River Restoration Strategy of Amami-Oshima Island, Tokunoshima Island, Northern Part of Okinawa Island, and Iriomote Island (Draft)

1. Background to Strategy Formulation

(1) Significance of rivers on the property and background to the installation of river structures

The property contains the most important and significant remaining natural habitats for the in-situ conservation of the unique and rich biodiversity of the central and southern parts of the Ryukyu Chain (Central and Southern Ryukyus) and is of high value for the protection of numerous endemic species and globally threatened species. The species representing the Outstanding Universal Value (OUV) of the property, such as the Amami rabbit, Okinawa rail, and Iriomote cat, mainly inhabit forests. A characteristic of the property is the subtropical marine climate greatly influenced by the warm Kuroshio Current and monsoons. It is an area of abundant water with an annual rainfall of over 2,000 mm, resulting in the formation of small and large river systems within the subtropical rainforest of the property. These river systems provide water and feeding grounds for the species representing the OUV, as well as stable habitats for inland water fish and rheophytes.

In the four regions that comprise the property, the habitats of the threatened and endemic species representing the OUV are close to areas where local people live and industrial activities take place. Over many generations, the regions' natural environment has been used sustainably based on traditional lifestyles and beliefs so as to support people's livelihoods. Water resources in particular are essential to the livelihoods of the local people. The topography in the four regions are steep, with rivers running a short distance. Because of this, rainwater flows out to the ocean in a relatively short time. In addition, due to the topography with few flat areas, settlements and agricultural lands are concentrated in the flat areas alongside rivers or near the river mouths. As a result, it creates conditions unique to the regions: a relatively high incidence of water shortages and the frequent occurrence of floods in the flat areas. It is therefore very important for people living in the regions to use the limited water resources effectively and to protect their livelihoods from floods and other events that have caused deaths and injuries in the past.

Furthermore, geologically the regions are mainly composed of old sedimentary rocks such as sandstones, shales, and clay-slates from between the Paleozoic and the Mesozoic eras. Many sections are fractured by faults and the surfaces are weathered and vulnerable. In addition, the regions are often struck by typhoons, causing landslides and mudslides in the mountainous areas and floods in downstream river basins. With future climate change, such phenomena could escalate in scale. For these reasons, river structures, including multipurpose dams for water use and control, intake weirs, check dams, and *sabo* check dams have been built since long ago in order to secure water resources for the livelihoods of the local people and to protect themselves and their properties from disasters. The river structures have been regarded as essential.

There has not been clear evidence-based finding on the impact of river structures on wild plants and animals in the property and buffer zones. Because relevant studies have been so few, their impact is currently unknown. In response to the request of the World Heritage Committee (Decision 44 COM 8B.5), a study on river restoration has been initiated in order to maintain and enhance the value of the property. To begin with, the study will be carried out to determine the impact of the river structures on the property and to verify causal relationships.

(2) Basic concept of river management in Japan

As an effort to conserve and restore riverine environments in Japan, the River Act was revised in 1997. The revised River Act added the improvement and conservation of riverine environments as its objective, together with water control and use which were already stipulated. In addition, the Government of Japan established a Basic Policy on Nature-Oriented River Management in 2006 to conserve and create diverse river landscapes, habitats, and breeding environments for wild plants and animals. Furthermore, the Basic Environment Plan approved by the cabinet in 2018 for the conservation of environment prescribes the promotion of green infrastructure projects designed to create sustainable and attractive national lands and local communities by utilizing the diverse functions of the natural environment (e.g., providing habitats, forming healthy landscapes, controlling temperature rises, preventing and mitigating disasters) in terms of both tangible and intangible aspects, such as the improvement of social overhead capital and land use. The plan also includes the promotion of ecosystem-based disaster risk reduction (Eco-DRR) by identifying the function of the ecosystem which reduces disaster risks and by proactively conserving and restoring the ecosystem.

In keeping with these concepts, Okinawa Prefecture stated its intent to promote the adoption of environmentally-friendly construction methods in the Biodiversity Strategy of Okinawa (2013), announcing that the prefecture would manage its rivers based on the Nature-Oriented River Management concept that advocates river improvements with consideration to biodiversity and the conservation, restoration and creation of diverse river environments as well as habitats and breeding environments for wild plants and animals. For instance, a riverine environment restoration project was implemented on the Oku River in the northern part of Okinawa Island from 2008 to 2018, improving drop structures and restoring riffles and pools by re-establishing the former river channel. This led to the recovery of diverse river flows and habitats, resulting in the sightings of migratory fish such as *Mugil* and *Kuhlia* swimming upstream from the ocean.

Furthermore, the Biodiversity Strategy and Action Plan of Kagoshima Prefecture (2014) positions the promotion of public works with consideration to biodiversity as one of the items of its action plan, requiring that Nature-Oriented River Management be the basis of river improvements and advocating for the establishment of fishways and other measures as well as conservation of diverse waterfront environments, such as riffles and pools which are valuable habitats for fish. Moreover, the Amami

Island Group Promotion and Development Plan (2019) lists the implementation of nature restoration-type public works to conserve and restore habitats for animals and plants, such as Ryukyu ayu-fish, as an effort to conserve the value of the world natural heritage.

(3) Establishment of a taskforce for scientific review on river restoration strategy

At the extended 44th session of the World Heritage Committee held in July 2021, decisions were made to inscribe the property on the World Heritage List and to make four requests to Japan. One of the requests was to develop "a comprehensive river restoration strategy in order to transition wherever possible from hard, engineered infrastructure to employ nature-based techniques and rehabilitation approaches such as replenishment, vegetation, and the formation of different habitat types." In response to this request, the Government of Japan established a taskforce comprising six experts in river engineering, disaster prevention engineering, and biology, as well as relevant administrative organs, discussed the request from scientific perspectives, and formulated the river restoration strategy.

2. Aim of the strategy

This strategy sets out an approach to river restoration for the entire four regions to understand the impact of river structures on the OUV and to consider the actions to be taken for the existing river structures that impact the OUV.

3. Goal

The strategy aims to achieve the following two goals.

- Conduct an assessment to evaluate the impact of river structures on the OUV.
- Take actions wherever possible to mitigate the impact on the OUV identified in the above assessment while ensuring the livelihoods of local people (lives and properties), monitor and assess the impacts of these actions, and achieve river restoration.

4. Basic approach to river restoration

River restoration in this strategy means to restore the natural flows of rivers, including their continuity and disruptions, to improve the diverse habitats of the endemic and threatened species which constitute the OUV in rivers and rely on the natural freshwater process and habitats. Currently, there is a lack of detailed scientific knowledge about the impact of river structures on the OUV and specific causal relationships. As the first step, it is necessary to review literature, monitor the impact of river structures on diadromous fish, rheophytes, amphibians, and so on, and conduct analyses and examinations.

After identifying the specific causal relationships of the impact of river structures, improvement measures will be examined to mitigate such impact, while bearing in mind a transition from hard, engineered infrastructure to employ nature-based techniques and restoration approaches. In considering improvement measures, the local peoples' livelihoods (lives and properties) must be

preserved, taking into account the functions the structures play in, for instance, preventing forest deterioration and other disasters. In addition, sufficient consideration must be given to factors such as the stress that might be placed on the current ecosystem from new disruptions caused by the implementation of improvement measures and the impact of incidental actions (e.g., construction of temporary roads, felling of trees, and invasion of alien species). Furthermore, collaboration with the local people, their consensus, and transparency of the process must be ensured.

In recognition that river restoration based on this strategy will be a long-term endeavor, river restoration must take place adaptably while keeping up to date with progress in nature-based river restoration techniques, and carefully considering changes to conditions affecting rivers such as the escalation of disasters due to climate change and population changes in the affected river basins.

5. River restoration process

River restoration will be implemented in the following four phases: impact comprehension phase, restoration policy examination phase, countermeasure implementation phase, and effectiveness examination and monitoring phase.

5.1 Impact comprehension phase

5.1.1 Scope of impact assessment

An impact assessment will be conducted for the list of existing river structures standing against the flow of major rivers in the property and its buffer zones (see attachment) provided to IUCN by the Government of Japan as supplementary information in November 2019.

5.1.2 Selection of target species subject to the impact assessment in each river in which the assessed river structures exist

The species to be assessed will be selected from the species representing the OUV (taxonomic groups) in each river in which the assessed river structures exist. These species will be mainly diadromous fish, rheophytes, and amphibians. When selecting the species to be assessed, the reason for their selection must be clearly stated.

5.1.3 Impact comprehension study

After clarifying the impact the assessed river structures have had on the assessed species using existing research papers, interviews with experts, and other means, monitoring will be conducted to evaluate their impact where information is lacking and necessary information will be collected to determine their impact. In evaluating the impact, attention must be paid to understanding which stages of the life history of the species being assessed are affected.

5.1.4 Compiling the results of the impact assessment

The information collected will be sorted based on advice from experts and so on, and the results of the

impact assessment of the river structures on the target species will be compiled.

5.2 Restoration policy examination phase

Based on the results of the impact assessment, the specific causal relationships of the impact of the river structures on the OUV will be analyzed and examined, and improvement measures for the river structures will be discussed to remove the factors causing the impact. A study and evaluation of potential risks due to adopting the improvement measures, such as the risks to disaster prevention, will also be conducted and restoration policy will be discussed based on the results of such study and evaluation. In the long term, restoration policy will be reviewed flexibly as changes in the conditions affecting rivers are comprehended. Restoration policy must be examined based on "4. Basic approach to river restoration" mentioned above.

5.3 Countermeasure implementation phase

Countermeasures will be implemented based on the restoration policy discussed. In implementing countermeasures, sufficient attention must be paid to preventing negative impacts on the heritage value, such as the invasion of alien species.

5.4 Effectiveness examination and monitoring phase

After implementing countermeasures, their effectiveness will be monitored and examined. If no improvement is seen, further countermeasures will be implemented, and their effectiveness will be monitored and examined as needed based on the PDCA cycle.

6. Evaluation of river restoration strategy

The strategy will be subject to a review approximately five years after its formulation based on the progress and results of the impact comprehension study.

資料１－２－添付資料c-1-別表【英】

No.	Region	Property/buffer zone	River	River structure that disrupts the flow	Management body	Year of the completion
1	Amami-Oshima Island	Property and buffer zone	Okawa River	Intake weir	Amami City	1983
2	Amami-Oshima Island	Buffer zone	Naon River	Intake weir	Kyushu Electric Power Co., Inc	1956
3	Amami-Oshima Island	Buffer zone	Naon River	Intake weir	Naon Irrigation Association	Before the Meiji period (1868-1912)
4	Amami-Oshima Island	Property	Sumiyo River	Intake weir	Kyushu Electric Power Co., Inc	1959
5	Amami-Oshima Island	Buffer zone	Yakugachi River	Ground sill	Kagoshima Prefecture	Unknown
6	Amami-Oshima Island	Buffer zone	Asato River and its tributary	Sabo check dam	Kagoshima Prefecture	1961 1966
7	Amami-Oshima Island	Buffer zone	Shirinashi River	Sabo check dam	Kagoshima Prefecture	1983
8	Amami-Oshima Island	Buffer zone	Sutarumata River	Sabo check dam	Kagoshima Prefecture	1997
9	Amami-Oshima Island	Buffer zone	Kamiya River	Sabo check dam	Kagoshima Prefecture	2012
10	Amami-Oshima Island	Buffer zone	Uekawa River	Sabo check dam	Kagoshima Prefecture	1999
11	Amami-Oshima Island	Property	Honda River	Sabo check dam	Kagoshima Prefecture	2011
12	Amami-Oshima Island	Buffer zone	Yanma River	Sabo check dam	Kagoshima Prefecture	1990
13	Amami-Oshima Island	Buffer zone	Agina River	Sabo check dam	Kagoshima Prefecture	1993
14	Amami-Oshima Island	Property	Ishira River	Sabo check dam	Kagoshima Prefecture	1993
15	Amami-Oshima Island	Property	Ishira River	Sabo check dam	Kagoshima Prefecture	1985
16	Amami-Oshima Island	Property	Yakugachi River	Sabo check dam	Kagoshima Prefecture	1999
17	Amami-Oshima Island	Property	Yakugachi River	Ground sill	Setouchi Town	Unknown
18	Amami-Oshima Island	Property	Kawauchi River *1	Sabo check dam	Kagoshima Prefecture	1962 1963
19	Amami-Oshima Island	Buffer zone	Kogachi River	Ground sill	Kagoshima Prefecture	Unknown
20	Amami-Oshima Island	Property	Kawauchi River *2	Ground sill	Uken Village	1995
21	Amami-Oshima Island	Property	Kawauchi River *2	Ground sill	Uken Village	Unknown

*1: The Kawauchi River in Amami City.
*2: The Kawauchi River in Uken Village.

No.	Region	Property/buffer zone	River	River structure that disrupts the flow	Management body	Year of the completion
1	Tokunoshima Island	Buffer zone	Akirigami River	Check dam	Forestry Agency	1991
2	Tokunoshima Island	Property	Akirigami River	Check dam	Forestry Agency	1983
3	Tokunoshima Island	Property	Akirigami River	Check dam	Forestry Agency	1973
4	Tokunoshima Island	Property	Akirigami River	Check dam	Forestry Agency	1987
5	Tokunoshima Island	Property	Kametoku River	Check dam	Forestry Agency	2003
6	Tokunoshima Island	Property	Kametoku River	Check dam	Forestry Agency	1990
7	Tokunoshima Island	Property	Akirigami River tributary	Check dam	Forestry Agency	1988
8	Tokunoshima Island	Property	Akirigami River tributary	Check dam	Forestry Agency	1990
9	Tokunoshima Island	Property	Akirigami River tributary	Check dam	Forestry Agency	1995
10	Tokunoshima Island	Property	Akirigami River tributary	Check dam	Forestry Agency	1997
11	Tokunoshima Island	Property	Akirigami River tributary	Check dam	Forestry Agency	2009
12	Tokunoshima Island	Property	Akirigami River tributary	Check dam	Forestry Agency	1992
13	Tokunoshima Island	Property	Akirigami River tributary	Check dam	Forestry Agency	2006
14	Tokunoshima Island	Buffer zone	Akirigami River	Water utilization dam	Amagi Town	1968
15	Tokunoshima Island	Buffer zone	Soya River and Tari River	Sabo check dam	Kagoshima Prefecture	1982

No.*1	Region	Property /buffer zone	River	River structure that disrupts the flow	Management body	Year of the completion
1	Northern part of Okinawa Island	Buffer zone	Oku River	Sabo check dam	Okinawa Prefecture	1983
2	Northern part of Okinawa Island	Buffer zone	Yona River	Sabo check dam	Okinawa Prefecture	1983
3	Northern part of Okinawa Island	Buffer zone	Okuma River	Sabo check dam	Okinawa Prefecture	1982
4	Northern part of Okinawa Island	Buffer zone	Hiji River	Sabo check dam	Okinawa Prefecture	1985
5	Northern part of Okinawa Island	Buffer zone	Benoki River	Intake weir	Kunigami Village*2	Unknown
6	Northern part of Okinawa Island	Buffer zone	Benoki River	Water utilization dam	Okinawa General Bureau, Cabinet Office	1988
7	Northern part of Okinawa Island	Buffer zone	Fungawa River	Water utilization dam	Okinawa General Bureau, Cabinet Office	1983
8	Northern part of Okinawa Island	Buffer zone	Aha River	Water utilization dam	Okinawa General Bureau, Cabinet	1983

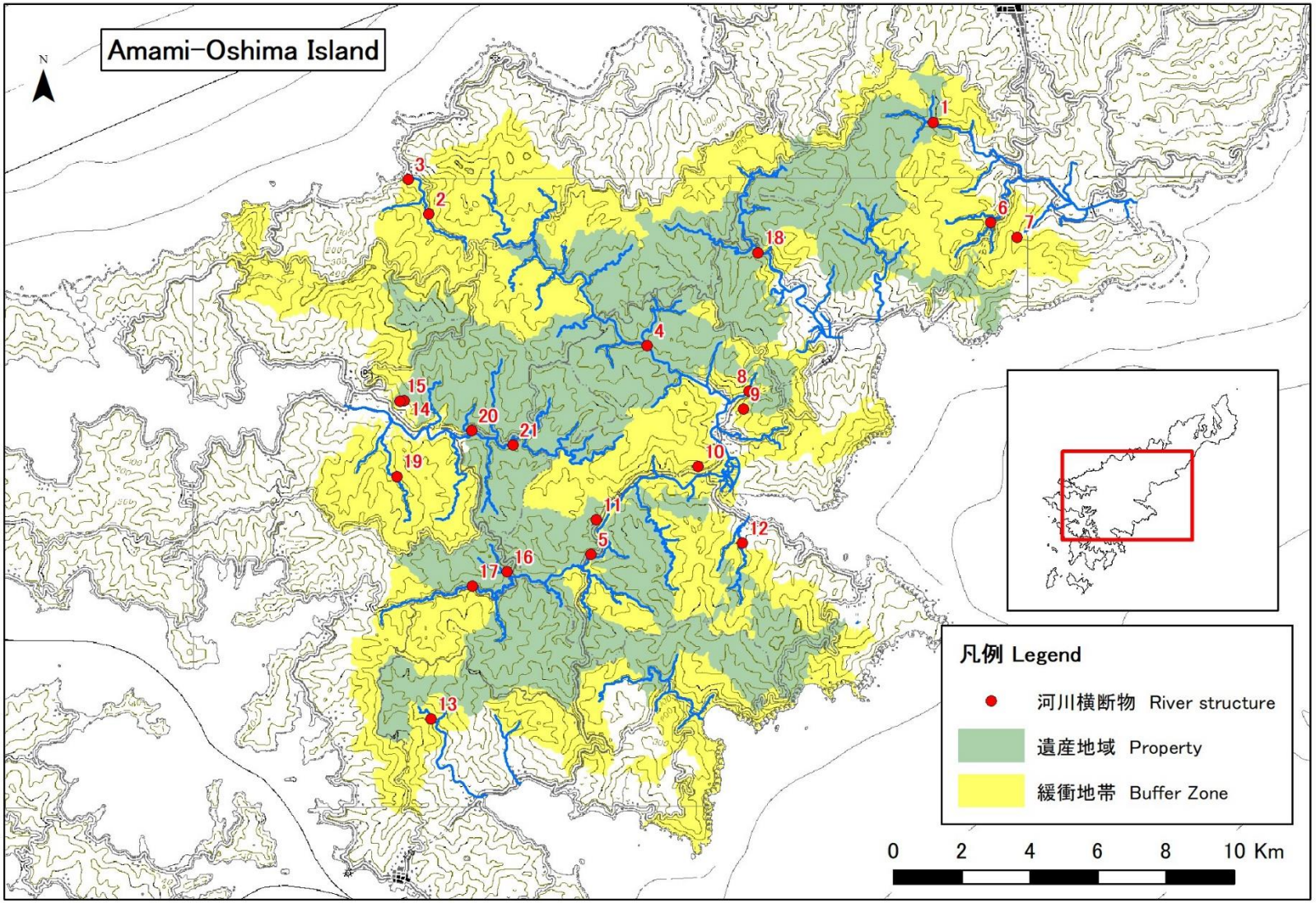
Revised from supplementary information submitted in November 2019.

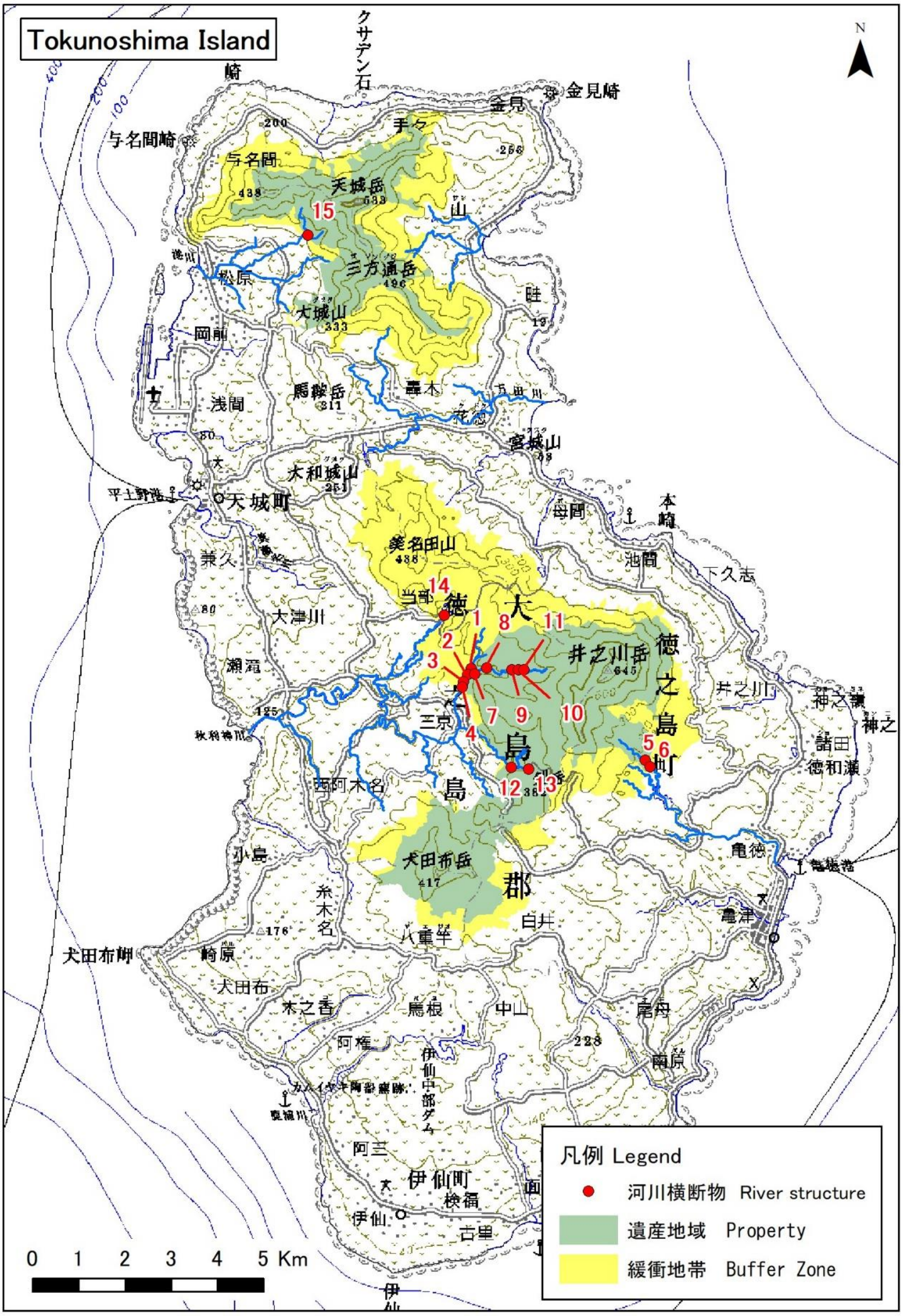
*1 : The check dam at Takazato River tributary (No. 6), listed in the supplementary information in November 2019, was removed from the list and map as it was found to be outside the property and buffer zone. The numbers after that have been moved up.

*2 : Corrected from "Okinawa Prefecture" to "Kunigami Village".

No.	Region	Property/buffer zone	River	River structure that disrupts the flow	Management body	Year of the completion
1	Iriomote Island	Property	Nakama River tributary	Check dam	Forestry Agency	1994
2	Iriomote Island	Property	Nakama River tributary	Check dam	Forestry Agency	1996
3	Iriomote Island	Property	Nakama River tributary	Check dam	Forestry Agency	2009
4	Iriomote Island	Property	Nakama River tributary	Intake weir	Taketomi Town	1975
5	Iriomote Island	Property	Aira River	Intake weir	Taketomi Town	1977
6	Iriomote Island	Property	Male River	Intake weir	Taketomi Town	1978
7	Iriomote Island	Property	Fukai River	Intake weir	Taketomi Town	1981

資料１－２－添付資料 c-1-別図




Tokunoshima Island
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天城岳
三方通岳
大城山
馬鞍岳
美名田山
井之川岳
犬田布岳
天城町
徳之島町
伊仙町
凡例 Legend
河川横断物 River structure
遺産地域 Property
緩衝地帯 Buffer Zone
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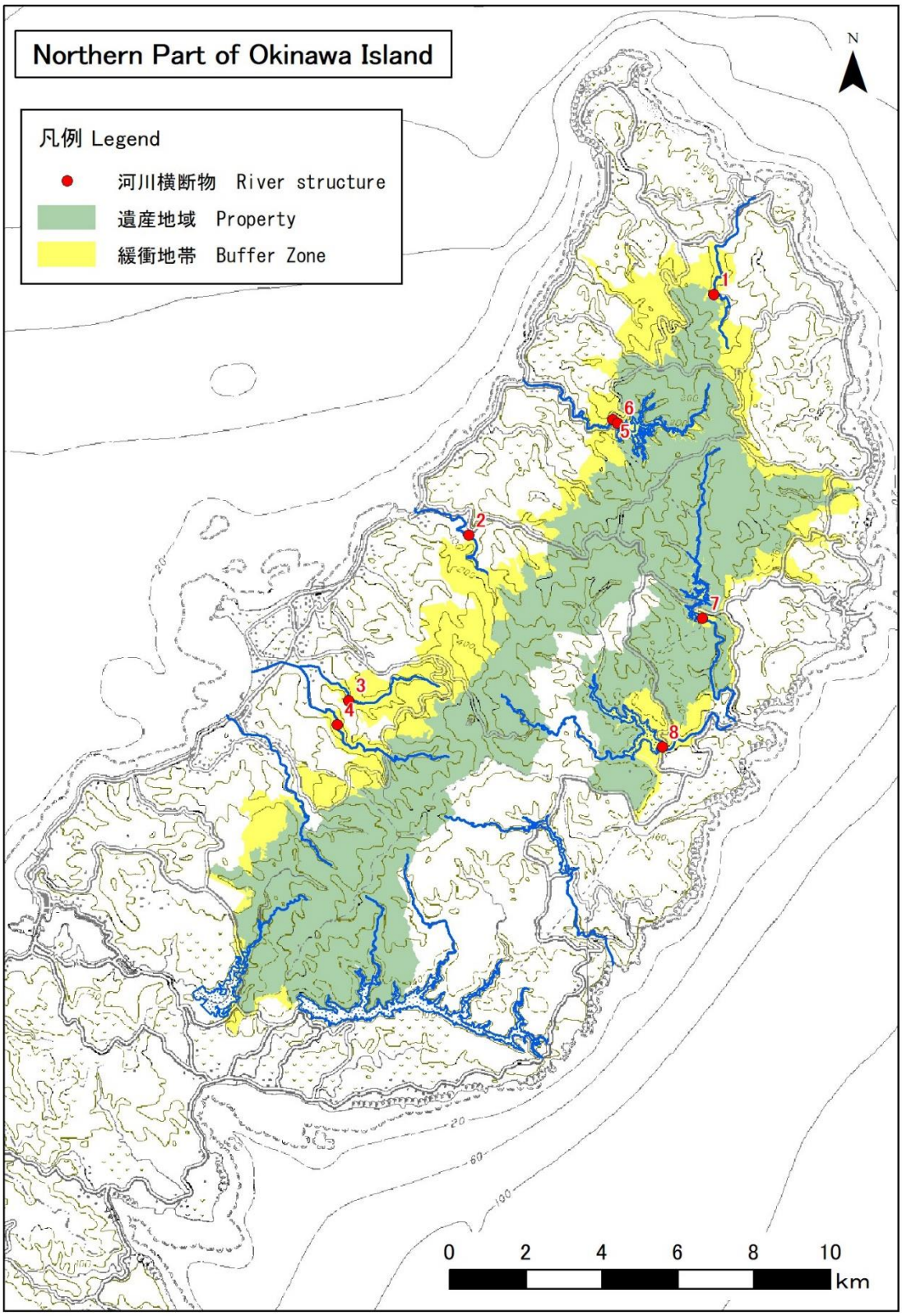
Northern Part of Okinawa Island
凡例 Legend
河川横断物 River structure
遺産地域 Property
緩衝地帯 Buffer Zone
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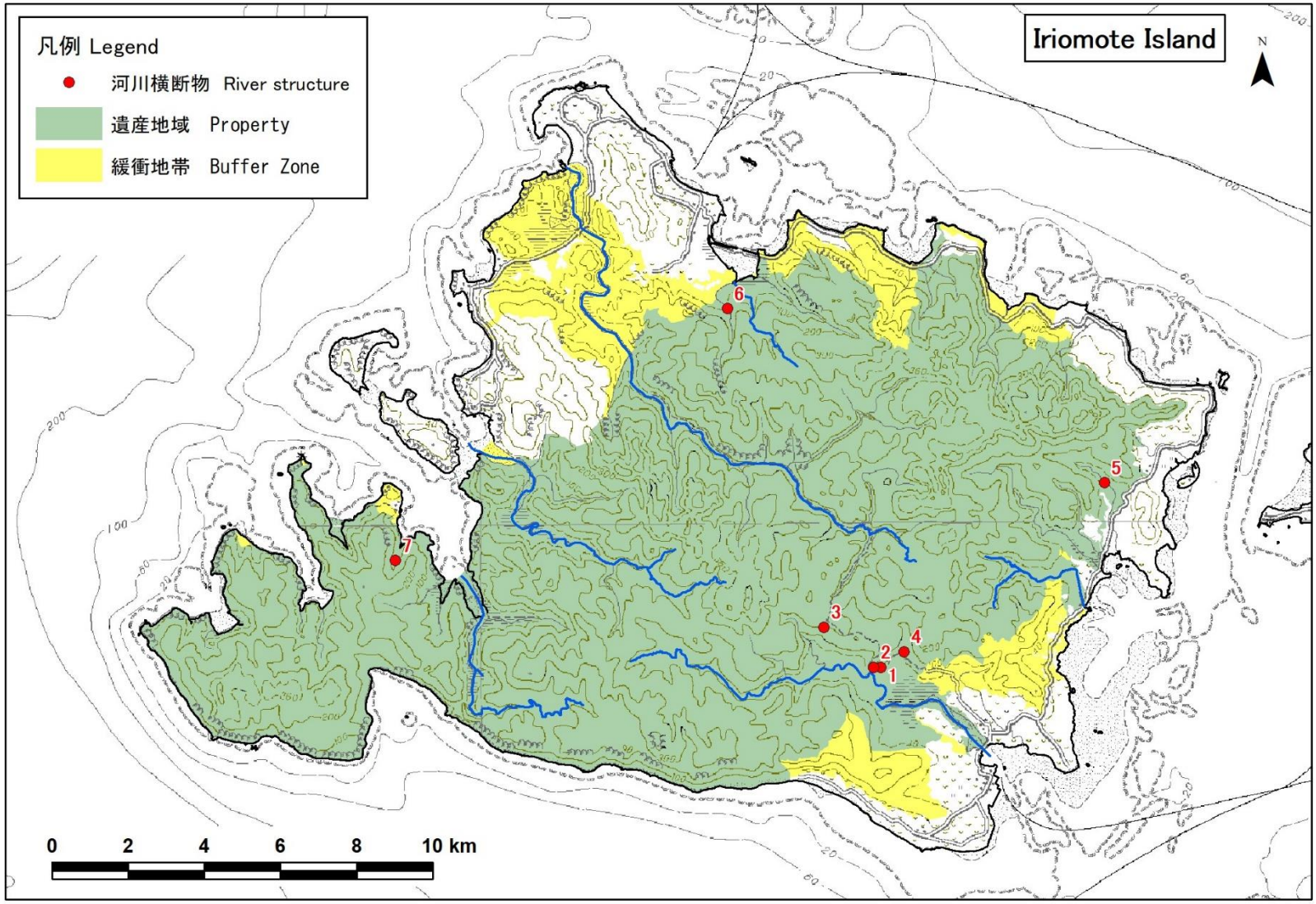
凡例 Legend
河川横断物 River structure
遺産地域 Property
緩衝地帯 Buffer Zone
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