

**2-DIMENSIONAL GEORESISTIVITY SURVEY AT SAN  
MARIANO, ISABELA**



**SMART WATER INFRASTRUCTURE AND MANAGEMENT R&D CENTER**

## PHYSIOGRAPHY

The municipality of San Mariano has a land area of 145,916 hectares, this is about 11.14% of the total land area of Isabela. It comprises of 36 barangays with a relatively flat terrain on the western part suitable for agricultural farming and settlement of infrastructure. The eastern part has a sloping terrain where the mountains of Siera Madre is situated. San Mariano is the Isabela's largest and the country's 3<sup>rd</sup> largest municipality

## LOCAL GEOLOGY

The geology of San Mariano, Isabela is characterized by a mixture of sedimentary, igneous, metamorphic rock formations, and others. A large portion of the eastern municipality is made up of undifferentiated Cretaceous igneous rocks indicating that the area is a volcanic origin as represented by mountains. Moreover, the low-lying areas of the central to western part of the municipality are underlain by Quaternary Alluvial, Oligocene to middle Miocene, and Paleocene Pleistocene. The Quaternary Alluvial are favorable for agriculture and potential groundwater zones. The Oligocene to middle Miocene contains major limestones which is significant as they contain karst features and underground aquifer which a source of groundwater. Lastly, Paleocene to Pleistocene sedimentary rocks are present across various barangays, marking a long geological history of sediment deposition.

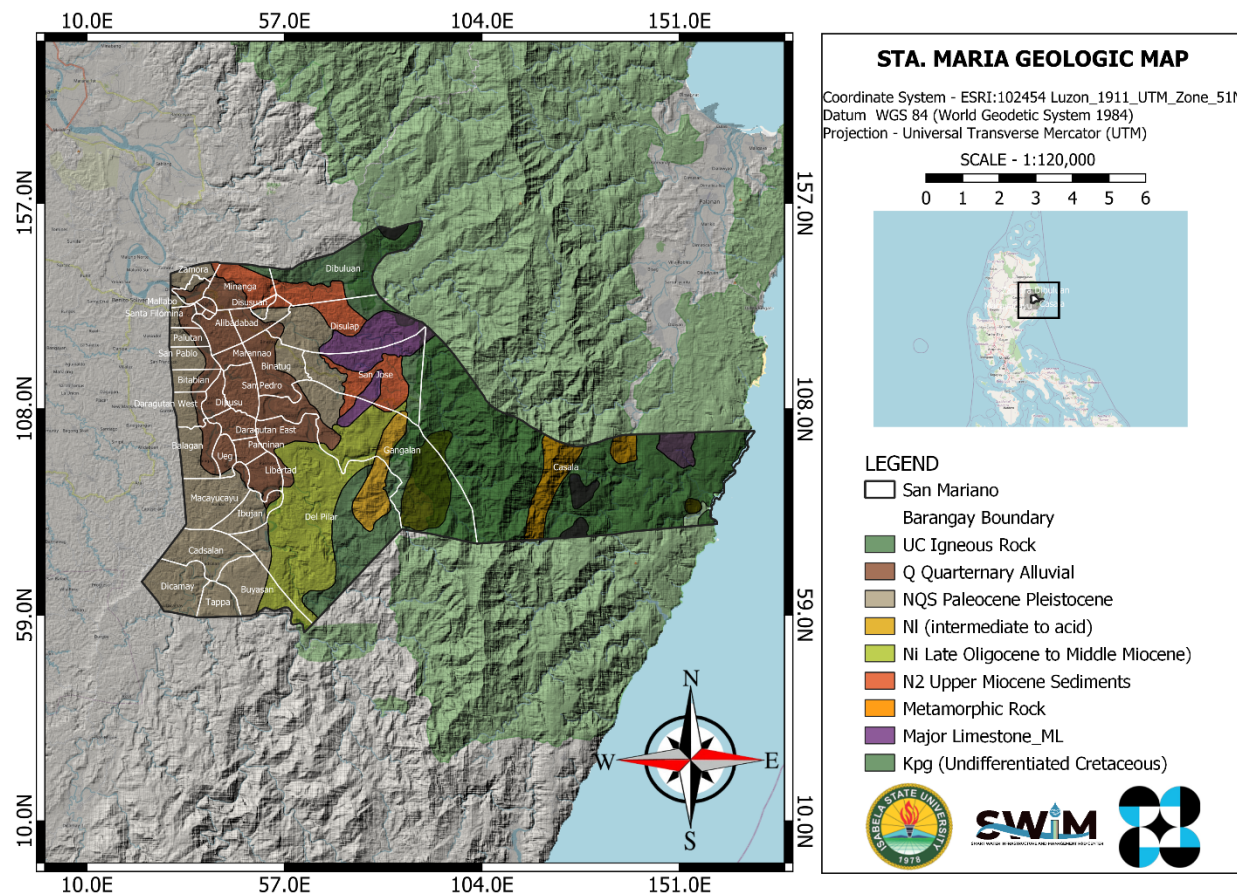


Figure 1. Geologic Map of San Mariano

## GEOLOGICAL STRUCTURE

There are no perceptible geologic structures that could significantly affect the groundwater storage and flow. The only identifiable features and structures are found in the uppermost most of the soil and wells extending on the saturated zone or aquifer.

## **PRINCIPLES**

Resistivity is a geophysical surveying technique that utilizes electrical measurements conducted on the ground surface to identify the depth and thickness of subsurface resistivity layers. In groundwater investigations, resistivity surveys help improve the understanding of underground formations and reduce the likelihood of drilling unsuccessful wells.

Since soil and rocks generally act as electrical insulators with high resistance, electrical currents primarily pass through moisture-filled pore spaces. The resistivity of these materials is influenced by factors such as porosity, permeability, the amount of pore water, and the concentration of dissolved solids. Various soil and rock types exhibit different resistivity values depending on their composition, texture, degree of fracturing or weathering, and groundwater content. This method involves injecting a known and often constant electrical current into the ground using two electrodes, called current electrodes. This process generates a potential field (voltage), which is then recorded through another pair of electrodes known as potential electrodes. The resistance obtained from these measurements is adjusted using a geometric factor to calculate the apparent resistivity.

Resistivity surveys can be conducted to analyze the sequence of resistivity layers beneath a specific location, a technique known as vertical electrical sounding (VES). The resistivity values obtained are then interpreted to determine the possible types of rock present below the surface.

## **RESULT**

The image below shows the analyzed data of the 2D electrical survey at San Mariano, Isabela. It consist of three sections namely the measured Apparent Resistivity Pseudosection (top), the calculated Resistivity Pseudosection (middle), and the Inverse Model Resistivity Pseudosection (bottom). The measured Apparent Resistivity Pseudosection and calculated Resistivity section is close to each other meaning the data results is accurate and reliable.

The Inverse – Resistivity Pseudosection has a RMS error of 8.3% which is in acceptable range of accuracy indicating that the model is reliably fit. The uppermost layer, from 0 to 4 meters below, shows resistivity values of 148 ohm.m to 400 ohm.m indicating the presence of compacted soil and rocks. At a depth of 5 meters to 7 meters, resistivity values of 52 to 88 ohm.m is obtained which still a high resistivity value and the presence of moisture is not yet clear, this layer contains sand or gravel. Furthermore, at a depth of 8 meters extending up to 16.4 meters has a resistivity values ranging from 10 ohm.m to 30 ohm.m. These low-resistivity zones typically indicate the presence of saturated materials such as clay or water-bearing sandy layers suggesting a possible aquifer. The deepest part of the section which shows very low resistivity values of 10.8–18.3 ohm-m is found at a depth around 13–16 meters

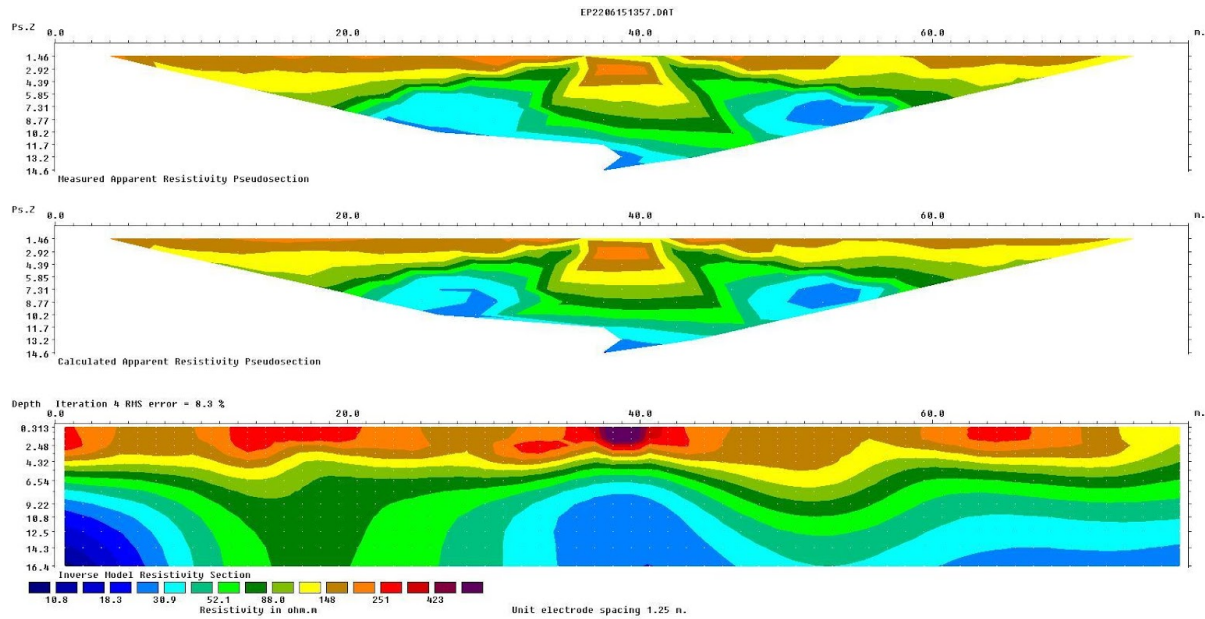


Figure 2. Geo-resistivity result of San Mariano, Isabela

## CONCLUSION

The resistivity survey reveals a stratified subsurface with potentially water-bearing layers between depths of 6 to 13 meters, particularly in the central part of the profile. These low-resistivity zones likely represent aquifers, therefore, the ideal minimum drilling depth for groundwater extraction would be around 10 to 13 meters. Further hydrogeological verification such as test drilling or borehole logging is recommended to confirm the presence and quality of groundwater..