The Heritage of Human Resilience in the Face of Natural Disasters

Tateyama Sabo

Sediment disaster prevention system

– an amazing project for build back better and coexisting with nature –

2025

TOYAMA Prefecture

Japan

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Preface

Tateyama Caldera, a huge depression caldera located in the south-eastern part of Toyama Prefecture in the central mountainous region of Japan: (the Northern Alps), has one of the harshest natural environments in the world, as a large amount of sediment collapsed and deposited by the Hietsu Earthquake of 1858 and about 5,000 mm of precipitation. After the earthquake, the Toyama Plain, downstream of the Joganji River, which rises in the Tateyama Caldera and is one of the steepest rivers in the world, was repeatedly subjected to enormous sediment disasters (debris flows and flood inundations).

Since the end of the 19th century, "Tateyama Sabo", a Sabo projects (sediment disaster prevention using erosion and sediment control facilities, reforestation) using modern technology "comprehensive sediment management system of water system" has been developed in the Tateyama Caldera and the Joganji River to protect people living and restore land use in the Toyama Plain from sediment disasters, thanks to the wisdom and efforts of predecessors.

The Toyama Prefectural Government is conducting research and studies to register Tateyama Sabo as a World Cultural Heritage site, and to preserve and pass it on to future generations as a valuable cultural heritage common to all mankind, that protects the safety and security of people.

This booklet provides an overview of Tateyama Sabo, "an amazing project for build back better and coexisting with nature", and its potential outstanding universal value extracted from a technical viewpoint.

*"Sabo" refers to various measures to prevent sediment disasters caused by natural phenomena such as torrential rain, earthquakes, volcanic eruptions, and other man-made actions such as deforestation.

In this booklet, the term "Sabo" is used for these measures against sediment disasters and "Sabo Dam" for check dam for erosion and sediment control dam. "Sabo" was recognized as a common language in the world at the International Hydrological Congress held in Brussels in 1951.

contents

1 History of Tateyama Sabo

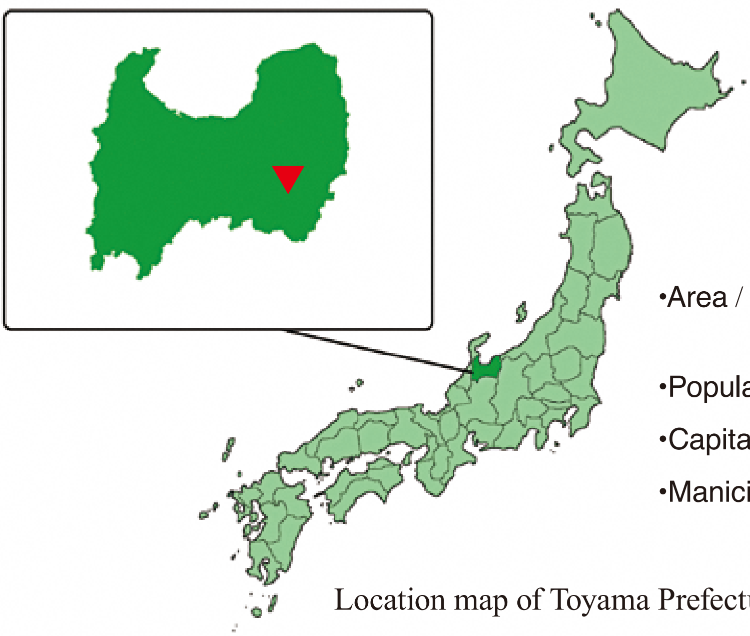
1.1 Introduction

Toyama Prefecture is located in the north central part of Honshu, the center of the Japanese archipelago stretching from north to south. It faces the Sea of Japan to the north, and is bordered by Niigata and Nagano Prefectures to the east, Gifu Prefecture to the south, and Ishikawa Prefecture to the west. Surrounded on three sides by steep mountains and spreading out like a plain embracing a deep bay, Toyama is characterized by its compact topography with a radius of 50 km centering on Toyama City.

The 3,000-meter-high Tateyama Mountain range of the Northern Alps rises in the southeastern part of Toyama Prefecture. The Tateyama Caldera is located on the south side of the Midagahara Plateau of Tateyama.

Tateyama Caldera is a large oval-shaped depression measuring 6.5 km east to west and 4.5 km north to south, formed by weathered igneous rocks from a volcano that began its activity more than 100,000 years ago, which was formed by erosion caused by heavy rainfall. The geology of the area is extremely fragile due to several active faults, including the “Atotsugawa Fault”, one of the most active faults in Japan, which runs adjacent to the site. The Tateyama area is one of the world’s wettest and snowiest regions, with annual precipitation exceeding 5,000 mm and snowfall reaching 5 m.

The Joganji River, which originates in the Tateyama Caldera area, joins its tributaries in the mountains and flows northward through the Toyama Plain into Toyama Bay. The Joganji River is one of the most rapid rivers in the world, flowing 56 km to Toyama Bay at an elevation difference of approximately 3,000 meters. Every time there is a heavy rainfall, it spills a large amount of sediments accumulated in the Tateyama Caldera, causing great damage to the Toyama Plain and threatening people’s lives as a “raging river”.



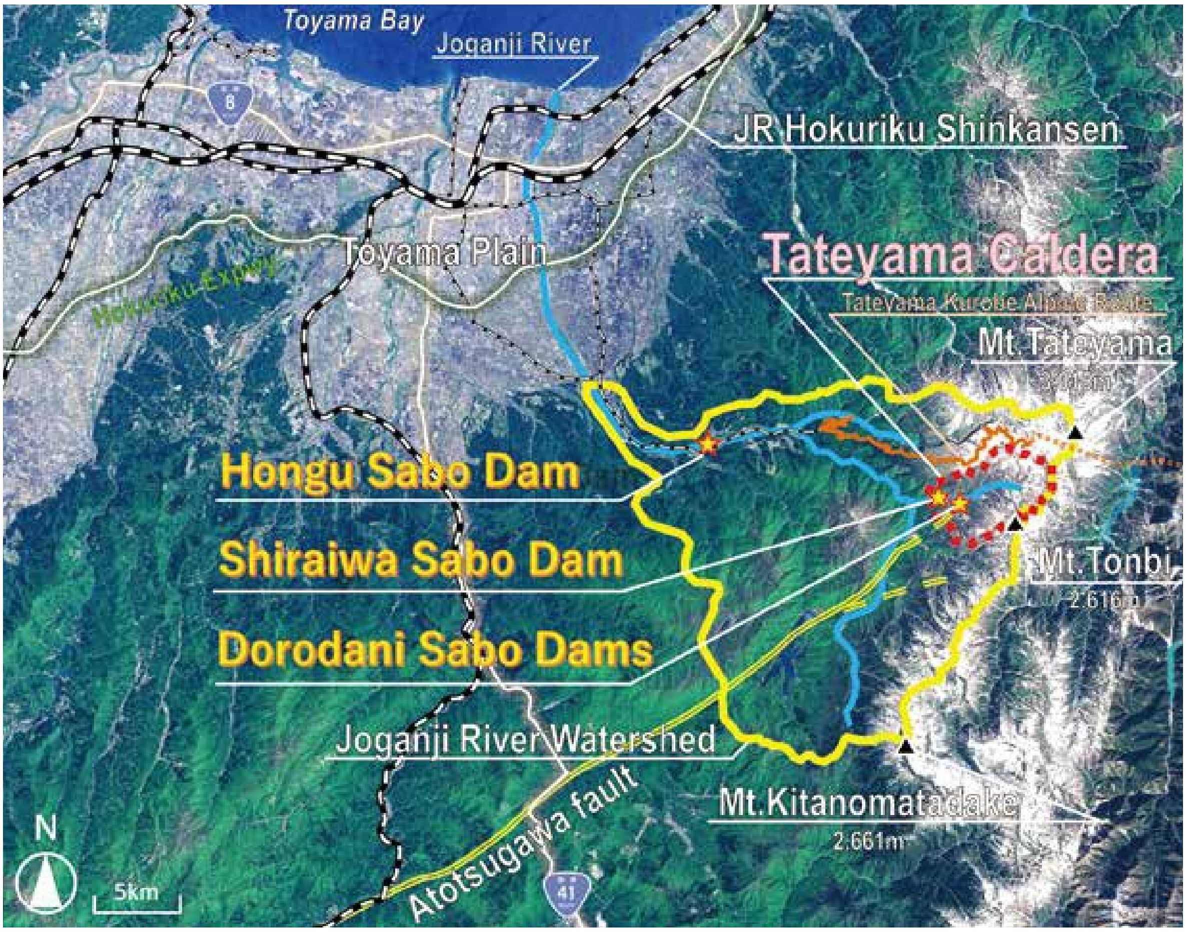
•Area / 4,247.58 km^2
(90 km east-west, 76 km north-south)

•Population / 995,955 (as of October 1, 2024)

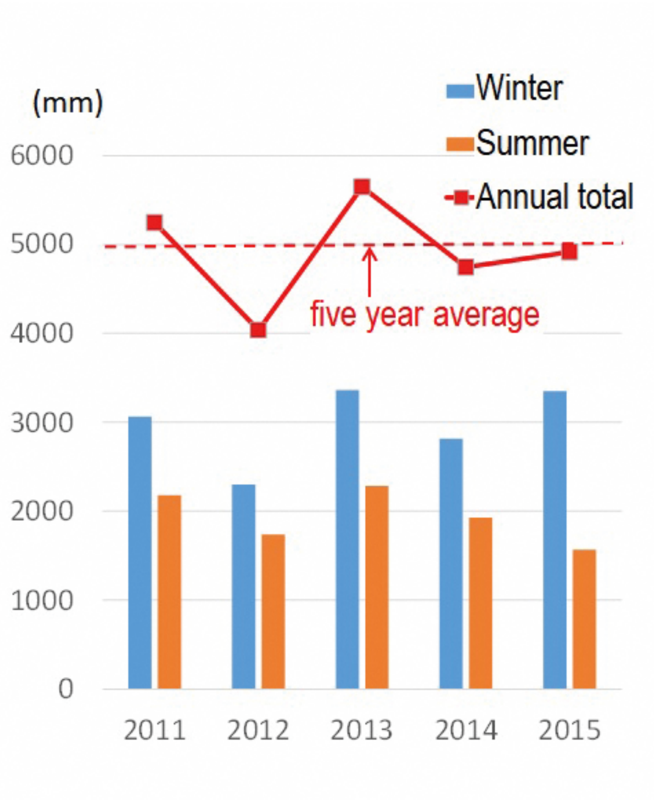
•Capital / Toyama City

•Manicipalities / 15 (10 cities, 4 towns, 1 village)

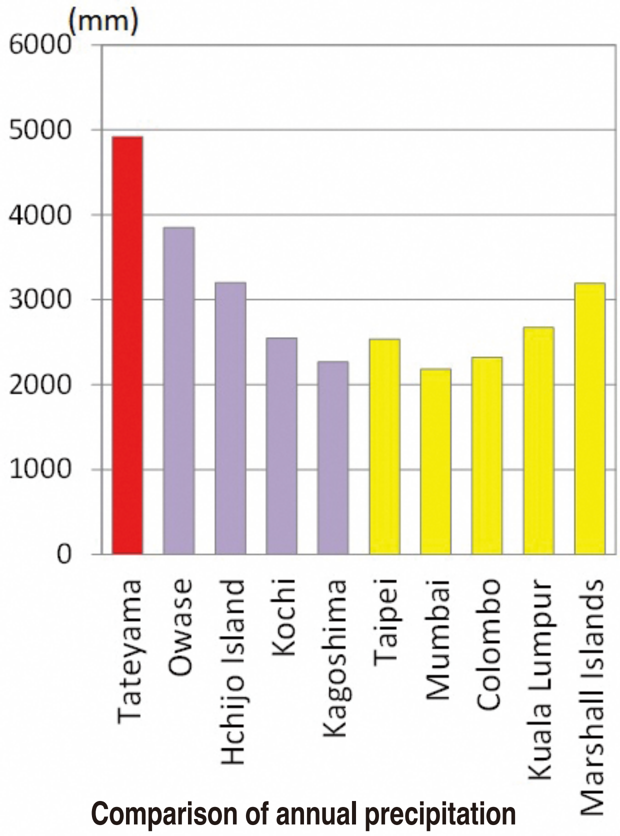
Location map of Toyama Prefecture, Japan


Toyama Bay
Joganji River
JR Hokuriku Shinkansen
Toyama Plain
Hokuriku Expwy
Tateyama Caldera
Tateyama Kurobe Alpine Route
Mt.Tateyama
Hongu Sabo Dam
Shiraiwa Sabo Dam
Mt.Tonbi
2,616m
Dorodani Sabo Dams
Joganji River Watershed
Mt.Kitanomatadake
2,661m
Atotsugawa fault
N
5km
8
41


Mt. Onanji 3,015m
Mt. Oyama 3,003m
Murodo Area
Tonbi Collapse
Midagahara Plateau
Tateyama Caldera
Tateyama Kurobe Alpine Route
Shiraiwa Sabo Dam
Joganji River

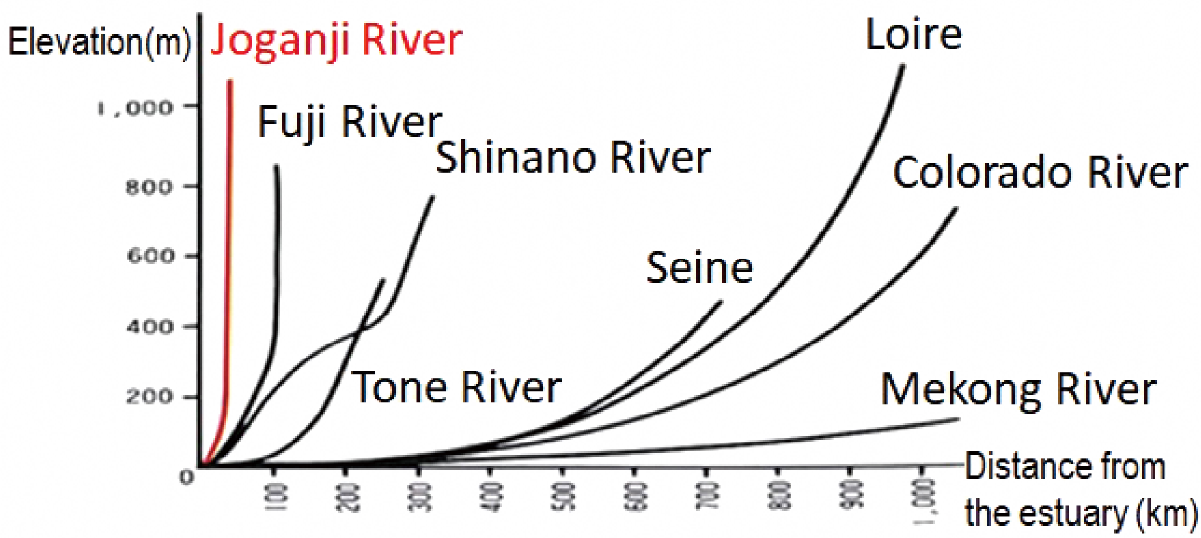


Changes of annual precitation in Tateyama



Comparison of annual precipitation between Tateyama and other areas in the world

(Data for Tateyama are from 2011 to 2015.
Data for other areas are the average from 1981 to 2010.)



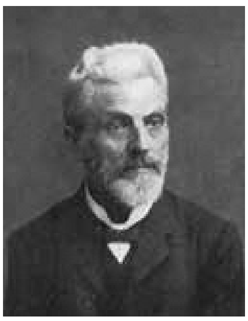
River bed slopes in the world

1.2 Birth of Toyama Prefecture and Sabo Projects by Toyama Prefecture

On April 9, 1858, a massive earthquake with an estimated magnitude of 7.3 to 7.6 the "Hietu Earthquake" occurred with the Atotsugawa Fault as its epicenter. This great earthquake caused the collapse of Mount "Tonbiyama" on the southern ridge of the Tateyama Caldera, and the collapsed sediment blocked the river channel of tributaries of the Joganji River, forming a number of landslide dams. The landslide dams were broken by a large amount of snowmelt water, and two massive debris flows swept down the Joganji River and into the Toyama Plain. As far as records show, 140 people were killed, 8,945 were injured, and 1,603 houses were lost.

Inundation Area of twice landslide dam breaks in the Joganji River in 1858
(Namerikawa City Museum Collection)

Since then, the Joganji River has become a "raging river" that debris flow and flood inundation repeatedly occurred every year. In 1883, Toyama Prefecture was separated from Ishikawa Prefecture to cope with the frequent floods, and from 1884, Toyama Prefecture spent a large amount of money on flood control works. However, disasters continued to recur, and in particular, the flood of 1891 caused extensive damage. This prompted Toyama Prefecture to request the national government to dispatch a river engineer, and in 1891, a Dutch engineer, Johannis de Rijke, was dispatched. Johannis de Rijke discerned that the large amount of collapsed sediment and devastation of the Joganji River headwaters were the cause of the flood damage. However, he considered it impossible to control the water source with the technology and budget of the time, and drew up a plan to renovate downstream of the river, including intakes for the water supply for agricultural use has been consolidated and repairing the levees. The river improvement work under de Rijke's leadership was completed in 1893, but the flooding did not subside thereafter due to the lack of upstream countermeasures.



Johannis de Rijke

Survey of the Joganji River by Johannis de Rijke

With financial support from the national government, Toyama Prefecture initiated a 20-year plan from 1906 for Sabo projects in the headwaters area. Small stone-pile hillside works with afforestation below collapse of Mount Tonbiyama and then stone-pile check dams reinforced with concrete were constructed in Yukawa River, which is one of the main branches of the Joganji River. However, the key Yukawa No.1 Dam was completely destroyed by a massive debris flow of approximately 20 m in height that occurred in July 1922.

1.3 Start of Sabo Projects by the National Government

In 1919, Toyama Prefectural Government requested that the national government undertake Sabo work in the Joganji River. The Toyama City Council also submitted a “Statement of Opinion” to the Governor of Toyama Prefecture and the Minister of Home Affairs of the national government in response to the residents’ opinions for Sabo work by the national Government. The Sabo Act was revised in 1924, and Sabo projects under the direct control of the national government began on the Joganji River in 1926. Sabo engineers in modern Japan, including Masao Akagi, who became the first director of the Tateyama Sabo Office, worked hard to establish a comprehensive sediment control technology for the entire water system by combining the technology in Alpine stream they learned in Austria with traditional and new Japanese technology.

Specifically, a series of 22 Sabo dams “Dorodani Sabo Dams” was constructed from 1930 to 1938 at the confluence with the Yukawa River in the “Dorodani”, which was most severely degraded, to flow water over unstable sediment, to control and deter sediment production in the upper reaches of the river, and to restore forest. a large-scale Sabo dam “Shiraiwa Sabo Dam” was built from 1929 to 1939 at the only place where bedrock was exposed in the main stream of the Yukawa River to stabilize the large amount of sediment, and stabilize the foundation of constructing Sabo dams upstream. From 1935 to 1936, the “Hongu Sabo Dam” was constructed to storage sediment in the middle reaches of the river.

Over the next 100 years, various Sabo facilities were systematically constructed, flood damage to the Joganji River was dramatically reduced, and the lives of people in the basin were restored to safety. There has been no flood inundation with huge amounts of sediment since the disaster of 1969. In addition, the devastated mountain slopes have been stabilized and vegetation has made a spectacular recovery. However, a large amount of unstable sediment still remains in the Tateyama Caldera, and the preservation of Sabo facilities and the construction of new Sabo dams are still ongoing.

Nevertheless, the Dorodani Sabo Dams, Shiraiwa Sabo Dam, and Hongu Sabo Dam, which were constructed in the early days of 1900s, are representative of existing Sabo facilities in Japan in terms of size, structure, and function. After World War II, Japanese engineers transferred Japan's advanced Sabo technology to sediment disaster-prone countries in Southeast Asia, Central and South America, and elsewhere, contributing to disaster prevention.

Tateyama Mountain Range and Toyama City developed by overcoming sediment disasters

2 / Japanese Important Cultural Property of Tateyama Sabo

There are three historical Sabo facilities, Dorodani Sabo Dams, Shiraiwa Sabo Dam, and Hongu Sabo Dam, represent Tateyama Sabo. These three dams are designated as Important Cultural Properties of Japan “Joganji River Sabo Facilities”.

2.1 General Description

In 2017, the national government of Japan designated the Sabo dams at Hongu and Dorodani on the Joganji River as Important Cultural Properties. This followed the designation of the Shiraiwa Sabo Dam as an Important Cultural Property in 2009 the first a Sabo facility so designated. They are now collectively protected, as one whole, as “The Joganji River Sabo facilities”. They are Sabo facilities that were built during the modern period in the midstream and upstream portions of the Joganji River, which originates in the Tateyama Mountains in the northern Japanese Alps and flows northward into the Toyama Plain.

The Tateyama Mountains are subject to very high precipitation and carry in the crater a large amount of unstable debris that collapsed during a huge earthquake in 1858. Consequently, the Toyama Plain downstream suffered severe damage from frequent debris-related disasters. Beginning in 1906, Toyama prefectural government conducted Sabo work for 20 years, trying to stop the debris flows. In 1926, the national government took over based on a plan by Mr Masao Akagi, the father of modern Sabo and the full-fledged Sabo work started using modern technology.

2.2 Justification of the Designation as an Important Cultural Property

The Joganji River Sabo facilities consist of Sabo dams constructed in three locations: Shiraiwa (completed in 1939), Dorodani (completed in 1938), and Hongu (completed in 1936). At Dorodani, in the upper reaches, there is a series of dams built in steps that curb the production of debris at the source; a large Sabo dam at Shiraiwa plays a central role in containing debris, and the large dam at Hongu in the middle reaches retains debris to stop it from flowing downstream.

Together, these Sabo dams help to control the Joganji River system, one of the most torrential river systems in Japan, and laid the foundation for water management and sediment control in this area. As such, they possess high value in the history of water management and sediment control in Japan. The Shiraiwa Sabo Dam is a large complex structure that was built with what were pioneering mechanized construction methods at that time; the Hongu Sabo Dam is a large debris-retaining dam that was built quickly, despite unfavorable foundation conditions due to a torrential river, and the Dorodani Sabo Dams are a long series of dams built in a narrow valley, complemented with hillside works over an extensive area to stabilize collapsing slopes along the valley. They represent the technological apex of modern disaster-prevention facilities combating debris flows.

2.3 Dorodani Sabo Dams

The Dorodani Sabo Dams are a series of Sabo facilities that were constructed in steps over the debris to prevent erosion and collapse of the valley slopes in the headwaters. The construction was done under the direct supervision of the national government. Mr Kaichiro Takahashi, the director of the Tateyama Sabo Office at that time, led a team of civil engineers from the national and prefectural governments in surveying the area and designing the dams. The construction started in 1930 and was completed in 1938, including dams, riverbed consolidation works, and hillside consolidation works.

A series of dams were situated at the bottom of a steep valley in a gentle curve over an altitude difference of 120 m and a length of 420 m. Nineteen concrete gravity dams were built with bank revetment works between them. The construction of the dams was completed in 1932. Dam No.1, which is located farthest downstream, is the largest, measuring 9 m in height and 47 m in length. The surface is paved with andesite blocks in a 45-degree herringbone pattern. Because the dams are placed on debris instead of bedrock, the spillway is wide and deep to prevent debris flows from hitting the banks directly.

Three riverbed consolidation works were built immediately downstream from Dam No. 1 to prevent scouring. The largest, closest to the dam, measures 7 m in height and 52 m in length and its surface is paved with andesite blocks in a 45-degree herringbone pattern.

Hillside consolidation works were conducted to prevent the collapse of valley slopes by enabling the regeneration of vegetation cover on the slopes. The elaborate dry-stone structures remain, including those built at the foot of the hills, stepped earth-retaining works on the left bank upstream and on the sides of the first and second dams downstream; water channels drain the rain runoff from the hillside to the bottom of the valley. There is a small single-arch stone bridge at the lower end of a water channel on the left bank of the fourth dam downstream.


Dorodani Sabo Dams

Immediatery after the completion of the Dorodani Sabo Dams by Ministry of Home Affairs (1933)

Current condition of the Dorodani Sabo Dams

Vegetation is recovering beautifully.

A monument at the Dorodani Sabo Dams

This monument "Gotengai" (reportedly written by Tsunenosuke Hamada, the 14th governor of Toyama Prefecture) is a symbol which represents the purpose to conduct the Sabo project in the Tateyama Caldera, located far from human habitation, and to protect the downstream Toyama Plain from damage caused by sediment disasters and flood inundation.

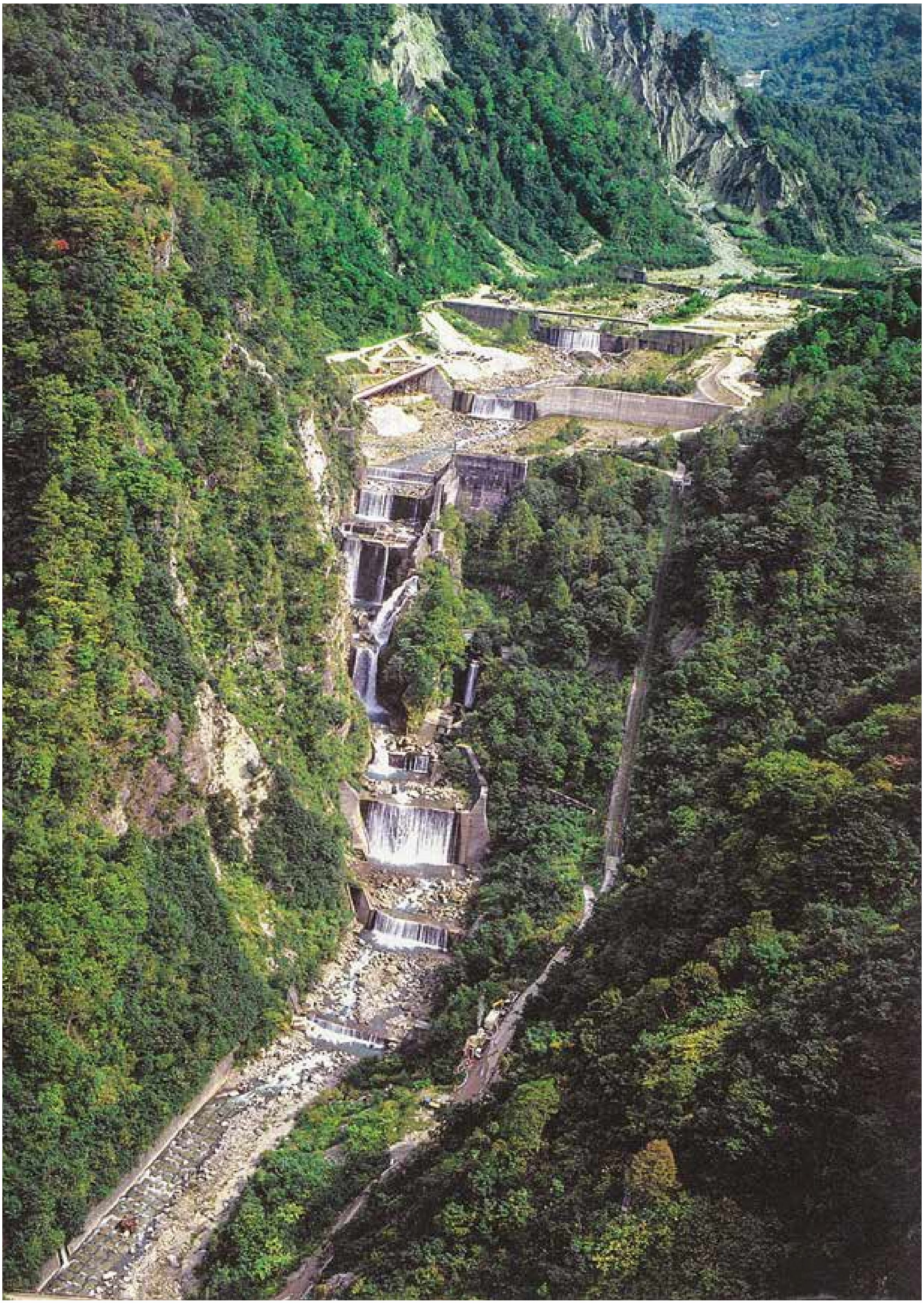
2.4 Shiraiwa Sabo Dam

The Shiraiwa Sabo Dam was based on a plan drawn up by Mr Masao Akagi, an engineer with the Ministry of Home Affairs, to tackle the challenging task of preventing debris-caused disasters by stopping debris from the Tateyama caldera in the headwaters of the Joganji River and consolidating the mountain slopes and riverbeds. It was constructed under the direct supervision of the national government from 1929 to 1939, using large pioneering machines for that time. It is the core Sabo facility located in the upper reach of the Joganji River. Built at a place where the bedrock is exposed, known as Shiraiwa (literally, “white rock”), it is a composite facility that ingeniously combines the main structure, substructure, riverbed consolidation works, and slope consolidation works using unique concrete square frames.

The main structure is attached to rock at its base and on the right bank. It is a concrete gravity dam measuring 20 m high and 76 m long. The spillway is steeply graded and its surface is paved with andesite blocks in a 45-degree herringbone pattern to minimize the damage from overflowing debris on the dam body. The structure on both sides of the spillway are graded based on earthquake-proof theories, with 40-m-high bank revetment works extending upstream for 70 m. In addition, a 70-m-long training dyke is attached to the main structure and the substructure on the left bank. Because the left bank consists of unstable volcanic sediment, while the right bank is stable bedrock, the dam structures and bank revetment works were connected, and the downstream side of the bank revetment works was supported with landfill as a measure to ensure overall stability.

When it was built, the substructure incorporated part of the Yukawa No.1 Dam, which had been built on the same site by the prefectural government before the national government took over the disaster-prevention works. It is attached to the rock at its base and on the right bank, with the left bank side attached to the training dyke. It is a concrete gravity dam measuring 10 m high and 31 m long with its surface paved with andesite blocks in a running bond. Stone-paved revetment works were installed along the training dyke.

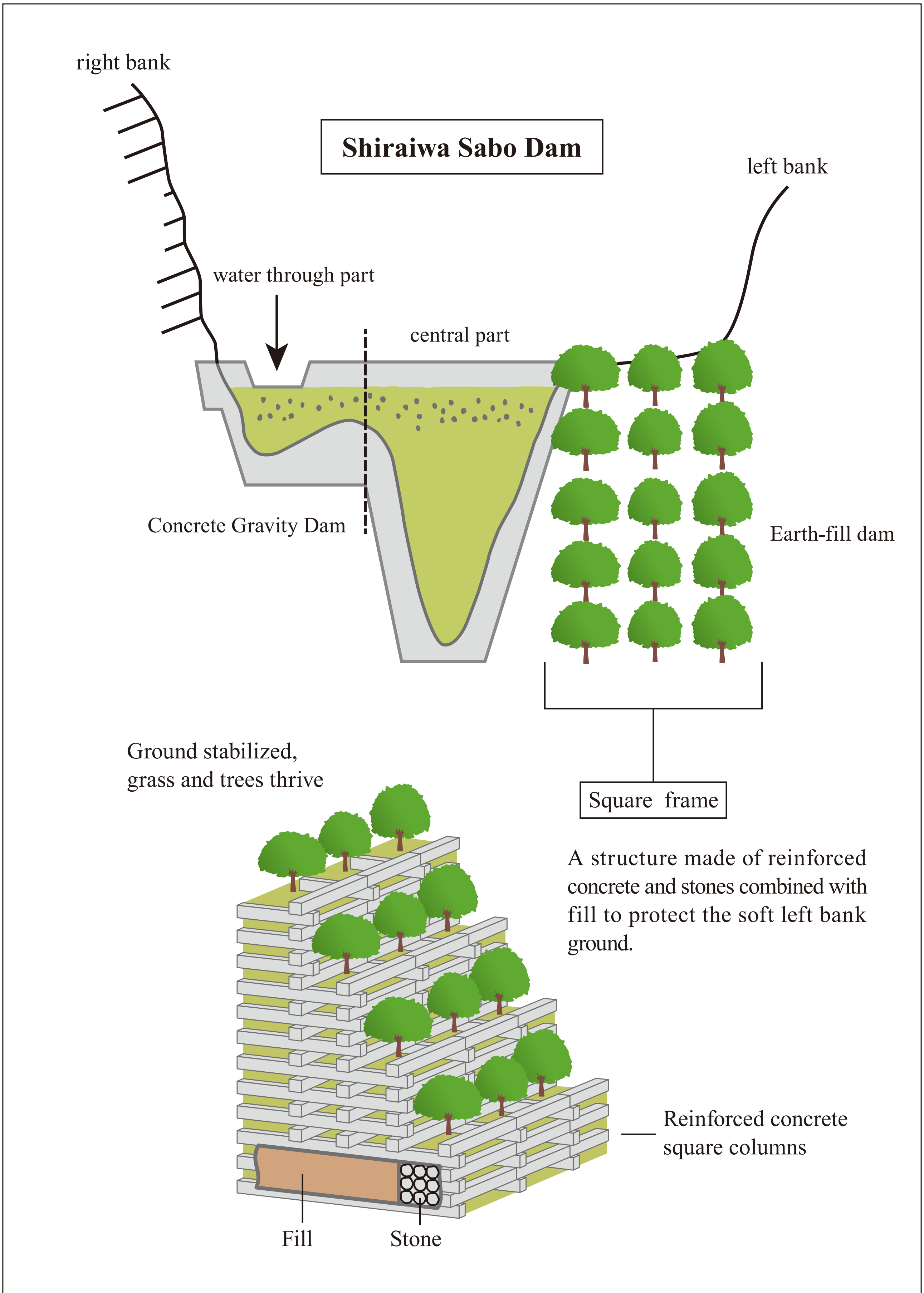
The riverbed consolidation works were built 24 m downstream from the substructure to reinforce the foundation with a concrete structure measuring 33 m high and 37 m long. The square concrete frames consist of 30 tiers of precast concrete lumber filled with stone and were placed to protect the slope of the backfilling works for the bank revetment. At the bottom, retaining walls are installed to reinforce the foundation of the backfilling works.



Shiraiwa Sabo Dam


Square frame

Square frame Schematic diagram of the structure



Revised from the August 2018 issue of JR West's "West NAVI"

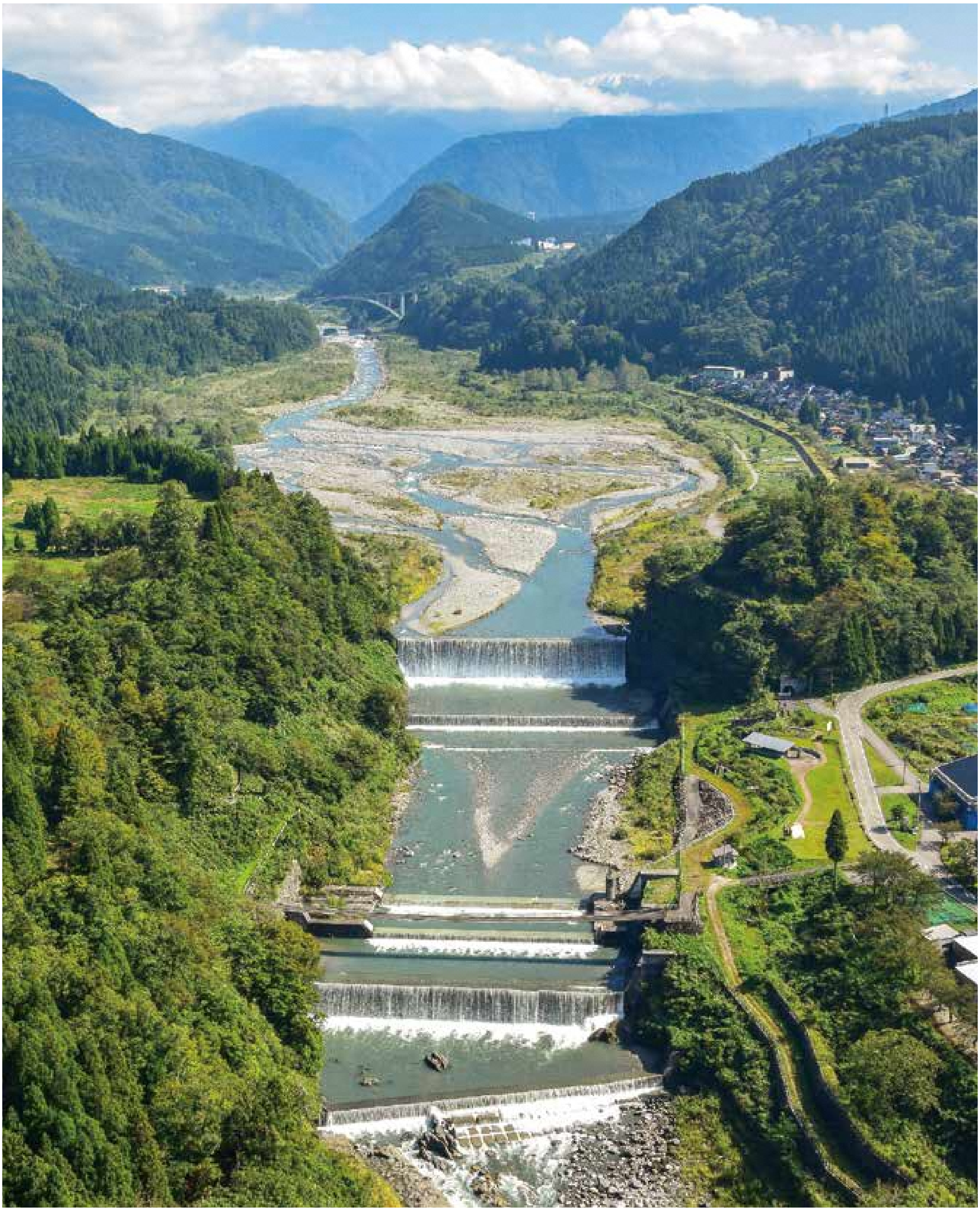
2.5 Hongu Sabo Dam

The Hongu Sabo Dam is a large Sabo dam in the middle reaches of the Joganji River that retains and deters debris from upstream. It was built at a bottleneck, 9.3 km upstream from the tip of the alluvial fan of the Joganji River. The construction was assigned to the national government by the prefectural government and was conducted from 1935 to 1936 based on an idea conceived by Mr Makoto Kaba, who was an engineer in the Ministry of Home Affairs at that time, to prevent debris-caused disasters by capturing the debris overflowing from the upstream Sabo works at the headwaters before it reaches the populated plains downstream. It is also effective in preventing the downstream riverbed from rising due to sedimentation. It consists of the main structure and a substructure.

The main structure is a concrete gravity dam measuring 22 m in height and 107 m in length. It has a debris-retention capacity of 5 million m^3, ranking it among the largest in Japan. The dam body is filled with coarse stone and concrete. The downstream surface is paved with andesite blocks in a 45-degree herringbone pattern. The upstream surface is finished with mortar. To prevent scour under the dam, an 18-m apron was attached as an integral measure to protect the structure immediately downstream from the dam and to reduce the speed of the undercurrent flowing under the dam.

The substructure is a concrete gravity dam immediately downstream from the apron, measuring 6 m in height and 96 m in length. It is filled with coarse stone and concrete like the main structure.

Hongu Sabo Dam



Hongu Sabo Dam

A large sediment storage area extends upstream.

3 Changes and Development of Japanese Sabo Technology

3.1 Japanese Native Sabo Technology for Reforestation and Its Improvement

During the Edo period, many of the mountains in Japan, particularly in the Kinki region, became bald mountains due to man-made deforestation, for example to collect firewood and building materials. Sediments easily flew out of bald mountains, and as a result, there have been the frequent occurrence of floods and sediment disasters, debris flows and inundation with plenty of sediment, due to the formation of alluvial fans and ceiling rivers at the foot of the mountains. In 1666, the Edo shogunate ordered the regulation of acts related to the prohibition of deforestation. And although there are old records of small hillside work to reduce sediment discharge, no significant results have been achieved to stop the devastation of many mountain areas.

In 1871, the Meiji government began a Sabo project in the upper reaches of the Kizu River in the Yodo River System to take measures against the obstruction of boat traffic between Kyoto and Osaka due to the rise of the riverbed caused by sediment discharge from the mountains. The construction method at this time, the Japanese native Sabo technology as same as in the Edo period, is considered to be construction with small stone walls and stone-pile check dams, and planting seedlings and cuttings for reforestation.

Hillside works at Tanakami area
(Photo taken in 1908)
Source: Photo Album of Seta River Sabo Hillside Works

From 1873 to 1903, Johannis de Rijke, a Dutch engineer who was invited and hired by the Meiji government as one of the experts for civil engineering especially on flood control, and sediment and erosion control, repeatedly emphasized the importance of preventing sediment discharge from mountains for flood control, and provided technical advice on Sabo projects in various parts of Japan. In particular, in the upper stream area of the Yodo River and the Kiso River, which have become bald mountains, he improved the Japanese native Sabo technology, and instructed the implementation of stone-pile check dams and planting for reforestation. Johannis de Rijke is called the founder of modern Sabo in Japan because of his achievements in reducing sediment discharge through these achievements of reforestation. However, Johannis de Rijke's technical advice was not effective in dealing with raging rivers with steep gradients and largely devastated areas in the upper stream area.

Yoroi Dam
(Otsu city, Shiga prefecture; Courtesy of Shiga Prefecture)

Dorodani Dams
(Photo taken in 1908)

Stone-pile check dam in Nishinotani

Stone-pile spillway in Nishinotani

In the Tateyama Caldera, small stone-pile check dams, stone channel works, and hillside works constructed by the Toyama Prefectural Government were built by the Japanese native Sabo technology. The old Dorodani Dams, which was built by the Toyama Prefectural Government, largely damaged and washed away by a debris flow event in 1929, is also thought to have been constructed using the Japanese native Sabo technology.

3.2 Introduction of Sabo Technology from Europe

In 1897, the "Sabo Act" was enacted by the Meiji government. Since it was difficult to deal with raging rivers with steep gradients and large largely devastated collapsed areas in the upper stream area using the Japanese native Sabo technology for reforestation, the Meiji government promoted the introduction of technology from Europe. In Europe, measures for sediment and erosion control such as the construction of check dams placed across streams have been implemented against sediment discharge caused by glacial sediment deposits and forest devastation due to salt mining. In particular, the introduction of technology from Austria is remarkable.

The Meiji government invited Amerigo Hofmann from Austria as a professor at Tokyo Imperial University from 1904 to 1909. Hofmann's assistant professor, Kitao Moroto, studied at the University of Natural Resources and Life Sciences in Vienna (BOKU University) from 1909 to 1912 under the guidance of Professor Ferdinand Wang. Soon after returning from his studies in Vienna, Moroto became a professor at Tokyo Imperial University and published Japan's first technical book on Sabo in 1916. Masao Akagi, who later became the first director of the Tateyama Sabo Office, was a student of Moroto's at Tokyo Imperial University, and entered the Ministry of Home Affairs after graduating from the university in 1914. Maruo Ikeda, who is famous for his technical advice on the French-style spillway on the Ushibuse River in Nagano Prefecture, completed in 1916, also studied in France to learn European Sabo technology.

Amerigo Hofmann
(BOKU University)

Kitao Moroto

Ferdinand Wang
(BOKU University)

Masao Akagi

Maruo Ikeda

A characteristic European Sabo technology is the installation of high (about 10-20 m) check dam across a stream to reduce sediment production by fixing the foot of mountain, prevent longitudinal erosion of the stream, and reduce the velocity of running water by reducing the longitudinal gradient of the stream. The structural feature of the check dam in Europe was seen in the steep slope of the downstream side of the check dam in the water-through part to prevent the check dam from wearing due to collision between the body of the check dam and the flowing debris.

The period Sabo Dams constructed in the Yukawa River during the Tateyama Sabo Project conducted by Toyama Prefectural Government coincided with the period of the early introduction of concrete to Sabo dams in Japan, and there are records that they were constructed using stone-pile with concrete. In old construction photos, the Sabo Dams in the Yukawa River had features such as the large size of the facility with a height of over 10 m, and the steep slope of the downstream side of the water passage can be observed.

Yukawa No.1 Sabo Dam

3.3 Tateyama Sabo Projects by the National Government

In 1922, the Sabo dams constructed in the Yukawa river and other streams in Tateyama Caldera were in introduction phase of concrete technology to Sabo works in Japan, and the small amount of concrete used was not strong enough against the debris flow, resulting in catastrophic destruction by repeated debris flows. As a result, after these debris flows, Toyama Prefectureal Government abandoned their Tateyama Sabo Project, and demanded that the National Government take over the project.

In 1923, the Great Kanto Earthquake caused serious sediment disasters, and then in 1924, the Sabo Act was revised to conduct the National Sabo Project even in a single prefecture. The Ministry of Home Affairs decided to wait for Masao Akagi, who had studied at the University of Natural Resources and Life Sciences in Vienna to return to Japan before deciding on conducting the Tateyama Sabo Projects by the National Government. Upon his return, Akagi surveyed the upper reaches of the Joganji River and determined that Sabo Project was feasible. Akagi's decision was an important turning point for the Tateyama Sabo, as it led to permanent measures that continue from 1926 to this day.

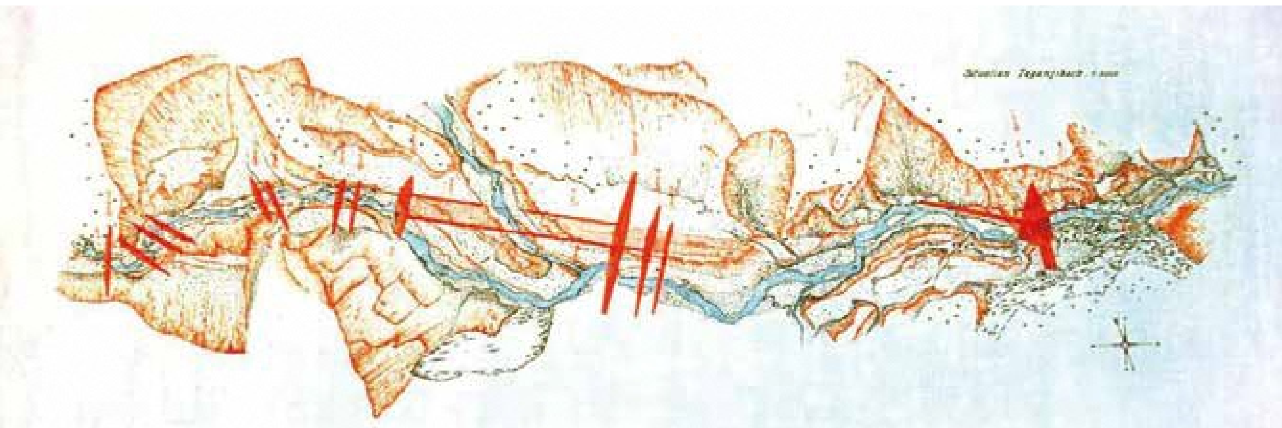
Yukawa No.1 Sabo Dam broken by debris flows

The reconstruction of Dorodani Sabo Dams were carried out by the Ministry of Home Affairs under the contract of disaster restoration project of Toyama Prefectural Government. It was constructed as a group of boulder concrete dams, but its function is the same as the former Dorodani Dams constructed by Toyama Prefectural Goverment. The purpose of Dorodani Sabo Dams was to a spillway over erodible unstable sediments, prevent erosion of unstable sediments, and reforestation by building a continuous arrangement of Sabo dams. The Dorodani Sabo Dams can be a remarkable example of the function of Japanese native Sabo technology.

As for Shiraiwa Sabo Dam, firstly Akagi planned to place a large-scale Sabo dam in a straight line across the Yukawa River. However, due to the creativity of Tokuichi Kaki and other on-site engineers, the exposed rock part of the riverbed on the right bank was constructed as a Sabo dam influenced by European technology made of boulder concrete, as same as in the project of the Toyama Prefectural Government. The non-overflow portion in the central part of the Shiraiwa Sabo Dam has the structure of a water storage dam due to the large height of the dam, although the foundation is on the exposed bedrock. Since the design method for this section is almost the same as that of a water storage dam, an earthquake-resistant design developed by Nagaho Mononobe was introduced for the first time for a Sabo dam. The left bank is constructed as an earth dam because the foundation is not grounded to the rock and the ground support is insufficient for a concrete structure. The upstream side of the dam is protected from erosion by a revetment and the downstream side is covered to protect from surface erosion by “square frame”, cribworks which are made of reinforced concrete bars placed in a square and stones packed inside of them.

The Structure of Shiraiwa Sabo Dam is unique in the world in that it is a hybrid of Sabo technology influenced by European technology and two types of water storage dam technology. It is the most important and symbolic Sabo facility in Tateyama Sabo. The Shiraiwa Sabo Dam fixed about 200 million m^3 of unstable sediment and supported the foundation of Sabo dams upstream at the outlet of Tateyama Caldera. The construction of the Shiraiwa Sabo Dam required a concentrated investment of budget and labor, the transportation of a large amount of construction materials by trolley, the use of the latest construction technologies of the time (concrete, earthquake-resistant design, trolley, and derrick crane) and quality control, all of which were major factors leading to its successful construction despite severe constraints such as heavy sediment discharge and limited construction time.

Tateyama Sabo Trolley



The figure of Joganji River Sabo master plan drawing

The left bank of the Shiraiwa Sabo Dam is an earth dam structure, which could become a weak point of the Sabo dam if there were flowing water to erosion. The Matsuo Sabo was constructed in 1952 upstream of the Shiraiwa Sabo Dam to guide flowing water and sediment to the right bank side. The Shiraiwa Sabo Dam and the Matsuo Sabo Dam were inseparable.

3.4 A Sabo Dam "Hongu Sabo Dam" by Flood Control Projects

On the other hand, while other engineers, including Makoto Kaba, in the Ministry of Home Affairs recognized the importance of taking measures at Tateyama Caldera, they proposed the construction of a Sabo dam downstream of Tateyama Caldera with a large height and a sediment storage function as a more immediate measure for flood control of the Joganji River.

Makoto Kaba

Makoto Kaba was engaged in the Sabo projects after the Great Kanto Earthquake and also led the construction of high dams for sediment storage in Midai River of the Fujigawa River system in Yamanashi Prefecture from 1916 to 1922. Ashiyasu Sabo Dam is considered the first concrete Sabo dam, its inside is made of boulder concrete and the surface is covered by stone-pile with concrete, in Japan. Although "Sabo Controversy" between Masao Akagi and Makoto Kaba resulted in priority being given to the Sabo project as claimed by Masao Akagi. However, the flood damage in 1934 prompted the Ministry of Home Affairs to establish the plan to renovate the Joganji River (conducted by Masayoshi Tominaga) in 1936 and start the flood control project by the National Government in the Joganji River.

Ashiyasu Sabo Dam
(Courtesy of Yamanashi Prefecture)

In 1935, the Ministry of Home Affairs began constructing the Hongu Sabo Dam, based on the contract entrusted by the Toyama Prefectural Government. As mentioned above, the Hongu Sabo Dam was initially constructed as a flood control facility (made of boulder concrete) for permanent and temporary sediment storage, and was later incorporated as an facility of the Sabo Project. Today, the Hongu Sabo Dam remains one of the largest Sabo dams in Japan, with a sediment storage capacity of approximately 5 million m^3. The construction of the Hongu Sabo Dam also used the latest construction technologies of the time, such as the concentration of labor, which including three-shift system, the transportation of large quantities of construction materials by rail transport, and the use of derrick cranes.

3.5 Enhancement of Sabo Projects throughout Japan Led by Masao Akagi

"Sabo koji"

Published in 1938
by Civil Engineering Bureau,
Ministry of Home Affairs

Masao Akagi returned to the Ministry of Home Affairs after returning from his study in Vienna. Then he served as the first director of the Tateyama Sabo Office and was also in charge of Sabo projects throughout Japan. In 1938, the Ministry of Home Affairs, under the leadership of Masao Akagi, compiled a material "Sabo Koji" about the system of construction methods by organizing the Japanese native Sabo technology and Sabo technologies from Europe, and distributed it to related-organizations in the Ministry of Home Affairs and prefectural governments as a technical standard for Sabo projects. In the material, Akagi wrote, "Although sediment control in water source area is the most important method for preventing debris flows, it is also necessary to construct a large Sabo dam to control sediment downstream of a river to eliminate the danger immediately after the event of debris flows". This description combines the measures in the upper stream area emphasized by Masao Akagi and the measures in the middle of the river emphasized by Makoto Kaba, and is considered to be the first concept of Sabo in a water system as a comprehensive sediment management system of water system. Subsequently, the Ministry of Home Affairs enhanced the system and administration of Sabo projects.

The Tateyama Sabo Project was Akagi's first major project after returning to the Ministry of Home Affairs from his study in Vienna, and it is assumed that the successful construction of the Shiraiwa Sabo Dam solidified Akagi's evaluation and position as an leading engineer and then Akagi served as a founder for the establishment of Sabo administration. Akagi also established the Japan Sabo Association in 1935 to promote the spread of Sabo projects throughout Japan and to demand that the National government enhance Sabo projects. Through Masao Akagi's achievements, Sabo established itself as a comprehensive technology for disaster prevention and as one of the major disaster prevention projects in Japan.

3.6 Flood Control Project of the Joganji River after World War II

In 1949, the "Rivised Joganji River Flood Control Plan" was established an integrated improvement plan, which consisted of controlling sediment discharge through installing Sabo facilities in the upper and middle reaches of the river, and excavating the riverbed and installing flood control measures downstream.

Based on the revised plan, National Sabo project in the upstream area and Flood control projects in the downstream area were conducted. In the Sabo projects, new Sabo dams were constructed such as the "Onigajo Sabo Dam" and "Setokura Sabo Dam", and in the flood control projects, riverbed excavation and stabilization the flow channel. Since the Joganji River has riverbed fluctuations during floods, new technologies such as "cross-shaped blocks" were introduced to prevent erosion of the foundations of revetments that stabilize the flow channel, or to protect the foundations by following the erosion. These techniques were pioneered as flood control technologies for steep and devastated rivers throughout Japan, and eventually spread throughout Japan.

To evaluate Sabo projects quantitatively, “Kotaro Kimura”, an engineer of the Ministry of Home Affairs devised “Kimura Concept”. In the Kimura Concept, the amount of sediment to be transported to the planned reference point was set by subtracting the effects of sediment deposit in a channel and Sabo dams from the planned sediment production. The Kimura Concept added a quantitative concept to the planning of Sabo projects in water systems.

This planning method based on the Kimura Concept became the technical standard for Sabo planning in Japan, and was published in 1958 in the “Technical Standards for River and Sabo Works”. This standard is the highest technical standard for implementing flood control and Sabo projects. This standard allows the functions of the Dorodani, Shiraiwa, and Hongu Sabo Dams of the Tateyama Sabo to be combined and quantitatively described as an integrated function of the comprehensive sediment management system of water system. This integrated sediment management system is unique in the world because it demonstrates the process of establishing a technology to ensure downstream safety against the enormous amount of unstable sediment in the upstream area.

3.7 Dissemination of Sabo Technology to the World

In 1951, at the International Association of Hydrological Sciences in Brussels, Belgium, Walter C. Lowdermilk, Chairman of the Supreme Committee on Science and Technology, directly under the President of the United States, said, “I would like to propose that the control of sediment and erosion in streams be called Sabo”. Since then, Sabo in Japan has become an internationally used term as “Sabo”.

As seen in the evaluation of Sabo by Lowdermilk, Japanese Sabo technology had international recognition and was disseminated overseas, mainly in Southeast Asia and Latin America, mainly through JICA’s technical cooperation projects and the dispatch of experts as Japan’s postwar compensation. For example, the transfer of Sabo technology in a water system to the Bilibili Dam on the Jeneberang River in Indonesia following the massive collapse of Mount Bawakaraeng in Sulawesi Island, Indonesia, as a measure to prevent the outflow of enormous amounts of sediment, can be seen as a typical example of overseas transmission of a comprehensive sediment management system of water system.

Comprehensive sediment management system of water system is also used as a planning method for sediment caused by volcanic eruption as a measure to prevent the discharge of enormous amounts of sediment, and the technology has spread to Southeast Asia, and Central and South America, where it has become established as a method for formulating volcanic Sabo plans. The Gendol River in Mount Merapi in Indonesia and Mount Pinatubo in the Philippines can be seen as typical examples of such measures. Comprehensive sediment management system of water system and volcanic Sabo have much in common in terms of technologies for preventing massive sediment discharges, and many technologies have been applied from Sabo in water system to volcanic Sabo.

In this way, Japanese Sabo technology has been introduced to about 20 countries and regions around the world, mainly in Southeast Asia, and Central and South America, where natural conditions are similar to those in Japan, and is making a significant contribution to disaster prevention in countries around the world.

Indonesia : Sabo dam in Mt.Merapi
(Courtesy of Yachiyo Engineering Co., Ltd.)

Indonesia : Sabo Dam in Jeneberang River
(Courtesy of Yachiyo Engineering Co., Ltd.)

4 Potential Outstanding Universal Value of Tateyama Sabo

We have organized the potential “Outstanding Universal Value” (OUV) of Tateyama Sabo based on its characteristics related to disaster prevention especially from a technical perspective into the following three perspectives.

4.1 Overall Findings about OUV

1) Comprehensive disaster prevention technology born in disaster-prone Japan

First, Sabo is a comprehensive technology for disaster prevention that was born in disaster-prone Japan and has played a major role in the development of the country.

The Japanese archipelago is prone to earthquakes and volcanic eruptions, as well as torrential rainfalls due to frequent typhoons and baiu front, and winter snowfall, which results in an annual precipitation about twice the world average. The risk of sediment disasters is particularly great because about 75% of the country is mountainous and steeply sloped. On the other hand, the small amount of inhabitable area makes it difficult to relocate to other areas easily, and the population density in inhabitable areas (plains) is high. In addition, since ancient times, agriculture (rice production) has been the main source of livelihood, and the rice produced has occupied an important position in the economy as the core of the tax system. Therefore, it was essential to protect human lives and property from sediment disasters and to preserve the plains where rice is produced in paddy fields.

Sabo technology in Japan developed through the ingenuity and efforts of civil engineers such as Masao Akagi, who introduced modern European technology and construction methods and integrated them with native and traditional Japanese technology for hillside works and reforestation, eventually leading to the development of the comprehensive sediment management system of water system and the comprehensive and systematic establishment of Sabo technology. Subsequently, Sabo projects have been promoted nationwide through active investment and the development of legal frameworks to achieve balanced land conservation and development all around Japan, and today, they support the conservation of human lives and property and economic development of Toyama Prefecture and the rest of Japan. It is precisely because sediment disaster were a major threat that comprehensive measures could be systematized, and Sabo is a typical example of the comprehensive disaster prevention technology developed in disaster-prone Japan.

2) Japan's comprehensive management of water systems represents the technological apex in the modern world

Next, Japanese Sabo technology, including that of Tateyama Sabo, is at the highest level where it can be said to have reached in the modern era in terms of disaster prevention technology based on comprehensive water system management, and this technology has been transferred to Southeast Asia and Central and South America, contributing to disaster prevention in countries around the world.

In Japan, although not sufficient, forests have been protected to conserve water resources and prevent sediment disasters. During the Edo period (1603-1867), the shogunate regulated deforestation, and at the same time, measures were taken to prevent streambed erosion, such as small hillside works and stone-pile erosion control works at water source areas.

After the Meiji period, European technology was introduced to deal with large-scale sediment disasters such as that in the Tateyama Caldera. However, at that time, the mainstream in Europe was "point or line" Sabo construction, which mainly the construction of staircase-like dams along the branch streams that flowed into the U-shaped valley formed by glaciers. Japanese engineers developed their original integrated sediment management system in a water system that controls sediment production in the upstream area and sediment discharge in the midstream area, and design and construction technology.

Such comprehensive sediment management technology for the entire river basin in modern Japan was not available in other countries at the time and is at the cutting-edge of its kind worldwide.

Today, this Japanese comprehensive sediment management technology is used in about 20 countries in Southeast Asia, including Indonesia and Nepal, and in Latin America, including Venezuela and Costa Rica, and is making a significant contribution to the development of disaster prevention projects in those countries.

St. Leonhard im Pitztal, Tyrol, Austria

Typical mountain stream flowing into a U-shaped valley carved by glaciers

3) A Type of Modern Sabo Technology

Finally, Tateyama Sabo is a typical example of modern Sabo technology.

In order to deal with the discharge of approximately 200 million m^3 of unstable sediment deposited in the Tateyama Caldera, a number of state-of-the-art large construction machines were used from the Taisho period (1912-1926) to the early Showa period (1926-1989), which was unprecedented Sabo project in the world.

The Tateyama Sabo project also established Japan's first technology for comprehensive sediment management system of water system by integrating Sabo and flood control facilities to ensure the safety of downstream areas, such as the Dorodani Sabo Dams to control sediment production in upstream areas, the Shiraiwa Sabo Dam to fix unstable sediment, and the Hongu Sabo Dam to store sediment in the middle reaches of rivers.

The Tateyama Sabo has representative and well preserved Sabo facilities in the early days when Sabo theory and technology for the comprehensive sediment management system of water system were established, and it became the foundation and standard for subsequent disaster prevention measures, especially flood control in rapid and devastated rivers, in Japan. Even today, for approximately 100 years, the Tateyama Sabo facilities is still fully functional as active disaster prevention facilities and continues to protect the safety and security of the Toyama Plain. It is a representative example of modern Sabo in Japan.

4.2 About Conformity with the "World Heritage" Criteria

At present, the criteria for evaluating the Outstanding Universal Value of Tateyama Sabo, which is required to be inscribed on the World Heritage List, are organized as follows.

Criteria (i) represent a masterpiece of human creative genius;

(Special mention) Response to severe natural threats by the wisdom of mankind

(Specifics)

Comprehensive disaster prevention technology born in one of the world's harshest sediment disasters-prone areas (disaster-prone countries) is a masterpiece of human wisdom that demonstrates tireless efforts against severe natural threats.

Criteria (ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;

(Special mention) Global exchange and influence of technology

(Specifics)

By incorporating advanced technologies from Austria and other European countries into Japan's traditional Sabo (erosion and sediment control, and reforestation) technology, a unique Sabo system was established in Japan.

The technology developed and established in Japan eventually spread to other countries around the world, particularly in Southeast Asia and Central and South America, contributing greatly to the development of technology and measures for sediment disaster prevention measures in each country.

Criteria (iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;

(Special mention) Outstanding civil engineering technology

(Specifics)

The project was built using innovative and cutting-edge civil engineering technologies of the time, such as earthquake-resistant design and composite structures, to ensure the safety of downstream areas against the approximately 200 million m^3 of unstable sediment caused by mountain collapses and natural dam breaks.

It has typical modern Sabo facilities that utilized civil engineering techniques that were novel and advanced at the time.

Sabo facilities and flood control facilities were developed in an integrated plan, and the comprehensive sediment management system of water system with an entire river-wide perspective was systematically established for the first time in the world.

(The world’s first comprehensive sediment management system established as the basic standard of modern Sabo technology).

Typical Sabo facilities from the early days of the technology establishment are well preserved and are still fully functional as active disaster prevention facilities.

Criteria (v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;

(Special mention) Realization of disaster prevention and restoration of the natural environment

(Specifics)

The densely populated Toyama Plain has been protected by comprehensive erosion control measures for over 100 years.

In the Tateyama Caldera, the progress of Sabo projects has resulted in a spectacular recovery of vegetation that had suffered catastrophic damage.

Tateyama Sabo is a representative example of how nature has been regenerated as well as disaster prevention.

Comprehensive sediment management system with a river-wide perspective

Dorodani Sabo Dams (22 dams)
Built from 1930 until 1938
Function:
- Spillway on unstable sediment
- Erosion prevention
- Reforestation

Shiraiwa Sabo Dam
(Tallest Sabo dam in Japan : 108m)
Built from 1929 until 1939
Function:
- Fixing unstable sediment

Hongu Sabo Dam
(Largest storage volume : 5 million m^3)
Built from 1935 until 1936
Function:
- Temporal storage of sediment

4.3 Integrity

We believe that the Tateyama Sabo maintains a high degree of integrity as follows.

All of the major structures (Dorodani Sabo Dams, Shiraiwa Sabo Dam and Hongu Sabo Dam), which are outstanding in terms of civil engineering technology, typical of modern integrated sediment management technology, and representative elements embodying its achievements, are included in the potential area of properties, and the attributes and elements necessary to understand its Outstanding Universal Value are not in excess or deficient.

All of the potential property components (Dorodani Sabo Dams, Shiraiwa Sabo Dam, and Hongu Sabo Dam) are protected as Important Cultural Properties in accordance with the Act on Protection of Cultural Properties of Japan. The area in which the properties are located and the surrounding environment, including the buffer zone, are appropriately protected under the related laws of Japan as designated Sabo areas under the Sabo Act (activities that promote sediment discharge are legally restricted), special protection areas and special areas under the Nature Park Act, and national forests under the Act Concerning Utilization of National Forest Land.

Therefore, there is no negative impact of development or abandonment of management on the constituent properties, and the properties have a high degree of integrity with respect to the conservation of the properties and the surrounding environment.

4.4 Authenticity

We believe that Tateyama Sabo maintains a high degree of authenticity as follows.

The properties have been repaired and renovated, mainly in the wing of Sabo dams, due to damage caused by debris flows that have occurred repeatedly since construction was completed, but the shape and design of the properties at the time of construction have been well maintained.

The Ministry of Land, Infrastructure, Transport and Tourism (Tateyama Mountain Area Sabo Office) has been in charge of the maintenance and repairs. The materials and techniques that do not damage the value of the properties have been used in accordance with modern technical and safety standards that are essential for maintaining the functions of disaster prevention facilities, while maintaining the physical structure and structural features as cultural properties, and with consideration for economic efficiency and availability.

In the vicinity of each property, expansion and repair works of facilities and equipment essential for the maintenance of the properties are continuously carried out to ensure the preservation of the properties as cultural properties while maintaining their disaster prevention functions in the future.

The layout of Sabo facilities is optimized to protect the safety and security of people living in the downstream “Toyama plain” from the frequent occurrence of debris flows and flood inundations. The locations, use, and functions of Sabo facilities remain unchanged even 100 years after its installation.

Therefore, Dorodani Sabo Dams, Shiraiwa Sabo Dam, and Hongu Sabo Dam, all have a high degree of authenticity in terms of attributes such as “form and design,” “materials and substance,” “use and function,” “traditions, techniques and management systems,” and “location and setting”.

4.5 Comparison Analysis: Toward Inscription on the World Heritage List

1) Comparison with overseas Sabo facilities

Areas where Sabo is required, threatened by sediment disasters, are limited by geological, climatic, and environments affected by human activities. Outside of Japan, for example, there is a history of sediment and avalanche control using dams in Austria, Switzerland, France, Italy, and Germany.

Among them, the oldest dam for sediment control in Europe, the Ponte Alto Dam in Italy, was the tallest in the world at 41 m when Masao Akagi visited the dam in 1924. The Shiraiwa Sabo Dam, which Masao Akagi planned after returning from his study in Vienna, Austria, was built to a height of 63 m, surpassing Ponte Alto, and still have functions as the largest Sabo dam in Japan today.

Check dams in Bretter Wantbach,
Matrei, Osttirol, Austria

(Source: 100 Jahre Wildbachverbauung in Osterreich)

Check dams in Emsbach,
Hohenems, Austria (1902)

(Source: 100 Jahre Wildbachverbauung in Osterreich)

2) Comparison with World Cultural Heritage Sites Related to Water Management Systems

Currently, the “Operational Guidelines for the Implementation of the World Heritage Convention” and charters related to World Heritage have not established a typology related to disaster prevention like Sabo, nor is it listed in the “World Heritage List”.

On the other hand, the report “Filling the Gaps-an Action Plan for the Future” published by ICOMOS includes a category “8. Agricultural, Industrial and Technological Heritage”. This category has a subcategory “Water Management Systems (Environmental and Irrigation)” and more than 10 World Cultural Heritage sites can be identified under the subcategory, which includes reclamation and agricultural water use facilities.

Although the structures and purposes of the World Heritage sites related to “Water Management Systems” are clearly different from those of the Tateyama Sabo, they are considered to be useful as references for research and study for the World Heritage registration of the Tateyama Sabo in terms of their response to severe natural threats with human wisdom, outstanding civil engineering technology, global exchange and influence of technology, and good state of conservation.

World Cultural Heritages of Water-Related Technologies

	Name	Country	Year of Inscription	Criteria
Water management systems	Schokland and Surroundings	Netherlands	1995	(iii), (v)
	Defence Line of Amsterdam	Netherlands	1996	(ii), (iv), (v)
	Mill Network at Kinderdijk-Elshout	Netherlands	1997	(i), (ii), (iv)
	Ir.D.F. Woudagemaal (D.F. Wouda Steam Pumping Station)	Netherlands	1998	(i), (ii), (iv)
	Droogmakerij de Beemster (Beemster Polder)	Netherlands	1999	(i), (ii), (iv)
	Mount Qingcheng and the Dujiangyan Irrigation System	China	2000	(ii), (iv), (vi)
	Aflaj Irrigation System of Oman	Oman	2006	(v)
	Shushtar Historical Hydraulic System	Iran (Islamic Republic of)	2009	(i), (ii), (v)
	Landscape of Grand Pre	Canada	2012	(v), (vi)
	Cultural Landscape of Bali Province: the Subak System as a Manifestation of the Tri Hita Karana Philosophy	Indonesia	2012	(iii), (v), (vi)
Ports	Naval Port of Karlskrona	Sweden	1998	(ii), (iv)
Bridges	Ironbridge Gorge	United Kingdom of Great Britain and Northern Ireland	1996	(i), (ii), (iv), (vi)
	Vizcaya Bridge	Spain	2006	(i), (ii)

	Name	Country	Year of Inscription	Criteria
Bridges	Mehmed Paša Sokolovic Bridge in Višegrad	Bosnia and Herzegovina	2007	(ii), (iv)
	The Forth Bridge	United Kingdom of Great Britain and Northern Ireland	2015	(i), (iv)
Aqueducts	Old Town of Segovia and its Aqueduct	Spain	1985	(i), (iii), (iv)
	Pont du Gard (Roman Aqueduct)	France	1985	(i), (iii), (iv)
	18th-Century Royal Palace at Caserta with the Park, the Aqueduct of Vanvitelli, and the San Leucio Complex	Italy	1997	(i), (ii), (iii), (iv)
	Pontcysyllte Aqueduct and Canal	United Kingdom of Great Britain and Northern Ireland	2009	(i), (ii), (iv)
	Aqueduct of Padre Tembleque Hydraulic System	Mexico	2015	(i), (ii), (iv)
Canals and locks	Canal du Midi	France	1996	(i), (ii), (iv), (vi)
	The Four Lifts on the Canal du Centre and their Environs, La Louvière and Le Roeulx (Hainaut)	Belgium	1998	(iii), (iv)
	Rideau Canal	Canada	2007	(i), (iv)
	Seventeenth-century canal ring area of Amsterdam inside the Singelgracht	Netherlands	2010	(i), (ii), (iv)
	The Grand Canal	China	2014	(i), (iii), (iv), (vi)

Source: “Tateyama Caldera Disaster Prevention Heritage” Comparison Analysis Report, pp.15 and 16 (partly amended)

Criteria for the assessment of Outstanding Universal Value

(i) represent a masterpiece of human creative genius;

(ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;

(iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;

(iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;

(v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;

(vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria);

5 Spreading Awareness and Disseminating Information on Tateyama Sabo

Toyama Prefectural Government, in cooperation with the government of Japan, is actively promoting and disseminating information on the value and importance of Tateyama Sabo both domestically and internationally.

Through holding international symposiums in Toyama and exhibiting and presenting at international conferences, we promote the reputation and international recognition of the value of Tateyama Sabo.

The Tateyama Caldera Sabo Museum introduces the nature and culture around Tateyama Caldera and Sabo technology of Tateyama Sabo to visitors using easy-to-understand exhibitions.

In cooperation with the Tateyama Mountain Area Sabo Office of the Ministry of Land, Infrastructure, Transport and Tourism, the museum also holds a hands-on learning experience excursions to Tateyama Caldera, which is normally off-limits for construction of Sabo facilities. This is an opportunity for visitors to learn about the achievement of Tateyama Sabo, wisdom and hard work of our ancestors, and to experience the harsh natural environment.

Furthermore, “Youth Program” is held to promote understanding of the value of Tateyama Sabo among high school and university students from within and outside of the Toyama Prefecture, and to develop human resources who will be responsible for its preservation and utilization in the future through lectures from World Heritage specialists and site visits.

In addition, there is a private group of supporters to register Tateyama Sabo as a World Heritage Site.

1. name: “Tateyama Sabo Women’s Salon Association” (established in 2001)
2. Main activities

A group of women supporters of the Tateyama Sabo Project, established to disseminate the tragedy of sediment disasters and the necessity for Sabo projects to their children, grandchildren and local residents from a woman’s perspective.

Since its establishment, the group has held lectures and study groups every year, as well as actively collecting information on sediment disasters through site visits and tours in Japan and overseas.

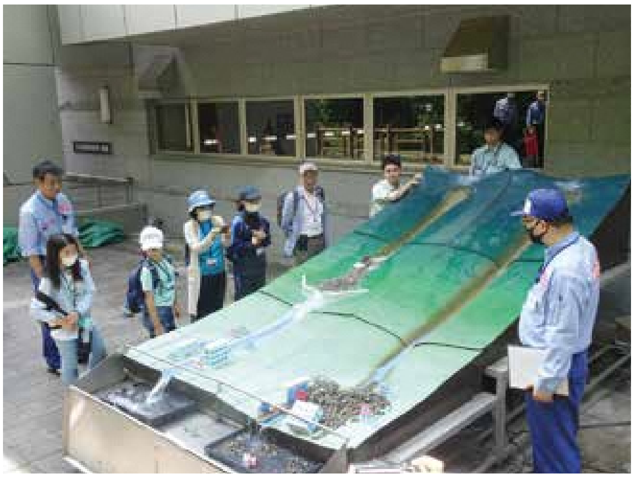
Tateyama Sabo International Symposium

ICOMOS GA2023 in Sydney, Australia

Tateyama Caldera Sabo Museum

Tateyama Sabo Women's Salon Association Site Visit

Youth Program Site Visit



Youth Program Debris Flow Model Experiment

Conclusion

The history of Tateyama Sabo is overcoming the difficulties of sediment disasters and building an economically and socially prosperous community through the accumulated wisdom and efforts of our predecessors while facing of the harsh natural environment.

Toyama Prefectural Government considers the Tateyama Sabo Project not only important for our prefecture, but also a valuable cultural heritage of the whole world that shows one of the solutions to protect people’s safety and security from dangerous sediment disasters, a problem common to all humankind.

For this reason, we will continue to conduct surveys and research and disseminate information to register Tateyama Sabo as a World Cultural Heritage so that it can be properly preserved and passed on to future generations as a common heritage for all humankind.

Published on 2025 January

Written and edited by Toyama Prefectural Government, JAPAN (The World Heritage and Hometown Education Promotion Division, the Lifelong Learning and Cultural Assets Office, and SABO-sediment Control Division, Tateyama Caldera Sabo Museum)

Barrages sabô en activité présentant une valeur historique

Projets nationaux d'infrastructures sabô à partir de 1926

Le 28 novembre 2017, les barrages de Hongû et Dorodani, situés sur le parcours de la rivière Jôganji, ont été désignés comme biens culturels importants du Japon, faisant suite au barrage de Shiraiwa, premier aménagement sabô moderne à avoir reçu cette désignation. Ils sont collectivement protégés en tant qu'aménagements sabô de la rivière Jôganji.

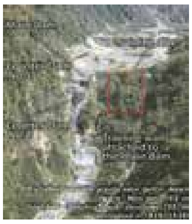
Living sabo dams of historical value

Sabo projects under national government from 1926

In 28 November 2017, Hongu and Dorodani sabo dams situated in the reaches of the Joganji River were additionally designated as Important Cultural Properties of Japan, following Shiraiwa sabo dam, the first modern sabo facility that has been designated as an Important Cultural Property. They are collectively protected as sabo facilities of the Joganji River.

Barrage sabô de Shiraiwa

Shiraiwa sabo dam



Le barrage de Shiraiwa a été achevé en 1939 à l'embouchure de la caldeira de Tateyama pour stabiliser ses sédiments. D'une hauteur de 63 m (108 m en incluant les structures souterraines), il s'agit du plus haut aménagement sabô du Japon. C'est une structure hybride, composée à la fois d'un barrage en terre consolidé par des barres de béton armé, et d'un barrage de type « barrage-poids »

Shiraiwa Dam was completed in 1939 at the mouth of the Tateyama Caldera to stabilize debris in the caldera. Measuring 63m in height(108m, including sub-structures), it is the tallest sabo facility in Japan. It is a hybrid structure, consisting of the earth dam that is consolidated with unique square precast concrete frames and the concrete gravity dam.

Barrage sabô de Hongû

Hongu sabo dam

Le barrage de Hongû a été achevé en 1936 au milieu de la rivière Jôganji pour retenir les débris. Il dispose d'une capacité de 5 millions de m^3. Il est consolidé par des blocs de pierre pyramidaux à base carrée. Il se fond très bien dans le paysage des montagnes environnantes.

Hongu dam was completed in 1936 in the midstream of the Joganji River to retain debris. It boasts of a capacity of 5 million m^3. Its surface is consolidated with square pyramidal stone blocks. It is harmonious with the surrounding mountain landscapes.

Barrage sabô de Dorodani

Dorodani sabo dam

Les barrages de Dorodani (« vallée de la boue ») ont été achevés en 1938 dans un affluent de la rivière Jôganji, pour empêcher la progression de l'érosion dans la zone dévastée. Il s'agit d'une série de barrages sabô construits en cascade. Des ouvrages de consolidation ont également été réalisés au flanc de la montagne, avec des techniques japonaises traditionnelles. Aujourd'hui, les arbres ayant poussé et la végétation s'étant densifiée dans les environs, les paysages d'une petite gorge naturelle se sont reconstitués.

Dorodani dams were completed in 1938 in a tributary of the Joganji River, called Dorodani (literally, "mud valley"), to prevent erosion expansion in the devastated area. They are a series of sabo dams built in a cascade style. Japanese traditional works to consolidate mountainsides were also used. Today, tree have grown thickly in the surrounding area, and the landscapes of a natural small gorge have recovered.

Le monument symbolise l'objectif qui était « de réaliser des projets sabô dans la caldeira de Tateyama, située loin de toute habitation, et de protéger la plaine de Toyama en aval des dommages dus aux sédiments et aux inondations »

The monument is a symbol of the objective "to undertake sabo projects in the Tateyama Caldera, located far from human habitation, and to protect the downstream Toyama Plain from sediment and flood damage

→

Patrimoine du XX^e siècle

Sur la base de la haute valeur académique des aménagements sabô de Tateyama, les barrages sabô de Shiraiwa, Hongû et Dorodani ainsi que les voies du petit train ayant servi aux travaux de construction des barrages ont été sélectionnés par l'ICOMOS Japon en décembre 2017 comme l'un des vingt sites du patrimoine japonais du XX^e siècle.

20th century heritage

Shiraiwa, Hongu, and Dorodani sabo dams as well as the trolley train track for sabo works were selected by ICOMOS Japan as one of the twenty 20th century heritages of Japan in December 2017 based on the high academic value of the sabo facilities of Tateyama.