

Flood Management in Japan

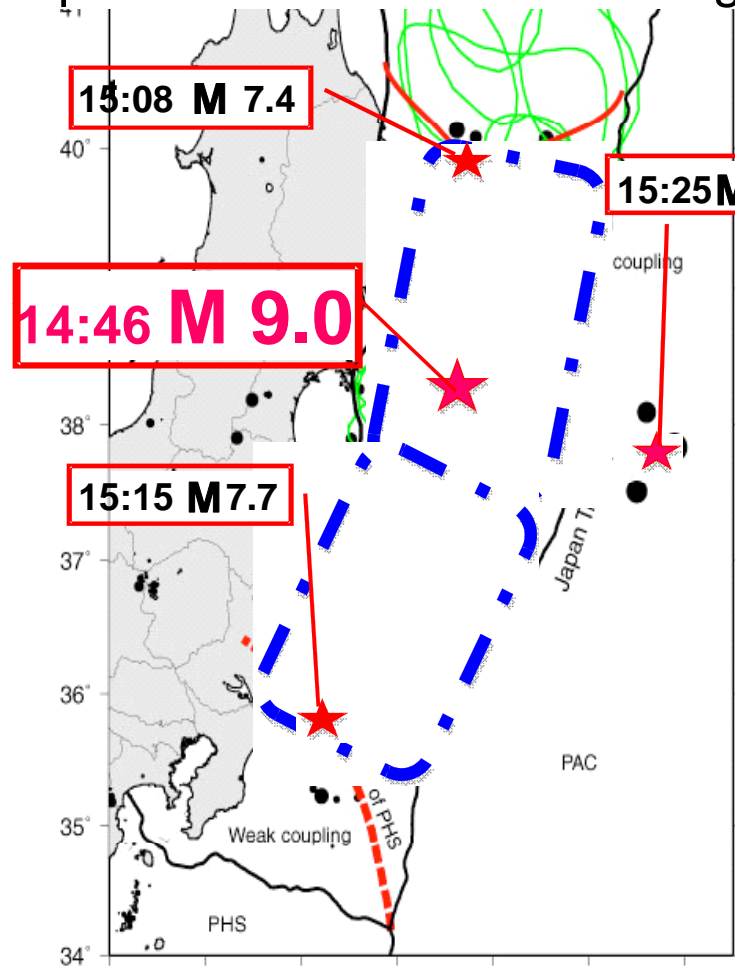
1. Comprehensive Flood Control Measures
2. Provision of River information
3. Responses to the Niigata Torrential Rain Disaster
4. About ICHARM
5. Responses to 2011 Thailand Floods
6. Outline of the Tsunami-Resilient City

Overview of Earthquake & Tsunami

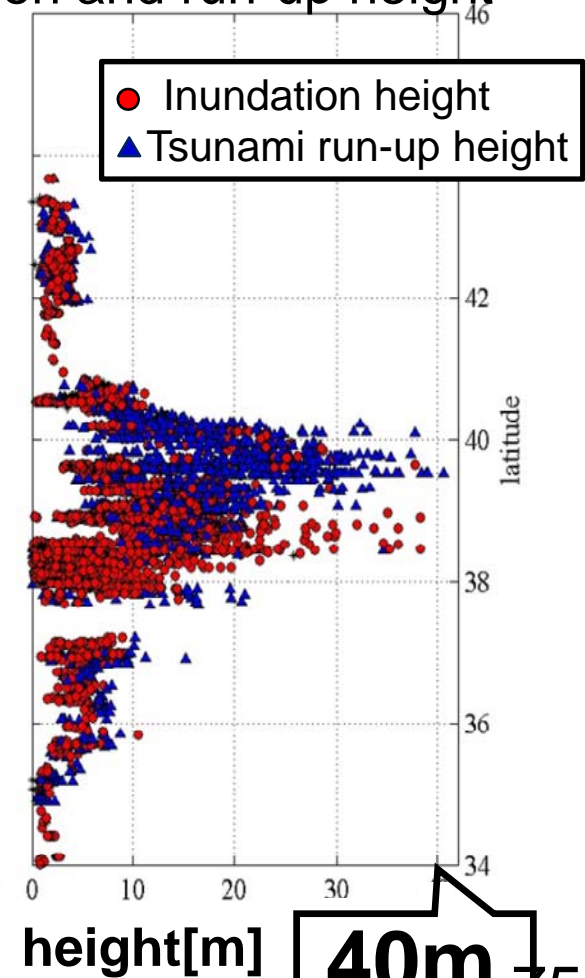
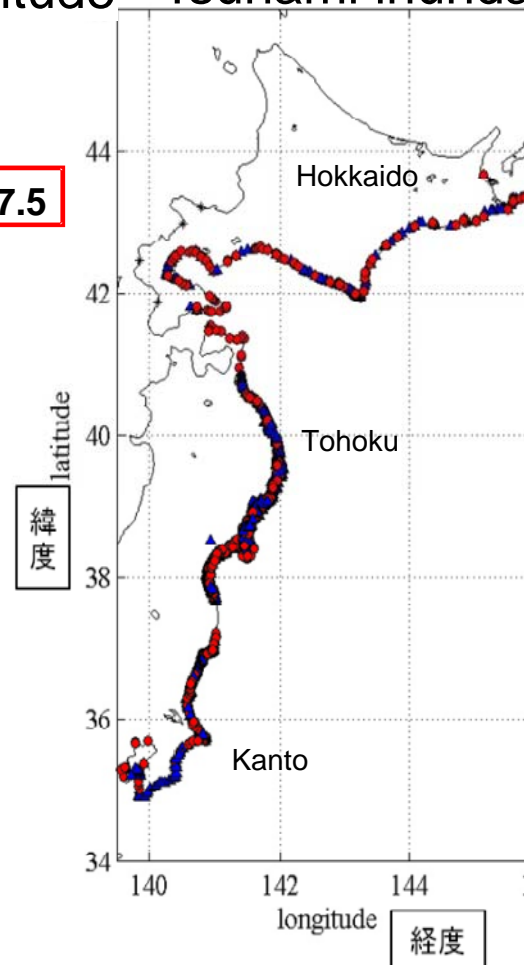
- On March 11 a massive earthquake of magnitude 9.0 occurred off Sanriku coast. Strong shocks were widely observed.
- Focal region ranged over in the rectangle of around 450km long and 200km wide*.
- The earthquake caused massive tsunami from Hokkaido to Kanto.
- The scale of tsunami was equal to or larger than that of the Jogan Tsunami (869). The return period is estimated to be 500 to 1000 years.

※White Paper on Disaster Management 2011, Cabinet Office, Government of Japan

Epicer distribution and magnitude Tsunami inundation and run-up height



Research Center for Prediction of Earthquakes and Volcanic Eruptions, Tohoku University
http://www.aob.geophys.tohoku.ac.jp/info/topics/20110311_news/index.html

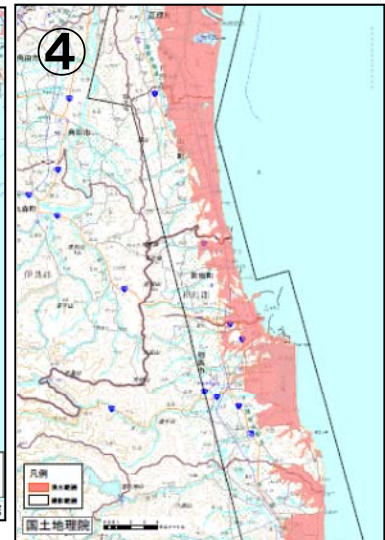
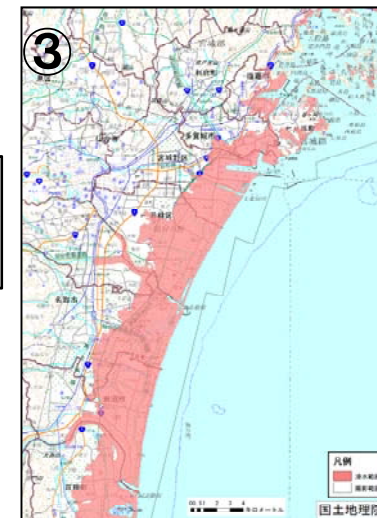
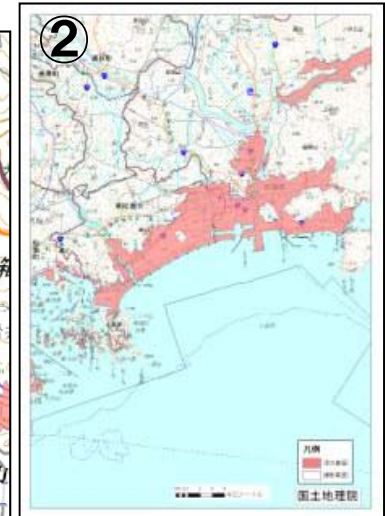
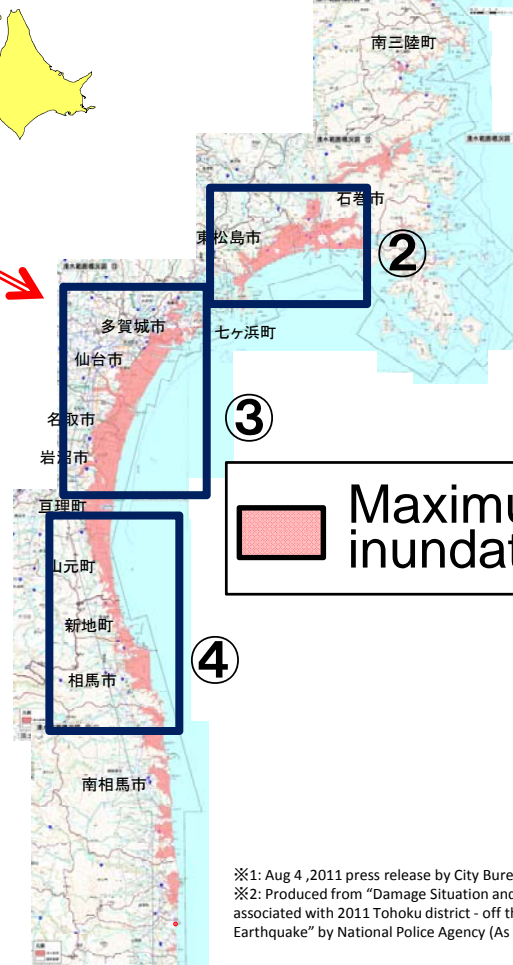
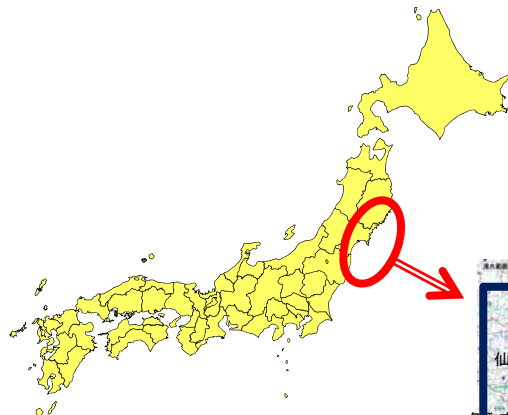


The 2011 Tohoku Earthquake Tsunami Joint Survey Group report (As of July 5, 2011)
<http://www.coastal.jp/tjtj/>

40m 75

Damages caused by Tsunami (1/2)

- 535km² of land was inundated by tsunami in Tohoku and Kanto region. Approx. 10% (119km²※1) of urban area was inundated.
- Approx. 115,000 buildings were destroyed, fatalities were around 15,790 and missing persons were around 4,060. ※2



※1: Aug 4, 2011 press release by City Bureau
 ※2: Produced from "Damage Situation and Police Countermeasures associated with 2011 Tohoku district - off the Pacific Ocean Earthquake" by National Police Agency (As of Sept 16, 2011)

Produced from "Inundation Condition Map" by Geospatial Information Authority

Fundamental Strategy for Tsunami Disaster Measures

Reducing human and economic damages by “disaster mitigation” is the fundamental for all levels of tsunami.

Comparatively Frequent Tsunami

- Aim to ensure protection of human lives, assets and national land (coastal line), etc against comparatively frequent tsunami (once every several tens of year to a hundred year and several tens of year) on the basis of constructing coastal protection facilities.
- Conduct technical development and improvement of structures so that they cannot be easily broken even when the tsunami height exceeds the design level.

Largest Scale Tsunami

- Aim to prevent as much human damages as possible against largest scale tsunami by “Integrated Prevention” combining structural and non-structural measures such as land use regulation, building code and emergency/evacuation procedures.

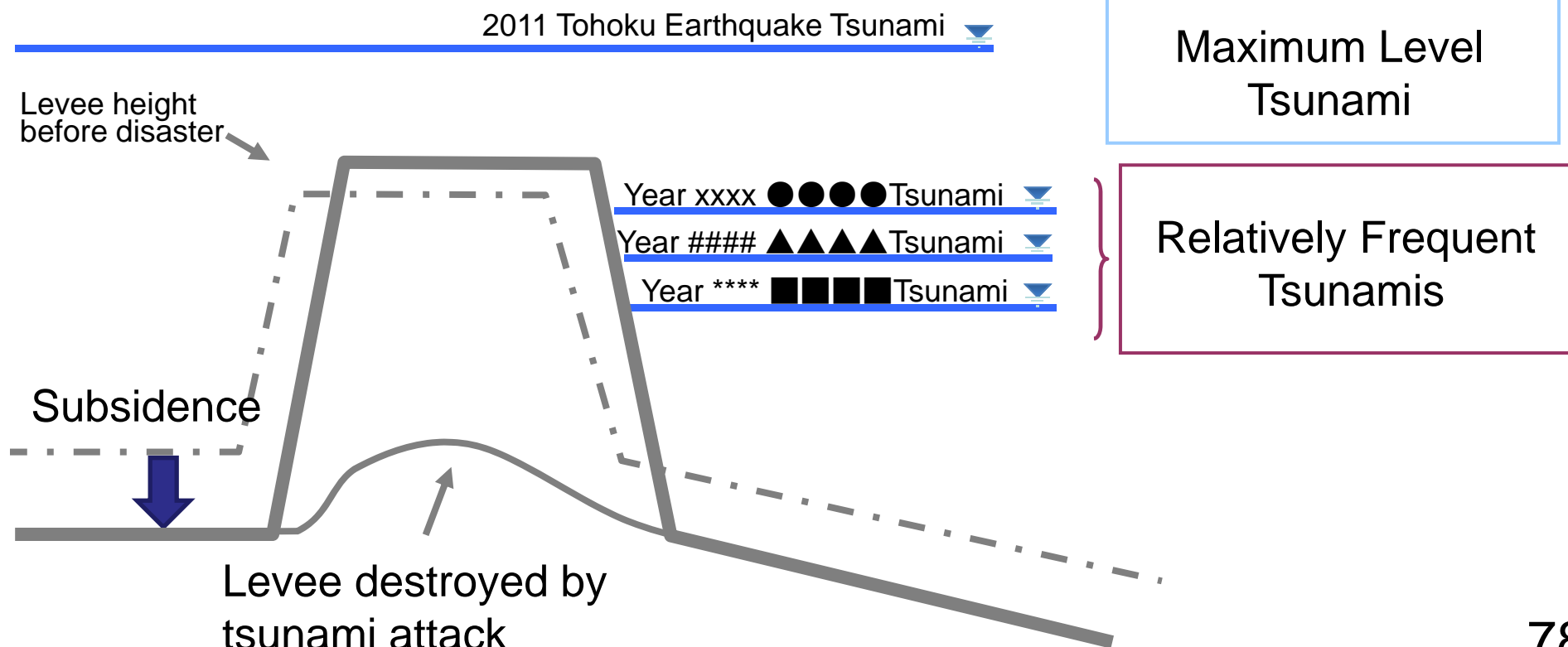
Determining the Height of Coastal Levees (1/2)

Determining Design Tsunami Level, the basis for Coastal Levee Height

For the series of coastlines and ports:

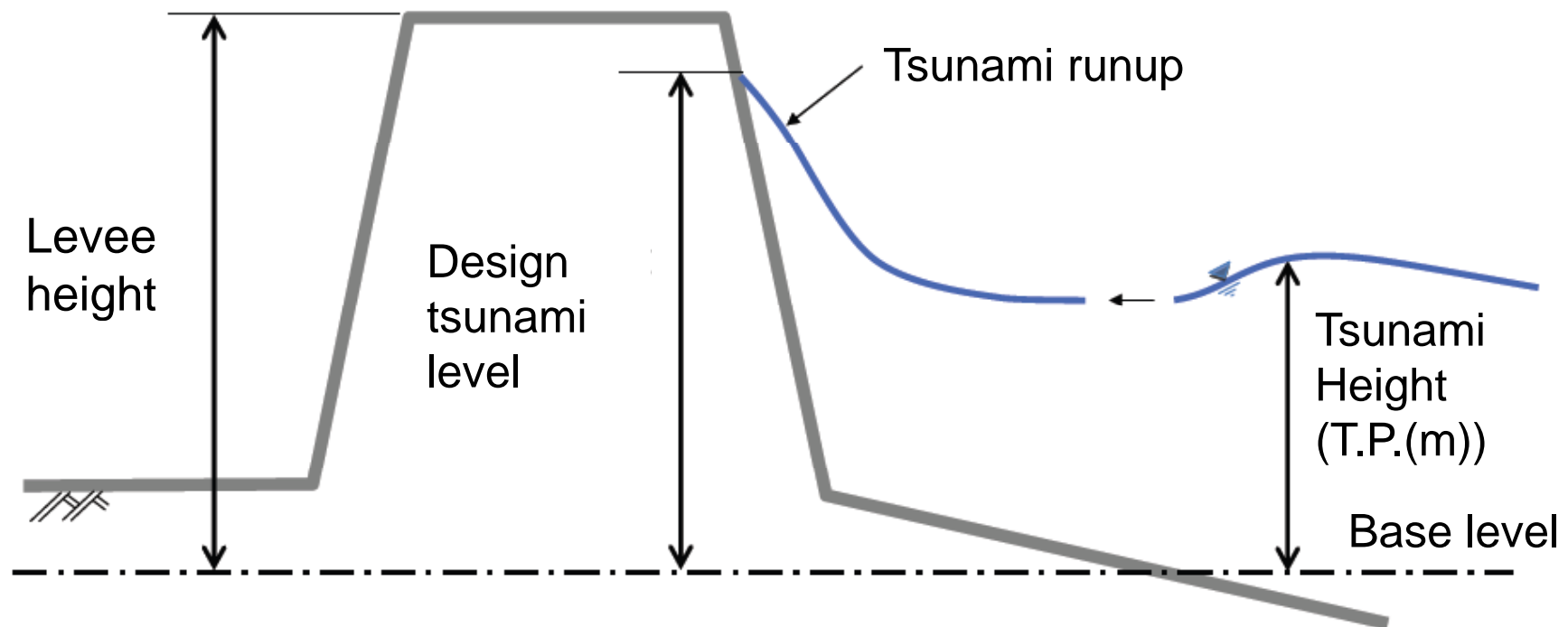
- Historical tsunami trace height records are investigated
- Conduct tsunami simulation for earthquakes with high probability of occurrence

➡ Design tsunami level is set by tsunamis occurring every several tens of years to a hundred and several tens of years



Determining the Height of Coastal Levees (2/2)

- Levee height is set by considering the environmental aspects, economic efficiency and manageability.



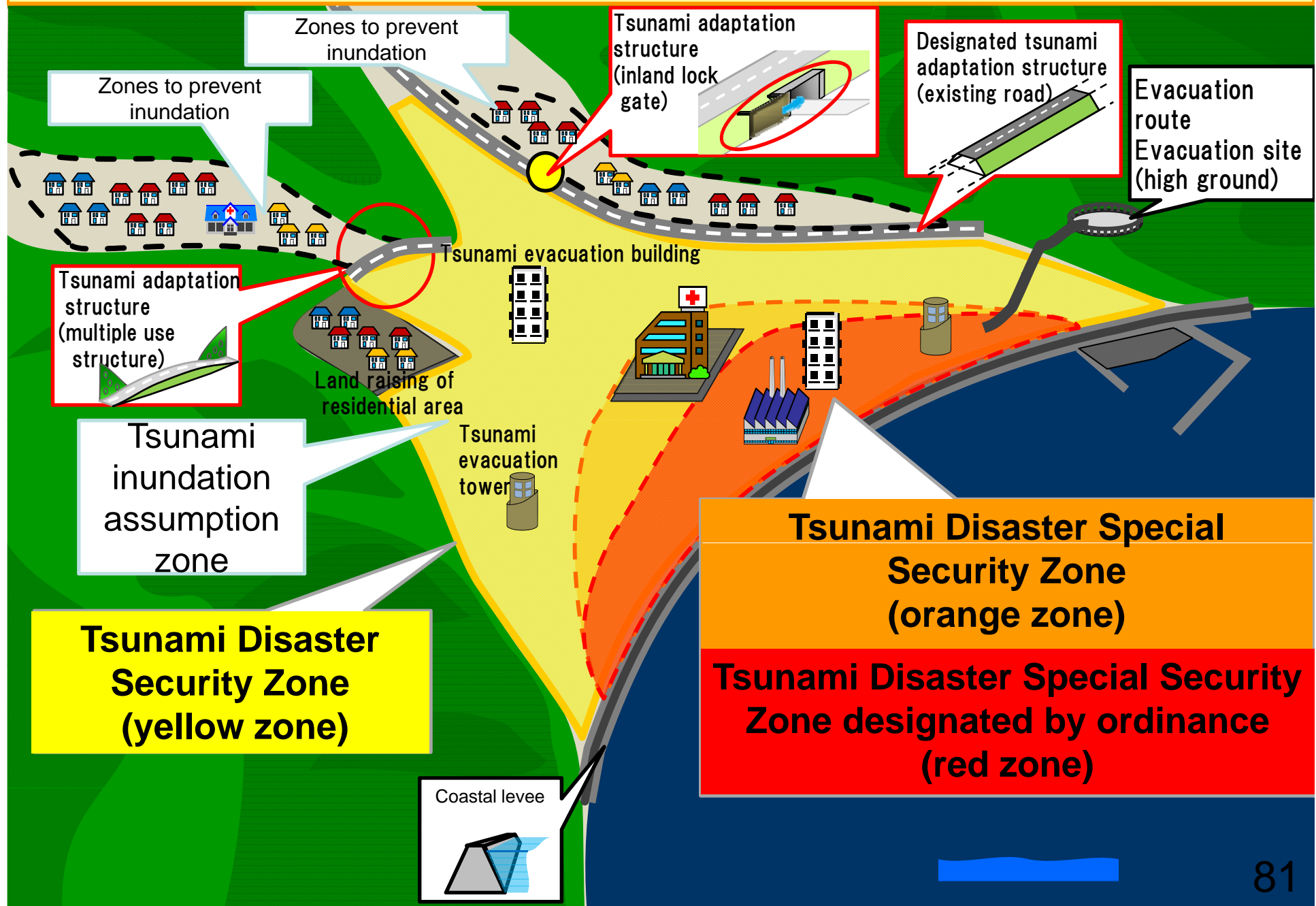
Preparedness for Largest Scale Tsunami (Tsunami-Resistant City)

Outline of the Act for Tsunami-Resilient City

○ In order to prevent/reduce tsunami disasters in the future, develop a standard institutional system to be utilized nationally and promote “tsunami resilient city” through “integrated prevention” incorporating structural and non-structural measures.

1. Basic Guidelines to be set by Minister for Land, Infrastructure, Transport and Tourism.
2. Tsunami Inundation Assumption to be set by Governors.
3. Promotion Plan (a plan to comprehensively promote tsunami resilient city) to be prepared by municipalities.
4. Development of tsunami adaptation structures
5. “Tsunami Disaster Security Zones” to be designated by Governors.
Prevent expansion of inundation
Escape from tsunami
(Yellow zone: development of preparedness and evacuation procedures)
6. “Tsunami Disaster Special Security Zones” to be designated by Governors.
Avoid tsunami
(Orange and Red zone: land use regulation)

Image of Tsunami-Resilient City



Yellow Zone (Tsunami Disaster Security Zone)

Zones where residents or others have possibilities of losing their lives or being injured by tsunamis.

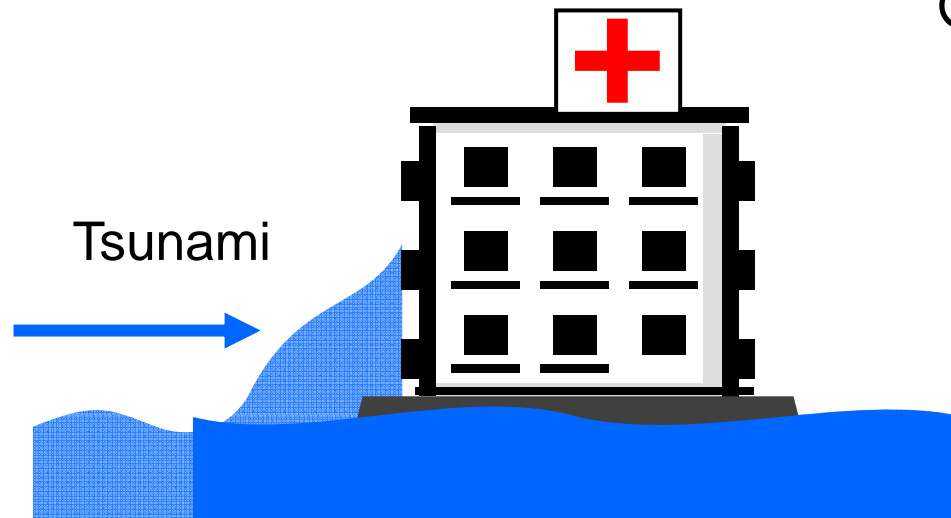
➡ Development of preparedness and evacuation procedures (Escape from tsunami)

- Inclusion of tsunami preparedness/evacuation procedures (evacuation facilities/routes, tsunami evacuation drills, information delivery, etc) in the local disaster management plans for municipalities
- Preparation of tsunami hazard maps by municipalities
- Designation of evacuation facilities and execution of management agreements (succession effective) by municipalities
- Preparation of evacuation plans or implementation of tsunami evacuation drills in underground facilities or facilities used by people who need assistance for evacuation

Orange Zone (Tsunami Disaster Special Security Zone)

Zones included in the Yellow Zone where residents or others have high possibilities of losing lives or being injured by tsunami.

➡ Land Use Regulations (Avoid Tsunami)



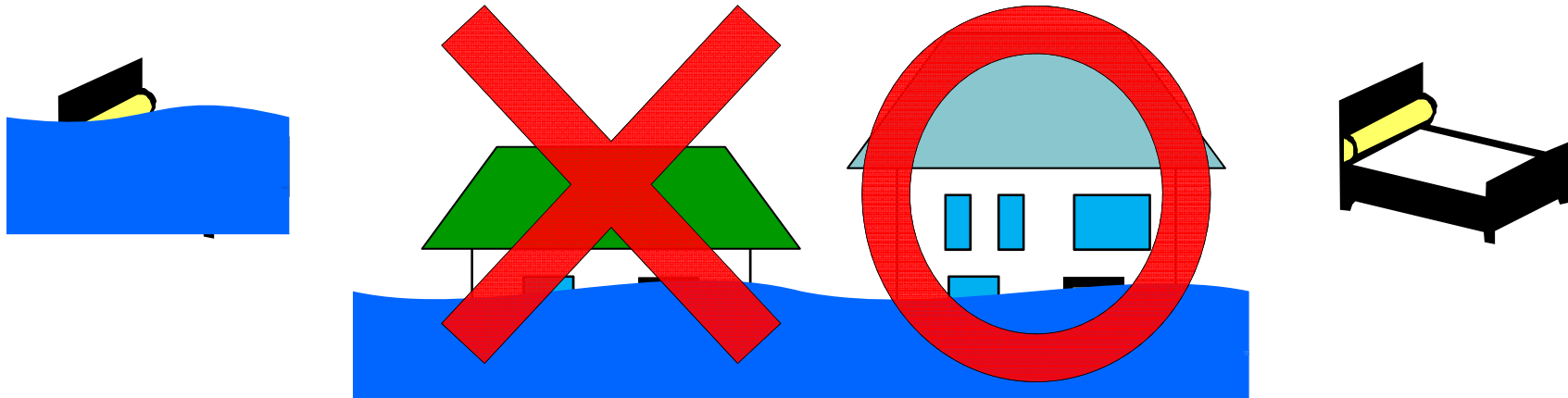
○ Hospitals and social welfare facilities

- Building or embankment structures to be safe against tsunamis
- Floor level of rooms to be above the tsunami water level

Red Zone (Tsunami Disaster Special Security Zone designated by ordinance)

Zones included in the Orange Zone where persons can not evacuate smoothly or promptly when tsunami occurs.

➡ Land Use Regulations (Avoid Tsunami)



○ Residential houses

- Building or embankment structures to be safe against tsunamis
- Floor level of rooms or rooftop where persons can evacuate to be above the tsunami water level

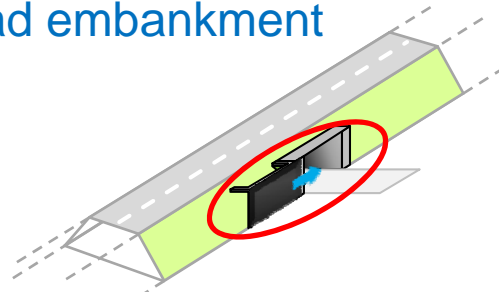
Development of Tsunami Adaptation Structures

(Prevent inundation expansion)

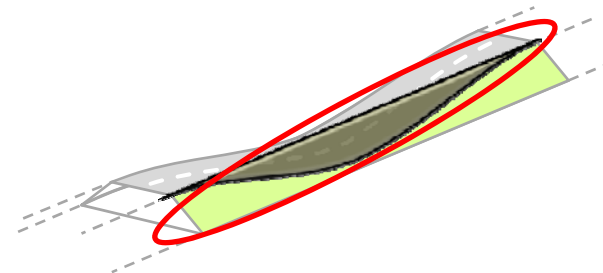
- Tsunami Adaptation Structures
Such structures as embankment structures, inland lock gates, protective walls or breast-walls built and managed by governors or mayors based on the tsunami inundation assumptions in order to prevent or mitigate human damages caused by tsunami disaster.

Schematics of Tsunami Adaptation Structure

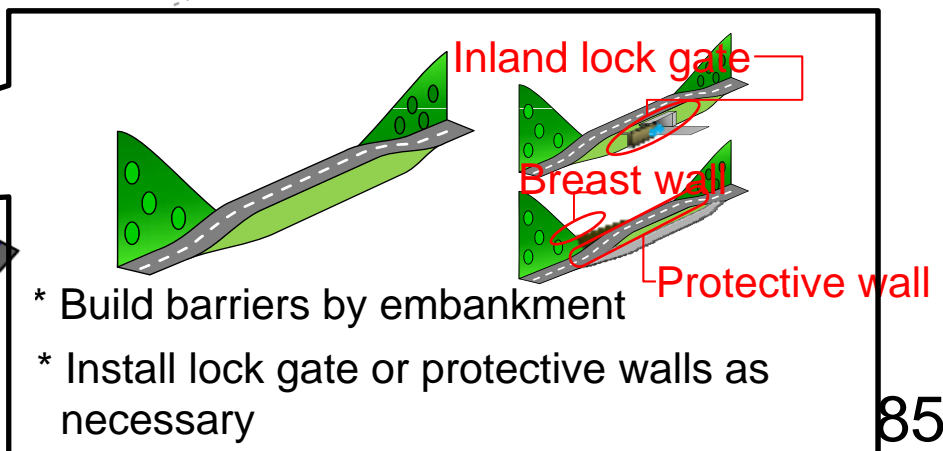
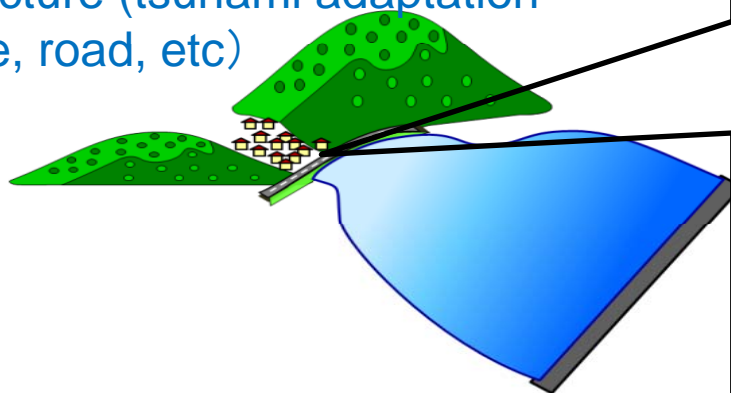
- Installation of inland lock gate to existing road embankment



- Installation of breast-wall to existing road embankment

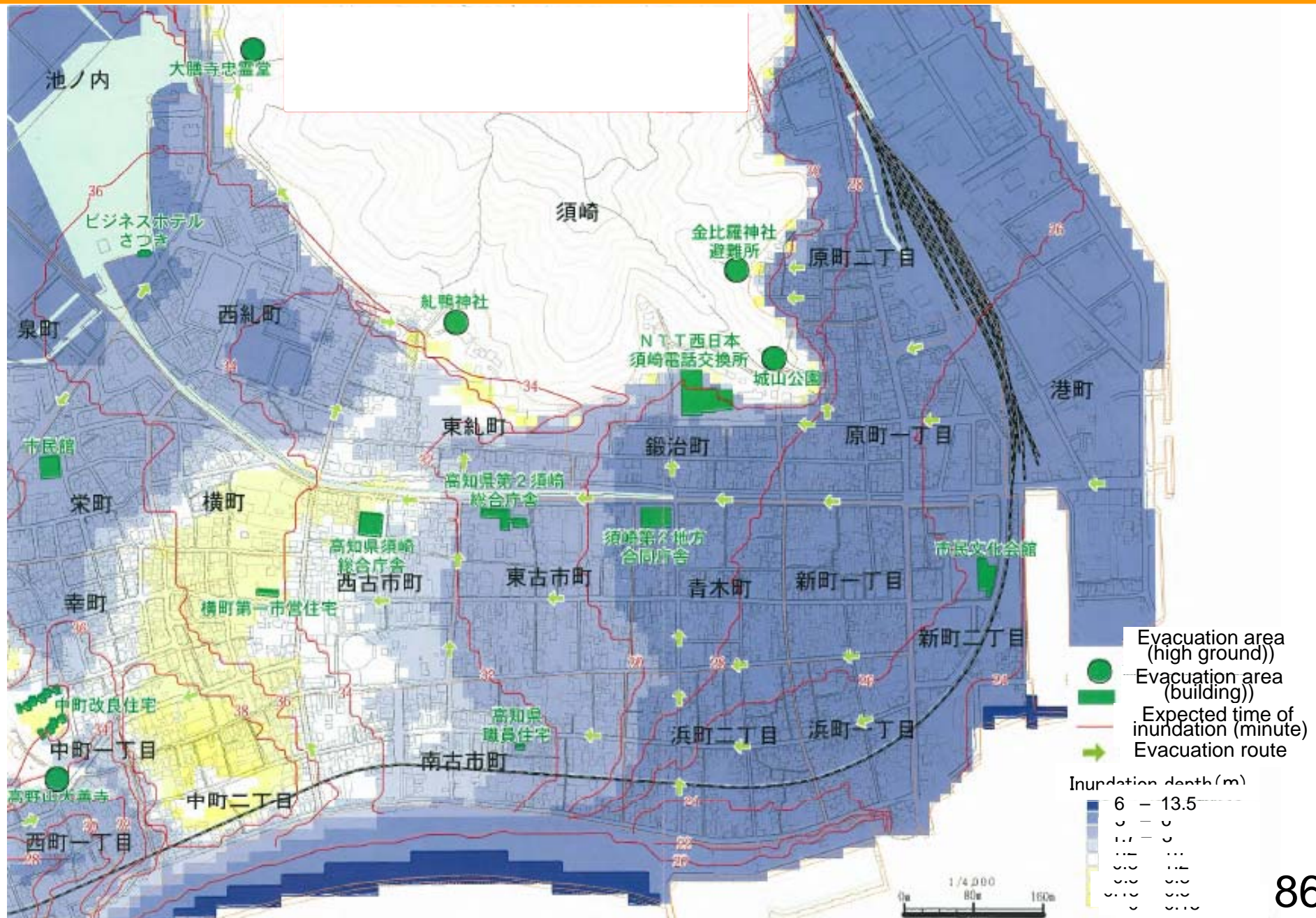


- Embankment structure as multiple-use infrastructure (tsunami adaptation structure, road, etc)



- * Build barriers by embankment
- * Install lock gate or protective walls as necessary

Making and publishing Hazard Map



Designating Tsunami Evacuation Building



Constructing Evacuation Route



Conducting Evacuation Drill

