

# The Senkawa Josui: The Changing Uses of a Constructed Waterway In Early Modern and Modern Japan

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「千川上水—近世・近代上水の変化する役割」

1590年に徳川家康は江戸入府になり、江戸市民に飲料水・生活用水を供給する必要となった。17世紀初期に神田上水・玉川上水が開削され、その以降の人口増加に伴い、未給水地域に新しい上水が整備された。千川上水は1696年に玉川上水を水源とし、江戸の小石川・本郷・浅草方面へ給水を目的として開削された。しかし、1707年に江戸周辺農村の嘆願により、農業用水としての利用が許可され、1722年に千川上水は上水として廃止された。その後、水車が設けられ、そして明治初期に工業水として利用された。この論文は千川上水の開削と運営、そして社会情勢の変化に伴う役割変化を考察する。最後に、近世から近代へと動いていく日本の水資源利用に関する意識に注目する。

**キーワード：** 千川上水、玉川上水、徳川幕府、用水、水車

**Keywords :** Senkawa Josui, Tamagawa Josui, Tokugawa bakufu, irrigation water, waterwheel

## Introduction

Japan's average annual precipitation of approximately 1,718 mm is roughly twice the world average.<sup>1</sup> It is therefore not surprising that water has long played a conspicuous role in Japanese economic, social and cultural development. In the Edo era (1600-1867), in addition to everyday domestic uses, water was important for rice and other forms of agriculture, for transportation, and as an energy source. But if the total volume of water made all of these uses possible, water was not always in the necessary locations or in the required amounts. Hence there was a need for technology and engineering to bring drinking water to urban areas, to allow irrigation over wide areas of the country, to set up transportation networks, and to move water away from areas where flood damage was likely. In other words, water management—reflected in words such as *jōsui* (for clean water), *yōsui* (primarily for irrigation water), and *chisui* (for flood control)—played a crucial role in Edo era development under the Tokugawa bakufu.

Built in 1696 under the order of the Tokugawa bakufu, the Senkawa Josui 千川上水, or Senkawa Canal, diverted drinking water from a point on the Tamagawa Josui 玉川上水 some 20 kilometers west of Edo and carried it to destinations in the city's expanding northeast. The Senkawa Josui is not to be confused with the Sengawa 仙川 river, a natural tributary of the Tama and today a place name in Chofu City. The Senkawa Josui was the fourth and last of the subsidiary water systems built in Edo in the late 17<sup>th</sup> century; it was also the last of the so-called six Edo water systems.

This, however, was just the beginning of the Senkawa Josui's successive transformations. In 1707 the Tokugawa government permitted agricultural villages along the canal to access it for

rice field irrigation, and by the 1720s irrigation had become the Senkawa's primary function. Modernization in the 19<sup>th</sup> century brought further changes. In the mid-1860s, the Senkawa Josui was fitted with a waterwheel to supply energy for a reverberatory furnace planned in Takinogawa village on the northern outskirts of Edo. From the 1870s, it was re-engineered to supply water to the emerging paper and textile industries in the Oji area of Tokyo. And from 1882 until 1907, it was revived as a source of drinking water for the exploding population of northeastern Tokyo.

This paper traces the successive transformations of the Senkawa Josui with the aim of offering a view of the rationale, scale, and process of water management in early modern and modern Japan. In addition to local histories, I have relied particularly on the work of historian Oishi Manabu and the researchers under his guidance. Together they analyzed Senkawa family documents held at the Nerima Shaku-jikoen Furusato Museum to produce a detailed study of the origins and political dimensions of the Senkawa Josui.<sup>2</sup> After a brief introduction to water management in Edo, the paper will consider the Senkawa Josui in each of its phases: as a drinking system; as an irrigation system; as a supply of waterpower for defense; and as a source of water for modern industry.

## Water Management in Edo: The Kanda and Tamagawa Josui

Water management was basic to the urban development policies promoted by the early Tokugawa shogun. It is well known that, when Tokugawa Ieyasu established Edo as his capital in 1590, it consisted of no more than a few hundred households scattered among the marshlands of Edo (now Tokyo) Bay.<sup>3</sup> Hibiya Inlet was so deep that Edo Castle was close to

the waterfront; the Sumida, Tone, and Watarase rivers flowed through the marshes into the bay. Although waterways crisscrossed the area, water transportation was difficult and fresh drinking water was scarce. Ieyasu and his successors oversaw the transformation of this unlikely terrain into Japan's political capital. Bakufu engineers filled in Hibiya Inlet and drained the swampy land along the bay. They diverted small rivers, built transportation canals, and massively re-engineered the Tone and Ara rivers to promote transportation north and east of the city, while also limiting flood damage in the low-lying delta districts.<sup>4</sup> They used canals and underground pipes to bring fresh drinking water into downtown Edo from the Kanda and Tama Rivers in the west. By the end of the 17<sup>th</sup> century, Edo was a teeming city of a million people and perhaps the largest urban area in the world.

Supplying fresh drinking water was a crucial element of the Tokugawa bakufu's water management in Edo. Since much of the water available – especially in the areas closest to the ocean – was salty, drinking water had to be

brought in from outside the city. The first major system, the Kanda Josui, drew on a spring that rose in the Inokashira area of present-day Mitaka City and flowed east toward Edo as the Kanda River.<sup>5</sup> The Josui was constructed, probably during the rule of the third shogun Iemitsu (1623-51), by connecting the Inokashira spring with other ponds and waterways, including the Koishikawa River in Edo. Figure 1 shows the general outline as depicted in an early eighteenth-century map of Edo's water systems. An open conduit flowed some 20 kilometers from Inokashira, passing through 16 villages until it reached Sekiguchi in present-day Bunkyo City. There the stream was dammed and divided into two routes: the main flow passed into underground pipes, while the remainder flowed over the dam, and continued east to Ryokoku and thence the Sumida. The underground pipes carried water to Korakuen, Edo home of the influential Mito daimyo, and then to the south and east: to Surugadai, the Kandabashi and Nihonbashi in the direction of Edo Castle, and to the Hamacho area near the Sumida River.

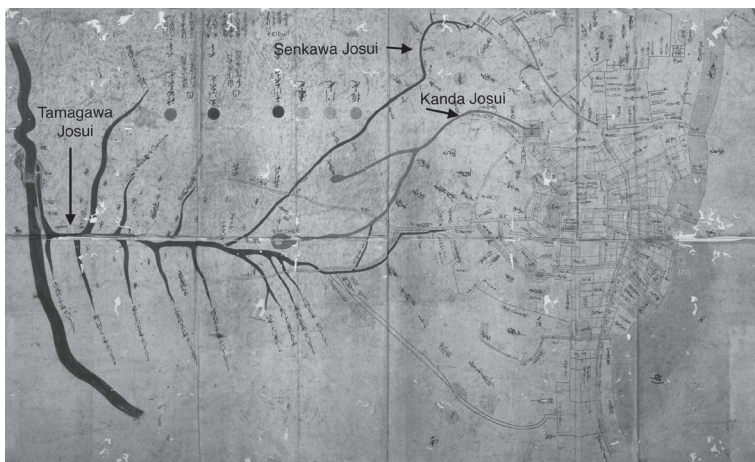


Figure 1: Edo Water Systems, cc. 1717-18

Courtesy of Nerima Shakujii-koen Furusato Museum

Impressive in efficiency and scale, the Kanda system was nevertheless inadequate to meet the needs of a rapidly expanding city. It was surpassed – though not replaced – by a much larger system drawn from the Tama, Edo's third longest river. The Tama River rises in what is now the border between Yamanashi and Saitama prefectures. It flows some 138 kilometers southeast through the western and southwestern areas of Tokyo to reach Tokyo Bay at Kawasaki City, where it marks the border between Tokyo and Kanagawa Prefecture.<sup>6</sup>

Unlike the Kanda Josui, which used natural waterways on the way to Edo, the Tamagawa Josui was a fully man-made system.<sup>7</sup> Its vast network of canals branched out from a main canal that drew water from a dam on the mid-Tama River at Hamura village, some 55 kilometers from the river mouth. According to the *Jōsuiki*, a bakufu record of Edo water systems compiled some 130 years later, the initiative came not from the bakufu but from two brothers, Shoemon 庄右衛門 and Seiemon 清右衛門 (either Edo townsmen or Tama area farmers), who secured a contract from the Edo town commissioner (*machi bugyō*), Kan'ō Moto-katsu 神尾元勝. They began work under bakufu supervision some time in 1653, and by the end of the year had completed the canal as far as Yotsuya. With the bakufu budget of some 6,000 *ryō* used up by the time they reached Takaido, the two contributed some 3,000 *ryō* of their own to complete the work as far as Toranomon in 1654. For this they were rewarded by receiving the family name Tamagawa (and were known thereafter as the Tamagawa Brothers).

While there are doubts about the exact contribution of the Tamagawa Brothers, there is no doubt that the Tamagawa Josui carried water from Hamura through a 43-kilometer open channel as far as Yotsuya Okido (a checkpoint

at the western entry to Edo) and from there to Toranomon. The Tama system used natural flows rather than pressurizing techniques; the gradient averaged a gentle 20 cm per 100 meters (some 92 meters difference in altitude over all). The water flowed freely; and there were no purifying devices. As with the Kanda system, political and status considerations influenced access: from Toranomon, water was channeled to Edo Castle and nearby samurai residences. Subsequently, however, an expanding network of stone and wooden underground pipes supplied water – for drinking and other daily needs, firefighting, gardens, and even a fountain – to samurai and townspeople in Kojimachi, Akasaka, Shiba, Kyobashi and other, primarily southwestern, districts not reached by the Kanda system. At the same time, outside of Edo, farm communities obtained irrigation water through subsidiaries that branched off from the main canal between Hamura and Yotsuya.

### The Construction of the Senkawa Josui: Drinking Water for Edo

In 1657 – just three years after the Tamagawa Josui was built, a devastating fire destroyed more than half – perhaps 70 percent – of Edo. In the period of recovery that followed, several subsidiary water systems were added: the Kameari (Honjo) Josui (1659) took water from a tributary of the Tone River, while the Aoyama (1660) and Mita (1664) systems were subsidiaries of the Tamagawa Josui itself. The Senkawa Josui was constructed on bakufu orders in 1696, during the office of the fifth Tokugawa shogun, Tsunayoshi (office 1680-1709).

Although there are no contemporary records, later accounts, including Senkawa family documents, consistently emphasize that shogunal priorities were decisive. Specifically, they state that the Senkawa Josui was built to

supply water to several facilities in northern Edo that were owned or favored by Tsunayoshi for outings (*onari* 御成り).<sup>8</sup> Most important was the Koishikawa (Hakusan) Goten, a mansion located on the site of what is now the Koishikawa Botanical Garden attached to the University of Tokyo in Bunkyo City. Tsunayoshi received the mansion as a child, in 1651. He also lived there for a time after his main Edo residence was destroyed in the 1657 fire. After he became shogun in 1680, Tsunayoshi frequently invited close daimyo there to hear his lectures on Confucian topics. In 1684 he moved the shogunal botanical garden, Azabu Gosaen, inside its grounds. It is likely that Tsunayoshi saw the Senkawa Josui as a source not only of drinking water for the Koishikawa Goten but also of water for the botanical garden and the moat that surrounded the mansion.

A second destination for the Senkawa Josui was Yushima Seido, a Confucian temple constructed by the scholar Hayashi Razan 林羅山 (1583-1657) in 1630 and moved by Tsunayoshi to the Kanda area in 1690. A third was Kan'eiji, a Tendai Buddhist temple located in what is now Ueno; it was the family temple of the Tokugawa shogun and Tsunayoshi's future burial place. Finally, somewhat at a distance – and probably lower in priority – was the Sensoji temple in Asakusa, which Tsunayoshi visited most years in the second half of his time as shogun.

While the decision to build came at the highest bakufu levels, contracts to oversee the work were offered to two merchants, identified as Tokubei 徳兵衛 (d. 1734) and Tahei 太兵衛; they were later joined by two others. Tokubei, born in Hitachi, had moved to the Hongo area of Edo as the adopted son of a family that had roots in Himeji; Tahei was from Izumi Province, which lies in present-day Osaka Prefecture.

Following the precedent set in the Tamagawa Josui construction, the contractors were expected to supply supplementary funds. As their reward, all four later received the name Senkawa and other privileges, including residences in Edo's Koishikawa area, the title of water official (*mizu motoyaku* 水元役) and a stipend. In practice, they worked as contractors, collecting water-use fees and overseeing the regular running of the Senkawa Josui, while also engaging in other water-related projects in Edo.<sup>9</sup> All four seem to have kept their association with the Senkawa until at least 1714; the families of Tokubei and Tahei continued theirs into the Meiji era (1868-1912).

Like the Mita and Aoyama systems, the Senkawa Josui drew water from the Tamagawa Josui. Inexplicably, however, given its downtown Edo destinations, it originated far from the city, at Hoya Shinden, as one of the several irrigation channels that branched off from the Tamagawa Josui in the Musashino countryside (Figure 2a). Structurally it was divided into two sections. The first was an open canal, about a meter wide and some 22 kilometers long, that extended across Musashino Province, from Hoya Shinden to Sugamo village on the Nakasendo highway in northern Edo. Figure 1 shows the canal heading northeast, well above the Kanda River and passing through Seki, Shakuji, Shimo-Nerima, and Nagasaki villages. Still in Musashino, it made a hook-shaped curve through Itabashi, the first major post-station of the Nakasendo, passing by Takinogawa on its way to Sugamo, gateway to Edo (See also Figure 2b). In today's terms, the canal extended northeast from Shinmachi, on the border of Nishi Tokyo and Musashino cities. It passed through the Nerima, Toshima, Itabashi, and Kita areas of Tokyo, before ending in Sugamo on the eastern side of Toshima City.



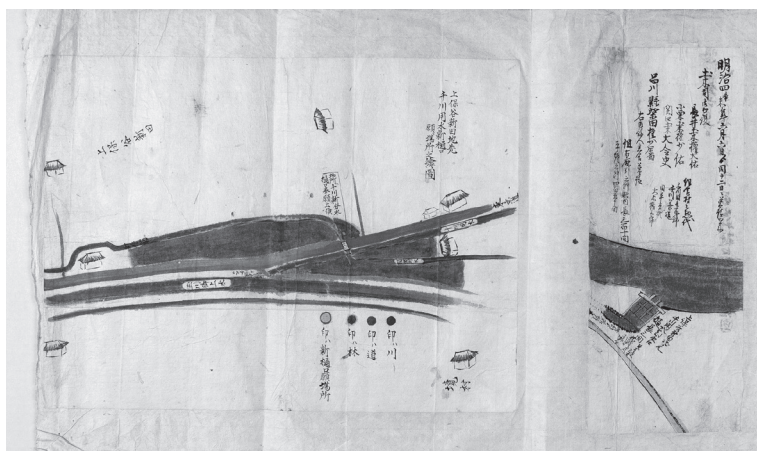


Figure 2a: Diversion of the Senkawa Josui from Tamagawa Josui at Hoya Shinden  
 Kami Hoya Shinden Chisaki Senkawa Hori Shin Suimon Irihi Ezumen  
 上保谷新田地先千川堀新水門以樋絵図面  
 Courtesy of Nerima Shakujikoen Furusato Museum

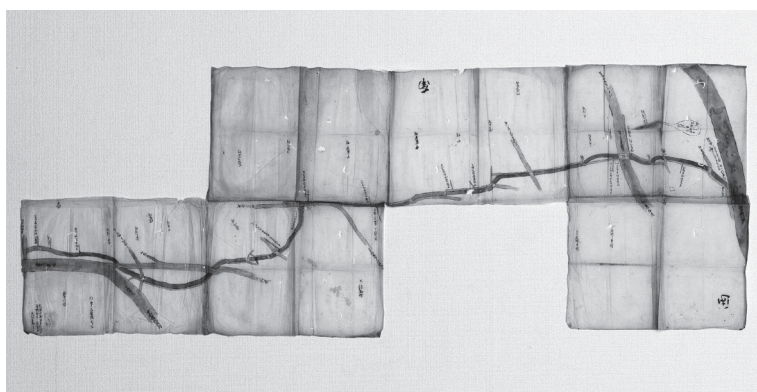


Figure 2b: Senkawa Josui Canal from Hoya Shinden to Sugamo  
 Senkawa yōsuibori Hoya Shinden yori Sugamo mura made no ezumen  
 千川用水堀 保谷新田より巢鴨村迄之絵図面  
 Courtesy of Nerima Shakujikoen Furusato Museum

The countryside through which the canal passed was relatively undeveloped. There was little rice cultivation. Some of the villages belonged directly to the Tokugawa family, others to low-level retainers. As late as the early 19<sup>th</sup> century, the two largest villages (Kami Nerima and Shimo Nerima) each had fewer than 500 households.<sup>10</sup> Even after the massive land development that was to transform the Musashino area over the next half-century,

dry fields predominated. Itabashi and Sugamo, although livelier and located on a major thoroughfare, had not yet been absorbed into Edo City's administrative structure.

At Sugamo, the water was pooled and then directed into the second section of the Senkawa Josui: a network of underground pipes. Unlike the Kanda Josui, which half a century earlier had used some stone reinforcements, the Senkawa pipes – a little more cheaply built

– were made entirely of wood, mostly cypress and red pine.<sup>11</sup> The main underground line extended from Sugamo to Hongo, just over 5 kilometers in a south-southeasterly direction.<sup>12</sup> Then it separated into two branches. One branch went to Kan'eiji temple (in Ueno) and on to Sensoji (in Asakusa), about 3 kilometers to the east, passing mostly below samurai residences and temples. The other branch continued southeast for several kilometers, to Yushima Seido and beyond, passing mostly below the residences of samurai and townspeople. Figure

3, also from the early 18<sup>th</sup> century, shows an underground network that included the higher (*yamanote*) areas of Koishikawa and Hongo and the lower (*shitamachi*) areas of Kanda, Shitaya, and Asakusa – far more than the four locations originally targeted. In today's administrative units, the area included parts of Bunkyo, Toshima, Taito, Kita, and Chiyoda cities. The total length of the underground pipelines was about 23 kilometers, about the same length as the above-ground canal and apparently double that originally planned.

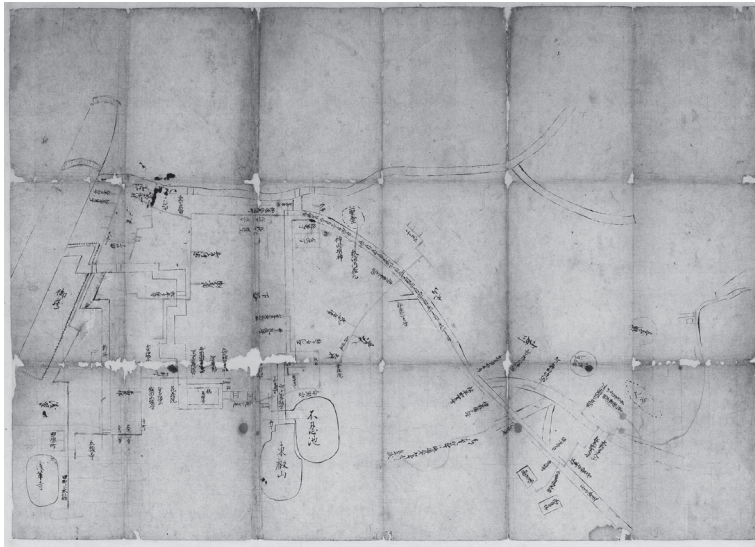


Figure 3: The Senkawa Josui Underground Network  
Courtesy of Nerima Shakujikoen Furusato Museum

The Senkawa Josui carried water to an astonishing number of users in northeastern Edo. By Furutani Kae's calculation, it reached the residences of 1,022 samurai (from the powerful Maeda daimyo of Kaga domain to numerous low-ranking retainers), 250 temples, and numerous townspeople.<sup>13</sup> All users paid a fee, with the samurai families carrying the heaviest burden and the temples the least.

### Agricultural Interests: From Drinking Water to Irrigation

In 1707, the headmen of Igusa, Shakujii and Naka villages (in present-day Suginami, Toshima, and Toshima cities respectively) sent a letter to the Tokugawa bakufu through the Senkawa family, complaining of chronic water shortages and requesting permission to access the Senkawa Josui as it passed through their village.<sup>14</sup> Although there is no indication that the irrigation needs of these villages had been

part of the original planning, the request could easily have been anticipated. Given the evident need and the growing economic importance of the areas surrounding Edo, it is not surprising that approval came readily. Tsunayoshi's government offered water access to 20 villages located along the length of the open Senkawa channel. The water was to be used on rice fields only. Each village was to pay an annual fee - a relatively modest 3 *shō* (5.4 liters ) of unhulled rice per *tan* (992 square meters) - to the Senkawa family for canal maintenance, including the construction and repair of bridges, banks, and guardhouses.

The 1707 decision marked the beginning of the Senkawa Josui's transformation from an urban water system (*jōsui*) into an irrigation channel (*yōsui*) serving a strong rural constituency. The transformation progressed significantly in 1722, when the bakufu, now headed by Tokugawa Yoshimune (office 1716-45), abruptly closed off the Senkawa's underground pipes in the city. It ended Senkawa Josui (along with the Aoyama and Mita systems) as a drinking water system for Edo, while leaving its irrigation functions from Hoya Shinden to

Sugamo in place. The Senkawa Josui was just 26 years old. The reasons for the decision are unclear. One story is that the Confucian scholar Muro Kyuso 室鳩巢 (1658-1734) convinced Yoshimune that the abundance of underground canals was drying out the earth and increasing Edo's susceptibility to fire.<sup>15</sup> More plausibly, the move came as part of the bakufu's broader attempt to streamline and control the costs of water management.<sup>16</sup> In the case of the Senkawa Josui, family documents suggest that the destruction of Koishikawa mansion in 1714 after Tsunayoshi's death was also a factor.<sup>17</sup>

As an irrigation channel, the Senkawa Josui had an immediate impact on the Musashino villages it served. All 20, regardless of jurisdiction, combined to form an irrigation cooperative to manage the new water system, beginning with the construction of canals to connect each village with the main water supply.<sup>18</sup> Although dry field crops, including vegetables, continued to dominate, each of the 20 embarked on rice growing in what had been considered unpromising agricultural land. A map of 1881 shows a small band of rice fields lining the Senkawa on its way toward Edo (Figure 4).

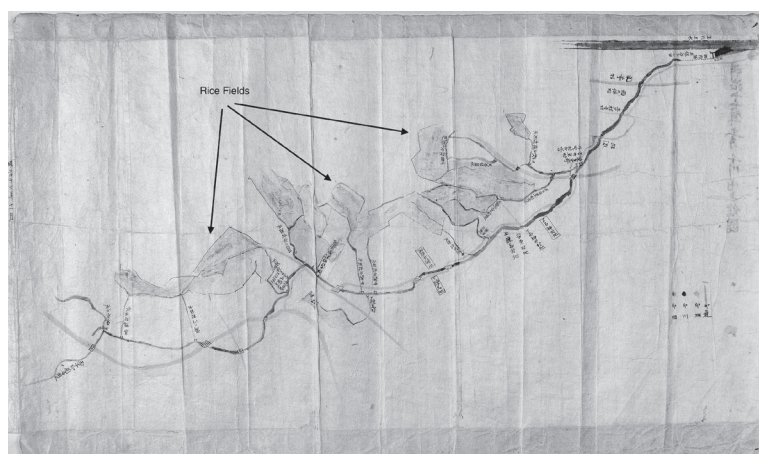


Figure 4: Rice Fields Along the Senkawa Josui (1880s)

Courtesy of Nerima Shakujikoen Furusato Museum



The transformation of the Senkawa also impacted social and political relations. No longer necessary in the city, the four Senkawa families lost the Edo residences that the bakufu had granted them. Two of the families disappeared from the records, leaving the Tokubei and Tahei lines (often referred to as the “two Senkawa families”) to manage the system under the newly streamlined system set up in the bakufu’s finance office (*kanjōsho*). In 1737, the head of Tokubei’s family moved to Shimo-Nerima.<sup>19</sup> (Tokubei’s heir Chozaemon 長左衛門 (d. 1748) married his daughter to a Nerima native, Genzo (d. 1767); Genzo in turn succeeded as head of the Senkawa family and moved it to Shimo-Nerima.) Senkawa Genzo owned no land in Nerima and probably depended on an allowance from the water fees for his livelihood.

Working within the revamped bakufu system, the two Senkawa families acted as contractors, mediators, and managers in the day-to-day operation of the Senkawa water system.<sup>20</sup> Responding in 1788 to a request by the bakufu public works office for clarification of their work content, the heads of both families described a range of duties relating to the physical maintenance of the Senkawa Josui, including the outlet from the Tamagawa Josui, outlets to individual villages, embankments, and a total of seven bridges. When repairs were necessary, they procured materials, hired labor, and oversaw the actual work. They also reported patrolling channels during the irrigation season, paying guards posted at Shakujii and Kami Itabashi villages, and maintaining the guard huts. In the off-season, they dredged the channels. They paid for the work with the water fees that they collected annually from each village according to the rate set in 1707.

Two additional tasks indicate the importance

of the Senkawa Josui in connecting villages to wider economic and political networks. First was the adjustment of water volumes. Since irrigation rights were granted specifically for rice growing, water was usually available only between the third and the eighth month; at other times the canal was closed off and the supply stopped. However, since villages often needed water earlier than the third month (to plant seedlings, for example), the Senkawa family regularly requested the bakufu’s public works office to have the Tamagawa Josui gate opened, in part or in full. The bakufu’s response was often to authorize a 30% opening. Especially from the 1780s, the request (and the 30% allowance) became a formality. In fact, there were constant adjustments to the water supply. During the regular open season, if the weather was especially dry, villages often requested an increase in volume; for this they paid an additional fee that the Senkawa family collected and passed on to the bakufu. Conversely, if the Tama River was low, the bakufu on occasion restricted water flow to the Senkawa Josui.

A second task was the negotiation of rights relating to waterwheels, especially after the 1750s, as demand increased across the Kanto region for the milling and pounding of grain. Since waterwheels reduced the flow of water, downstream villages often objected to their construction. Taking advantage of a temporary increase in water volume during the 1780s, when the Senkawa underground pipes were briefly reopened to supply drinking water in Edo, Izaemon, a farmer of Igusa village built a waterwheel on the canal.<sup>21</sup> However, when the drinking water function was stopped in 1787 and the water supply returned to its previous levels, villages downstream of Igusa complained that the waterwheel was interfering

with their irrigation. The public works office decided that the waterwheel could be used only when the gate from the Tamagawa Josui was opened at 50% or more. In 1805, a request by Izaemon to move the waterwheel prompted another round of negotiations, again resulting in a bakufu decision aimed at protecting the irrigation rights of the downstream villages. Similarly, in 1822, when Yahei of Takinogawa village at the very lower end of the Senkawa Josui wanted to build a waterwheel on his own land, the bakufu moved to protect the irrigation rights of his neighbors.<sup>22</sup> The intensity of the disputes, the involvement of the bakufu, and the eventual outcomes underscored the primacy of rice field irrigation as the main function of the Senkawa Josui and the political strength of the cooperatives in defending their water rights.

### Water Power for National Defense

The balance of interests supported by the Senkawa Josui changed from the late Edo era, as the growing importance of national defense created new demands for water. Responding to the need to develop Western-style technology for cannon, the bakufu deputy Egawa Hidetatsu (Tarozaemon) (1801-55) oversaw the construction of a cannon foundry at Yushima in Edo in 1853 and a reverberatory furnace at Nirayama in Izu Province in 1854. In 1864, however, responsibility for defense was transferred to bakufu official Oguri Tadamasa (1827-68), more powerful than Egawa and more experienced in Western technology. Aiming to concentrate facilities geographically, Oguri looked for a location that was close to Edo and close to water energy to build a cannon foundry. The process was to build a blast-furnace (*yōkōro* 溶鉱炉) of fire-resistant brick, smelt a large quantity of iron inside, and use it to cast the cannon.

Of course, this required energy – and in Japan's pre-coal era, this meant water. Oguri and other bakufu officials decided on Takinogawa village, largely because of the possibility of using water from Senkawa Josui to build a waterwheel.<sup>23</sup>

Takinogawa, the second lowest downstream village on the Senkawa open canal and home to fewer than 100 households, was surrounded by water. On its northern side, the Shakujii River, which rose in Hana Koganei (present-day Kodaira City), flowed east to the Sumida River, offering access to the Ara river transportation system as well as irrigation. The Saka River joined the Shakujii on the eastern boundary of the village; the Yabata, a local stream, flowed to the south. Adding to these natural rivers, the Senkawa Josui ran roughly north-south past the village on its way from Itabashi to Sugamo. Thanks to its beautiful natural surroundings, Takinogawa had become a popular place for day trips from Edo. Despite the abundance of water, however, Takinogawa farmers focused on vegetable growing rather than rice. Their special products were burdock root and carrots, produced for sale in Edo. In 1867, rice accounted for a scant 0.5 *tan* (495 square meters) of farmland. Oguri's group concluded that, by cutting the many "useless" diversions that had emerged along the Senkawa Josui, it would be relatively simple to secure enough water to power a waterwheel without harming agriculture.

Work on the Senkawa water system began in the ninth month of 1865 and finished by the close of the year.<sup>24</sup> A channel, about 2.2 kilometers in length, was built to link the Senkawa Josui with the foundry site. Already, the Shakujii River had been widened and deepened to allow transportation from the Ara and Sumida rivers. Finally, another channel, dug between the Senkawa Josui and a dam on the

Shakujii River near Oji village, provided an outlet for any extra water from the Senkawa and additional, free water for the villages that used the Shakujii River. The project required 25,370 workdays, at a cost of 2,589 *ryō*. Much of the labor was supplied by local residents and overseen by the two Senkawa family heads. In addition to paying for labor, the bakufu compensated farmers for land acquisitions as well as for the interruption to farm work. Headman Juzaemon of Takinogawa encouraged villagers to take the compensation payments and simply accept the Senkawa project as bakufu work.

After the furnace was completed in 1866, the watergate from the Tamagawa Josui to the Senkawa Josui was left permanently open. Since this meant an increase in the water volume carried by the Senkawa, Takinogawa villagers made several attempts to increase their irrigation entitlements.<sup>25</sup> However, bakufu priorities for the Senkawa Josui had shifted from rice field irrigation to energy for national defense. In contrast with its earlier concern to protect agriculture from waterwheel enterprises, the bakufu now offered few additional concessions. In view of its new military importance, the bakufu transferred management of the Senkawa Josui to the foundry, offering the two Senkawa family heads and the Takinogawa village headman semi-military appointments as guards.

### Water for Modern Industry

After the establishment of the Meiji government in 1868, northeastern Edo, including the area around Takinogawa and Oji that are now part of Kita City, became a focus for the development of modern industry.<sup>26</sup> In 1872, after the Takinogawa military facility was moved to the Korakuen area of Tokyo, the Kajima Spinning Mill was founded on the Takinogawa site. In

1875, Shashi Kaisha, forerunner of Oji Paper Company, opened its production center at nearby Oji. In 1876, the Ministry of Finance set up a paper money printing division in Oji. Already in 1871, the Military Affairs Ministry had acquired Kaga domain property at Itabashi. In 1876 it established the Itabashi Gunpowder Arsenal there, continuing the military character of the area into the modern era.

In each of these cases, the availability of water from the Senkawa Josui and Shakujii River attracted private and government enterprises. Both channels could support water power, and the Shakujii in addition offered transportation links with the Ara River. The competition among companies for water rights produced an intricate web of agreements with local communities, represented by their irrigation cooperatives.<sup>27</sup> The future Oji Paper Company, for instance, claimed that its decision to locate its factory at Oji was made possible by a deal that it struck – based on the support of the Oji headman – with the 23 villages of the Shakujii River Shimo Yosui cooperative in 1874. The cooperative offered rights to the additional water it had been receiving from the Senkawa Josui since 1865 as part of the reverberatory furnace construction at Takinogawa. In return, Oji agreed to reimburse the cooperative for payments it had made at the time of construction and to take responsibility for future dredging, repairs, and other expenses. In 1875, Oji exchanged detailed arrangements regarding access and payments with Kajima Spinning Mill, which, located higher on the Senkawa Josui at Takinogawa, used Senkawa water before it passed into the channel on which Oji now depended. Based on such arrangements, there were, by 1884, as many as 11 waterwheels in what is now Kita City; Takinogawa village had four (on the Senkawa Josui) and Oji village

three (on the Shakujii River).

But the early arrangements proved insufficient to the vastly increased water needs of emerging modern industry.<sup>28</sup> Water diverted to industry was water taken from agriculture, and there was much competition between the two, especially in summer when farmers most needed water. Moreover, old practices for water management – by the bakufu, the Senkawa family, and the village cooperatives – had broken down, and old understandings were often unclear and contested. Even attempts to protect water rights by sending guards as far upstream as Hamura and Koganei proved ineffective: village communities stole water from companies and from each other. In 1875, when the Ministry of Finance requested additional water to support a waterwheel at its planned money printing facility in Oji, resistance from villages along the Shakujii River was so strong that the Ministry was temporarily forced to accept a reduced water allowance and severely restricted hours of use. As a result, Oji Paper felt obliged to offer half of its newly negotiated water rights to the money printing facility.

In 1878, the Tokyo government approved a special increase in the volume of water diverted from the Tamagawa Josui to the Senkawa at Hoya Shinden to allow the money printing functions to proceed. In 1882, it offered a similar special arrangement to the Senkawa Suidō Kaisha, a water company founded by Iwasaki Yataro (1835-85) and others to restore urban drinking water services from the Senkawa Josui to Koishikawa, Hongo, Shitaya and Asakusa. However, private industry could not expect such treatment. Every increase in water allotment from the Senkawa Josui had to be negotiated within the existing framework of competing interests.

In the late 1880s, as the Oji paper company

moved to full production, its response was to seek a market outside the Senkawa framework.<sup>29</sup> In 1887 it negotiated to buy surplus water from several villages served by subsidiaries of the Tamagawa Josui in the Kodaira area, some 8 kilometers west of Hoya Shinden. To transport the water, the company dug a new channel to connect with an existing channel in the Tanashi area. This in turn connected with the Shakujii River, which carried the water downstream to Oji. The construction cost, some 1,445 yen, was shared by Oji Paper Company, five other waterwheel operators, and the Shimo Yosui cooperative, on the understanding that all would gain access to the new water supply. In 1889 and 1893, Oji Paper made further water purchases in the upper Tama area. Money, engineering capacity, and the availability of water further upstream in the Tama River allowed Oji Paper to bypass the Senkawa Josui, so important in the earlier negotiations, in finding an intermediate solution to the problem of supplying water to newly industrializing Tokyo.

## Conclusion

The Senkawa Josui, so important to Edo-Tokyo and the Musashino region in the 18<sup>th</sup> and 19<sup>th</sup> centuries, became less so in the 20<sup>th</sup> century. Its underground wooden pipes supplied water to northeastern Tokyo until they were closed off in 1907, unable to compete with the more modern water system that had spread throughout the city. By this time, although Senkawa water was still in use for industrial purposes, coal and electricity had long replaced waterwheels as energy sources. Irrigation from Senkawa Josui continued into the postwar era, especially in Nerima City. By the 1950s, however, contamination from industry and urban living had become sufficiently alarming that Nerima and other local

administrations shut off the water and covered over much of the canal with roads and railway tracks. Recently, cherry trees and bicycle paths have transformed some sections of the canal into leisure sites, while treated sewage has begun flowing through the Senkawa as part of a Tokyo City initiative, begun in 1989, to restore the flow of clear water in underground pipes.

What can we learn from the story of the Senkawa Josui? First, its successive transformations offer a water-based view of broader shifts in Japanese history since the Edo era and a sense of the crucial role of water management in shaping Japanese society. The construction of the Senkawa Josui in 1696 to supply drinking water to locations in northeastern Edo favored by Shogun Tsunayoshi reflects the importance of shogunal priorities in the development of Edo and the technical expertise that made urban development possible. The expansion of its irrigation functions from 1707 reflects the continuing importance of agricultural development across the Kanto region as urban food supply for Edo and economic support for the Tokugawa bakufu. And finally, the efforts by Oji Paper and other emerging industries to secure access to Senkawa Josui water in the opening decades of the Meiji era point to the negotiation of competing economic and political interests that accompanied Japan's emergence as a modern industrial power.

Second, the Senkawa Josui's story offers a view of the attitudes to the natural environment that underpinned the development of early modern and modern Japan. Given its physical, social and political characteristics, it does not surprise that manipulating water – to fill in the marshes, develop transportation, control floods, irrigate farmland, and supply drinking water – was key to the development of Edo

and its modern successor. What repeatedly surprises, however, is the boldness of such manipulations. The history of the Senkawa Josui shows that individuals, local communities, governments and businesses in the Edo and Meiji eras were prepared to construct waterways on a grand scale and quickly, to adjust them frequently, and abandon them readily to meet changing needs. They linked the Senkawa Josui, a constructed waterway, with the Tamagawa Josui, the Shakuji River and other waterways in such a way that there could be little differentiation between canals and natural rivers, little sensitivity to river ecology, and little concern to maintain the integrity of particular water systems. The efforts by Oji Paper and other city waterwheel operators to seek out surplus water in western Musashino, buy it as a commodity, and transport it to Tokyo through a series of unrelated waterways suggest an instrumental attitude that recognized few boundaries in the manipulation of the natural environment for economic and political ends.

A walk or drive along the Senkawa Josui today reveals little more than a former waterway – overrun with grasses, boarded over, or, even more likely, lost underground. No longer particularly useful, it might even be described as a backwater rather than as a waterway. But the history and present condition of the Senkawa Josui raise issues about the management and uses of water that remain relevant – particularly in a city like Tokyo, which is still looking for ways to use natural resources in ways that are functional, responsible, and beautiful.

<sup>1</sup> [http://www.mlit.go.jp/tochimizushigen/mizsei/water\\_resources/contents/current\\_state2.html](http://www.mlit.go.jp/tochimizushigen/mizsei/water_resources/contents/current_state2.html)

<sup>2</sup> Oishi Manabu and Tokyo Gakugei Daigaku Kinseishi Kenkyukai, eds 大石学(監修)東京学芸大学近世史研究会(編), *Senkawa jōsui yōsui to*



- Edo Musashino kanri taisei to ryūiki shakai* 千川上水・用水と江戸・武蔵野:管理体制と流域社会 (Meicho Shuppan, 2006).
- <sup>3</sup> Suzuki Masao 鈴木 理生, *Sūpā bijuaru han 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), 4-102; Suzuki, *Edo no kawa, Tokyo no kawa* 江戸の川・東京の川 (Inoue Shoin, 2005), 11-179. Introduced in Patricia Sippel, “Japan’s First Urban Water Disaster: The Great Kanto Flood of 1742,” *Toyo Eiwa Jogakuin Daigaku Gendaishi Kenkyu Kiyo* 東洋英和女学院大学現代史研究紀要 (No. 10, 2014), 1-33.
- <sup>4</sup> 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.
- <sup>5</sup> Ito Koichi 伊藤 好一, *Edo jōsuidō no rekishi* 江戸上水道の歴史 (Yoshikawa Kobunkan, 2010), 1-42; Hatano Jun, “Edo’s Water Supply,” in James McClain, John M. Merriman, Kaoru Ugawa, *Edo and Paris: Urban Life and the State in the Early Modern Era*, 234-xx; “Gijutsu nooto” (Tōkyō-to Chishitsu Chōsagyo Kyōkai, No. 25, 1998) (accessed Nov. 24, 2016, at [http://www.tokyo-geo.or.jp/tech-note-pdf/No25\\_1.pdf](http://www.tokyo-geo.or.jp/tech-note-pdf/No25_1.pdf)).
- <sup>6</sup> [http://www.mlit.go.jp/river/basic\\_info/jigyo\\_keikaku/gaiyou/seibi/pdf/tama-4.pdf](http://www.mlit.go.jp/river/basic_info/jigyo_keikaku/gaiyou/seibi/pdf/tama-4.pdf)
- <sup>7</sup> Ito, 27-31; Kosaka Katsunobu 小坂克信, “Tamagawa jōsui no bunsui to enkaku 玉川上水の分水の沿革と概要” (The Tokyu Foundation for Better Environment, 2014) (accessed Nov. 24, 2016, at <http://www.tokyuenv.or.jp/wp/wpcontent/uploads/2014/10/G210.pdf>); Kanki Kazuo 神吉 和夫 and Watanabe Tsuneo 渡部 恒雄, “Edo suidō no kisoteki kenkyū sono 1: Jōsuiki ni miru Edosuidō no kikō to kinō 江戸水道の基礎的研究 その1 - 『上水記』にみる江戸水道の構造と機能 -” (*Nihon Dobokushi Kenkyū Happyōkai Ronbunshū* 日本土木史研究発表会論文集 (8: June 1988), 274-81) (accessed on Nov. 24, 2016 at [https://www.jstage.jst.go.jp/article/journalhs1981/8/0/8\\_0\\_274/\\_pdf](https://www.jstage.jst.go.jp/article/journalhs1981/8/0/8_0_274/_pdf)).
- <sup>8</sup> Senkawa family accounts date from 1768 (Yamahata Minoru 山端穂, “Senkawa jōsui no kaisetsu 千川上水の開設,” in Oishi, 61-62, 64, and 66-68) and 1794 (Ono Junzo 小野順三, “Goyōdome ni miru Senkawake no shokumu to shakkaiteki chii 御用留に見る千川家の職務と社会的地位,” in Oishi, 139-40). On the establishment of the Senkawa Josui, see Yamahata (57-83) and Yamahata, “Genroku ki ni okeru shogun onari to Hakusan Goten 元禄期における将軍御成と白山御殿 (in Oishi, 87-108).
- <sup>9</sup> It is sometimes said that they received the name Senkawa 千川 because they lived in Sengawa village, but this appears to be incorrect (Oishi, 10-12).
- <sup>10</sup> Nerima-ku Kyodoshi Kenkyukai 練馬郷土史研究会 (Tokyo ni Furusato o Tsukuru Kai 東京にふる里をつくる会, ed.) *Nerima-ku no rekishi* 練馬区の歴史名 (Meicho Shuppan, 1977), 36-51.
- <sup>11</sup> Omatsu Kiichi, 大松 騏一, *Senkawa jōsui sanbyakunen no nazo o ou* 千川上水三百年の謎を追う (Higashi Ginza Shuppansha, 1996), 75-78.
- <sup>12</sup> Furutani Kae 古谷香絵, “Senkawa jōsui to Edo no machi 千川上水と江戸の町,” in Oishi, 109-31.
- <sup>13</sup> Furutani, 12.
- <sup>14</sup> Senkawa family document quoted in Yokoyama Kyoko 横山恭子, “Senkawa ke no gaikan - Edo kara Musashino e 千川家の概観—江戸から武蔵野へ—” (in Oishi, 21-55), 39-40.
- <sup>15</sup> Omatsu, 89-92.
- <sup>16</sup> Two years later, in 1724, it created a new office of public works (*fushinyaku* 普請役) under the Finance Commissioner (*kanjō bugyō* 勘定奉行) responsible for flood control as well as overseeing water management, including the collection of fees. 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), 76-77.
- <sup>17</sup> Yokoyama, 39-40.
- <sup>18</sup> Nakayama Atsushi, “Senkawa yōsui no yōsui kumiai,” in Oishi, 178.
- <sup>19</sup> Yokoyama, 49.
- <sup>20</sup> Ono Junzo 小野 順三, “Goyōdome ni miru Senkawake no shokumu to shakkaiteki chii 御用留に見る千川家の職務と社会的地位,” in Oishi, 133-63.
- <sup>21</sup> Ono, 154; Nakayama, 189-92, 204-211.
- <sup>22</sup> Kitaku-shi Hensan Chosakai 北区史編纂調査会,

*Kita-ku shi, tsūshihen, kinsei* 北区史 通史編  
近世 (Kita-ku, 1996), 329-31.

<sup>23</sup> *Kita-ku shi, tsūshihen, kinsei*, 575-79; Kudo  
Kohei 工藤航平, Takeshita Makoto 竹下誠 and  
Nomoto Teiji 野本禎司, “Bakufu noshintaihō  
seizōsho kensetsu seisaku 幕府の新大砲製造所建  
設政策の実現過程と千川上水” in Oishi, 436-37.

<sup>24</sup> *Kita-ku shi, tsūshihen, kinsei*, 579-87; Kudo,  
Takeshita and Nemoto, 446-64.

<sup>25</sup> Kudo, Takeshita and Nemoto, 466-70.

<sup>26</sup> Kitaku-shi Hensan Chosakai 北区史編纂調査会,  
*Kita-ku shi, tsūshihen, kin-gendai* 北区史 通史  
編 近・現代 (Kita-ku, 1996), 34-45.

<sup>27</sup> *Kita-ku shi, tsūshihen, kin-gendai*, 86-98.

<sup>28</sup> *Kita-ku shi, tsūshihen, kin-gendai*, 100-101.

<sup>29</sup> *Kita-ku shi, tsūshihen, kin-gendai*, 101-04.