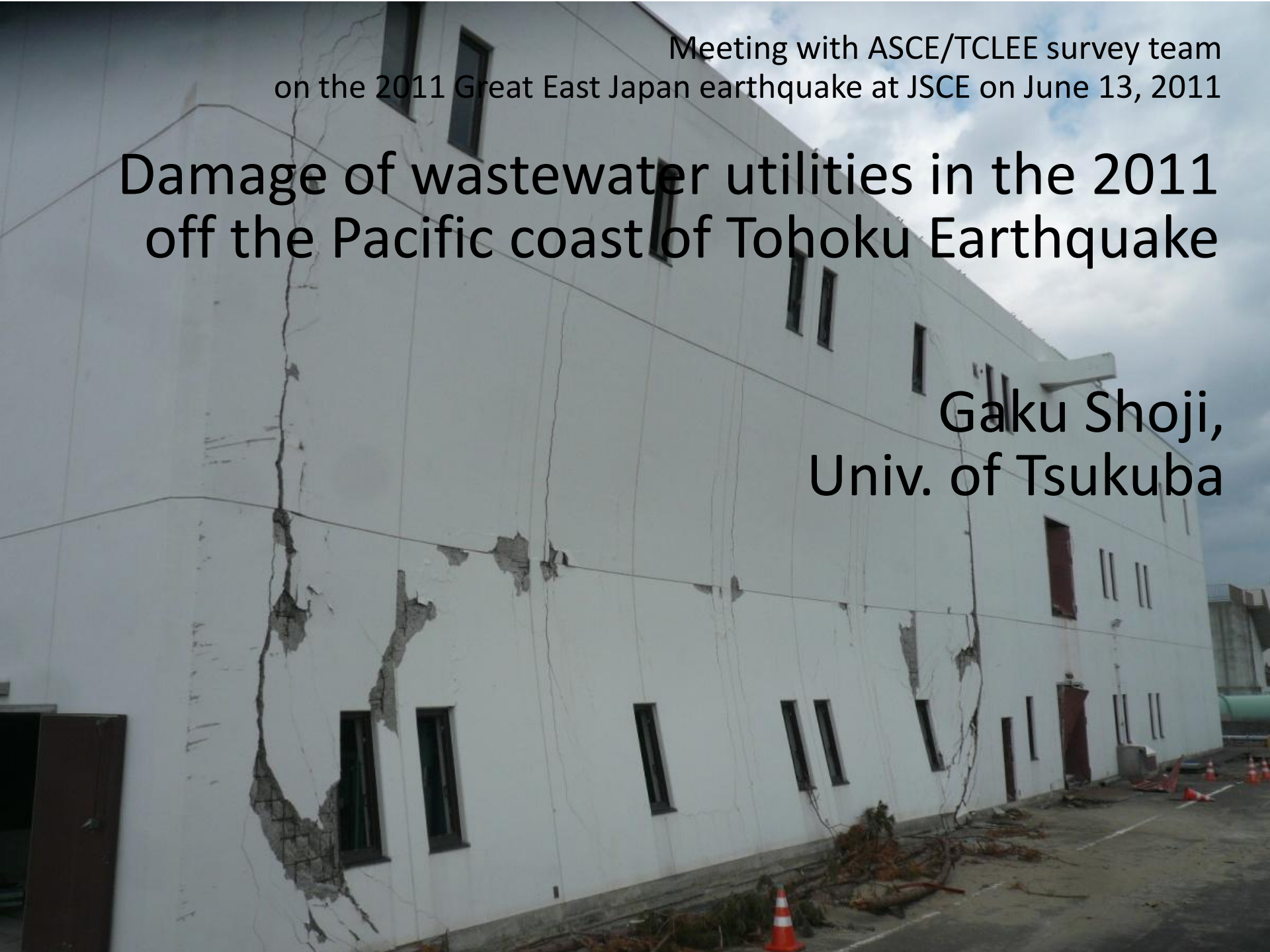


Meeting with ASCE/TCLEE survey team
on the 2011 Great East Japan earthquake at JSCE on June 13, 2011

Damage of wastewater utilities in the 2011 off the Pacific coast of Tohoku Earthquake

Gaku Shoji,
Univ. of Tsukuba



Damage of treatment facilities and pump facilities

138° 00"E 139° 00"E 140° 00"E 141° 00"E 142° 00"E 143° 00"E

▣ Treatment facilities

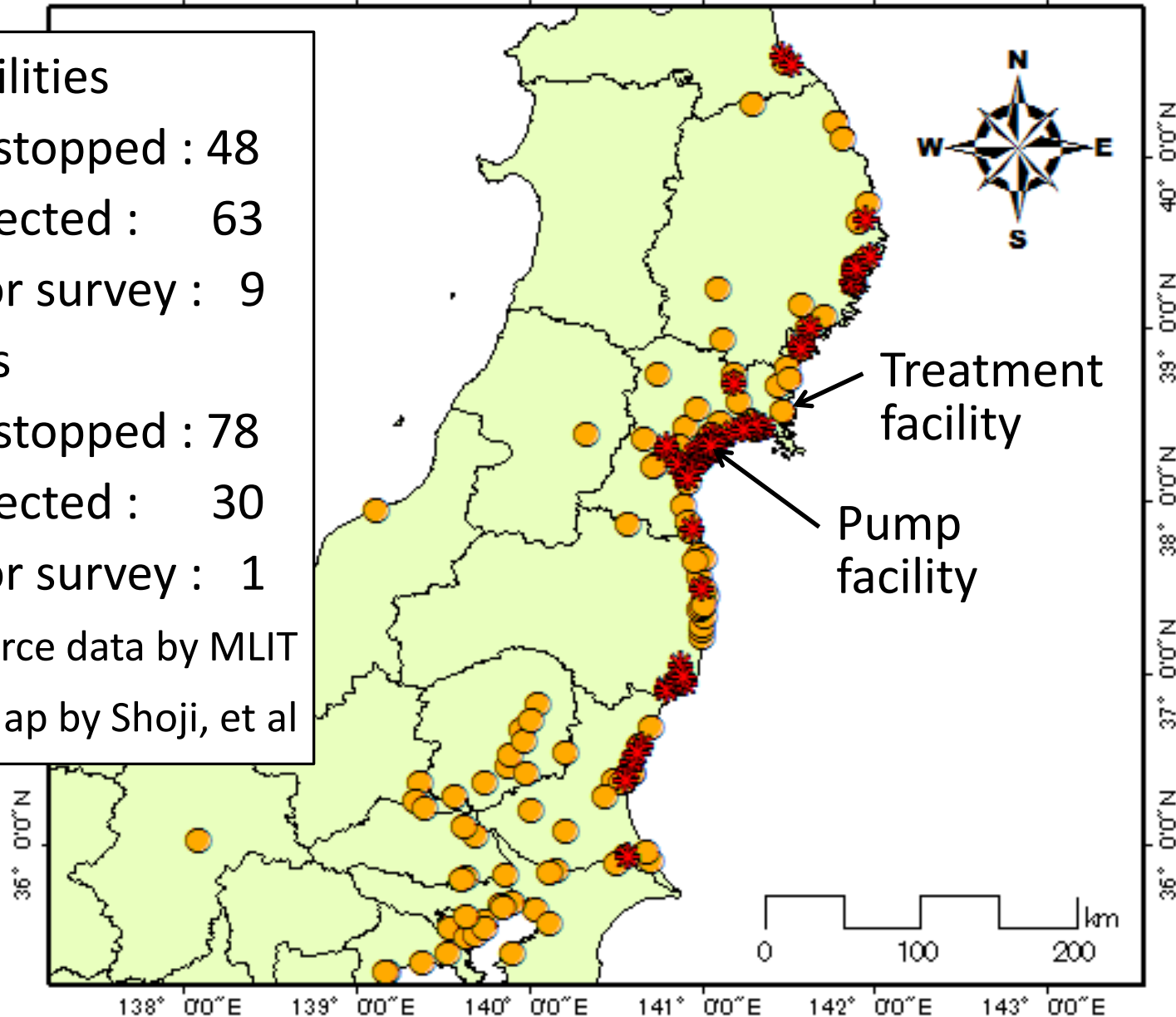
- Functionally stopped : 48
- Physically affected : 63
- Impossible for survey : 9

▣ Pump facilities

- Functionally stopped : 78
- Physically affected : 30
- Impossible for survey : 1

Source data by MLIT

Map by Shoji, et al



Damage of sewer pipes and manholes

138° 00"E 139° 00"E 140° 00"E 141° 00"E 142° 00"E 143° 00"E

▣ Iwate pref

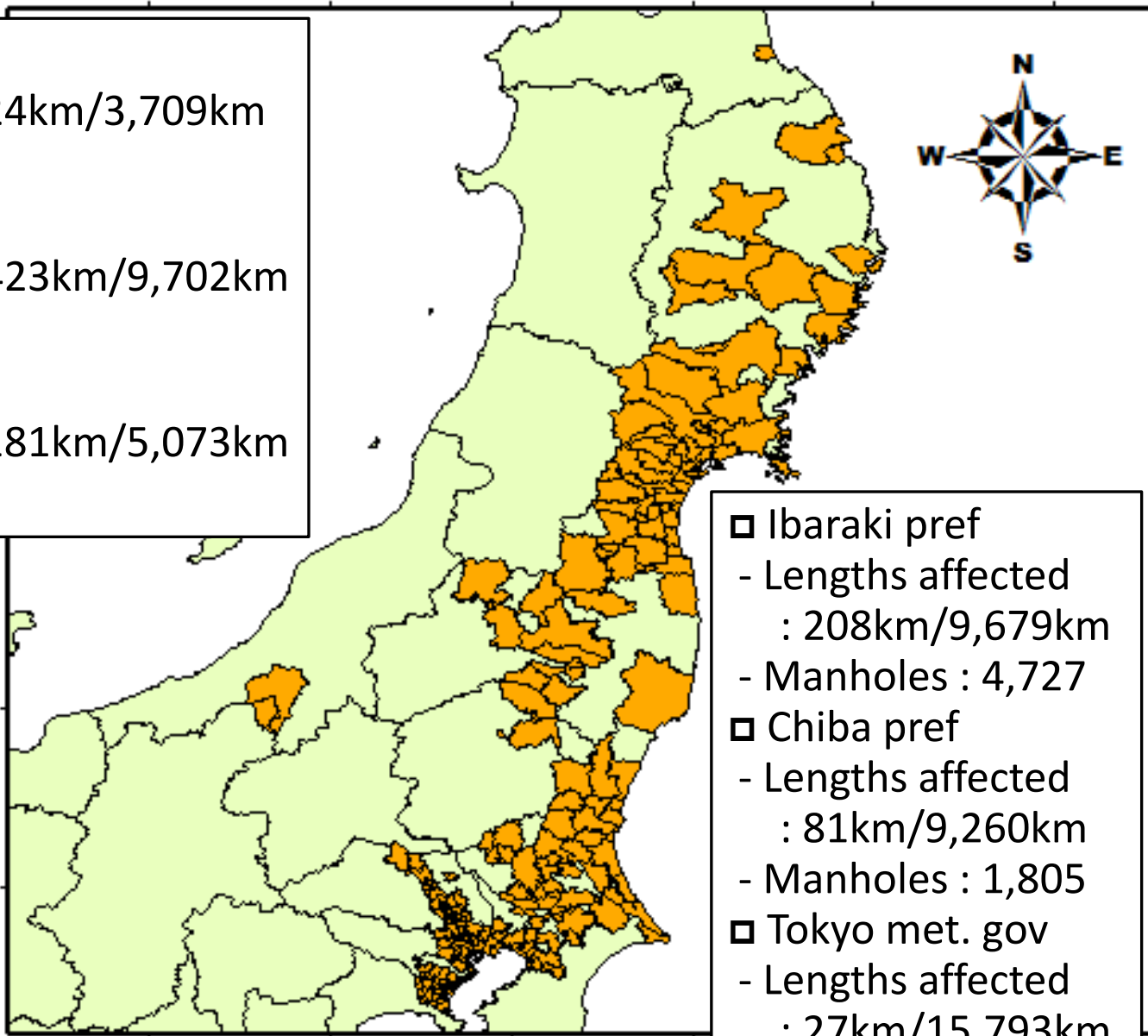
- Lengths affected : 24km/3,709km
- Manholes : 248

▣ Miyagi pref

- Lengths affected : 423km/9,702km
- Manholes : 11,076

▣ Fukushima pref

- Lengths affected : 181km/5,073km
- Manholes : 3,397



▣ Ibaraki pref

- Lengths affected : 208km/9,679km
- Manholes : 4,727

▣ Chiba pref

- Lengths affected : 81km/9,260km
- Manholes : 1,805

▣ Tokyo met. gov

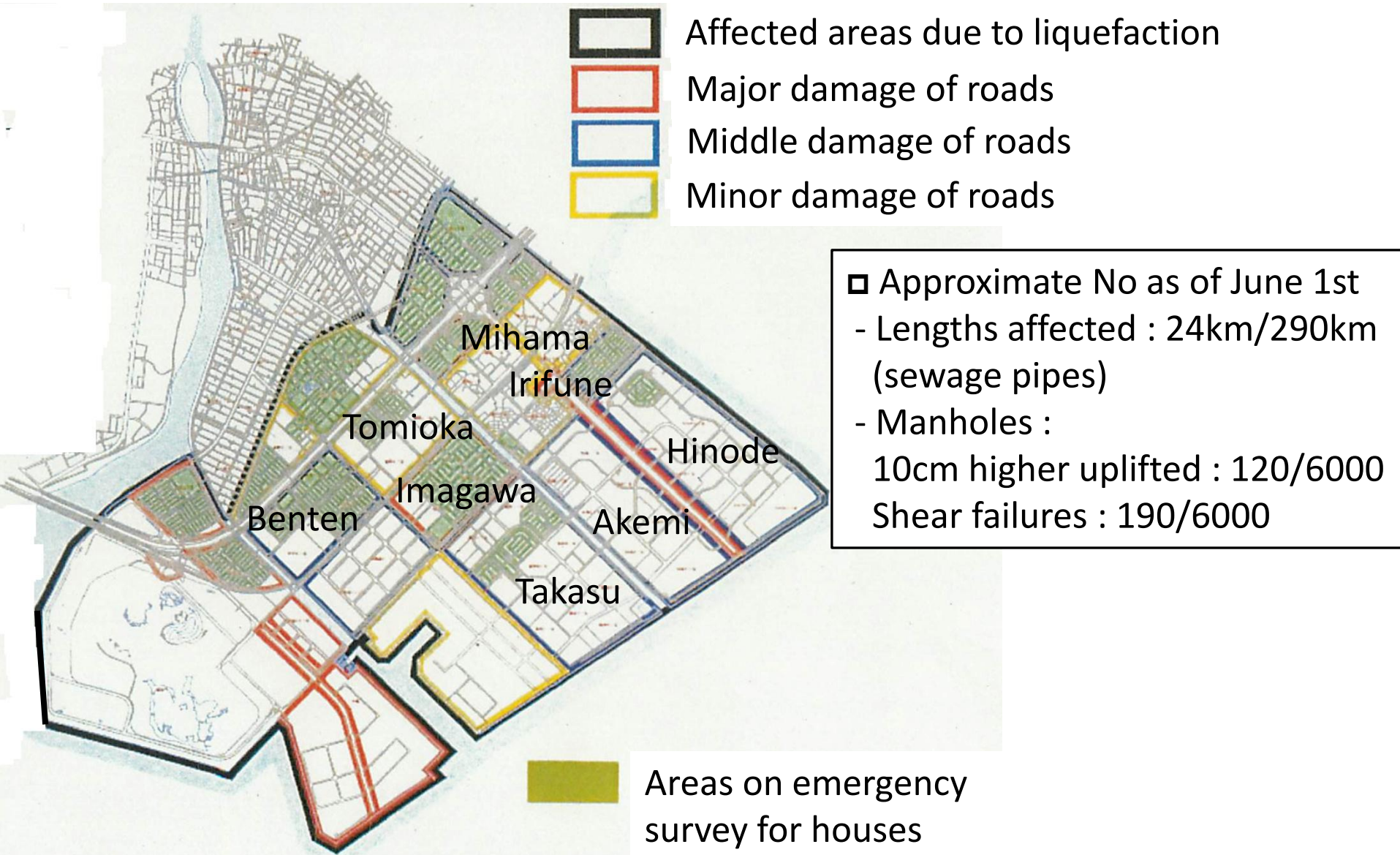
- Lengths affected : 27km/15,793km
- Manholes : 212

38° 0'0"N
37° 0'0"N
36° 0'0"N

40° 0'0"N
39° 0'0"N
38° 0'0"N
37° 0'0"N
36° 0'0"N

138° 00"E 139° 00"E 140° 00"E 141° 00"

Damage due to seismic excitations and induced liquefaction - courtesy of Urayasu city



Damage and early restoration of sewage pipes at Urayasu city



Benten



Imagawa



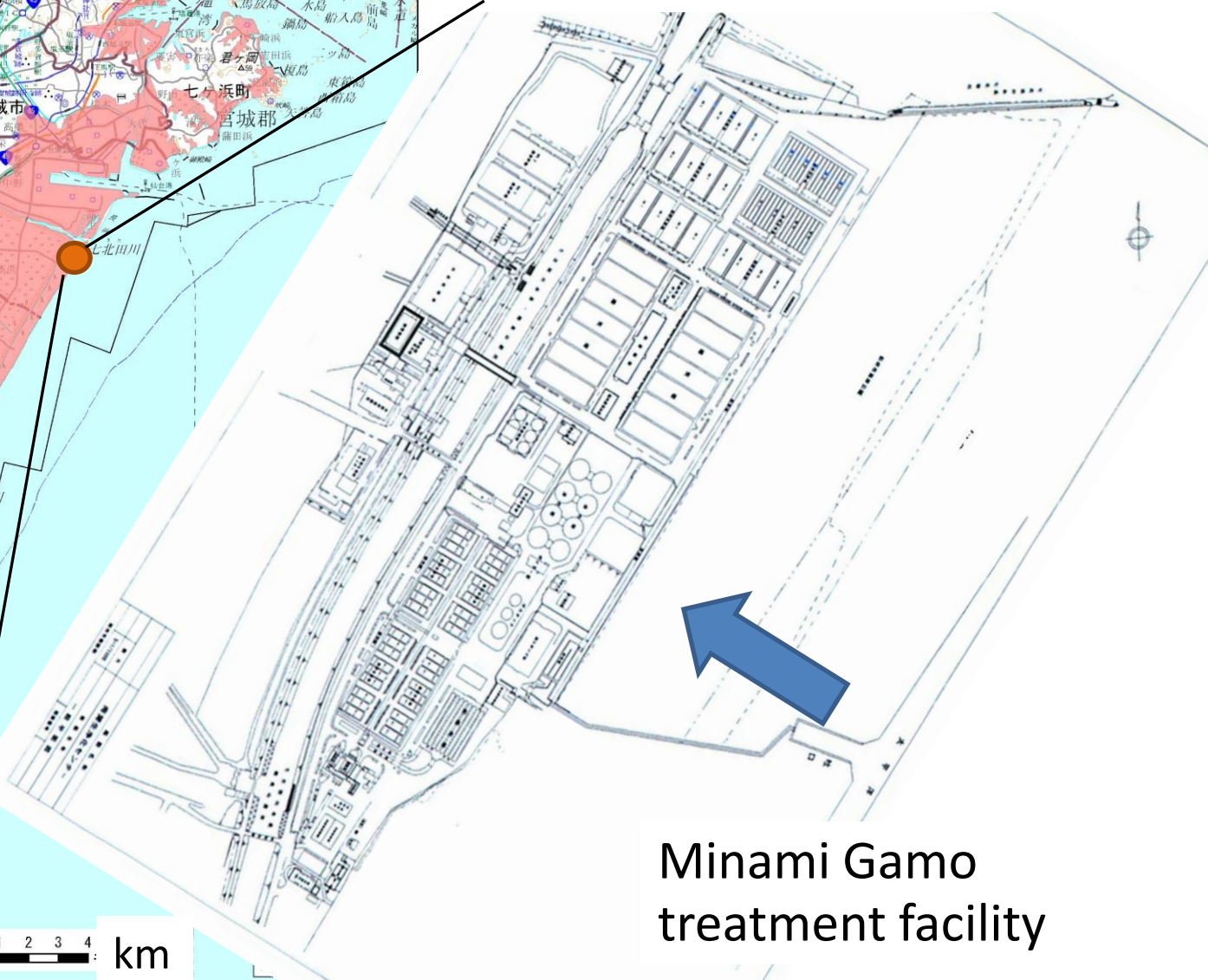
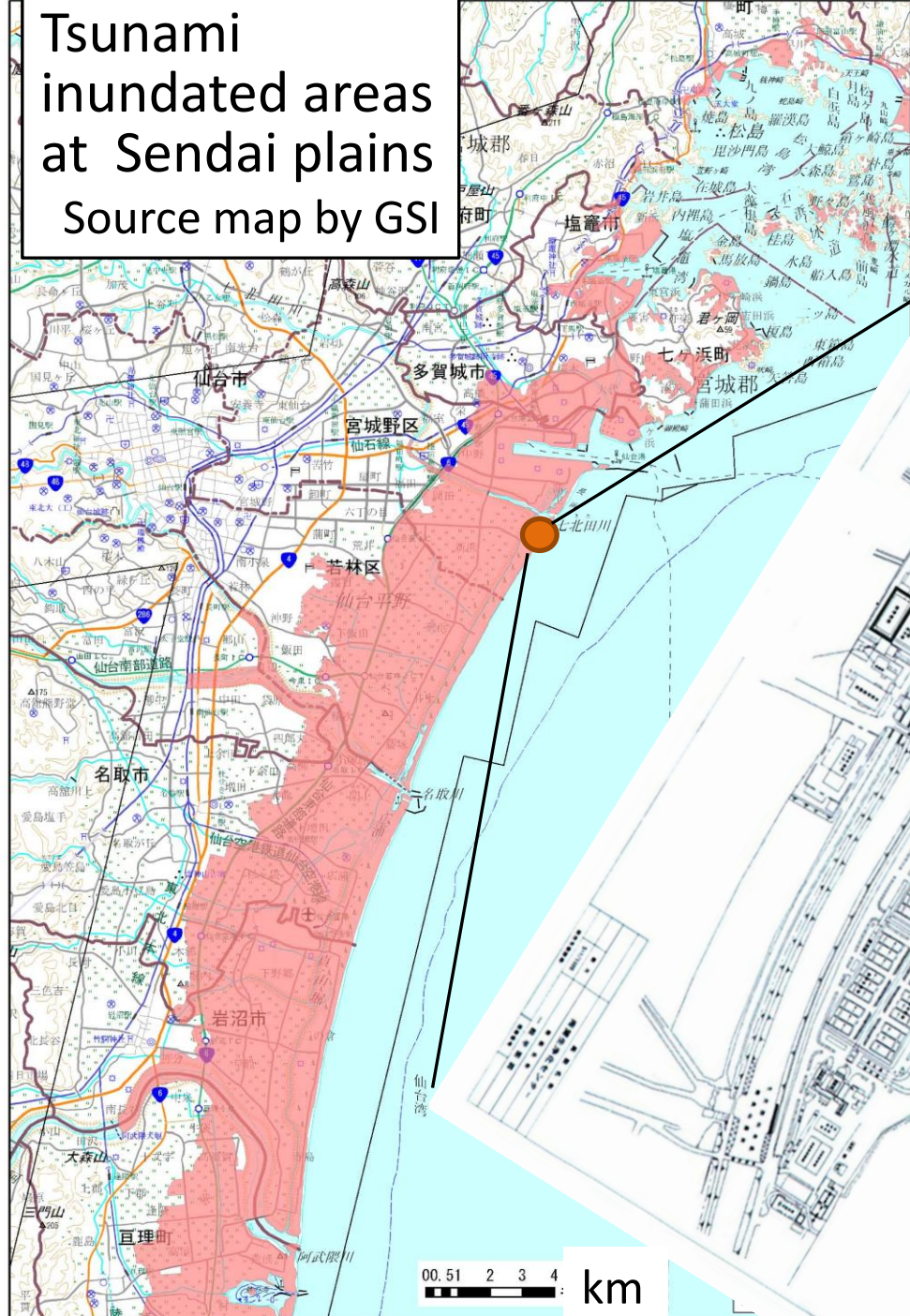
Tomioka



Emergency restoration

Tsunami inundated areas at Sendai plains
Source map by GSI

Damage due to tsunami wave loads
- at Sendai city



Minami Gamo treatment facility

Physical damage of No.3 pump house due to tsunami wave loads at Minami Gamo treatment facility

- ▣ Structural failure modes by inundation depth of about 8m to 9m
 - Deformation of 1m or more in out-of-plane at the RC wall



Physical damage in the No.3 pump house by 8m to 9m inundation from the ground level at Minami Gamo treatment facility

- Physical and functional failure modes of mechanical systems

1st floor



2nd floor



Summary

- ▣ Damage induced by ground shakings and liquefaction
- ▣ Damage induced by tsunami wave loads

The framework on seismic and tsunami resistant management for wastewater utilities should be rebuilt.

e.g. Special committee at MLIT (Chair: Prof. Hamada)