BIO-PHYSICAL CHARACTERISTICS AND RESOURCES

2.1 Topography

Maguindanao has a generally flat terrain and scattered hills with fertile valleys and isolated mountain ranges. It can be divided into two physiographic units: the southwest mountain clusters and the Maguindanao lowlands.

The southwest mountain clusters include the one (1) big groups of mountain elevations –Blit.

The Maguindanao lowlands include the north extremity of Cotabato Basin, northeast of the province's highlands. Thick accumulation of detrital materials derived from the weathering and erosion of the adjacent emergent landmass compose the area.

2.2 Slope

The province has a higher land area of 0-8% slope with 427,837.83 hectares, it implies that this is low lying area which is prone to flooding. Fifty percent (50%) above slope with an area of 88,534.74 hectares, this area mostly in the municipality of South Upi. The area is gently sloping from the foothills to relatively flat as it approaches the sea and Liguasan Marsh.

Table 2.1 Land Area by Slope (has) Maguindanao,2015

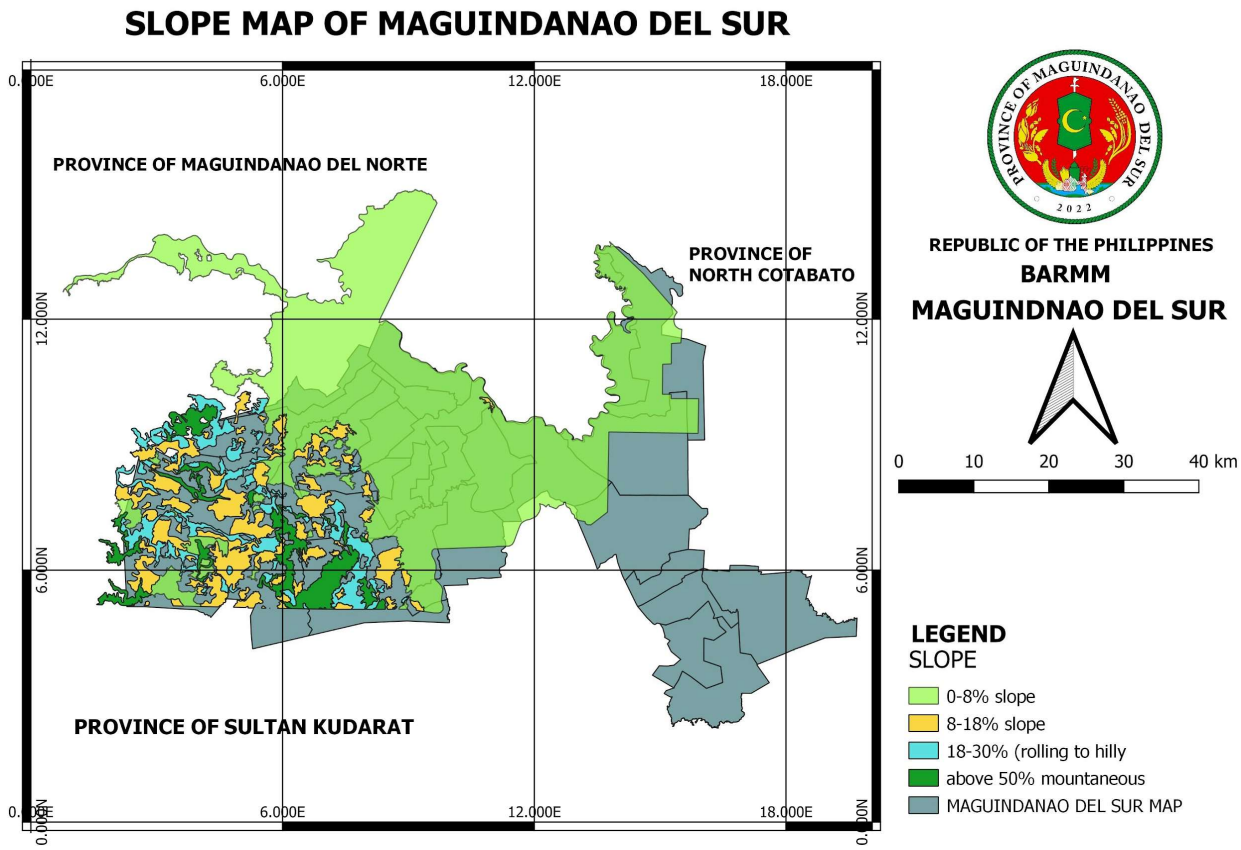
Slope %	Land Area (has)	Percent	Description
0-8	210,347.73	43%	Slope broad alluvial plains and collu-alluvial terraces
8-18	62,577.68	29%	Sedimentary hills and volcanic slope
18-30	46,251.08	8%	Rolling to hilly
30-50	87,642.1	11%	
50 and above	55,028.52	9%	High altitude mountainous
Total	**461,874.11**	100%	

Source: FMS,MENRE

2.3 Elevation

Most of the areas in the province have an elevation of less than 500 meters above sea level. Few areas have an elevation of 500-1,000 meters while there are only three (3) areas that have an elevation of more than 1,000 meters

Map 2.1 Slope Map of Maguindanao del Sur



2.4 Surface Water Resources

In the Bangsamoro, there are two major river basins: the Mindanao River basin (MRB). Under Maguindanao del Sur, the Mindanao River basin is the second largest river basin in the Philippines.

The MRB is divided into 5 sub-basins such as the Pulangi river sub-basin and the Ala river sub-basin in view of hydrological conditions, particular water management concerns and focused in-depth management planning and implementation.

Table 2.3 Ratio of Maguindanao in the Mindanao River basin.

Sub-Basin	Area (km2)	Ratio (%)
Kabacan Sub-basin	933	0
Lower Pulangi Sub-basin	697	42
Upper Pulangi Sub-basin	3,228	1%
Buluan Sub-basin	2,004	26
Ala Sub-basin	3,488	19

In Maguindanao del Sur, the biggest river is the Pulangi River. It is at the same time the northeast boundary of the province and as such the western banks are within the province's jurisdiction. The river meanders with flood plains developed at places together with extensive delta, which make its immediate vicinity marshy. It drains westward into the Mindanao Sea. Several smaller streams and creeks dissect the area.

The Mindanao River, which is the receiving body of the Pulangi and Gatisan Alah Rivers, is the biggest and longest river in Mindanao. Several perennial rivers and creeks with significant flows are draining the province.

The southern portion is being drained by the northeast-flowing Talayan River and its tributaries and several perennial creeks which discharges into Gatisan Alah River.

Tapping these surface water sources will necessitate the construction of intake structures and other facilities needed for complete treatment. Considering the facilities needed for surface water source, the initial investments involved would entail huge expenses. Hence, it is recommended that a more detailed and extensive study should be conducted, prior to considering surface water as probable water source.

2.5 Groundwater Resources

In general, none of the igneous are well cemented, compacted sedimentary rocks can be considered as dependable sources of sustainable groundwater. Only the Pleistocene to Recent deposits can be considered as potential source of significant quantity of water reserve.

Groundwater Availability in the Province

- **Shallow Well Areas.** By definition these are areas having water-bearing formations where water can be withdrawn up to the depth of not more than 20m from the ground surface. These are the areas underlain mostly by Recent Alluvium and Pliocene to Recent Pyroclastics (QVP). Though generally classified as deep well areas, in some cases shallow groundwater also occur within the Pliocene to Pleistocene Clastic Rocks (N_3S) and Late Miocene to Pliocene Clastic Rocks (N_2S).
- **Deep Well Areas.** In deep well areas, the aquifers exist to depth of more than 20m from the ground surface. These can be found in areas by R, QVP, (N_3S) and (N_2S) wherein the first two are more productive. Where sandstone and conglomerate are low-yielding well can also be drilled in the N_1S. High-yielding deep wells are common in the QVP.
- **Difficult Areas.** These areas are not suitable for well development. In the province, the areas under this category are the Ultramafic Complex (UC), Cretaceous to Paleogene sediments and volcanics (Kpg), Diorite and Other Intrusive Rocks (NI), Early to Middle Miocene Volcanics (N_1V), Late Miocene Volcanics (N_2V), Quarternary Volcanics (QV) and Early to Middle Miocene Rocks (N_1S). Limestone deposits generally fall under this category. Limited groundwater, if any, occurs in the fractured and/or weathered zones. Springs are the common sources of water in these areas.

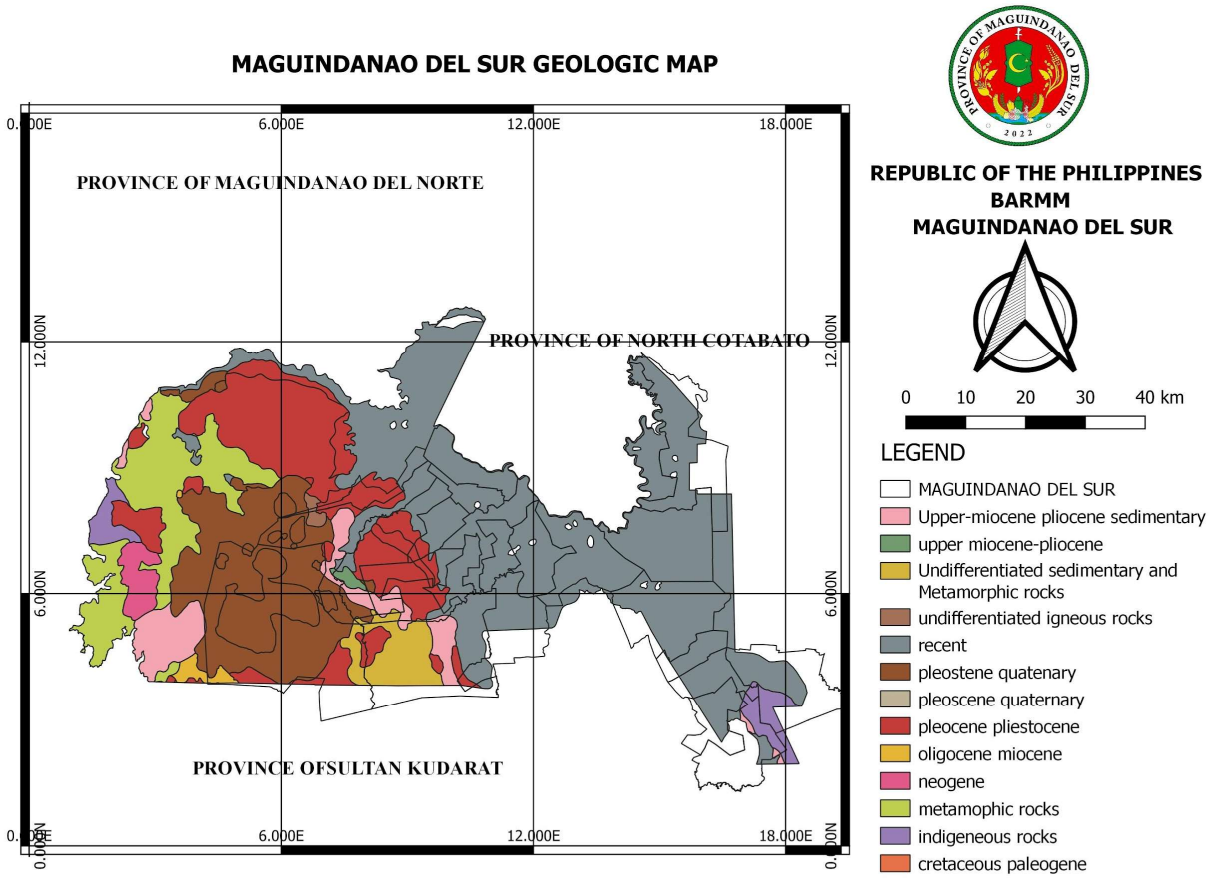
2.6 Geologic Features

The hydrogeologic make-up of the province of Maguindanao mainly consist of uplifted ingenious and sedimentary rocks formed during pre-Cretaceous to Recent. They are the result of magmatic and tectonic action generated by westward and northeast crustal dipping plates that were subducted during the course of the province's evolution. The subduction zones south of Cotabato, along the Agusan-Davao Trough and east of

Surigao are considered most significant in the geologic development of Lanao del Sur and its adjoining provinces.

The sedimentary rocks which were intercalated with the igneous rocks were formed during the Cretaceous to Pleistocene. The oldest known rocks are partly metamorphosed Cretaceous to Paleogene dense, relatively impervious tuffaceous mudstone and greywacke which are intercalated with lava flows. These are mostly transformed sedimentary deposits derived from basic oceanic crust. Final uplift of younger deposits above sea level occurred during the Pleistocene to Recent time.

Map 2.3 Geologic Map



Source: PPDO