

UNDERSTANDING AND NAVIGATING PHIVOLCS HAZARD MAPS

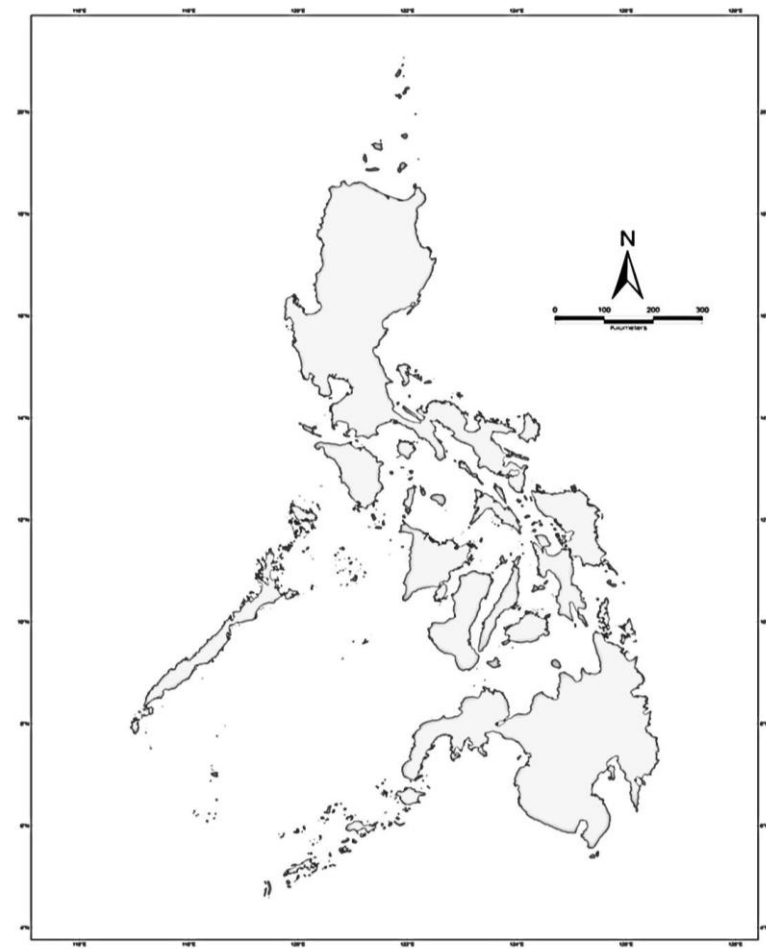
09 December 2025

Jeffrey S. Perez

Supervising Science Research Specialist / Geologist

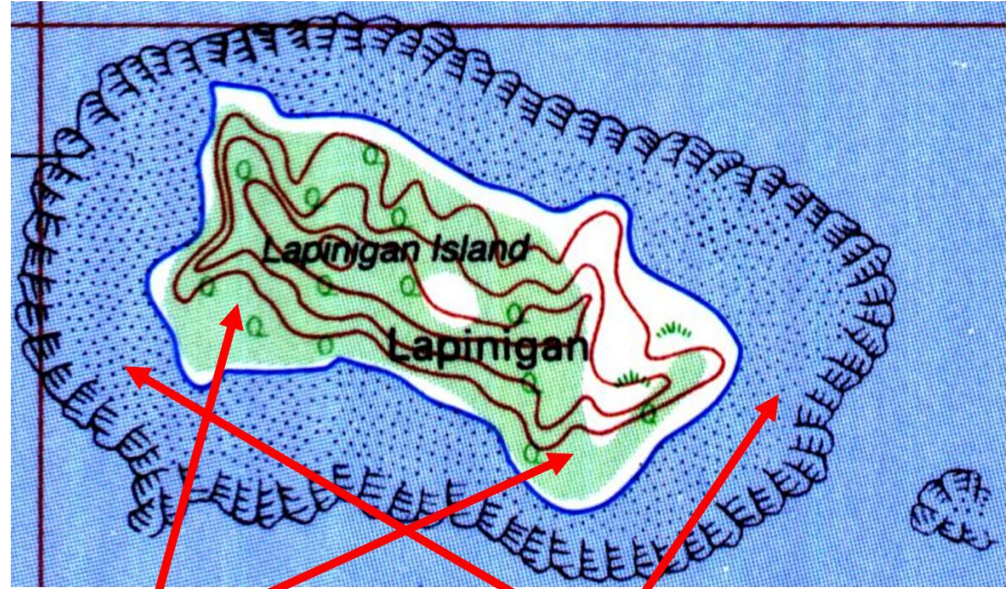


Basic Map Reading



What is a map?

- A map shows:
 - locations or positions of existing features



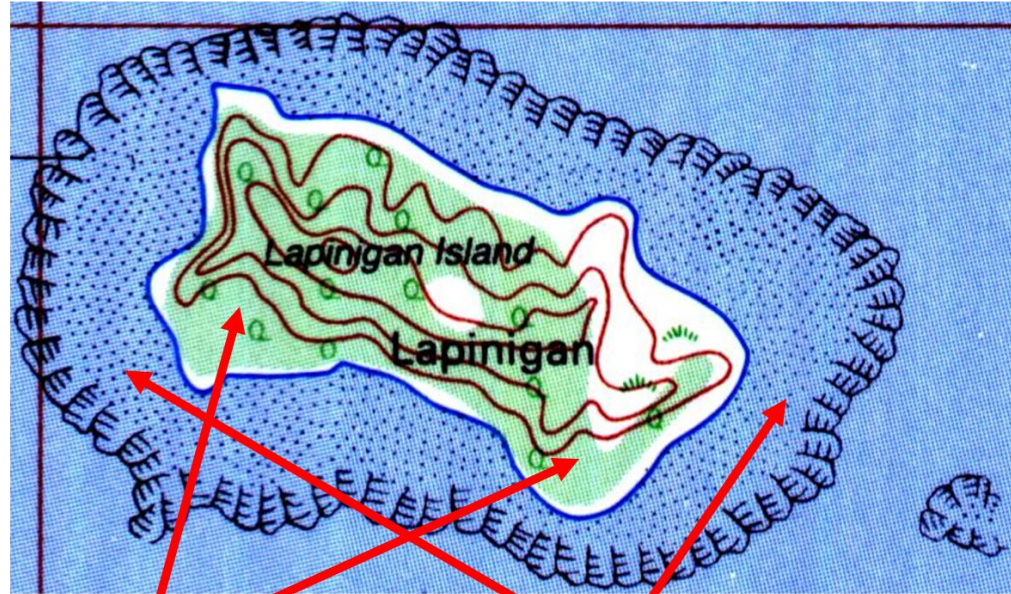
Orchard/forest is found
in Lapinigan Island

Coral reefs surround
Lapinigan Island



What is a map?

- A map shows:
 - locations or positions of existing features



Orchard/forest is found
in Lapinigan Island

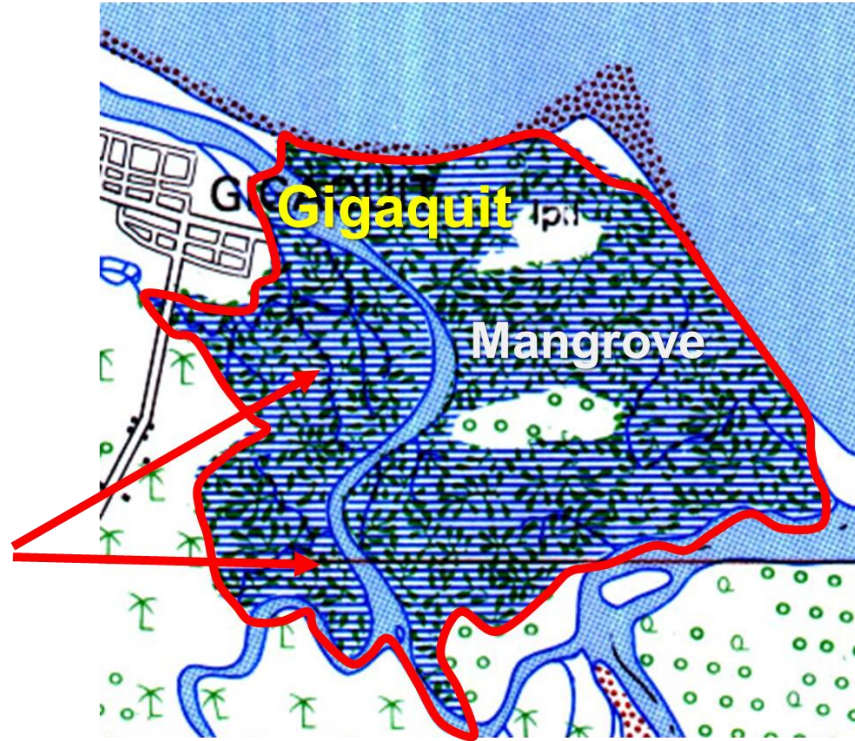
Coral reefs surround
Lapinigan Island



What is a map?

- A map shows:
 - areas/coverages/
extent

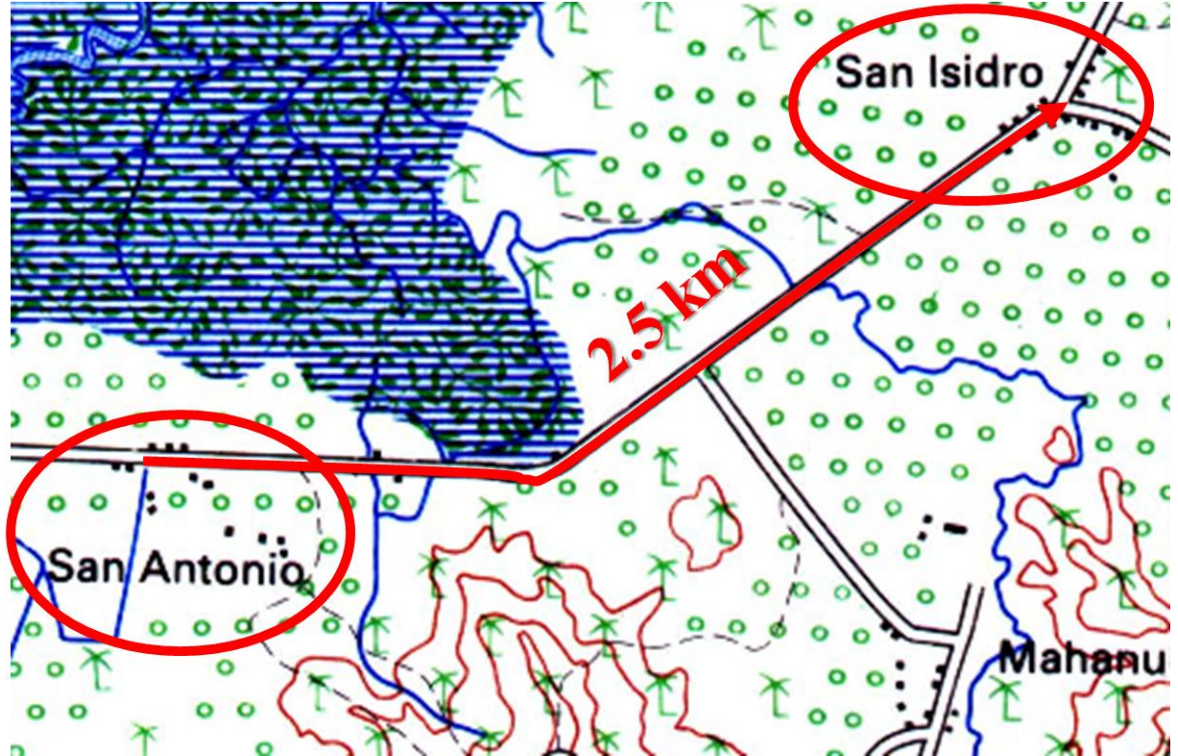
Area in Gigaquit
covered by
nipa/mangrove



What is a map?

- A map shows:
 - distances

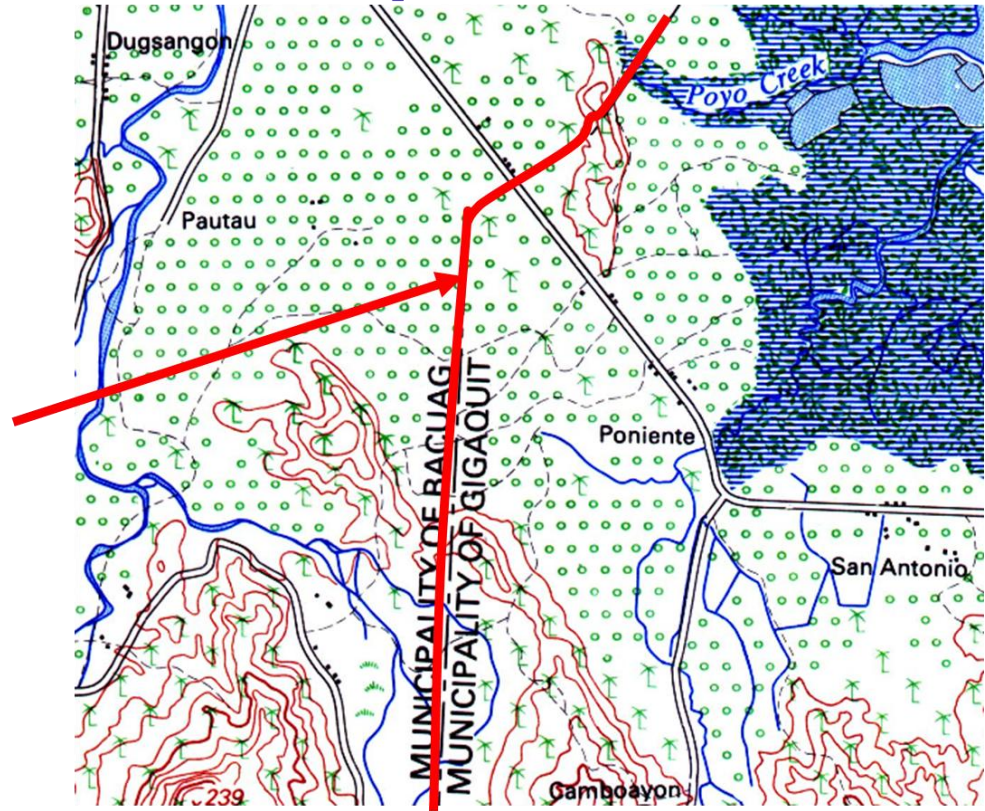
Distance from
San Antonio to
San Isidro



What is a map?

- A map shows:
 - boundaries

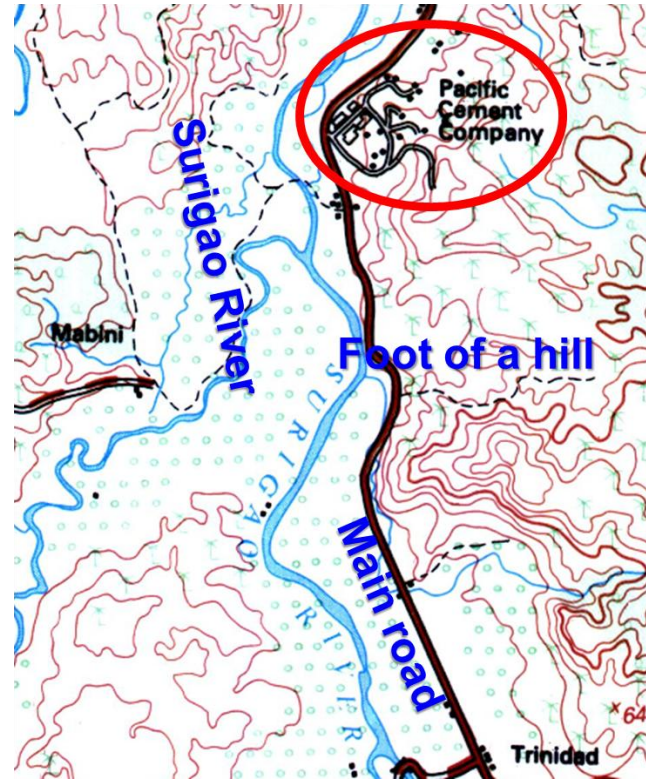
Boundary between
the municipalities of
Bacuag and Gigaquit



What is a map?

- A map shows:
 - ground features or characteristics

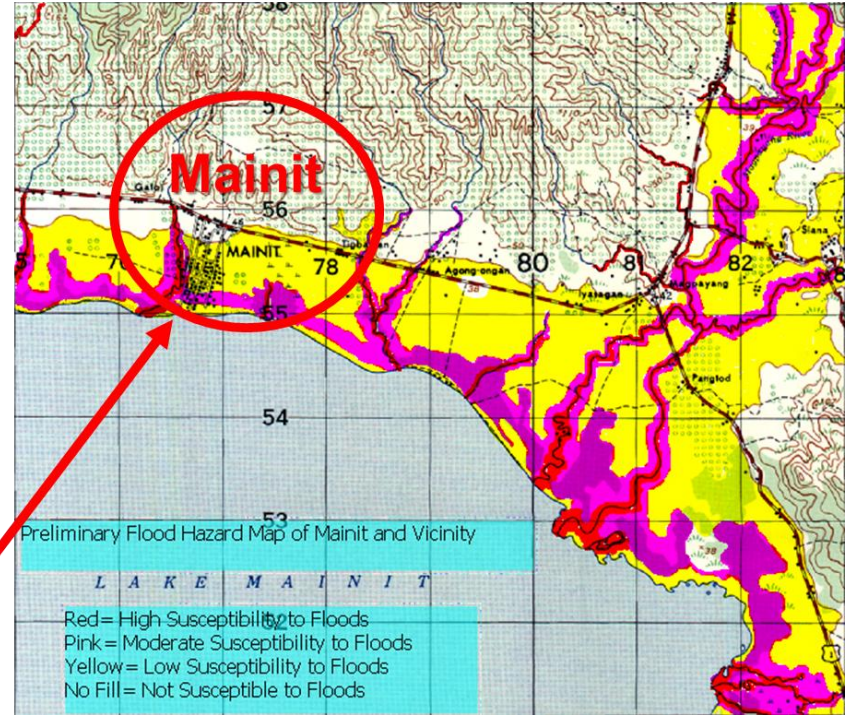
Pacific cement company is along the national road and close to Surigao River



What is a map?

- A map shows:
 - facts, events, trend, prediction, possibilities and other phenomena

The municipality of Mainit has low to moderate susceptibility to flood hazard.

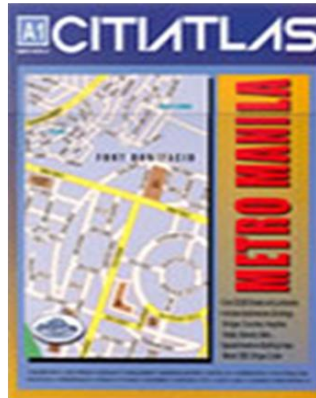


What is a map?

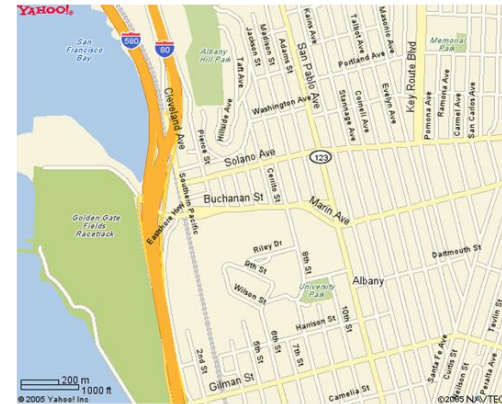
- is a picture or representation of the Earth's surface, showing how things are related to each other by distance, direction, and size.



sketch of a trail



street or
vicinity map

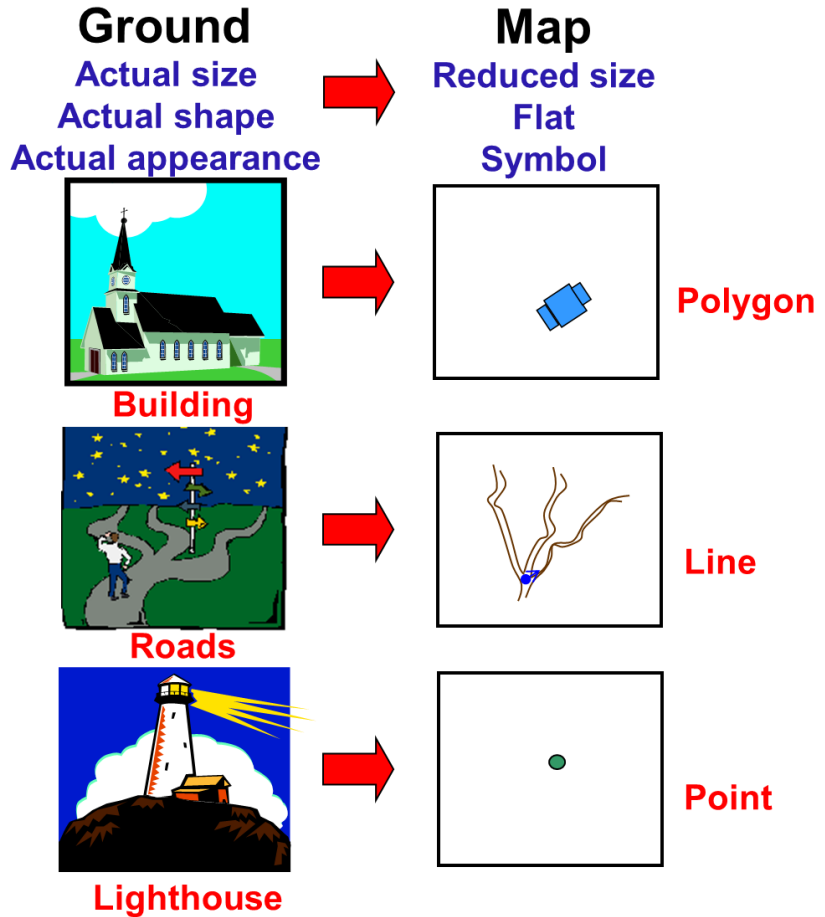


road maps



What is a map?

- In a map, real world features are represented:
 - graphically by using symbols
 - on a plane surface
 - at their correct positions
 - at a reduced scale



Why make a MAP?

- made for various reasons ⇒ resulting to varying contents
- example: General Purposes ⇒ shows roads, towns, cities, rivers, lakes, parks, and political boundaries (local, regional)

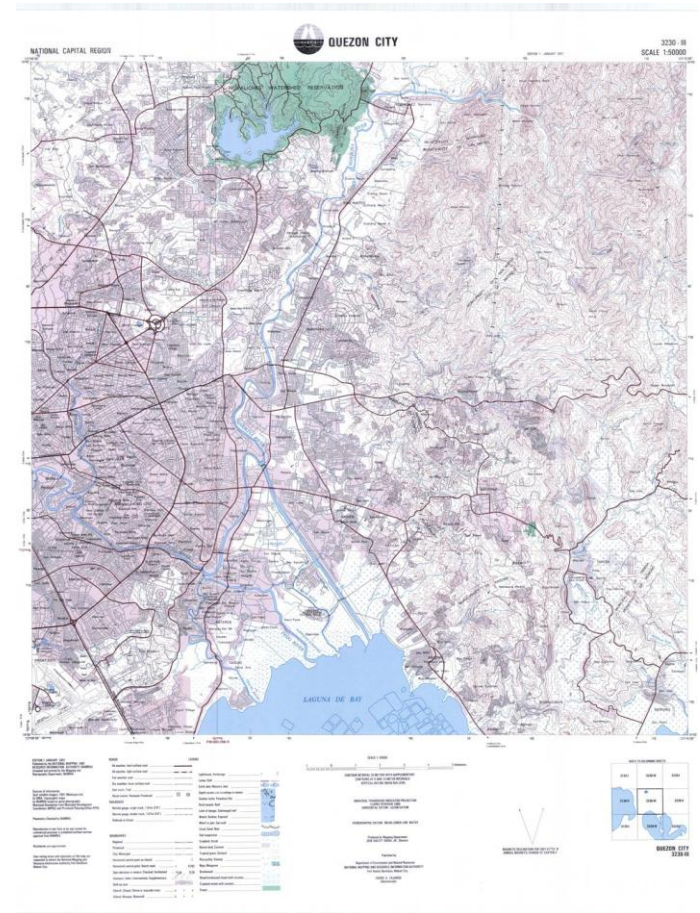
Where do we use Maps?

- national & local government administration
- military applications
- tourism & recreation
- planning (urban & commercial planning)
- facility management (water, electric, telephone)
- land registration
- education
- hazard studies & disaster management

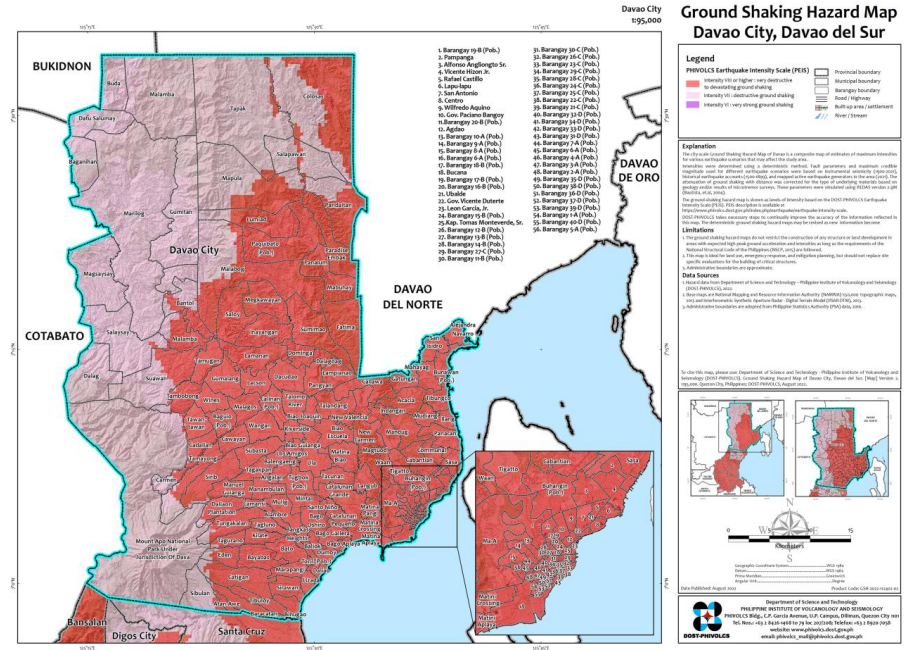


Types of Maps

- ❑ Topographic Map
- ❑ Planimetric Map
- ❑ Administrative Boundary Map
- ❑ Land Use Map
- ❑ Land Cover Map
- ❑ Nautical Chart
- ❑ Cadastral Map
- ❑ Etc.

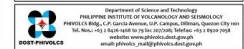
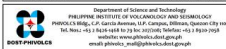


Ground Shaking Hazard Map

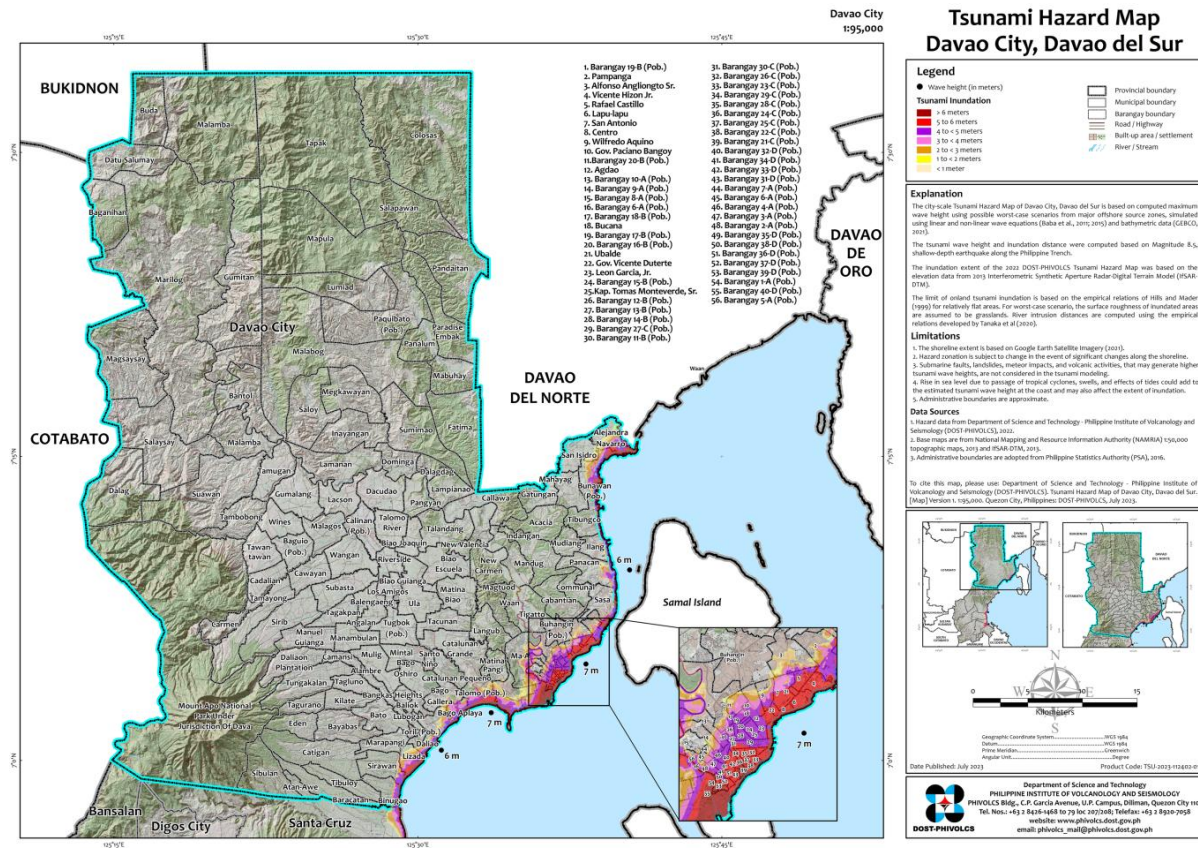


<https://gisweb.phivolcs.dost.gov.ph/gisweb/>

Earthquake-Induced Hazard Map



<https://gisweb.phivolcs.dost.gov.ph/gisweb/>

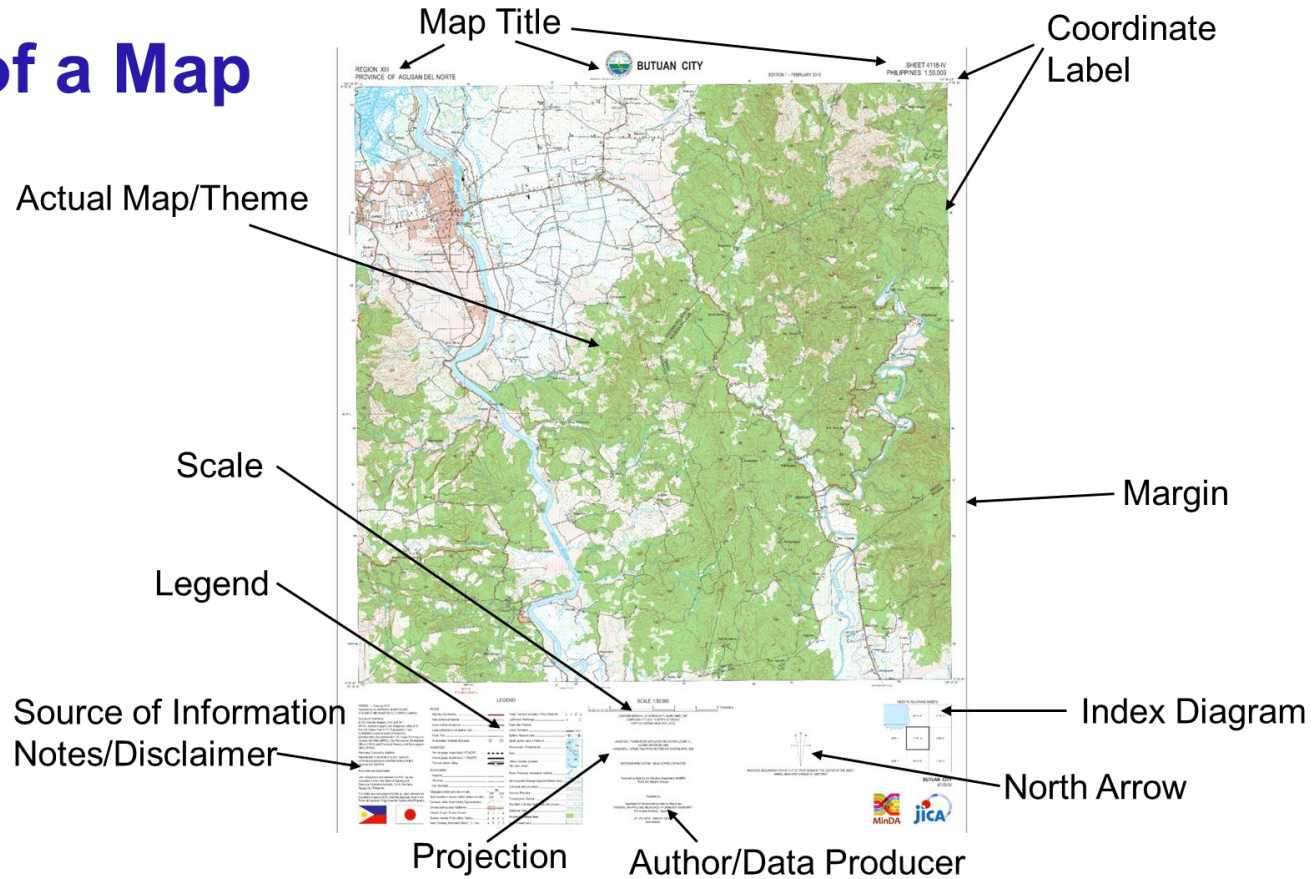


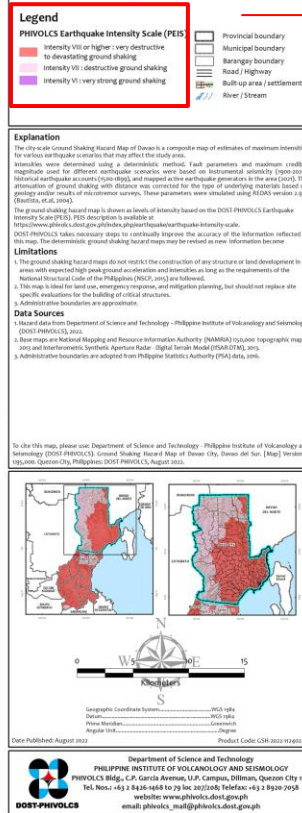
Tsunami Hazard Map

<https://gisweb.phivolcs.dost.gov.ph/gisweb/>



Parts of a Map

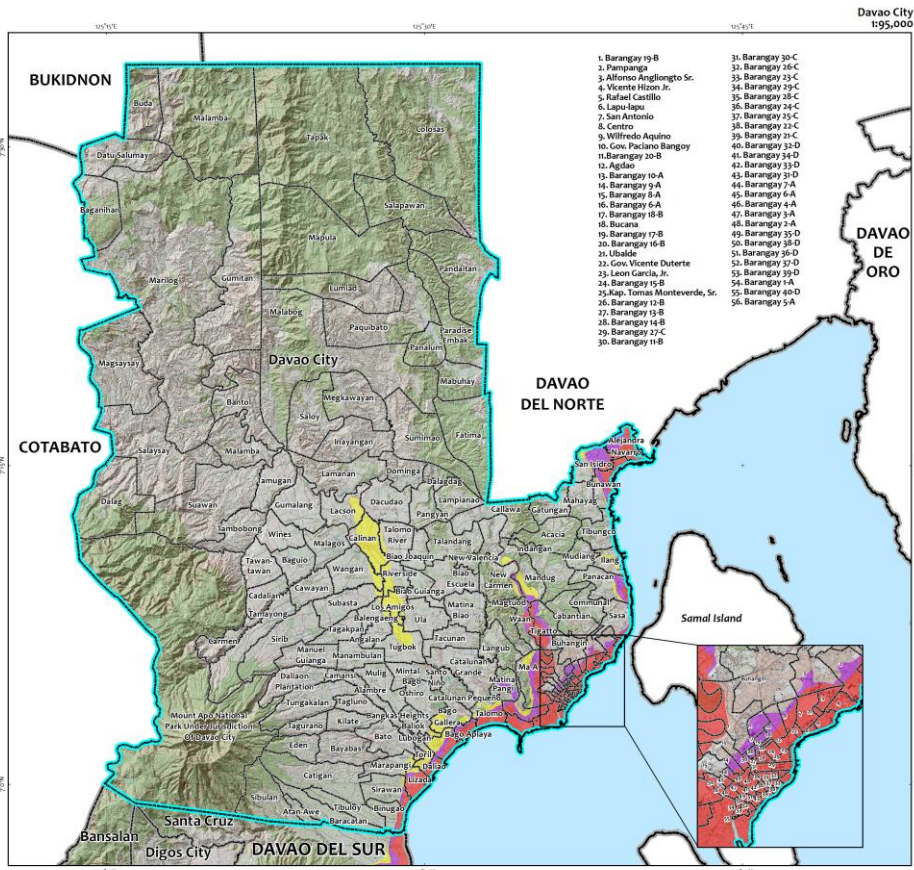




Legend

PHIVOLCS Earthquake Intensity Scale (PEIS)

-  Intensity VIII or higher : very destructive to devastating ground shaking
-  Intensity VII : destructive ground shaking
-  Intensity VI : very strong ground shaking



Davao City
1:95,000

Liquefaction Hazard Map Davao City, Davao del Sur



Explanation

The Davao Liquefaction Hazard Map of Davao City, Davao del Sur was based on geology, presence of active faults, historical accounts of liquefaction, geomorphology and hydrology of the area. The presence of Liquefaction hazard does not restrict construction of any structure and development, however, proper engineering consideration must be taken into account (e.g. strict adherence to the National Building Code of the Philippines).

DOST-PHIVOLCS takes the necessary steps to continually improve the accuracy of the Liquefaction information reflected in this map. The Liquefaction Hazard Map may be revised as new information becomes available.

Limitations

1. All hazard zone boundaries are approximate and provisional.

2. This map is semi-detailed and may be used for susceptibility zoning for regional and local developments, emergency response and mitigation, and planning. Site specific evaluation is needed for construction of major structures and facilities.

3. Administrative boundaries are approximate.

4. Coastal boundaries of the hazard are based on the latest location of the coast as shown in the most recent Google Satellite imagery available in the International Synthetic Aperture Radar-Digital Terrain Model (DSAT-DEM). The boundaries may change through time, as coasts are continuously subjected to processes that may contribute to their erosion or aggradation.

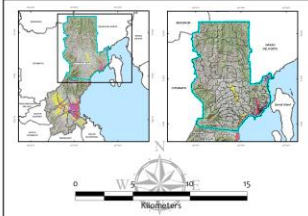
Data Sources

1. Hazard data from Department of Science and Technology/Philippine Institute of Volcanology and Seismology (DOST-PHIVOLCS), 2004.

2. Base maps are National Mapping and Information Authority (DMAT), 2000s topographic maps, 2015, and Interferometric Synthetic Aperture Radar-Digital Terrain Model (DSAT-DEM), 2015.

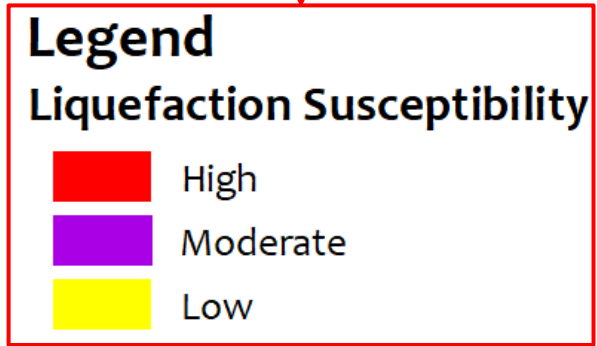
3. Administrative boundaries are adopted from Philippine Statistics Authority (PSA), 2016.

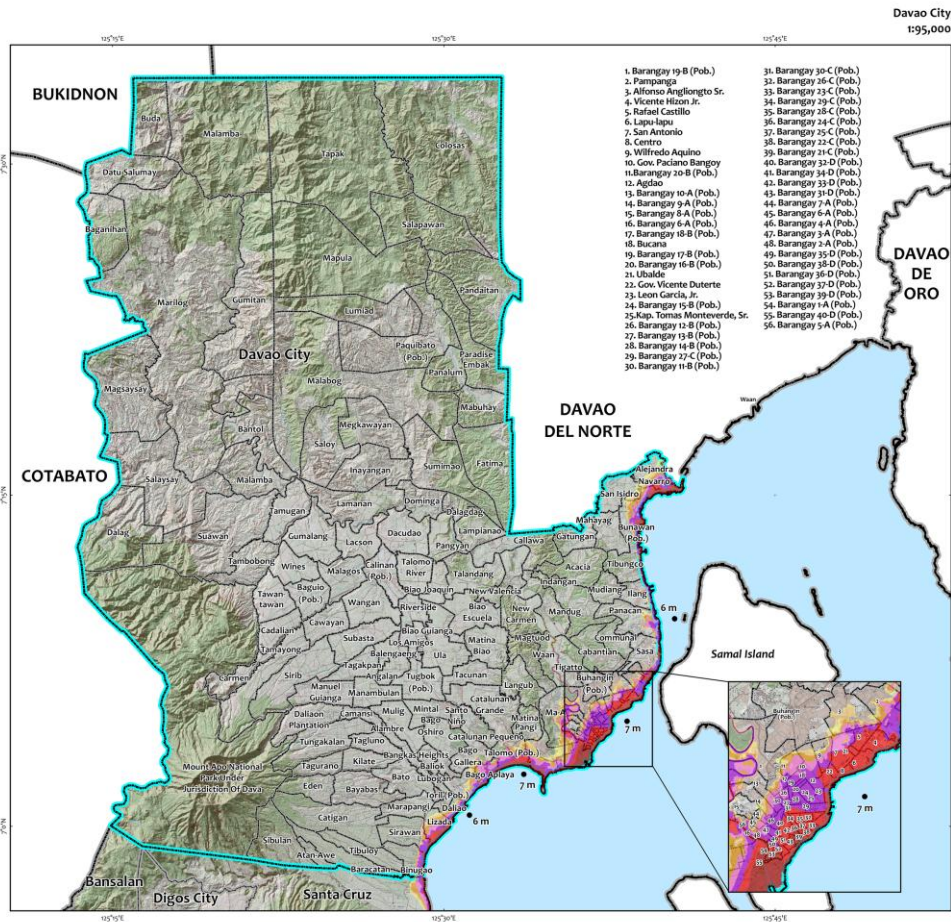
To use this map, please use Department of Science and Technology/Philippine Institute of Volcanology and Seismology (DOST-PHIVOLCS) Liquefaction Hazard Map of Davao City, Davao del Sur [Map Version 1.0, 2020, Davao City, Philippines: DOST-PHIVOLCS, November 2020].



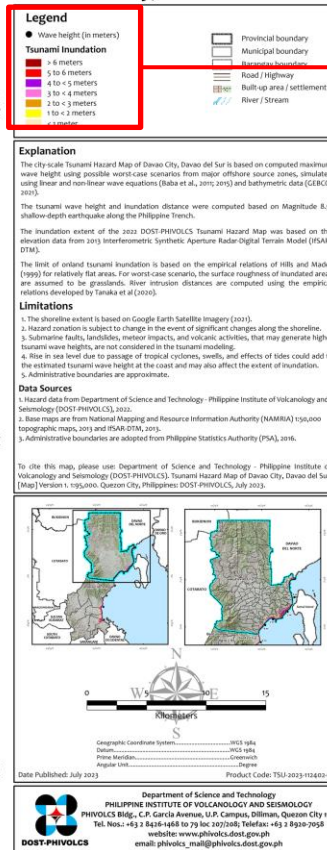
Geographic Coordinate System: PHIVOLCS 1983
Datum: PHIVOLCS 1983
Projection: UTM
Scale: 1:95,000
Product Code: (S) 001-10000-01

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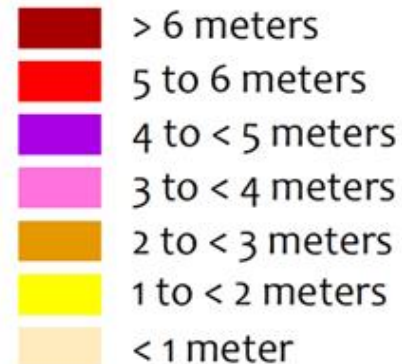
Tsunami Hazard Map Davao City, Davao del Sur



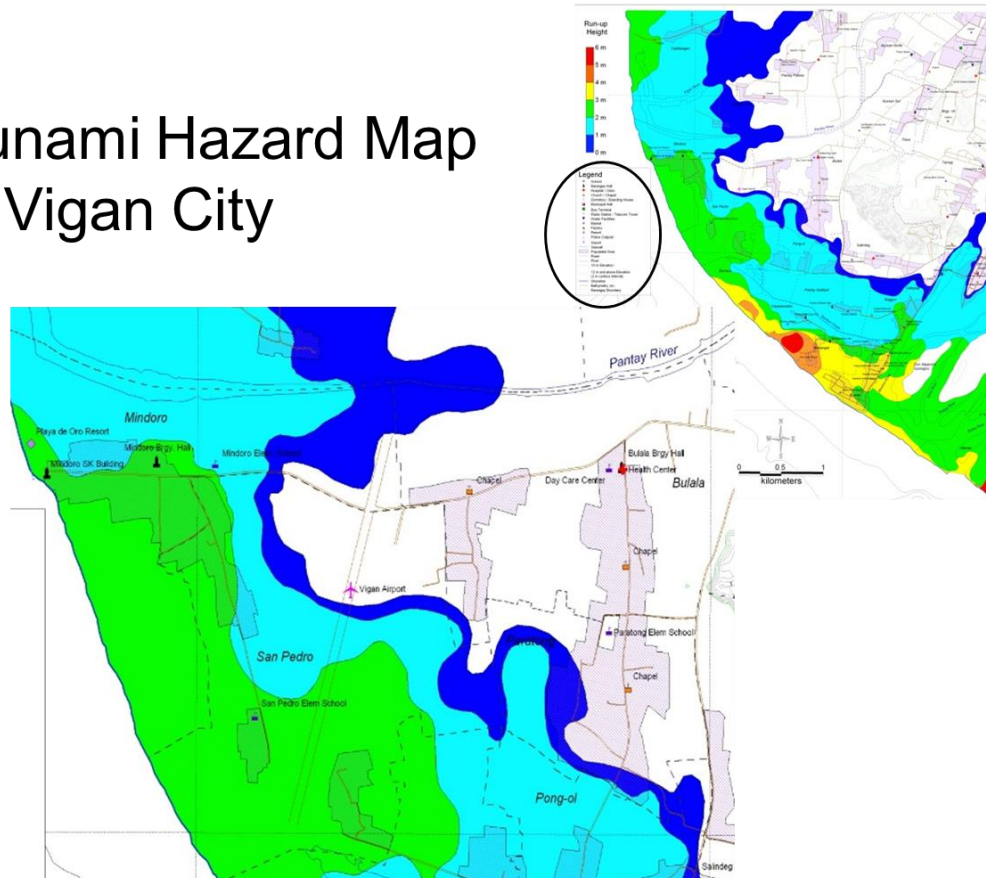
Legend

● Wave height (in meters)

Tsunami Inundation



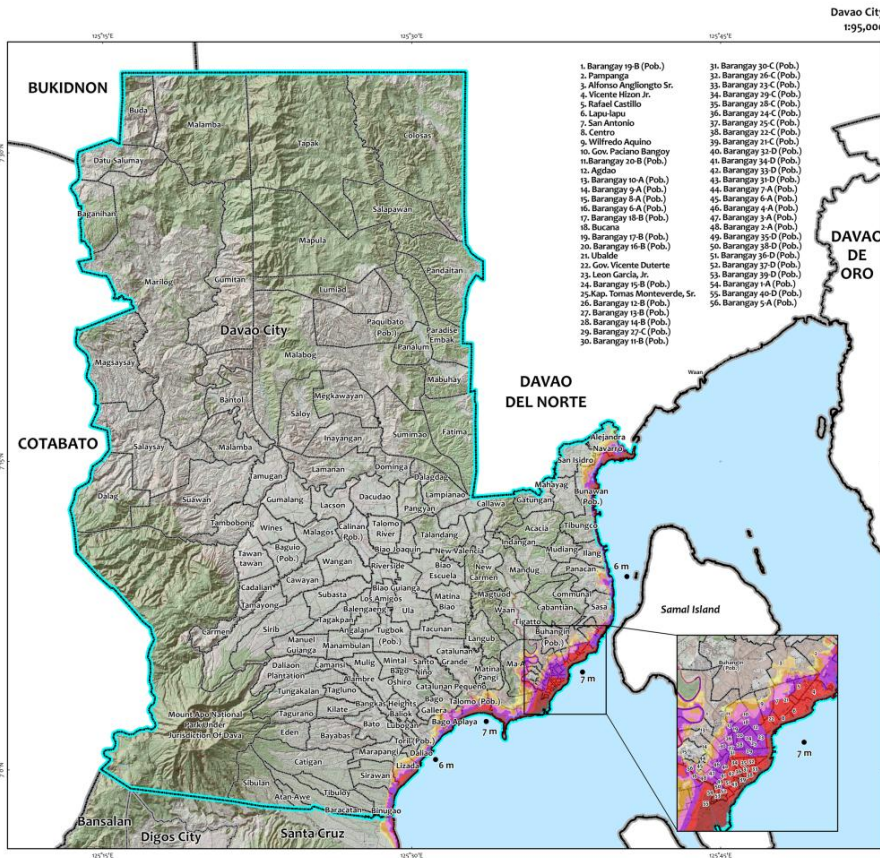
Tsunami Hazard Map for Vigan City



Legend

- School
- Barangay Hall
- Hospital / Clinic
- Church / Chapel
- Dormitory / Boarding House
- Municipal Hall
- Bus Terminal
- Radio Station / Telecom Tower
- Water Facilities
- Market
- Factory
- Resort
- Police Outpost
- Airport
- Seawall
- Populated Area
- Road
- River
- 10 m Elevation
- 12 m and above Elevation (2 m contour interval)
- Shoreline
- Bathymetry (m)
- Barangay Boundary





Tsunami Hazard Map Davao City, Davao del Sur

Explanation / Limitations / Data Sources

Explanation

The city-scale Tsunami Hazard Map of Davao City, Davao del Sur is based on computed maximum wave height using possible worst-case scenarios from major offshore source zones, simulated using linear and non-linear wave equations (Baba et al., 2011; 2015) and bathymetric data (CEBCO, 2021).

The tsunami wave height and inundation distance were computed based on Magnitude 8.5, shallow-depth earthquake along the Philippine Trench.

The inundation extent of the 2022 DOST-PHIVOLCS Tsunami Hazard Map was based on the elevation data from 2013 Interferometric Synthetic Aperture Radar-Digital Terrain Model (IFSAR-DTM).

The limit of onland tsunami inundation is based on the empirical relations of Hills and Mader (1999) for relatively flat areas. For worst-case scenario, the surface roughness of inundated areas are assumed to be grasslands. River intrusion distances are computed using the empirical relations developed by Tanaka et al (2020).

Limitations

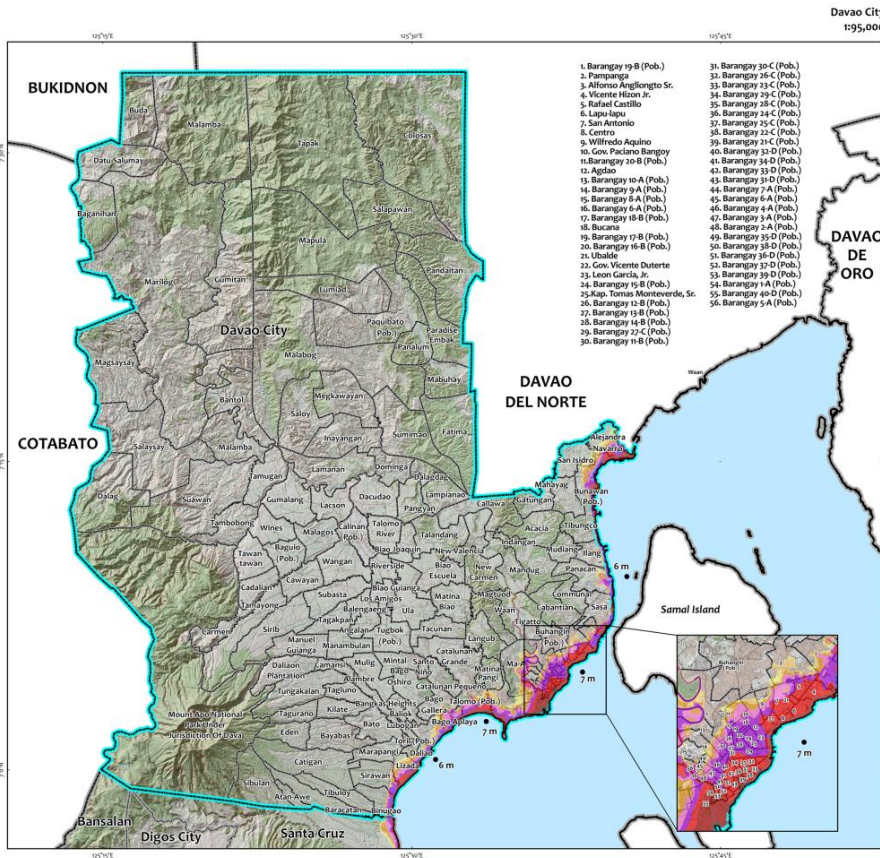
- The shoreline extent is based on Google Earth Satellite Imagery (2021).
- Hazard zonation is subject to change in the event of significant changes along the shoreline.
- Submarine faults, landslides, meteor impacts, and volcanic activities, that may generate higher tsunami wave heights, are not considered in the tsunami modeling.
- Rise in sea level due to passage of tropical cyclones, swells, and effects of tides could add to the estimated tsunami wave height at the coast and may also affect the extent of inundation.
- Administrative boundaries are approximate.

Data Sources

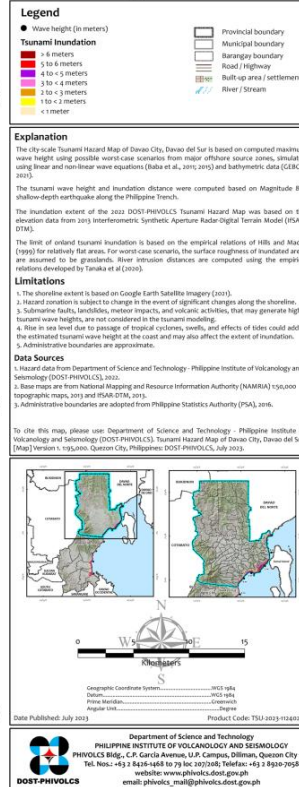
- Hazard data from Department of Science and Technology - Philippine Institute of Volcanology and Seismology (DOST-PHIVOLCS), 2022.
- Base maps are from National Mapping and Resource Information Authority (NAMRIA) 1:50,000 topographic maps, 2013 and IFSAR-DTM, 2013.
- Administrative boundaries are adopted from Philippine Statistics Authority (PSA), 2016.

To cite this map, please use: Department of Science and Technology - Philippine Institute of Volcanology and Seismology (DOST-PHIVOLCS). Tsunami Hazard Map of Davao City, Davao del Sur. [Map] Version 1: 1:95,000. Quezon City, Philippines: DOST-PHIVOLCS, July 2023.

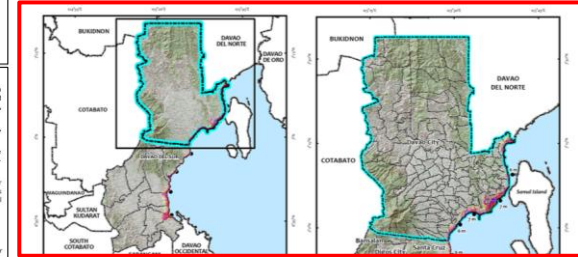


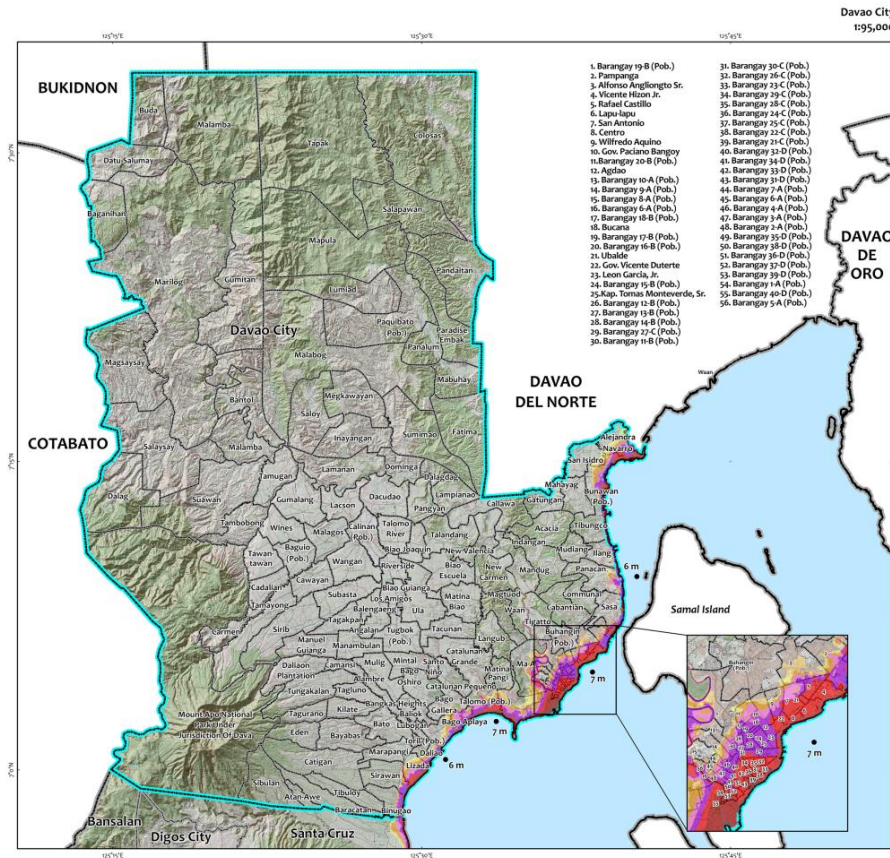


Tsunami Hazard Map Davao City, Davao del Sur



Index Map





Tsunami Hazard Map Davao City, Davao del Sur



Explanation

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The tsunami wave height and inundation distance were computed based on Magnitude 8.5, shallow-depth earthquake along the Philippine Trench.

The inundation extent of the 2012 DOST-PHIVOLCS Tsunami Hazard Map was based on the elevation data from 2013 interferometry, Synthetic Aperture Radar Digital Terrain Model (RSAT-DTM).

The test of inland tsunami inundation is based on the empirical relations of Hibi and Mader (1990) for relatively flat areas. For worst-case scenarios, the surface roughness of inundated areas are assumed to be grasslands. River intrusion distances are computed using the empirical relations developed by Tanaka et al. (2010).

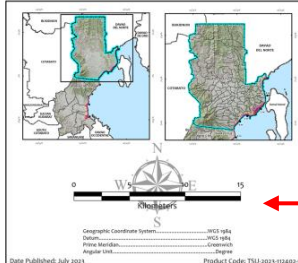
Limitations

- The shoreline extent is based on Google Earth Satellite Imagery (2015).
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- Due to sea level rise due to climate change, the effects of tides could add to the estimated tsunami wave height at the coast and may also affect the extent of inundation.
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- Administrative boundaries are adopted from Philippine Statistics Authority (PSA), 2016.

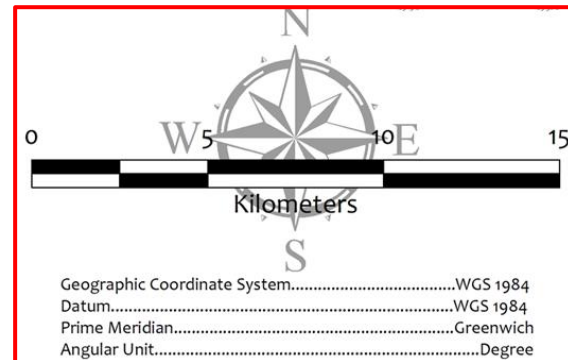
To cite this map, please use: Department of Science and Technology - Philippine Institute of Volcanology and Seismology (DOST-PHIVOLCS). Tsunami Hazard Map of Davao City, Davao del Sur. [Map] version 1. 195,000. Quezon City, Philippines: DOST-PHIVOLCS, July 2013.



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North Arrow / Scale bar



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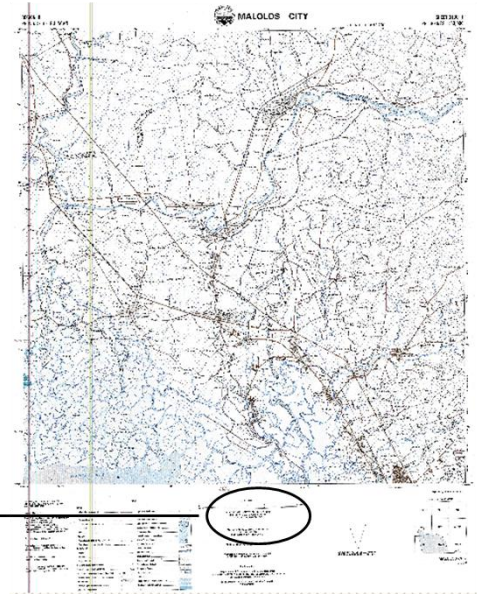
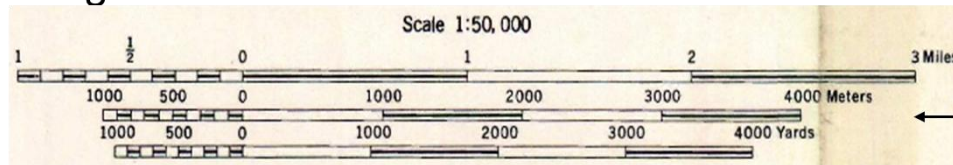


Department of Science and Technology
Philippine Institute of Volcanology and Seismology

Parts of a Map

Scale

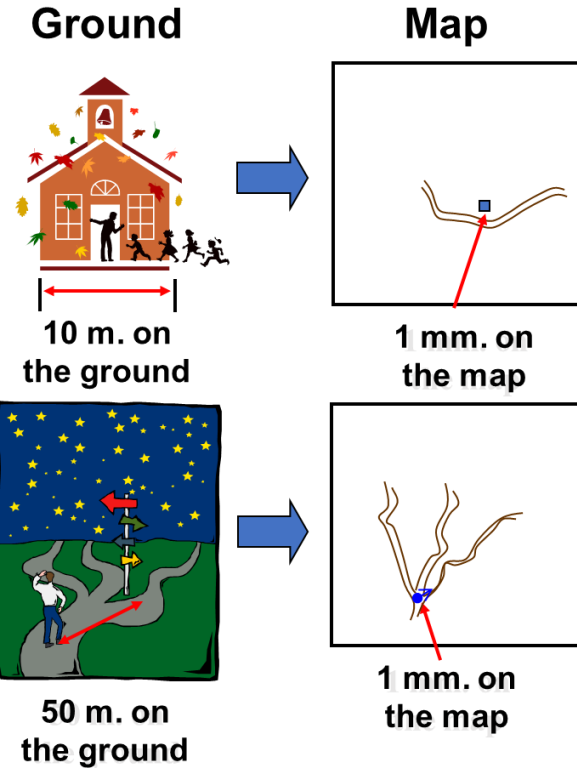
- Scale – the relationship between a distance on the map and the true distance on the ground measured in the same unit. It shows how much you would have enlarged your map in relation to the actual size of features on the ground.
- Small (e.g., 1:250,000) vs. large (e.g., 1:10,000)
- Smaller scale means:
 - Fewer features
 - Smoother features
 - Combining features
 - Displacing features



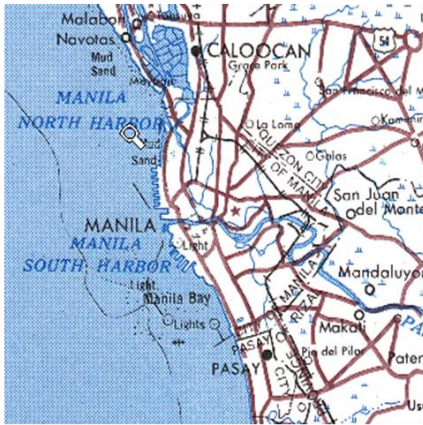
Parts of a Map

Scale

- 1:10,000
 - 1 mm : 10,000 mm
 - 1 mm : 10 m
 - 1 cm : 10,000 cm
 - 1 cm : 100 m
- 1:50,000
 - 1 mm : 50,000 mm.
 - 1 mm : 50 m
 - 1 cm : 500 m



S
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1:250,000 Topographic Map



Smaller
Scale



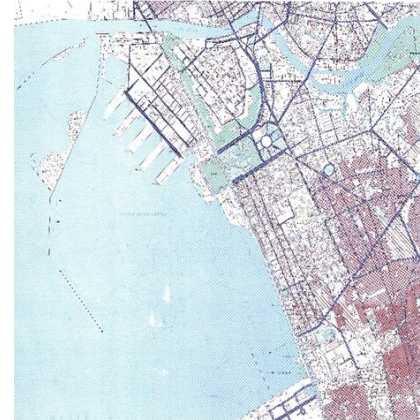
1:50,000 Topographic Map



Larger
Scale

Map Scale

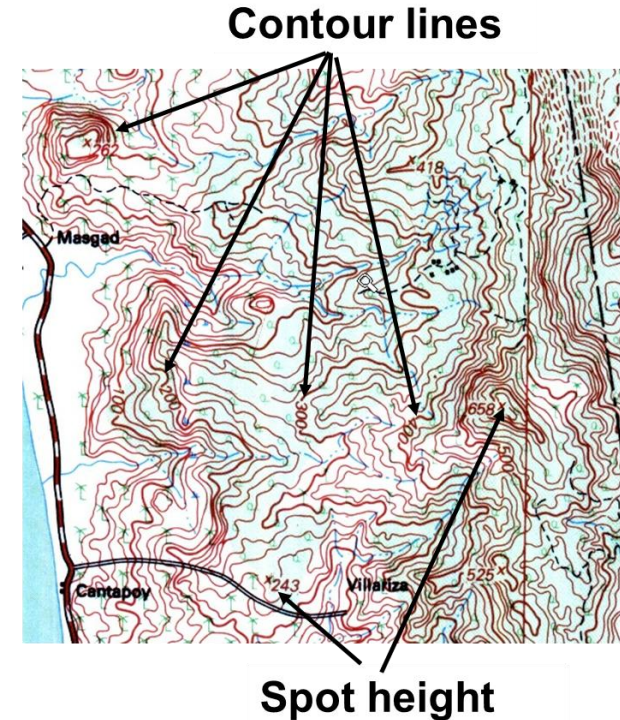
1:10,000 Planimetric Map



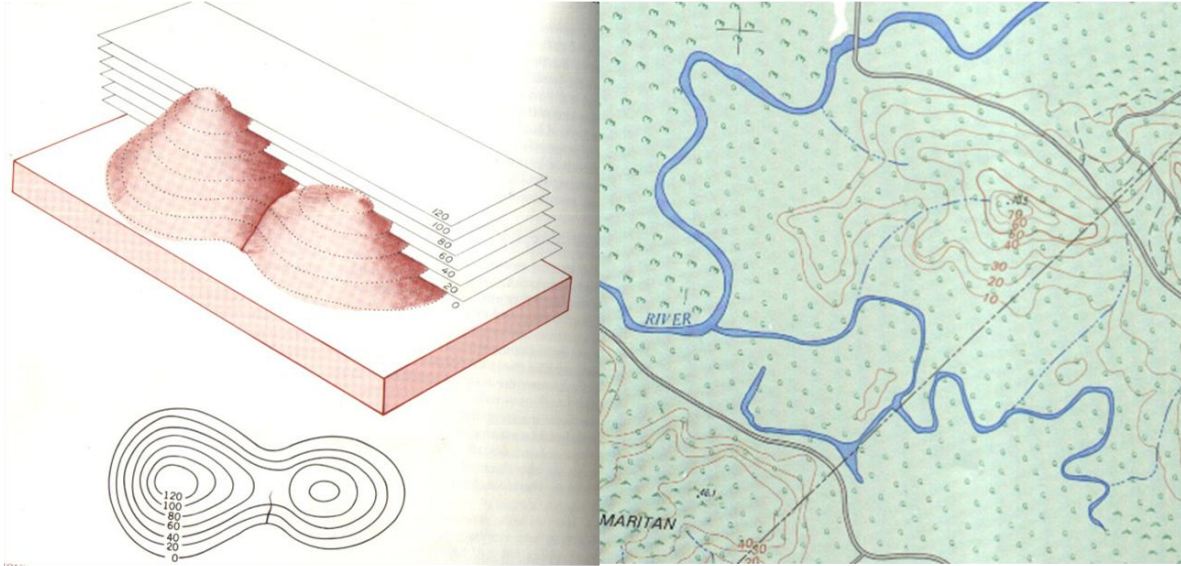
How to Read Topographic Map?

Thin brown to red lines represent contours or points of similar elevation. The closer they are together, the steeper the terrain.

- **Steep slopes** - contours are closely spaced
- **Gentle slopes** - contours are less closely spaced
- **Valleys** - contours form a V-shape pointing up the hill - these V's are always an indication of a drainage path which could also be a stream or river.



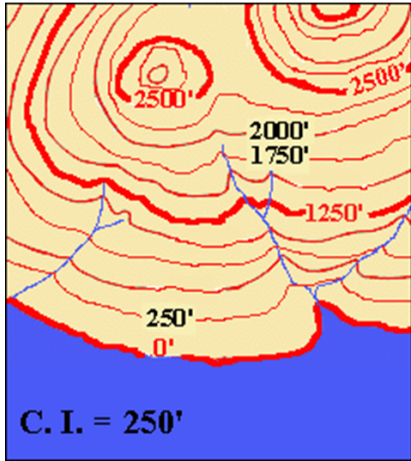
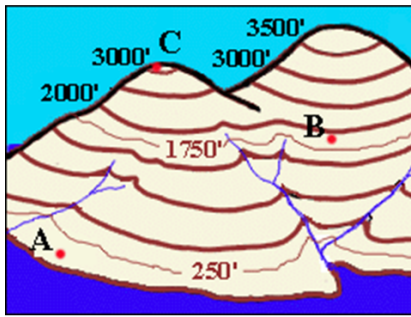
CONTOUR LINE – a line connecting points of equal elevation above a certain datum onland;
- (kinky or curved lines in a map)



Topographic maps $\Rightarrow$ 3 dimensional world in 2 dimensions

Mountains and valleys are represented as **concentric circles and lines.**

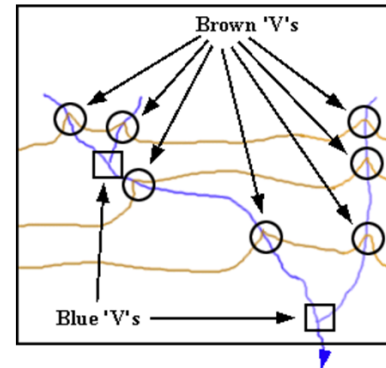




Rule of V's for valleys and rivers

- Contour lines form an **inverted V** when crossing a river or valley
- The **apex of the V's point upstream**
- Look for the brown inverted V's (contour lines)
- *The "V's" can be short or long, sharp or blunt, but they always point in the upstream direction! And the river flows the other way!"*

Don't confuse with the V's formed by two rivers joining together



How to Read Topographic Map?

Ground Elevation as shown by Thin Brown to Red Contours of similar elevation or Points. The closer together they are, the steeper the terrain.

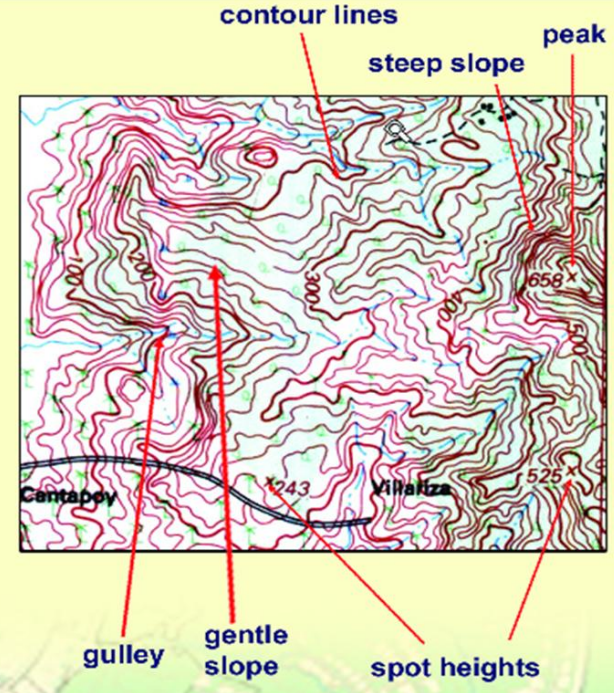
- **Ground elevation as shown by contour lines and spot heights.**

Steep slope is shown by *closely spaced contour lines*

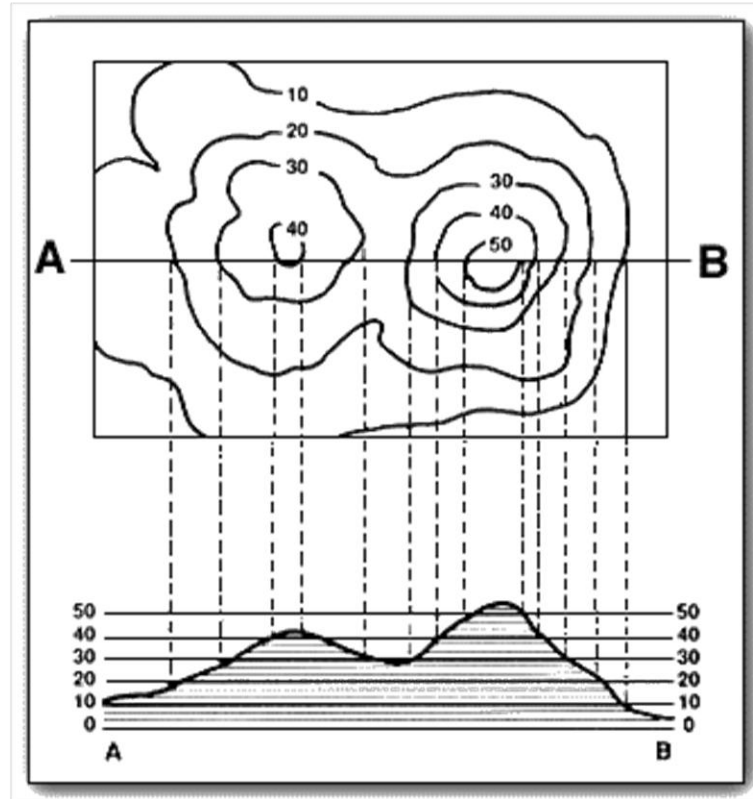
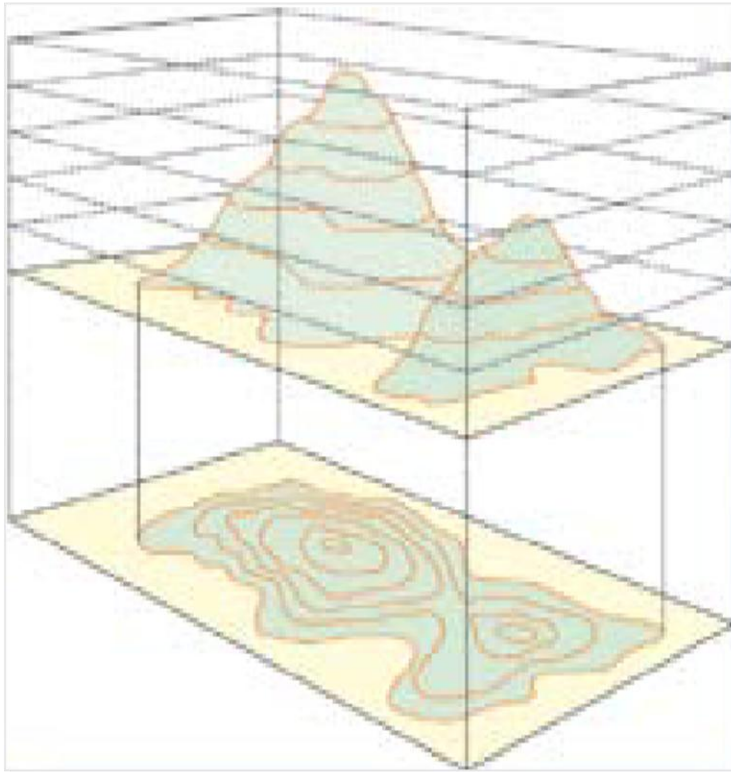
Gentle slope is shown by *widely spaced contour lines*

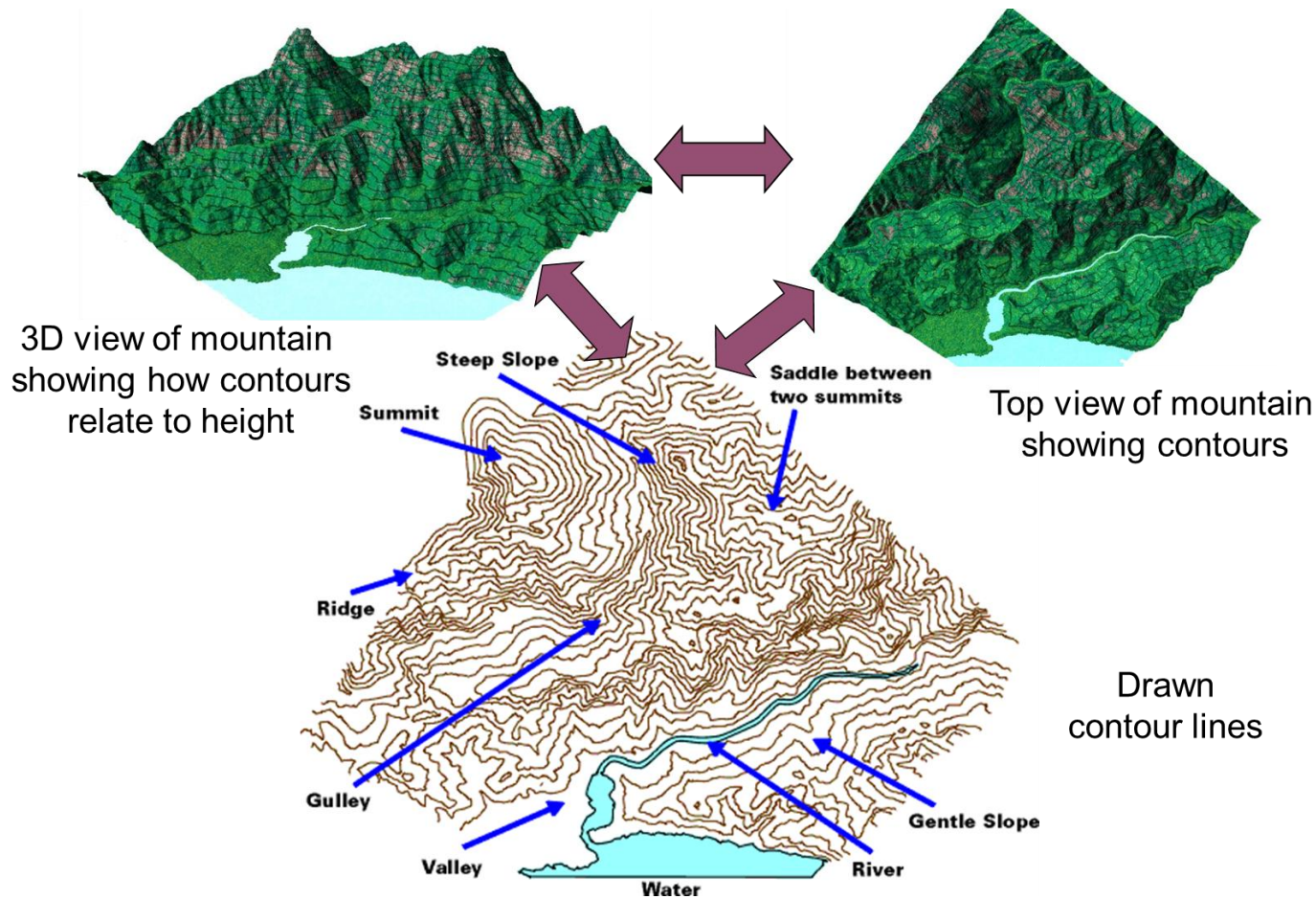
Gulley is shown by *V-shaped contours lines*

Peak is shown by a *spot height inside a closed contour line*



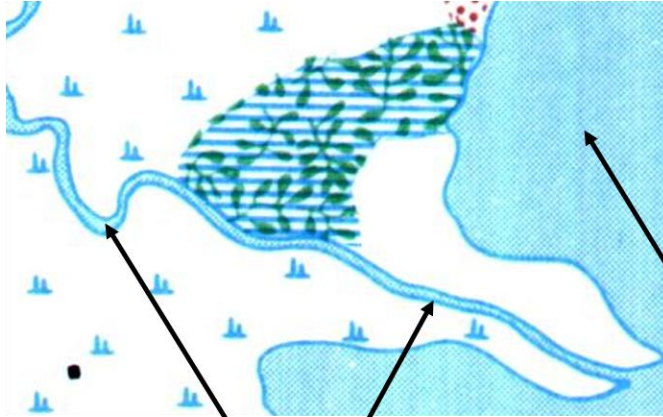
How contour lines show hills and mountains?





How to Read Topographic Map?

- Blue represents water



Water/River



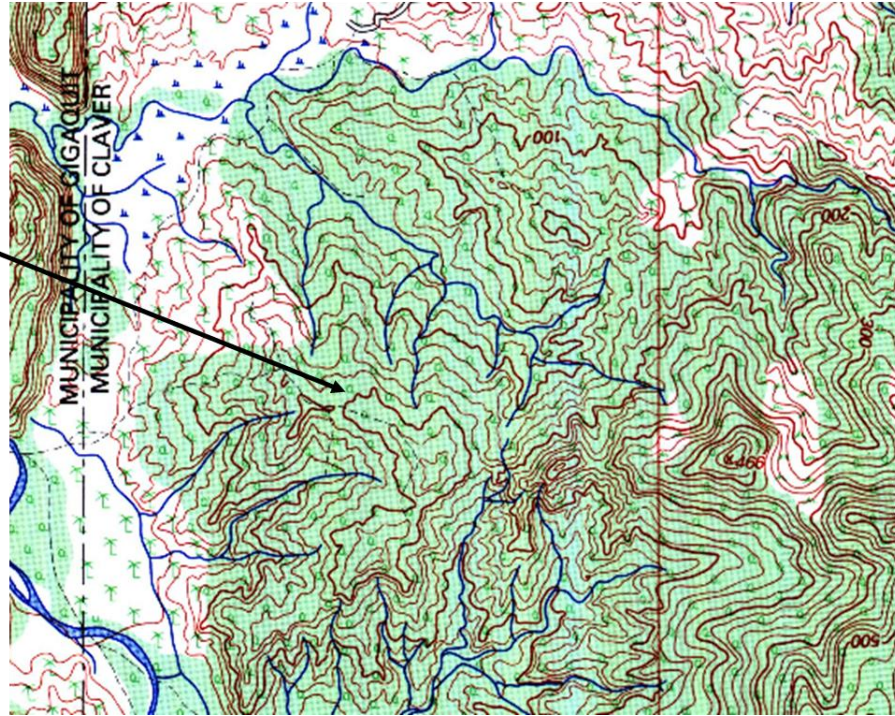
Water/Sea



How to Read Topographic Map?

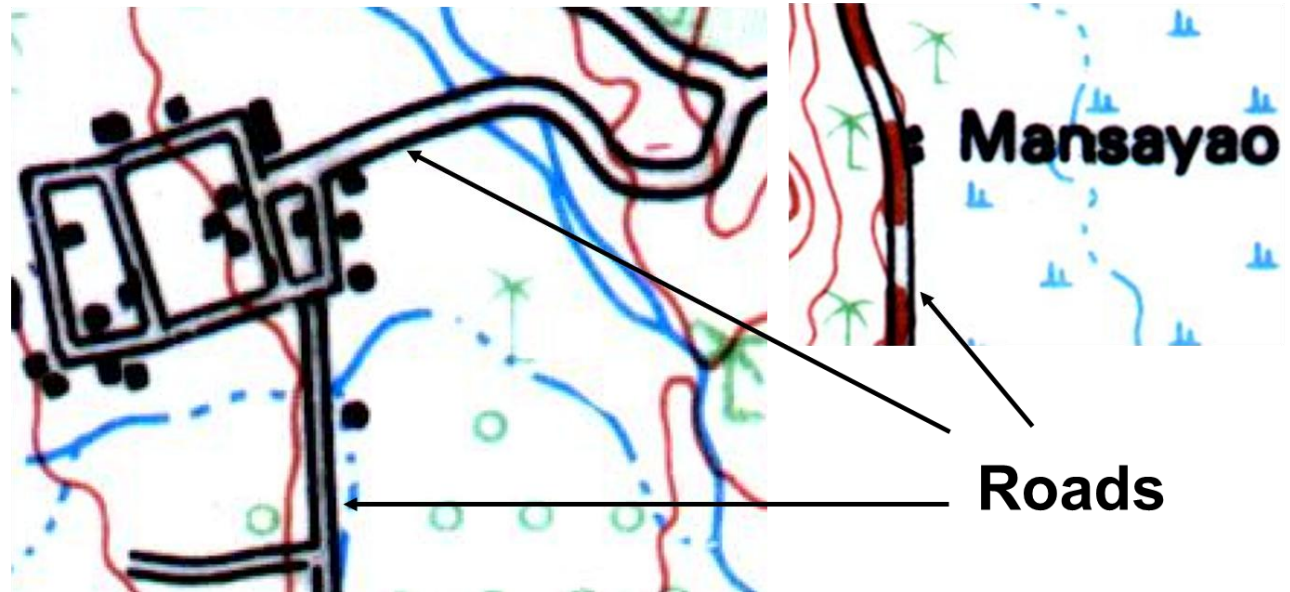
- Green represents orchards and forested areas.

Orchards/
forested
area



How to Read Topographic Map?

- Roads and highways are represented in white with black outline or a combination of alternating black and red bands with black outline.

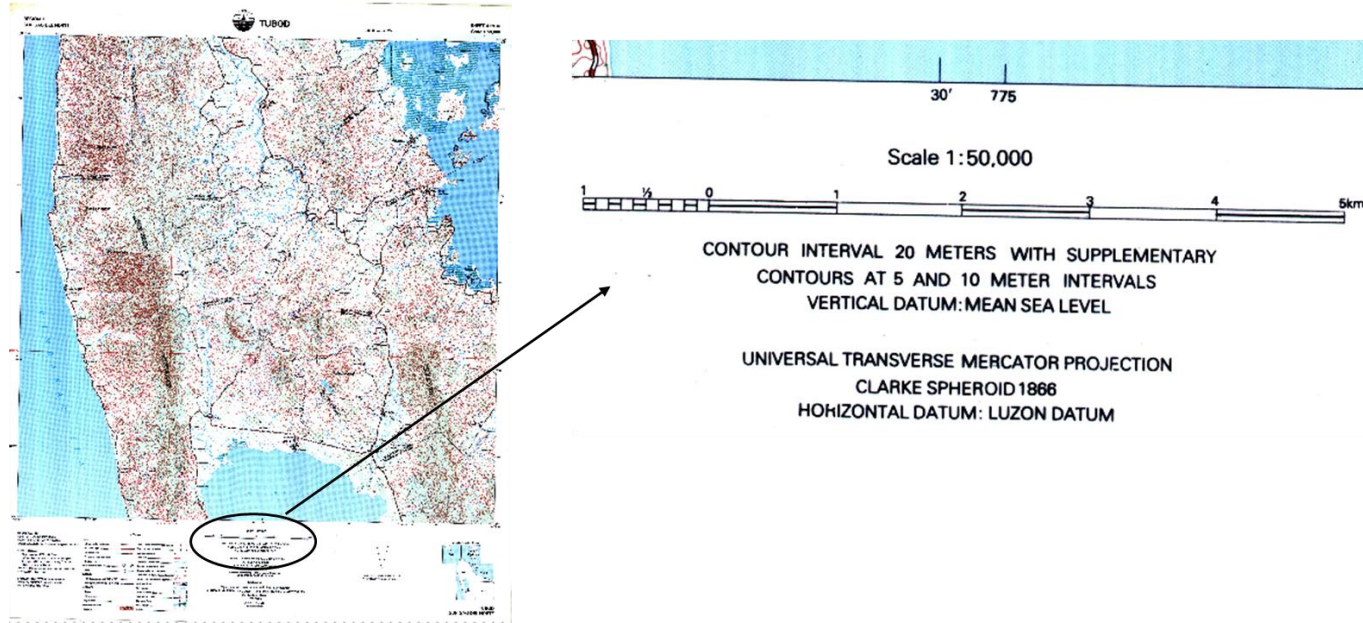


Roads



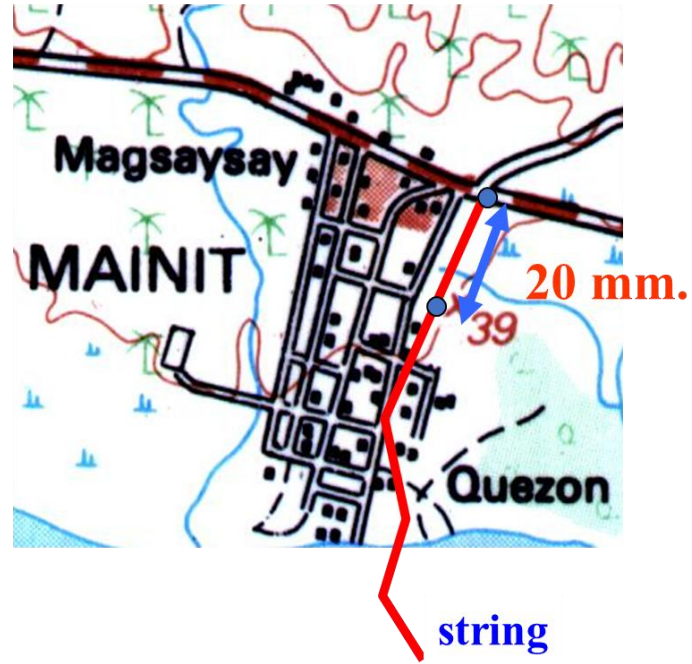
How to Measure Distance Using a Scale Bar on a Map?

1. Find the scale bar for the map you're going to use.



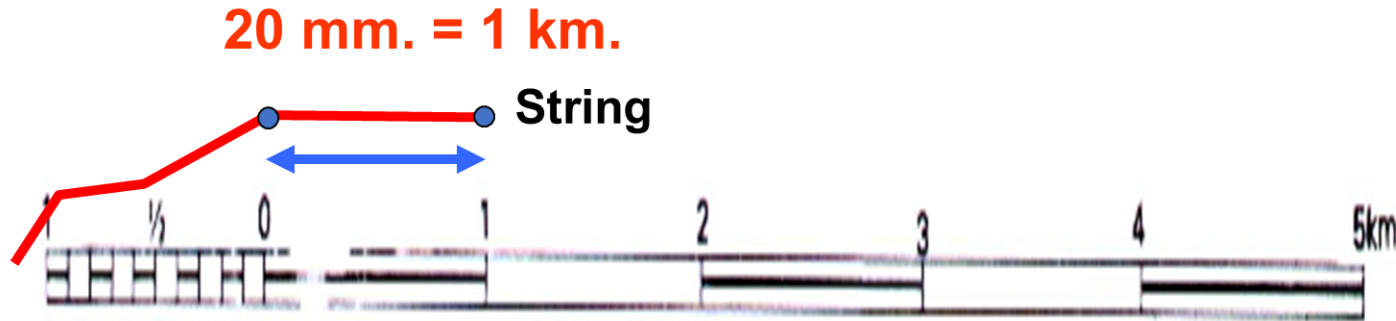
How to Measure Distance Using a Scale Bar on a Topographic Map?

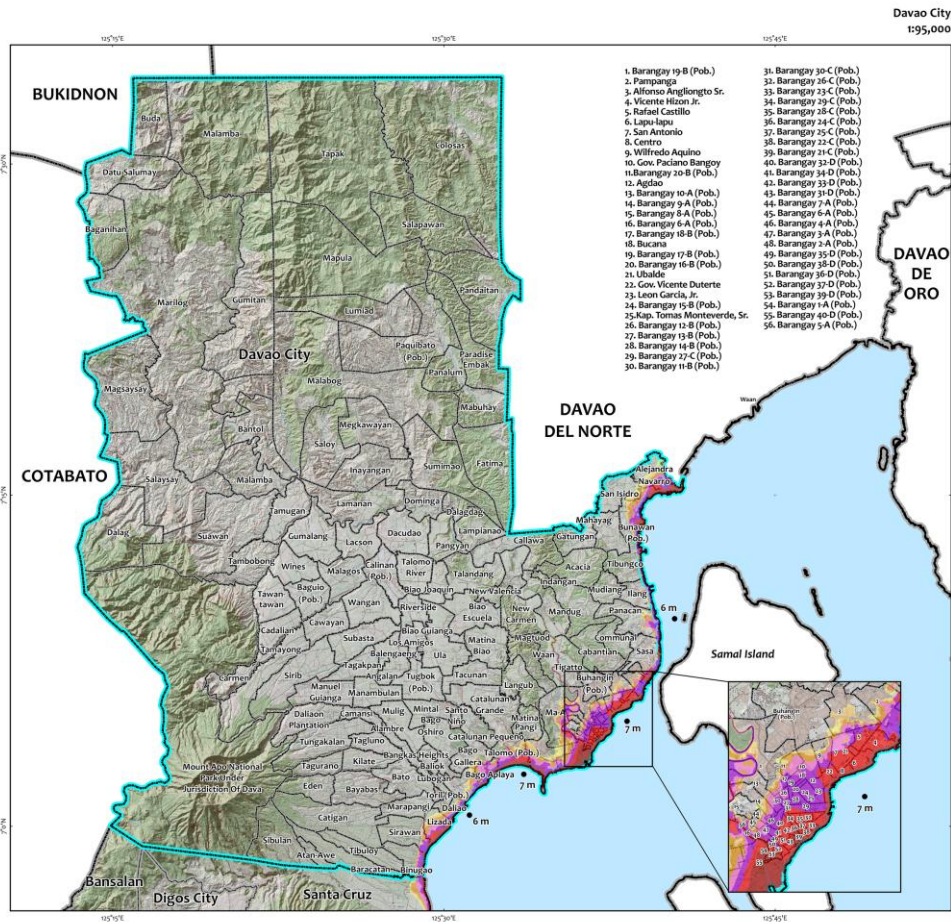
2. Use a ruler to measure the distance between the two places. If the line is quite curved, use a string to determine the distance and then measure the string.



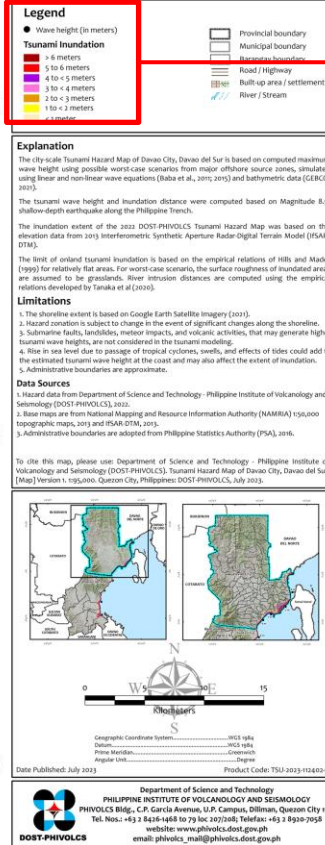
How to Measure Distance Using a Scale Bar on a Topographic Map?

3. Place the ruler or string against the scale bar on the map and read the distance.





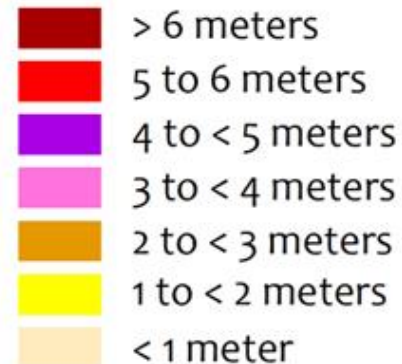
Tsunami Hazard Map Davao City, Davao del Sur

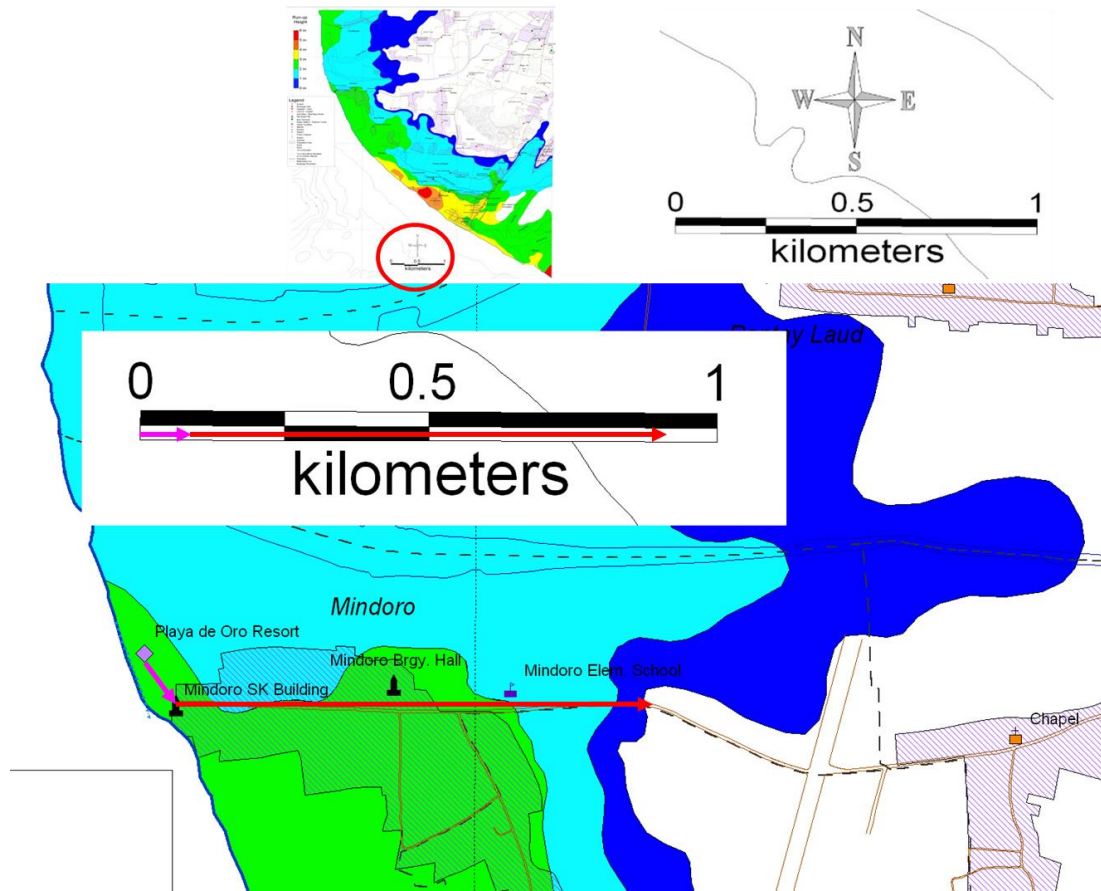


Legend

● Wave height (in meters)

Tsunami Inundation





Evacuation Route and Distance



HAZARD MAPS

- Earthquake-Induced Landslide Hazard Map
- Distribution of Active Faults and Trenches Map
- Ground Shaking Hazard Map
- Liquefaction Susceptibility Map
- Tsunami Hazard Map
- Peak Ground Acceleration Map
- Spectral Acceleration Map
- Risk Analysis Map
- Dynaslope Map
- Ashfall Hazard Map
- Ballistic Projectile Hazard Map
- Fissure Hazard Map
- Lahar Hazard Map
- Lava Flow Hazard Map
- Pyroclastic Flow Hazard Map
- Volcanic Tsunami Hazard Map
- Permanent Danger Zone Map



SCAN TO DOWNLOAD HAZARD MAPS



THANK YOU



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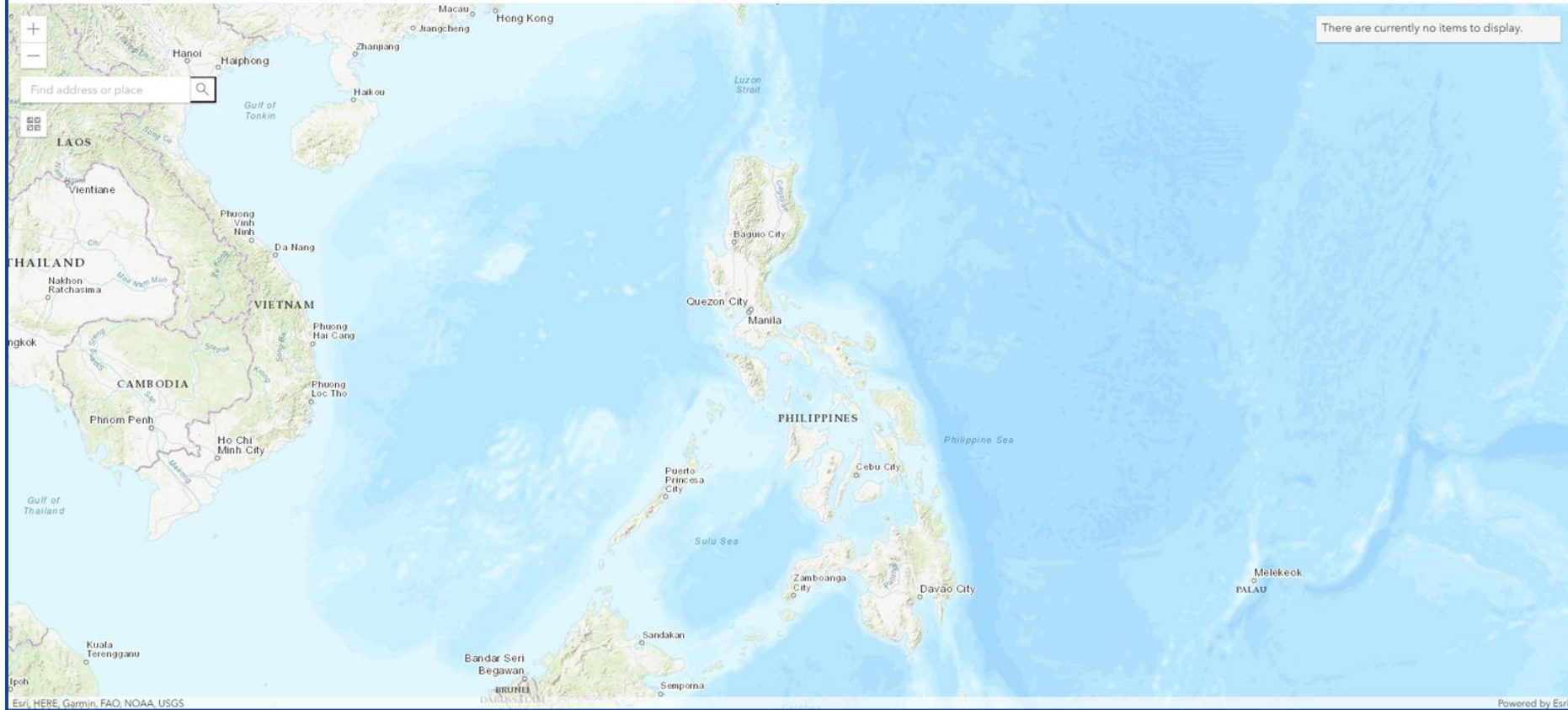
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Exercise:

1. Download the tsunami hazard map of your municipality/city, province, or region.
2. Determine the highest tsunami height in your map
3. Identify on your map the longest tsunami inundation.





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REGION XI (DAVAO REGION) ▼

DAVAO DEL SUR ▼

DAVAO CITY ▼

- Select Barangay - ▼

Hazard Maps:

Earthquake

☒ **Select All**

☒ Earthquake-induced Landslide

☒ Ground Rupture (Active Fault)

☒ Ground Shaking

☒ Liquefaction

☒ Others

☒ Tsunami

Volcano

☒ **Select All**

☒ Active & Potentially Active Volcanoes

☒ Ballistic projectile

☒ Fissure

☒ Lahar

☒ Lava flow

☒ Permanent Danger Zone

☒ Pyroclastic Flow

☒ Volcanic Tsunami

Other Maps:

☒ **Select All**

☒ Deep-Seated Landslide

☒ Peak Ground Acceleration

☒ Risk Maps

☒ Spectral Acceleration

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DAVAO DEL SUR ▼

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- ☒ Risk Maps
- ☒ Spectral Acceleration

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HAZARD MAPS FOR DAVAO CITY, DAVAO DEL SUR, REGION XI (DAVAO REGION)

Click the image to download.

Earthquake-induced
Landslide (4.3 MB)Earthquake-induced
Landslide (11.1 MB)Ground Rupture (Active
Fault) (9.7 MB)Ground Rupture (Active
Fault) (16.6 MB)

Ground Shaking (7.6 MB)



Ground Shaking (11.6 MB)



Liquefaction (3.9 MB)



Liquefaction (11.0 MB)



Tsunami (9.5 MB)



Tsunami (14.7 MB)

