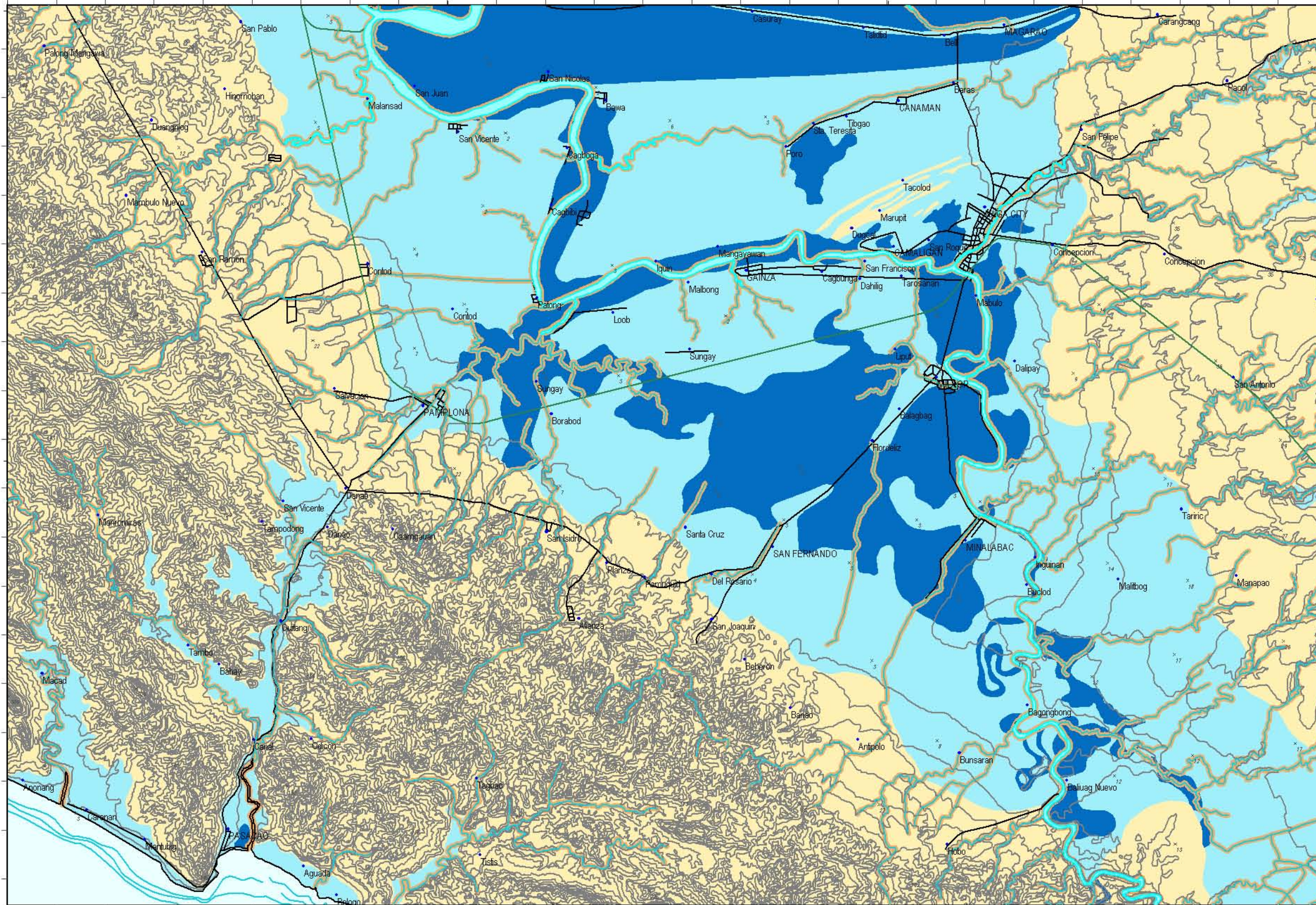


# FLOOD HAZARD SUSCEPTIBILITY MAP OF NAGA CITY QUADRANGLE

13° 40' 00"  
123° 00' 00"

13° 40' 00"  
123° 15' 00"



## LEGEND:

- Flood Hazard Susceptibility Zones
- Non flood prone areas
  - Seasonally to rarely flooded areas
  - Regularly to frequently flooded areas
  - 0 to 50 m. from river banks

## Symbols:

- river
- road
- railroad

## EXPLANATIONS:

Flood hazard susceptibility zones were derived based on the geomorphological analysis of landforms and the fluvial system. Information on flood occurrences, flood depths, duration of inundation as well as topographic information supported the geomorphologically-based flood hazard mapping

**Regularly to Frequently Flooded Areas:**  
Areas that are frequently flooded. More heavy rains of 1 to 2 days could bring about flooding in these areas. Moderate to strong typhoons could submerge these areas 0.5 to 2.0 m. in flood waters for a few days to a few weeks. Development of urban settlements in these areas are not recommended.

**Seasonally to Rarely Flooded Areas:**  
Areas that become inundated during moderate to strong typhoons. Flood depths vary from a few centimeters to 1 m. Floods last from a few hours to a few days

**Non Flood Prone Areas:**  
Areas with no reported flood occurrences

Field data collection by: A. E. Dayao and C.U. Carranza  
Geomorphological interpretation by: A.E. Dayao  
Digital cartographic processing by: A.E. Dayao  
GIS processing by: A.E. Dayao  
Checked by: A.F. Jusi  
Approved by: R.A. Juan

Other sources of Information:  
1:50,000 NAMRIA Topographic Map  
1951 B/W Aerial photos  
1991 B/W Aerial photos

13° 30' 00"  
123° 00' 00"

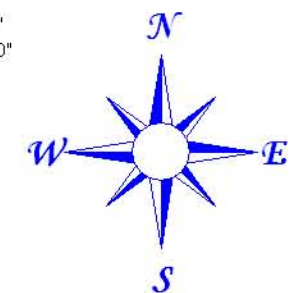
13° 30' 00"  
123° 15' 00"

SCALE 1:85,000



Universal Transverse Mercator Projection  
Clarke 1866, Luzon Datum

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Daraga, Albay

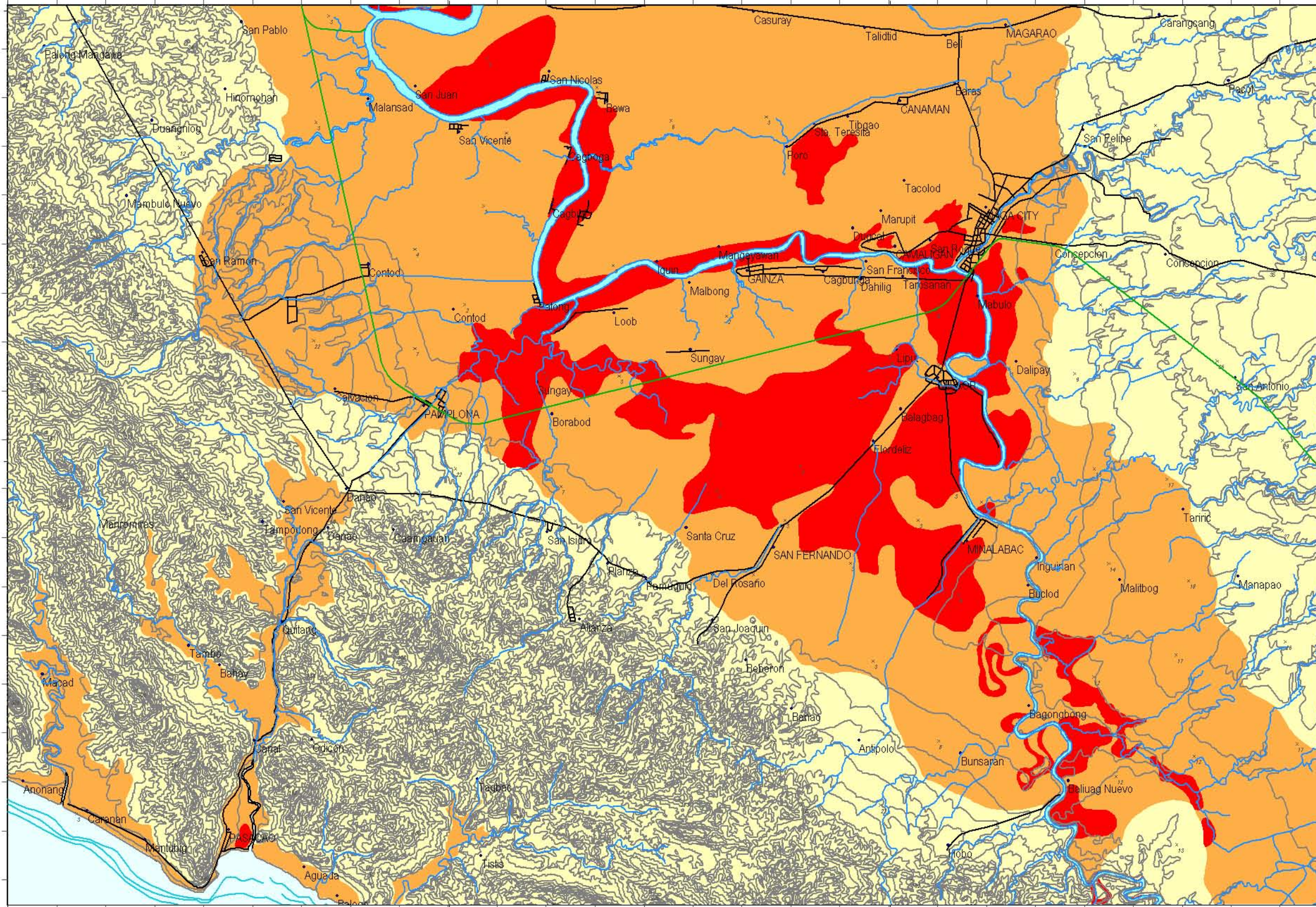




# LIQUEFACTION POTENTIAL MAP OF NAGA CITY QUADRANGLE

13° 40' 00"  
123° 00' 00"

13° 40' 00"  
123° 15' 00"



## LEGEND:

- Liquefaction Potential Zones:
- Areas where liquefaction is not likely
  - Areas where liquefaction is possible
  - Areas where liquefaction is likely

## Symbols:

- river
- road
- railroad

## EXPLANATIONS:

There are no reported liquefaction occurrences based on several field interviews. However, zones of different liquefaction potential were derived based on the geomorphological analysis of the study area following previous studies made by Iwasaki and Yasuda.

**Areas where Liquefaction is Likely:**  
Areas where liquefaction is likely include river beds, old or abandoned river beds, swamps and backswamps. These areas are unsuitable for urban development. Multi-storey buildings should be required of geotechnical studies addressing or mitigating the effects of liquefaction.

**Areas where Liquefaction is Possible:**  
The floodplain of the Bicol River, the fluvial and fluvio-deltaic levees, the fluvio-deltaic plain and the alluvial plains are areas where liquefaction is possible.

**Areas where Liquefaction is not Likely:**  
Areas where the likelihood of liquefaction is unlikely.

Field data collection by: A. E. Dayao and C.U. Carranza  
Geomorphological interpretation by: A.E. Dayao  
Digital cartographic processing by: A.E. Dayao  
GIS processing by: A.E. Dayao  
Checked by: A.F. Jusi  
Approved by: R.A. Juan

Other sources of Information:  
1:50,000 NAMRIA Topographic Map  
1051 RAW Aerial photos

13° 30' 00"  
123° 00' 00"

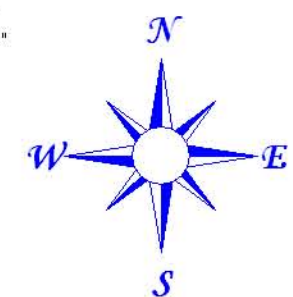
13° 30' 00"  
123° 15' 00"

SCALE 1:85,000



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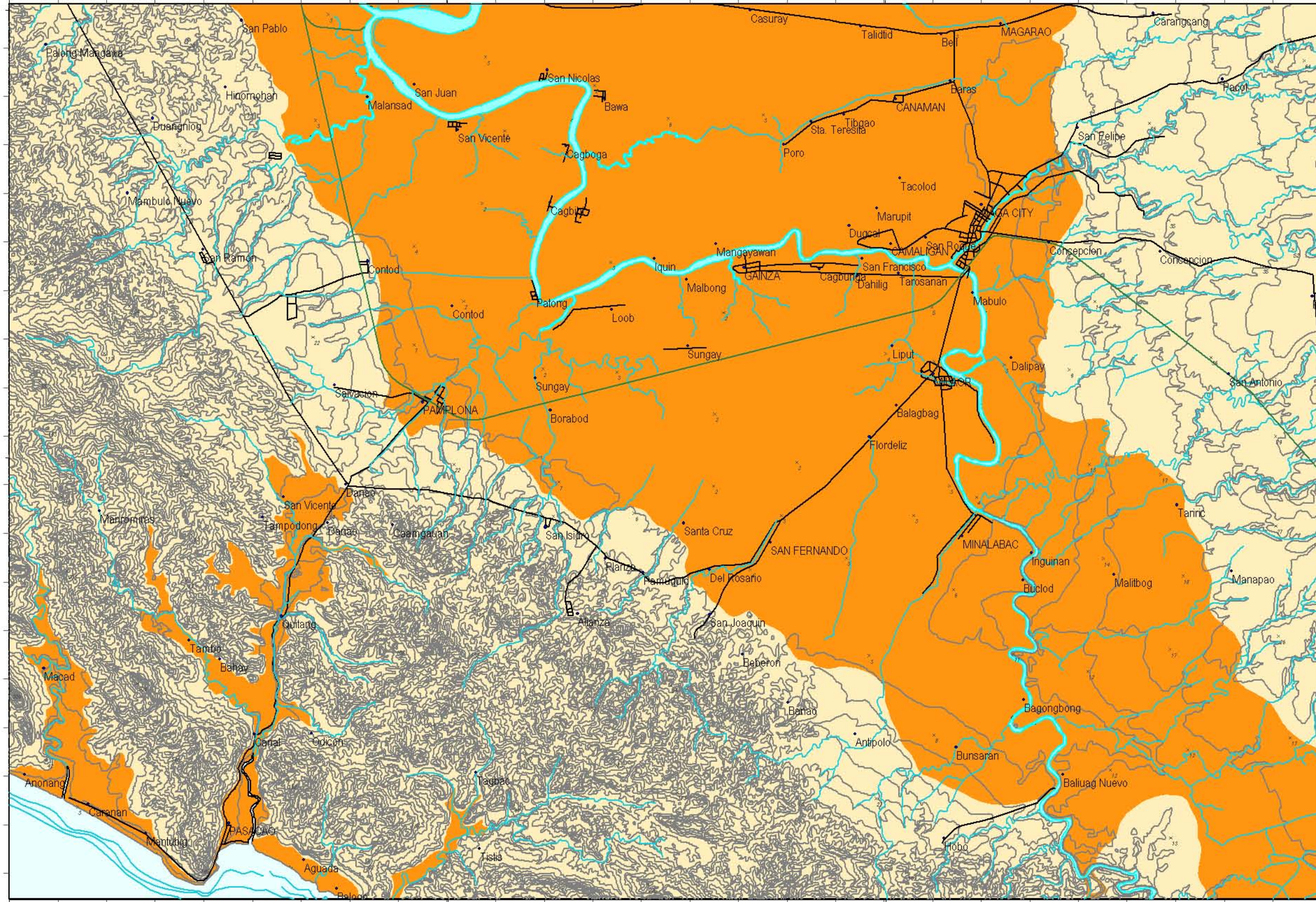






# GROUND SETTLEMENT SUSCEPTIBILITY MAP OF NAGA CITY QUADRANGLE

13° 40' 00"  
123° 00' 00"

13° 40' 00"  
123° 15' 00"



## LEGEND:

Ground Settlement Susceptibility Zones:  
 Areas not susceptible to ground settlement  
 Areas susceptible to ground settlement

## Symbols:

 river  
 road  
 railroad

## EXPLANATIONS:

Areas of possible ground settlement were delineated through the analysis of the geomorphological lay of the study area, the sub-surface soils and the ground water levels.

### Areas Susceptible to Ground Settlement:

Areas where fluvial and fluvio-deltaic sands, silts and clays coupled with shallow ground water table are sites of possible ground settlement. Settlements may be reduced by correct design of foundation structure. Buildings having 3 storeys or more should be tested for settlement and/or consolidation. Buildings having 4 storeys or more should undergo detailed geotechnical studies.

### Areas not Susceptible to Ground Settlement:

Areas where the possibility of ground settlement is low or absent. Still, buildings of 4 storeys or more should undergo geotechnical studies.

Field data collection by: A. E. Dayao and C.U. Carranza  
 Geomorphological interpretation by: A.E. Dayao  
 Digital cartographic processing by: A.E. Dayao  
 GIS processing by: A.E. Dayao  
 Checked by: A.F. Jusi  
 Approved by: R.A. Juan

Other sources of Information:  
 1:50,000 NAMRIA Topographic Map  
 1951 BW Aerial photos  
 1991 BW Aerial photos

13° 30' 00"  
123° 00' 00"

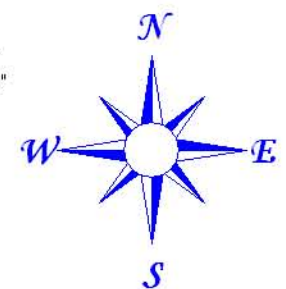
13° 30' 00"  
123° 15' 00"

SCALE 1:85,000



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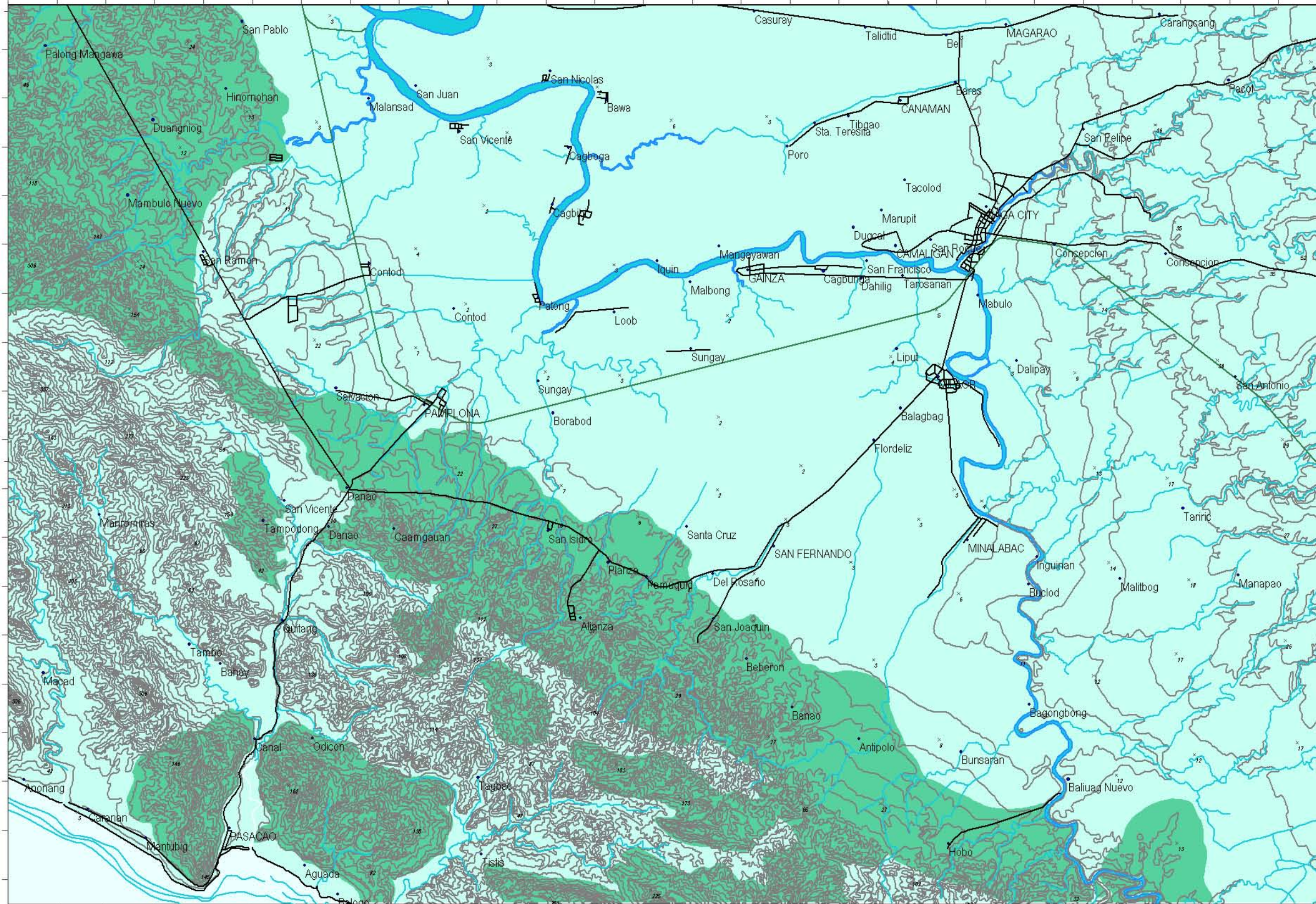




# SUSCEPTIBILITY TO GROUND SUBSIDENCE DUE TO KARST IN NAGA CITY QUADRANGLE

13° 40' 00"  
123° 00' 00"

13° 40' 00"  
123° 15' 00"



## LEGEND:

- Ground Subsidence Susceptibility Zones
- Areas not susceptible to ground subsidence
  - Areas susceptible to ground subsidence

## Symbols:

- river
- road
- railroad

## EXPLANATIONS:

Susceptibility map for ground subsidence due to karst processes was primarily derived from the lithologic map of the study area. Field observations on sinkholes and ground subsidence observed on concrete roads and damaged houses supported the mapping.

Areas not Susceptible to Ground Subsidence:  
Non-imestone areas that are not prone to ground subsidence due to karst.

Areas Susceptible to Ground Subsidence:  
Areas that are prone to ground cavitation, sinkhole formation and ground subsidence in areas underlain by limestone and calcareous siltstones and shales.

Field data collection by: A. E. Dayao and C.U. Carranza  
Geomorphological analysis by: A.E. Dayao  
Digital cartographic processing by: A.E. Dayao  
GIS processing by: A.E. Dayao  
Checked by: A.F. Jusi  
Approved by: R.A. Juan

Other sources of Information:  
1:50,000 NAMRIA Topographic Map  
1951 BAW Aerial photos  
1991 BAW Aerial photos

13° 30' 00"  
123° 00' 00"

13° 30' 00"  
123° 15' 00"

SCALE 1:85,000



Universal Transverse Mercator Projection  
Clarke 1866, Luzon Datum

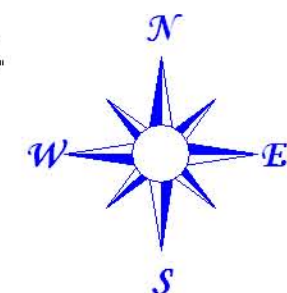
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Daraga, Albay



UNITED NATIONS DEVELOPMENT PROGRAMME  
ENR SHELL PROGRAMME  
Development of Mitigation Scheme for Geological  
Hazards Project



Department of Environment  
and Natural Resources

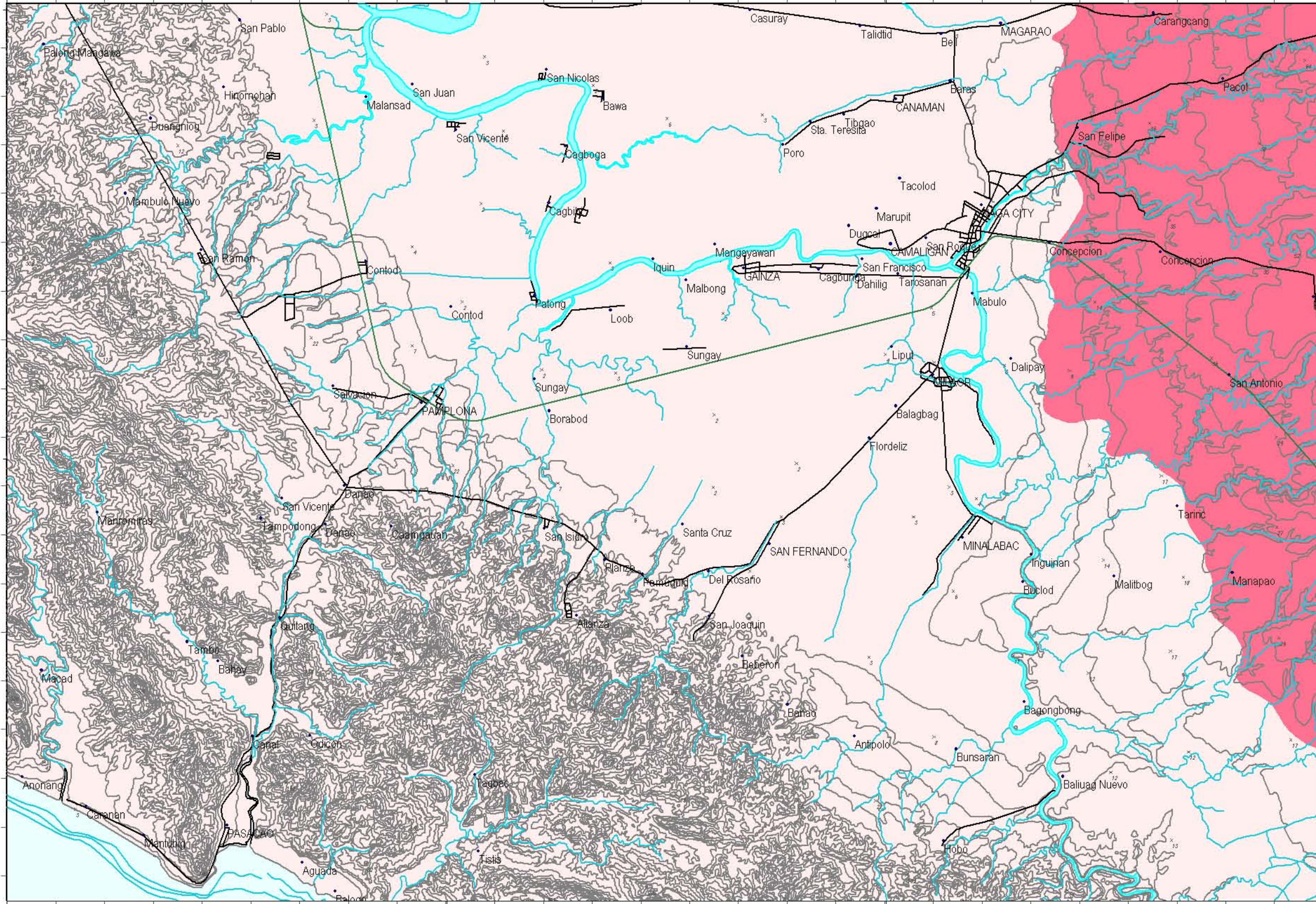




# VOLCANIC HAZARD SUSCEPTIBILITY MAP OF NAGA CITY QUADRANGLE

13° 40' 00"  
123° 00' 00"

13° 40' 00"  
123° 15' 00"



**LEGEND:**

Volcanic Hazard Susceptibility Zones:

- Areas not susceptible to volcanic hazards
- Areas susceptible to possible lahars and ashfall

Symbols:

- river
- road
- railroad

**EXPLANATIONS:**

The nearest volcano, Mt. Isarog, has no recorded eruption history. But should it become active, it will pose hazards to communities situated on its footslopes. The hazard susceptibility map is largely geomorphologically-based considering the type of volcanic deposits observed in the different terrain units.

**Areas Susceptible to Lahars and Ashfall:**  
The upper and lower volcanic footslopes of Mt. Isarog are areas of lahar deposition. Thus, should the volcano become active again, these areas will be prone to lahar hazards particularly in areas close to rivers that emanate from the upper volcanic slopes. Ashfall could also be deposited in these areas depending on wind directions. Likewise, big pyroclastic flows could also reach these footslopes in case of explosive eruptions.

**Areas not Susceptible to Volcanic Hazards:**  
Areas where the effects of eruption by Isarog Volcano would either be absent or minimal.

Field data collection by: A. E. Dayao and C.U. Carranza  
 Geomorphological interpretation by: A.E. Dayao  
 Digital cartographic processing by: A.E. Dayao  
 GIS processing by: A.E. Dayao  
 Checked by: A.F. Jusi  
 Approved by: R.A. Juan

Other sources of Information:  
 1:50,000 NAMRIA Topographic Map  
 1951 BAW Aerial photos  
 1991 BAW Aerial photos

13° 30' 00"  
123° 00' 00"

13° 30' 00"  
123° 15' 00"

SCALE 1:85,000



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