NPP SITING IN WESTERN PART OF JAVA ISLAND INDONESIA: REGIONAL ANALYSIS STAGE

A. Sarwiyana Sastratenaya
Yuliastuti

Presented at
OECD NEA
CNRA International Workshop on
"New Reactor Siting, Licensing and Construction Experience"
September 14-17, 2010 , Prague, Czech Republic

NATIONAL NUCLEAR ENERGY AGENCY OF INDONESIA (BATAN)

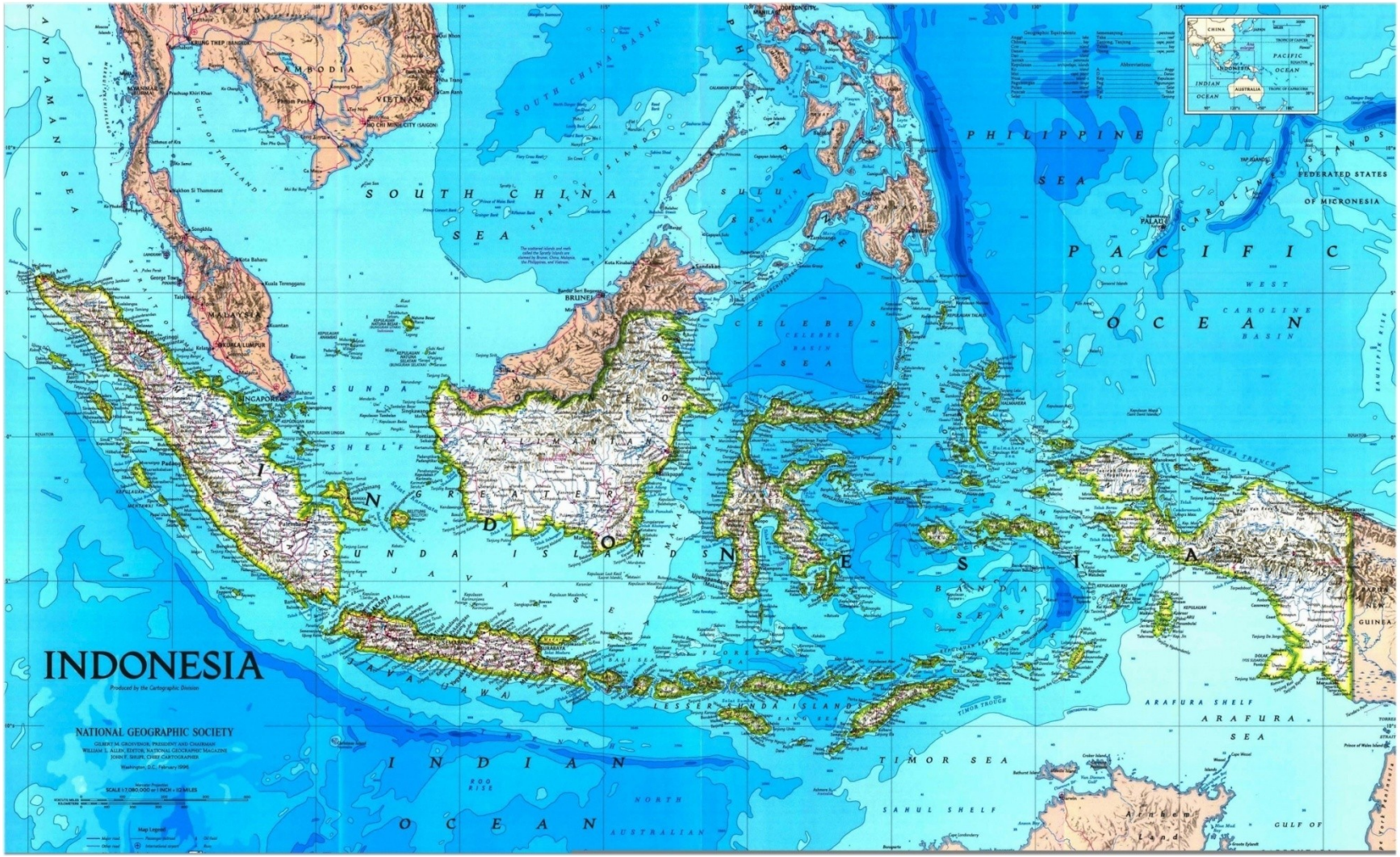
Content

1. General Information of Indonesia
2. Site Selection Process
3. Regional Analysis
    A. Coverage area
    B. Methodology
    C. Topical & Integrated Regional Analysis
4. Summary & Recommendation

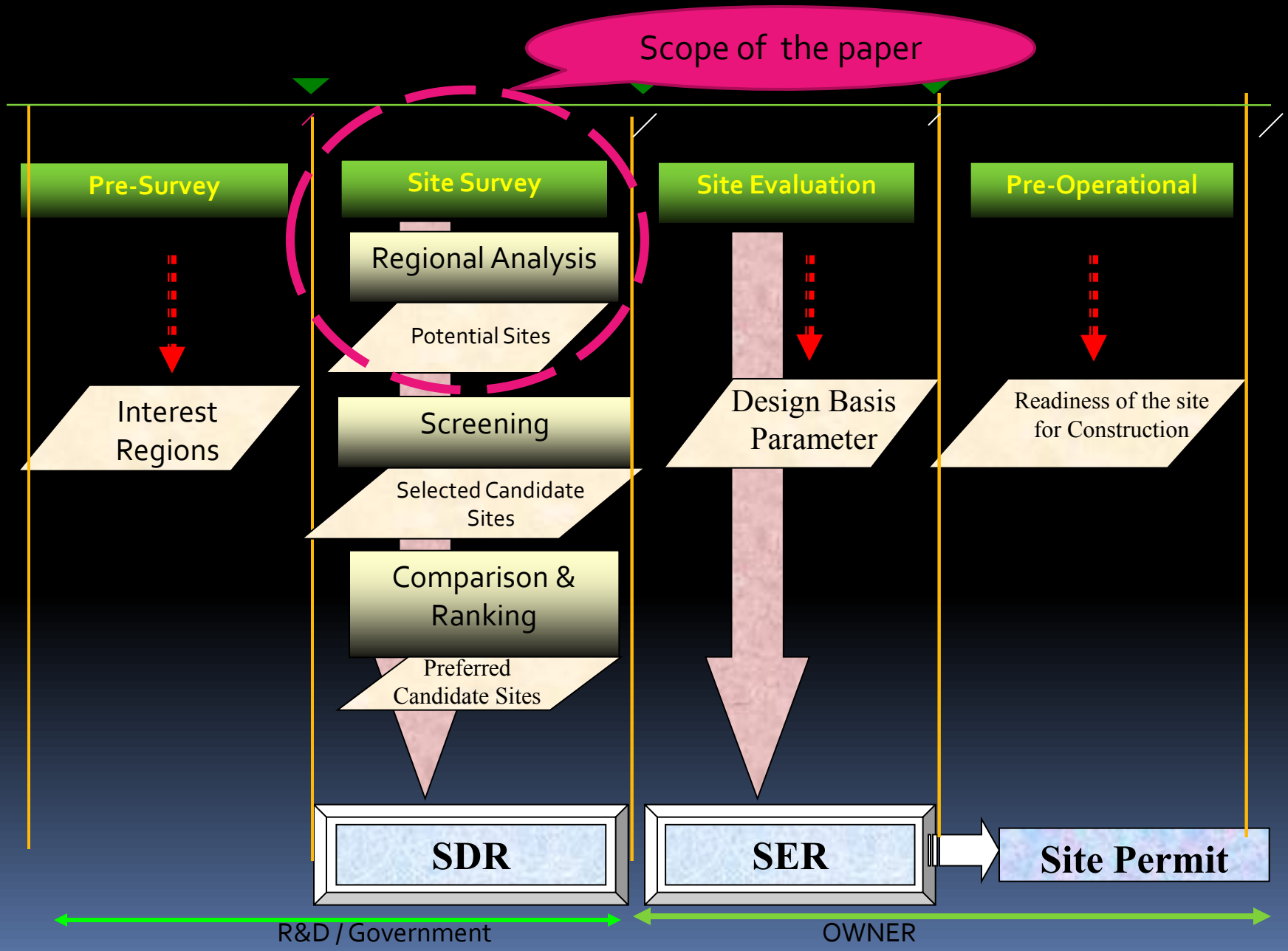
1. GENERAL INFORMATION

- An archipelago with 17,508 islands
- 1.9 million square miles total
- Fourth most populous country in the world, 223 million people (2006), 1.49% growth rate
- 59% of population reside in Java, in a 7% total area
- 400 volcanoes, 100 active, 112 in Java island
- Air temperature : 27.6° to 36.8° C (day) and 14.6° to 24.6° C (night)
- Humidity: 63% to 83%

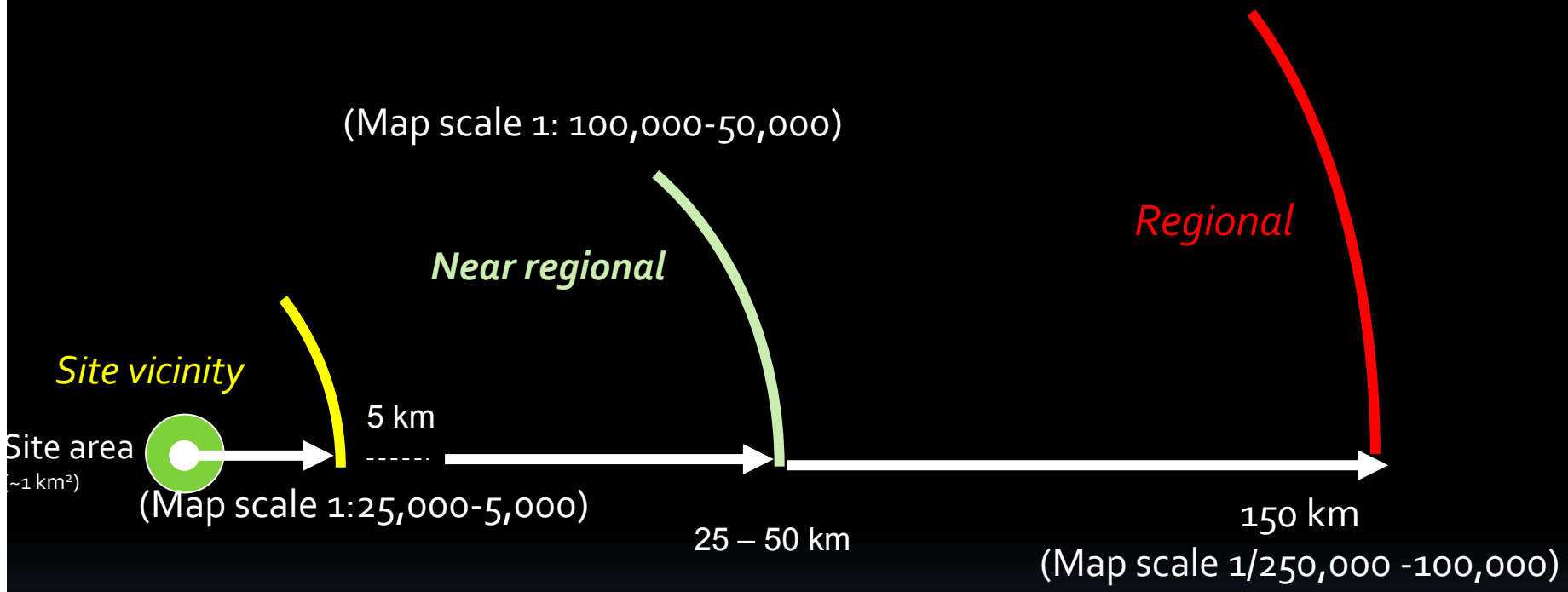
Map of Indonesia



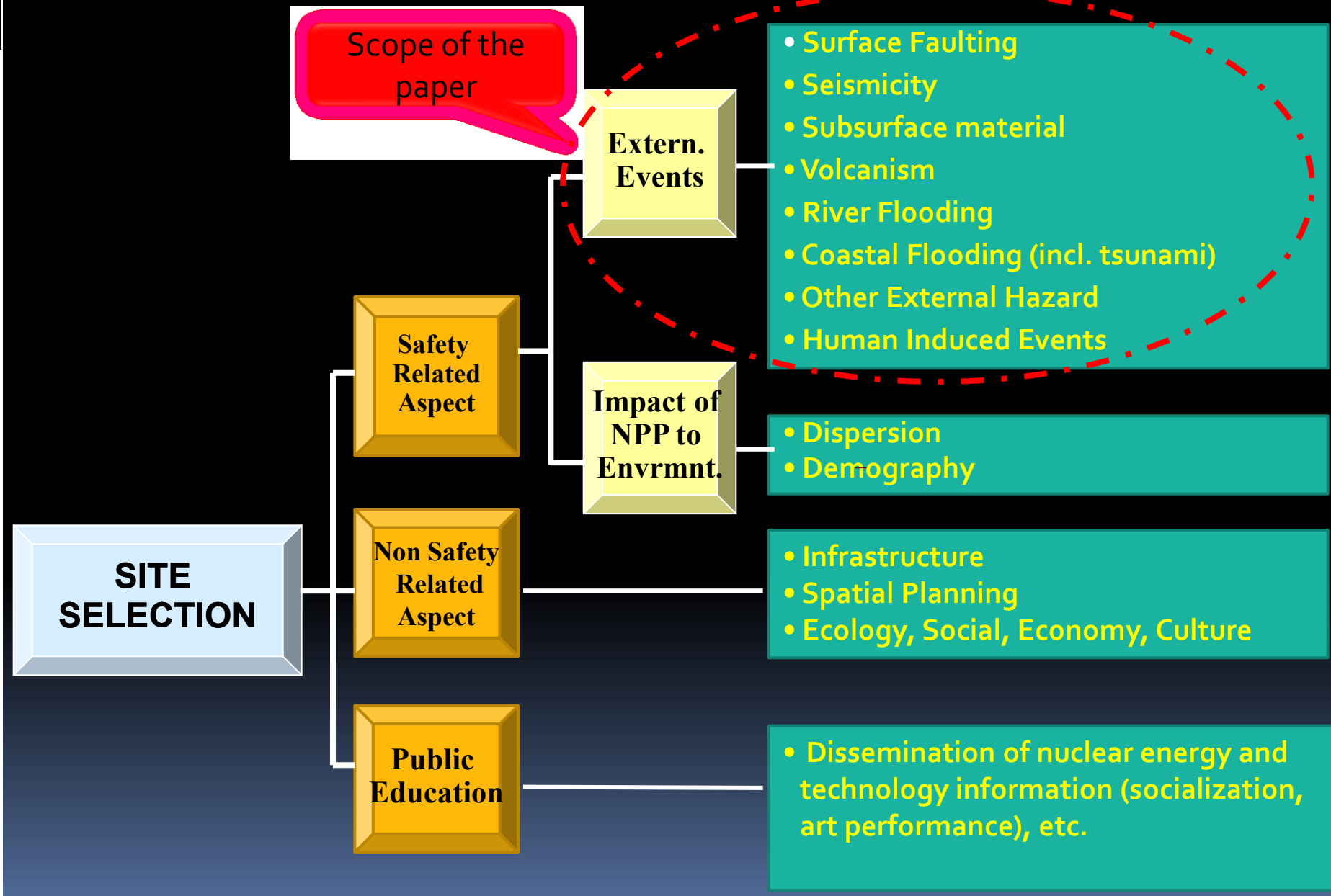
2. SITE SELECTION PROCESS



Coverage Area on Site Selection Process

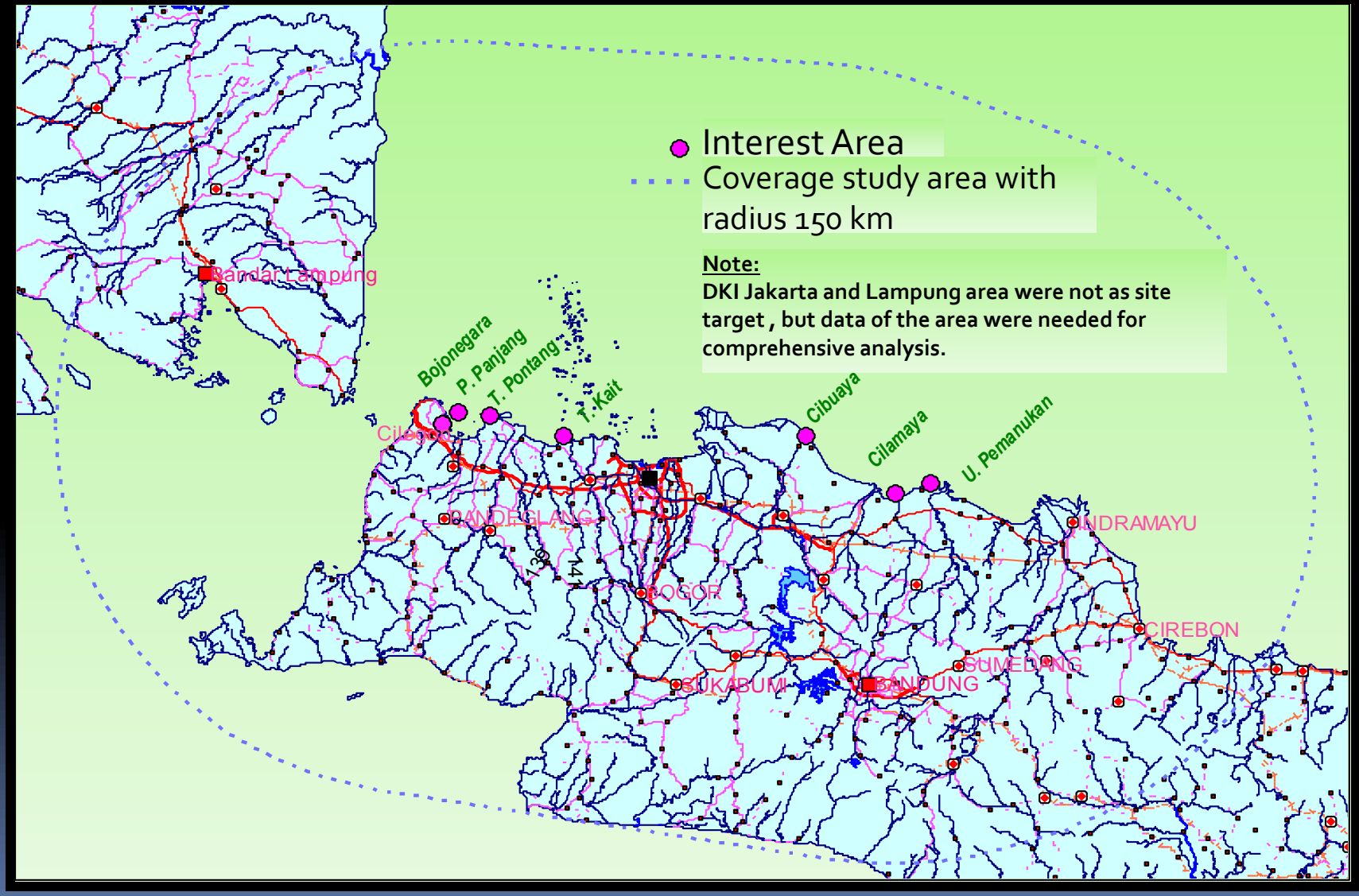


Aspect of Study

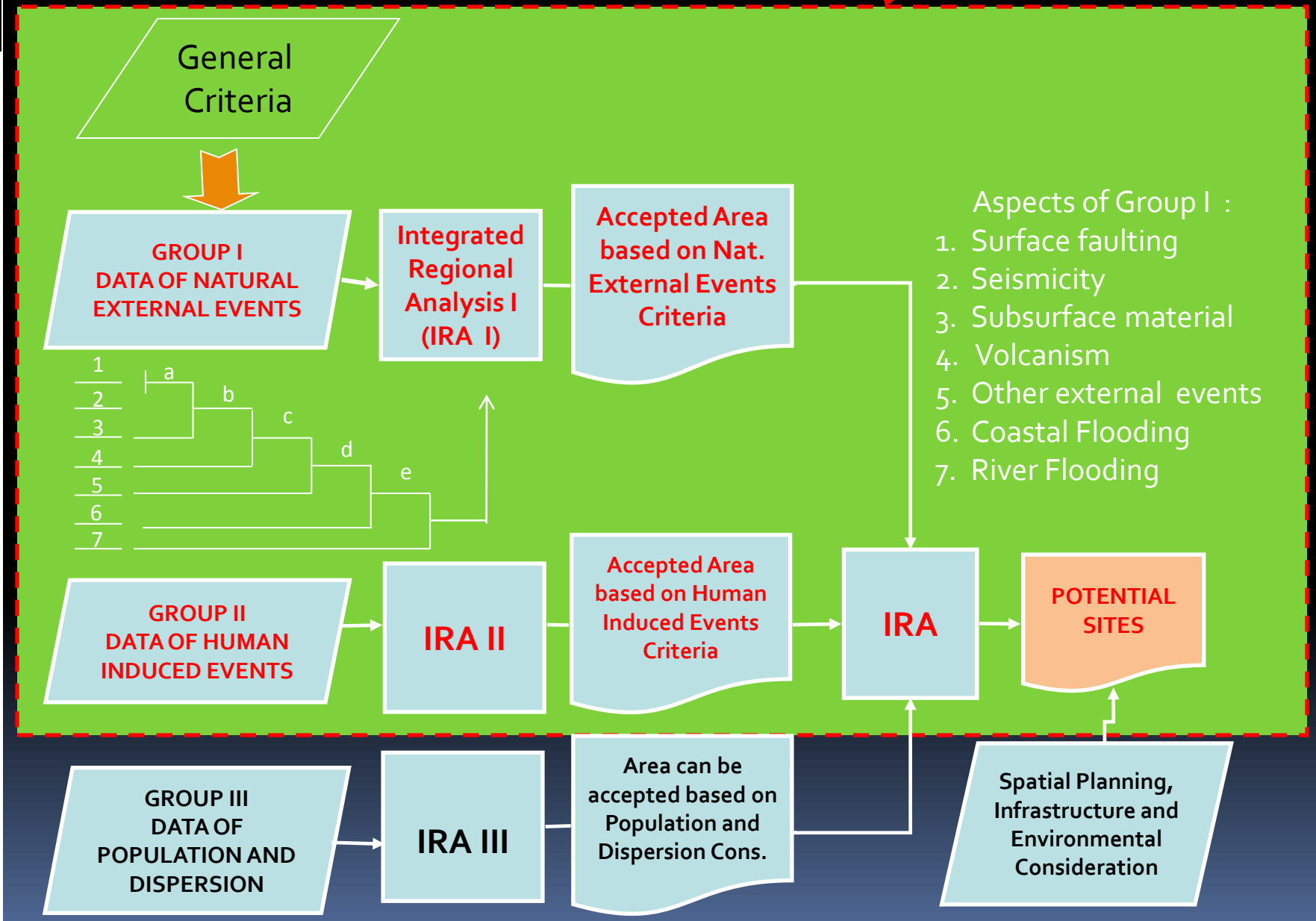


3. REGIONAL ANALYSIS

A. Coverage Area



B. Methodology



C. Topical & Integrated Regional Analysis

a. Natural External Events

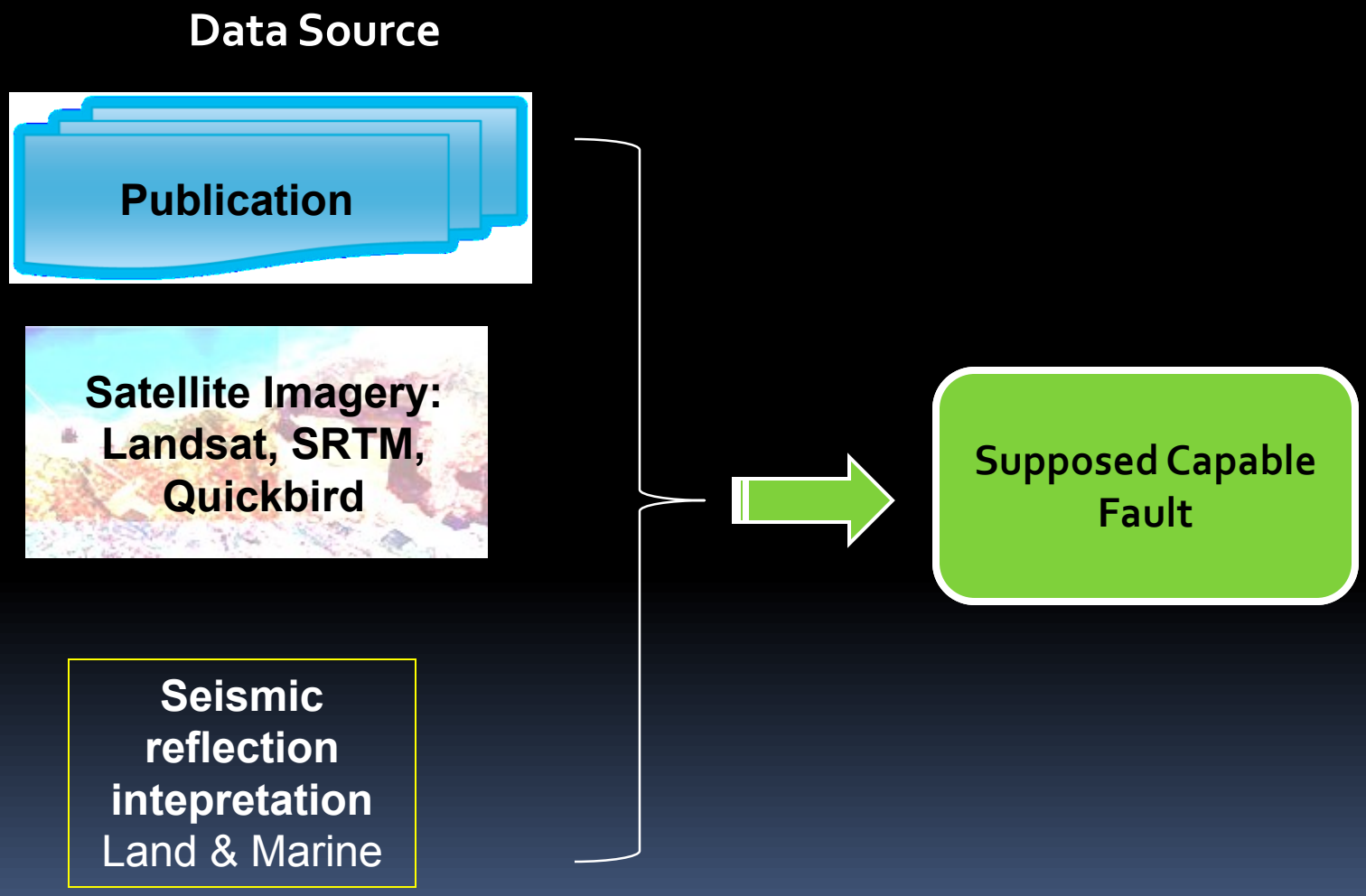
1) Surface Faulting

- ❖ Acceptance criteria:
  - Distance of active fault (considered as supposed capable fault) to potential site should be ≥ 5 km
  - Capable faults is not toward to the site

Note :

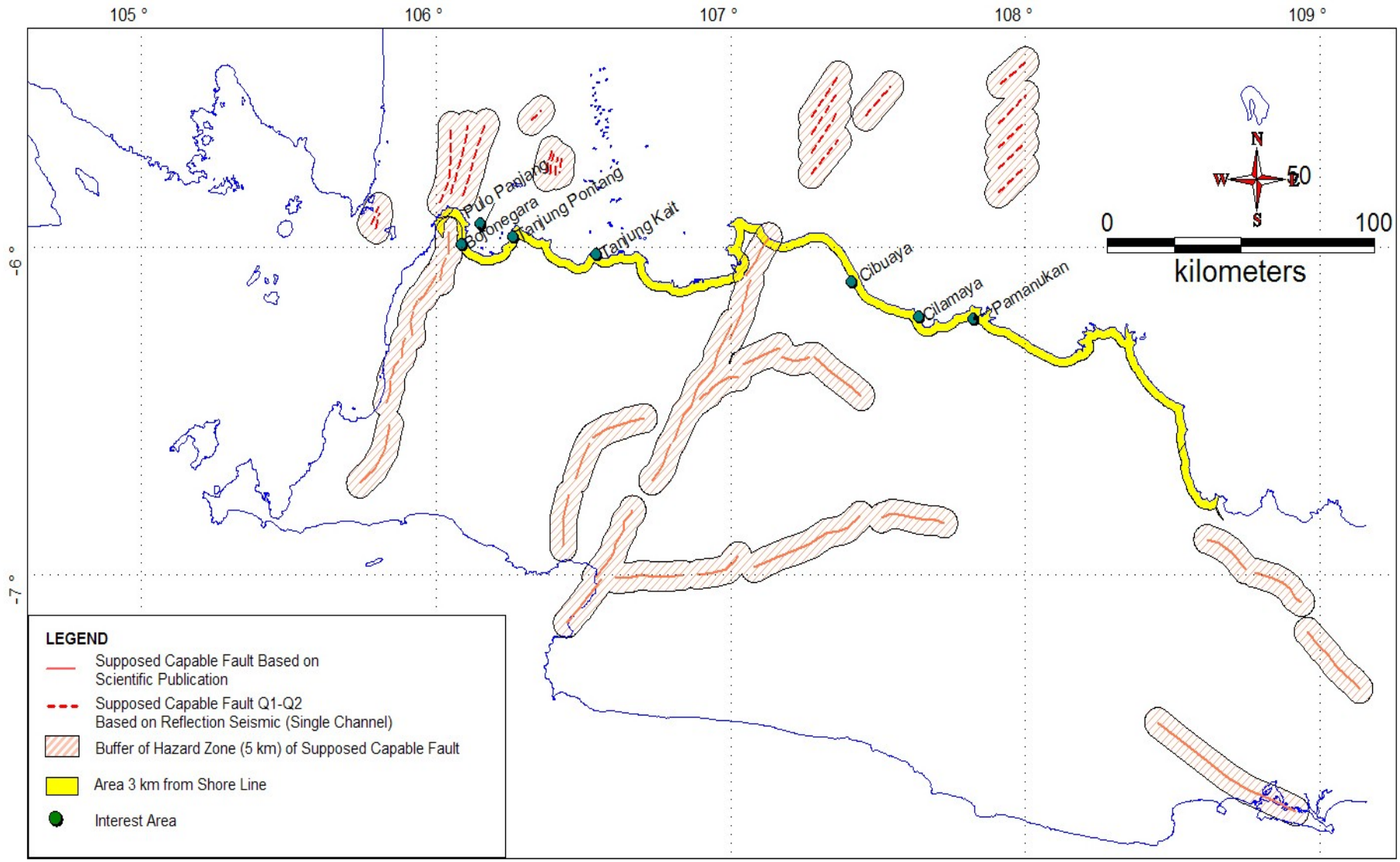
Fault is considered to be capable if younger than 120,000 years old or younger than Middle Pleistocene.

❖ Identification of Supposed Capable Fault



SRTM : Satellite Radar Terrain Map

Supposed Capable Faults Hazard Zone

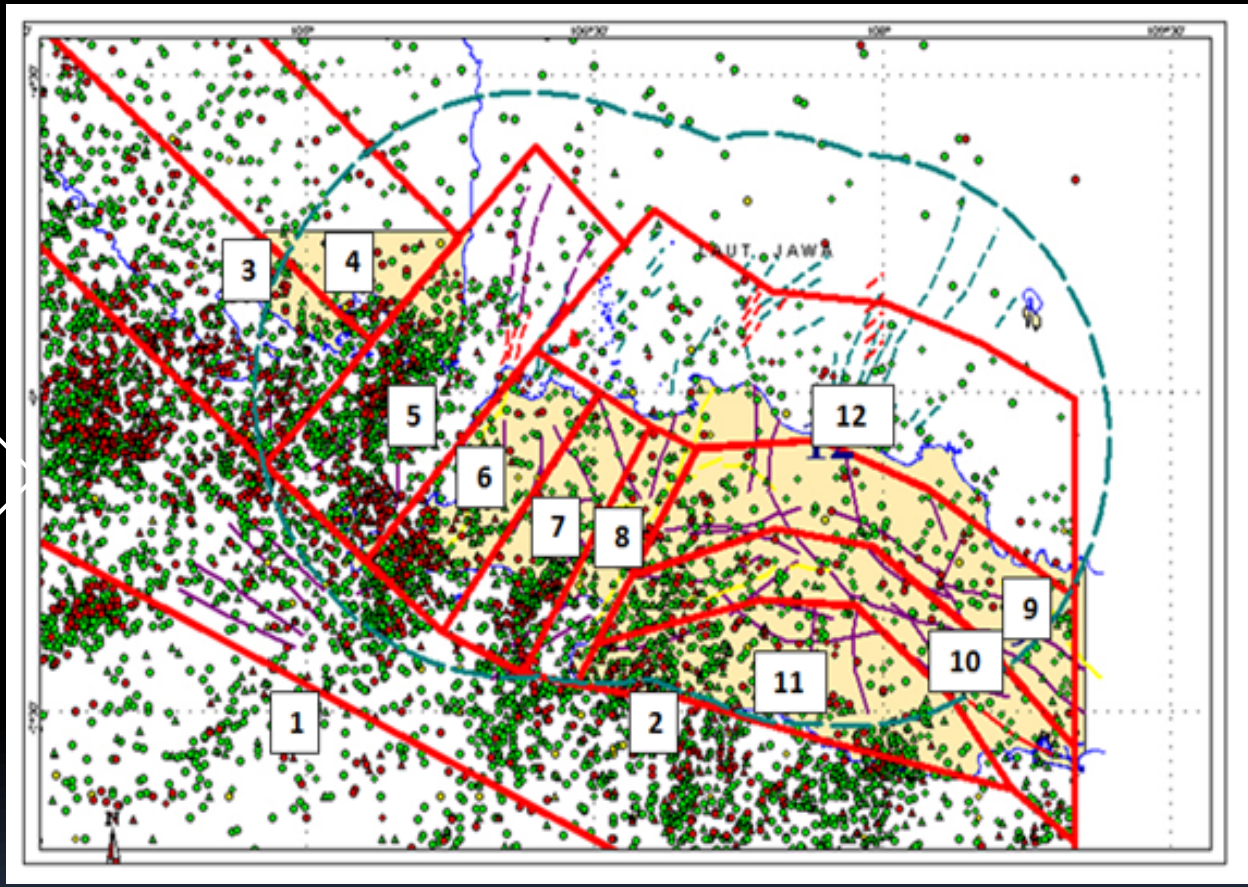


2) Seismicity

- Acceptance criterion:
  - Peak Ground Acceleration (PGA) is defined to be ≤ 0.4 g, in order to minimize the NPP construction cost
- The data used in the seismicity analysis are obtained from the earthquake catalog data in Indonesia. The data has been tabulated by the Incorporated Research Institute for Seismology (IRIS) since 1964 to 2008 from various sources, such as the USGS / NEIC, ISC, Harvard, and other databases. Other data obtained from the Novosibirsk Tsunami Laboratory of the year 1770 to 2001, and from the damage earthquake catalog of Geology Board from 1833 to 2006, and the calculated data of focal mechanism solutions from Harvard CMT catalog.

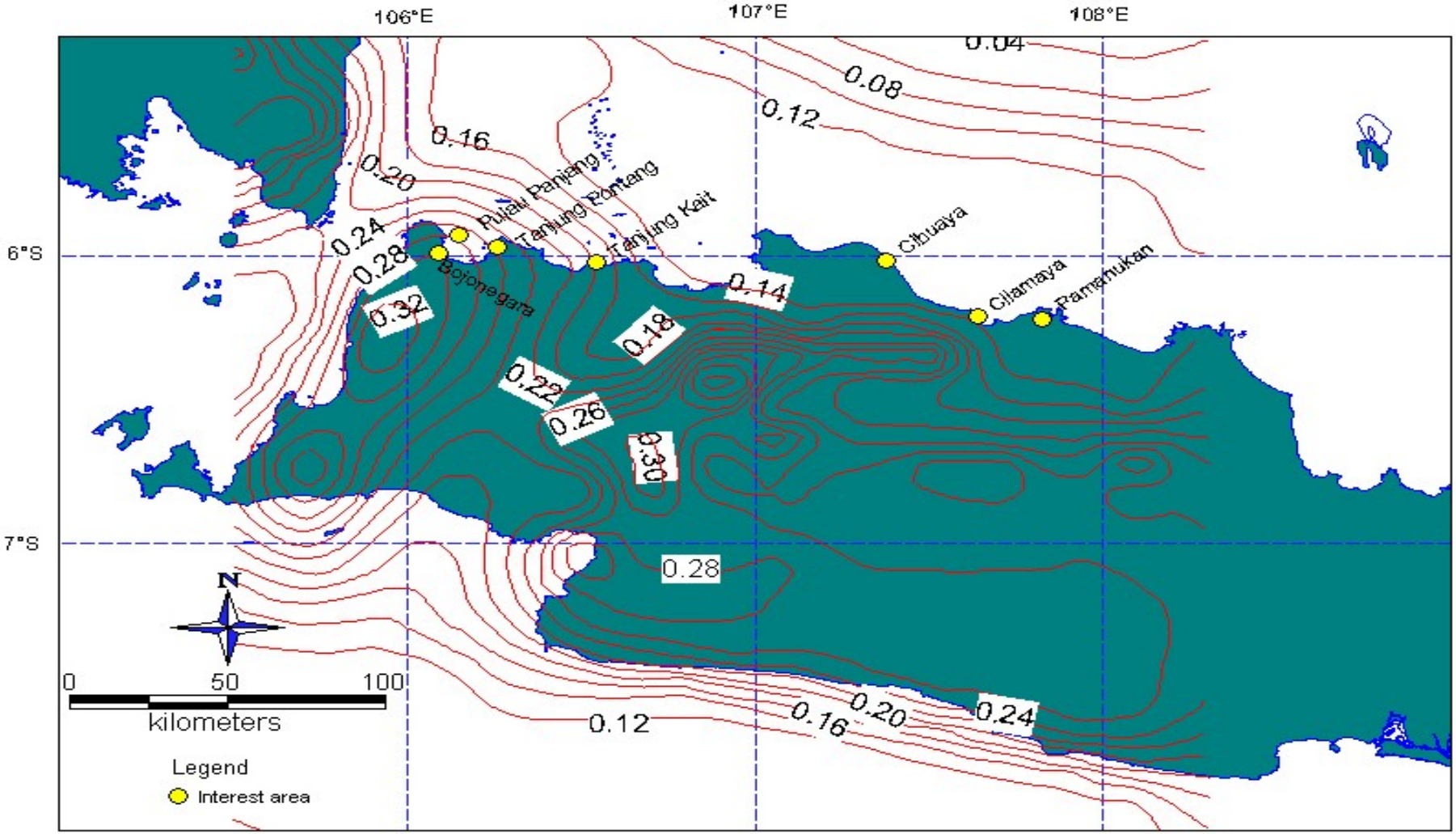
❖ Seismic Zone For Area of Study

- Earthquake distribution
- Geodynamics setting
- Faults Pattern completed with its focal mechanism



Zone 1: Subduction
Zona 2: Fore Arc
Zona 3: Sumatera Fault
Zona 4: Lampung Fault
Zona 5: Panaitan Fault
Zona 6 :Banten Fault
Zona 7: Bayah Fault
Zona 8: Citarik Fault
Zona 9: Baribis–Bumiayu Fault
Zona 10: Cimandiri – Citanduy Ft
Zona 11: Pegunungan Selatan Ft
Zona 12: Java north fault

PGA Map of 250 Years of Exceedance Using Uncertainty of 0.15



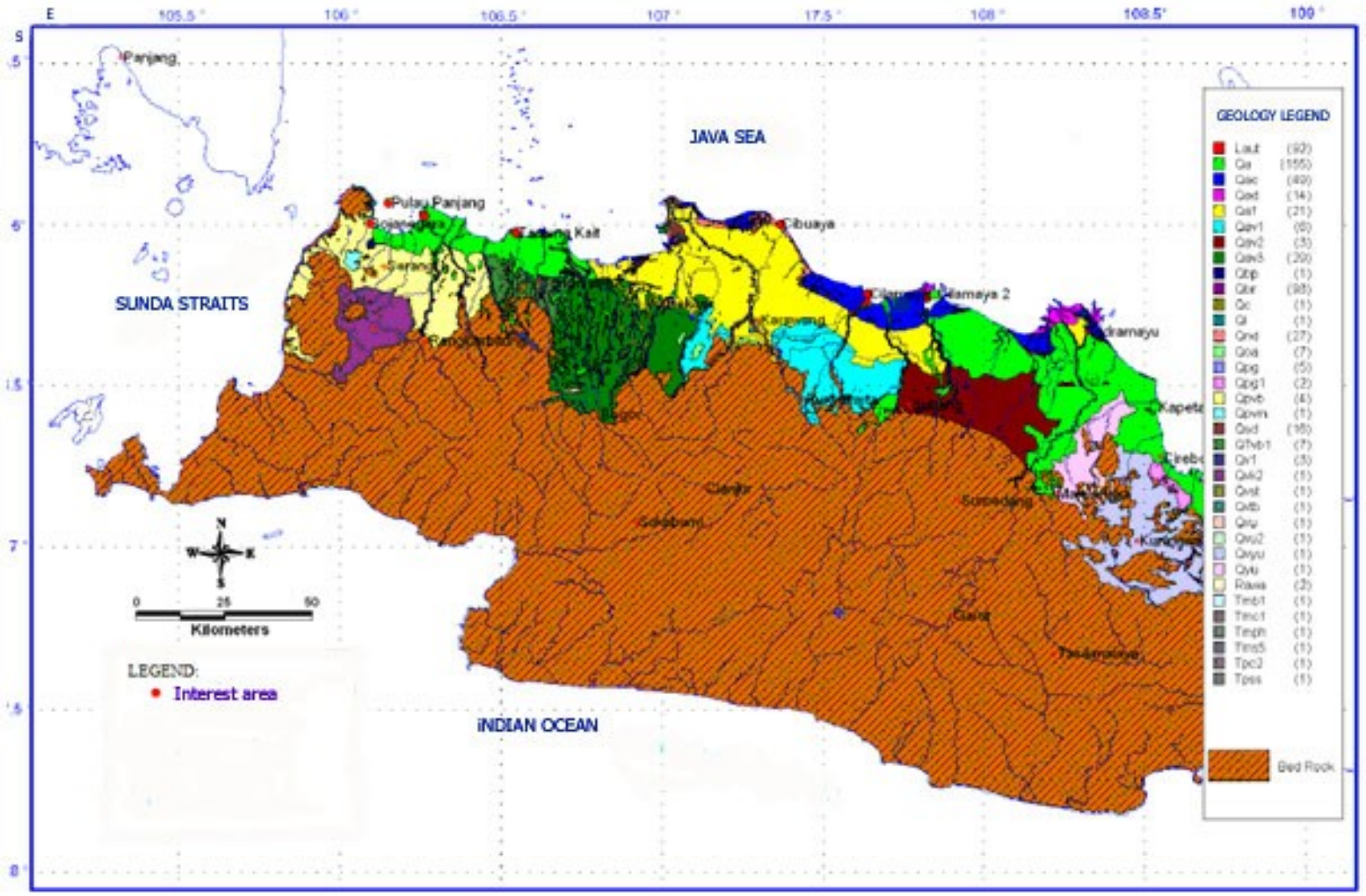
Bojonegara : 0.3 g
P. Panjang : 0.28 g
Tj. Pontang : 0.26 g
Pamanukan : 0.135 g

Tj. Kait : 0.2 g
Cibuaya : 0.131 g
Cilamaya :0.140 g

3) Subsurface Material

- The purpose of subsurface material investigation is to acquire the geotechnical characteristics and the soil profile of the site
- Based on the secondary data available, it can be concluded that:
  - North coast of Banten and West Java Province is lying on alluvial deposits which are defined as from unconsolidated to semi consolidated material. Meanwhile, the land of Pulau Panjang, a small island in the northern Banten Province, is lying on the coral reefs which are regarded as relatively hard material
  - Sediment on the north coast of Banten and West Java Province is more than 200 m thick. Quarternary rocks compose of clay with sand intercalation are at depth 0-230 m.
  - The whole interest area are not in danger of ground movement events
  - Bojonegara, Pulau Panjang, Tanjung Pontang and Cibuaya area are not lie in liquefaction zone.
  - Liquefaction events on the north coast of Banten and West Java Province have never been reported.

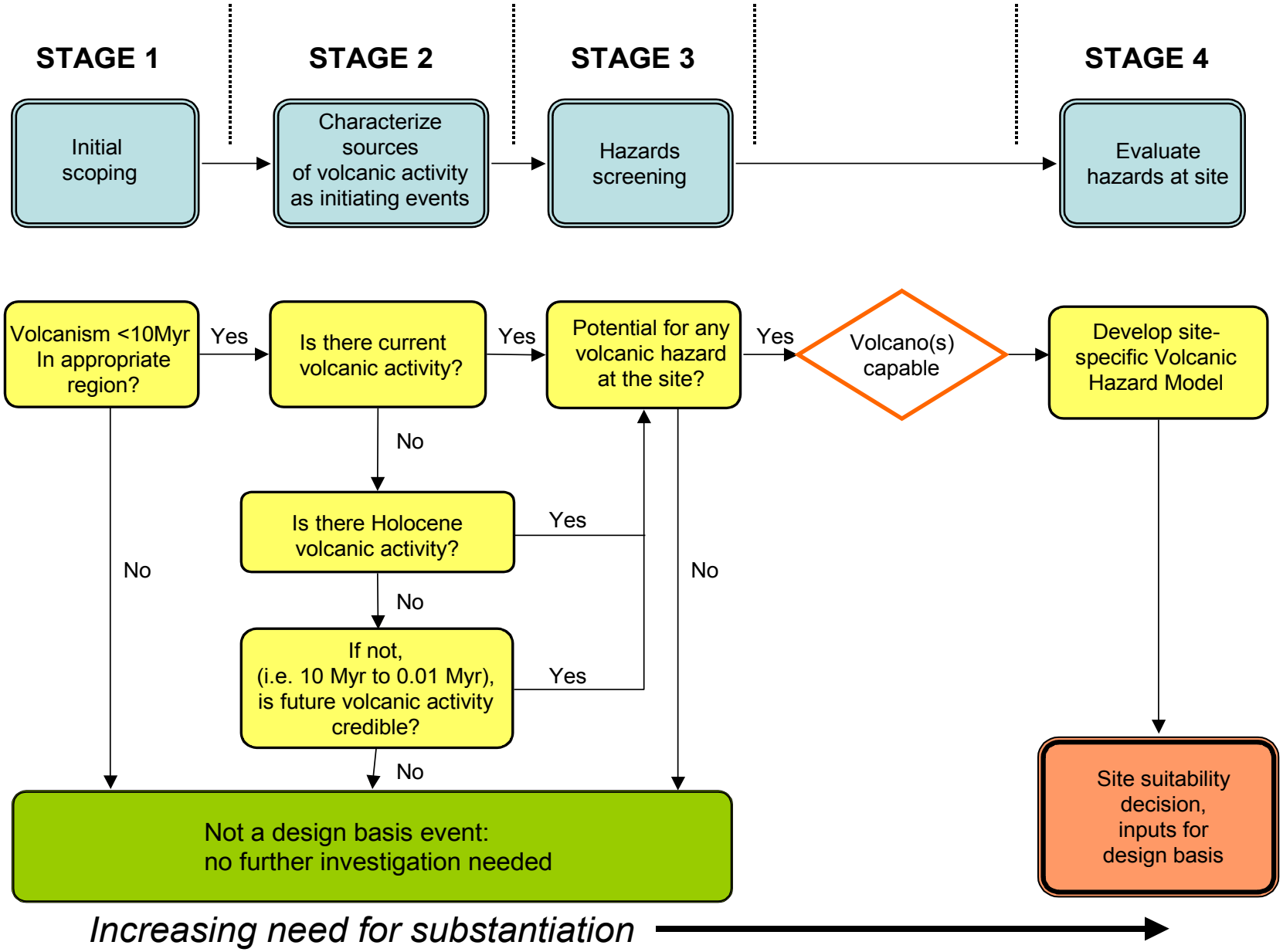
Bedrock and Quaternary Rocks Distribution Map



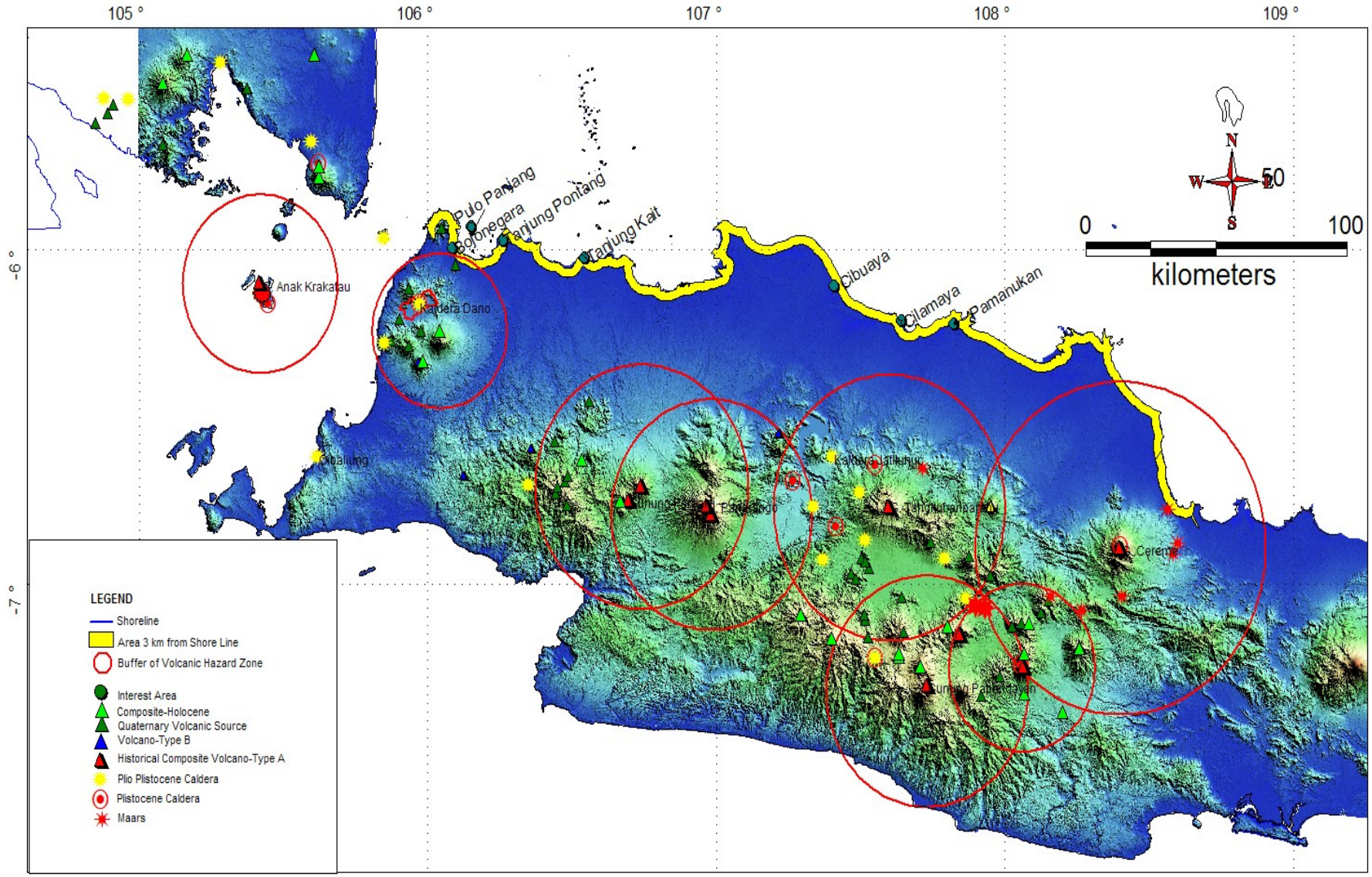
4) Volcanism

- Definition of Capable Volcano:
  - Historical volcanic activity (volcanic activity 1600 a.d., Indonesia type A)
  - Manifestation of magmatic activity at present (Indonesia: Type B and C). Type B is characterized by its cone morphology, while type C is characterized by fumarolic activity but unclear cone morphology
  - Last activity time < maximum repose interval
  - Quaternary Composite Type, Pliocene Caldera Type
- Criteria
  - Potential site is not laid in the SDV radius of capable volcano such as phyroclastic flow, phyroclastic fall, lava flow

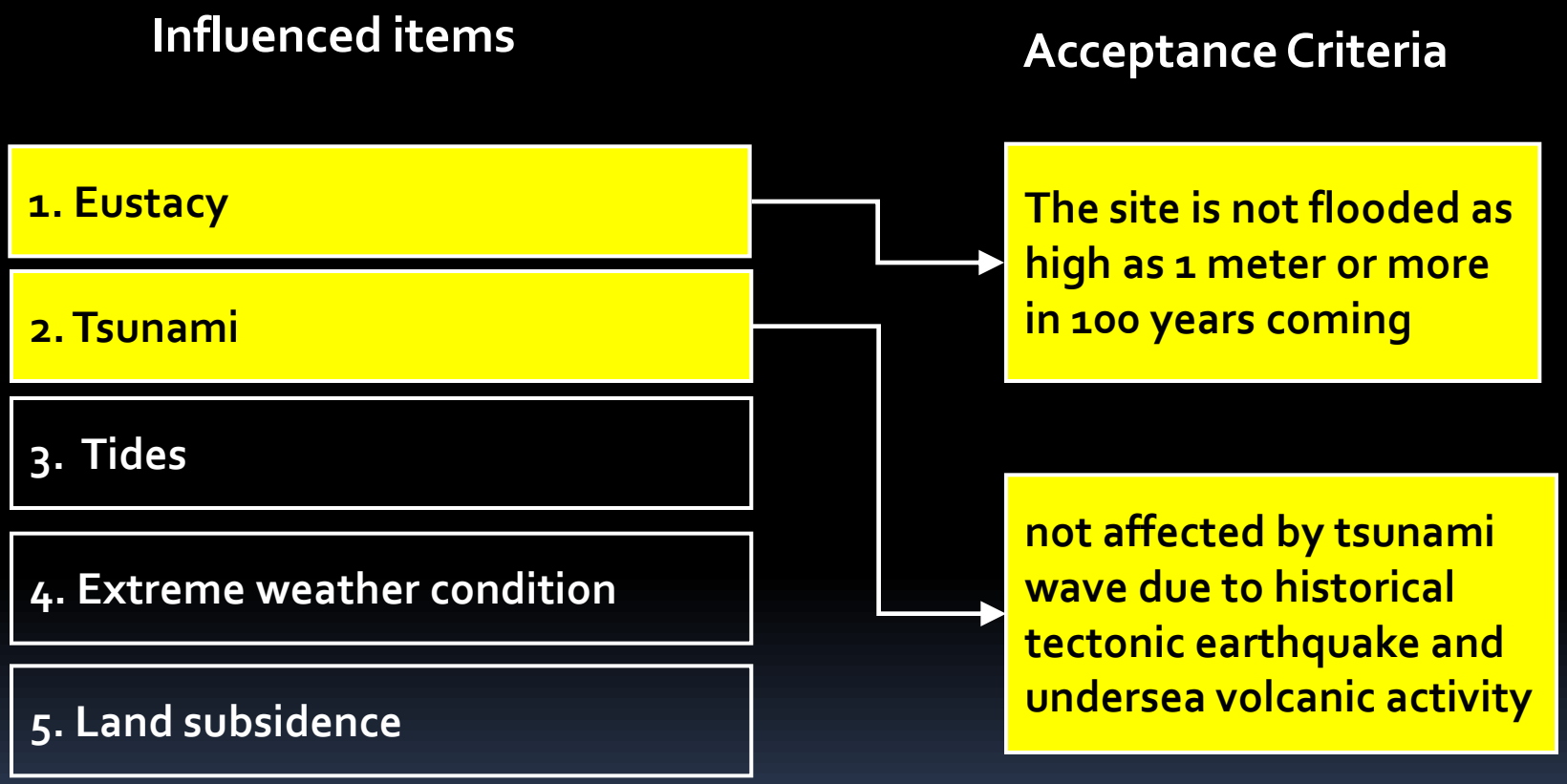
Flowchart of Volcanic Hazard Analysis



Volcanic Hazard Zone

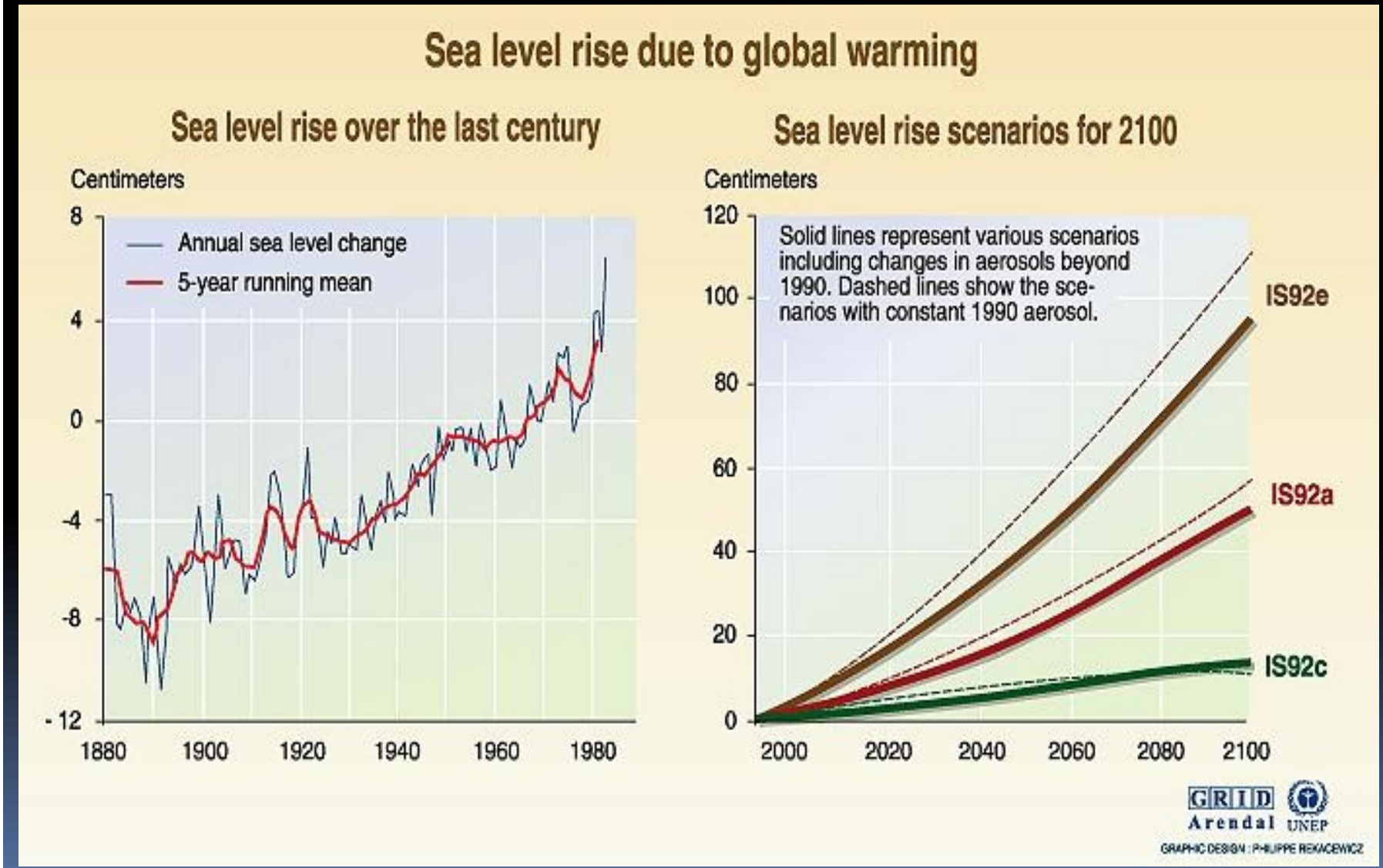


5) Coastal Flooding

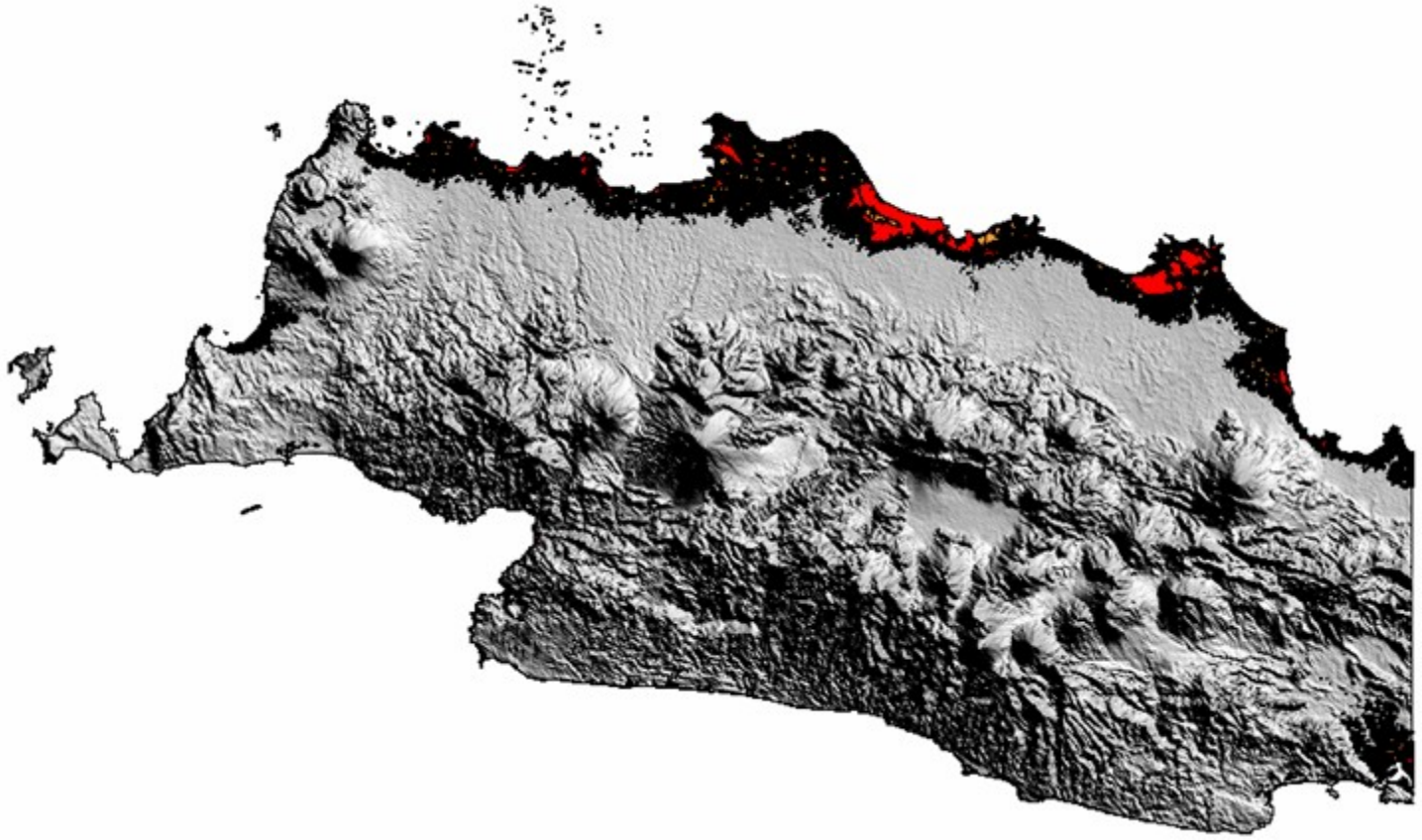


❖ Eustacy

Eustacy of sea-level rise is caused by the addition of the water volume due to ice melting as well as thermal expansion due to increased water temperature



Coastal Flooding Modelling in Area of Study Caused by Eustacy



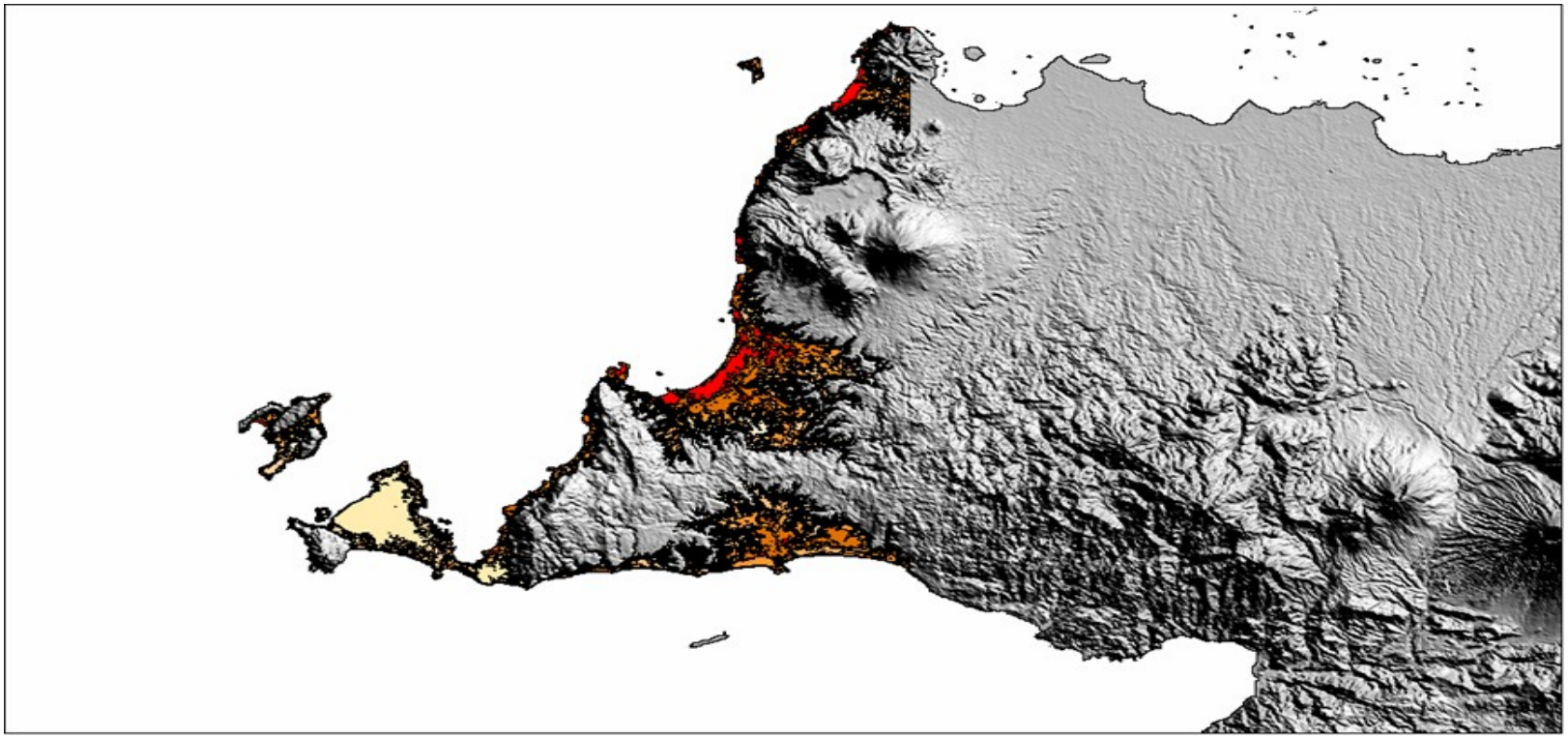
The modelling was based on worst scenario of global sea level rising of 1cm/year after 100 years

* The red color presents the flooded area

❖ Tsunami

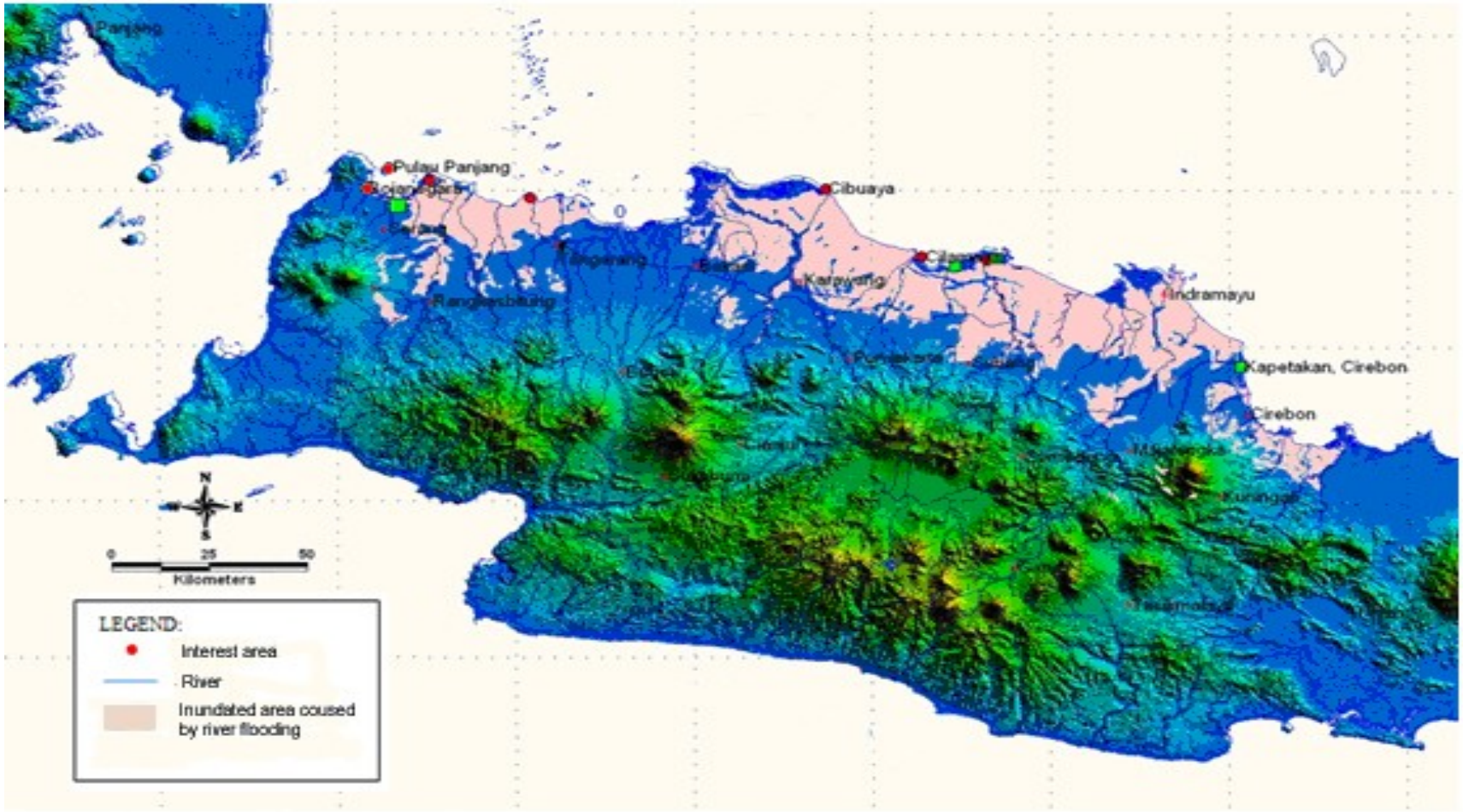
- Tsunami attributable to volcanic which was caused by the collapse of Krakatoa caldera in year 1883 occurred in Sunda Strait.
- Tsunami attributable to tectonic was caused by tectonics related to subduction zone happened in the far south.
- Tectonic tsunami which is not related to subduction zone occurred in Sunda Strait such as the Panaitan tsunami.

Flooded Area Affected by Krakatoa Tsunami



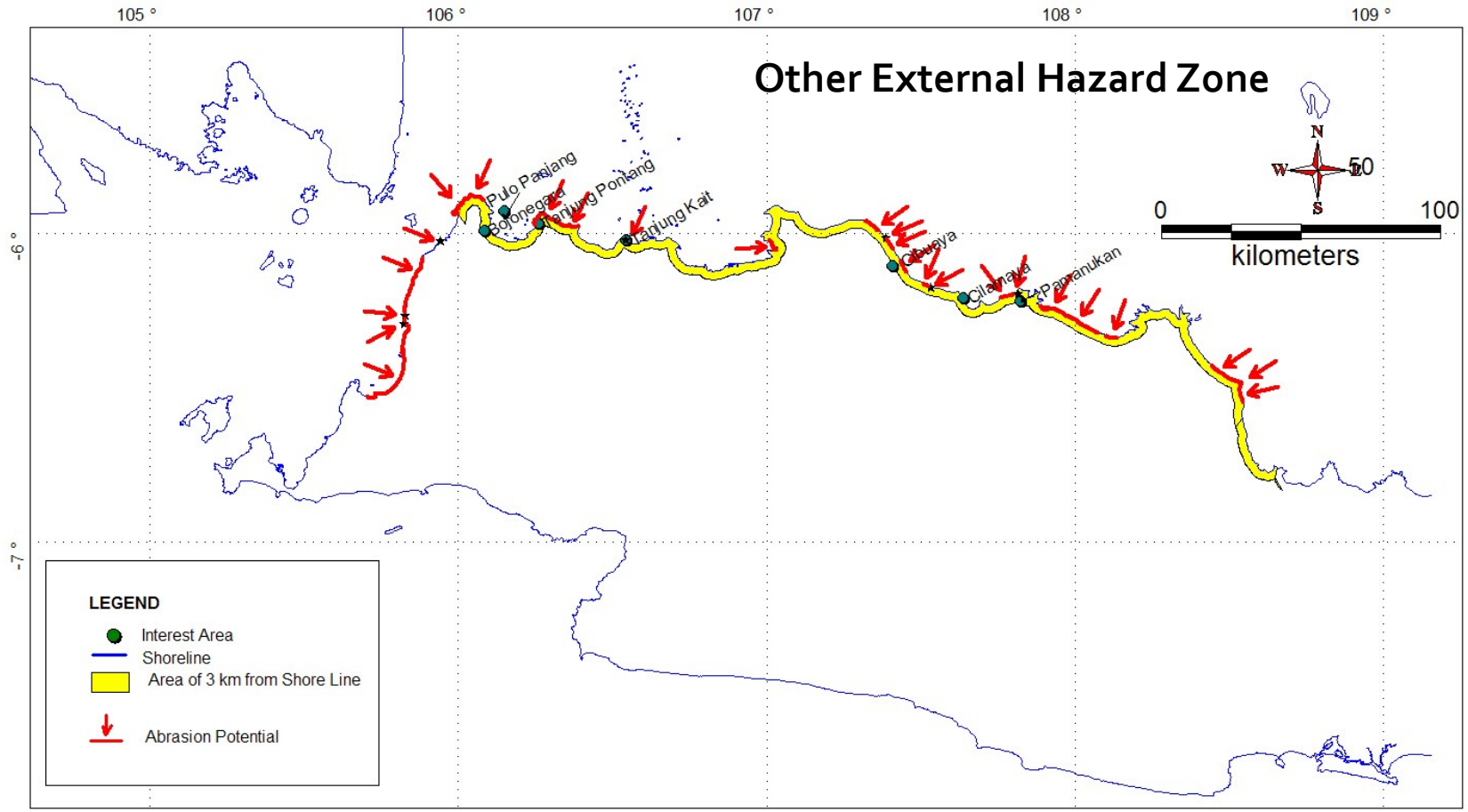
6) River Flooding

Acceptance criterion:
The site is not flooded by river flooding as high as 1 meter or more with return period of 100 year.

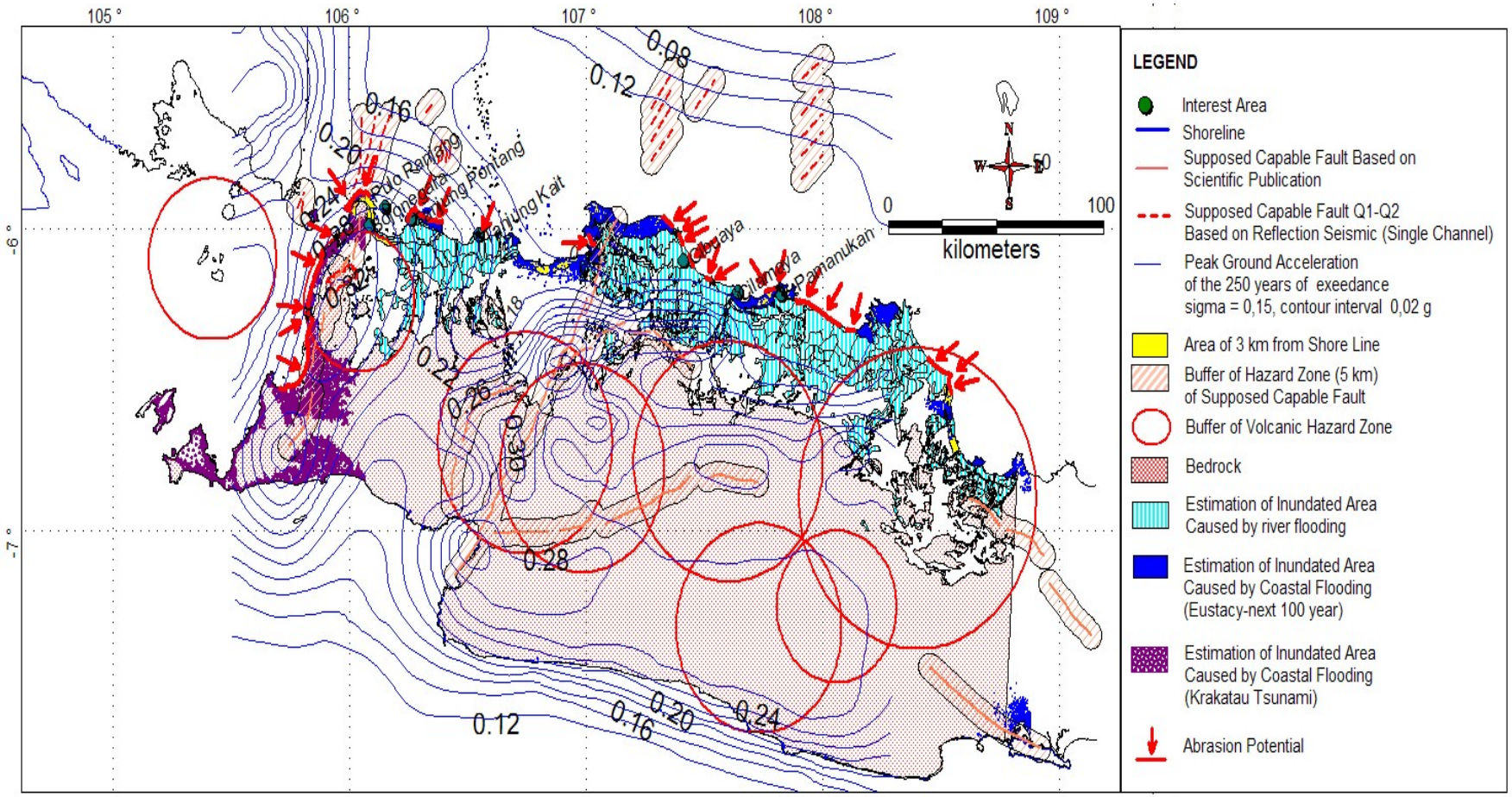


7) Other External Hazard

Other external hazard consist of coastal abration, uplifting, extreme meteorological events, gas emission and forest fires.



b. Integrated Regional Analysis of Natural External Events (IRA – I)

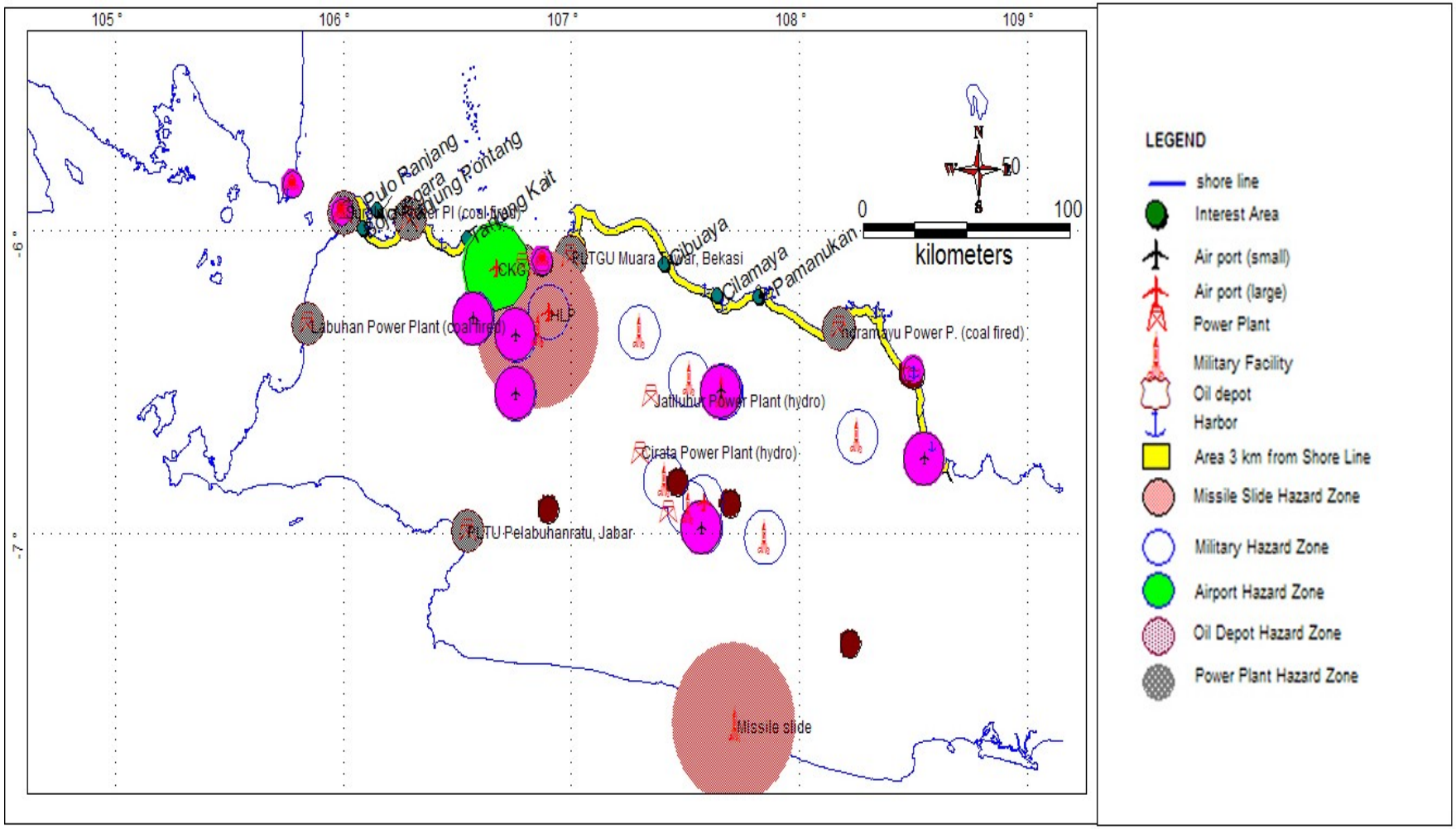


Hazard zone for seven natural external event aspects

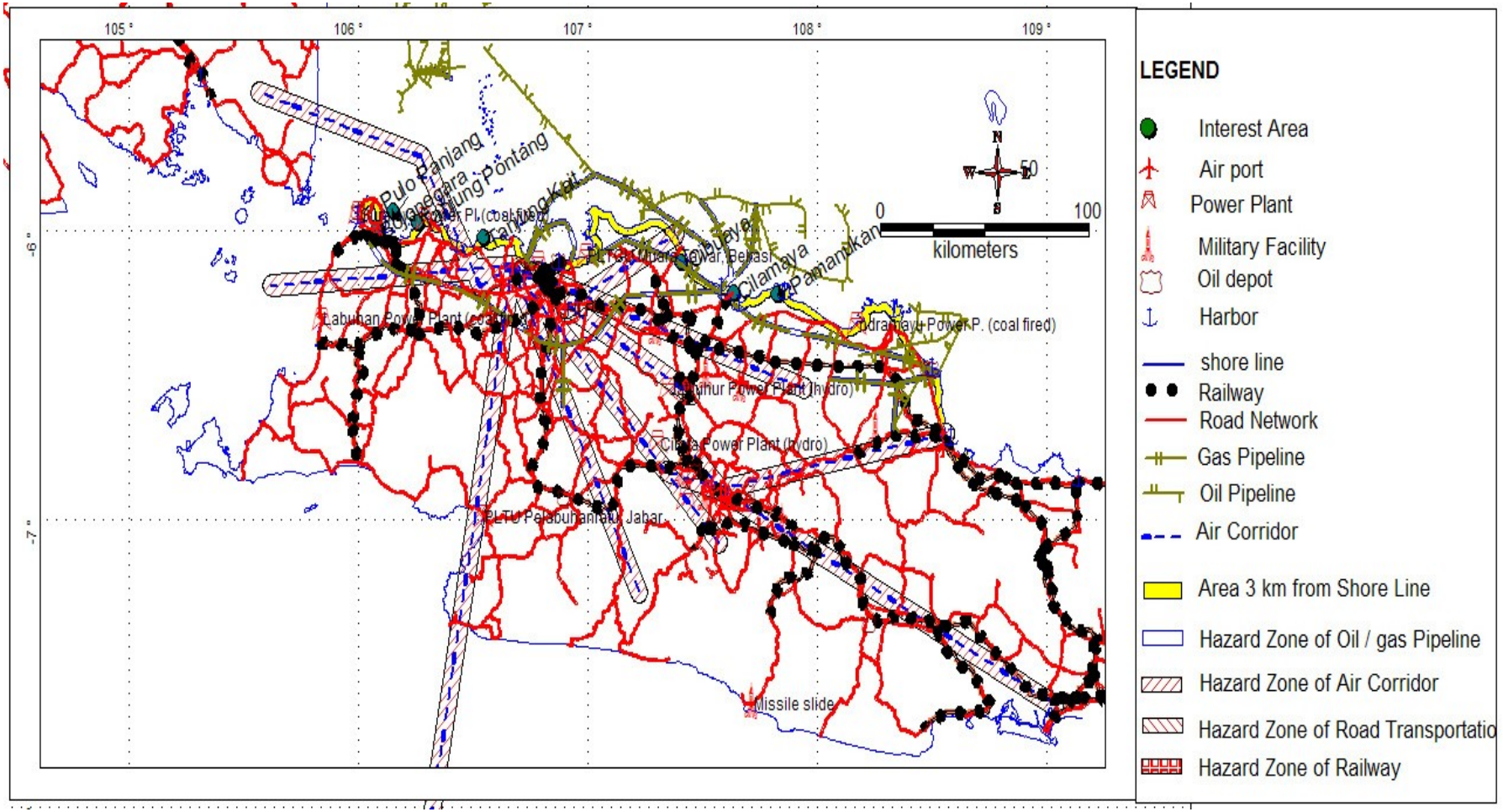
c. Human Induced External Events

Item	Screening Distance value (SDV) radius
Stationary Source	
• Large & busy airport	16 km
• Small-medium airport	10-20 km
• Permanent & large military facility	30 km
• Small-medium military facility	10-20 km
• Oil/gas refinery, power generation and petrochemical industries	3 - 5 km
• Large harbor	3 - 5 km
Mobile Source	
• Toll/Artery road and railway	0,5 -1 km
• Gas or oil pipe line	1 km
• Cruise line	4 km

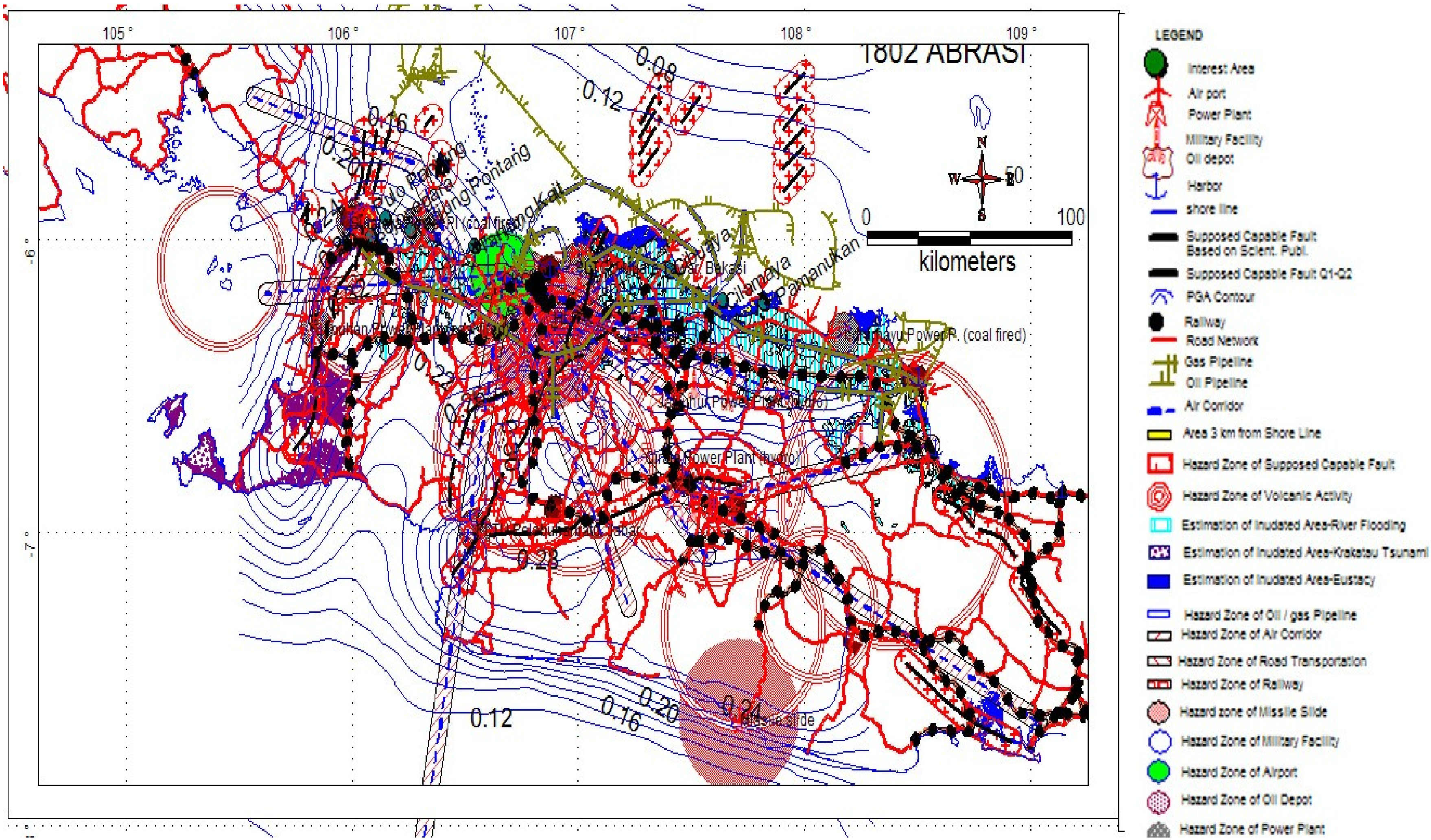
Stationary Source Hazard Zone



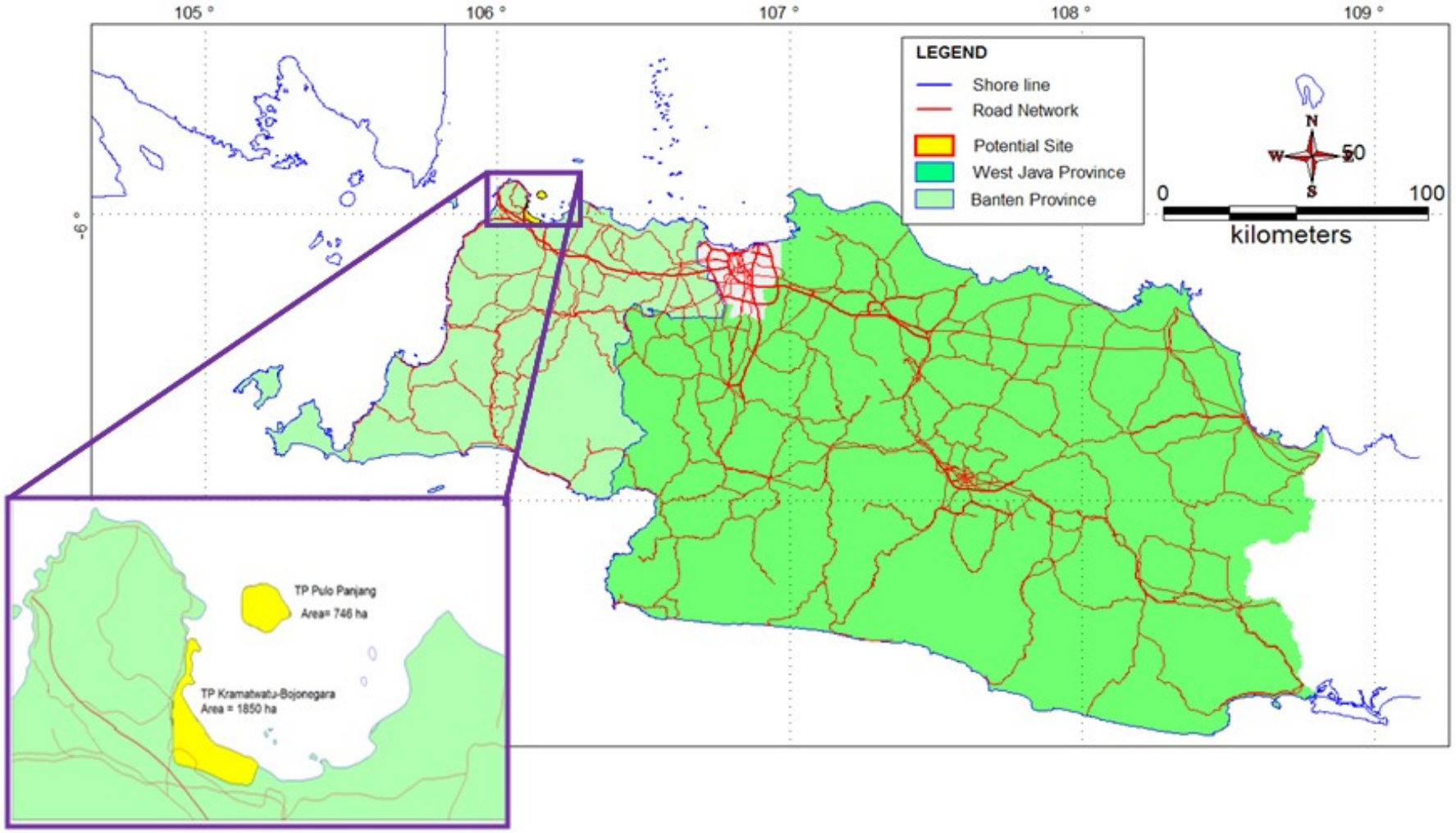
Mobile Source Hazard Zone



d. Integrated Regional Analysis of Natural & Human Induced External Events (IRA- I & II)



Two Potential Sites
Kramatwatu – Bojonegara & Pulau Panjang



4. SUMMARY & RECOMMENDATION

- Combining the hazard zone of natural and human induced external event would produce a free-hazard zone. Furthermore, it can be defined and delineated to 2 (two) potential sites namely Kramatwatu-Bojonegara and Pulau Panjang.

- However, those potential sites to become a selected candidate site as the results of near regional analysis stage, need further investigation and some field works in order to achieve appropriate data, especially on verification of supposed capable faults and deep investigation of capable volcanoes in the radius of 50 km from the site.

Thank You