jitsugyo Shuppansha, 2006), 6.

A series of land reclamation and waterway projects ordered by Tokugawa Ieyasu and his successors turned this marshy land into the city of Edo. Civil engineers drained swampy land around the bay, leveling Mount Kanda to supply soil and rocks for filling the marshes at Hibiya Inlet. They laid out plans for residences, warehouses, shrines, and temples, and brought drinking water in wooden pipes from the Kanda River in the west. They constructed canals for transportation within the city and built the Tokaido highway as the first step in a national road system. After the

Tokugawa bakufu was founded in 1603, Edo exploded into massive growth as the capital of the new regime. By 1610 it was reportedly a clean, well-organized city of 150,000 people.

Especially after the *sankin kotai* system of enforced residence developed in the 1630s, daimyo families established their Edo residences and offices, prompting further land clearance and

Chart 2: Residential Layout of Edo

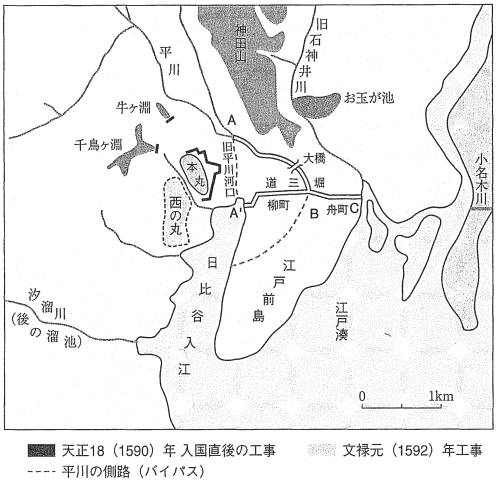


Source: Hidenobu Jinnai, "The Spatial Structure of Edo," in Nakane Chie and Oishi Shinzaburo, eds, *Tokugawa Japan: The Social and Economic Antecedents of Modern Japan* (Tokyo University Press, 1990), 141.

construction.[2] And as the samurai population grew, so, too, did the numbers of townspeople who earned their living selling food and other services. Samurai occupied primarily the hilly or *yamanote* area to the north, west, and south of Edo Castle. Merchants, craftsmen and ordinary residents lived in the so-called low area, or *shitamachi*, on both sides of the Sumida River, which had grown out of the reclamation activities along Edo Bay. By the turn of the 18th century, Edo was a city of 1,000,000 people. It had replaced Kyoto as the political, military, cultural capital of Japan, and was probably the largest city in the world (Chart 2).

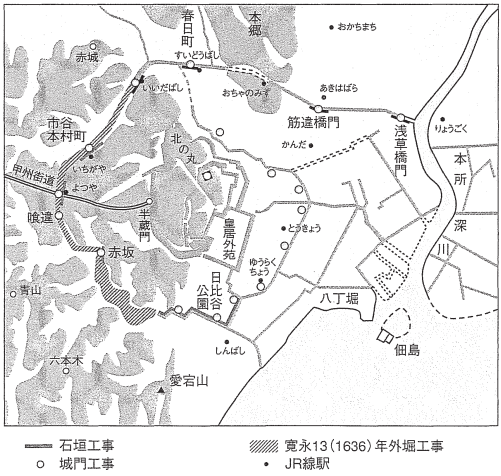
A crucial element in the Tokugawa bakufu's efforts to enhance economic development and flood protection was the re-making of Edo's waterways, particularly along the bay. For example, Ieyasu's development of the area close to Edo Castle began with the digging of Dosanbori, a channel that ran east from the castle for about 1.25 kilometers (Charts 3a and 3b). Two small rivers, the Hira and Koishi, which originally flowed into Hibiya Inlet, were diverted away from the inlet to join the canal, where they formed the Kanda River. The Kanda emptied directly into the Sumida River at Ryokoku, reaching the ocean on the far eastern section of Edo Bay. Linking the Kanda with the Sumida allowed transportation of food and supplies to the castle and excavated earth to fill in Hibiya Inlet. At the same time, diverting the smaller rivers away from the inlet served to protect the castle surrounds from their frequent overflowing. The result was a new urban district close to Edo Castle that could be used for daimyo residences, water storage, and construction of an outer moat.

Chart 3a: Construction of Dosanbori (c. 1590)



Source: Suzuki Masao 鈴木理生 , *Suupaa Bijuaru Edo・Tokyo no chiri to chimei* スーパービジュアル版 江戸・東京の地理と地名 (Nihon Jitsugyo Shuppansha, 2006), 7.

Chart 3b: Filling Hibiya Inlet (1607)



Source: Suzuki Masao 鈴木理生 , *Suupaa Bijuaru Edo・Tokyo no chiri to chimei* スーパービジュアル版 江戸・東京の地理と地名 (Nihon Jitsugyo Shuppansha, 2006), 7.

Further east along the bay, the need to accommodate a growing commoner population while enhancing the transport of goods encouraged successive rounds of land reclamation and river engineering. Small islands at the mouth of the Sumida River were reclaimed to form Tsukuda and the present-day Etchujima area, and development continued along the lowlands in what are now Tokyo's Eto and Edogawa wards. A canal was built to link the Sumida, Naka, and Edo rivers horizontally, allowing the shipment of food and necessaries in the city. To protect from flooding, large embankments were built along the upper reaches of the Sumida River as a way to hold floodwater in the area of rice paddies along the river and prevent it from rushing down the waterway and inundating the city.

(3) River Re-Engineering in the Kanto Region: The Eastern Diversion of the Tone

Beyond the immediate urban area, river work in the broader Kanto Plain supported the Tokugawa bakufu's plan for development. The most important was the diversion of the Tone, Edo's largest river and the foundation of a multi-river network that connected Edo with the northern Kanto region. The Tone River rises in the Echigo mountains that form the border between Gunma and Niigata prefectures. Connecting with major tributaries such as the Agatsuma, Watarase, Kokai, and Kinu, the Tone today flows south, then east, crossing the Kanto Plain before it reaches the Pacific at Choshi in Chiba Prefecture. It is Japan's second longest river (322 km) and has the largest catchment area (16,840 km2), extending

across five Kanto prefectures (Saitama, Chiba, Ibaraki, Tochigi and Gunma) as well as Tokyo Metropolis.[3] The Ara River is smaller: 169 km long, with a catchment of 2,940 km2. It rises in Mt. Kobushi at the intersection of Saitama, Nagano, and Yamanashi prefectures, flows south east through the Chichibu mountains and the Kanto

Chart 4: The Tone and Ara Systems Today

Source: Japan Water Agency
www.water.go.jp/honsya/honsya/english/jwa_ta/map1.html

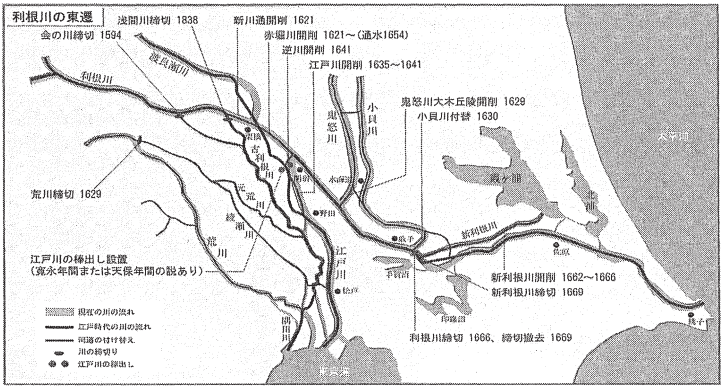
Plain before reaching Tokyo Bay at the boundary of Edogawa and Eto wards. The Sumida River branches off from the Ara at Iwabuchi in Tokyo's Kita Ward, before flowing 23km south through Asakusa and Ryokoku into Tokyo Bay closer to the center of the city in Chuo Ward.

The current river system is, however, the product of 17th century river engineering.[4] At the time of Ieyasu's arrival in Edo, the Tone and its major tributary, the Ara, flowed into the northern section of Edo Bay. The Tone was unconnected to its current Watarase or Kinu tributaries. However, just four years after he made Edo his capital and almost a decade before he had become shogun, Tokugawa Ieyasu ordered the first stage of what was to be a major restructuring of the Kanto Plain river network: separating the Ara from the Tone and diverting the Tone eastward so that it flowed not into Tokyo Bay but directly into the Pacific Ocean at Choshi in present-day Chiba Prefecture.

The operations were complex and time-consuming. In 1594, Ieyasu's engineers closed off a small loop in the Tone, near what is now Hanyu City in Saitama Prefecture, diverting the water to a small river, the Asama, that formed the eastern side of the loop. In 1621, they created an 8km channel that connected the Asama to the Watarase River, again to the east. The Watarase thus became a tributary of the Tone. A series of further channels linked the Tone and Watarase to the Hitachi and Kinu rivers, through which the Tone reached the Pacific Ocean at present-day Choshi in 1654. The original lower section of the Tone, re-worked as the Edo River, continued to flow into Tokyo Bay. Already in 1629, the Ara had

been separated from the Tone, allowing it flow into Edo Bay as an independent river.

Chart 5: The Eastern Diversion of the Tone River



Source: Koekishadanhojin Doboku Gakkai Suikogaku Iinkai 公益社団法人土木学会 水工学委員会 , ed., *Nihon no kawa to kasen gijutsu o shiru - Tonegawa* 日本のかわと河川技術を知る～利根川（Koekishadanhojin Doboku Gakkai）, 2012, 37.

Although the specific aims of this 60-year Eastward Transfer Project are unclear, the promotion of agricultural development and regional transportation in the northern Kanto region were major objectives. Flood control was also an important consideration. Shifting the Tone delta out of Edo Bay promised to reduce the volume of water hurtling into Edo during the high rainfall season, while the separation of the Ara from the Tone had the effect of taming their combined turbulence. Meanwhile, levees newly built or strengthened in key areas offered the hope of flood protection for lower Kanto villages and Edo itself. Of crucial importance were reinforcements to the Chujo Levee located near Kumagaya, in present-day Saitama Prefecture (Chart 6). Built in medieval

times, the Chujo Levee was part of a flood protection system that used levees in key places combined with overflow basins (rather than an unbroken line of dykes) to direct flood waters safely into an overflow area.[5] The Kanto rivers were thus reorganized in an ambitious network that facilitated transportation and agricultural development, promoting close economic and human ties across the region while aiming to secure protection against floods. By the end of the 17th century, Edo was the center of a broader regional economy that supported the growing numbers of people who lived and worked across the Kanto Plain.

(4) Floods in the Kanto Region

Despite extensive flood control measures, the dangers of flooding were not easily avoided. Reflecting a trend seen across Japan, flooding emerged as a chronic problem in the increasingly densely populated lower Kanto Plain. Although the *Tōkyō shishi kō* and other historical compilations list water disasters from the early Edo era, their scale and frequency intensified from the late 17th century (Table 1). As elsewhere in Japan, flood vulnerability peaked from late summer to early autumn. In some cases, the cause was a single, particularly strong typhoon that carried torrential rain. More often, an unusually rainy season or a succession of typhoons steadily raised water levels on the Tone, Ara, and other Kanto rivers until they reached a point at which another bout of rain was more than the rivers and their flood control systems could contain.

Table 1: Major Floods in Edo, 1680-1856

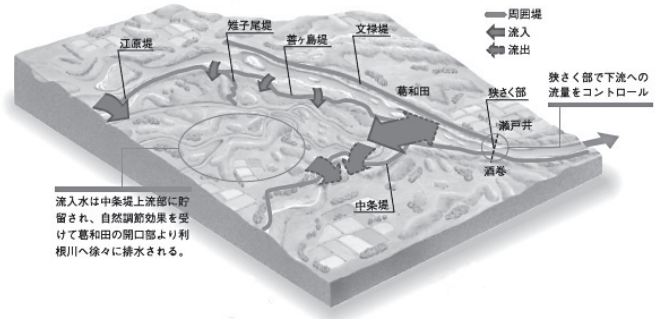
Year	Month (Old Calendar)	Rivers Flooded	Major Levee Failure	Key Areas
1680	8	Sumida		Edo Castle; Tsukiji, Honjo, Fukugawa, Asakusa
1704	7-8	Tone, Arakawa	Sarugadono	Honjo, Fukagawa, Asakusa, Kasai
1721	7i-8	Tone, Sumida Watarase	Chujo	Honjo, Fukagawa, Senju
1723	8	Tone	Chujo	Fukagawa, Asakusa, Oshi
1728	8-9	Tone, Ara, Edo, Sumida, Kanda	Sarugadono	Widespread damage
1735	8	Tone, Ara, Sumida, Tama		Asakusa, Senju
1742	8	Tone, Ara, Sumida, Edo, Kanda, Tama	Chujo	Widespread damage
1749	8	Tone, Ara, Edo, Kanda, Sumida		Ushigome, Koishikawa, Asakusa, Shitaya
1780	6	Tone, Ara, Watarase		Honjo, Ryokoku.
1786	7	Tone, Ara, Sumida, Edo	Chujo	Widespread damage
1791	8-9	Tone, Sumida, Watarase	Chujo	Widespread damage along Edo Bay
1802	6-7	Tone, Ara	Chujo	Honjo, Fukagawa, Kasai
1846	6	Tone, Ara, Edo, Tama, Watarase		Honjo, Fukagawa, Katsushika, Asakusa
1856	8	Tone, Watarase		Widespread damage to Edo Castle and samurai and commoner residences

Sources: Tokyo Shiyakusho, ed., *Tōkyō shishi kō* 東京市史稿 , hensai hen 2 (Rinsen Shoten, 1974); Hata Ichijiro 畑市次郎 , *Tokyo saigai shi* 東京災害史 (Yusei Tsushinsha, 1952), 122-41; Asakusa-ku Shi Hensan Iinkai 淺草区史編纂委員会 ed., *Asakusa-ku shi* 浅草区史 , kasai hen (1933), 44-56; Hashimoto Naoko 橋本直子 , *Kōchi kaihatsu to keikan no shizen kankyōgaku :Tonegawa ryūiki no kinsei kasen kankyō o chūshin ni* 耕地開発と景観の自然環境学～ 利根川流河川環境を中心に (Kokon Shoin, 2010), 39.

A key factor was the effectiveness of flood control mechanisms along the Tone and Ara rivers and their tributaries. Located

strategically at a point where the Tone narrowed, its gradient eased, and its flow slowed, the Chujo Levee, for example, functioned to trap any overflowing water and direct it to safety, thus reducing the amount of downstream flow.[6] Crucially, it was placed on the right (Edo) side of the river in order to stop water from flowing across the plains to the capital. There was one other important point: the Chujo Levee lay just north of the point where the Tone had been diverted eastward in the early Edo era. A break in its defenses sent the river tumbling down its original course into Edo. This meant that flood damage in Edo, naturally concentrated in the low-lying areas to the east of the city, was at its worst in the areas to the east of the Sumida where the original Tone had joined the ocean.

Chart 6: The Chujo Levee



Source: Japan Institute of Country-ology and Engineering
www.jice.or.jp/room/200811140.html

In 8/1680 (corresponding to the end of September in the current calendar), a single typhoon brought wind and rain strong enough to destroy an estimated 3,420 residences, including samurai

and merchant houses and a section of Edo Castle.[7] A subsequent tsunami brought huge damage to low-lying communities, including Honjo and Fukugawa on the eastern side of the Sumida River as well as reclaimed areas closer to Edo Bay in present-day Tsukiji. Some 700 people reportedly died.

More typical was the pattern of flooding recorded in 1704. Heavy summer rains in the Kanto region caused the Tone and Ara rivers to swell in their upper reaches, putting pressure on the levees that protected Edo and other downstream communities. Finally, in the seventh month (early August in the current calendar), rains overwhelmed the Sarugamata Levee, located on the Edo River to the east of the city in what is now Katsushika Ward, with similar breaks following elsewhere along the lower Tone and other Kanto rivers. Floodwaters surged into the lowlands of eastern Edo, submerging an area that extended more than 10 kilometers northeast from Asakusa, across the Sumida and Edo rivers into what is now Chiba Prefecture. It was reported that the death toll, for which there is no estimate, was worsened by the collapse of the Tone River levees. Bakufu officials acted quickly to rescue the stranded and distribute daily food rations to the victims; within three months, they had mobilized four daimyo from unaffected regions to work on repairs to the Tone and Ara rivers.[8]

In its background causes, in the unfolding of the disaster, in the areas worst affected, and in government response, the 1704 flood set a pattern for future flood catastrophes in Edo. Moreover, despite efforts to repair river damage promptly, there was no easing in their frequency. In 1717, in at least three occasions in the 1720s,

and again in 1735, turbulent rivers overflowed their banks and flooded downtown Edo. In almost all cases, the collapse of major levees in the northern Kanto region magnified the damage in the city, particularly in the eastern lowlands that formed the deltas of present and past rivers. None of these, however, matched the scale of the devastating flood that assailed the city in 1742. Known later as the Great Kanto Flood, it was, however, a series of disasters that began in Osaka, travelled northeast through Honshu caused by two typhoons that hit Honshu in close succession following a particularly cold and rainy summer. The most devastating flood of the Edo era, and the first major assault on its largest urban area, it reflected both the characteristic susceptibilities of the northeastern rivers and the changing social environment of the Kanto river network.

(5) The 1742 Great Kanto Flood: From Osaka to Edo

On the afternoon of 7/26 (the end of August in the current calendar) in 1742, an extremely powerful rain typhoon came on land at Osaka Bay, bringing enough rain to flood the Yodo River in Osaka, the Kamo River in Kyoto, and other rivers.[9] The Sanjo Bridge in Kyoto collapsed, temples and shrines were damaged, and the Gosho and downtown areas were flooded. The bodies of the drowned floated in the Yodo River. Keeping its strength, the typhoon moved northeast across Honshu. Heavy rain fell in the provinces of Owari, Mikawa, and Hida provinces (present-day Chubu region), causing the Kiso, Ibi and Nagara rivers to overflow. From the afternoon of the 27th, it passed through Shinano, Echigo,

and Kai provinces (present-day Koshinetsu region) as it moved east.

In its upper and middle sections that fall in present-day Nagano Prefecture, the Shinano River is known as the Chikuma. From its source at the Yamanashi-Nagano border, the Chikuma cuts its way north through the center of Nagano, passing through the Sakuma, Ueda, Nagano, and Iida basins on its way to the Japan Sea at Niigata. It was along this line of basins that the worst of the 1742 flood damage hit.[10] Mountainsides weakened by constant rain collapsed, and muddy water from upstream and from tributaries could not be contained in basin exits. At Kamibata village, in the mountains of what is today Minami Saku district, a landslide reportedly destroyed 140 of about 180 houses; 2,488 people died, leaving just 374 survivors.

Further down the river, at Komoro, castle town of the Makino daimyo family, the scale of the disaster was worse. By 8/1, dirt and stones from upstream, as well as from tributaries that flowed from west and east into the town poured into the town. Mountainsides collapsed and buried parts of the town, including sections of the castle. The Chikuma River rose to about 6 meters and much of the town was filled with a muddy sea of up to 1.5 meters deep. Drinking water was scare; connections with the outside were cut; food prices rocketed. A disaster report later sent by the Komoro daimyo to the bakufu listed 5,848 deaths, 434 houses washed away, 42 houses destroyed, and 23 horses lost.

Some 20 kilometers downstream from Komoro was the smaller domain of Ueda. Here, too, the worst damage was from crumbling mountainsides. Some 158 people died, 671 houses were washed

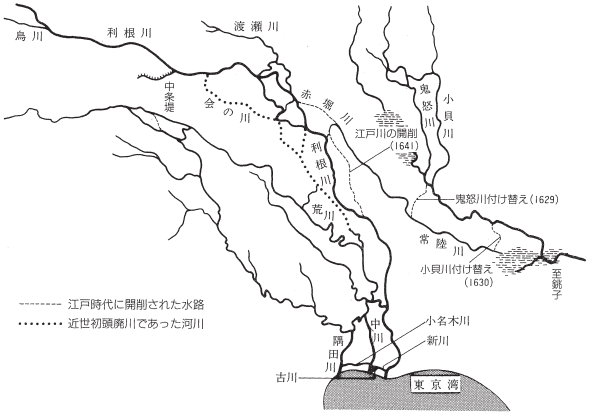
away, 574 houses were damaged, and 11 horses were lost. Land equivalent to about 27,000 *koku* of the domain's 50,000 *koku* was damaged. Daimyo Matsudaira Tadazane collected some 100 bodies – mostly of women and the aged – who had been washed into the domain from upstream. As in Kamibata and Komoro, the disaster suffered here was the worst of the Edo period.

Another 30 kilometers below Ueda was Matsushiro domain, the biggest in Nagano Province. The castle town of Matsushiro was located in the Nagano basin, where the Chikuma meets the Sai, its major tributary, before heading northeast toward Niigata. Here a large-scale channel diversion conducted by the domain had reduced the incidence of overflowing and flood damage, but it was not enough to withstand the waters in 1742. On the evening of 8/1, the Chikuma overflowed, bringing floodwaters right to castle and burying the moat. Daimyo Sanada Nobuyasu was forced to escape by boat to a higher village. Reported losses for Matsushiro included 1,220 people and 64 horses swept away. In addition, there were 998 landslides, 1731 houses washed away, and another 857 houses destroyed. The total damage of the 1742 flood in Nagano Province was uncountable. Along the Chikuma River, at least 10,000 died, especially the aged, women, and children. There was also considerable damage in the lower reaches of the Shinano, around Nagaoka.

While the scale of flooding experienced in 1742 was relatively rare along the Chikuma River, it came as the worst in a series of large and small disasters that hit the Tone and other Kanto rivers. Moreover, while the Shinano damage was concentrated along the

river's upper to middle reaches, the flooding in the Kanto region the flooding extended through the entire network of waterways. It hit the upper stretches of the Tone River in present-day Gunma Prefecture, spread broadly to include the Ara and other Kanto rivers, extending finally into the lower reaches of the Sumida and Edo rivers and the city of Edo itself (Chart 7).

Chart 7: The Eastern Kanto Rivers



Source: Okuma Takashi 大熊孝 , *Kōzui to chisui no kasenshi* 洪水と治水の河川史 —水害の制圧から受容へ (Heibonsha, 1988), 109.

Flood damage in the Kanto region was magnified by the scale and duration of the rains. Here flooding was caused not one typhoon, but by two, coming in quick succession. Rain began to fall on 7/27 and continued with little pause until the evening of 8/3. On 8/4, the typhoon disappeared off the Sanriku-oki, near Sendai. Even then, however, river levels in the Kanto continued to rise. By 8/8 a second typhoon had brought new rain that lasted until 8/10, and it was not until 8/23 that weather conditions had normalized.[11]

A young monk Sukai, of Shorenji, located near the Tone River in what is now Ota City in Gunma Prefecture, recorded the details of the flooding in his area. He described a muddy wave that cut through the levees on the left bank of the Tone River, swallowing villages in its path. Inside Shorenji, muddy water rose some 2.5 meters; barrels of miso and soy sauce as well as furniture and other belongings were washed away; grain became sodden. Sukai and other young monks worked to save books and precious objects by piling up tatami mats and placing the books on top. Some people from the nearby village fled to higher land; others were swept away in the floodwaters. Some climbed on roofs for safety, only to have the roofs washed away, along with the contents of the houses. Fourteen big cypress trees fell in front of the temple. Water stayed in front of the temple gate until 8/15. For two months the Shorenji monks slept in the main temple building, which amazingly did not flood.

Sukai's experience was repeated in villages down the length of the Tone and nearby rivers. Oshi domain lay between the Tone and Ara rivers, its low-lying agricultural land susceptible to flooding. Rain began on 8/1. On the morning of 8/2, levees on the Ara broke near Kumagaya to the west; around the same time, levees broke on the Tone to the east. The Ara rose to about 5.9 meters. Water from both rivers poured into Oshi domain. Fields were flooded; water entered the castle; and people, horses, and chests were washed away.[12]

Less than 30 kilometers south of Oshi domain, Kawagoe domain spread out on the plain between the Ara (to the east) and the

Iruma (to the west) rivers. Here, too, rain began on 8/1. The Ara rose quickly, burst its levees, and flooded villages around the town of Ageo. Okunuki Gohei, the heroic headman of Kugeto village in present-day Kawagoe City, took his boat out day after day to rescue stranded farmers. Kawagoe domain reported to the bakufu that levees were broken in 96 places, 28 villages were severely flooded, and 6 bridges washed away. Twenty-four people died.

In Edo, the impact came not all at once, but in stages, as levees on the Tone, Ara, and other rivers collapsed, thrusting walls of water downstream, across the Kanto Plain. On 8/1, the rains that had been falling for several days strengthened. That night, embankments along the Sumida collapsed, causing floods in downtown Edo. Further east, on the Edo River, the Sarugamata Levee burst, following the pattern of 1680 and other previous floods and covering the area in muddy water. On 8/ 2, the Sumida River reached close to two meters, and houses around Asakusa and Ryokoku began to flood.

On the evening of 8/2, it became clear that flooding would be catastrophic when the Chujo Levee on the mid-Tone River broke and again exposed the city's vulnerability.[13] A great wall of muddy water rushed down the Tone's originally channels, heading through the fields of Musashino toward the capital. On 8/3, the rain abated but river levels continued to rise, particularly at night, when water pressing down from the Ara met high tide waters. Under the impact, levees on the Sumida broke. The Sumida water level dropped briefly, only to rise on 8/5, when a new wave of muddy water arrived, this time across the fields from the Tone's broken

levees. On 8/5, in the Kasai area alone, the bakufu handed out food relief to 7,000 people. Had there been no second typhoon, the flood levels might have gradually fallen, but by 8/8 more rain was falling. Under pressure of the extended rains, the Kanda, another tributary of the Ara, overflowed, causing extensive flooding in the city. Floodwaters did not abate until 8/12 and it was not until 8/23 that Sumida River levels normalized.

Although the 1742 flood brought widespread damage to Edo, it was, not surprisingly, concentrated in the reclaimed areas and other lowlands that encased Edo Bay, including the castle environs. The worst destruction was in the flood plains of the Sumida, Naka and Edo rivers, including present-day Sumida, Koto and Taito wards as well the low-lying Kasai territory, a farming area east of the Sumida River that corresponds to present-day Edogawa, Adachi, and Katsushika wards.[14] All three Sumida River bridges, the Ryokokubashi, the Shinohashi and Eitaibashi broke, cutting communication from Honjo and Fukagawa on its eastern side to the rest of Edo. When the canal that ran east-west between the Sumida and Edo rivers overflowed, Fukagawa and the entire area east of the Sumida in what is now Koto Ward was submerged.

One local account recorded that, as waters rose, people climbed to second floors, or onto rooftops, but even then, the aged and the young were washed to their deaths, and their wails could be heard along the banks of the Sumida and the Ryokuku area.[15] To the west of the Sumida, Shitaya and Asakusa received heavy damage. Ueno was traversable only by boat. Such was the level of flooding that it was reportedly difficult to identify the river from the muddy

expanses of water that stretched across the surrounding districts. Across the densely populated lowland, water reached the second floor of houses and shops; houses and furniture washed in from upstream. People climbed to rooftops to wait for the help that did not always come. Across Edo, as the Kanda River, other small rivers, and canals overflowed, even relatively high areas such as Ushigome and Aoyama suffered damage.

As of 8/7, it was reported that 3,914 people had died in Edo, and an additional 2,000 farmers in Kasai were missing. Some estimates place the number of deaths in the Edo area as high as 10,000. Total estimates for the flood from Osaka to Edo were double that number.

(6) After the Flood: Recovery and Repair

The Great Kanto Flood of 1742 flood demanded a range of responses in multiple jurisdictions that extended from Nagano Province to the city of Edo. At the immediate level, people had to be rescued, and food and shelter provided; over time, the debris had to be cleared, homes built, and fields restored. At the local and regional levels, work was conducted by village headmen, by *hatamoto* and daimyo governments. Within Edo, officials of Tokugawa Yoshimune's government moved quickly, under the leadership of Senior Councilor Matsudaira Norisato, Temple and Shrines Magistrate Ooka Tadasuke, and Magistrate of Finance Kan'o Haruhide.[16] Boats were dispatched through the worst affected areas: according to *Tōkyō shi shikō*, a total of 1,218 boats rescued 3,3357 people in Edo during the eight days from 8/5.[17] Matsudaira Norisato ordered rice to taken from the bakufu's Asakusa granary

and loaded on boats for distribution to those taking refuge, particularly along the Sumida River and in the Kasai area.[18] All of the needy were to receive food, regardless of whether or not they came under the bakufu's direct administrative control. Elsewhere in the broader Kanto region, the Kanto deputy was to arrange the distribution of supplies. Shopkeepers and the rich were also encouraged to contribute food. In Honjo, from 8/6, bakufu officials used local restaurant owners to distribute rice gruel, twice daily and then with less frequency. By 8/23, a total of 186,000 people were estimated to have received a meal, with almost half of the rice coming as private donations.

More challenging was the complex and expensive work of clearing flood damage, repairing levees, and returning the river and canal system to proper functioning. Daimyo and other local officials from central Honshu across the Kanto region submitted to the bakufu lists of damages, together with requests for help with reconstruction. Although the bakufu had long recognized its responsibility for responding to such region-wide disasters, it did not in 1742, however, have a budget or an organizational system ready to take on the work. It therefore revived the practice, used after the flood of 1704 but allowed to lapse in recent decades, of calling upon daimyo for assistance. It mobilized 10 daimyo, mostly from unaffected regions in western Japan, to assist with repairs along the Tone, Ara, and other Kanto regions (Table 2).[19] (Later, a special levy assessed on villages in Musashi province provided supplementary funds.[20])

Among the daimyo chosen were Hosokawa (of Kumamoto

domain), Mori (of Choshu domain), Todo (of Tsu domain), and Ikeda (of Okayama domain). Each was given responsibility for a specific river section in what turned out to be a massive bakufu-led operation that lasted from the tenth month of 1742 into the fourth month of 1743. It occupied tens of bakufu officials, thousands of daimyo staff, and hundreds of thousands of locally recruited laborers. The costs were enormous: for its section of the work on the Tone River, Choshu domain spent a total of 63,454 *ryō*; Okayama domain spent 65,353 *ryō*, on the Tone and three other rivers.[21] Although the bakufu's total contribution is assumed to have been considerable, in each work section it was just a fraction of what the assisting daimyo spent.[22]

Two further points should be noted. No bakufu-authorized operations were announced on the Chikuma in Nagano Province. The bakufu focused only on rivers in the Kanto region, where its own lands were concentrated and where flood damage most immediately threatened Edo. Second, while the details are not clear, the work appears to have focused on levee repair and strengthening, channel dredging, and minor channel diversion. In other words, although the 1742 flood had revealed catastrophic weaknesses in the flood control systems, the bakufu limited itself to the repair of existing mechanisms rather than trying new or bold approaches to flood protection and control. It was perhaps for this reason that, as Table 1 indicates, major flooding on the Kanto rivers continued at irregular but frequent intervals all the way through to the end of the Edo era.

Table 2: Daimyo-Assisted Repairs After the Great Kanto Flood of 1742

Daimyo	Domain	Assessed Product	Work Section (River)
Hosokawa	Kumamoto	540,000	Edo, Furu-Tone Naka, Yoko, Ayase
Mori	Choshu	369,410	Kami-Tone (south bank)
Tōdō	Tsu	323,900	Gongendō
Ikeda	Okayama	315,000	Kami-Tone (north bank), Tori, Kanna, Watarase
Abe	Fukuyama	100,000	Shimo-Tonegawa
Senkoku	Izushi	58,000	Kokai
Kyōgoku	Marugame	51,500	Ara, Shiba, Hoshi, Moto-Ara
Itō	Obi	51,000	Ara
Inaba	Usuki	50,060	Ara
Manabe	Sabae	50,000	Shin-Tone

Source: Otani Sadao 大谷貞夫 , *Edo bakufu chisui seisakushi no kenkyū* 江戸幕府治水政策史の研究 (Yuzankaku, 1996), 173.

(7) Conclusion

In an influential book on rivers and flood control, Okuma Takashi makes the point that a flood meaning a deluge, or swelling of water (*kōzui* 洪水) can be distinguished from a flood disaster (*suigai* 水害) that causes damage to humans.[23] Because of their particular physical characteristics, Japanese rivers have swollen and overflowed for centuries; floods are part of their natural cycle. Large-scale flood damage, on the other hand, is a more recent phenomenon. It increased significantly from the Edo period as a result of the aggressive land and water development carried out by a growing population from the early 17th century.

Because of its broad geographical scale, because of the large numbers of victims, because the damage cut across all statuses and

classes, and because it was the first major flood to threaten the capital of Edo, the Great Kanto Flood of 1742 may be considered the most dramatic and catastrophic flood of the Edo era. In its physical and social characteristics, it thus offers some hints on Japanese floods and river management in a historical context. At the same, as an Edo City disaster, it highlights the achievements and continuing vulnerabilities of urban flood control in Edo and its successor Tokyo.

First, the 1742 flood disaster raises the issue of environmental sensitivity in Japan before the modern era. More than 15 years ago, Susan Hanley emphasized the environmentally sound aspects of daily living in Edo period Japan.[24] Hidenobu Jinnai has long stressed the ecological soundness of the urban planning that underlay Edo's emergence as a world city.[25] More recently, the Japan's Ministry of the Environment has promoted the Edo era as a model "sound material-culture society, or *junkangata shakai* 循環型社会" from which 21st century people have much to learn.[26] But Japan's vigorous economic growth in the Edo period was based on an equally vigorous exploitation of natural resources—rocks, trees, and, especially, water. In fact, one could say that the Edo period marked the high point of a distinctively Japanese tradition of civil engineering, in which rivers were dammed, dredged and diverted to meet the economic and social needs of a rapidly growing society. As a consequence of these changes, flooding became a familiar, if distressing, part of daily life, especially for commoners living along major rivers and in their floodplains. Put simply, although we may be inclined to think of environmental problems as a product of the modern era, it was Edo era that first saw chronic and large-scale water damage.

The second point concerns the limitations of flood control in the Edo era. Okuma noted that, while irrigation methods developed through the application of mining technology, the technological developments in flood control were not remarkable.[27] Based on the levee construction methods devised from the late 16th century, the author of a 1680s agricultural treatise, for instance, identified the main points as nothing more complex than the constant monitoring and reinforcing of levees while watching for flood signs and predicting water flow. Even after chronic flooding demanded the attention of government leaders in the 18th century, their methods focused on the repair and extension of existing mechanisms rather than the development of new ones. Notably, the Chujo Levee, though built before the Edo period, remained the single most important flood control mechanism on the Tone River. Although it overflowed or collapsed in every major Tone flood of the era, the response of the Tokugawa government was to fix it, doggedly, after every failure. After the Great Kanto Flood of 1742, it had daimyo make extensive and costly river repairs, including on the broken Chujo Levee, but there was no sign that it had the will or capacity to apply its financial or technical resources to re-thinking the flood control problem. Unsurprisingly, bakufu repair work ameliorated but did not fix the problem of flooding. Significant success in flood protection had to wait until the modernization of river management conducted by the Meiji government (1868-1912) and its 20th century successors.

The Great Kanto Flood of 1742 was important for a third reason. As Edo's first major flood, it revealed risks in urban flood control

that continued to assail Japan's political capital well beyond the Edo era. Built on land reclamation and river engineering, Edo, like its successor Tokyo, was fundamentally vulnerable. Moreover, the very measures it undertook to mitigate risks had, at times, the converse effect of intensifying them. For instance, the Eastern Diversion of the Tone River, carried out over 60 years from 1594, aimed boldly both to enhance economic growth and to reduce flood damage around Edo Bay. While it successfully supported a growing population on an everyday level, when flood control mechanisms such as the Chujo Levee collapsed under pressure, the results were catastrophic. Even after Western technology was put to the service of river management in the Meiji era, floods in the capital continued. In 1910, a typhoon in the Kanto region caused the Tone and Ara rivers to overflow, broke levees in more than 7000 places, and submerged the Kanto region. An estimated 1,379 people died, 1.5 million people suffered damage. The overall economic damage was enormous. It was not until 1930, and following bitter community disputes, that the Chujo Levee was raised and extended and the Ara was re-engineered to allow a massive run-off area. Further disasters, including the 1947 Typhoon Kathleen, prompted a systematic review. Today, levees on Kanto rivers are just part of a total flood control system that includes dams, retarding basins, and region-wide planning.

But the dangers of flooding in Tokyo have not disappeared. In recent years, the term "urban flood" has been used globally to describe water disasters in built environments where there is not enough drainage to absorb high-intensity rainfall or river flows.

This was in part the problem experienced in lowlying Edo during the Great Flood of 1742, and the risks, though never resolved, have re-emerged. In 2013, the Japan Meteorological Agency and its affiliated research institute reported that the frequency of localized torrential downpours has increased 36 percent over the past 30 to 40 years; in Tokyo the increase is estimated at 48 percent over the past 100 years.[28] Experts warn that such outbursts could cause catastrophic damage, particularly in the underground shopping areas and subway networks. In 2001, the Tokyo Metropolitan Government established procedures for drawing up measures to protect its 35 million residents. In 2009, the national government completed the world's largest underground floodwater diversion facility, Metropolitan Area Outer Underground Discharge Channel in Kasubake, Saitama Prefecture, built to absorb overflow from Tokyo's waterways during rain and typhoon seasons. Whether this and other mechanisms will be enough to protect the world's largest population in one of the most precarious built environments remains is by no means certain.

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1 On the early development of Edo, see Suzuki Masao 鈴木理生 , *Sūpā Bijuaru EdoTokyo no chiri to chimei* スーパービジュアル版 江戸・東京の地理と地名 (Nihon Jitsugyo Shuppansha, 2006), 4-102; Suzuki, *Edo no kawa, Tokyo no kawa* 江戸の川・東京の川 (Inoue Shoin, 2005), 11-179.

2 On the social organization of the city, see Hidenobu Jinnai, "The Spatial Structure of Edo," in Nakane Chie and Oishi Shinzaburo, eds, *Tokugawa Japan: The Social and Economic Antecedents of Modern Japan* (Tokyo University Press, 1990), 124-46.

3 Koekishadanhojin Doboku Gakkai Suikogaku Iinkai 公益社団法人土木学会水工学委員会 , ed., *Nihon no kawa to kasen gijutsu o shiru - Tonegawa* 日本のかわと河川

技術を知る～利根川（Koekishadanhojin Doboku Gakkai, 2012,）2-32; Tonegawa Kenkyukai 利根川研究会 , ed., *Tonegawa no kōzui: Kataritsugu ryūiki no rekishi* 利根川の洪水―語り継ぐ流域の歴史 (Sankaido, 1995), 2-37.

4 *Nihon no kawa to kasen gijutsu o shiru - Tonegawa*, 34-38; Roderick Ike Wilson, "The Engineering of Japan's Modern River Regime, 1600-1920, " (Ph. D. dissertation, Stanford University, 2011), 30-38.

5 Okuma Takashi 大熊孝 *Kōzui to chisui no kasenshi* 洪水と治水の河川史 ―水害の制圧から受容へ (Heibonsha, 1988), 112-15; *Tonegawa no kōzui: Kataritsugu ryūiki no rekishi*, 46-50; Takasaki Tetsuro 高崎哲郎 , *Ten issai o nagasu: Edoki saidai no kanpō suigai saigoku daimyō ni yoru tetsudai fushin* 天、一切ヲ流スー江戸期最大の寛保水害・西国大名による手伝い普請 (Kajima Shuppankai, 2001), 29-31.

6 Okuma, 112-15; Hashimoto Naoko 橋本直子 , *Kōchi kaihatsu to keikan no shizen kankyōgaku :Tonegawa ryūiki no kinsei kasen kankyō o chūshin ni* 耕地開発と景観の自然環境学～ 利根川流河川環境を中心に (Kokon Shoin, 2010), 39-40.

7 Tokyo Shiyakusho, ed., *Tōkyō-shi shi kō* 東京市史稿 , hensai hen 2 (Rinsen Shoten, 1974); Hata Ichijiro 畑 市次郎 , *Tōkyō saigai shi* 東京災害史 (Yusei Tsushinsha, 1952), 122-25; *Arakawa-ku shi* (Tokyo-shi Arakawa-ku, 1934), 726-28.

8 *Tōkyō saigai shi*, 123-24; Chiba Kenritsu Sekiyadojo Hakubutsukan 千葉県立関宿城博物館 , ed., *Shizen saigai wo norikoete ~ Tonegawa chūryūiki no doboku isan kara mieru rekishi* 自然災害をのり越えて：利根川中流域の土木遺産から見える歴史 : 平成 20 年度企画展 (Chiba Kenritsu Sekiyadojo Hakubutsukan, 2008), 61.

9 Takasaki Tetsuro 高崎哲郎 , *Ten issai o nagasu : Edoki saidai no kanpō suigai saigoku daimyō ni yoru tetsudai fushin* 天、一切ヲ流スー江戸期最大の寛保水害・西国大名による手伝い普請 (Kajima Shuppankai, 2001), 3-4.

10 For the main events of the Chikuma River flood, see Takasaki, 8-19; Shinano Mainichi Shinbunsha Shuppankyoku 信濃毎日新聞社出版局 , ed., *Inu no mansui o aruku : Kanpō ninen no Chikumagawa daikōzui* 戌の満水」を歩く : 寛保 2 年の千曲川大洪水 (Shinano Mainichi Shinbunsha, 2002); Ministry of Land, Infrastructure, Transport and Tourism Hokuriku Regional Development Bureau: www.hrr.mlit.go.jp/shinano/367/chisui/s_05.html

11 For the main events of the flood in the Kanto region, see: Takasaki, 19-61; Hashimoto, 40-4; "Kanpō kōzui kiroku Tōkyō 寛保洪水記録東京" in Mori Kahei 森森嘉兵衛 and Tanigawa Ken'ichi 谷川健一 , eds, *Nihon shomin seikatsu shiryō shūsei* 日本庶民生活史料集成 , vol. 7 (San'ichi Shobo, 1970), 213-32.

12 Okunuki Yuzan 奥貫友山 , "Daisuiki 大水記" in *Nihon Nōsho zenshū* 日本農書全

集 , vol. 67, kasai to fukko 2 (Nosan Gyoson Bunka Kyokai, 1998).

13 Takahashi, 29-33.

14 Details of the flood in Edo are based primarily on *Tōkyō-shi shi kō*, 216-316; Taito-ku Shi Hensan Senmon Iinkai 台東区史編纂専門委員会 ed., *Taitō-ku shi tsūshihen* I 台東区史 通史編 I (Tokyo-to Taito-ku, 1997), 723-25; Asakusa-ku Shi Hensan Iinkai 淺草区史編纂委員会 ed., *Asakusa-ku shi* 浅草区史 , kasai hen (1933), 48-52; Takasaki, 48-57; Hashimoto, 40-41.

15 Takasaki, 51.

16 Takasaki, 53-84

17 *Taitōku shi tsūshihen I*, 726-29.

18 Takayanagi Shinzō 高柳真三 and Ishii Ryosuke 石井良助 , eds, *Ofuregaki Kanpō shūsei* 御触書寛保集成 (Iwanami Shoten, 1976).

19 Otani Sadao 大谷貞夫 , *Edo bakufu chisui seisakushi no kenkyū* 江戸幕府治水政策史の研究』(Yuzankaku, 1996), 172-239; Kasaya Kazuhiko, "Kinsei kuniyaku fushin no seijishiteki ichi 近世国役普請の政治的位置 ," (*Shirin* 59:4 1976), 51-52.

20 Kasaya, 54.

21 Otani, 229.

22 Otani, 185.

23 *Kōzui to chisui no kasenshi,* 10-11.

24 *Everyday Things in Premodern Japan: The Hidden Legacy of Material Culture* (Berkeley: California University Press, 1997).

25 "The Spatial Structure of Edo,"

26 Ministry of the Environment:
www.env.go.jp/recycle/3r/en/approach/report_material-cycle/2008.pdf

27 Okuma, 96-106.

28 Tonegawa Kasenryu Jimusho: www.ktr.mlit.go.jp/tonege/rekisi/kakokiroku.html; "Agency Says Torrential Rain Sharply Increasing, Flooding a Growing Risk," *The Asahi Shinbun*, July 8, 2013.

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日本初の都市型水害～ 1742 年の関東大洪水

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要　約

1742 年に近世における最大規模の洪水が関東甲信越地方を襲った。利根川や荒川の上流域で発生したこの大洪水は下流の江戸方面へと流れ込み、人々が密集していた江戸の下町を水没させた。江戸は大惨事に陥り、水死者は数千人にも及んだと推測されている。この論文は江戸に焦点をあて、1742 年の関東大洪水の物理的・社会的特徴を考察し、17 世紀江戸の発展を可能にした埋め立てや川改修事業、1742 年の洪水の概説、及び徳川幕府の対応を研究する。最後に、江戸時代における日本の河川の管理技術と水害対策とその制約を評価する。