

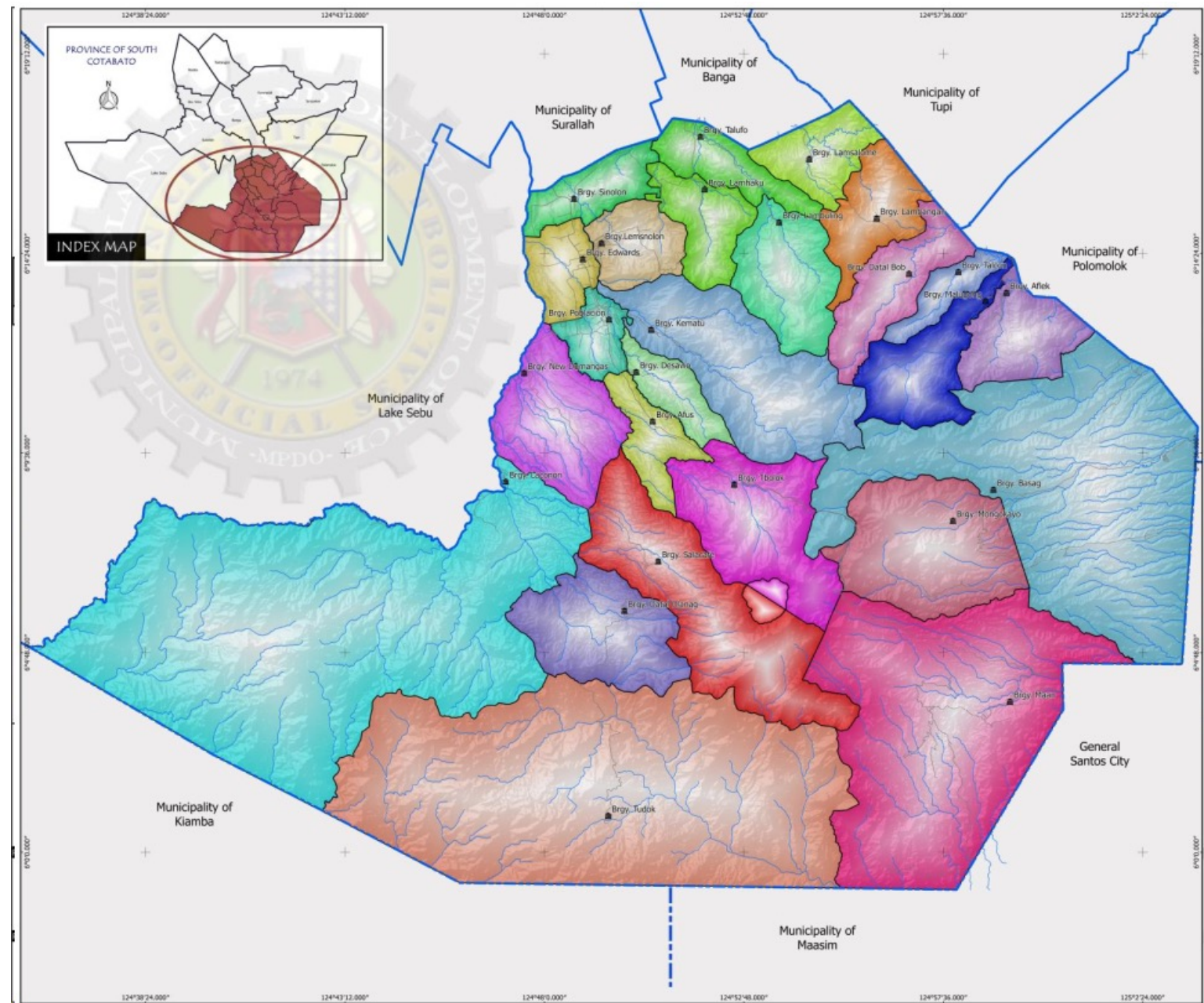
Volcanic, Earthquake, Landslide, and Flooding Hazards in T'boli, South Cotabato

**Project under the-
National Institutes of Health, University of the Philippines
Manila**

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Project Leader- Hon. Secretary Teodoro J. Herbosa**

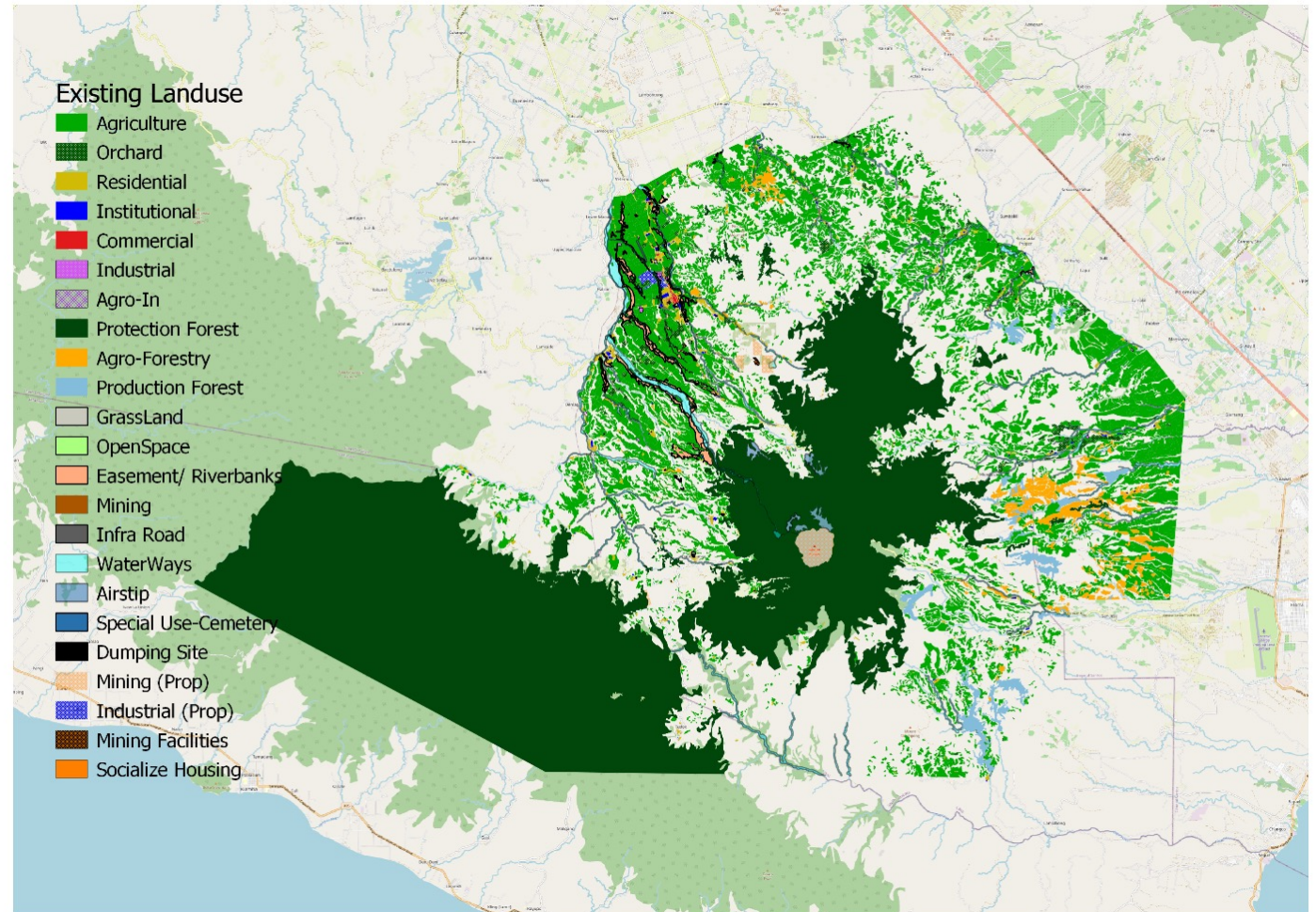
Introduction

- Small-scale mining is a source of livelihood and a significant contributor to the local economy in the municipality of T'boli, South Cotabato.
- A move to formalize the industry was done in the province in order to benefit small-scale mining sector and improve safety for registered small-scale miners.
- However, the work conditions and methods employed in this extraction process still lack the required standards of the International Labor Organization and the United Nations. For Occupational Safety and Health (OSH), and decent work.
- As a result, the miners face a myriad of occupational hazards, exposing them to precarious working conditions that endanger their health and well-being.
- This program seeks to delve deeper into the intricate web of challenges faced by the small-scale mining industry in Tboli by investigating the interplay between occupational and environmental risks that small scale miners face in the region with climate change and other environmental disasters such as landslides, seismologic, meteorologic and hydrologic events.



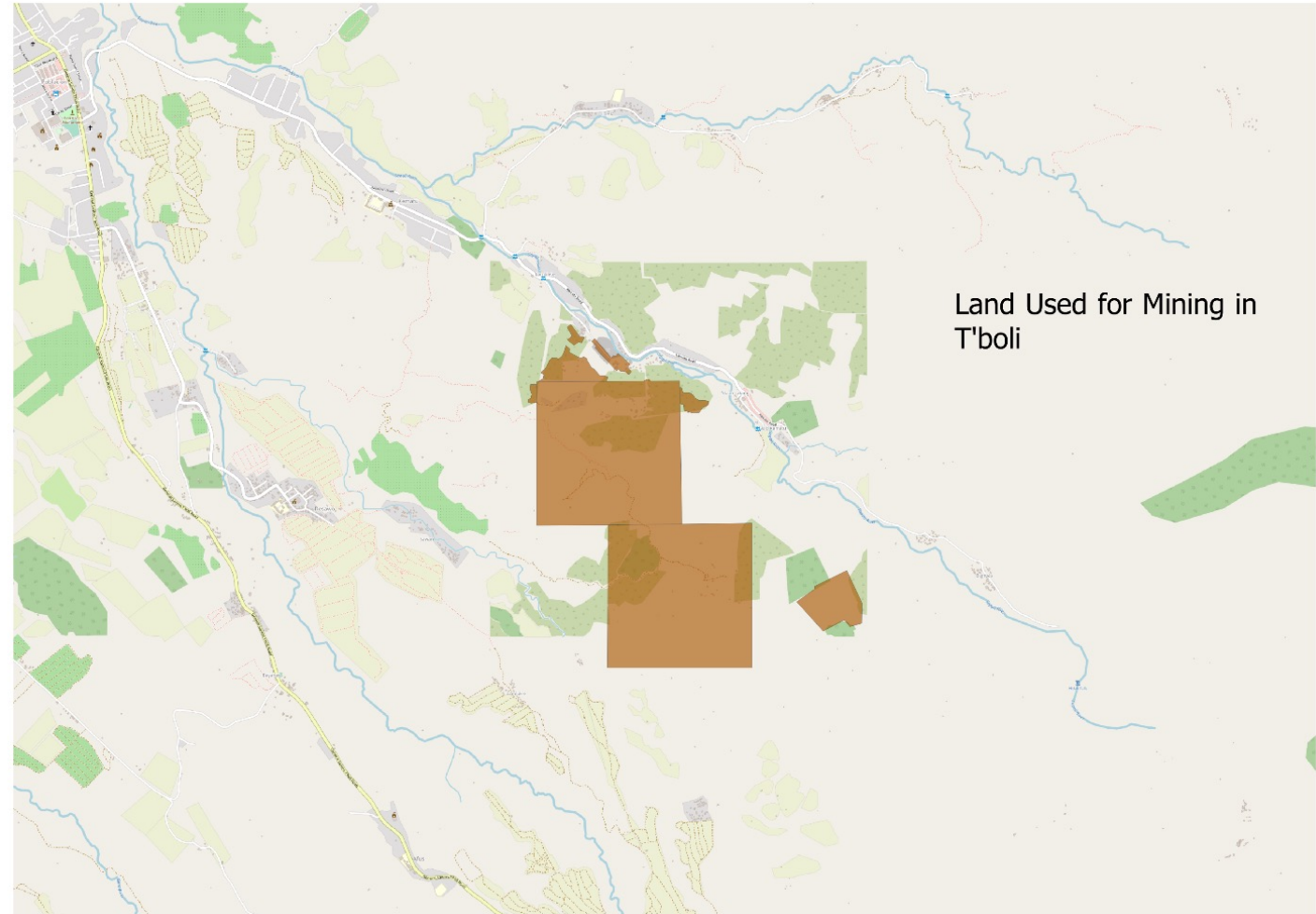
Existing Land Use Map of T'boli

- The municipality has a total of 104, 986 hectares of existing General Land Use in which the largest percentage of 39.34% (41, 301 Ha) is occupied by Forest Area (Production and Protection),
- An area that covers 34.89% (36, 625 Ha) of the land is utilized for Pasture or Grassland
- The third largest land area is 20.16% (21,165 Ha) which is being cultivated for the agriculture sector of the municipality.



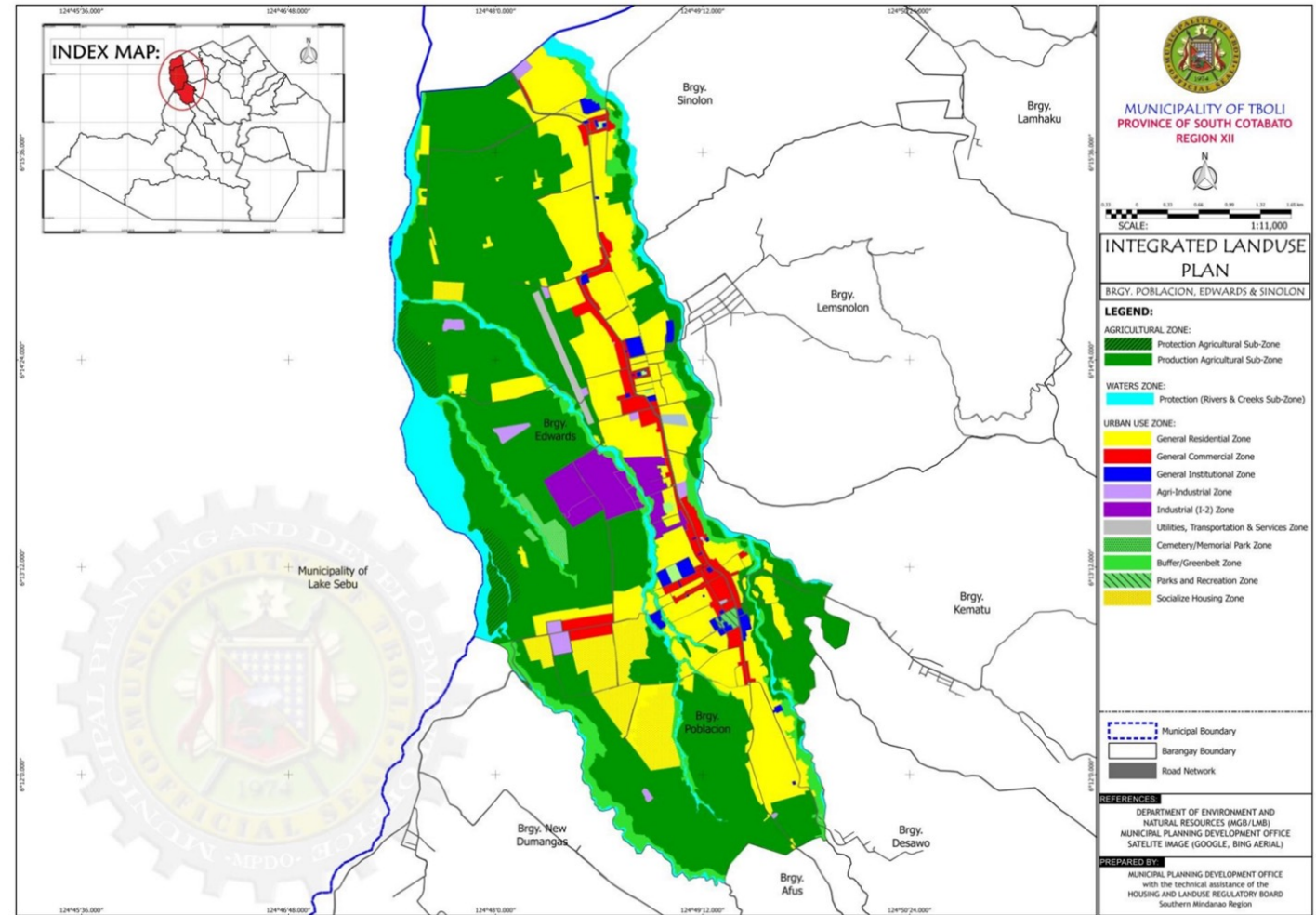
Small-Scale Mining (SSM) Areas

- As for mining, 438.7 hectares or 0.42% of the total land area of T'boli is allocated for Minahang Bayan purposes (small scale mining only).
- This increased from 358.7 hectares in previous years after the approval of new mining settlements.
- The increase of small-scale mining activity in the Municipality is due to various mining claims with viable gold production output.
- Currently, there are three (3) Minahang Bayan Cooperatives, the MCSMMAI, DISSMAI, and TMBMPC, which are the only registered and recognized by the local government units (LGU).
- There are no large scale mining companies in T'boli as it is allocated only for small scale mining under the supervision and monitoring of the LGU.



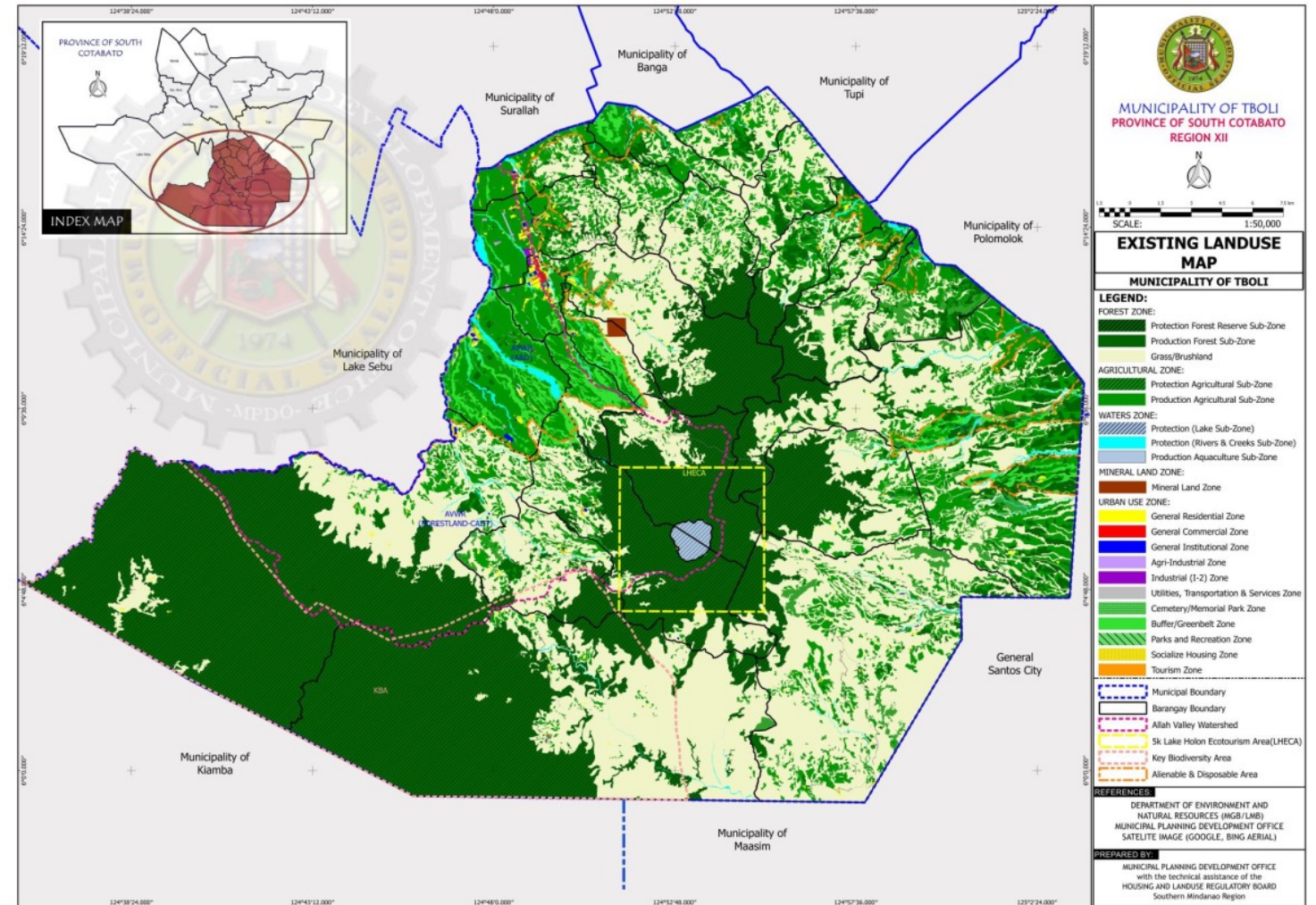
Mine Processing Areas

- The actual extraction of ores is in the approved mining areas, while the processing of minerals is conducted in the municipality's central business district, specifically, two barangays: Brgy. Edwards and Brgy. Poblacion.
- In Brgy. Poblacion, 528 hectares or 60.89% are allotted as "Production Areas", while settlement/housing area consists of 303.8 hectares (35.04%).
- In Brgy. Edwards, on the other hand, Production Areas consist of 665.6 hectares or 59.27% of the barangay land use, while settlement/housing has an accumulated area of about 342.9 hectares (30.53%).
- In the "Production Areas", a significant portion is used for the more than 100 approved ball milling sites and four approved processing plants.



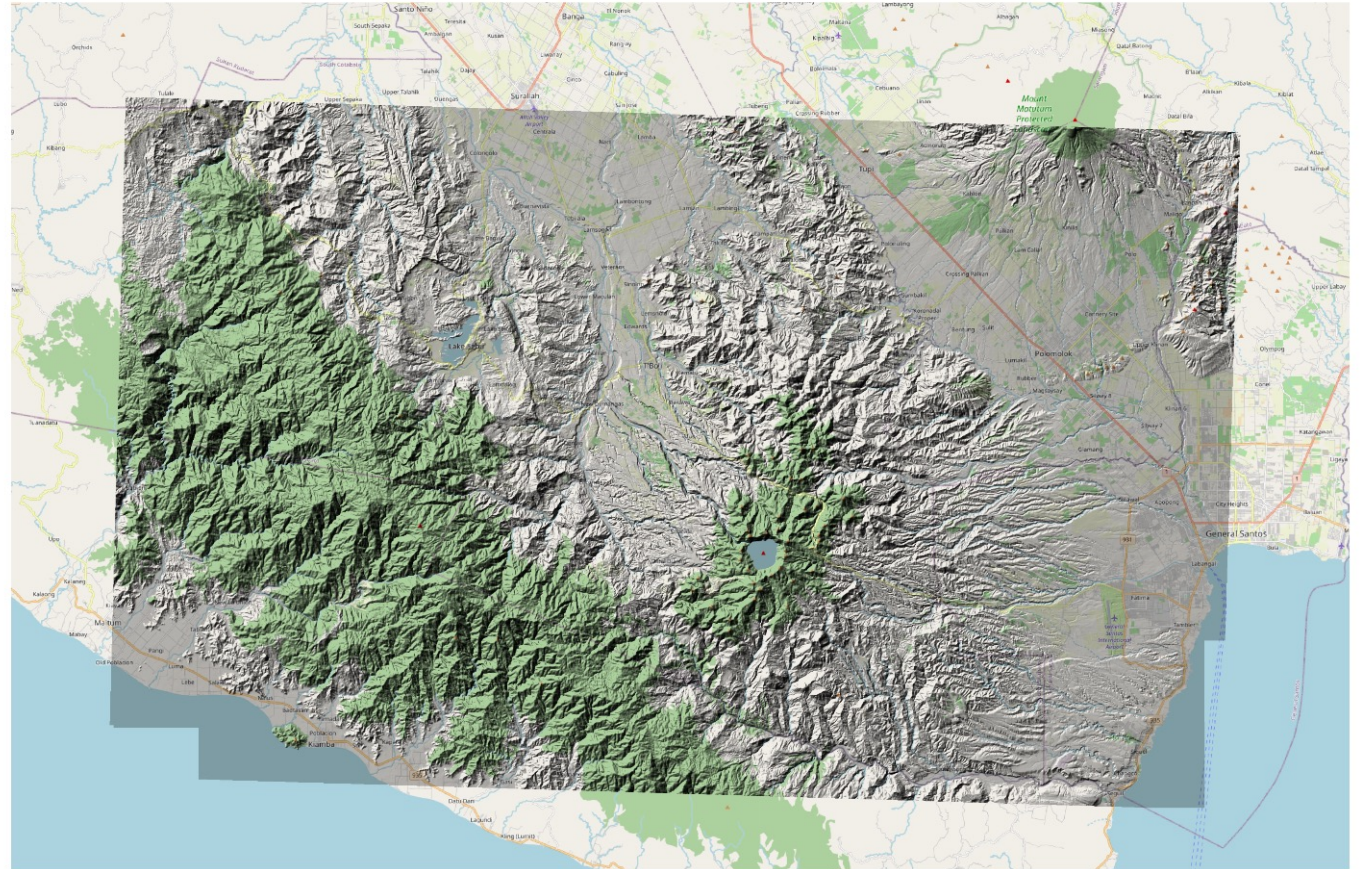
Forest Cover

- Based on T'boli Municipal Planning and Development Office records, the protected area of T'boli covers 33,770 hectares or 32.17% of the total area
 - These areas have an elevation of 1000 meters above sea level
- “Protection Forests” consists of 27,471 hectares of the protected areas
- Bushes and grasslands comprise 1,227.3 hectares of the protected areas
- “Multiple Use Zone for Agri-Crops and Agri Industry Plantation” consists of 890.1 hectares of the protected areas
- Settlements total to 63.07 hectares of the protected areas.



Digital Terrain Model of T'boli, South Cotabato

- A Digital Terrain Model (DTM) is a digital representation of the topography of the Earth's surface.
- It is a mathematical model that represents the elevation of the terrain at various points on a grid.
- Here, a digital terrain model of T'boli is obtained from the National Mapping and Resource Information Authority (NAMRIA) under the Department of Environment and Natural Resources (DENR).

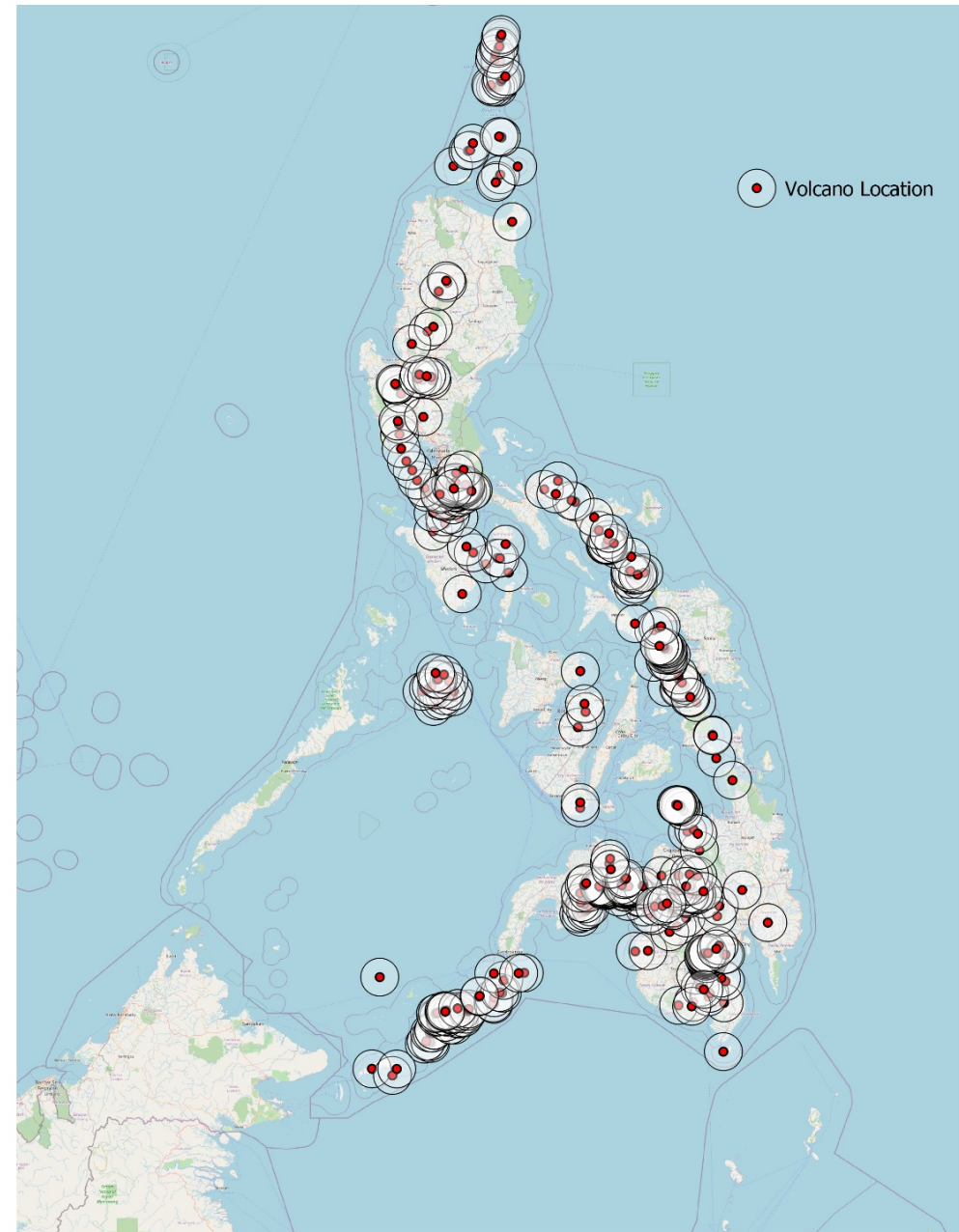


Digital Terrain Model of Tboli, South Cotabato

Volcanic Hazard

Volcanic Hazard

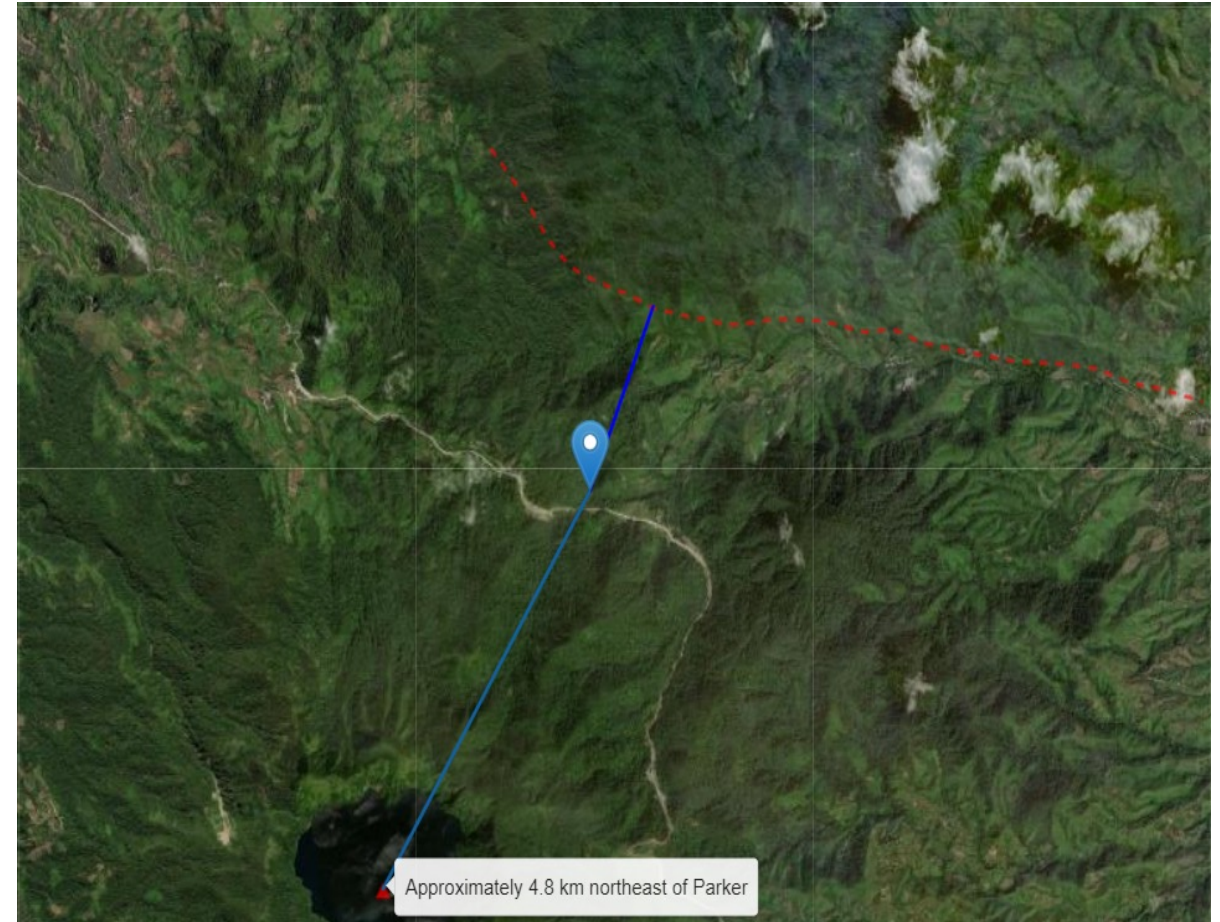
- The Philippines is part of the Pacific Ring of Fire, a region known for its high seismic and volcanic activity.
- At the moment, there are 24 active volcanoes in the Philippines.
- The Municipality of T'boli itself houses one of these active volcanoes: the Parker Volcano.



Philippine Volcano Locations Map

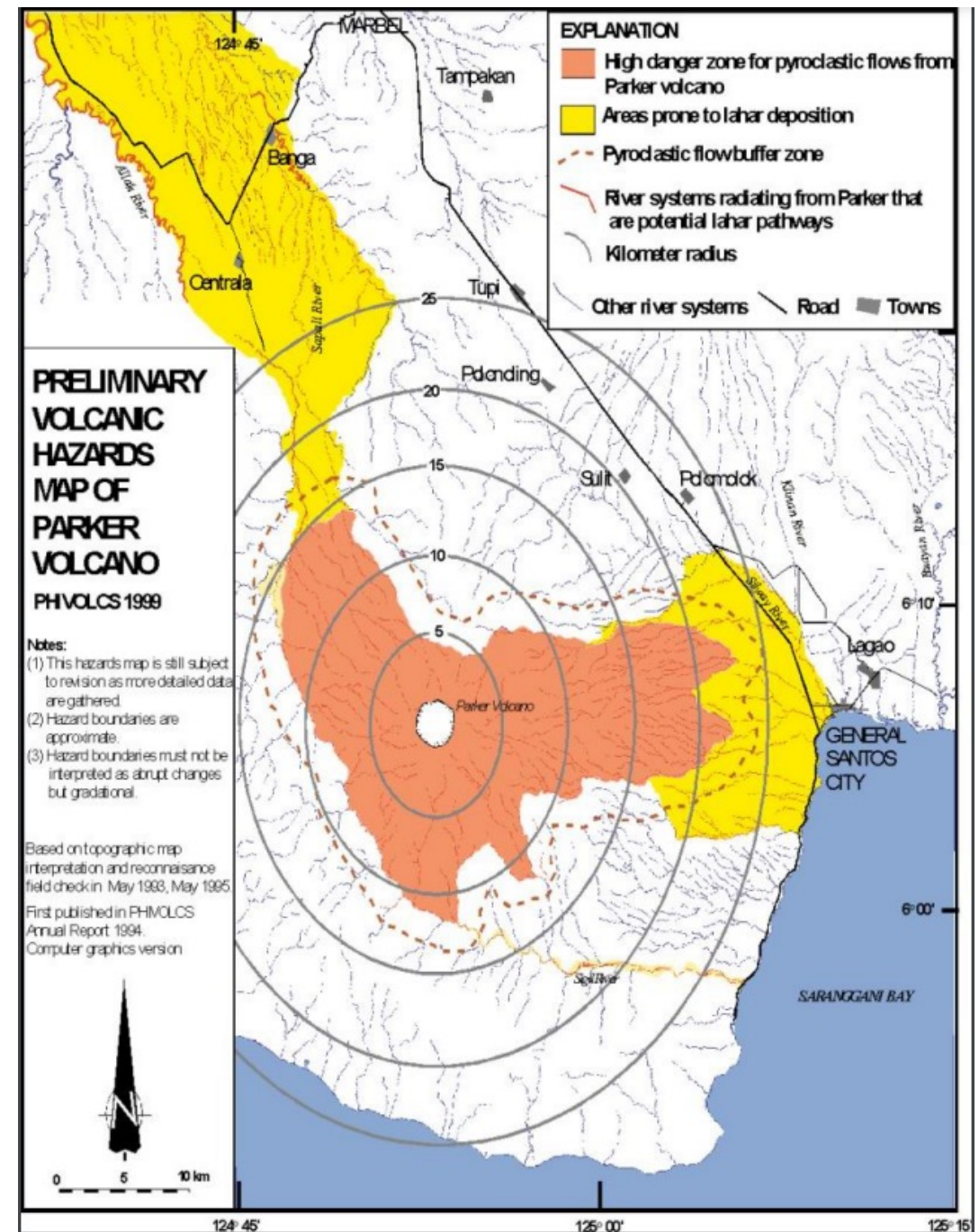
Volcanic Hazard

- Parker Volcano is a vegetated stratovolcano with a height of 1824 meters.
- The last recorded major explosion of the volcano was on December 26, 1640 to January 4, 1641 which caused darkness over the island of Mindanao.
 - This explosion resulted in the formation of the summit caldera in the volcano.
- On September 1995, there was an overflow of the Maughan Crater Lake of the Parker Volcano due to heavy rains associated with a passing typhoon.
 - The floods caused by this overflow killed more than 60 people and destroyed 300 homes and 9 bridges, as well as displacing 50,000 people.
- On 2002, there were concerns that the volcano might erupt after a magnitude 7.5 earthquake occurred near the volcano on March 6.
 - Portions of Parker Volcano's Wall breached and fell into the Maughan Crater Lake which released tons of water and washed away houses, displacing 33 families.



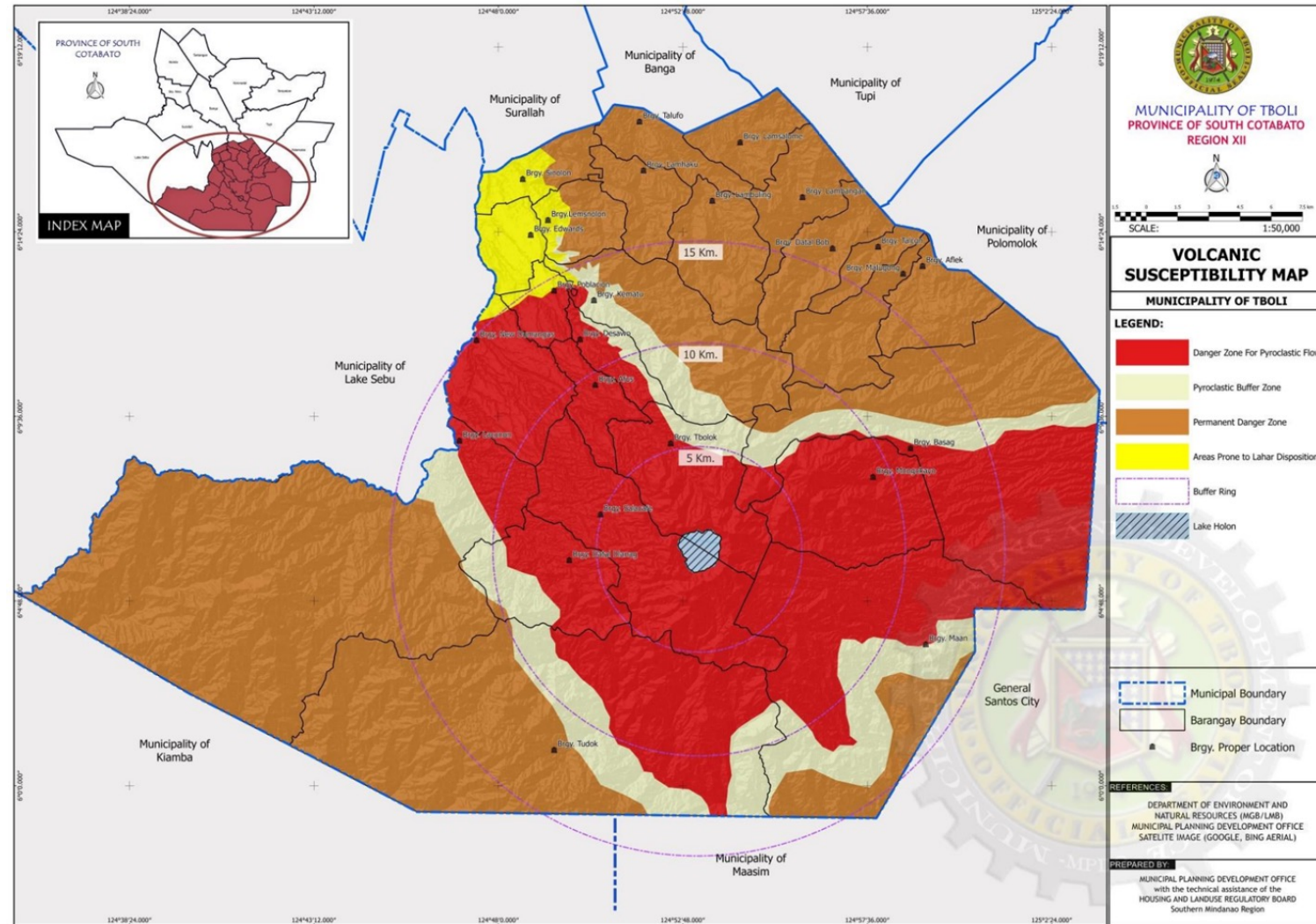
Preliminary Volcanic Hazards Map of Parker Volcano (PHIVOLCS, 1999)

- A preliminary volcanic hazard assessment by PHIVOLCS in 1999 shows the areas around the volcano which are in danger for pyroclastic flows and lahar deposits.
- The map shows that the immediate 15 to 25 kilometers around the volcano is within the high danger zone for pyroclastic flows from a potential eruption of the volcano.
- Considering that Tboli is only about 5 kilometers north of mount parker's crater, it is well within the high danger zone.
- The map also shows that lahar from a potential eruption of the volcano could reach further than the municipality of Banga following the Sapali River and the Allah River.



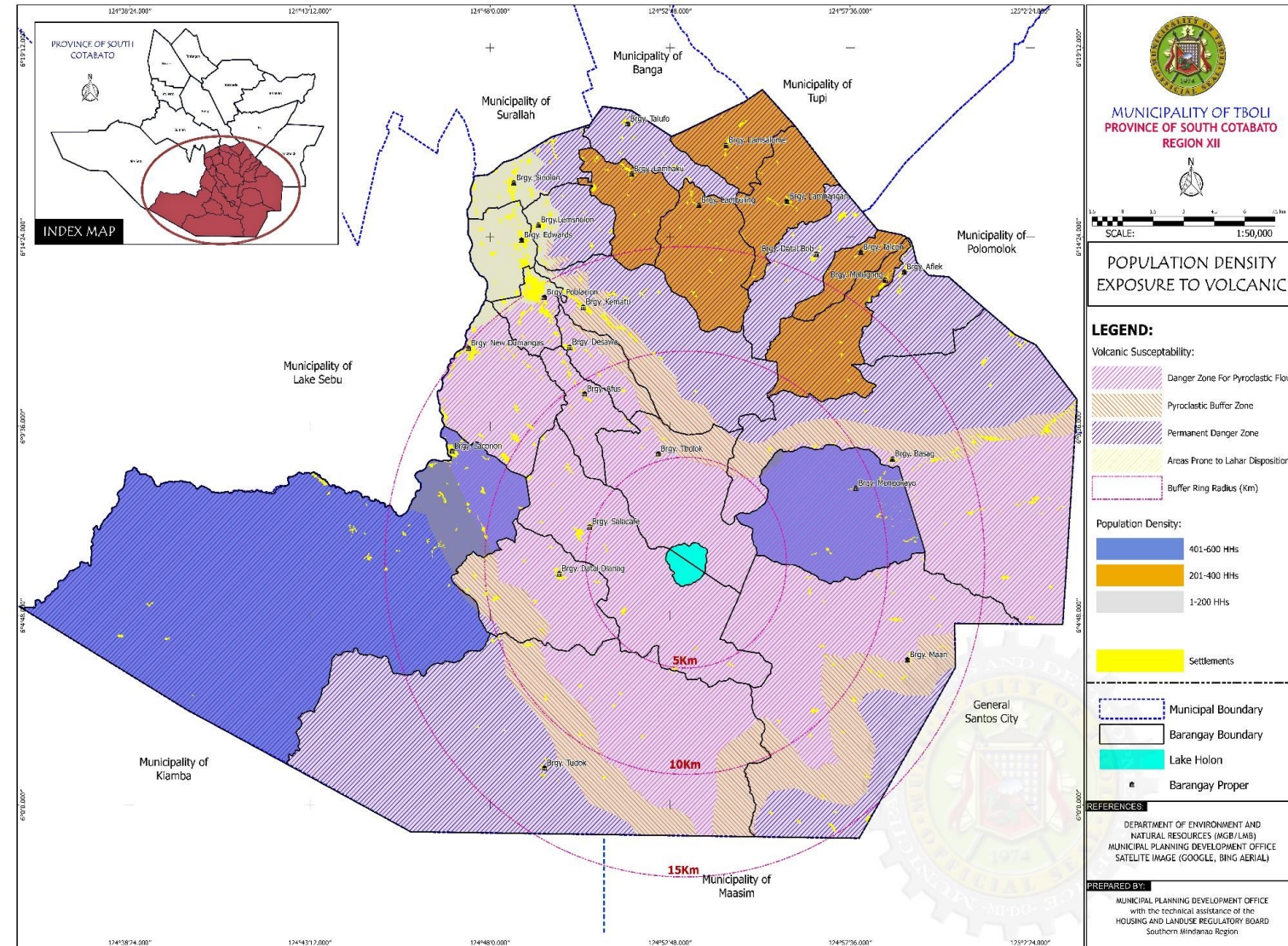
Volcanic Susceptibility Map of Tboli, South Cotabato (Tboli MPDO – DENR)

- 21 barangays in Tboli are positively susceptible to hazards and danger that may be brought about by any future volcanic explosions of Mt. Parker.
- Only four (4) out of the 25 barangays are unlikely to be considered to be danger zone as illustrated in the map but excluding volcanic-caused earthquake.
- Considering volcanic eruption scenario, Pyroclastic Flow consequences are assessed to be of high level of impact to population, critical facility and structures.
- The areas in the danger zones have a high probability of incidence/occurrence.



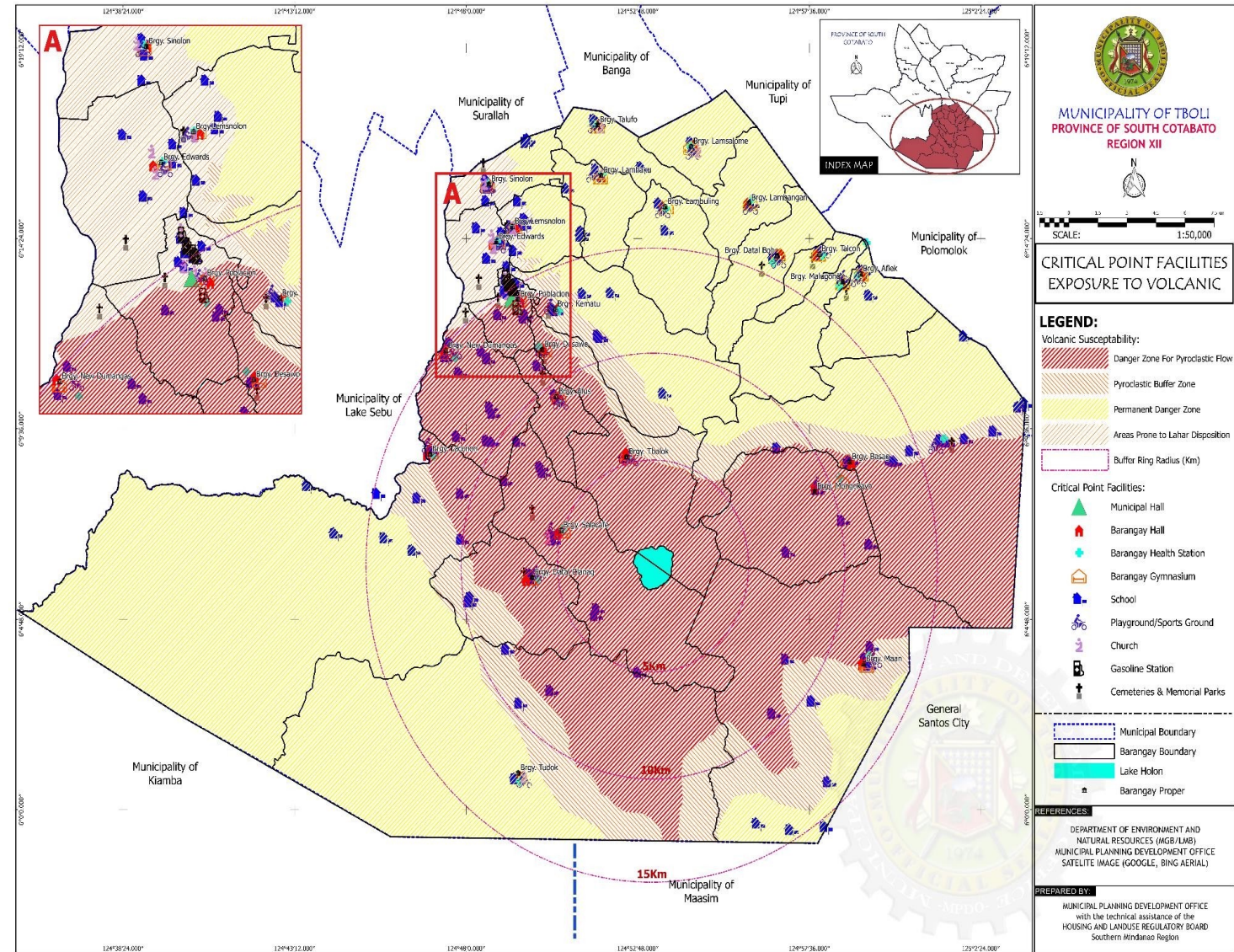
Population Density Exposure to Volcanic Eruption Map of Tboli, South Cotabato

- High Susceptibility Level areas under the danger zone have an estimated 1-10 Death or 10 to 100 Injuries per affected population in need of immediate assistance.
- On the other hand, Moderate Susceptibility Level areas are expected to experience 1- 10 injuries.
- A total of 59,495(65.06%) affected residents are exposed at “High” susceptibility, while 5,387(5.89%) are at “Moderate Susceptibility” level.



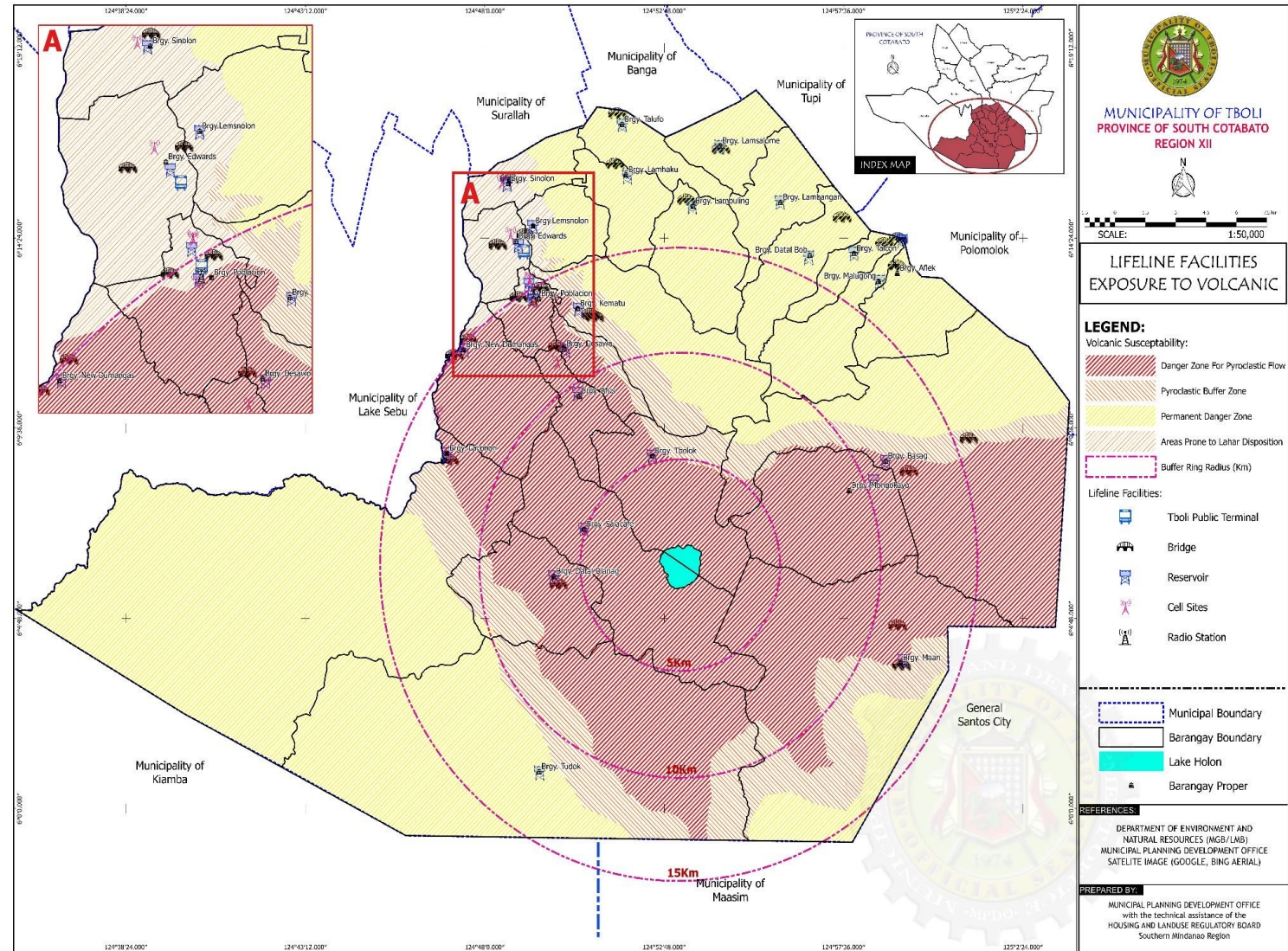
Critical Point Facilities' Exposure to Volcanic Eruption Map of Tboli, South Cotabato

- A total of 754 facilities are exposed to “High” susceptibility level for Volcanic hazard. This suggests that in an event of a volcanic eruption, 71.3% of facilities in T’boli will be in danger of catastrophic damage.



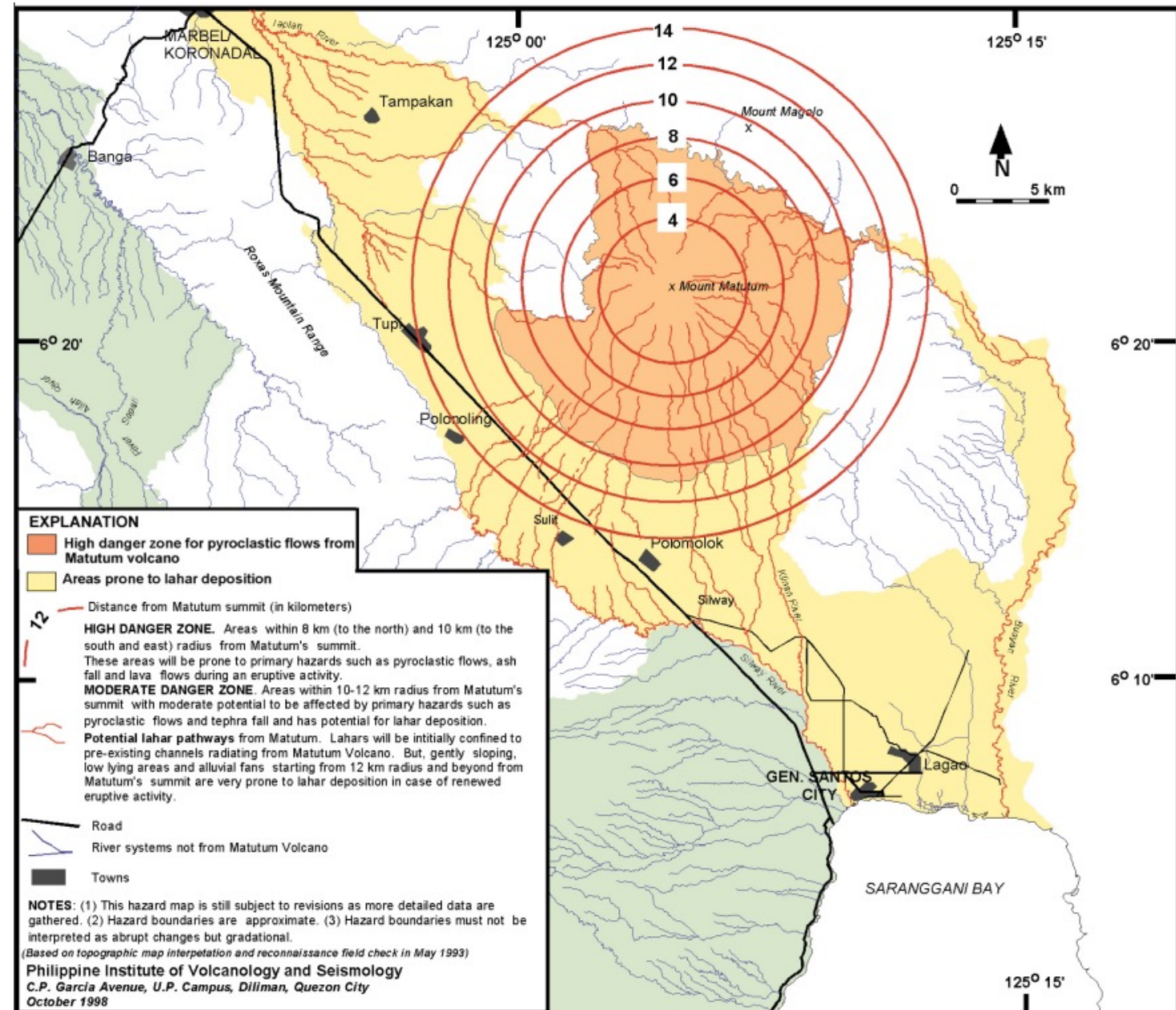
Lifeline Facilities' Exposure to Volcanic Eruption Map of Tboli, South Cotabato

- For the “Lifeline Roads”, a total of 260.41 kilometers or 72.6% of roads are exposed to High susceptibility for Volcanic hazard.
- 3.97 kilometers(1.0%) are assessed with a “Moderate” level out of the total road length of the municipality which is 351.62 km.
- The barangays that will be affected are the barangays of Afus(100%),Desawo(100%), Kematu(100%) Poblacion (100%), Salacafe(100%), Tbolok(100%), Mongokayo (100%), Datal .Dlanag ((100%), Tudok(100%), Maan 100%), Laconon(100%), Basag(94.6%), and Sinolon(59.8%),



Preliminary Volcanic Hazards Map of Matutum Volcano (PHIVOLCS, 1998)

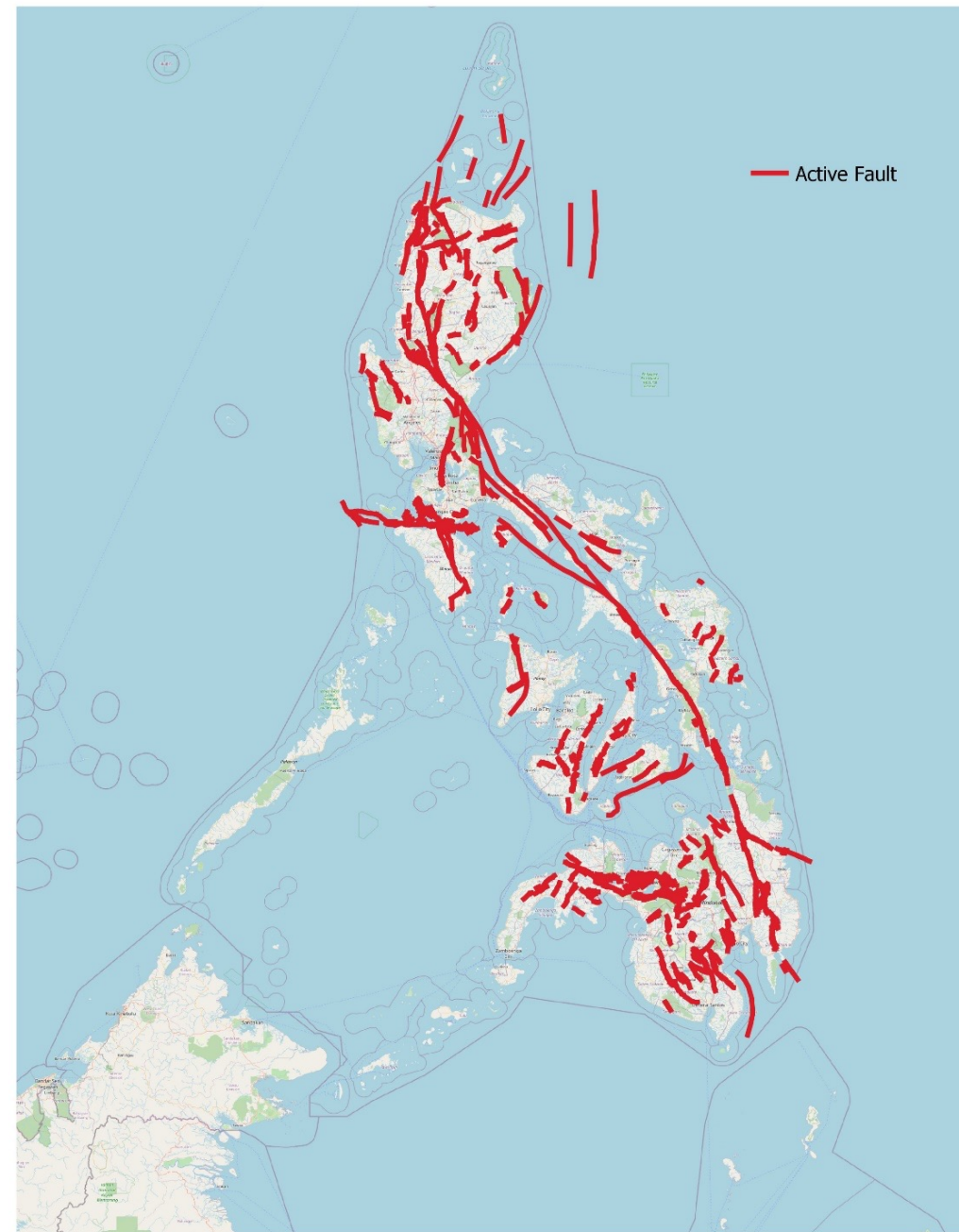
- Another potential volcano of concern is the Matutum Volcano, approximately 40 kilometers northeast of the municipality of Tboli.
- As of PHIVOLCS' assessment, Tboli is relatively in a safer distance in an event of eruption of the Matutum Volcano since the areas within 8 kilometers to the north and 10 kilometers to the south and east are only considered as high danger zones.
- Areas within 10-12 kilometers from the volcano's summit are given a moderate danger hazard, with lahar deposits being buffed by the Silway River.



Seismic Hazard

Seismic Hazard

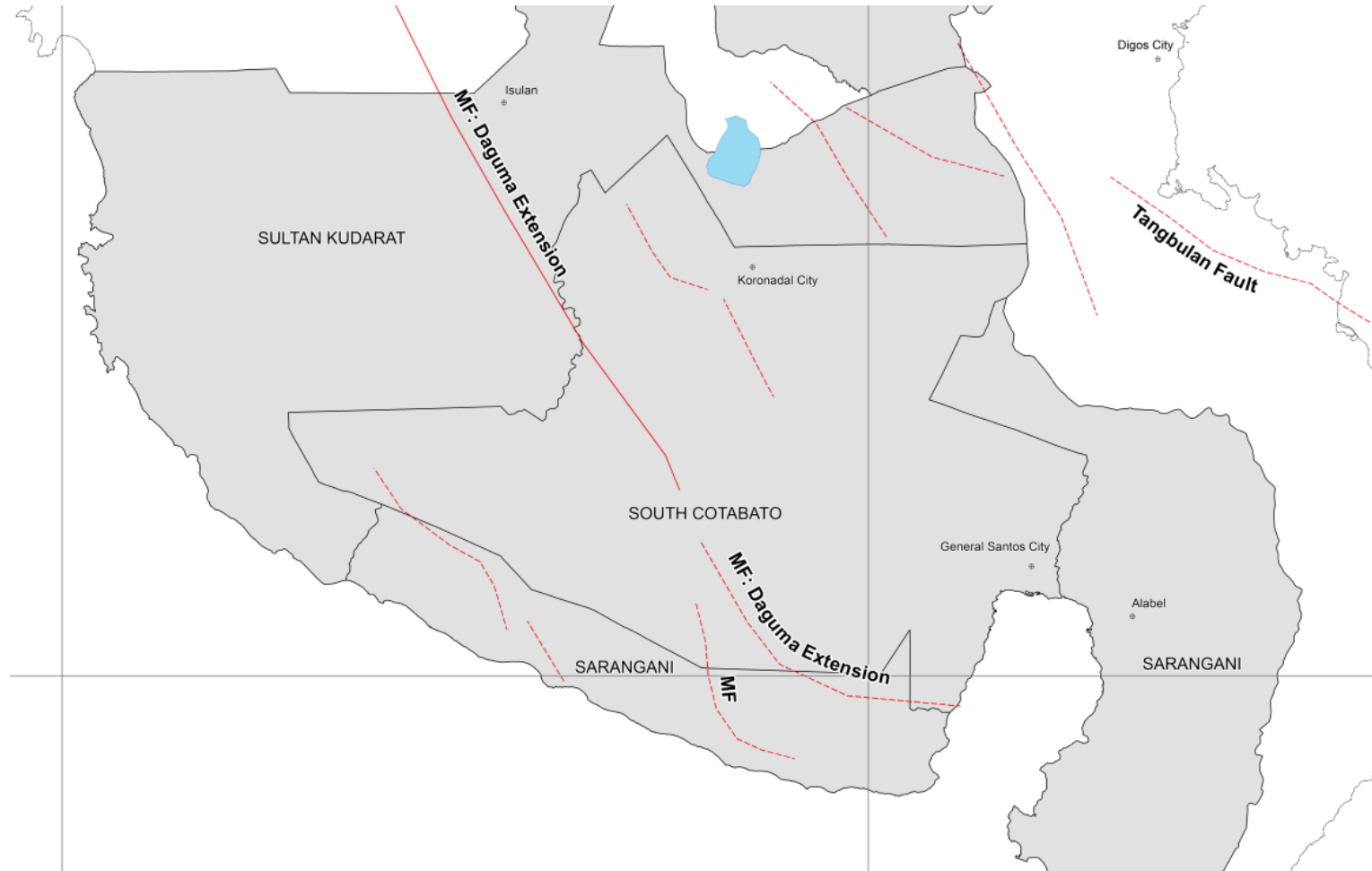
- Faults are breaks, fractures, fissures or zones of weakness where movement or displacement have occurred or may occur again.
- It may extend hundreds of kilometers across the earth's surface and tens of kilometers downward.
- The Philippines is located in a seismically active region, and there are several major fault systems in the country.
- The movement of tectonic plates in the region leads to the occurrence of earthquakes.



Philippine Active Fault Map

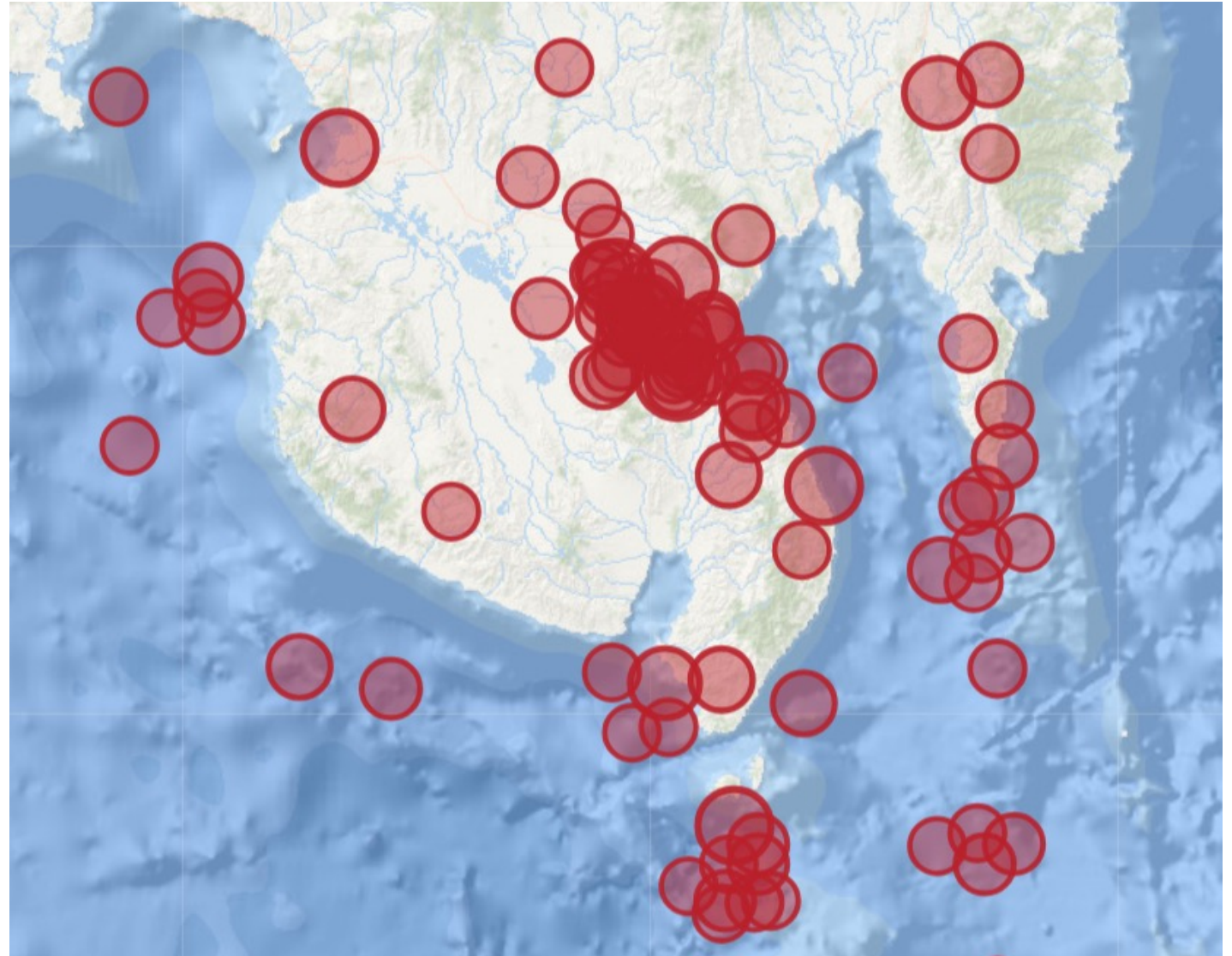
Active Faults and Trenches in Region 12

- The closest active fault in the municipality of 'Tboli is the Daguma Fault, which is a segment of the Mindanao Fault (MF).
- The Quaternary Mt. Parker volcano is located at the western end of this fault and, on radar images, seems to be cut by the fault and terraces formed by Quaternary limestone mark the Daguma Range.



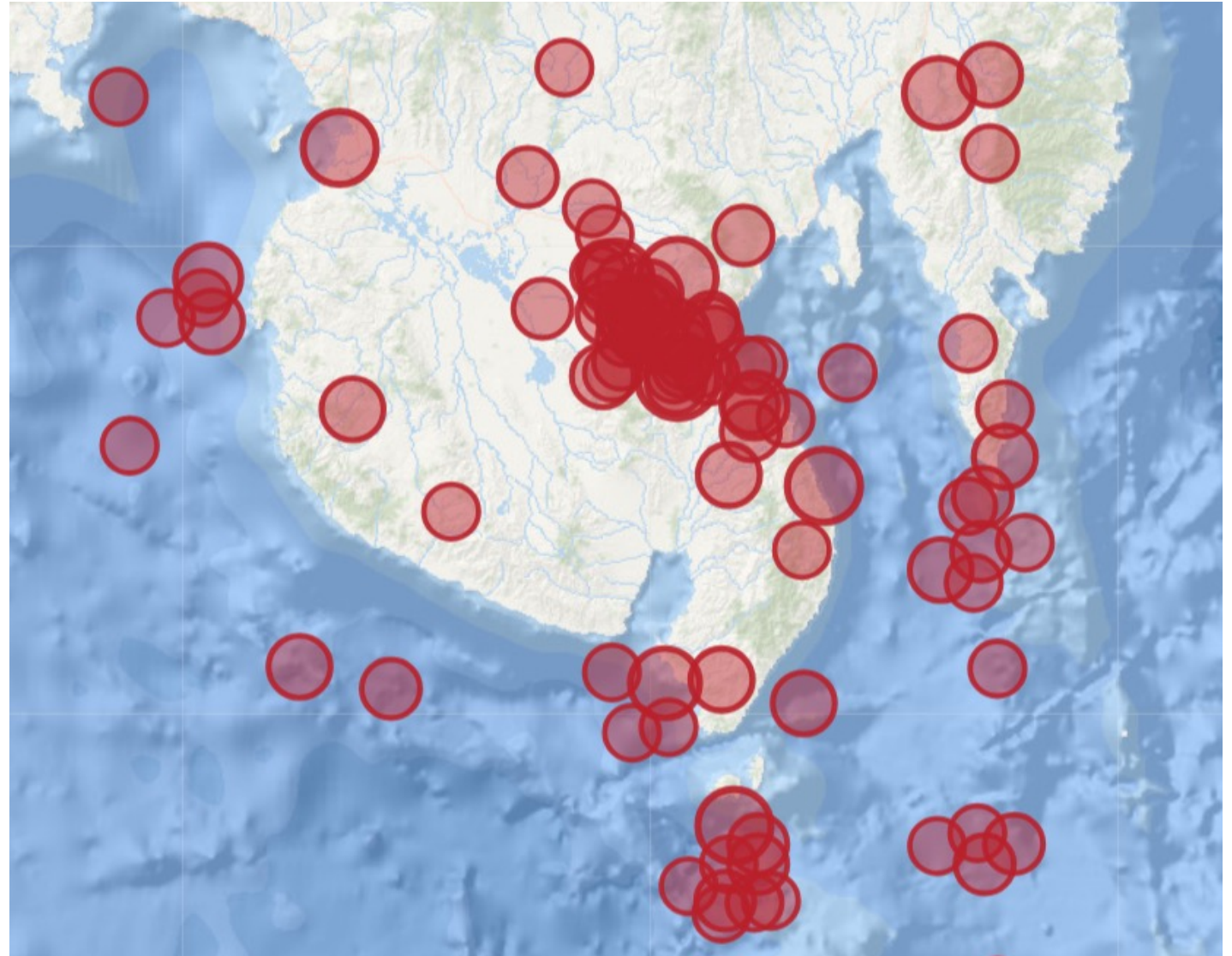
Earthquakes in Mindanao in the Past 5 Years with a Magnitude of 5.0 and above

- In 2022 alone, T'boli was shaken by 8 earthquakes of magnitude 5.0 or above, 46 earthquakes between 4.0 and 5.0, 243 earthquakes between 3.0 and 4.0, and 551 earthquakes between 2.0 and 3.0.
- There were also 110 earthquakes below magnitude 2.0 (which people don't normally feel).
- While not usually the epicenter itself, T'boli is near areas where several earthquakes are recorded.



Earthquakes in Mindanao in the Past 5 Years with a Magnitude of 5.0 and above

- In 2021, some barangays in Tboli are being closely monitored after a magnitude 4 tectonic earthquake caused the emergence of at least 4 hot springs from portions of the ground which eroded as a result of the earthquake. These hot springs were reported to have water actually boiling and smelling sulfuric
- Among the strongest earthquakes near Tboli in the past 5 years was one on December 15, 2019 where a magnitude 6.9 earthquake struck Davao Del Sur. This earthquake was felt in the municipality of Tboli with an Intensity IV



Peak Ground Acceleration

- Peak Ground Acceleration (PGA) is a measure of the maximum acceleration experienced by a specific location on the ground during an earthquake. It is one of the key parameters used to assess the intensity of ground shaking caused by seismic activity.
- PGA is typically measured in units of gravity (g), where 1g is equal to the acceleration due to gravity.
- PGA is the maximum instantaneous acceleration recorded at the Earth's surface and is influenced by various factors, including the earthquake's magnitude, depth, distance from the epicenter, and the geological characteristics of the site.
- In regions with high seismic activity, understanding Peak Ground Acceleration is essential for designing resilient structures and minimizing the potential for earthquake damage.
- The Philippine Earthquake Model (PEM) is a Probabilistic Seismic Hazard Analysis (PSHA) of the Philippines, it is an evaluation of the probability of occurrence of a certain earthquake ground motion integrating combined uncertainties in magnitude, location and intensity measure using Total Probability Theorem.
- This Probabilistic Seismic Hazard Analysis (PSHA) - Peak Ground Acceleration (PGA) Map of the Philippines is calculated from available historical and instrumental seismicity plotted in the Philippines.
- This shows the probabilistic peak ground acceleration at rock site model with 5% probability of exceedance in 50 years. The Source Model is characterized by 111 earthquake source zones (active faults, area sources and trenches).

Peak Ground Acceleration Map (Rock Site 500-year Return Period)

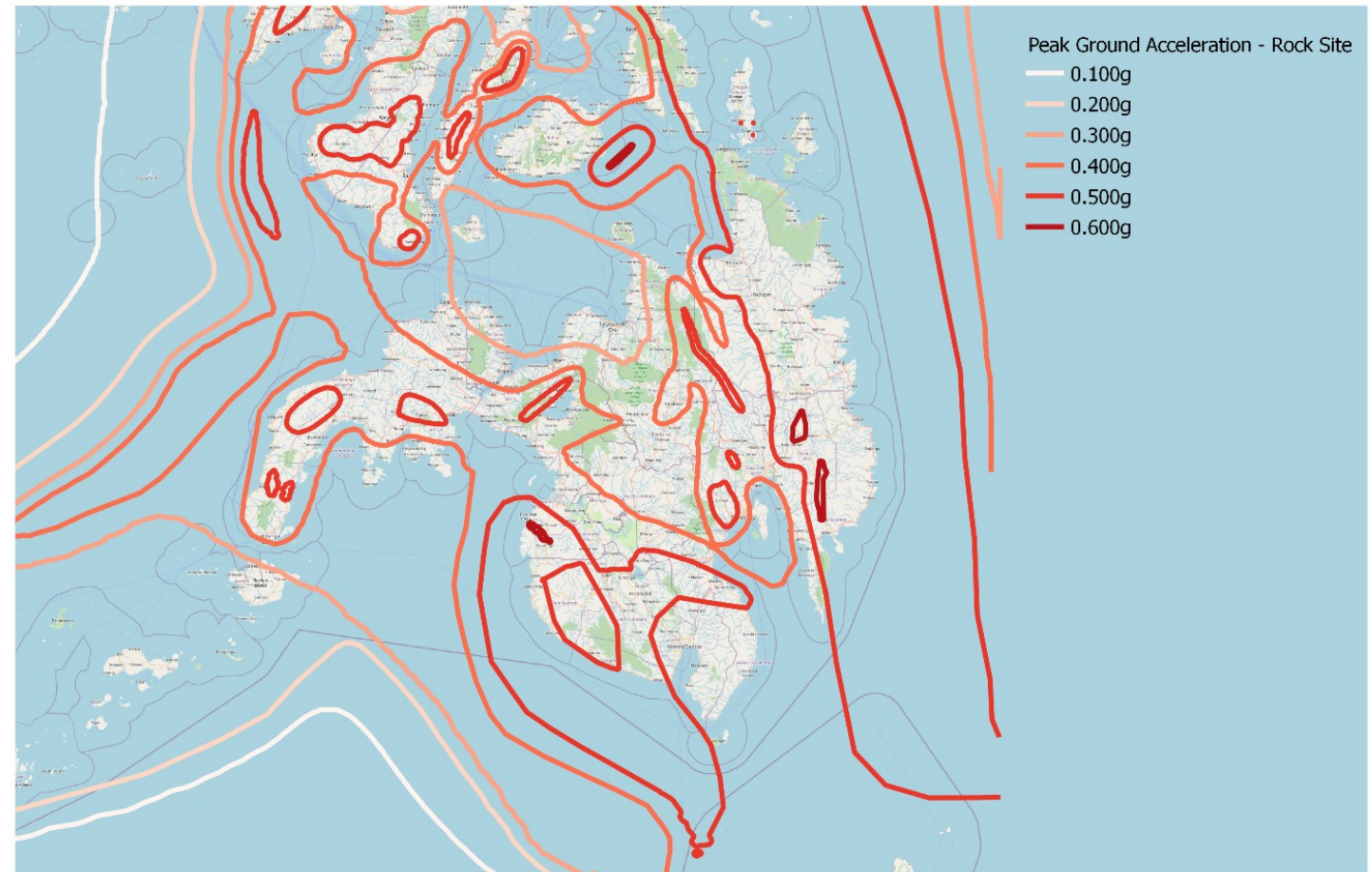
- The 500-year return map for Peak Ground Acceleration shows that Tboli is in an area near a PGA value of 0.500g.
- This suggests that there is on any given year, there is a 0.2% probability, or 1 in every 500 years on average, that an earthquake that exceeds a ground acceleration of 0.5g occurs.
- T'boli here is inside an area that encompasses almost the whole of southern Mindanao, up to the municipality of M'lang in the province of North Cotabato. The area near T'boli in particular is centered around Koronadal City which is a few kilometers away from the municipality of T'boli.



Mindanao Peak Ground Acceleration Map (Rock Site 500-Year Return Period)

Peak Ground Acceleration Map (Rock Site 1000-year Return Period)

- The 1000-year return map for Peak Ground Acceleration shows that Tboli is in an area near a PGA value of 0.500g.
- This suggests that there is on any given year, there is a 0.1% probability, or 1 in every 1000 years on average, that an earthquake that exceeds a ground acceleration of 0.5g occurs.
- T'boli is inside an area that covers almost the entire Region XII except Malapatan and General Santos. T'boli is also near a separate region which encompasses a huge part of Sultan Kudarat.



Mindanao Peak Ground Acceleration Map (Rock Site 1000-Year Return Period)

Peak Ground Acceleration Map (Rock Site 2500-year Return Period)

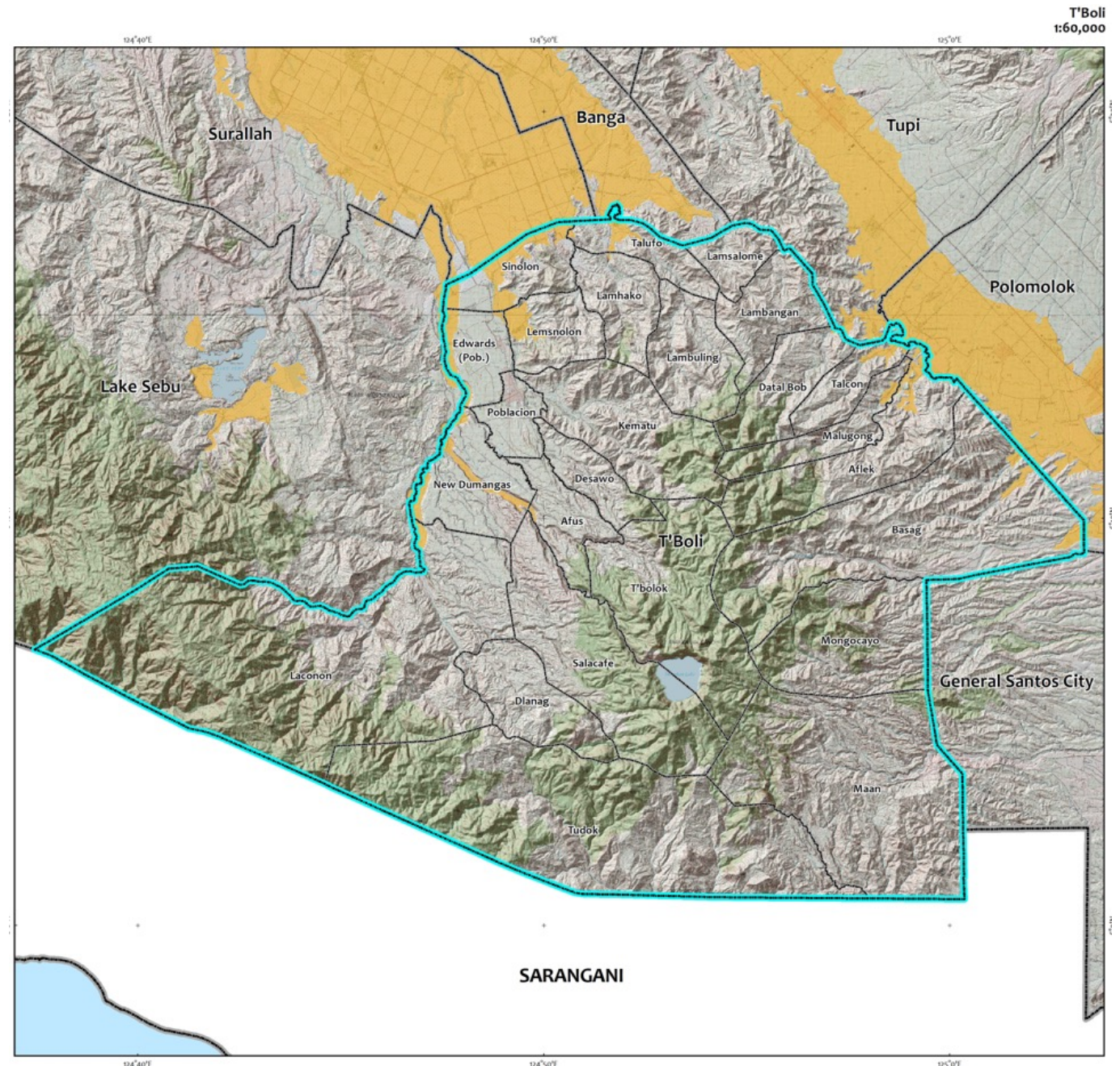
- The 2500-year return map for Peak Ground Acceleration shows that Tboli is in an area near a PGA value of 0.600g.
- This suggests that there is on any given year, there is a 0.04% probability, or 1 in every 2500 years on average, that an earthquake that exceeds a ground acceleration of 0.6g occurs.
- Here, T'boli in particular is not inside an encircled region. However T'boli is very close to an area in Koronadal City which has a PGA value of 0.600. To its south, there is also a region in the sea which also has a PGA of 0.600.



Mindanao Peak Ground Acceleration Map (Rock Site 2500-Year Return Period)

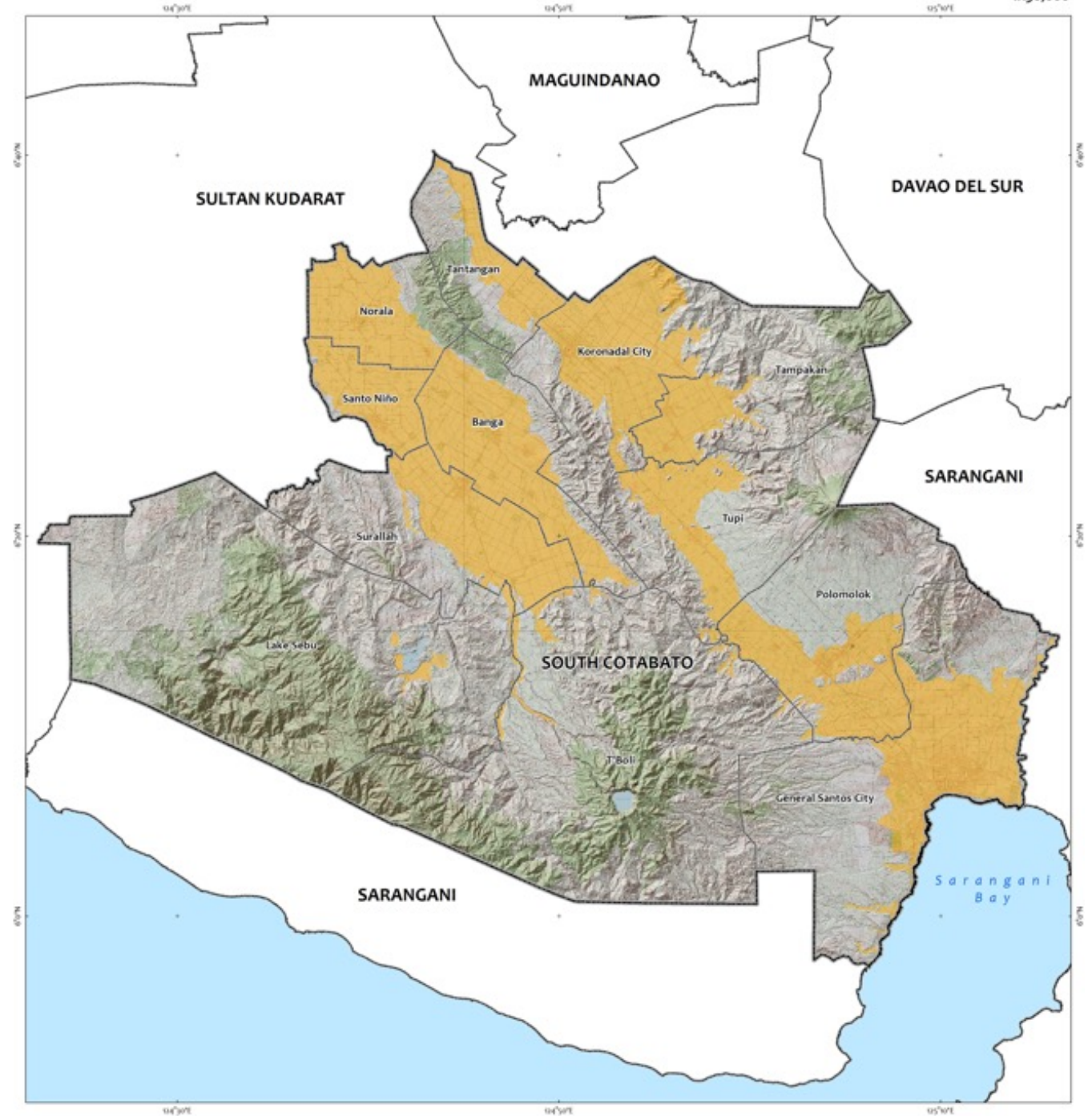
Liquefaction Hazard Map for T'boli, South Cotabato

- Liquefaction is another seismic hazard which takes place when **loosely packed, water logged sediments lose their strength due to strong ground shaking.**
- This is a cause of concern in T'boli where earthquakes tend to frequently happen.
- This liquefaction hazard map of T'boli according to DOST-PHIVOLCS is based on geology, presence of active faults and historical accounts of liquefaction, geomorphology, and hydrology in the area.
- The map shows liquefaction prone areas in Bgy. Edwards, New Dumangas, Sinolon, Talufo, Lemsnolon, Talcon, Malugong, Aflek, and Basag.



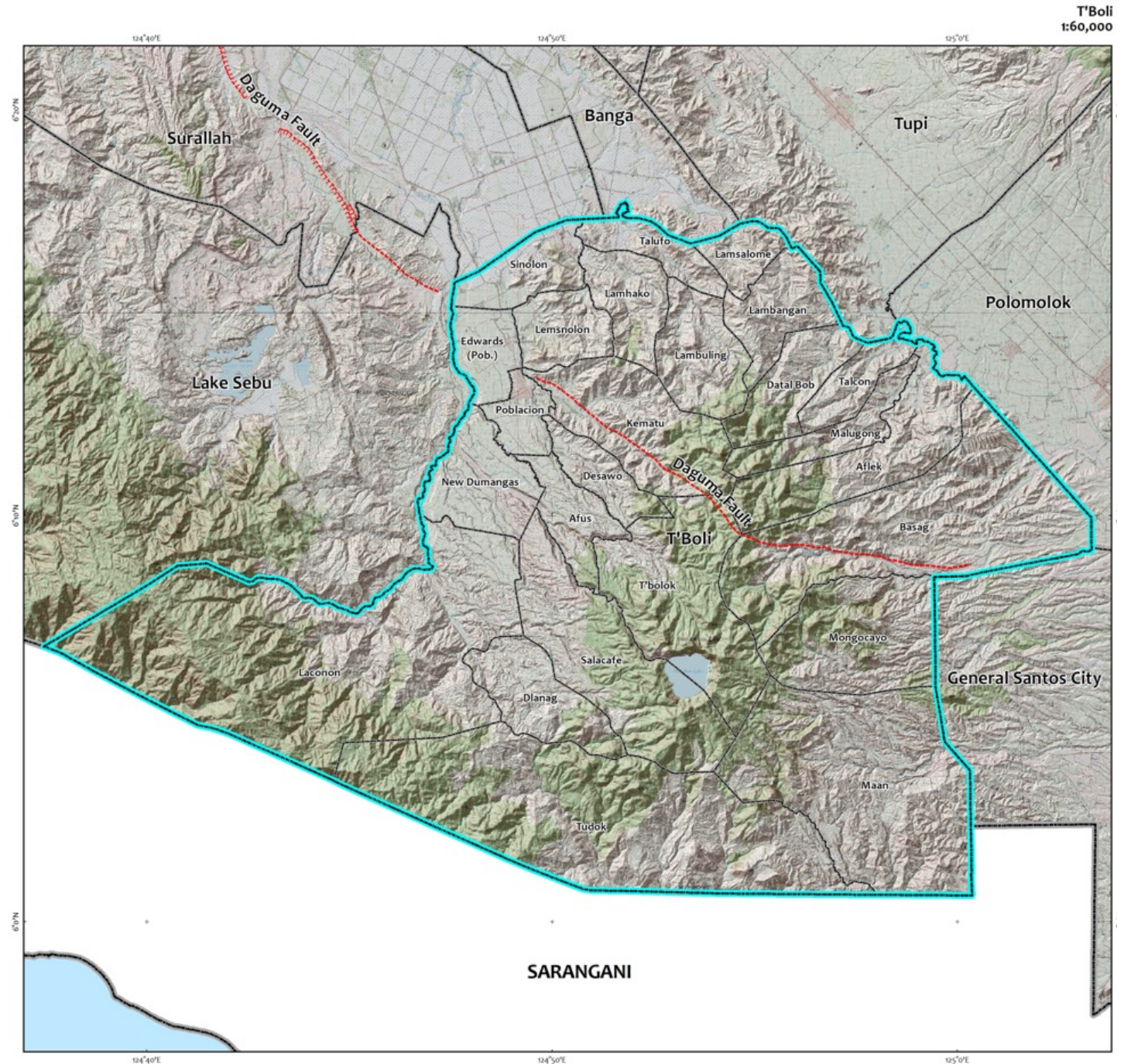
Liquefaction Hazard Map of South Cotabato

- Generally, the areas very susceptible to liquefaction are around Tboli, such as the municipality of Banga, Surallah, Norala, Sto. Nino, Tantangan, Koronalda, Polomolok and Tupi. These valleys between mountains.



Ground Rupture Hazard Map of Tboli, South Cotabato

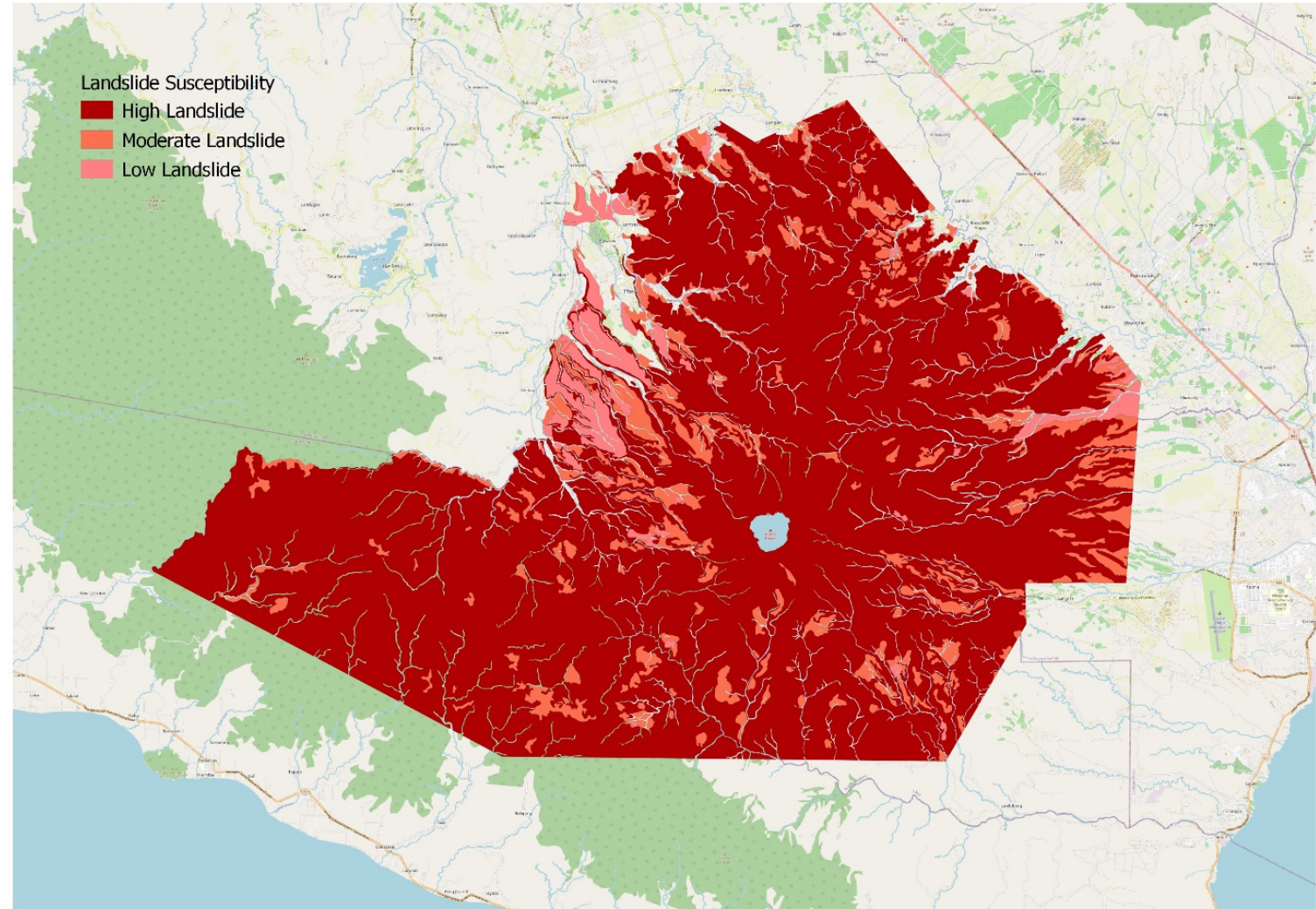
- According to DOST-PHIVOLCS, the active Daguma Fault has shown strong evidence of displacement and deformation of young sediments and geologic features within the last 10,000 years, and is probably going to move again in the future.
- Movements of this active fault may result in ground rupture which may be damaging to buildings and man-made structures built on top of the faults.
- As such, it is recommended to avoid building structures within 5 meters of both sides of the faults from the edge of the deformation zone.



Landslide Hazard

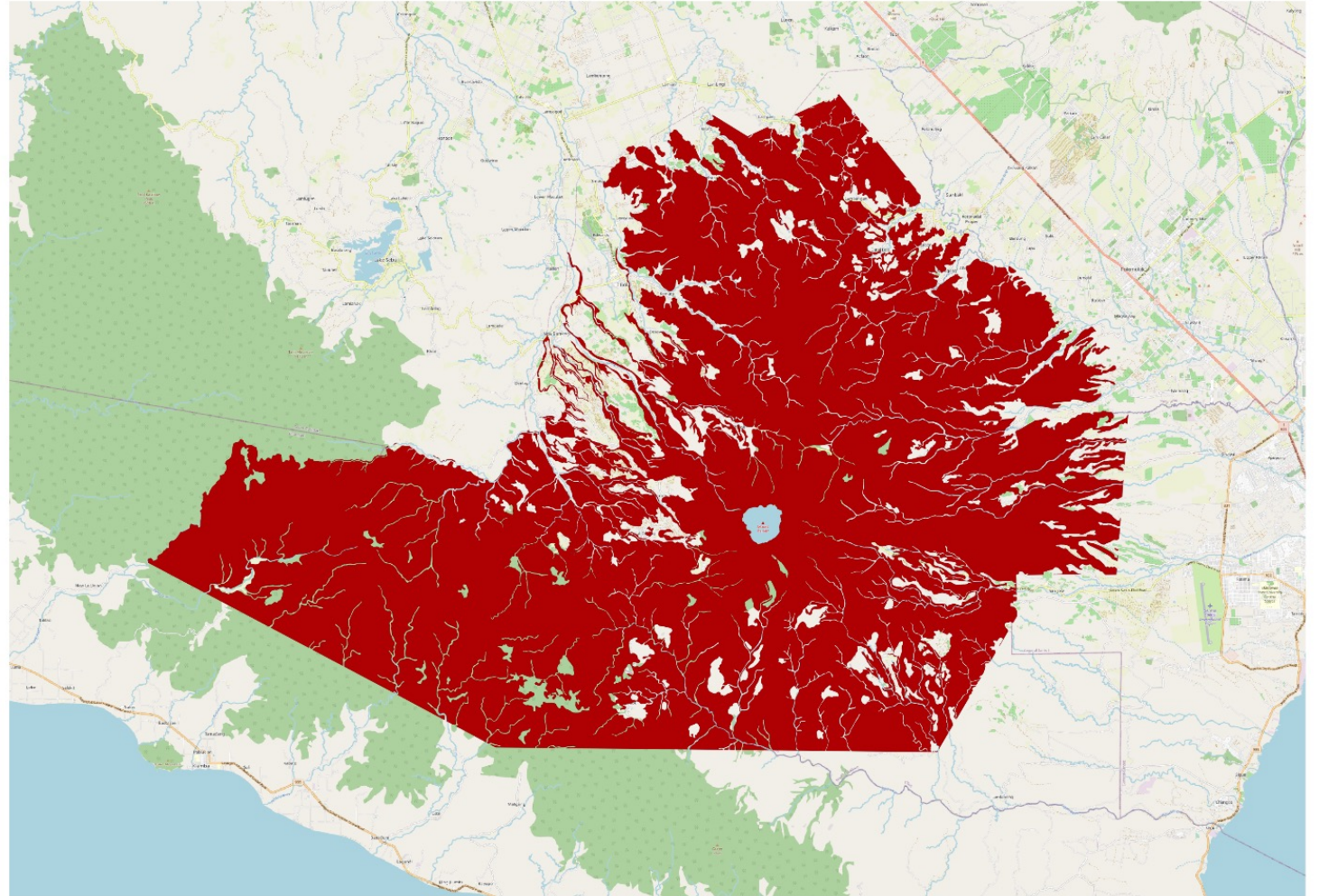
Landslide Susceptibility

- Almost the whole of T'boli has high landslide susceptibility, mostly due to rain.
- According to the T'boli MPDO, 35,709 hectares are highly exposed to landslide, 6,555 hectares are moderate, while, 9,002 hectares have low exposure.
- Municipality's landscape makes it prone to threats of rain-induced landslides and flash floods due to high degrees of physiographic landforms and slopes, and high degree of condensation and long season of rainfalls in a year.



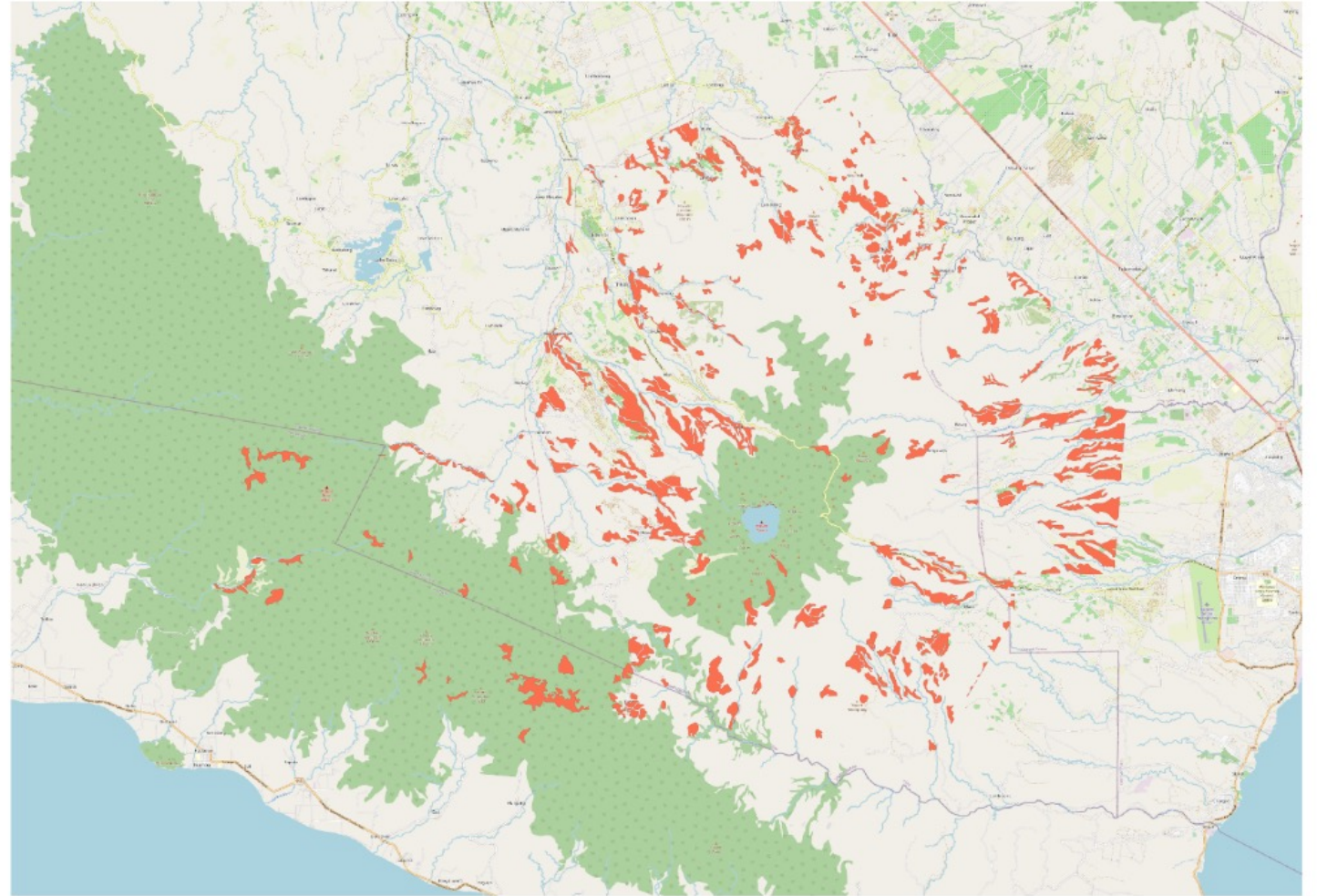
High Landslide Susceptibility Areas

- High landslide susceptibility areas cover almost the entire area of T'boli.



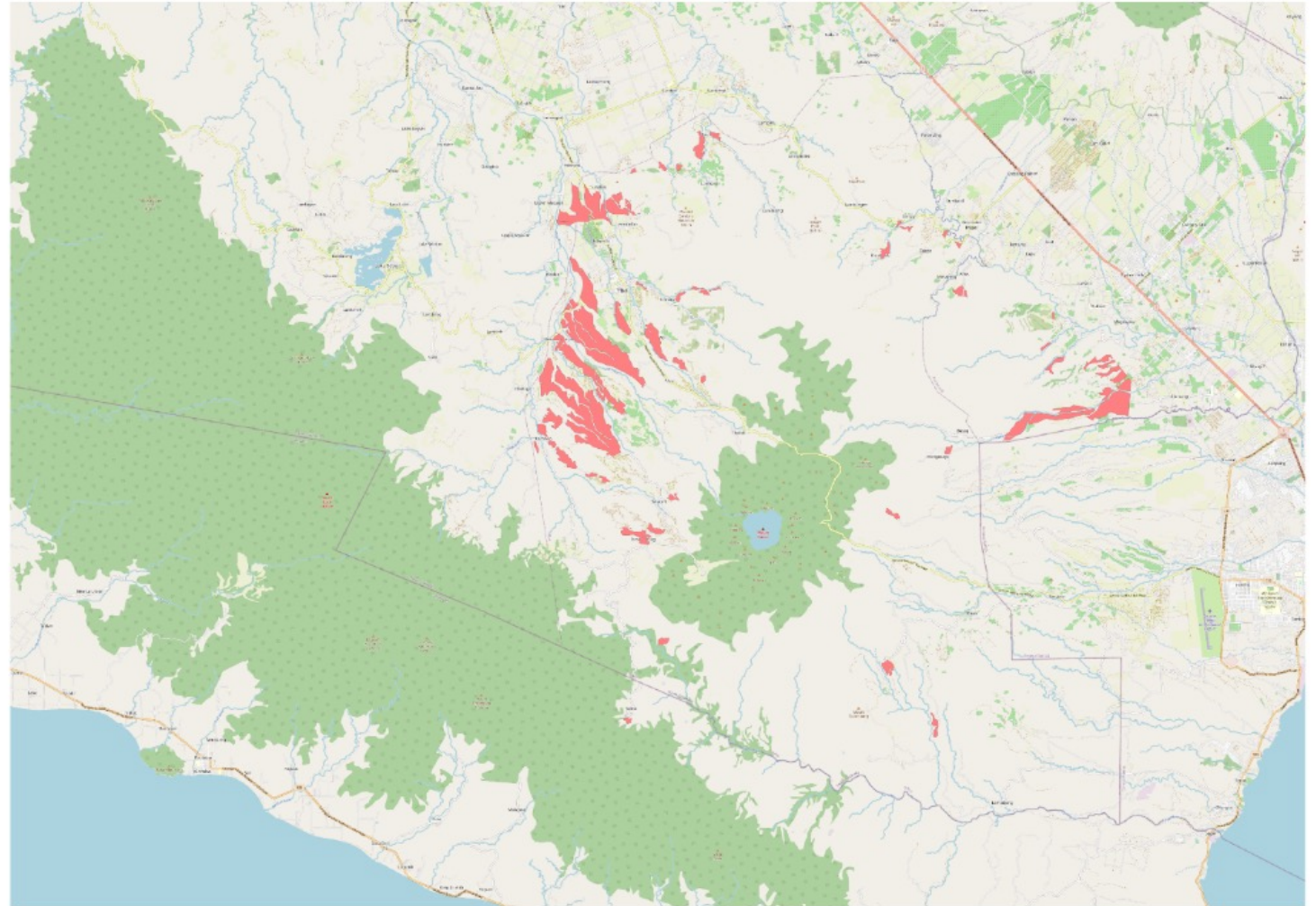
Moderate Landslide Susceptibility Areas

- Moderate landslide susceptibility areas are scattered across the map beside high susceptibility areas.



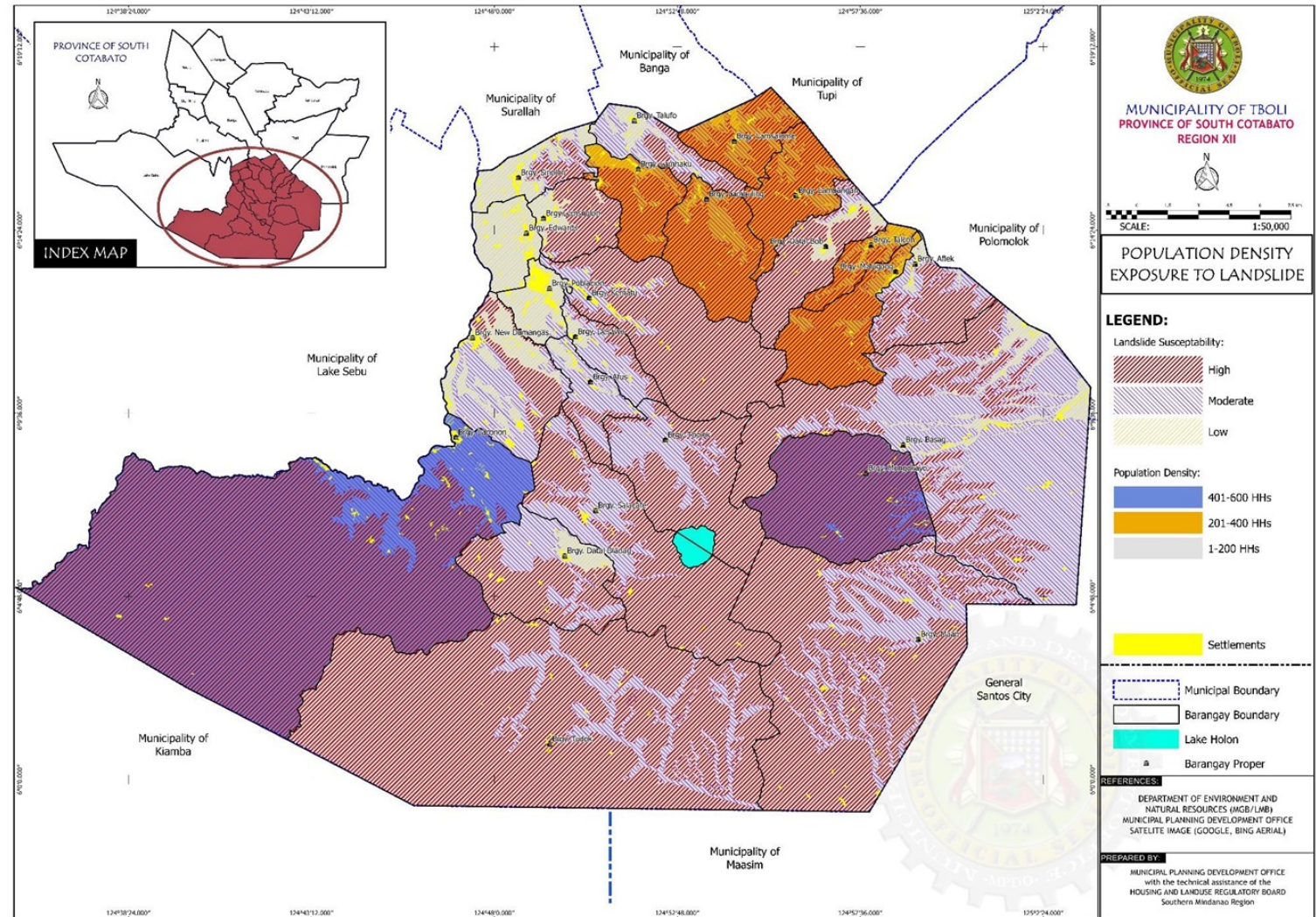
Low Landslide Susceptibility Areas

- Areas of low landslide susceptibility are those along lower elevations.



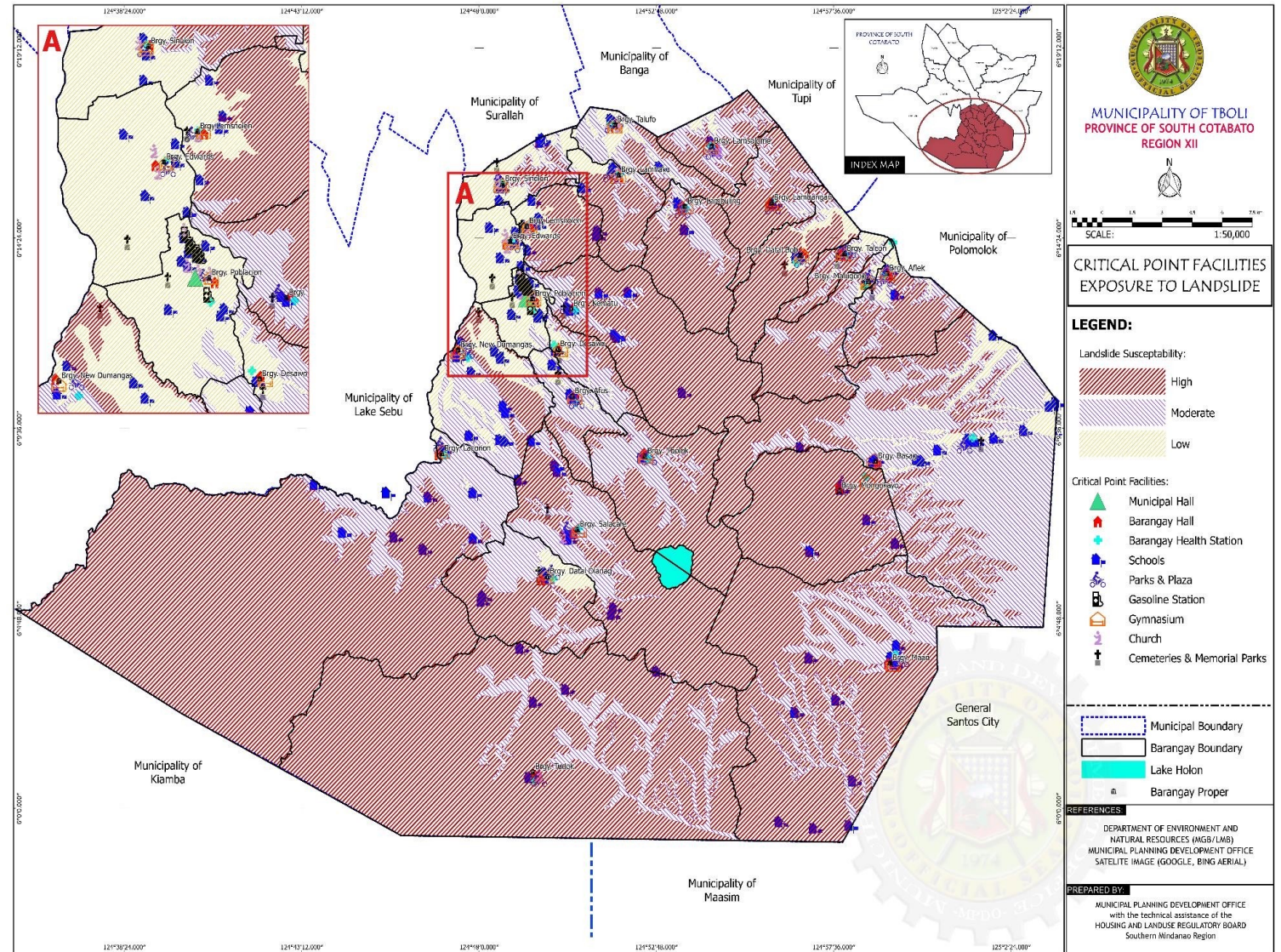
Landslide Hazard Population Exposure Map

- A total of 23,177(25.3%) people are exposed to “High” susceptibility for Landslide
- 19,686 (21.5%) are exposed to “Moderate” susceptibility out of the Municipality’s total population.
- Among the above affected population communities, the following barangays are under the High Susceptibility for landslide hazards: Mongokayo (100%); Tudok(100%); Lambangan; Maan Sch. (Bongo, Coong, Balnabo, Tablow, Pitak); Basag-Kebuling; Kematu-Butlihik, Lamluyon; Laconon-Dangkong, Manga, Salabanog; and Lemsnolon.



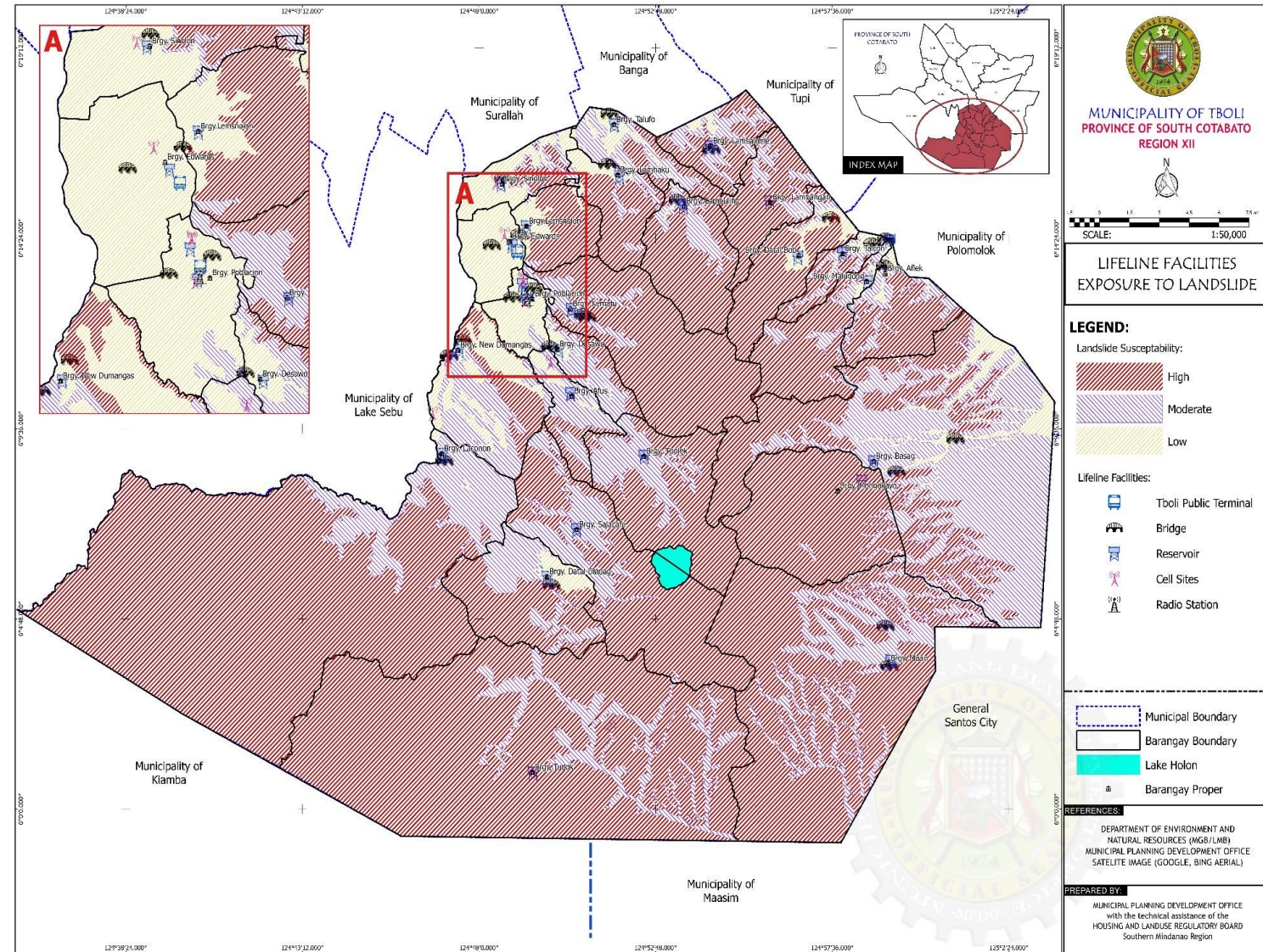
Landslide Hazard Critical Point Facility Exposure Map

- A total of 166 facilities (15.7%) are exposed to “High” susceptibility for landslide hazard, and 198 facilities (18.73%) are exposed to “Moderate” susceptibility out of the 1,057 critical point facility units of the Municipality.
- Possible affected barangays and communities are Mongokayo (100%); Tudok(100%); Lambangan; Maan Sch. (Bongo, Coong, Balnabo, Tablow, Pitak); Basag-Kebuling; Kematu-Butlihik, Lamluyon; Laconon-Dangkong, Manga, Salabanog; Lemsnolon.
- The estimated value of the exposed facilities in high susceptibility areas is Php87,462,000, while Php120,536,000 (15.64%) for moderate susceptibility areas.



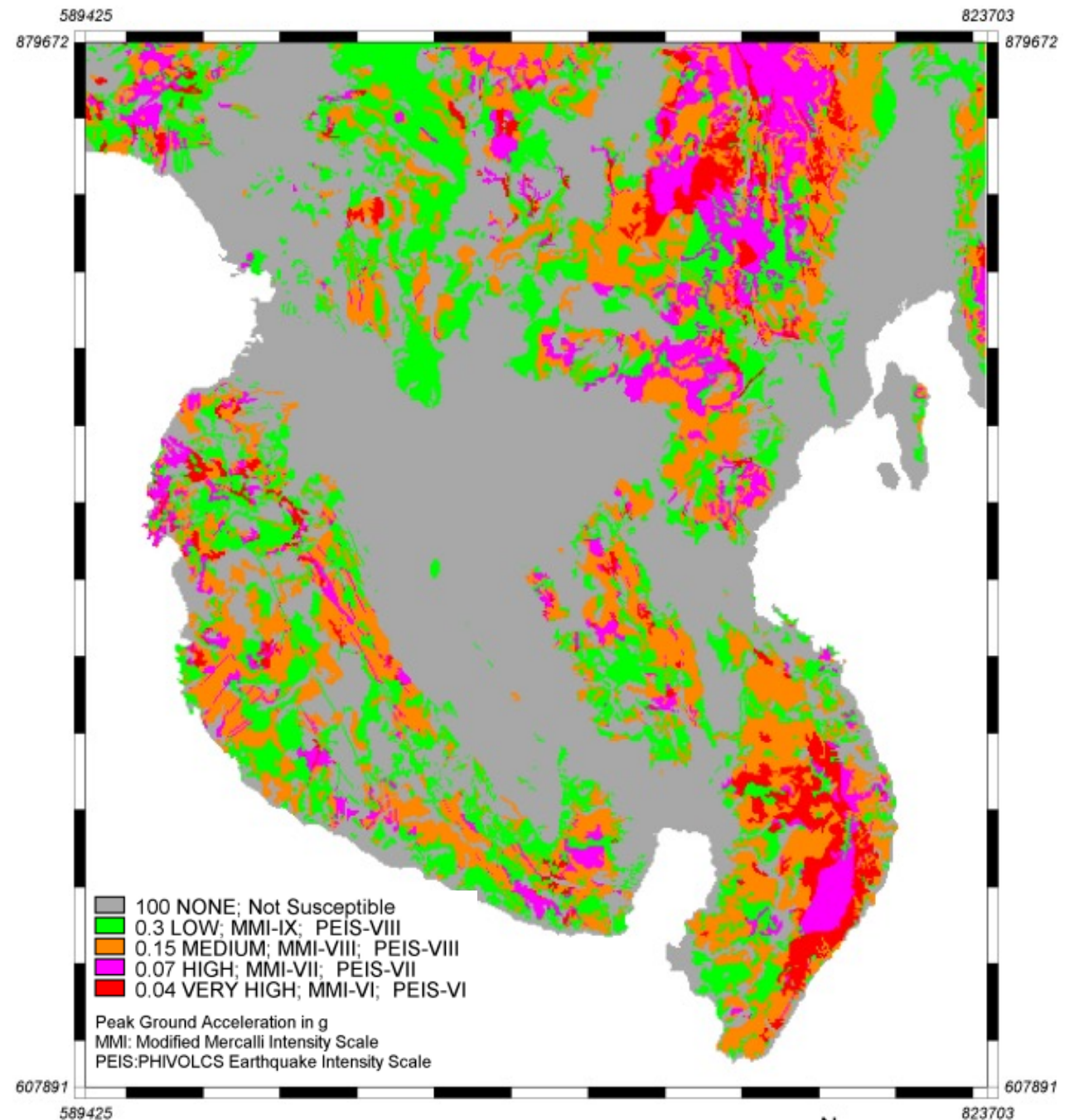
Landslide Hazard Lifeline Facilities Exposure Map

- A total of 152.197 kilometers(43.2%) of road are exposed to “High” landslide susceptibility level and 105.52 kilometers(28.1%) for “Moderate” landslide susceptibility level, out of 351.62 km of the Municipality’s total Road Length.
- The affected areas assessed are the barangays of Mongokayo (100%); Tudok(100%); Lambangan; Maan Sch. (Bongo, Coong, Balnabo, Tablow, Pitak); Basag-Kebuling; Kematu-Butlihik, Lamuyon; Laconon-Dangkong, Manga, Salabanog; Lemsnolon.



Earthquake-triggered Landslide Susceptibility

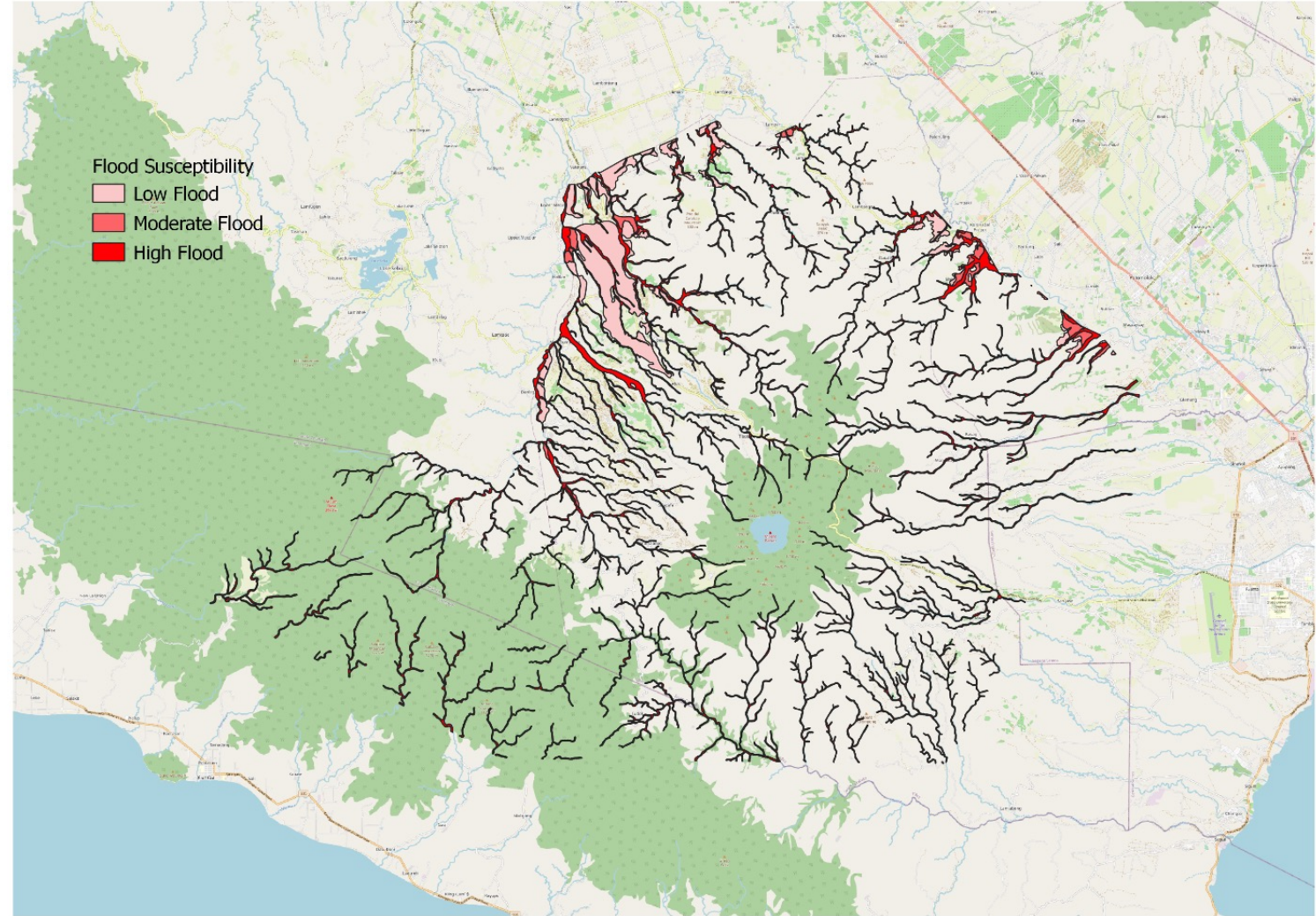
- Generally, areas in Sarangani, especially Alabel are medium to high susceptibility for earthquake-induced landslides in the southeastern part of Region XII.
- In the southwestern part of Region XII are areas in Sultan Kudarat, particularly, Shariff Aguak, Datu Blah Sinsuat, Lebak, Kalamansig, and Palimbang. Valley cities and municipalities such as Koronadal, Banga, Surallah, Tupi, Polomolok, and General Santos and areas in North Cotabato are generally not susceptible to earthquake-induced landslides.
- The municipality of Tboli seems to be safe from earthquake-induced landslides, since the areas with susceptibility are to the south of its area, to the municipality of Maasim.



Flooding Hazard

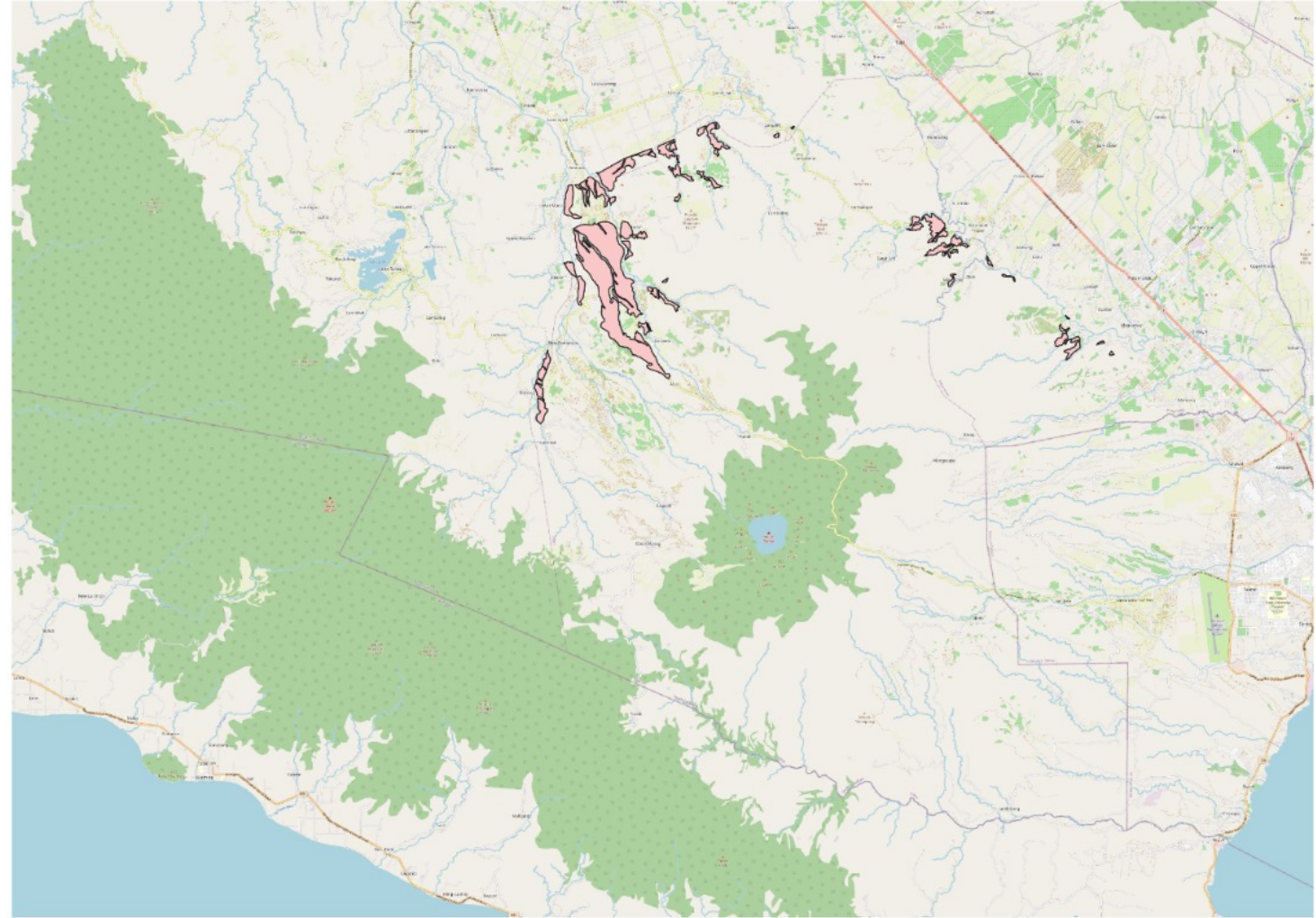
Flooding Hazard

- Flood susceptibility in T'boli is generally low and only typically occurs in less elevated areas.
- However, due to the risk of overflowing during rains, there is always high flood susceptibility in areas along rivers.



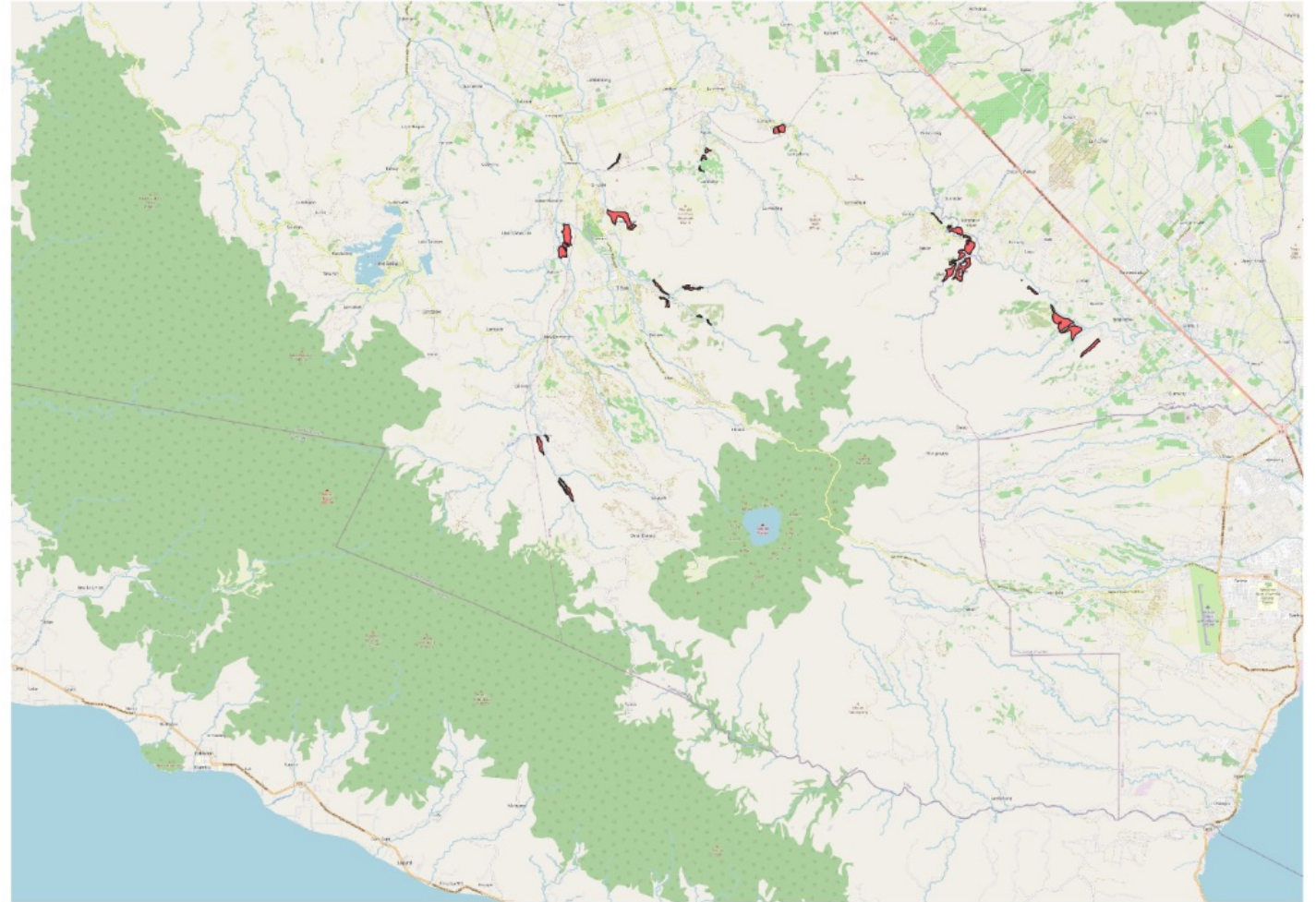
Low Flood Susceptibility Areas

- Areas of low flood susceptibility lie in the economic center of the municipality such as Brgy. Edwards, Brgy. Poblacion, extending to areas near Brgy. Desawo and Afus.
- There are also areas with low flood susceptibility near Koronadal Proper and Blanan.



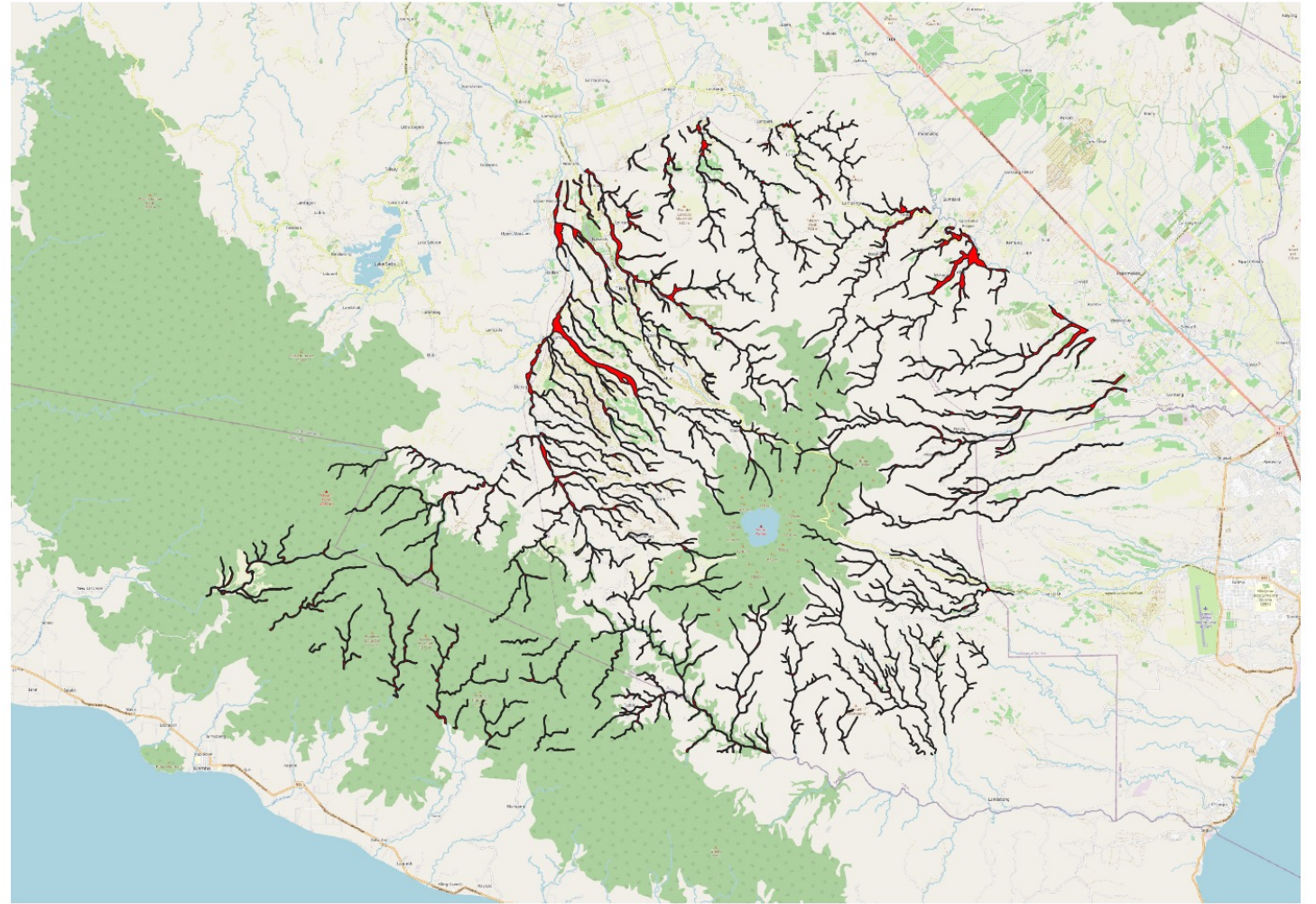
Moderate Flood Susceptibility Areas

- There are a few areas of moderate flood susceptibility, among which are areas near Koronadal Proper, and near the Silway River in Brgy. Rubber in General Santos City.
- There are also small areas of moderate flood susceptibility along the Kematu river, Sapali River, and Allah River.



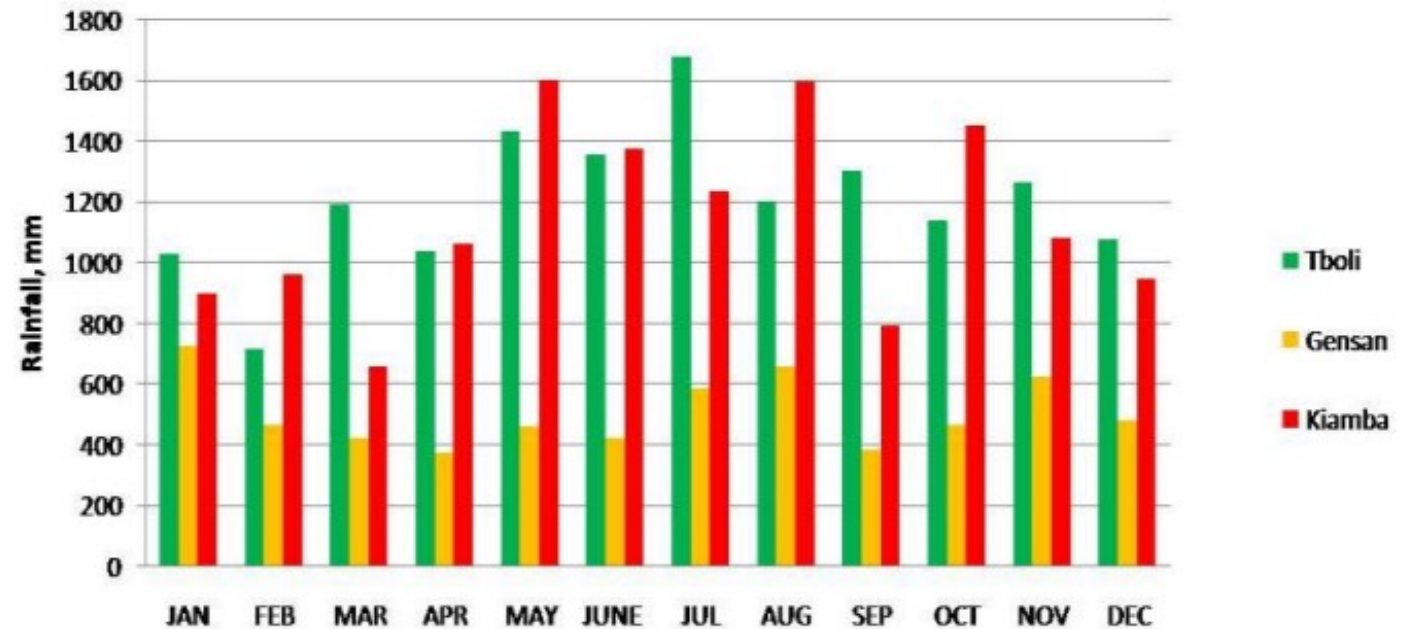
High Flood Susceptibility Areas

- High flood susceptibility areas are usually those along the river systems which could overflow in events of extreme or prolonged rain.
- There is a particularly wider area of high flood susceptibility in the Ga-o River in New Dumangas.
- There are also wider high susceptibility areas for flooding in the Talcon River in Brgy. Malugong and Aflek.



Comparative Rainfall Chart of Tboli, General Santos, and Kiamba (1998-2003)

- Analysis of rainfall in Tboli from 1998 to 2003 shows that the highest amount of rainfall in the area occurs during the month of May, June and July, which reaches up to more than 1600mm in its peak.
- However, a longer rainfall data for Tboli, the months of June, July, and August has the highest mean rainfall of 402.8mm, 354.06 and 330.29 respectively making this period wetter and with potential for increased in flooding and landslides.



Extreme Weather Events in T'boli

July 19, 2023

- Just recently, more than 20 families or at least 88 persons were affected by flooding and landslide in Tboli due to continuous heavy rains

March 9, 2022

- At least 300 individuals were temporarily displaced in South Cotabato due to flash floods and landslides caused by heavy rains due to a low pressure area which affected parts of Mindanao and Visayas.
- In Tboli, at least 30 fishponds were destroyed, affecting 10 farmers in Brgy. Dumangas.
- A house was also washed away by surging floodwaters

On March 30, 2011

- Continuous heavy rains caused the Sapali River to overflow.
- Four bridges were damaged, amounting to PhP200,000.00.
- One house was also damaged along with three cows drowning, amounting to PhP100,000 worth of damages.

March 31, 2011

- Heavy rains buried houses and mining tunnels operated by the Tribal Mining Corporation in Tboli, killing at least 3 people and wounding 2 others
- A day later on April 1, 2011 another landslide occurred in Brgy. New Dumagas, Tboli which caused the death of one person
- On the same day, three people were buried alive in a landslide in Sitio Tunnel, Brgy Kimatu in Tboli, which is a gold rush area

Extreme Weather Events in T'boli

August 2008

- 10 persons were killed in landslides and flashflood brought by heavy rains in Tboli
- 8 of which are children that are pupils of an elementary school in Barangay Desawo.

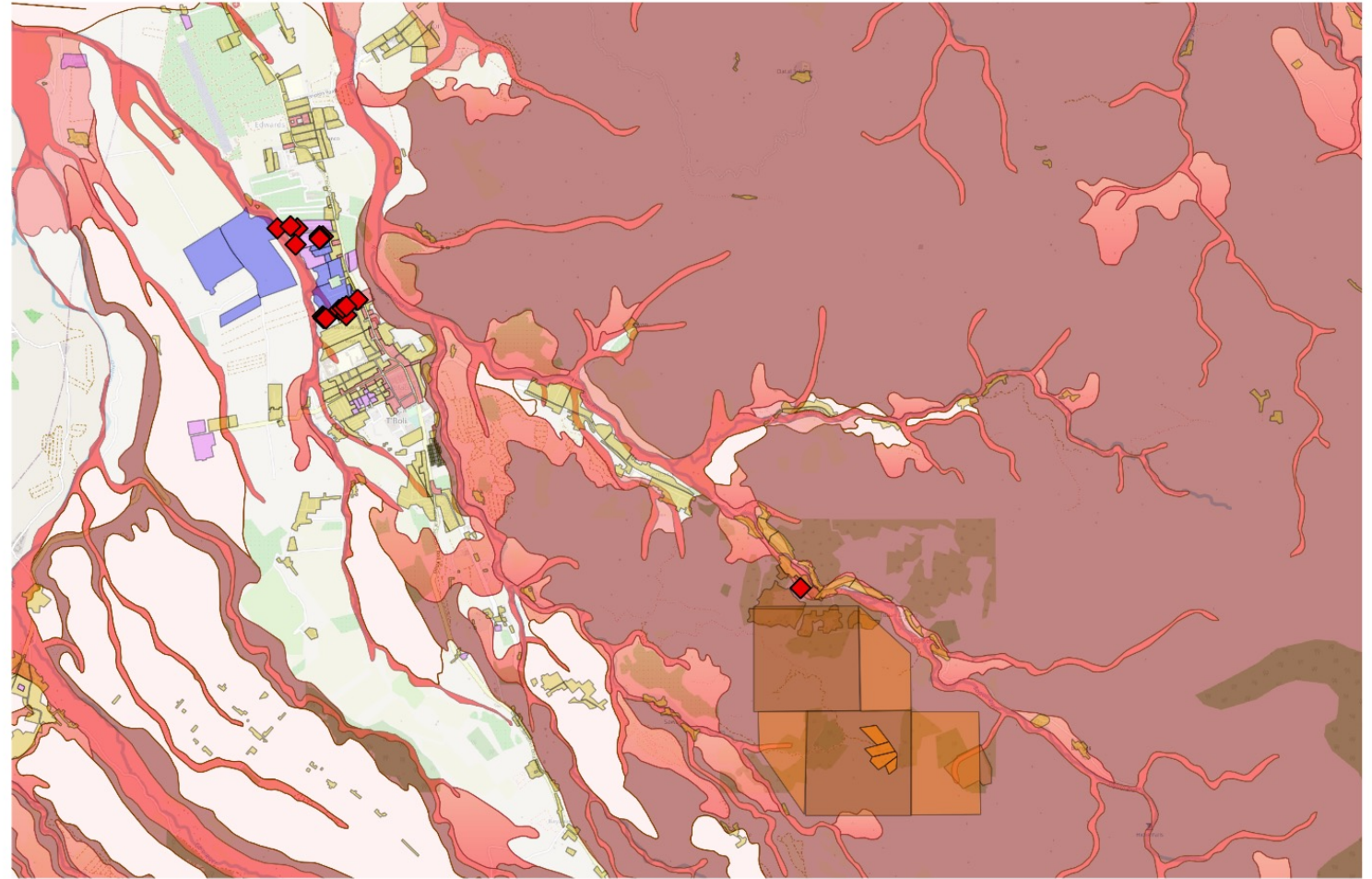
January 2007

- 2 gold tunnels in Tboli collapsed also due to heavy rains.
- These tunnels were also operated by the Tribal Mining Corporation.
- It was reported that heavy rains worsened the condition of the mountain which was already damaged by mining activities.

Environmental Hazards in Mining Areas

Samples with Above Safe Level Measurements Detected in T'boli Mining Areas with Landslide and Flooding Susceptibility

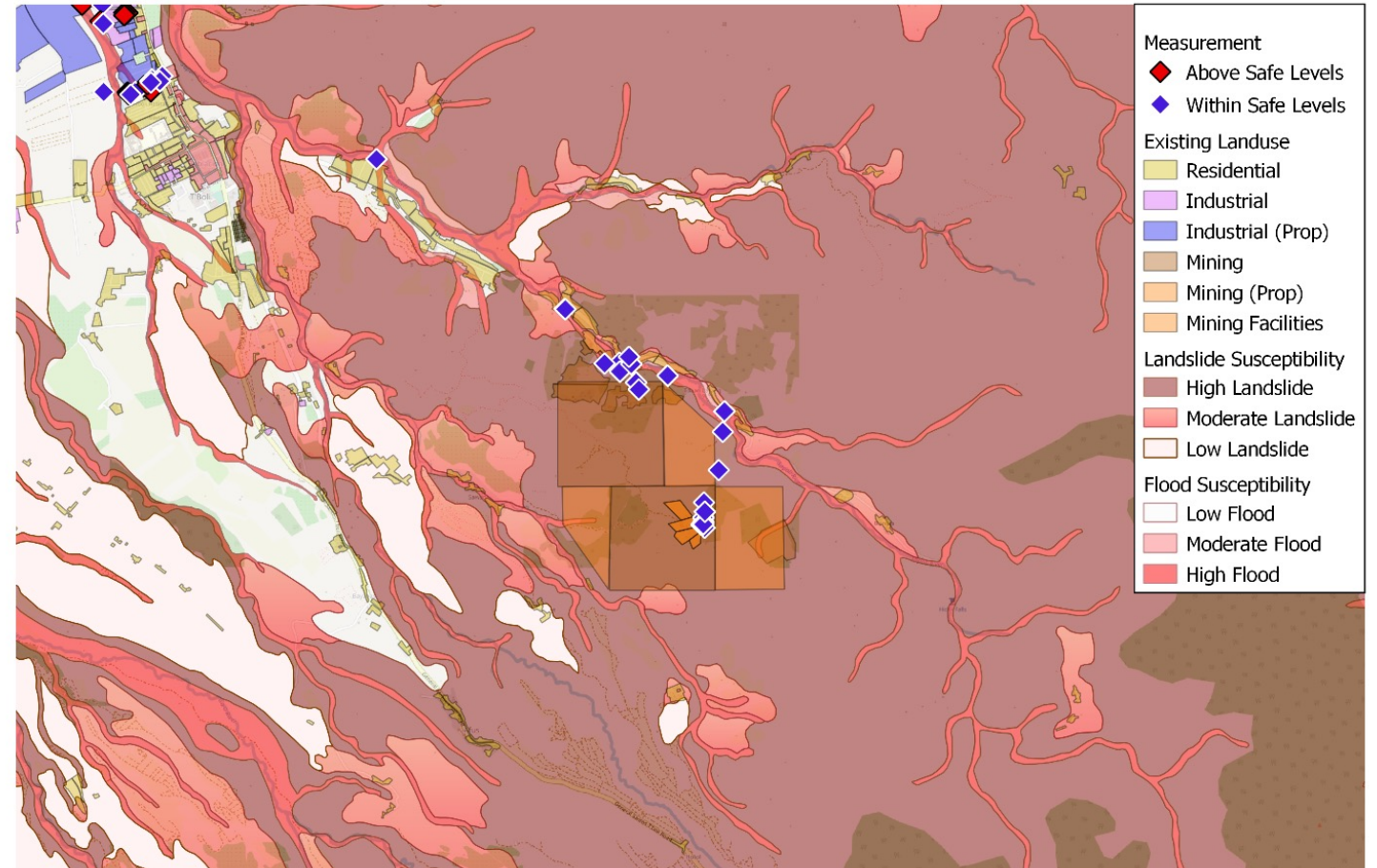
- The map shows the approved mining tenements in the Minahang Bayan (orange) and the land used for Industrial (Blue, Purple) and residential (yellow) purposes in T'boli, South Cotabato.
- The light red and dark red areas represent moderate and high susceptibility to landslide respectively, while the vein-like systems are high flooding susceptibility areas, and these are areas immediately surrounding the river systems in T'boli.
- The red dots represent samples that the researchers have gathered (air, water, biota, noise) flagged to have values above the recommended safe limits.



Samples with Above Safe Levels Detected in T'boli, South Cotabato

Hazards Present in Minahang Bayan Areas

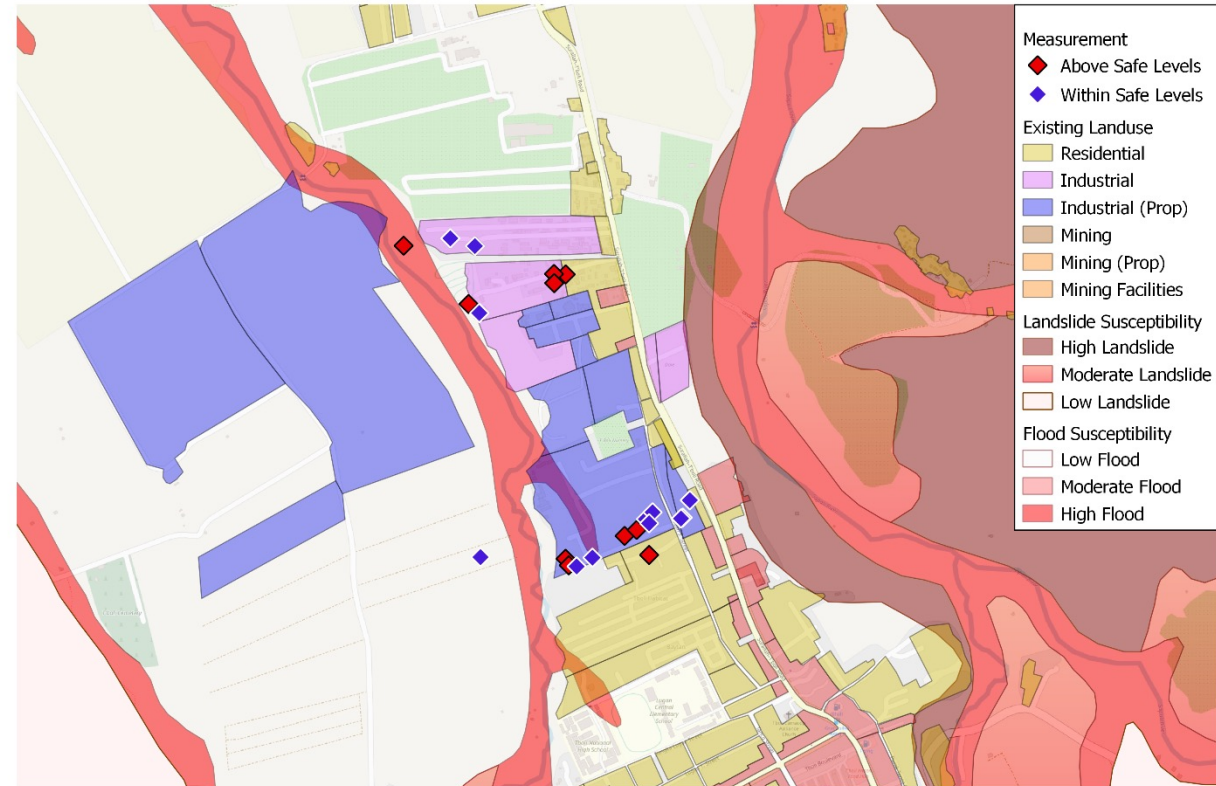
- In the Minahang Bayan, above safe level measurements from samples are scarce.
- However, the whole area is enveloped in high landslide susceptibility.
- This poses a grave threat to miners in cases of heavy and continuous rainfall or strong earthquakes as the risk of subsidence increases.



Hazards Present in T'boli Minahang Bayan Areas

Hazards Present in Mine Processing Areas

- The processing areas located in the municipality's business district are relatively safer from threats of landslides.
- Areas near rivers are at high susceptibility to flooding which may be dangerous since flooding in these areas can result in the release of toxic substances from mining operations, causing environmental contamination.
- As we can see in the map, there are samples inside the high flood susceptibility area found to have dangerously high levels of mercury.
- This contamination could contaminate the river system and cause toxic mercury to be introduced to agricultural settlements which the rivers supply water to.



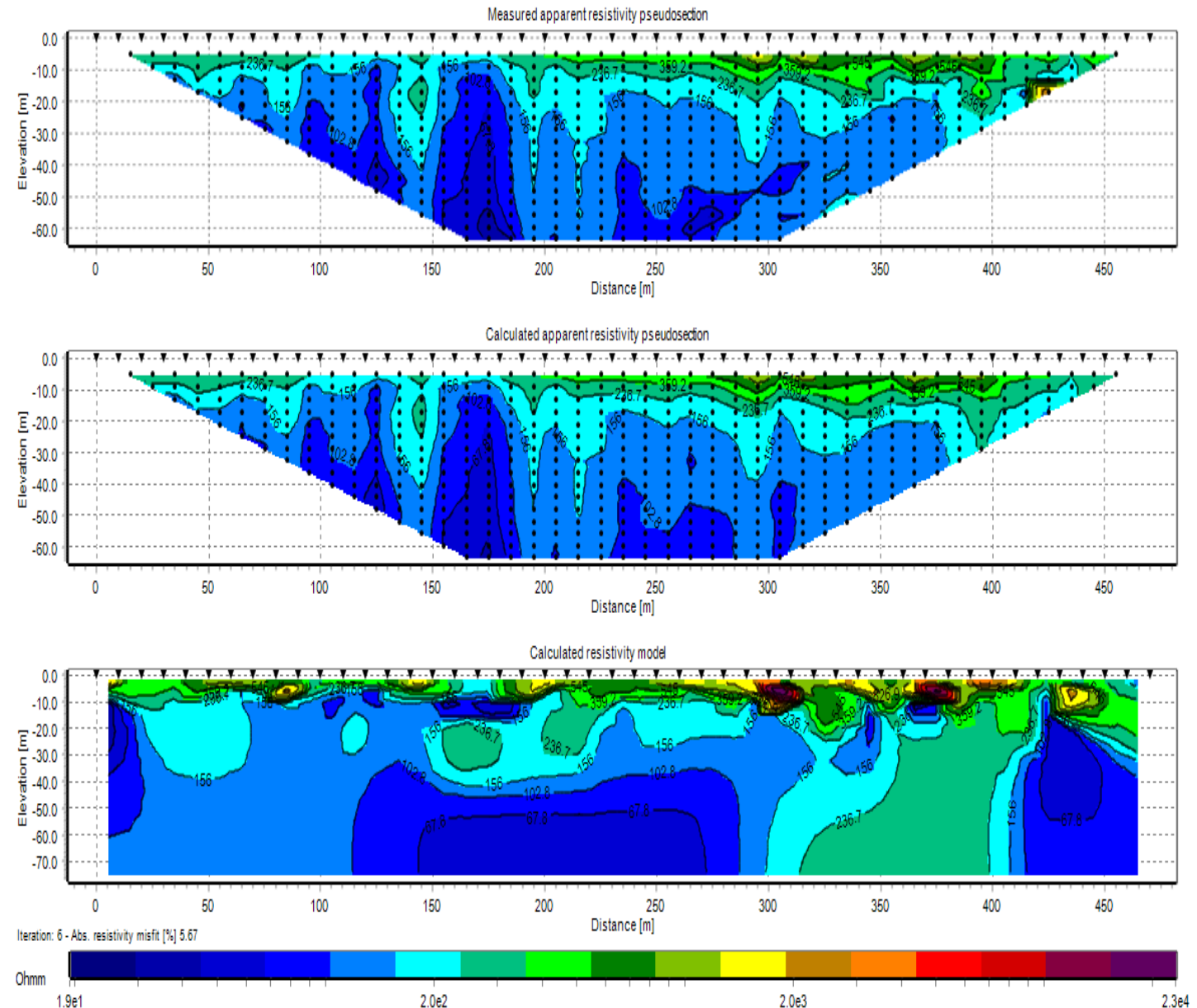
Hazards Present in T'boli Gold Processing Areas

Data Gathered from T'boli

Georesistivity and Microtremor Assessment

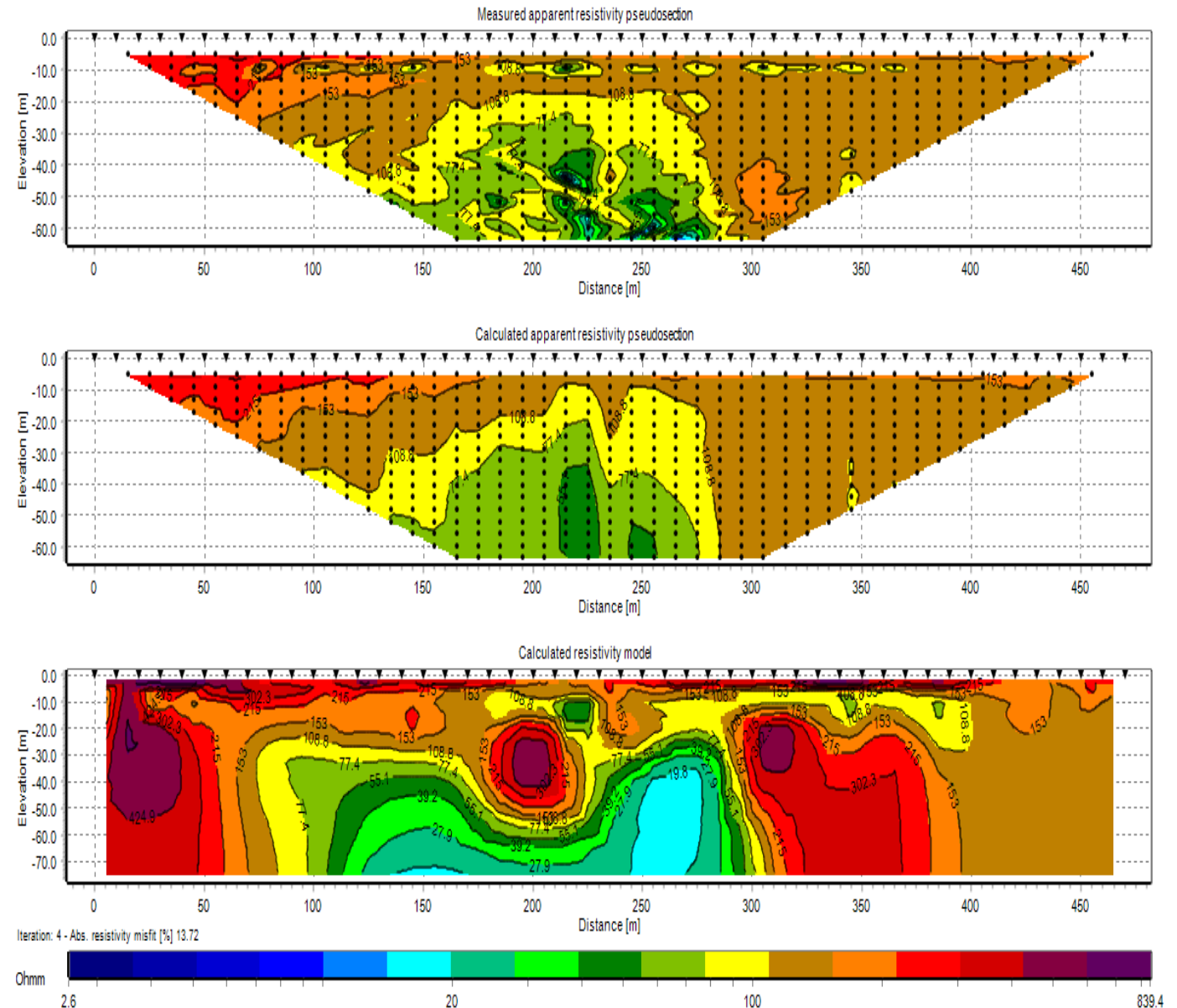
Georesistivity Measurement Site 1

- This was conducted in Sitio Chavez, Brgy. Edwards, T'boli South Cotabato
- The electrodes were placed in a line along a road beside ball mills and processing plants. The total length of the line is 480 meters.
- Somewhere between electrodes 25-48 lies a mine tailings pond where chemicals from an adjacent gold processing plant deposits their mine wastes
- The hypothesis to test here is whether the mine tailing has seeped out of the tailings pond, where it could potentially contaminate groundwater.
- The calculated resistivity model is still for analysis by an expert geologist.



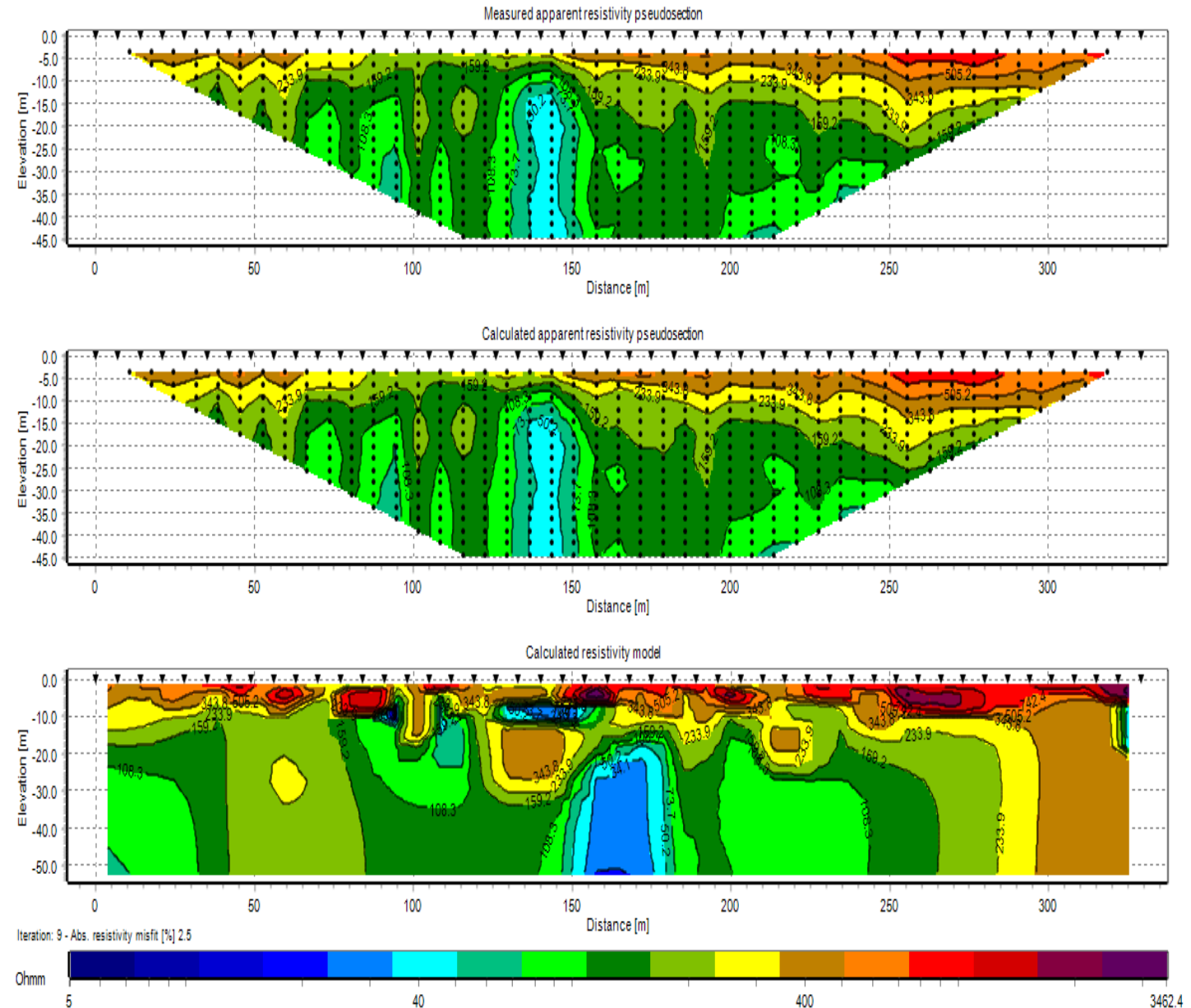
Georesistivity Measurement Site 2

- This was conducted in Sumbong Creek in T'boli
- Sumbong Creek is a tributary that runs along Brgy. Edwards, near the mine processing plants.
- The electrodes were placed in a line along the sumbong creek which at the time is dry. The total line length is 480 meters.
- It is possible that mine wastes that overflow from mine processing areas would flow and deposit into the creek.
- The hypothesis to test here is whether the mine tailing has deposited into the creek, potentially contaminating the main river that it flows into.
- The calculated resistivity model is still for analysis by an expert geologist.

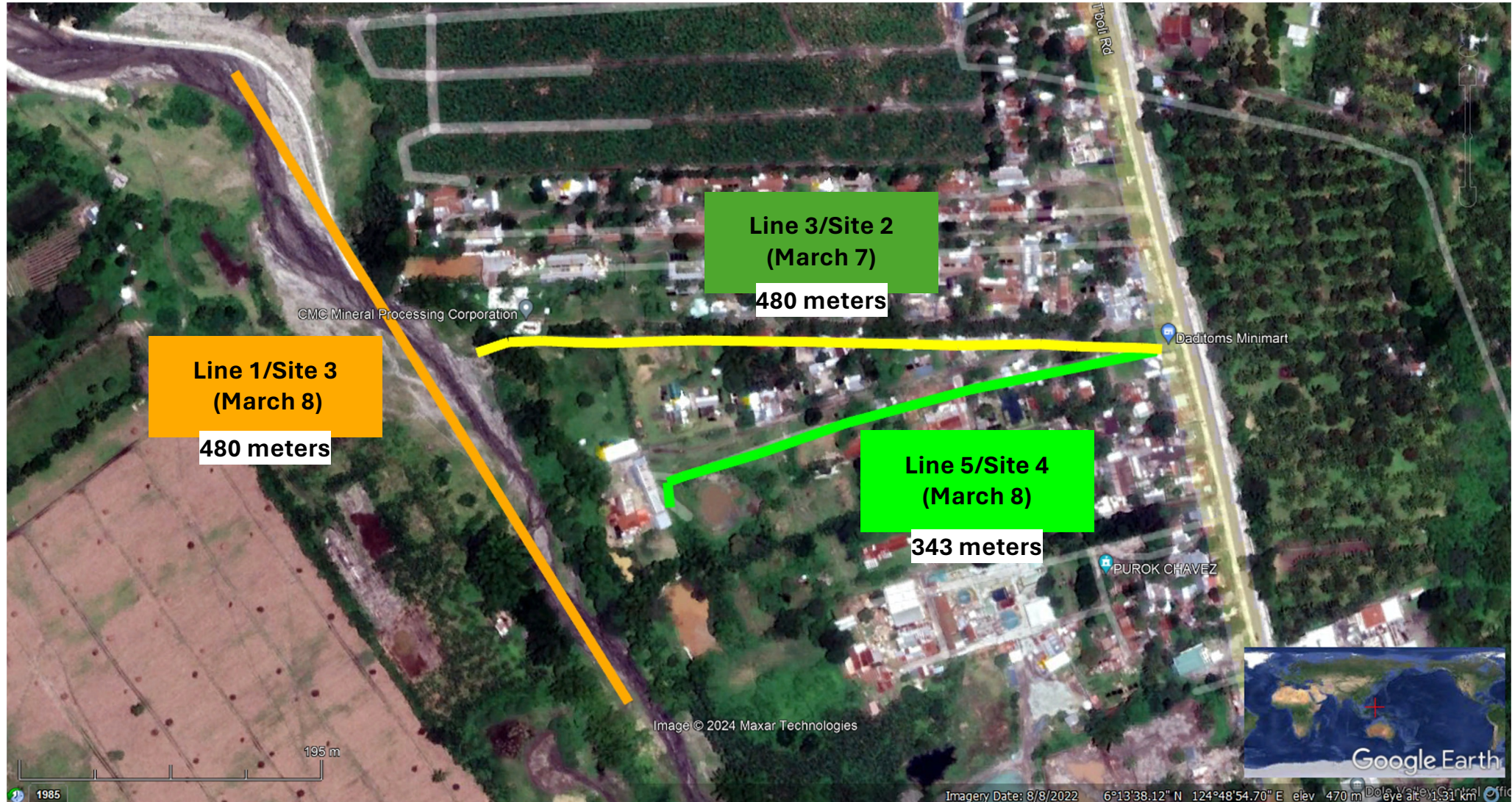


Georesistivity Measurement Site 3

- This was conducted in Sitio Chavez, Brgy. Edwards, T'boli South Cotabato
- The electrodes were placed along a road beside ball mills and processing plants.
- This line is parallel to the first line, but shorter due to limitations in accessibility. The total line length is 336 meters.
- The hypothesis to test here is whether the mine tailing has seeped out of the tailings pond, where it could potentially contaminate groundwater.
- The calculated resistivity model is still for analysis by an expert geologist.



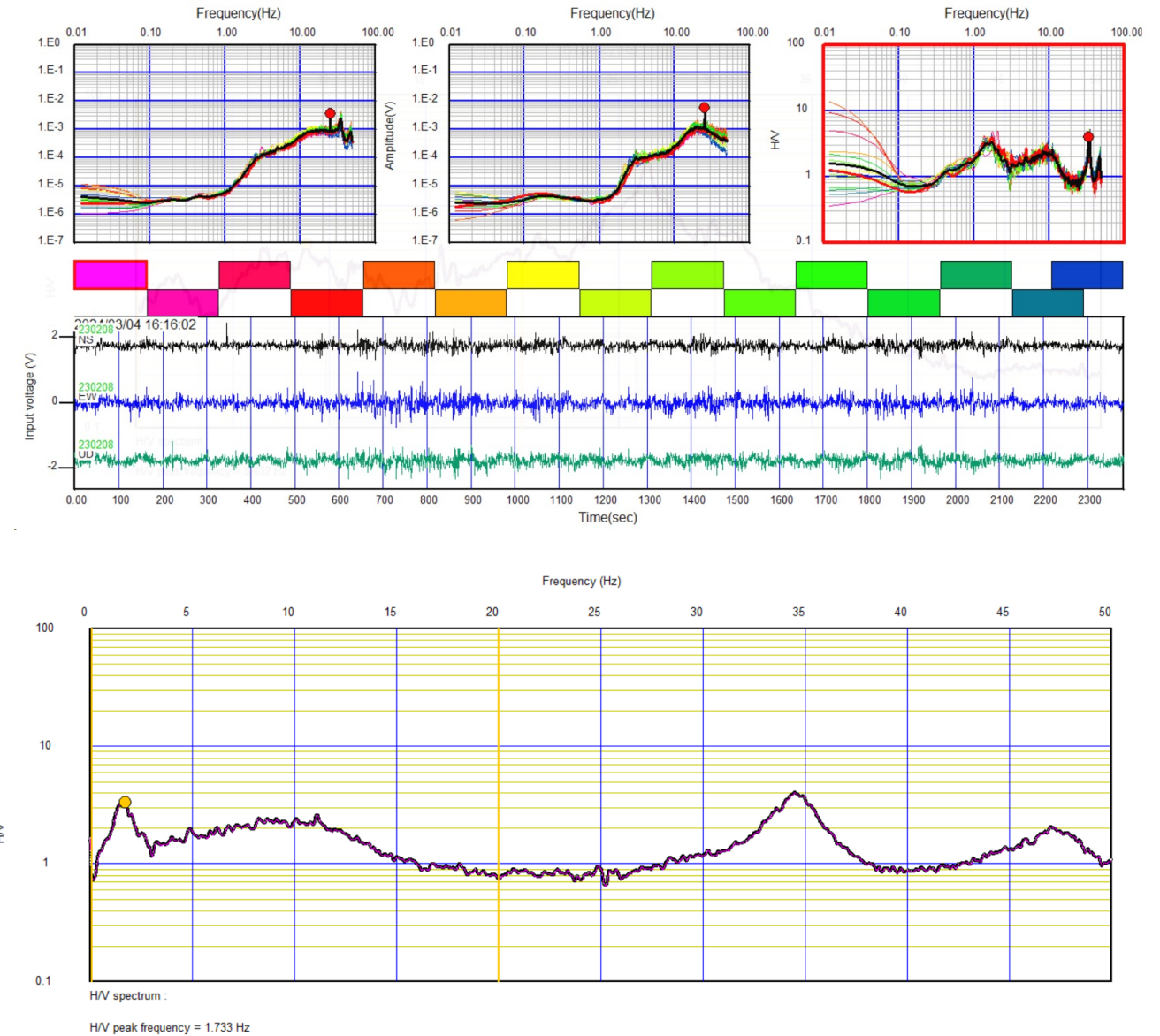
GeoResistivity Lines of Interest



Final GeoResistivity Line of Analysis in Purok Chavez, Barangay Edwards, T'boli

Microtremor Measurement Site 1

- This microtremor measurement was conducted in a field in an elementary school in T'boli, South Cotabato
- The data was acquired over 38 minutes of measurement
- Result shows an H/V peak frequency of 1.733 Hz
- The result of this measurement is still to be analyzed by an expert geologist in seismology.



Microtremor site 2

- This microtremor measurement was conducted in Sumbong Creek
- The data was acquired over 26 minutes of measurement
- Result shows an H/V peak frequency of 8.832 Hz
- The result of this measurement is still to be analyzed by an expert geologist.

