Disaster Risks in a Changing Climate

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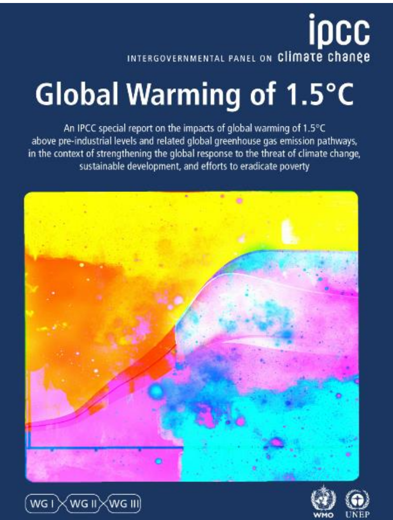
Asian Network on Climate Science and Technology (ANCST)




Ashley Cooper / Aurora Photos

Where are we now?

Since pre-industrial times, human activities have caused approximately 1°C of global warming.

- Already seeing consequences for people, nature and livelihoods
- At current rate, would reach 1.5°C between 2030 and 2052
- Past emissions alone do not commit the world to 1.5°C

Impacts of global warming 1.5°C (At 1.5°C compared to 2°C)

- <u>Less extreme weather where people live, including extreme heat and rainfall</u>
- By 2100, global mean sea level rise will be around 10 cm lower but may continue to rise for centuries
- 10 million fewer people exposed to risk of rising seas
- Lower impact on biodiversity and species
- Smaller reductions in yields of maize, rice, wheat
- Global population exposed to increased water shortages is up to 50% less
- Lower risk to fisheries and the livelihoods that depend on them
- <u>Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050</u>

Tropical Southeast Asia: projected to experience the largest impacts on economic growth

Robert van Waarden / Aurora Photos

Greenhouse gas emissions pathways

- To limit warming to 1.5°C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
- To limit warming to 1.5°C, CO_2 emissions would need to reach 'net zero' around 2050
- Reducing non-CO_2 emissions would have direct and immediate health benefits


Neil Emmerson / Aurora Photos

Greenhouse gas emissions pathways

- Limiting warming to 1.5°C would require changes on an unprecedented scale
  - Deep emissions cuts in all sectors
  - A range of technologies
  - Behavioural changes
  - Increased investment in low carbon options
- Progress in renewables would need to be mirrored in other sectors
- We would need to start taking carbon dioxide out of the atmosphere

Chapter 24, Asia:
Coverage - 51 countries/regions

Source: IPCC, 2013

INTERGOVERNMENTAL PANEL ON climate change

Central Asia (5)

- Kazakhstan
- Kyrgyzstan
- Tajikistan
- Turkmenistan
- Uzbekistan

North Asia (2)

- Mongolia
- Russia (East of Urals)

East Asia (7)

- China, Hong Kong Special Administrative Region (Hong Kong SAR)
- China, Macao Special Administrative Region
- Japan
- North Korea
- People's Republic of China (China)
- South Korea
- Taiwan Province of China (Taiwan POC)

West Asia (17)

- Armenia
- Azerbaijan
- Bahrain
- Georgia
- Iran
- Iraq
- Israel
- Jordan
- Kuwait
- Lebanon
- Palestine
- Oman
- Qatar
- Saudi Arabia
- Syria
- United Arab Emirates
- Yemen

South Asia (8)

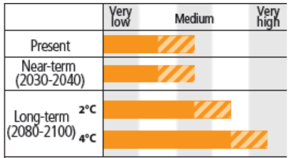
- Afghanistan
- Bangladesh
- Bhutan
- India
- Maldives
- Nepal
- Pakistan
- Sri Lanka

Southeast Asia (12)

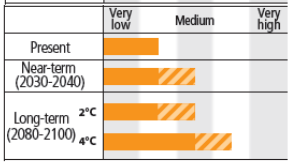
- Brunei
- Indonesia
- Lao People's Democratic
- Malaysia
- Myanmar
- Papua New Guinea
- The Philippines
- Republic Cambodia
- Singapore
- Thailand
- Timor-Leste
- Vietnam

Key Risks in Asia (AR5)

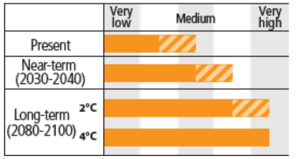
Increased **coastal, riverine and urban flooding** leading to widespread damage to infrastructure and settlements in Asia (medium confidence)



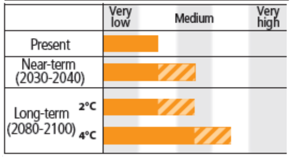
Increased risk of **flood-related deaths, injuries, infectious diseases and mental disorders** (medium confidence)



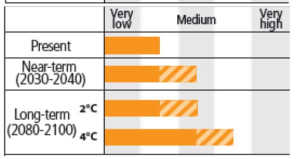
Increased risk of **heat-related mortality** (high confidence)



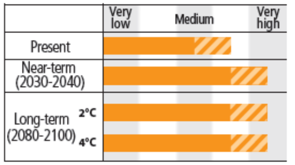
Increased risk of **water and vector-borne diseases** (medium confidence)



Increased risk of drought-related water and food shortage **causing malnutrition** (high confidence)



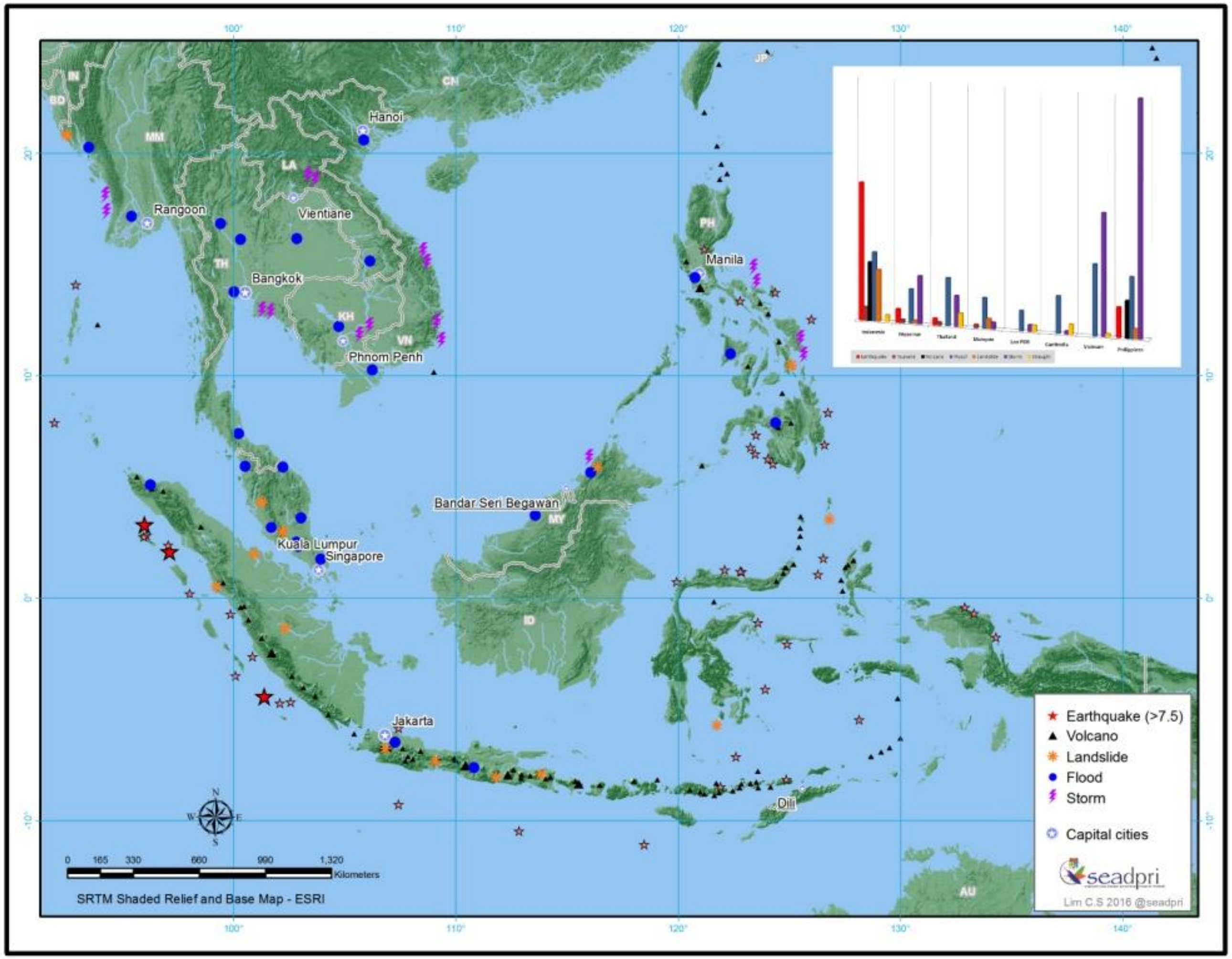
Water shortage in arid areas of Asia (medium confidence)



KEY CONCLUSIONS: IPCC-WG2, Chapter 24, Asia

- Water scarcity is expected to be a major challenge for most of the region due to increased water demand and lack of good management (*medium confidence*)
- There is ***low confidence*** **in future precipitation projections at a sub-regional scale** and thus in future freshwater availability in most parts of Asia.
- **Integrated water management strategies** could help adapt to climate change, including developing water saving technologies, increasing water productivity, and water reuse.

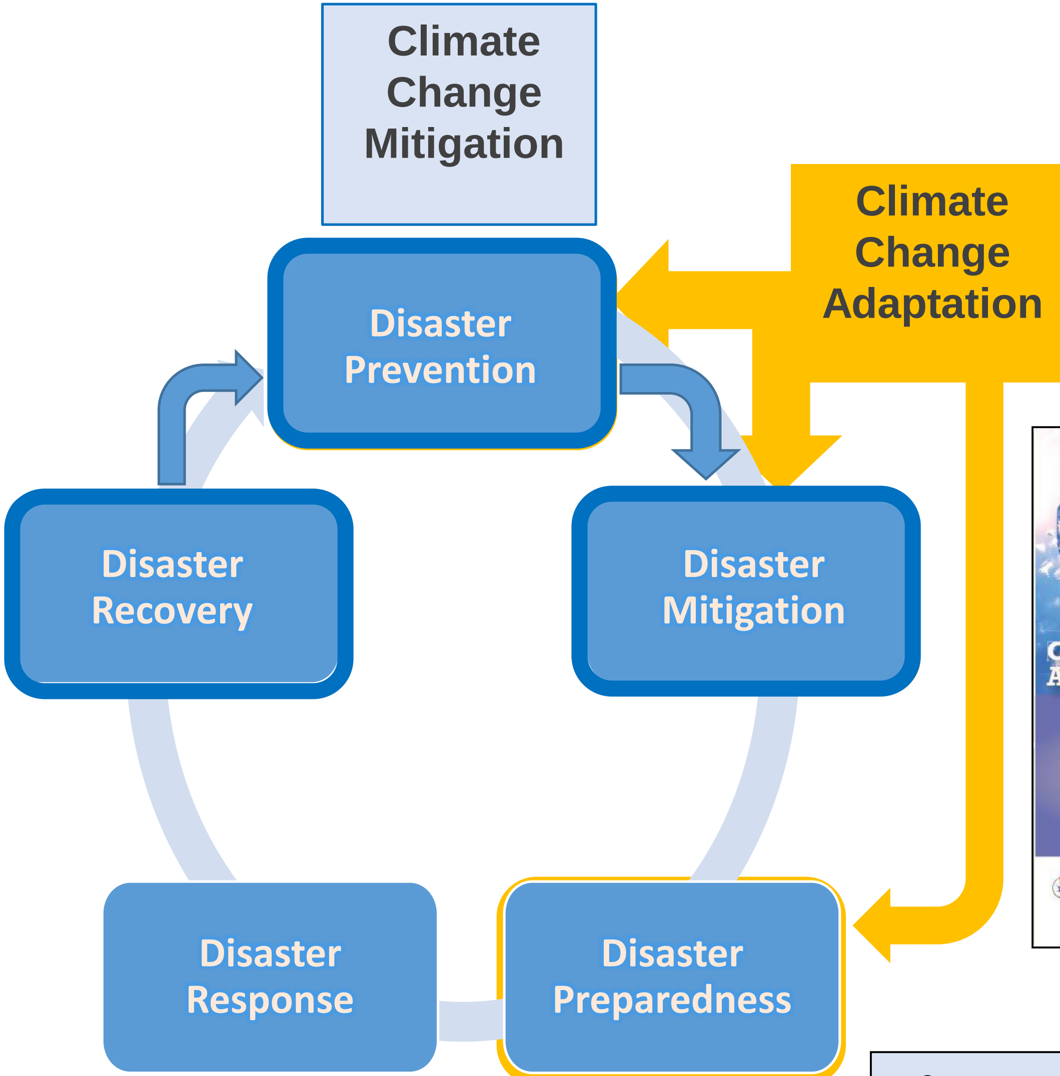
Disasters Events in Southeast Asia (last updated 2011)



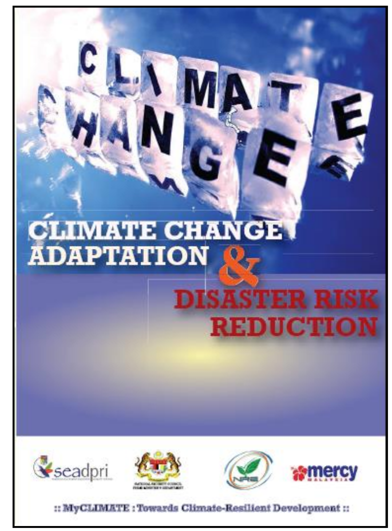
The first step in adaptation to future climate change – reduce vulnerability and exposure to present climate variability (IPCC 2014)

The majority of disasters that affect Southeast Asia are climate driven (flood, landslide, storm, drought) except for earthquake and volcanic eruption, which occurs primarily in Indonesia and The Philippines. Climate related threats account for 30% of the total GDP damage across cities in the region, where total GDP at risk can be as high as 5% [Source: Cambridge Centre for Risk Studies]

Disaster Risk Reduction as an entry point



Sendai Framework on DRR
SDG 13 on Climate Action
Paris Agreement



Effective risk management and adaptation are tailored to local and regional needs and circumstances (IPCC 2014)

FAST & SLOW ONSET HAZARDS IN GREATER KUALA LUMPUR [2008-2017]

What are the new risks? Where are the vulnerable groups? Where are the exposed assets and supply chains?

****Tsunami**

1 incidence

Landslides

65 incidences

Pluvial floods

118 incidences

Fluvial floods

12 incidences
1-12 days

Coastal inundation

9 incidences
2-6 days

Peat fires

12 incidences
3-30 days

Haze

13 incidences
1-22 days

Land degradation

Sea-level rise

Groundwater salinization

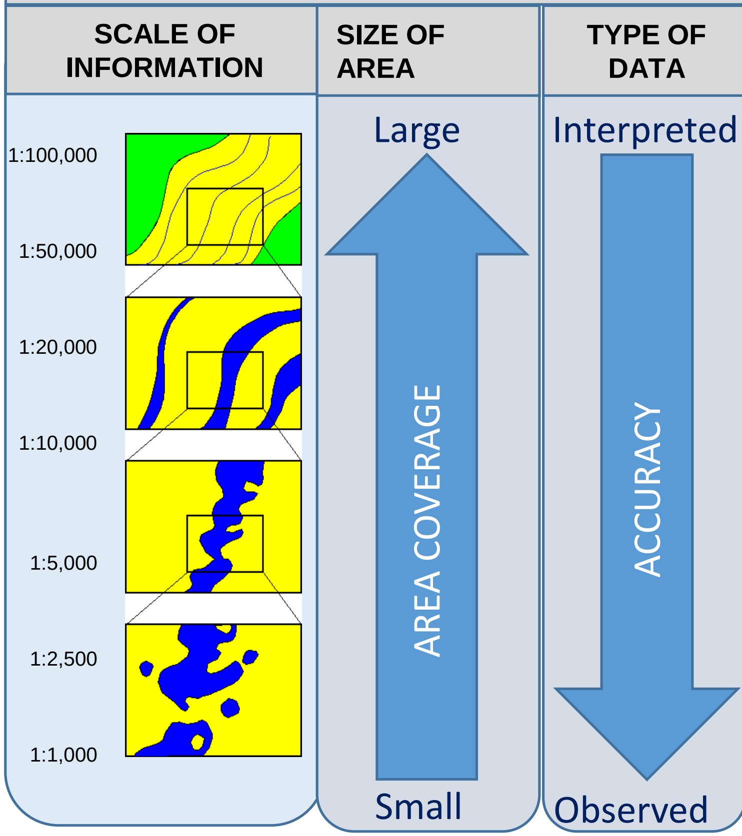
Subsidence

48 incidences

Seconds/Minutes/Hours — Days/Weeks/Months — Years/Unclear start/Ending

Scale of Information

SCALE OF INFORMATION FOR DECISION MAKING



REMARKS

Scientific Knowledge: Satellite imageries, DEM, topographic, geological maps etc. for desktop studies and general surveys.

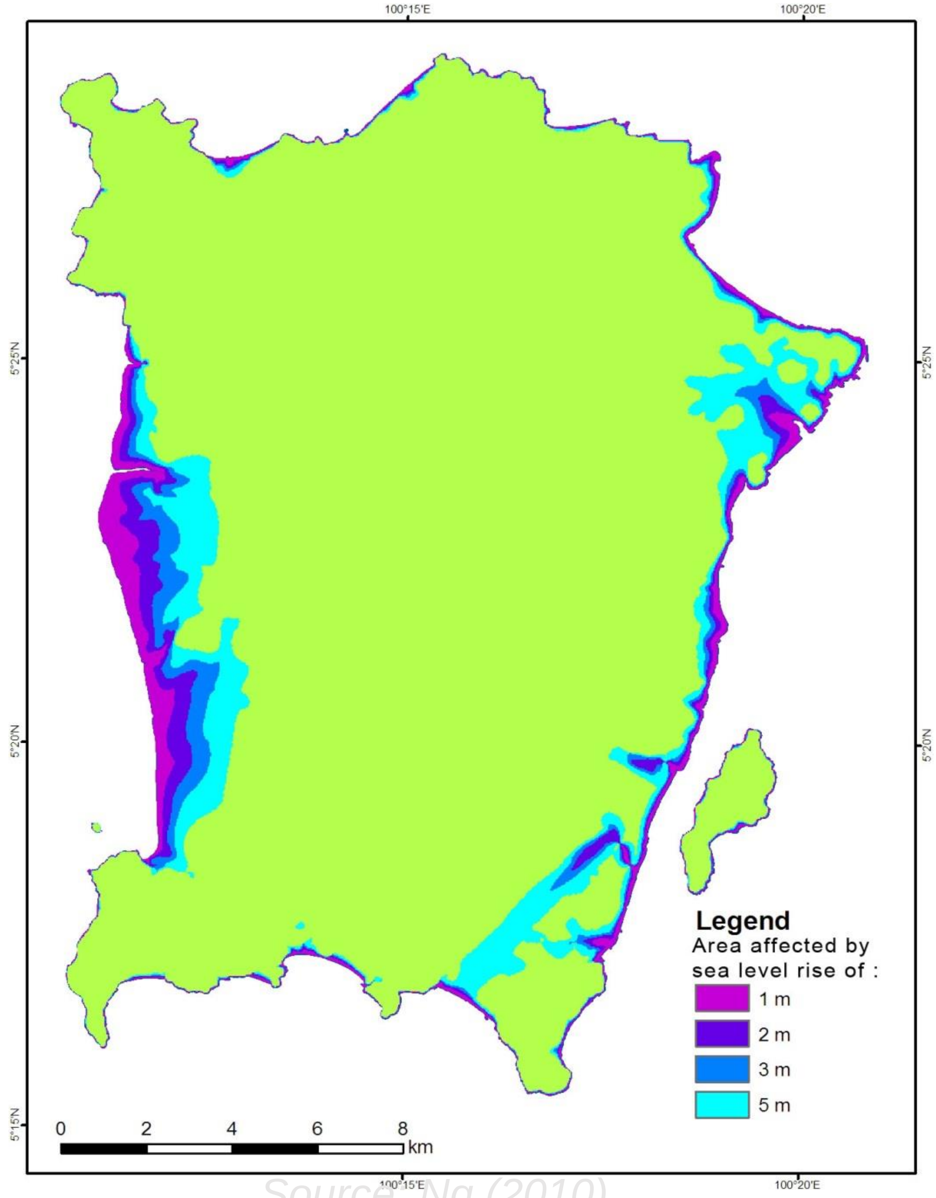
Scientific Knowledge: Airborne LiDAR, aerial images, field mapping etc. for specialized surveys.

Scientific Knowledge: Airborne LiDAR, field mapping, etc. for landuse planning and development suitability.

Scientific Knowledge: Terrestrial LiDAR, susceptibility investigation, field survey, etc. for local zoning and site investigation.

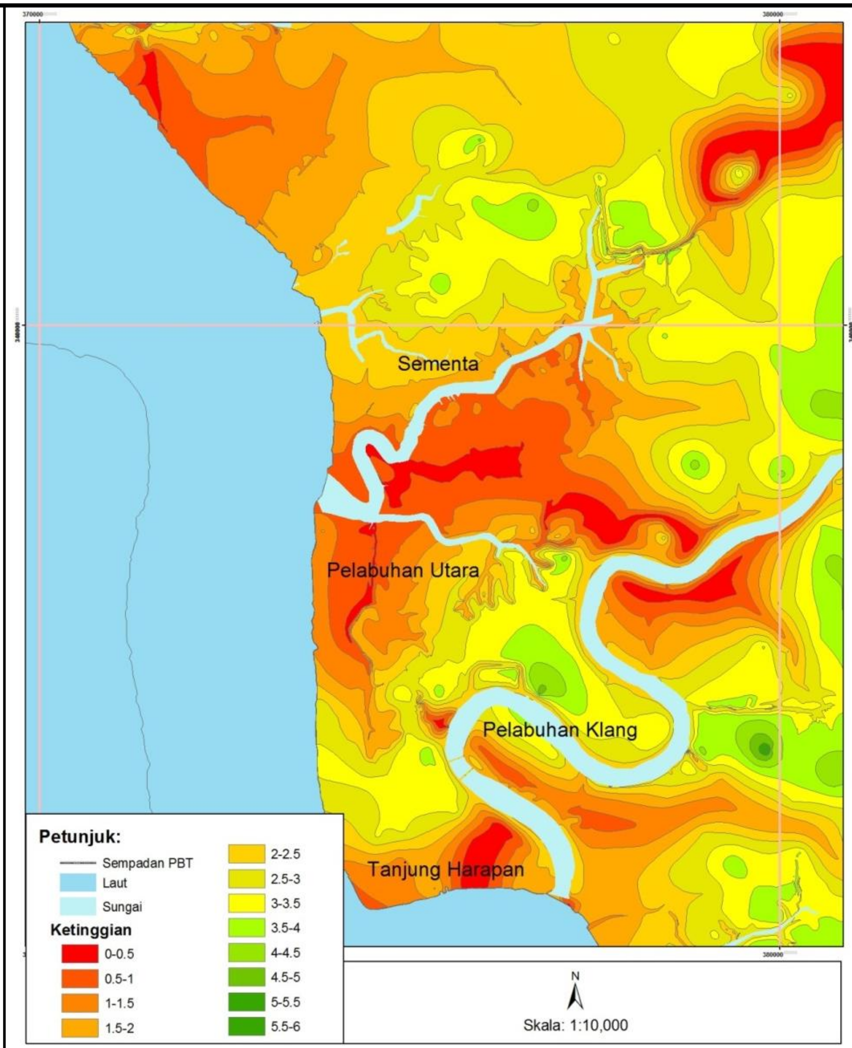
Community Knowledge: Household surveys and crowd sourcing.

Areas Potentially Affected by Sea-Level Rise in Penang Island

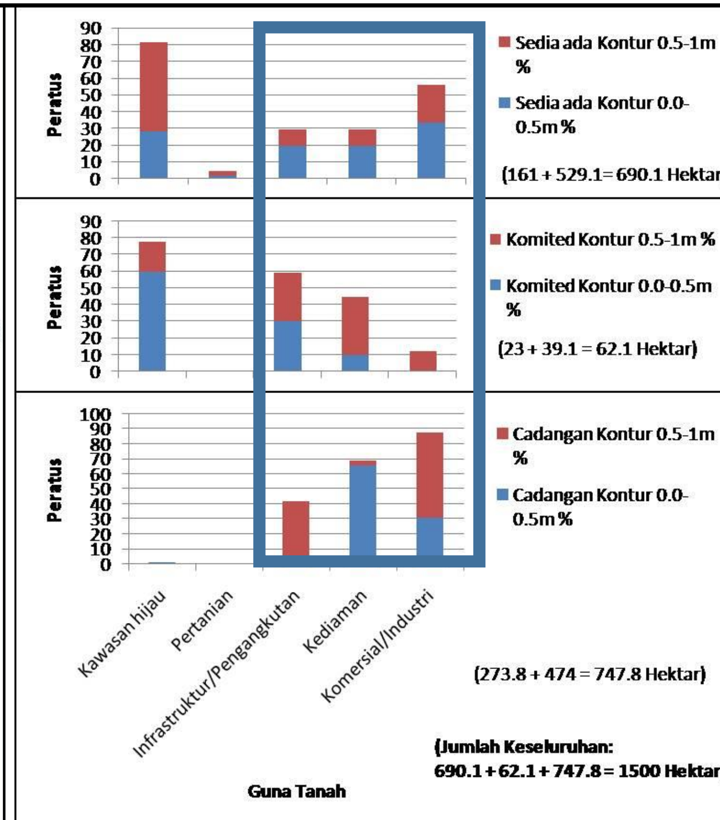


Source: Ng (2010)

Areas Potentially Affected by Sea Level Rise in Port Klang, Malaysia

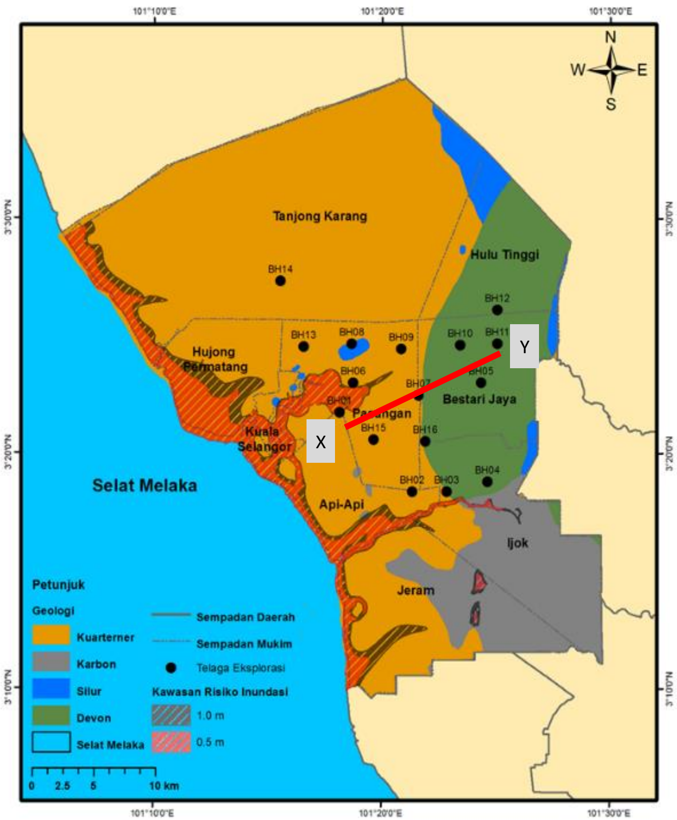


Source: Rasyidah et al., 2013 based on data from JPBD Selangor. Projection by NAHRIM for 2100



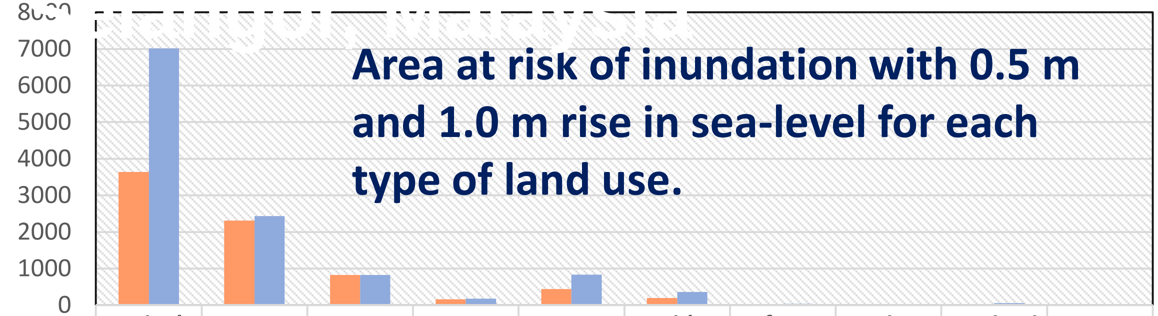
Adaptation Measures: Informed planning; Early warning systems; Maintenance of drainage; Risk pooling; Relocation, etc.

Areas Potentially Affected by Sea Level Rise in Port Klang, Malaysia



Landuse and areas under risk of inundation due to 0.5 m and 1.0 m sea level rise.

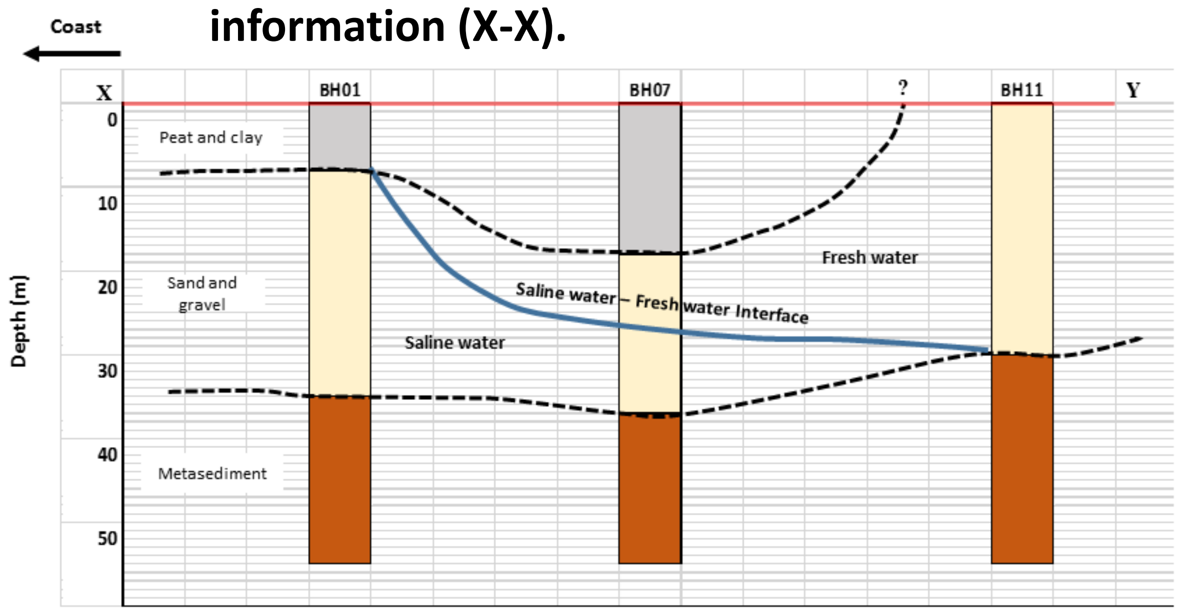
Source: Umi, A.J., Lim, C.S. & Pereira, J.J. 2018. Bulletin of the Geological Society of Malaysia, 66, 107-119.



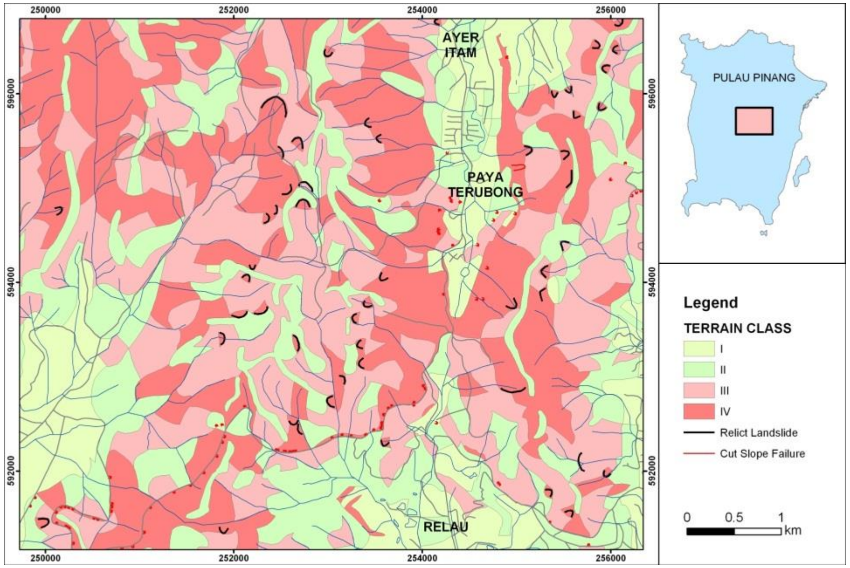
	Agriculture	Forest	Water body	Vacant land	Transportation	Residence	Infrastructure	Business	Institution	Industry
0.5 m	3640.32	2310.48	820.26	156.78	438.21	192.96	31.23	21.96	21.87	7.65
1.0 m	7010.55	2428.83	828.18	181.17	834.12	358.02	40.59	32.04	55.53	26.1

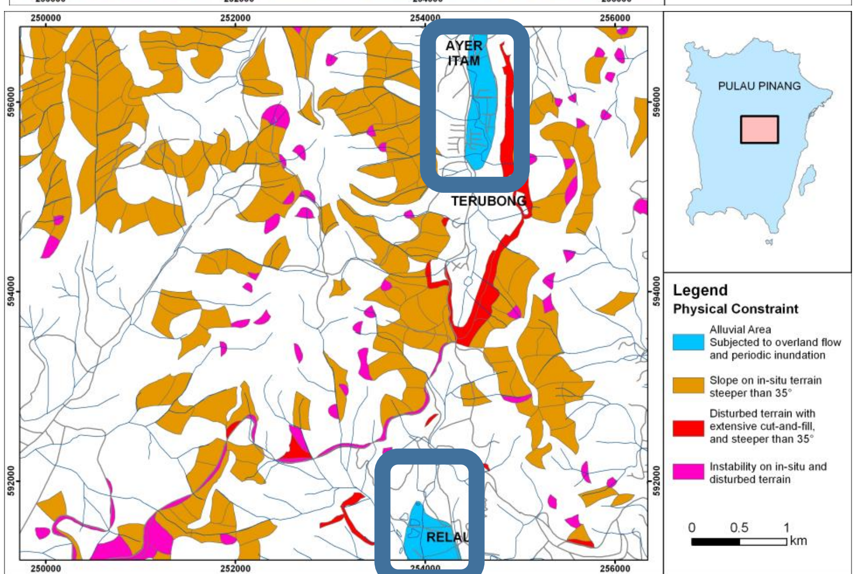
Type of Land use

East-west cross-section based on sub-surface information (X-X).



Areas Susceptible to Landslides/Floods





Source: Ng, 2011 based on data from JMG

<u>Risk Factors</u>:

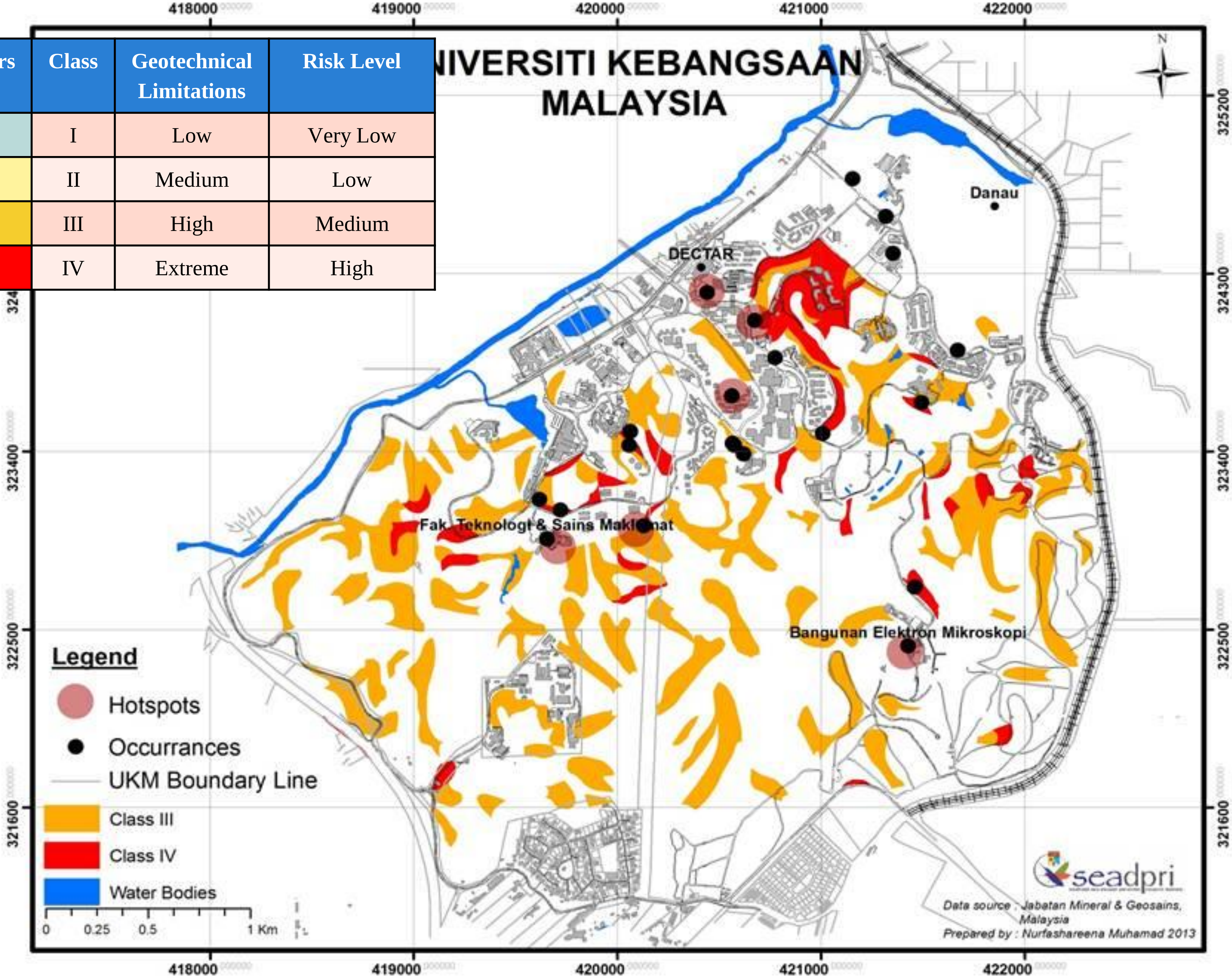
- Uninformed planning
- Development in unsuitable terrain
- Cleared areas/blocked drainage

<u>Adaptation Measures</u>:

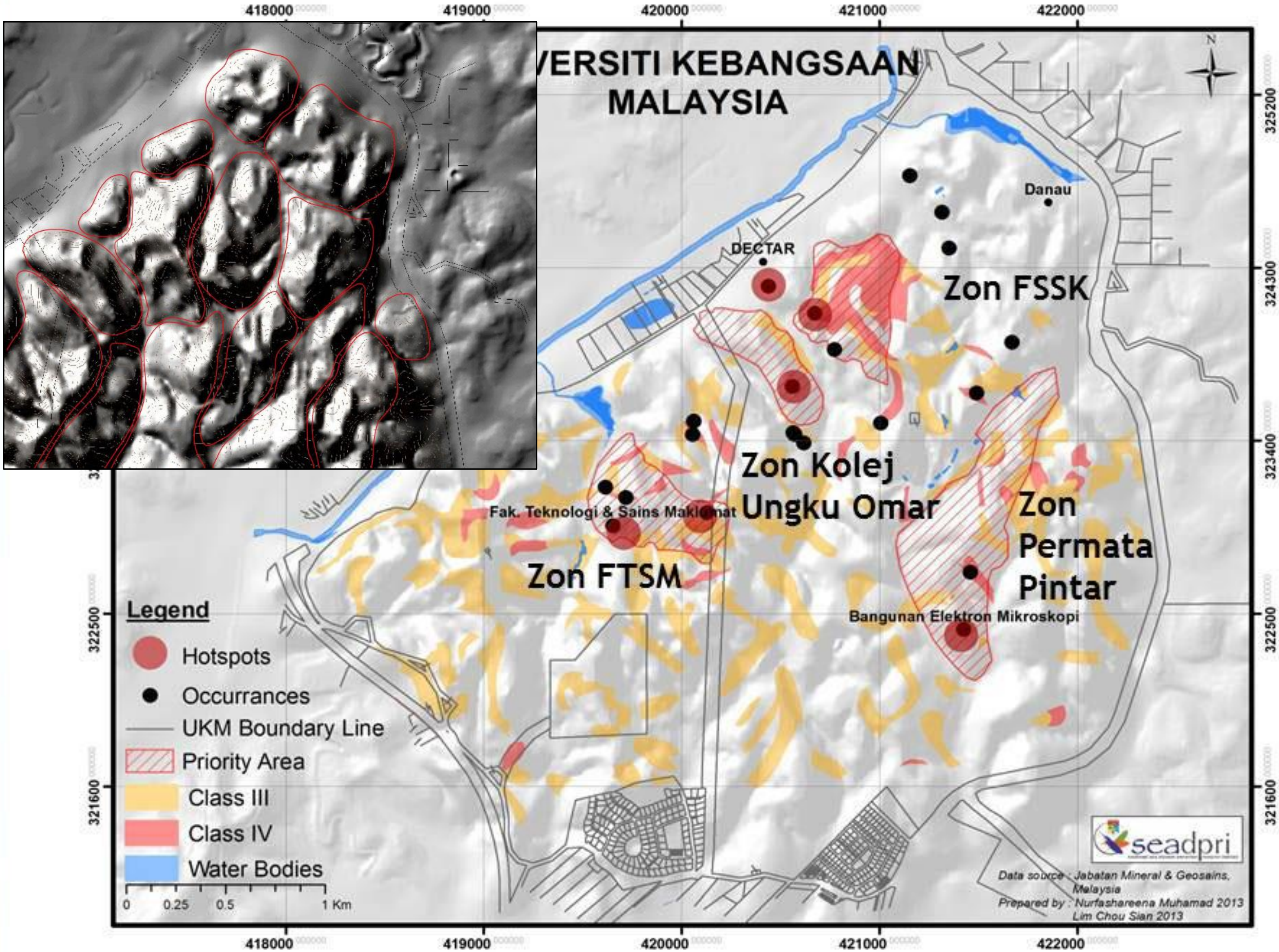
- Informed planning
- Regular slope inspection and maintenance
- Early warning systems
- Local community engagement
- Risk Pooling, etc.

Landslides locations, built up areas and geological terrain in UKM

Colours	Class	Geotechnical Limitations	Risk Level
(light blue-grey)	I	Low	Very Low
(light yellow)	II	Medium	Low
(yellow)	III	High	Medium
(red)	IV	Extreme	High

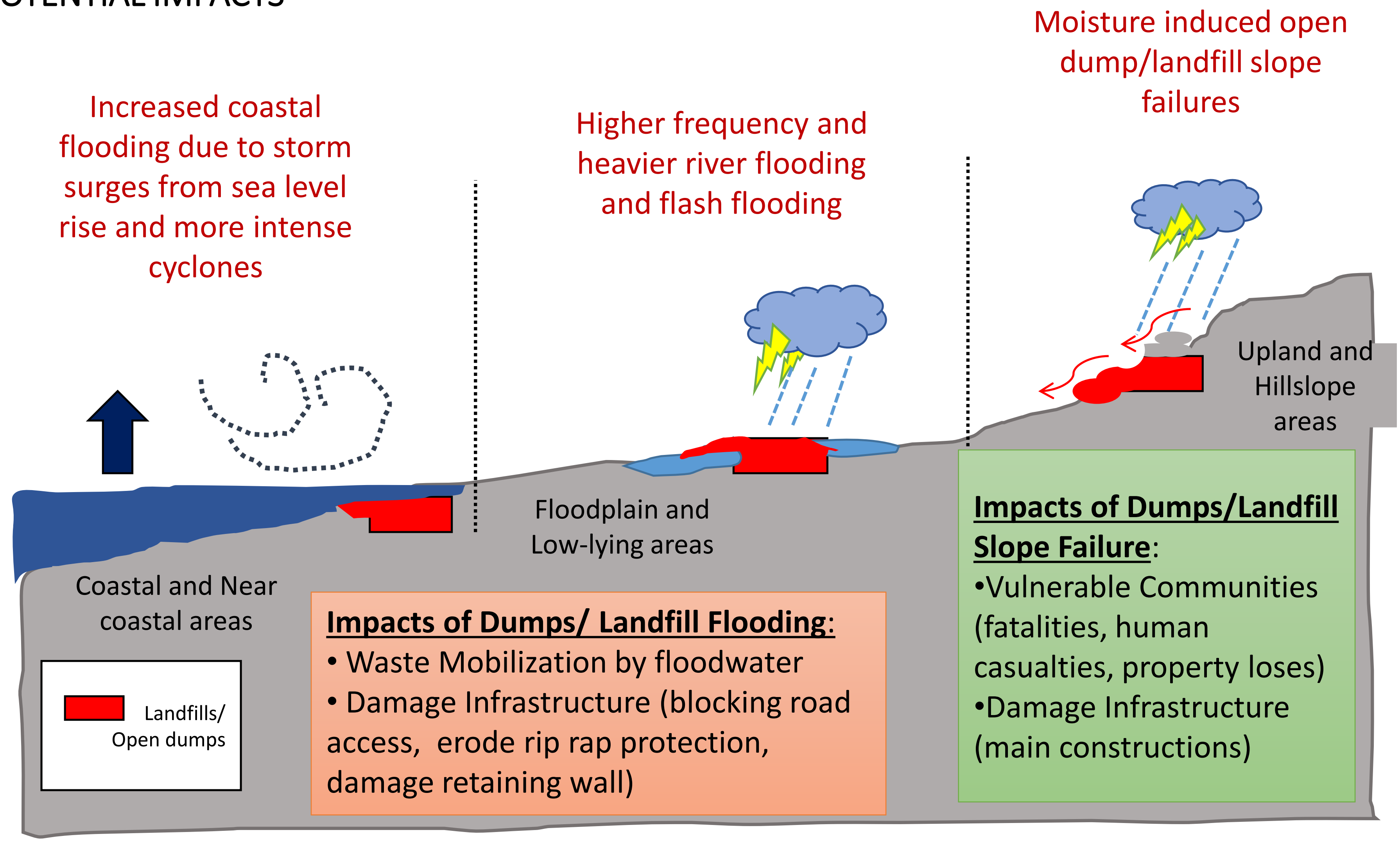


Relief and terrain of classes 3 and 4



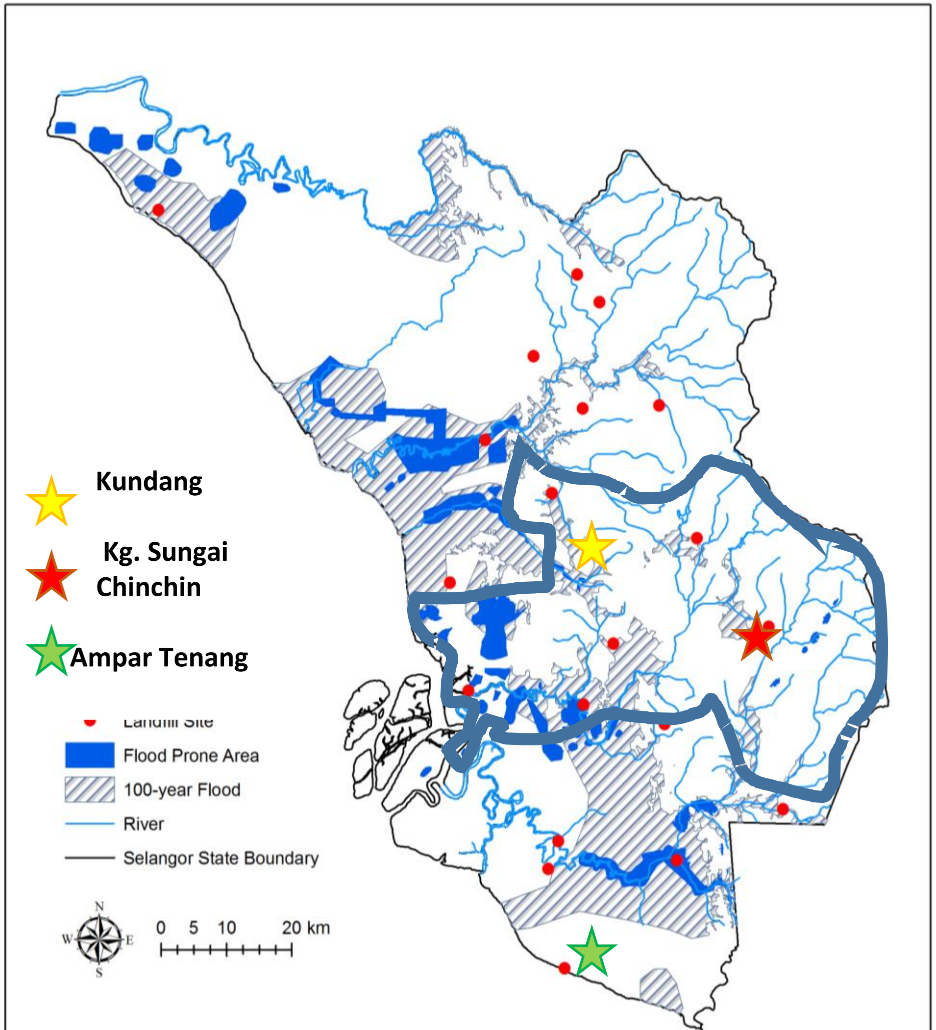
Emerging Hazards and Cascading Effects

POTENTIAL IMPACTS



Source: Nurul, Lim and Pereira 2013

Landfills and Emerging Hazards



Flood prone area and 100-year flood map with identified active and closed landfill sites in Selangor. (Sources: Flood map adapted from RFN-2 Report 2009, landfill sites from NAHRIM and NRE 2010) Source: Nurul, Lim and Pereira 2013

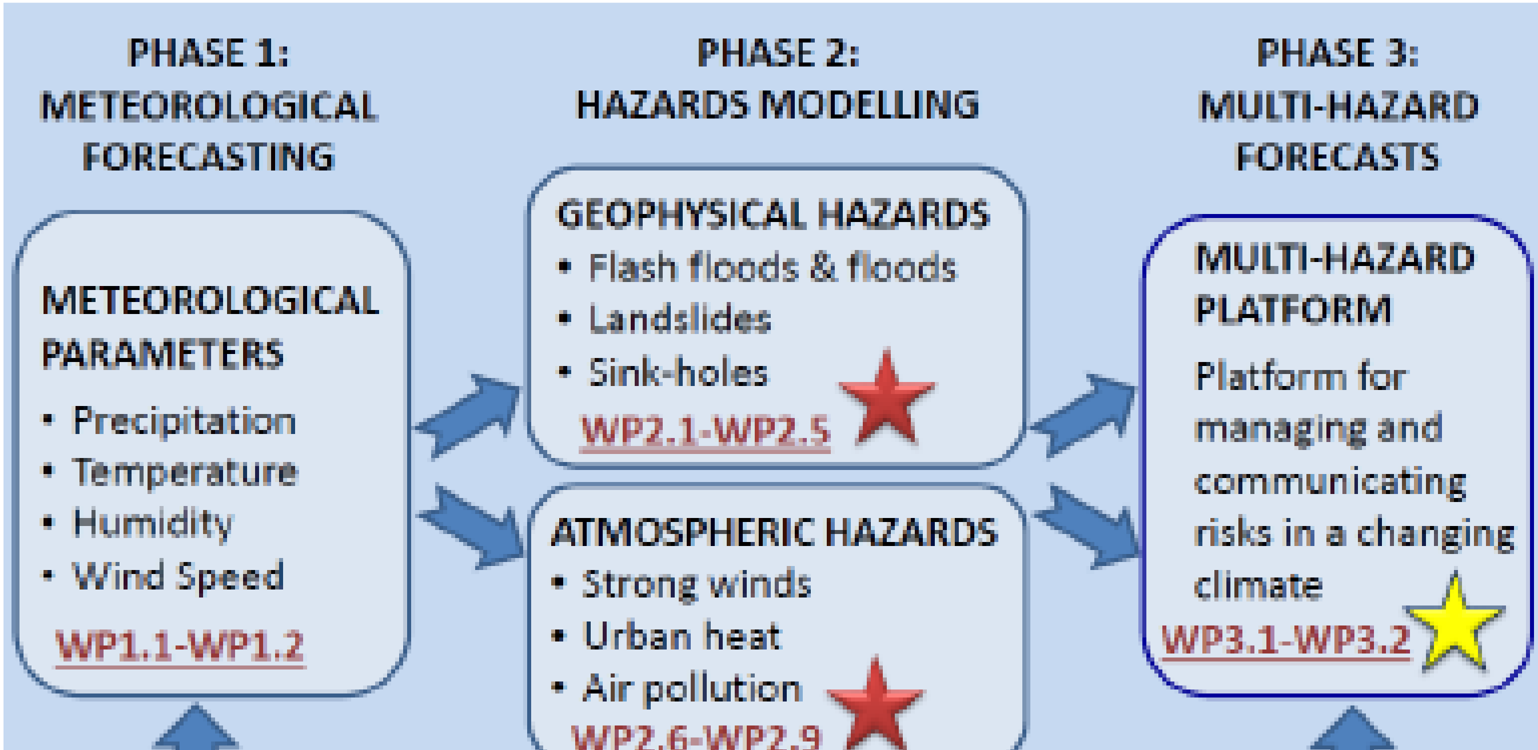
Exposure of Landfill Sites:

•Number of sites located within flood prone area: **4**

•Number of sites located within 100-year flood: **9**

•Number of sites potentially exposed to impacts from sea level rise: **3**

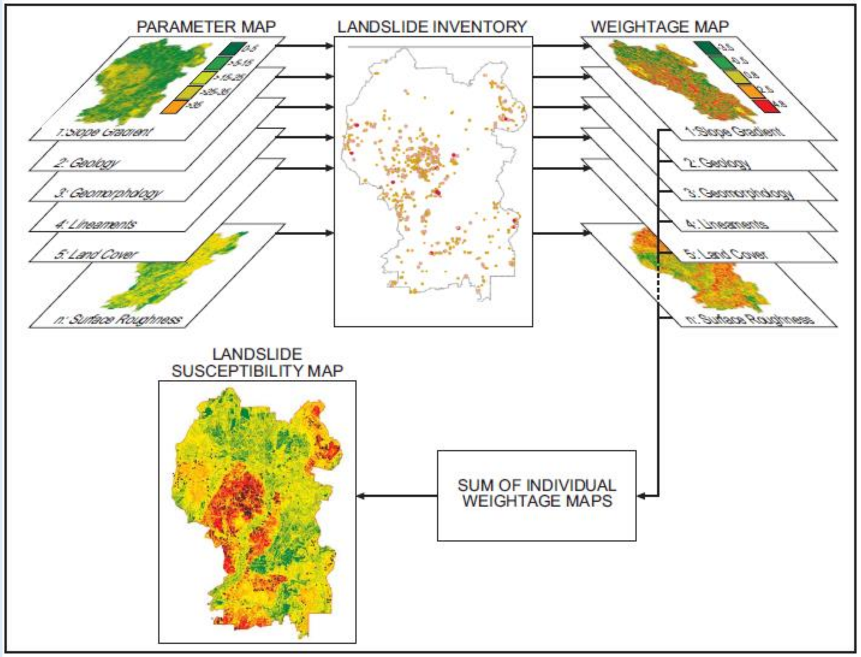
Disaster Resilient Kuala Lumpur



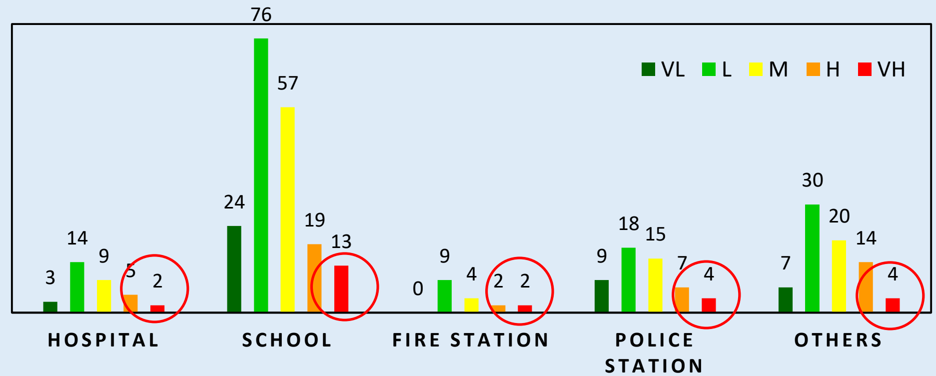
Local Weather Forecasts 300 m x 300 m	Hazard Forecasts	Disaster Alert	Public Warning

PROJECT LEADERS

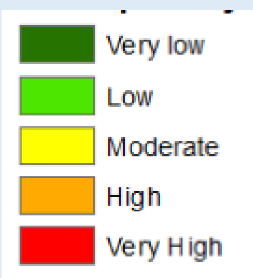
Prof. Joy Jacqueline Pereira, SEADPRI-UKM &
Prof. Lord Julian C.R. Hunt, University Of Cambridge



EXPOSURE OF CRITICAL FACILITIES

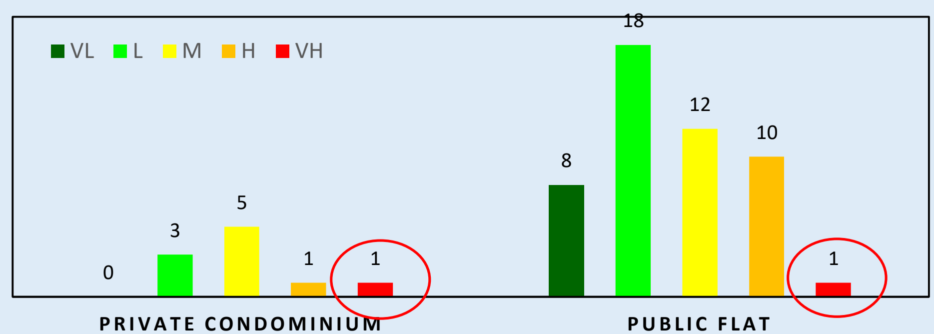


Susceptibility Level



Data source: JMG, DBKL, Landsat 8 and other public sources.
Prepared by: UM & SEADPRI-UKM, 2018

EXPOSURE OF PRIVATE CONDOMINIUM AND PUBLIC FLATS (PPA & PPR)



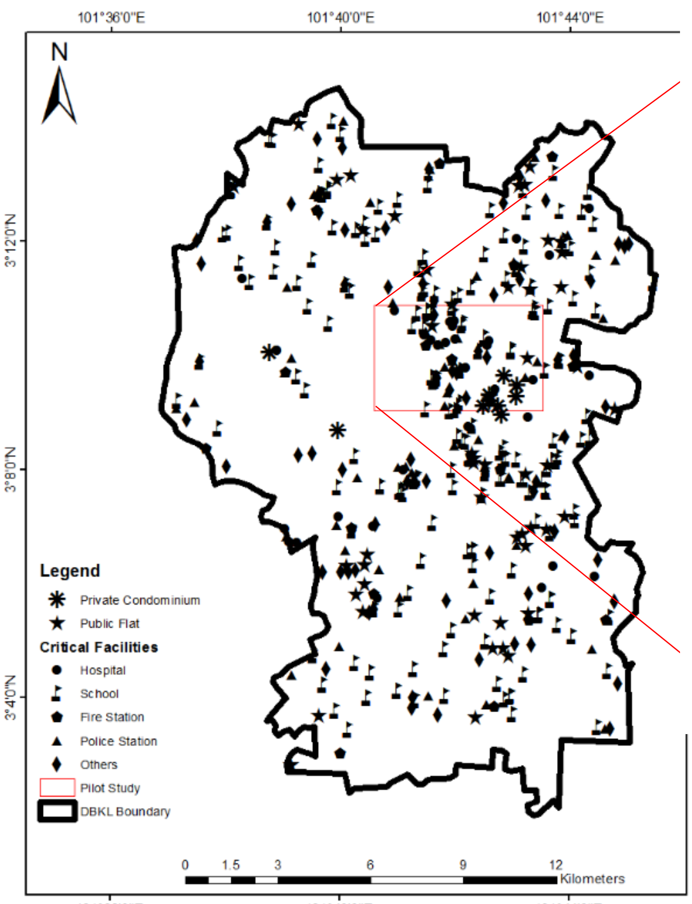
One Menerung, Bukit Bandaraya Kuala Lumpur

Pangsapuri PPR Bukit Jalil

Further work is ongoing to refine findings.

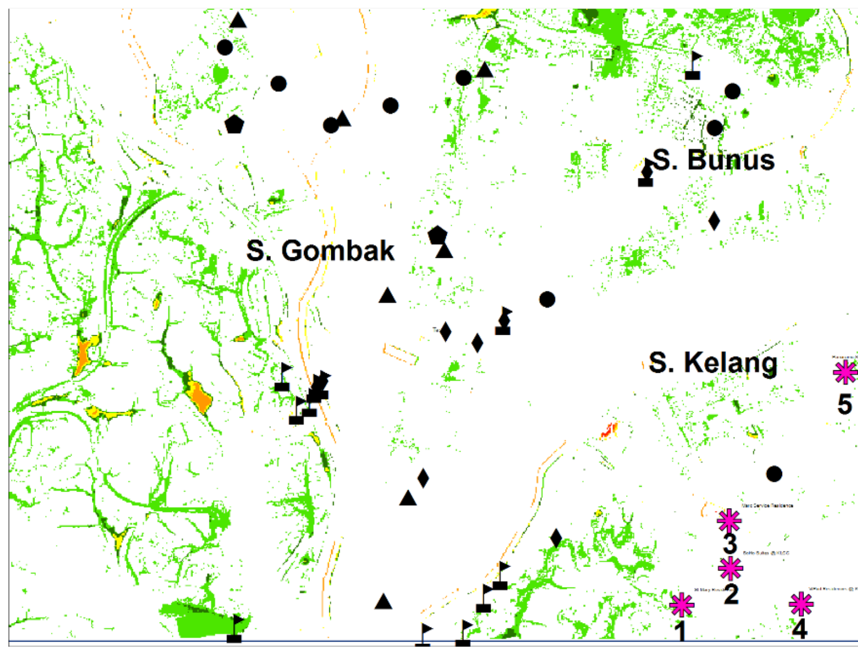
PILOT STUDY ON PLUVIAL FLOOD IN KUALA LUMPUR

Preliminary Findings



Private Condominium
Public Flat
Critical Facilities
Hospital
School
Fire Station
Police Station
Others
Pilot Study
DBKL Boundary

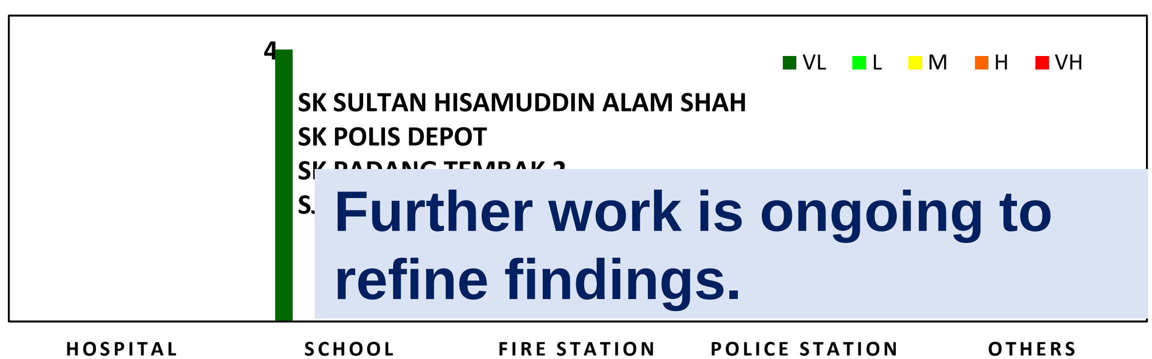
Data source: JPS, DBKL, and other public sources.
Prepared by: JBA & SEADPRI-UKM, 2018



Private Condominium
1 St Mary Residences
2 SoHo Suites @ KLCC
3 Marc Residences @ KLCC
4 ViPod Residence @ KLCC
5 Panorama KLCC

Levels
0.10 - 0.77
0.78 - 2.27
2.28 - 4.53
4.54 - 10.63
10.63 - 21.41

EXPOSURE OF CRITICAL FACILITIES IN PILOT STUDY



Further work is ongoing to refine findings.

Concluding Remarks

- **DRR is going to be increasingly challenging** with future climate extremes and change, limiting global warming to 1.5°C is vital;
- There is a need to advance area and **context specific actions for fast and slow onset hazards** as well as its cascading effects – to identify local level limits to adaptation;
- Scale of science information (based on natural boundaries) needs to match the **decision-making scale at the local level**;
- Scientific inputs need to be **synchronised with local administrative processes** (e.g. local plan reviews etc.);
- Establishment of **local knowledge networks** to provide sustained support to local level decision-makers – e.g. **ASM DRR Research Alliance Committee**, to promote university led, place-based research consortiums;
- Promote **transparency in science** (e.g. hazard modelling) and **public access to findings** through web-based products.

"Those who have the privilege to know have the duty to act".

Albert Einstein

THANK YOU!

seadpri
southeast asia disaster prevention research institute

Asian Network on
Climate Science and Technology
(ANCST)