Climate change impacts and adaptation for the conservation districts around the Seto Inland Sea, Japan

2024.9.5-6
CIVVIH SCIENTIFIC SYMPOSIUM
Climate change in historic towns and villages of the mediterranean area

FUKUKAWA Yuichi, Japan ICOMOS

NOTO Peninsula Earthquake (2024.1.1)

Japan is a country that is prone to natural disasters. On New Year's Day this year, there was an earthquake on the Noto Peninsula. However, today I would like to focus on heavy rains and high tides, which are closely related to climate change.

Google street view 2024.7

KUROSHIMA Conservation area

The SETO Inland Sea

An archipelago with approximately 700 islands of various sizes
The climate is mild and there is little rain

Conservation districts along SETO Inland Sea coast

Kurashiki

Tomo

Kasajima

Takehara

Tadotsu

Miyajima

Mitarai

Yanai

Conservation distrct:
Officially "an Important Preservation District for Groups of Historic Buildings"

ITSUKUSHIMA shrine on MIYAJIMA island

Although the shrine has survived many disasters, there are concerns that it will be affected more frequently due to climate change*

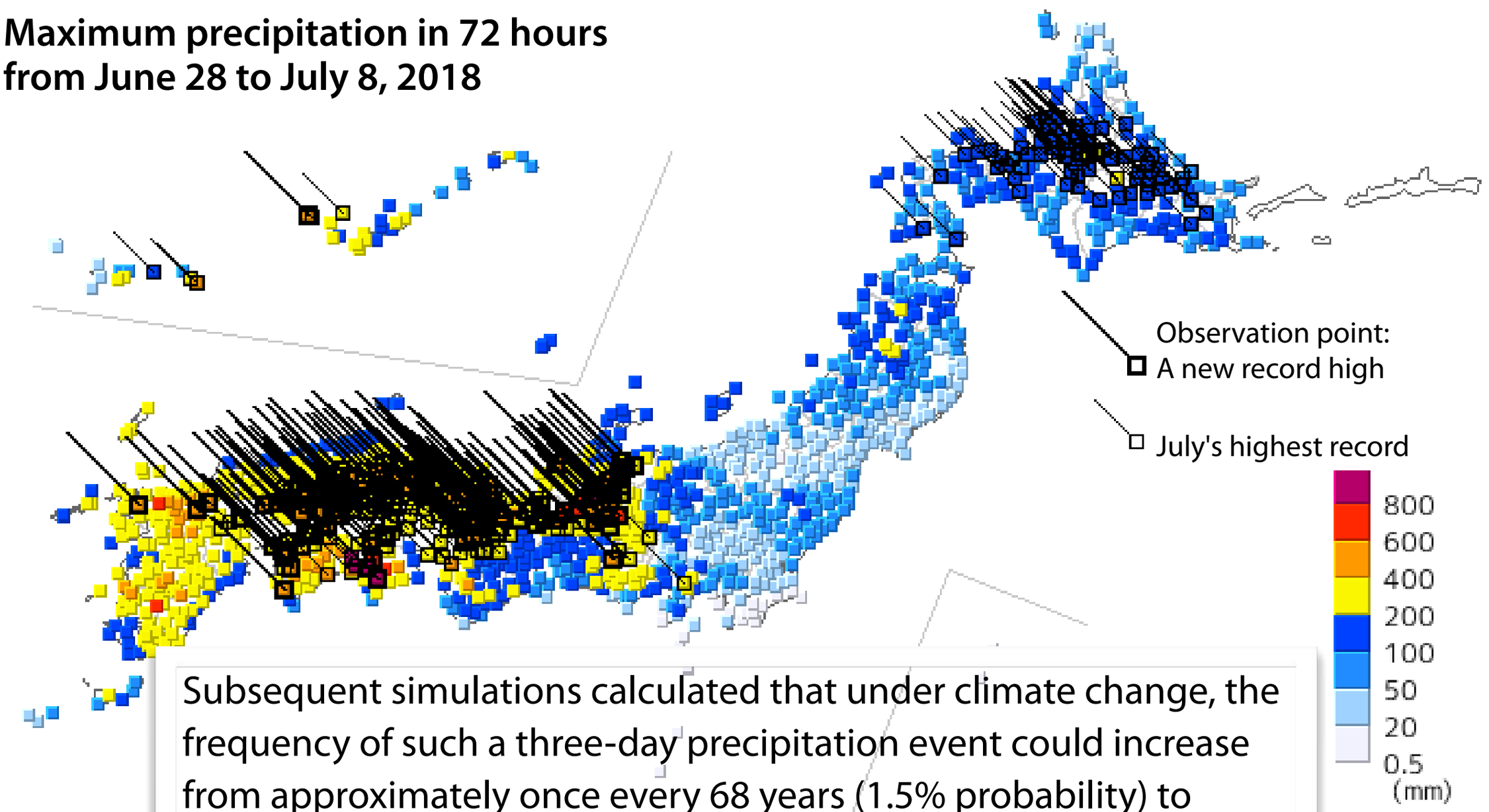
Conservation district

*https://www.mlit.go.jp/common/000036253.pdf

Western Japan Heavy Rain (2018.7.6～8)

61 people died (excluding related deaths)
Over 8,000 homes were completely or partially destroyed

Maximum precipitation in 72 hours from June 28 to July 8, 2018



Subsequent simulations calculated that under climate change, the frequency of such a three-day precipitation event could increase from approximately once every 68 years (1.5% probability) to approximately once every 21 years (4.8% probability).

Japan Meteorological Agency: Heavy Rains in July 2018 (Heavy Rains Caused by Fronts and Typhoon No. 7), July 13, 2018

Case of KURASHIKI, OKAYAMA pref.

Kurashiki

Tomo

Kasajima

Takehara

Tadotsu

Miyajima

Mitarai

Yanai

KURASHIKI

Kurashiki was one of the first cities in Japan to establish a system for historic conservation

Takahashi river

Kurashiki City Boundary

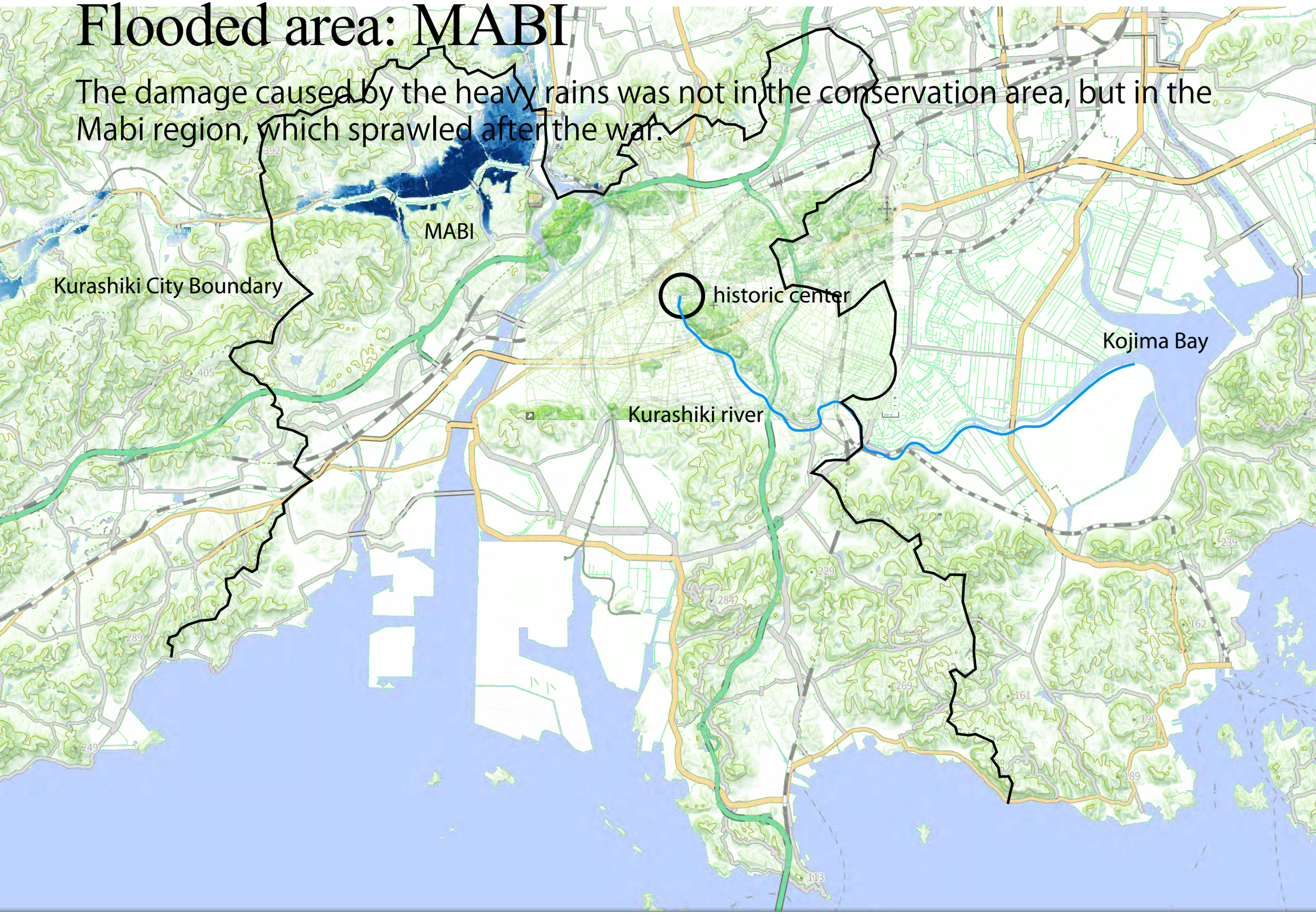
historic center

Kojima Bay

Kurashiki river

Flooded area: MABI

The damage caused by the heavy rains was not in the conservation area, but in the Mabi region, which sprawled after the war.



Flooding in MABI

0 500 1000 1500 2000 m

Estimated maximum flood depth

- 0m
- 1m
- 2m
- 3m
- 4m
- 5m

× 決壊 Breakdown
× 法崩れ Slope collapse
× 越水 Overflow

Flooded area: 1200ha
Number of deaths: 51
Flooded buildings: 4,600

Sukemasa river
Takamariver
小田川
Oda river
高梁川
Takahashi river
倉敷市

この地図は、7月7日の映像等の情報から浸水した範囲の端の地点を確認し、その地点の高さから標高データを用いて浸水面を推定し、浸水面から水深を算出し深さごとに色別に表現しています。
実際に浸水のあった範囲でも把握できていない部分、浸水していない範囲でも浸水範囲として表示されている部分があります。
破堤、法崩れ、越水の発生地点は「国土交通省総合災害情報システム（DiMAPS）」の情報をもとにしています。　国土地理院技術資料 D1-No.919

Geospatial Information Authority of Japan:
https://www.gsi.go.jp/common/000208572.pdf

Flooding in the conservation district

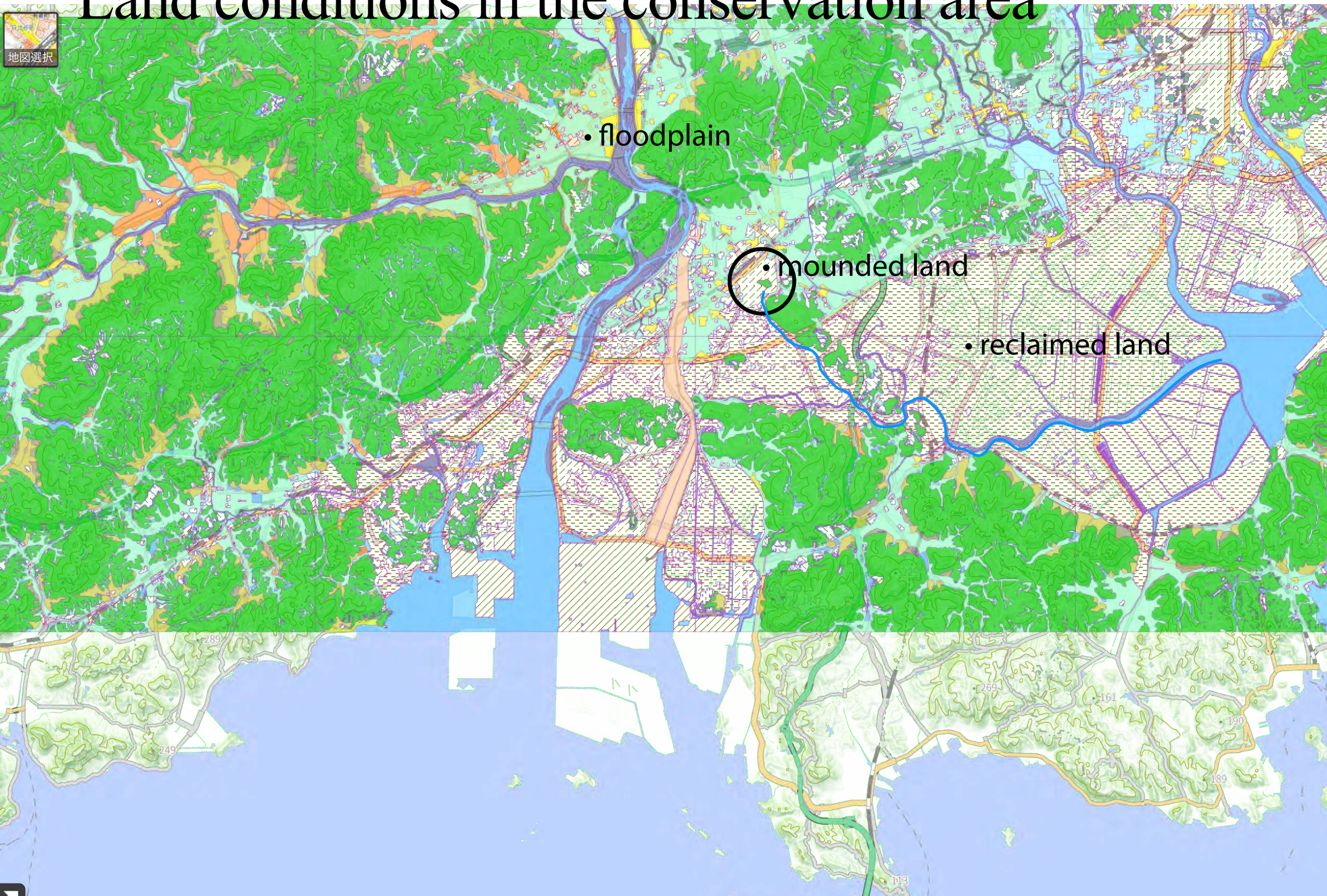
Inland flooding also occurred,
but the water was contained behind the main street

Drainage pump

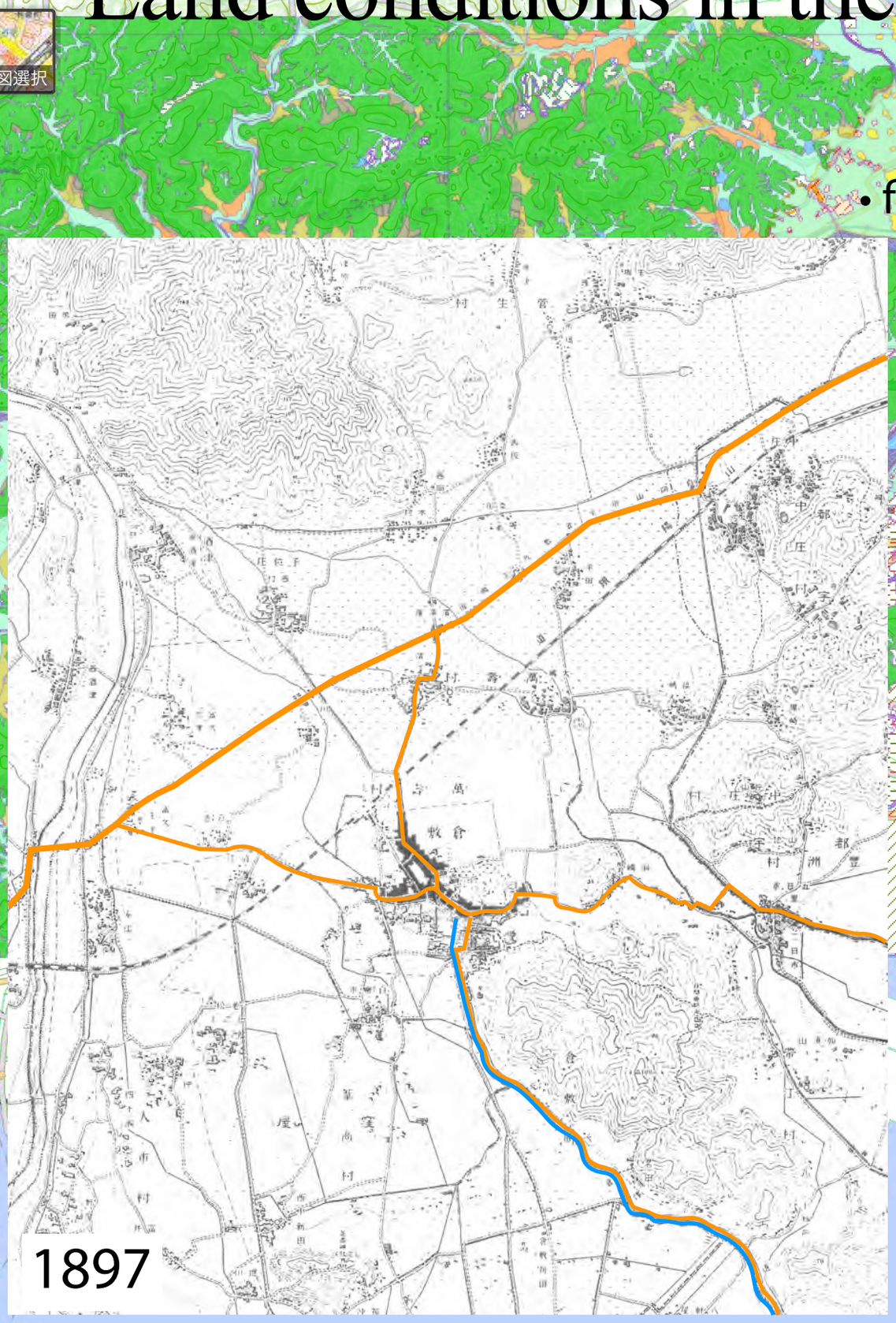
★ Important Cultural Property Buildings

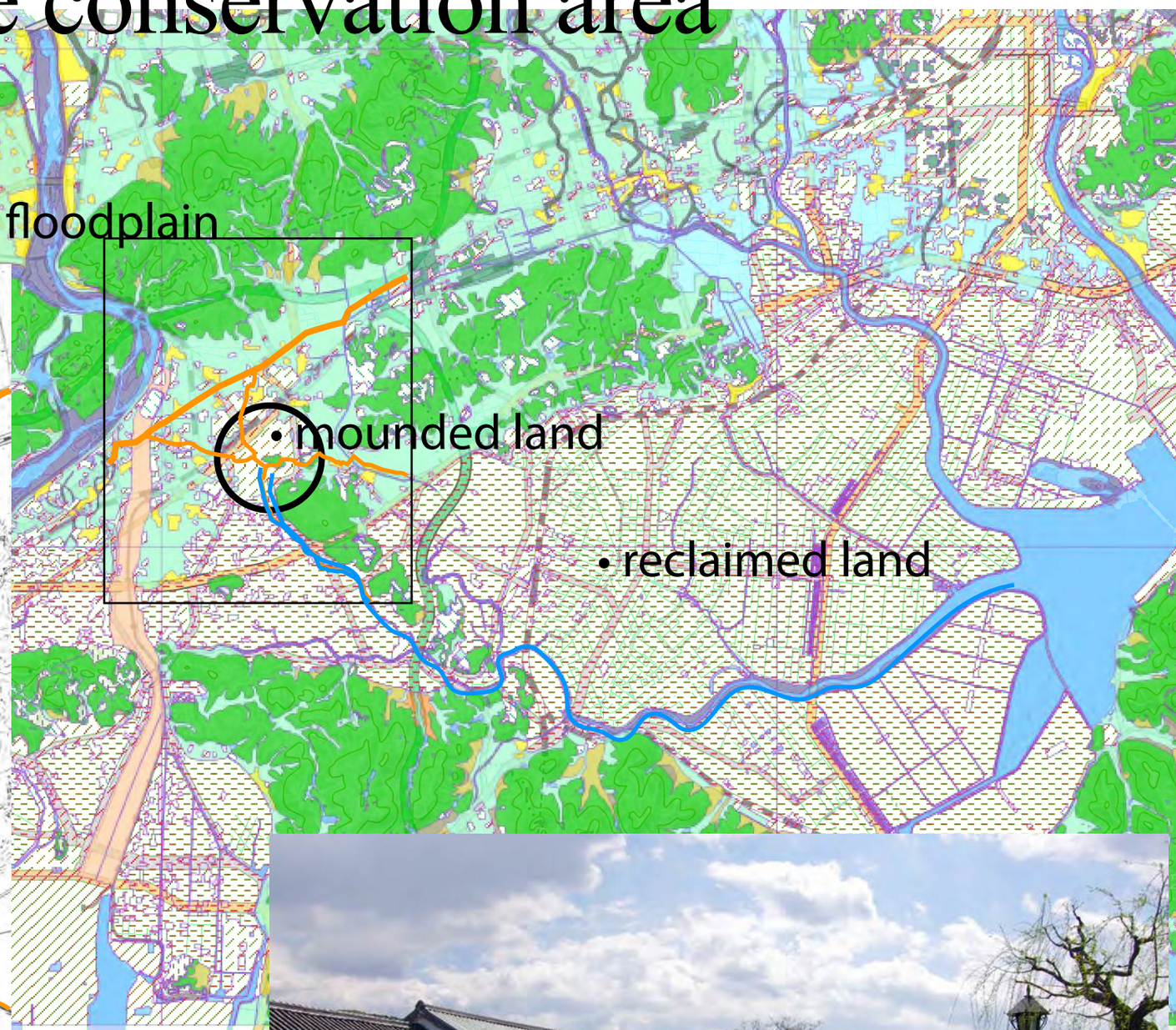
Conservation district

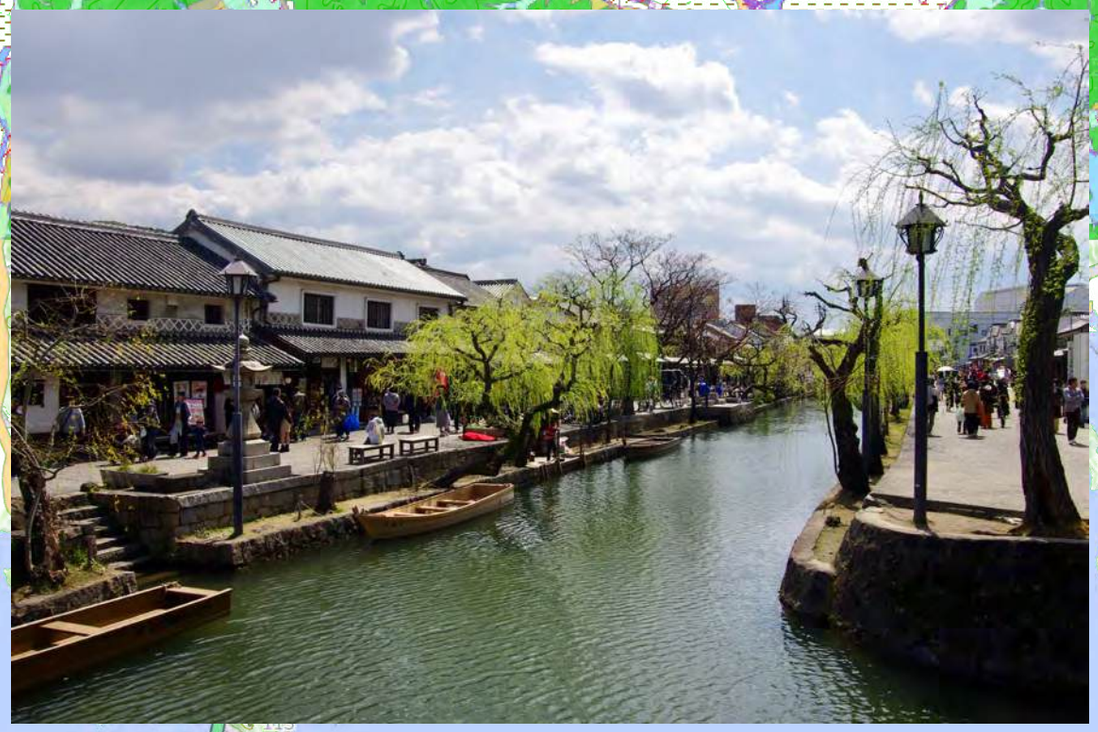
Land conditions in the conservation area



Land conditions in the conservation area

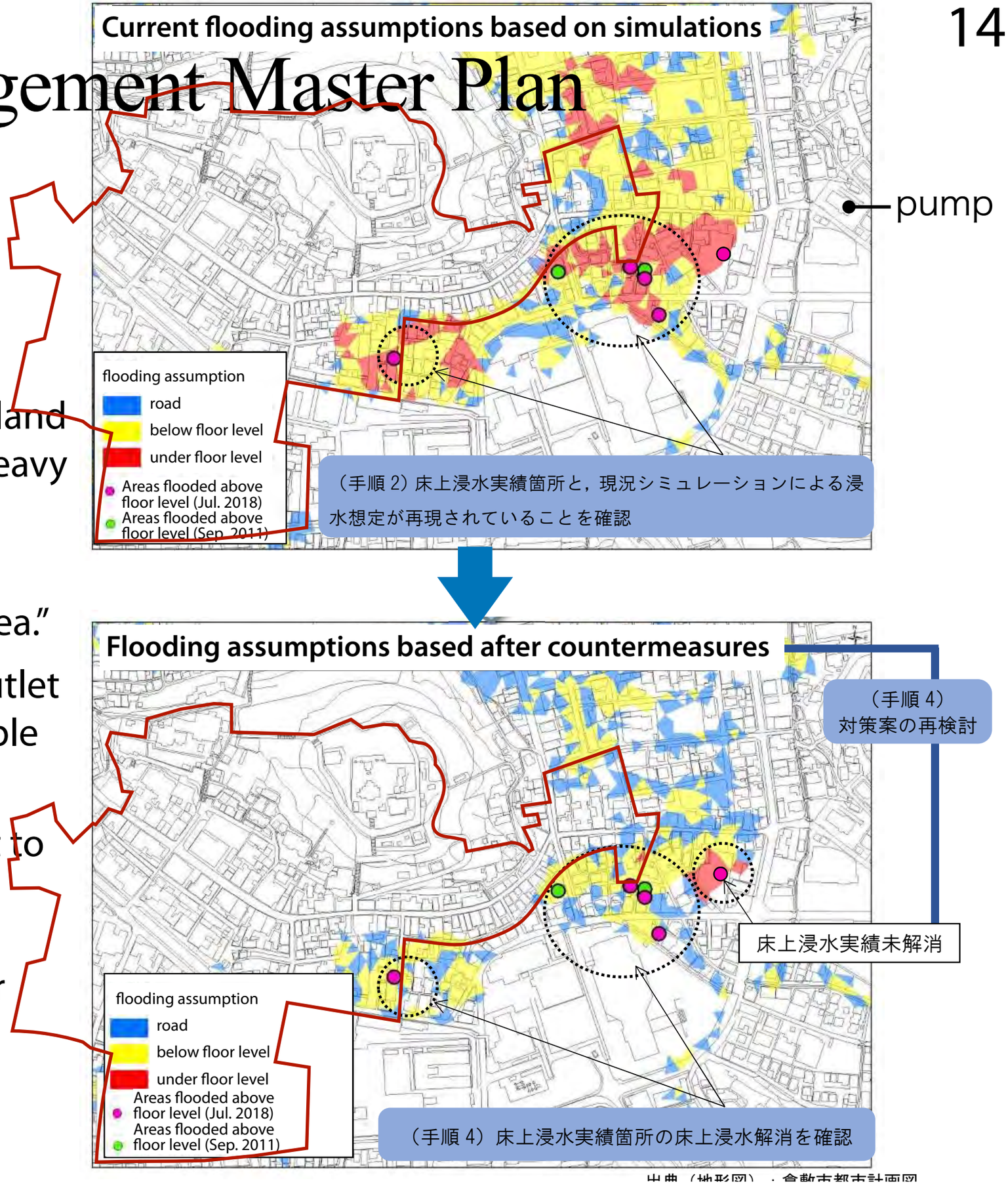






Stormwater Management Master Plan

- The conservation area had a combined sewer system, but inland flooding occurred during the heavy rains in Western Japan.
- The area is designated as a "temporary drainage control area."
- The peak discharge from the outlet of this area is below the allowable discharge to the main river.
- Construction will be carried out to install new pumps, new water conveyances, new discharge conduits, and flap valves (under construction).



Case of TAKEHARA, HIROSHIMA pref.

Due to the same Western Japan heavy rain, the conservation district of Takehara City in Hiroshima Prefecture was damaged by flooding on the floor

Kurashiki

Tomo

Kasajima

Takehara

Tadotsu

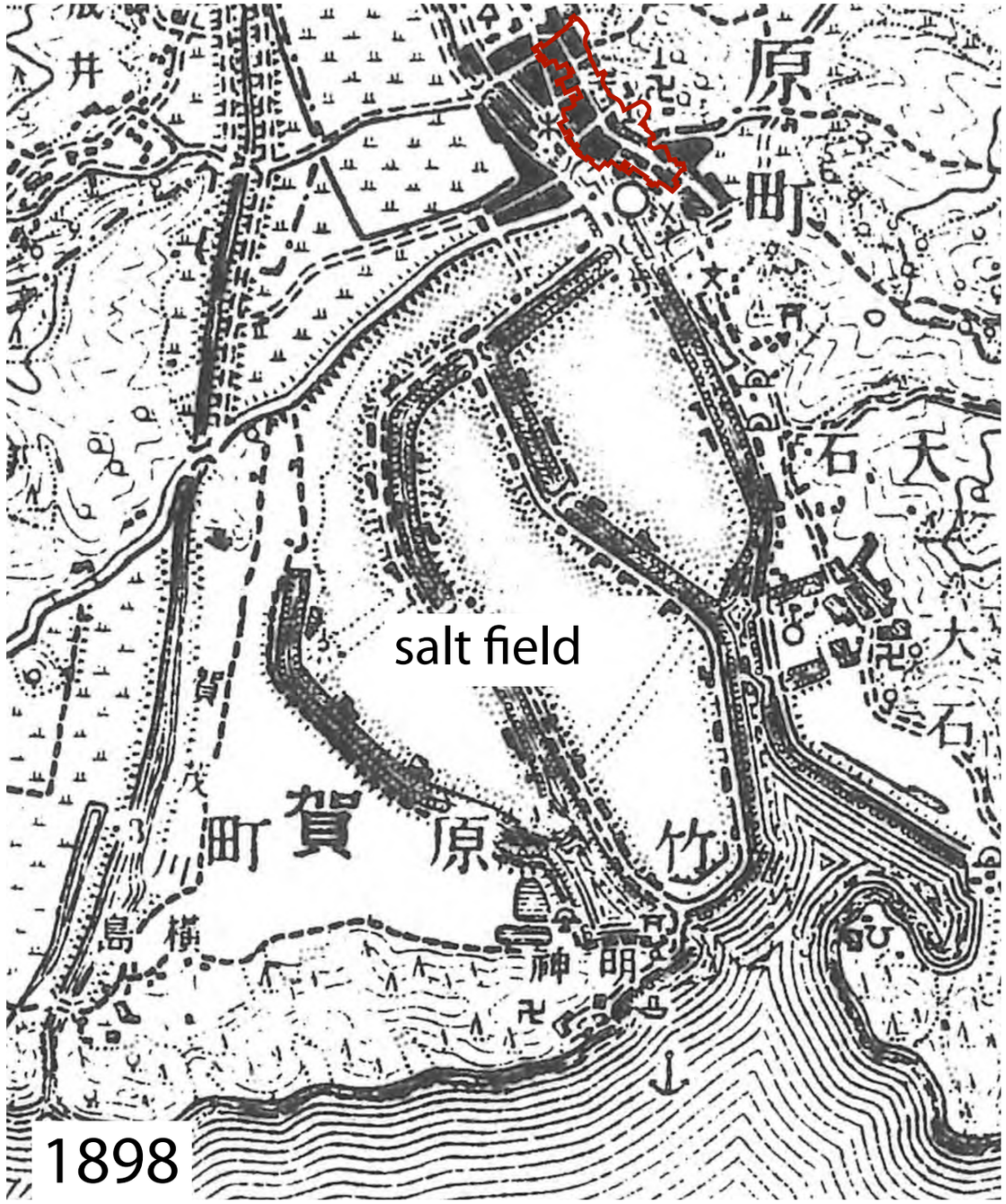
Miyajima

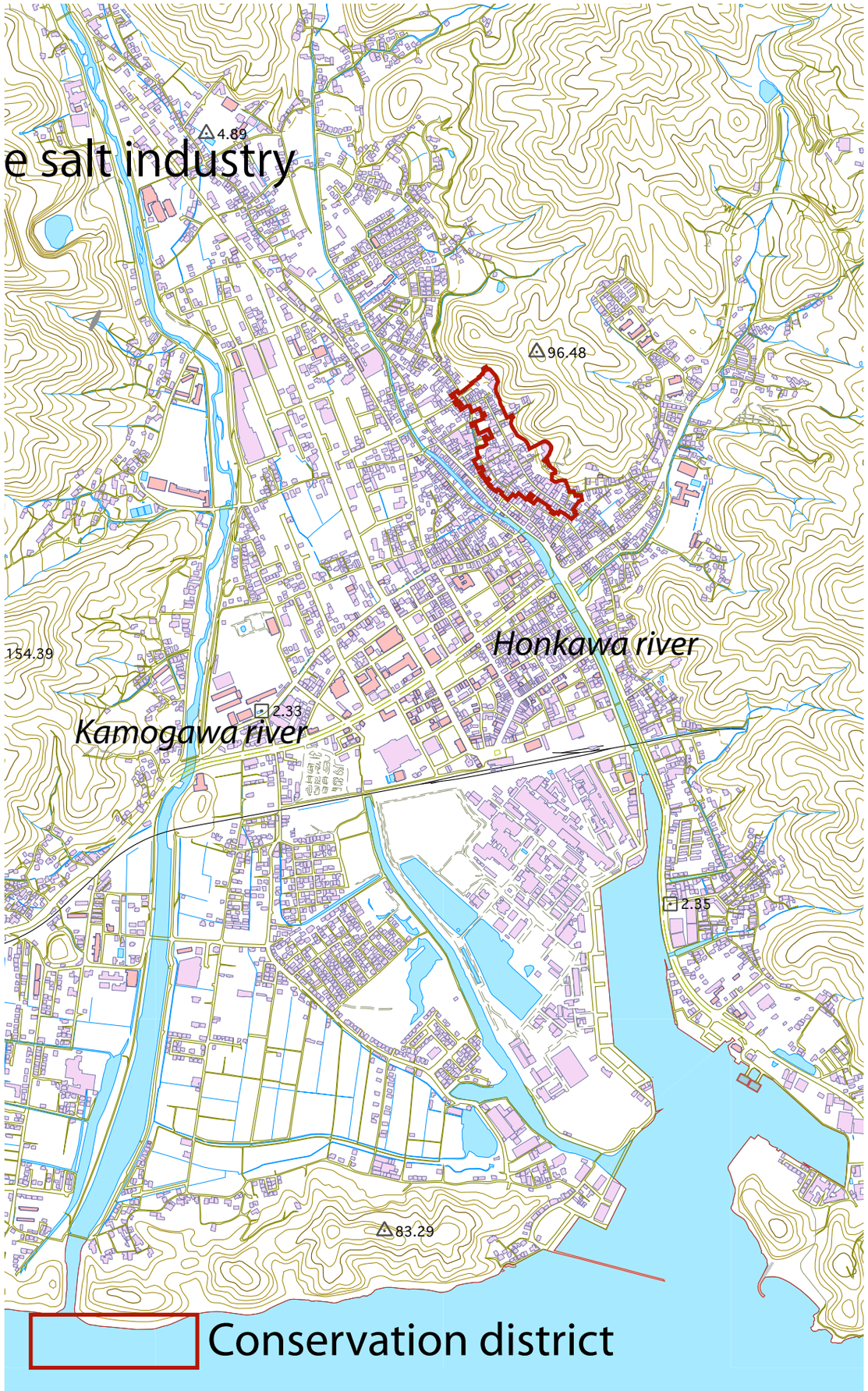
Mitarai

Yanai

TAKEHARA

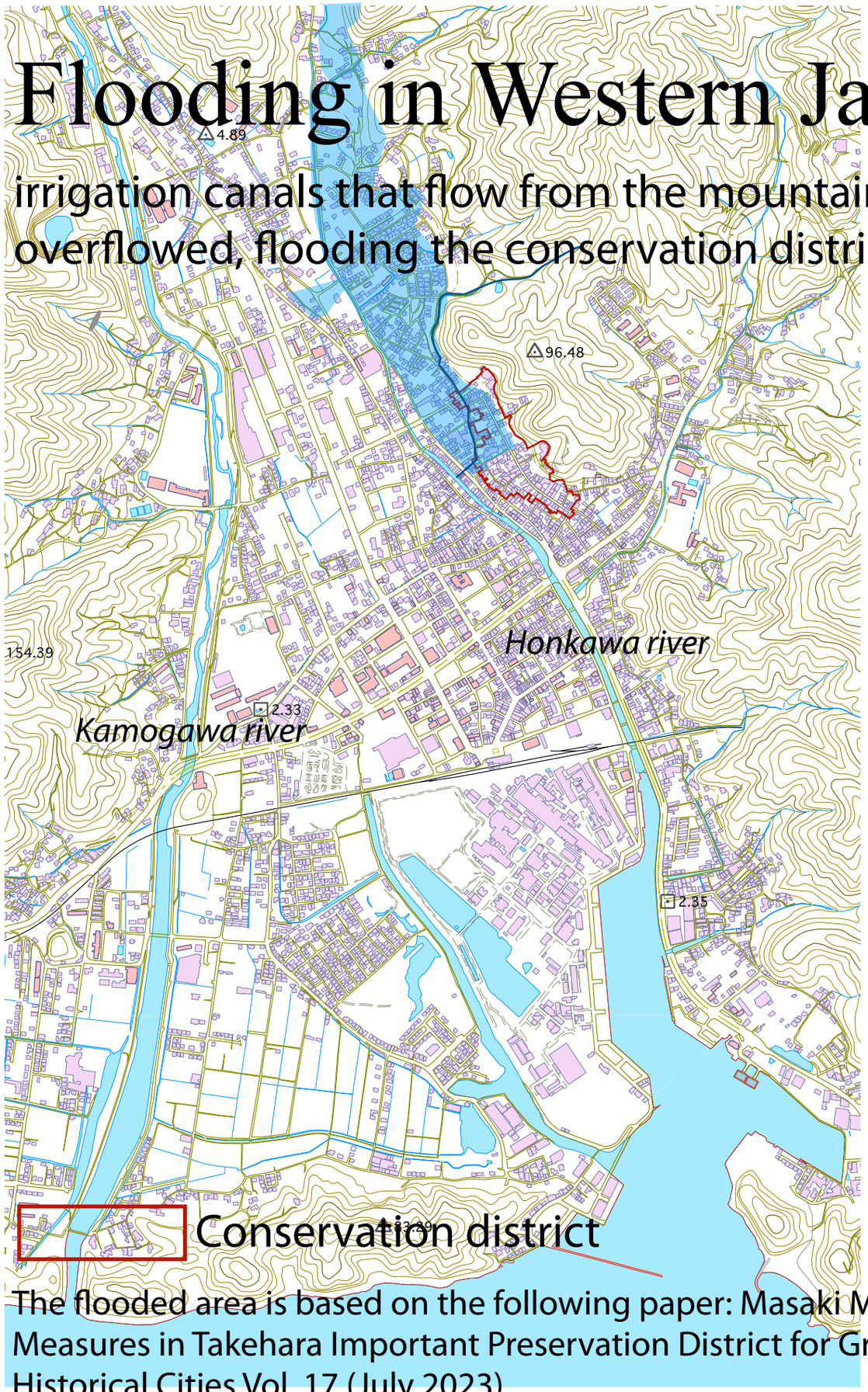
An old port town that prospered through the salt industry

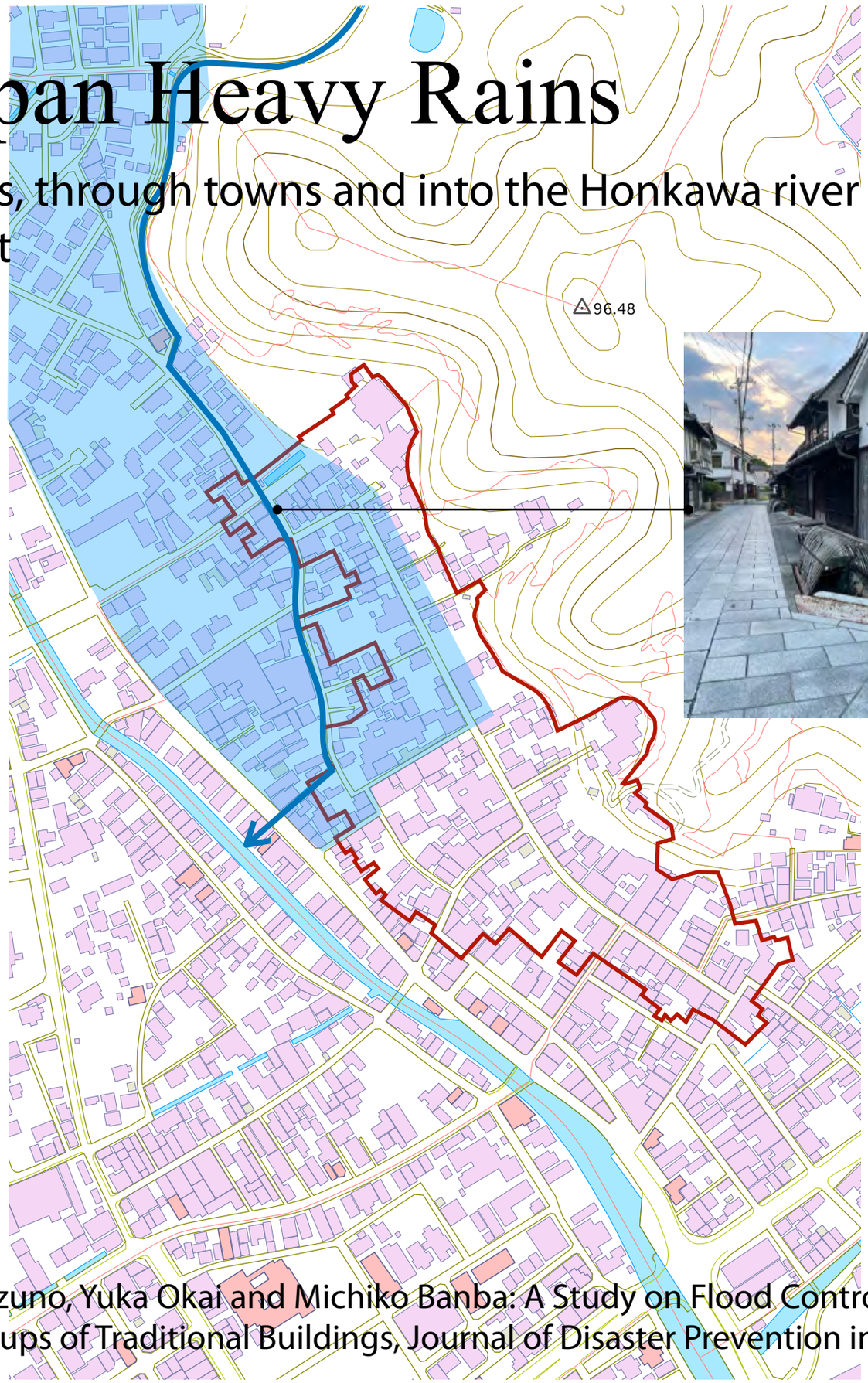




Flooding in Western Japan Heavy Rains

irrigation canals that flow from the mountains, through towns and into the Honkawa river overflowed, flooding the conservation district





The flooded area is based on the following paper: Masaki Mizuno, Yuka Okai and Michiko Banba: A Study on Flood Control Measures in Takehara Important Preservation District for Groups of Traditional Buildings, Journal of Disaster Prevention in Historical Cities Vol. 17 (July 2023)

浸水対策重点地域緊急事業【本川水系本川】（広島県）

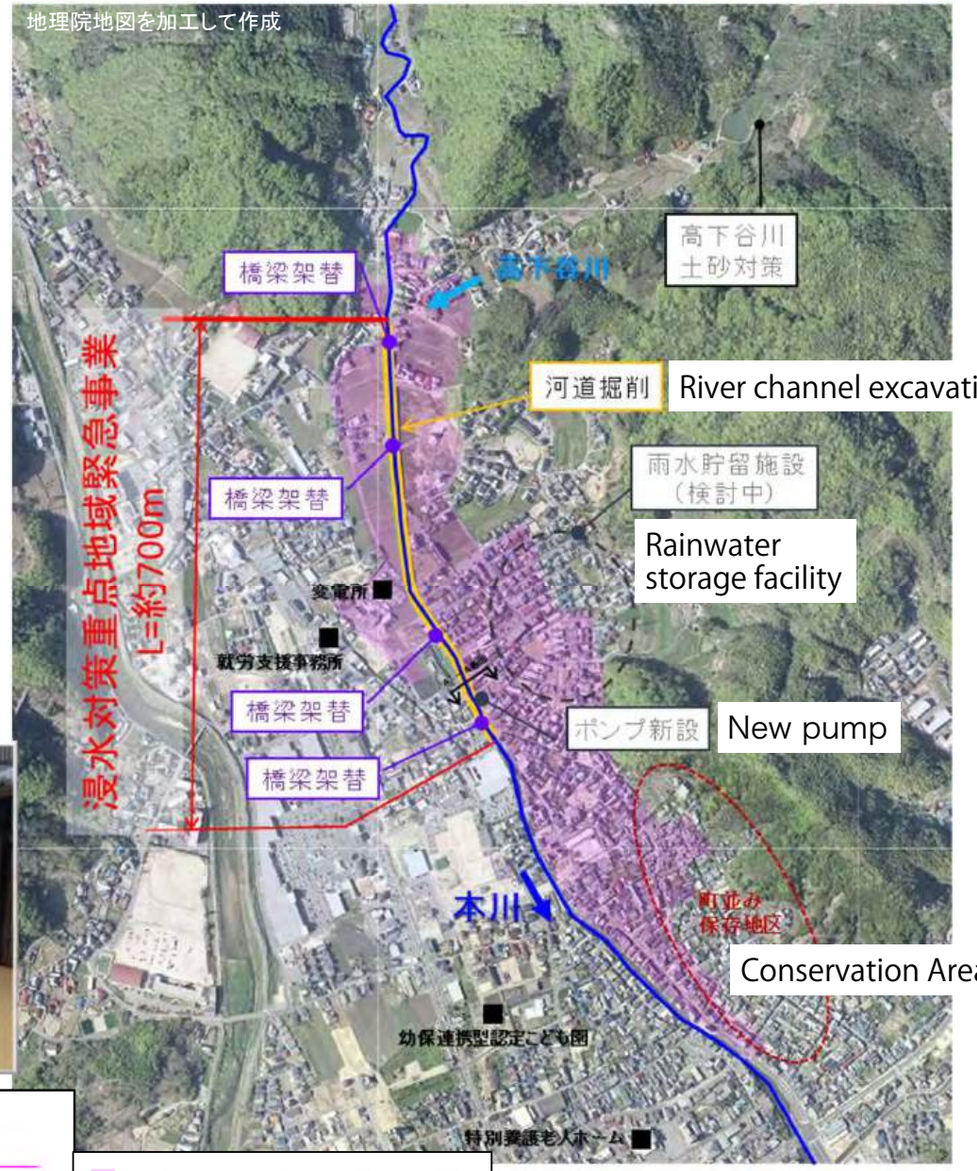
別添２　浸水重点

In the Honkawa River system in Takehara City, Hiroshima Prefecture, the flooding of July 2021 caused severe flooding damage, with 90 homes flooded above floor level and 166 homes flooded below floor level. As a result, the flood prevention priority emergency project will implement river dredging, bridge replacement, and other improvements, as well as promote river basin measures such as inland water countermeasures and land use restrictions, in order to improve the safety of the region as soon as possible.

【位置図】

〈県・市の独自事業〉

○県単独事業
　高下谷川土砂流出対策
○市単独事業
　雨水排水ポンプの整備
○適切な維持管理
　維持管理計画に基づいた河川点検の実施
○ソフト対策
　県・市：まるごとまちごとハザードマップの実施
　市：立地適正化計画の見直し
　県・市：特定都市河川指定等による流域治水の推進



【全体計画】
　河川名　　：二級河川本川水系本川
　事業内容　：河道掘削，橋梁架替等
　全体事業費：約21億円
　事業期間　：R4～R8
　施工地　　：竹原市

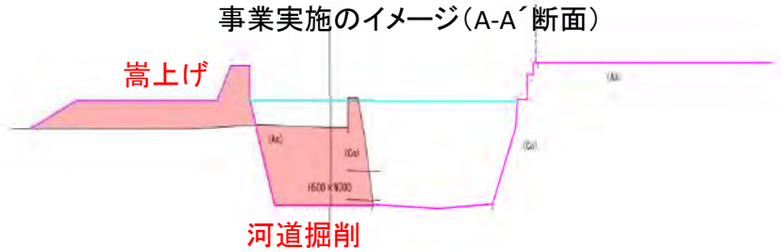
【令和4年度当初】
　実施内容　：測量設計
　事業費　　：70百万円（国費35百万円）

※防災・安全交付金については、国の意図を示すものであり、計画への配分後の使途は地方の裁量に委ねられ、国の意図と異なる配分を妨げるものではない。

浸水戸数	床上	床下	計
R3.7月	90戸	166戸	256戸

【事業効果】
令和3年7月豪雨相当の洪水から
床上浸水被害を解消

事業実施のイメージ（A-A´断面）



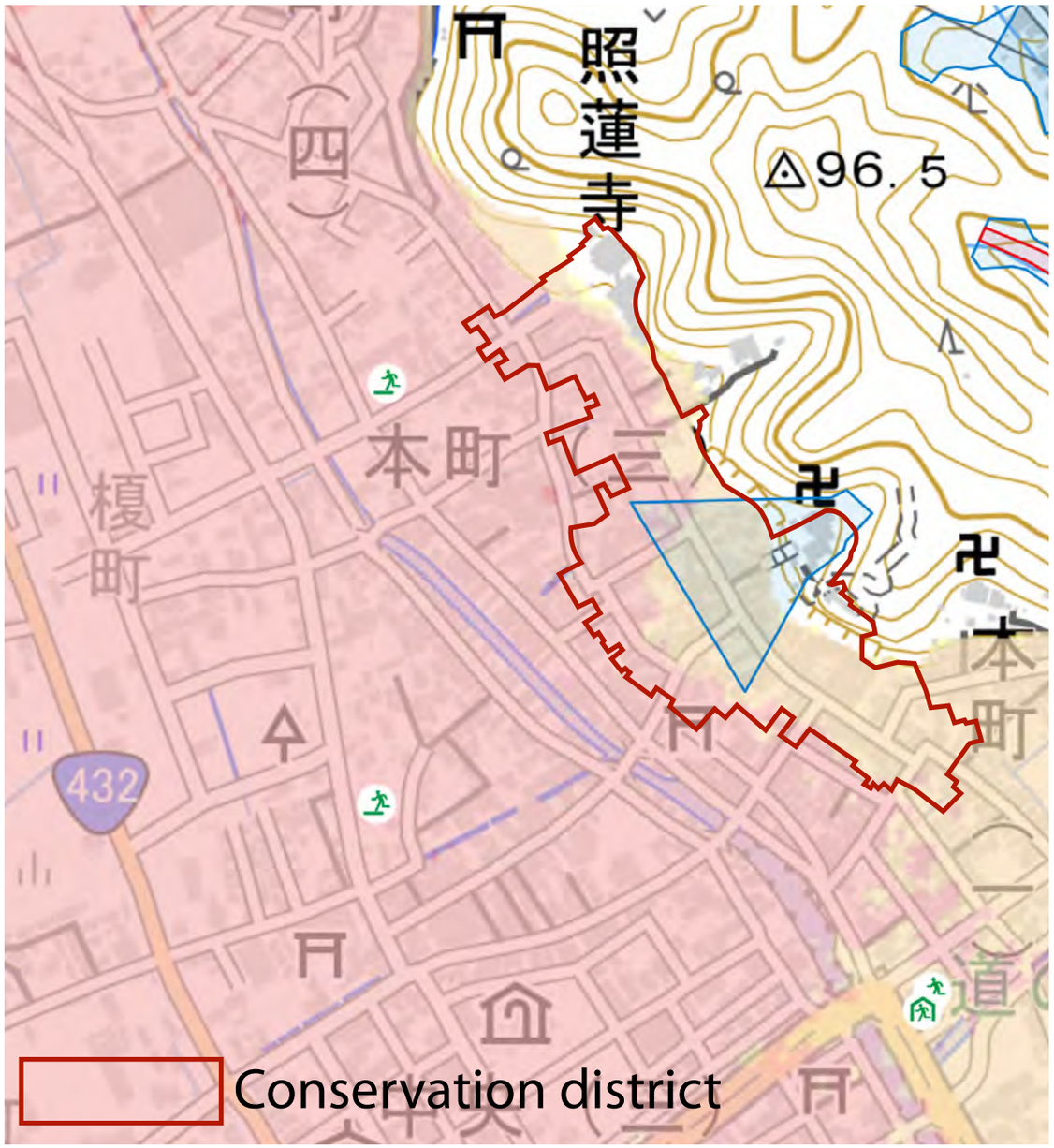
■ 令和3年7月洪水　浸水範囲
■ 浸水想定区域内の重要施設

※各施設は、今後実施する詳細な調査や検討等の結果により、変わる可能性もある。

https://www.pref.hiroshima.lg.jp/uploaded/attachment/477686.pdf

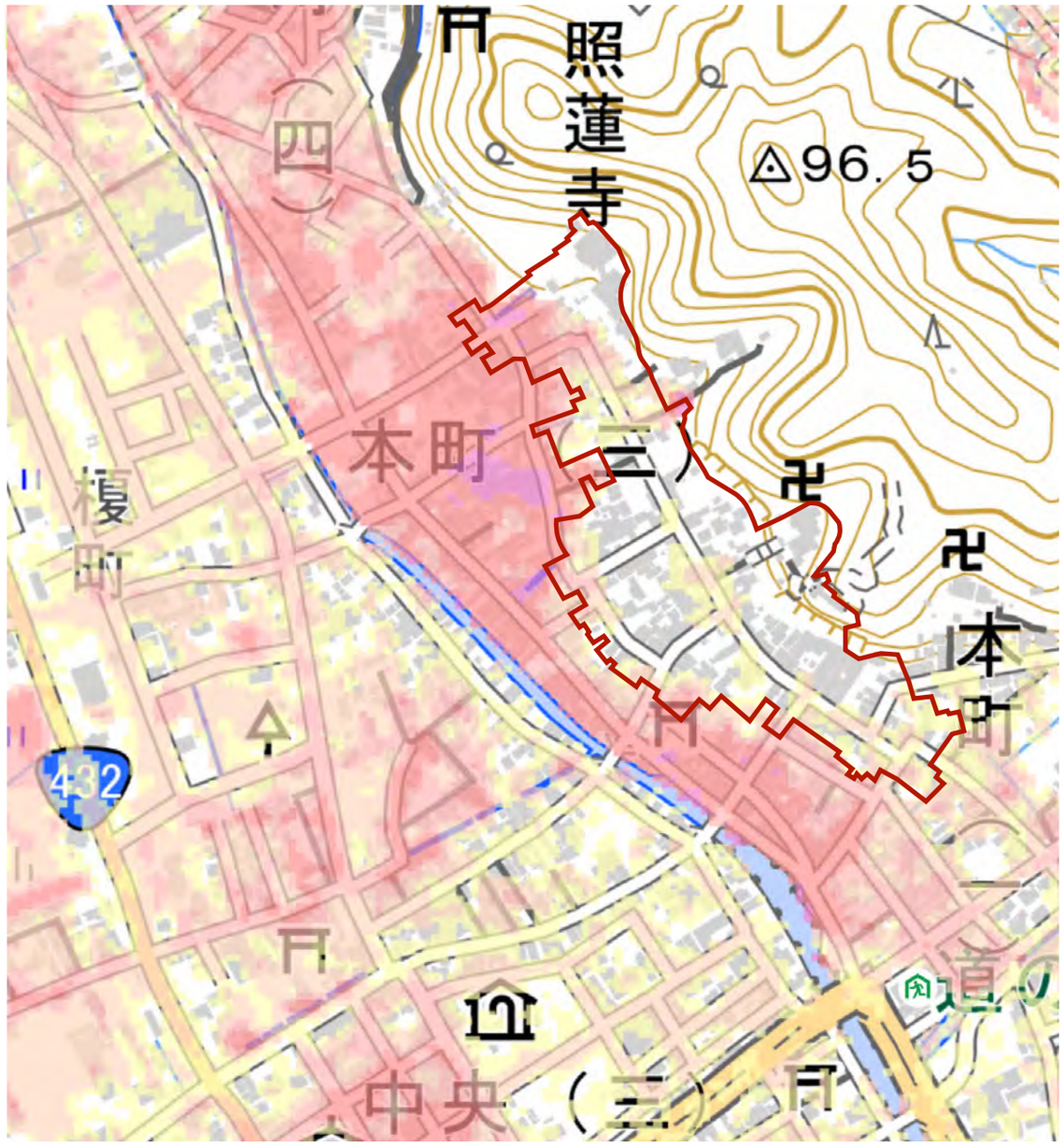
Hazard map: Flooding areas

According to one study, 30% of the nation's conservation areas are within the predicted maximum flooding area.



Estimated maximum flooding area (flood)

Simulation of flooding caused by the maximum possible rainfall (assuming rainfall that occurs once every 1,000 years)



Expected inland flooding area (inland water)

Flooding if rainfall equivalent to the maximum recorded in the past (August 18, 2021: 57mm/h) falls uniformly across the entire area

Case of TOMO, HIROSHIMA Pref.

Currently, disaster adaptation measures for conservation areas are sometimes compiled as disaster prevention plans. As an example, I will look at TOMO's disaster prevention plan

Kurashiki
Tomo
Kasajima
Takehara
Tadotsu
Miyajima
Mitarai
Yanai

TOMO conservation district

All of the port facilities from the Edo period, such as "Lighthouse," "Stone steps," "Breakwaters," "Dockyard," and "Boat guard station," remain. It is said that the town maps from the Edo period are also valid as modern maps

Stone steps

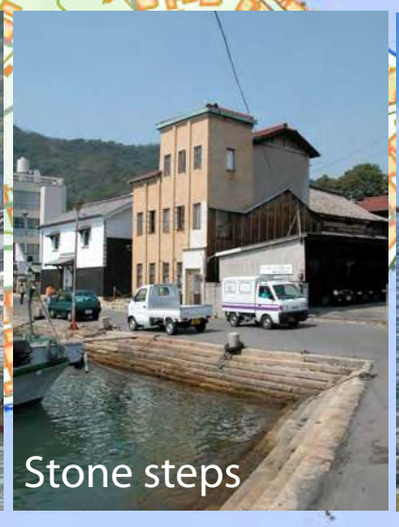
Light house

Dock yard

Boat guard station

Breakwaters

Conservation district



Reclamation and Bridge Construction Plan Issue

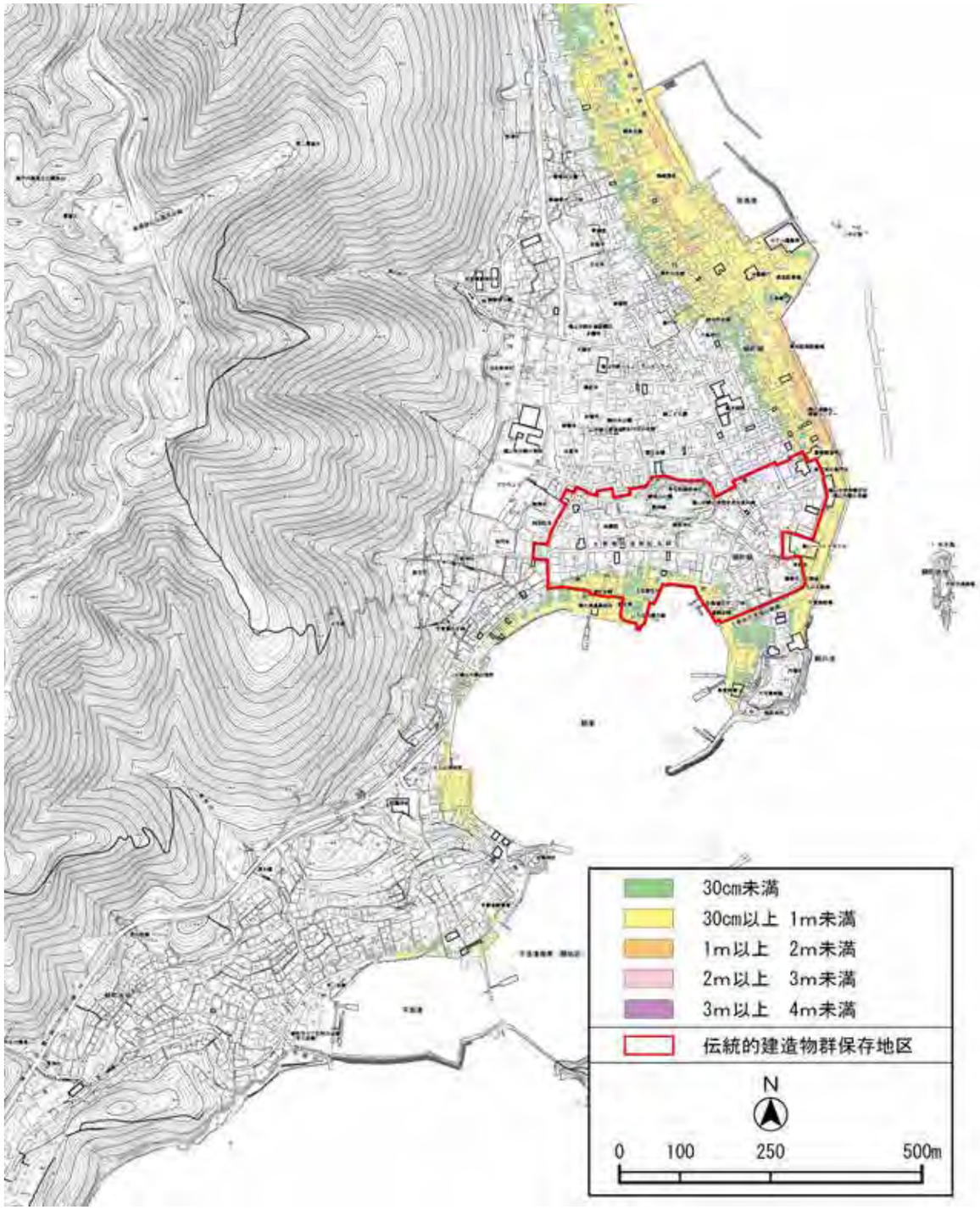
After a long and fierce debate, the Hiroshima Prefectural Governor decided on the tunnel plan in 2012. The tunnel was completed in July of this year

Conservation district

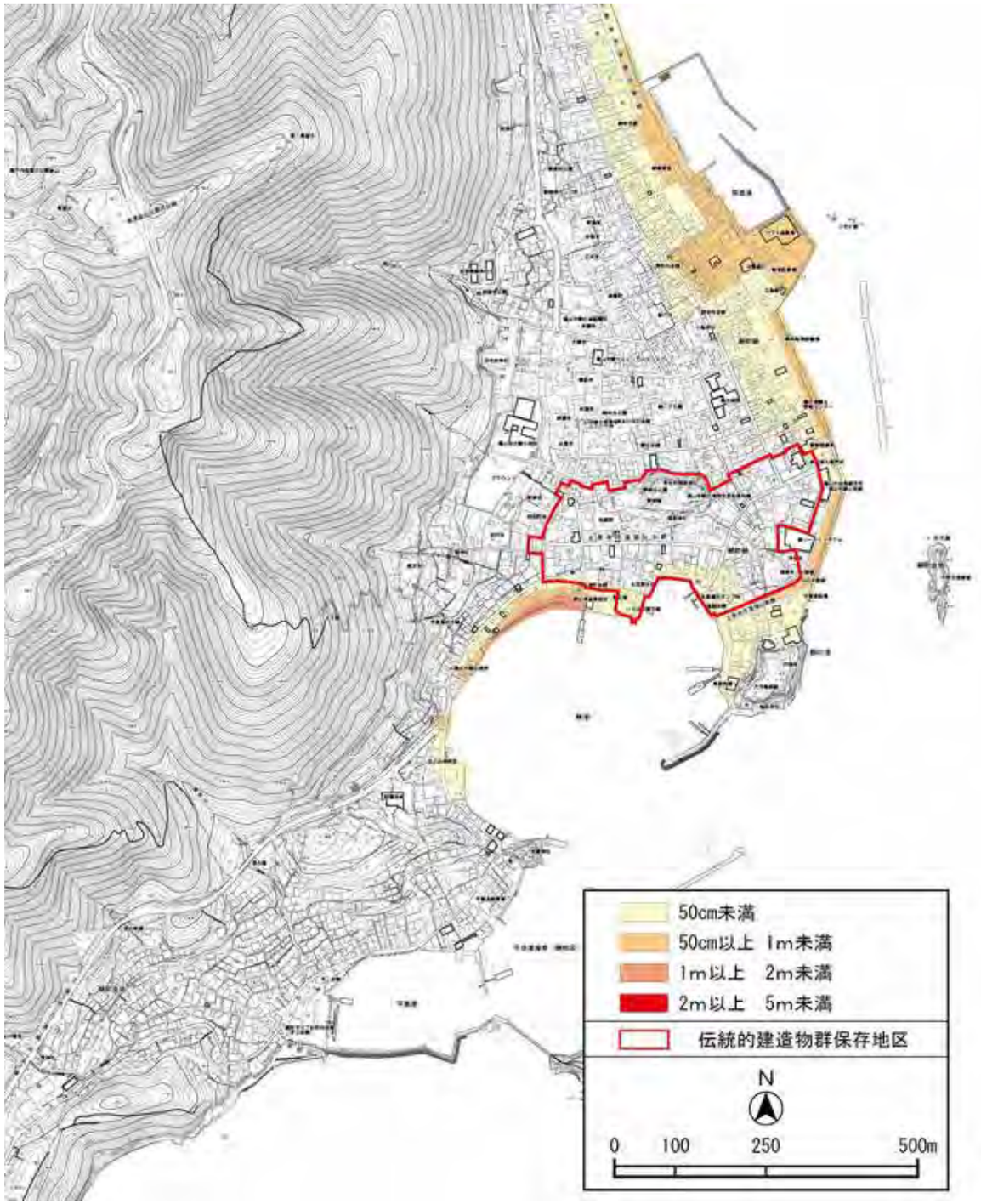
Disaster prevention plan for TOMO conservation area

Policy	Priority Initiatives
Fire: Do not start fires, do not let them spread, do not let fires spread	(1) Installation of residential fire alarms linked to neighboring houses (2) Publicizing and installing earthquake-sensitive breakers, (3) Installation and publicizing of outdoor fire extinguishers, (4) Deploying portable pumps and creating a system (structure) for their use, (5) Preparation of firefighting bases to help eliminate areas where firefighting is difficult, (6) Preparation of earthquake-resistant water tanks.
Earthquake: Prevent the collapse of buildings due to earthquakes and secondary damage after earthquakes	(7) Improving the earthquake resistance of buildings
Transportation: Ensure multiple routes for firefighting and emergency services	(8) Creating an environment that allows people to move between sites
Evacuation: Create an environment and conditions where everyone can evacuate safely	(9) Providing information to visitors
Disaster prevention system (position): Creating a disaster-resistant town where people support and help each other	(10) Identifying, watching over, and supporting people in the neighborhood who require special consideration in the event of a disaster (11) Creating a system (preparation) for emergency repairs and restoration of buildings after a disaster, (12) Reviewing, enhancing, and establishing subsidy measures,
Other disasters: Take measures against floods, landslides, tsunamis, and high tides	(13) Publicizing hazard maps, (14) Measures to prevent landslides, (15) Measures against tsunamis and high tides

Assumed flooding



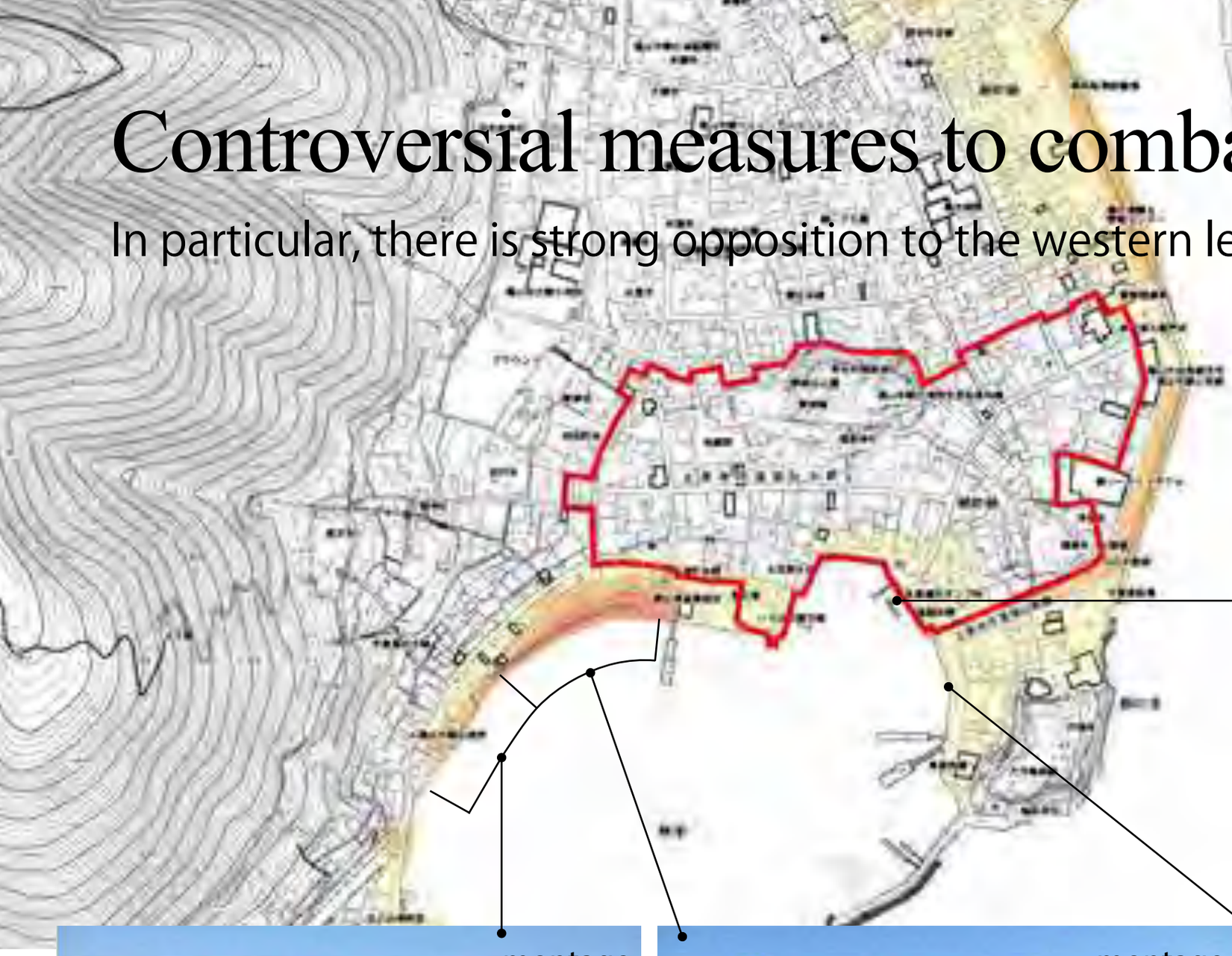
Assumed flooding due to tsunami



Assumed flooding due to storm surge (30-year probability)

Controversial measures to combat storm surges

In particular, there is strong opposition to the western levee and management road



Two pictures on the left (proposal): Hiroshima Prefecture: Regarding measures against high tides in the Enoura-Tanba area (finalizing the shape and design of the revetment), https://www.pref.hiroshima.lg.jp/soshiki/103/tomodezainkentou.html