# Chapter 2
# PHYSICAL FEATURES

## LAND AREA

The Sarangani Bay Learning Area is composed of municipalities in Sarangani Province and GSC. Sarangani Province is composed of 7 municipalities: Alabel, Glan, Kiamba, Maasim, Maitum, Malapatan and Malungon. All are coastal municipalities except for Malungon. The profile area has a total land area of 4,035.10 $km^2$ and a coastline of 226.4 km from Pinol Point in Maitum to Tinaca Point in Glan (Table 2.1).

Among the 7 coastal areas mentioned, Malapatan has the largest land area covering 840 $km^2$ (Figure 2.1), 55 percent of which forms the coastal *barangays*. However, Malapatan also has the second shortest coastline. Glan has the longest coastline at 64.3 km, while Alabel has the shortest coastline at 12.1 km (Figure 2.2). Alabel also has the smallest coastal land area at 8 percent of the total (Figure 2.3).

## TOPOGRAPHY

The topographic characteristic of the profile area is from rolling to steep slope. This is due to the presence of mountain ranges found along the land borders of the area. They are Alip Range to the east and Daguma Range, Mt. Parker, and Mt. Matutum to the north. However, none of the peaks of these mountains is within the political boundary of the province and the city. The highest mountain peak, Mt. Busa, situated within the province is about 2,083 m above sea level. Mt. Matutum, with an elevation of 2,286 m, is situated in the adjacent province, South Cotabato.

**Table 2.1. Habitat land area per municipality in the Sarangani Bay profile area.**

| | Alabel | General Santos | Glan | Kiamba | Maasim | Maitum | Malapatan |
|---|---|---|---|---|---|---|---|
| **Habitats (ha)** | | | | | | | |
| Sandy beach | 42 | 470 | 1,438 | 890 | 444 | 328 | 99 |
| Rocky shoreline | 23 | 51 | 187 | | 145 | 137 | 78 |
| Inshore flat | 7 | | 297 | | 153 | | 43 |
| Seagrass beds | 43 | 105 | 615 | 263 | 96 | 149 | 50 |
| Coral reef | 34 | 284 | 669 | 459 | 437 | 300 | 110 |
| Estuary | 4 | 68 | 173 | 274 | 88 | 186 | 25 |
| Mangrove | 27 | 37 | 118 | 96 | 152 | | 49 |
| **Land area (ha)** | | | | | | | |
| Terrestrial | | | | | | | |
| (incl. islands) | | | | | | 29,019 | |
| (excl. islands) | 45,215 | 62,054 | 59,891 | 46,507 | 40,158 | 29,018 | 64,547 |
| Marine | 2,831 | 16,122 | 72,329 | 49,782 | 59,131 | 35,842 | 8,797 |
| **Length of shoreline (m)** | | | | | | | |
| (incl. islands) | | | | | | 24,506 | |
| (excl. islands) | 10,803 | 30,159 | 66,167 | 36,546 | 44,893 | 24,243 | 18,426 |

*Data from the Participatory Coastal Resource Assessment 1998*

The lowland or flat areas with slope ranging from 0 to 8 percent are concentrated near the coast. The widest flat areas are situated in GSC (50 percent of the total land area), Alabel (24 percent), and Maitum (23 percent). Kiamba (17 percent) and Maasim (18 percent) have relatively narrow flat areas. Glan (6 percent) and Malapatan (5 percent) have the narrowest flat areas (Table 2.2).

**Table 2.2. Slope classification of the coastal municipalities of Sarangani Province and GSC. All values are in km$^2$.**

| Slope classification (percent) | Alabel | Glan | Kiamba | Maasim | Maitum | Malapatan | GSC |
|---|---|---|---|---|---|---|---|
| 0 to 3 | 98.56 | 33.15 | 59.14 | 50.71 | 68.38 | 46.08 | 190.30 |
| Nearly level to level | | | | | | | |
| 3.1 to 7 | | | | | | 68.48 | 78.80 |
| 3.1 to 8 | 32.00 | 11.56 | 13.56 | 79.69 | 7.30 | | |
| Nearly level to undulating | | | | | | | |
| 7.1 to 15 | | | | | | 57.60 | 151.17 |
| 8.1 to 15 | | | | | | | |
| 8.1 to 18 | 80.64 | 105.38 | 56.32 | 137.64 | 69.82 | | |
| Undulating to rolling | | | | | | | |
| 15.1 to 25 | | | | | | 185.60 | 71.30 |
| 15.1 to 30 | | | | | | | |
| 18.1 to 30 | 20.48 | 248.58 | 114.24 | 181.11 | 32.35 | | |
| Rolling | | | | | | | |
| 25.1 to 50 | | | | | | 482.24 | 44.49 |
| 30.1 to 45 | | | | | | | |
| 30.1 to 50 | 68.43 | 234.32 | 84.96 | 202.84 | 139.48 | | |
| Rolling to steep | | | | | | | |
| 45.1 > | | | | | | | |
| 50.1 > | 240.34 | 64.62 | 9.76 | 72.44 | 7.92 | | |
| Steep to very steep | | | | | | | |
| **Total** | **540.45** | **697.61** | **338.28** | **724.43** | **325.25** | **840.00** | **536.06** |

*Data from the City Planning and Development Office 1990; Municipal Planning and Development Office 1993; and Provincial Planning and Development Office 1994*

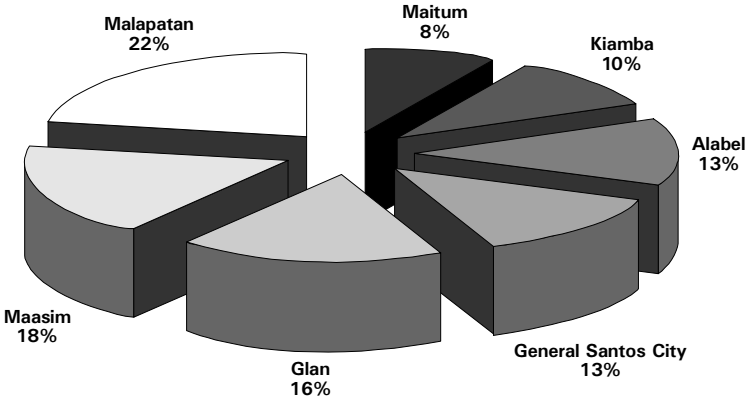


**Figure 2.1. Percent land area of each municipality compared to the total land area of the profile area.**

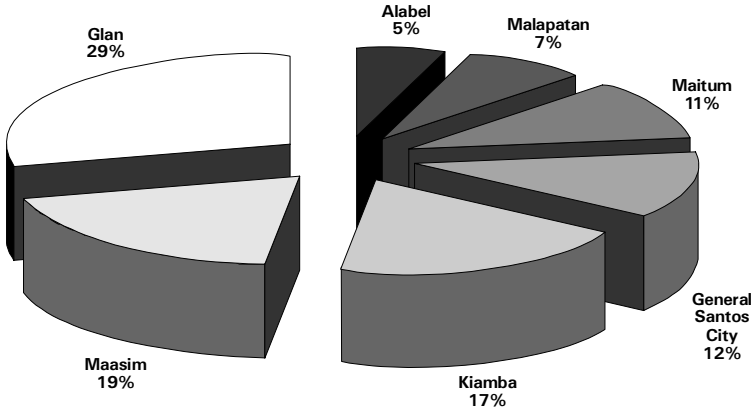


**Figure 2.2. Percent of coastline per municipality/city compared to that of the profile area.**

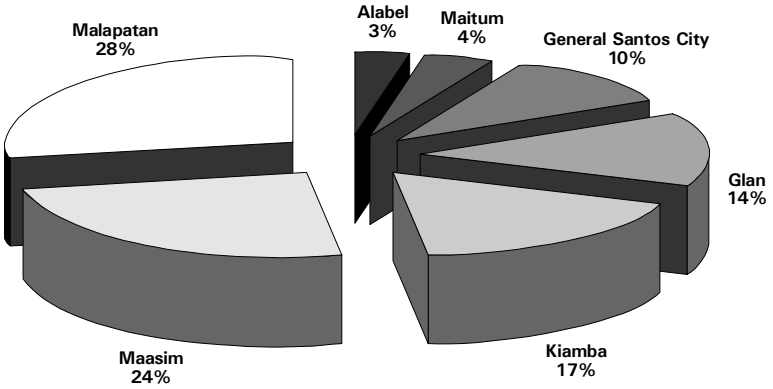


**Figure 2.3. Percent coastal land area per municipality/city in the profile area.**

**Table 2.3. List of watershed areas in Sarangani Province.**

| Watershed area | Location | Area (km$^2$) |
|---|---|---|
| Kling-Nalus-Tual-Suagen | Kiamba | 172.08 |
| Lun Masla-Suyan | Malapatan | 23.27 |
| Lun Padidu-Tuyan-Malapatan | Malapatan | 82.08 |
| Margus Grande | Glan | 21.00 |
| New La Union Barangay | Maitum | 0.70 |
| Glan-Malteo | Glan | 66.56 |

*Data from the Provincial Environment and Natural Resources Office (1997)*

## HYDROLOGY

There are about 6 watershed areas identified in the profile area. The largest watershed area is found in Kiamba covering 4 *barangays* with a total area of 172 km$^2$. The municipalities of Glan and Malapatan each have 2 watershed areas with a combined area of 87 and 105 km$^2$, respectively (Table 2.3).

Twenty-five percent of the total water consumption of SOCSKSARGEN is supplied by Mt. Matutum. Aside from the 6 watersheds, there are 4 major watersheds which are headwaters and catchments for several important rivers including Silway, Klinan, and Buayan-Malungon which empty into Sarangani Bay through GSC; and Alabel and Taplan-Marbel Rivers which flow to Lake Buluan (Table 2.4). Most of the tributaries of Silway, Klinan, and Buayan Rivers are contributing large amounts of suspended sediment due to severe erosion caused by improper agricultural land uses in the upland areas and deforestation of Mt. Matutum.

**Table 2.4. Characteristics of major watersheds.**

| River | Drainage area (km$^2$) | Length (km) | Length of catchment (km) | Average basin slope (degree) |
|---|---|---|---|---|
| Buayan | 1,049.30 | 61 | 39.00 | 0.04 |
| Klinan | 114.98 | 27 | 15.00 | 0.08 |
| Silway | 424.18 | 39 | 21.00 | 16.00 |
| Taplan | 63.40 | ND | 16.90 | 0.38 |

*ND = no data*

There are about 51 rivers and 19 creeks (those that are not dry during dry season) present in the entire area. These rivers include Kraang River, Kalaong River, Siguel River, Buayan-Malungon River, Lun Padidu, Lun Masla, and Glan River. The longest river is Lun Masla River found in Malapatan with a total length of 129 km. The rest of the rivers have lengths of less than 70 km. There are 3 rivers with lengths between 50 and 70 km, 12 rivers with lengths between 20 and 50 km and 28 rivers with lengths less than 20 km (Figures 2.4 and 2.5, Table 2.5).

**Table 2.5. Number of rivers and creeks per municipality in the profile area.**

| Municipality/ City | No. of rivers | Length range (km) | No. of creeks | Length range (km) |
|---|---|---|---|---|
| Alabel | 1 | 62 | 9 | 4-62 |
| Glan | 9 | 5-50 | ND | ND |
| Kiamba | 13 | 8-29 | 2 | 14-20 |
| Maasam | 7 | 13-27 | 1 | 8 |
| Maitum | 8 | 11-37 | 1 | ND |
| Malapatan | 7 | 11-129 | 3 | 8-14 |
| GSC | 6 | ND | 3 | ND |

*Note: The creeks listed include only those that are not dry during dry season.*
*ND = no data*

On the other hand, the longest creek is Amsikong found in Alabel. It has a total length of 20 km. The rest of the creeks have lengths less than 15 km.

In terms of the water discharge levels of these rivers, very few have available information. Data are available for only 14 rivers out

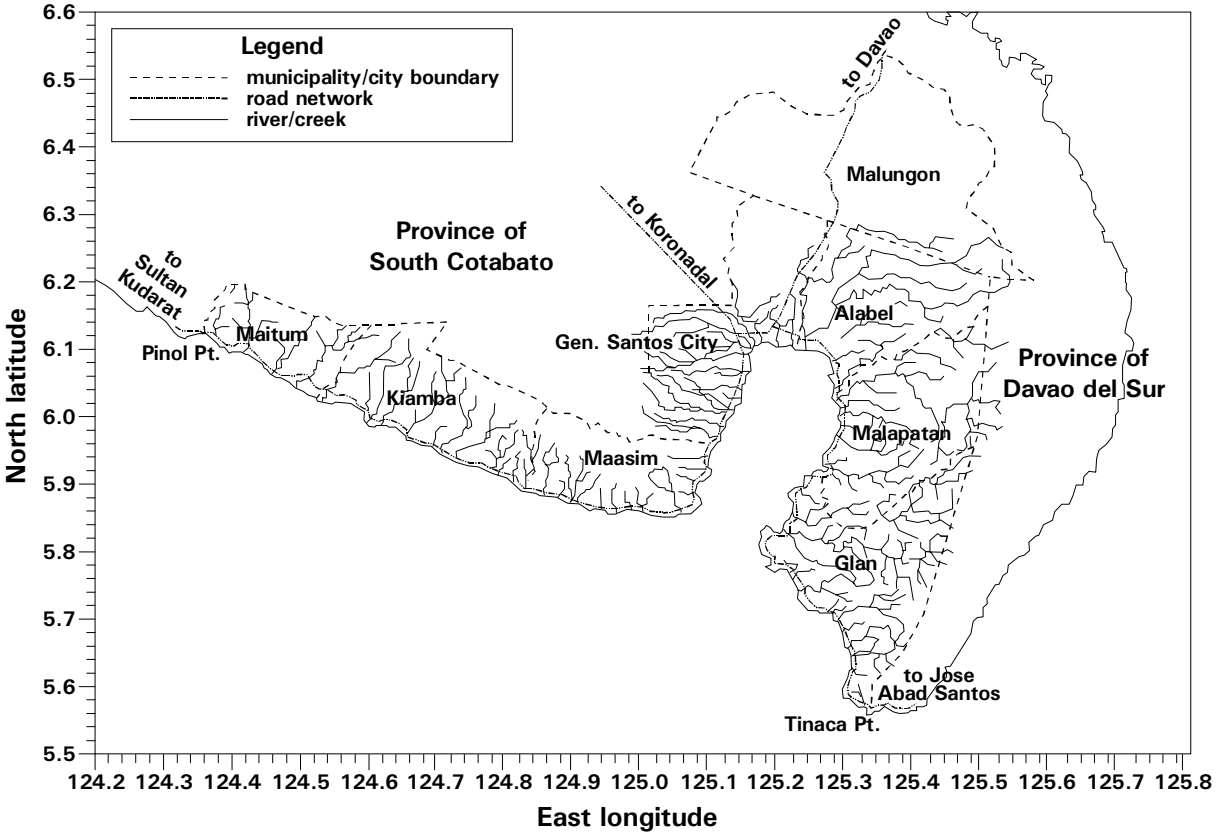


**Figure 2.4. Profile area rivers and creeks.**

of 51. The rivers with the largest discharge are Pangi River (12,603 liters per second (lps)) in Malapatan, Domolok River (10,213 lps) in Alabel, and Kalaong I River (8,820 lps) in Maitum. The rest of the rivers have discharge levels of less than 6,000 lps (Table 2.6).

The Industrial Environmental Management Project (IEMP) conducted physical, chemical, and biological studies of Sarangani Bay and some of the rivers that drain into the bay in 1997. Table 2.7 shows the analytical results of the samples taken from the bay and Figure 2.6 shows the locations of the stations where the samples were taken.

This means that the water is not potable due to the high level of fecal contamination and heavy silt load deposits. Studies by IEMP (1997) and MGP (LBII 1993) showed elevated concentrations of metals particularly cadmium, copper, and lead.

**Table 2.6. Water discharge levels of some rivers in Sarangani Province.**

| River | River length (km) | Discharge levels (lps) |
|---|---|---|
| Domolok | ND | 10,213 |
| Baliton | 11.25 | 411 |
| Glan Padidu | 16.00 | 503 |
| Glan | 50.50 | 3,516 |
| Badtasan | 12.00 | 1,133 |
| Kling | ND | 3,205 |
| Tambilil | 15.75 | 1,624 |
| Tual | 12.75 | 960 |
| Kalaong | 27.00 | 8,820 |
| Kiayap | ND | 131 |
| Luan | 16.00 | 1,066 |
| Pangi | 21.00 | 12,603 |
| Upo | 15.50 | 730 |
| Saub | 11.25 | 1,017 |

*Source: LBII (1993)*

**Figure 2.5. One of the silted rivers in Maitum flowing into Sarangani Bay.**

Results also showed a high concentration of suspended solids that are mostly attributed to the tributaries draining into Sarangani Bay. The suspended solids come from upland activities such as logging, mining, and livestock raising.

Sarangani Bay has an area of about 449 km$^2$, extending from Tampuan Point in Maasim to Sumbang Point in Glan. The length of coastline between these points is about 79 km. The average depth is 350 m. This, coupled with its wide opening and the low discharge rates of rivers, make Sarangani waters strongly oceanic in salinity. Consequently, the strong density difference between waters of the bay and riverine input inhibits mixing of the 2, leading to the formation of a surface plume which persists in the absence of wind mixing. The absence of wind mixing reduces vertical mixing and the possible dilution of pollutants. Tide generated currents are generally weak, except near the mouth of the bay and are incapable of moving materials more than 1 km. Strong wind-generated currents run along the coast in narrow bands,

**Table 2.7. Results of the physicochemical studies of Sarangani Bay, 1997.**

| Sampling station** | Temperature (°C) | | Conductivity (mS/cm) | | Turbidity (NTO) | | TSS (mg/L) | | TDS (mg/L) | | Oil and grease (mg/L) | | pH | | DO (mg/L) | | BOD (mg/L) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results |
| | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | |
| 1 | | 28.9 | | 46.0 | | 0 | | 36.0 | | 49.0 | | 1.0 | | 8.1 | | 6.6 | | 2.8 |
| 2 | | 29.3 | | 45.7 | | 0 | | 52.0 | | 34.4 | | *6.0* | | 8.0 | | 6.0 | | *3.3* |
| 3 | | 29.3 | | 45.9 | | 0 | | 44.0 | | 40.5 | | *6.0* | | 8.1 | | 7.0 | | 2.9 |
| 4 | | 29.5 | | 45.7 | | 0.1 | | 38.0 | | 56.5 | | *6.0* | | 8.1 | | 5.9 | | 2.3 |
| 5 | | 29.4 | | 45.8 | | 52.6 | | 163.0 | | 47.4 | | *3.0* | | 8.1 | | 5.9 | | *3.9* |
| 6 | | 28.9 | | 45.6 | | 9.7 | | 30.0 | | 58.0 | | *5.0* | | 8.0 | | 6.2 | | *3.6* |
| 7 | | 28.7 | | 45.5 | | 6.1 | | 42.0 | | 39.2 | | *4.0* | | 8.1 | | 6.2 | | 2.6 |
| 8 | | 29.1 | | 46.1 | | 9.0 | | 40.0 | | 60.8 | | *3.0* | | 8.1 | | 6.2 | | 2.4 |
| 9 | | 29.0 | | 45.9 | | 1.1 | | 40.0 | | 54.5 | | *6.0* | | 8.1 | | 6.2 | | 2.6 |
| 10 | | 28.7 | | 46.2 | | 0.9 | | 50.0 | | 43.4 | | *2.0* | | 8.1 | | 6.3 | | 2.9 |
| 11 | | 28.9 | | 46.1 | | 0 | | 56.0 | | 55.5 | | * | | 8.1 | | 6.3 | | *3.1* |
| 12 | | 29.0 | | 46.4 | | 13.1 | | 36.0 | | 55.8 | | *5.0* | | 8.1 | | 6.1 | | 1.6 |
| 13 | | 29.0 | | 45.8 | | 2.4 | | 27.0 | | 53.3 | | *3.0* | | 8.1 | | 5.9 | | *3.4* |
| 14 | | 28.7 | | 45.6 | | 2.8 | | 29.0 | | 54.6 | | *4.0* | | 8.1 | | 6.2 | | 2.4 |
| 15 | | 30.0 | | 45.9 | | 0 | | 32.0 | | 52.7 | | *3.0* | | 8.0 | | 6.7 | | 1.8 |
| **Average of results** | 3°C rise | **29.1** | - | **45.9** | - | **6.5** | <30% rise | **47.7** | - | **50.4** | 3 | **4.1** | 6.5-8.5 | **8.1** | 5.5 | **6.2** | 7 (10) | **2.8** |

* *Damaged*

\- *No applicable standard.*

*Values enclosed in parentheses are maximum values*

*Values in italics do not conform with Class SA standards*

** *Sampling stations are found in Figure 2.6*

*Source: IEMP (1997)*

*SA - marine waters suitable for the propagation, survival, and harvesting of shellfish for commercial purposes; tourist zones, national marine parks and reserves; and coral reef parks and reserves designated by law*

*SB - marine waters suitable for recreational water Class 1 or areas regularly used by the public for bathing, swimming, skin diving, etc.; and fishery water Class 1 or spawning areas for* Chanos chanos *and similar species*

*SC - marine waters suitable for recreation water Class 2 or bathing; fishery water Class 2 or commercial and sustenance fishing; and marshes and mangrove areas declared as fish and wildlife sanctuaries*

*SD - marine waters suitable for industrial water supply Class 2, e.g., cooling and other coastl and marine waters*

**Table 2.8. Results of the biochemical studies of Sarangani Bay, 1997.**

| Sampling station | Phenol (mg/L) | | Lead (mg/L) | | Cadmium (mg/L) | | Copper (mg/L) | | Mercury (mg/L) | | Total Coliform (MPN/100 ml) | | Fecal Coliform (MPN/100 ml) | | Pesticide | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results | Std used | Results |
| | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | | Class SC | |
| 1 | | - | | | | | | | | nd | | *1410* | | *> 16* | | nd |
| 2 | | *< 0.001* | | *0.622* | | *0.043* | | *0.107* | | nd | | *1700* | | *> 16* | | nd |
| 3 | | -- | | - | | -- | | -- | | nd | | *4100* | | *> 16* | | nd |
| 4 | | - | | *0.665* | | *0.046* | | *0.107* | | nd | | * | | * * | | nd |
| 5 | | *< 0.001* | | *0.515* | | *0.039* | | *0.085* | | nd | | *7000* | | *> 16* | | nd |
| 6 | | *0.002* | | *0.622* | | *0.03* | | *0.086* | | nd | | * | | * * | | nd |
| 7 | | *< 0.001* | | *0.644* | | *0.151* | | *0.107* | | 0.001 | | * | | * * | | nd |
| 8 | | *< 0.001* | | *0.665* | | *0.043* | | *0.107* | | 0.001 | | * | | * * | | nd |
| 9 | | *0.006* | | *0.601* | | *0.033* | | *0.107* | | nd | | * | | * * | | nd |
| 10 | | *0.007* | | *0.601* | | *0.039* | | *0.107* | | nd | | * | | * * | | nd |
| 11 | | *0.004* | | *0.644* | | *0.039* | | *0.107* | | nd | | * | | * * | | nd |
| 12 | | *< 0.001* | | *0.579* | | *0.039* | | *0.107* | | nd | | * | | * * | | nd |
| 13 | | *0.002* | | *0.622* | | *0.056* | | *0.107* | | nd | | *7600* | | *> 16* | | nd |
| 14 | | *0.003* | | *0.601* | | *0.043* | | *0.107* | | nd | | - | | -- | | nd |
| 15 | | *0.003* | | *0.601* | | *0.04* | | *0.107* | | < 0.01 | | *12000* | | *> 16* | | nd |
| | - | | 0.05 | | 0.01 | | 0.05 | | 0.002 | | 5000 | | - | | nd | |
| **Average of results** | | **0.004** | | **0.614** | | **0.049** | | **0.104** | | **0.001** | | **5640** | | **> 16** | | **nd** |

* *Not present in concentration to affect fish flavor/taste*

** *Sampling bottle was not accepted at the UP Public Health*

\- *Not applicable standard*

-- *No analysis*

nil *Extremely low concentration and not detectable by existing equipment*

nd *Not detected*

*Values in italics are not conforming with Class SA standards*

*Source: IEMP (1997)*

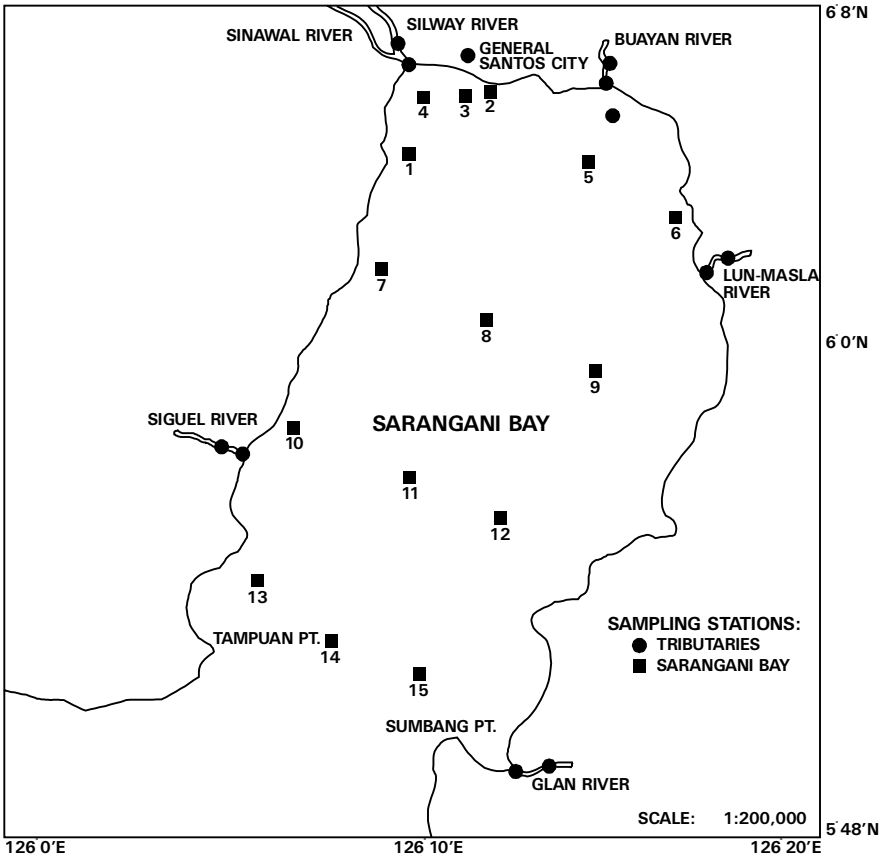


**Figure 2.6. Locations of stations for the Sarangani Bay water quality sampling.**

increasing interactions among marine ecological communities. Unfortunately, this also makes entrainment of pollutants along the coast more likely, increasing the vulnerability of coastal habitats and aquaculture activities.

Oil and grease seem to be the most common pollutant as almost all stations in the IEMP (1997) study show concentrations ranging from 1 to 6 mg/L. Oil and grease come mostly from shipping activities and from the fish canneries in GSC.

In 1997, the Silliman University Marine Laboratory (SUML) took samples in Sarangani Bay to analyze total coliform. All stations showed positive results. It is assumed that household waste is the major source since most households in the area do not have any toilets nor any proper wastewater drainage. Animal manure and garbage are also thrown into the sea or left unattended along the shore. Another possible cause of the high total coliform is the piggeries upstream that are brought to the bay via the river systems.

**SOIL**

Table 2.9 shows the soil classification of the province and the city. About 29.49 percent of the land area is classified as clay loam, 11.22 percent as loam, 6.26 percent as silty clay loam, 7.52 percent as sandy loam, 29 percent as mountain clay soil, 23.78 percent as undifferentiated soil, and 0.44 percent as fine sandy loam. Among the soil types mentioned, clay loam soil type is the best suited for agricultural purposes because of its ability to release the water it holds for plant use.

**Table 2.9. Soil classification per coastal municipality of Sarangani Province and GSC. All values are in km$^2$.**

| Soil type | Alabel | Glan | Kiamba | Maasim | Maitum | Malapatan | GSC |
|---|---|---|---|---|---|---|---|
| Loam | 125.14 | | | | | 232.73 | 100.00 |
| Sandy loam | 33.92 | 23.00 | | | | | 250.00 |
| Fine sandy loam | | | | | | 17.92 | |
| Silty clay loam | | 96.00 | 62.74 | | 96.79 | | |
| Clay loam | 164.48 | 578.60 | | | 227.56 | 101.76 | 131.00 |
| Mountain clay soil | | | 234.24 | 579.55 | | | 55.00 |
| Undifferentiated soil | 216.96 | | 121.30 | 144.88 | | 487.59 | |
| Total | **540.50** | **697.60** | **418.28** | **724.43** | **324.35** | **840.00** | **536.00** |

*Data from the City Planning and Development Office 1990 and Provincial Planning and Development Office 1994*

**LAND USES**

From the total land area of 4,081 km$^2$, 1,522 km$^2$ (37 percent) are classified as alienable and disposable (A&D) land while 2,558 km$^2$ (63 percent) are classified as forestland.

Furthermore, from the combined forestland of the province amounting to 2,304 km$^2$ (2,558 km$^2$ less GSC's 254 km$^2$), 741 km$^2$ (29 percent) are classified as protection forest and 764 km$^2$ (30 percent) as production forest. In 1997, a greater proportion of

the production forest was utilized for agricultural purposes, according to the Provincial Planning and Development Office (PPDO).

The province's A&D land is distributed as follows:

- 54 $km^2$ as irrigated rice land or fishponds;
- 345 $km^2$ as land for cultivated annual crops (such as corn, upland rice, pineapple, cotton, vegetables, sorghum, and others);
- 372 $km^2$ as land for perennial trees (such as fruit trees and coconut) and vine crops;
- 468 $km^2$ as pasture land (such as cows, horses, goats, and cattle); and
- 48 $km^2$ as builtup areas.

GSC does not have any protection forest. Most of the forestlands are being utilized for agricultural purposes. Furthermore, a large proportion of its A&D land is being utilized as builtup, agriculture, and pasture lands. There are areas in Sarangani Province that fall within the NIPAS. These are the areas that need to be protected and managed to maintain the natural biological and physical diversities of the environment notably areas with biologically unique features to sustain human life and development.

The province has a total of 741.91 $km^2$ of protected forestland. Of this, only 48.5 $km^2$ are within the NIPAS under Proclamation No. 147 and only 12.9 $km^2$ (26 percent) are within the coastal municipality. This is the Mt. Balabak Forest Reserve in Kiamba (12.9 $km^2$). The other protected area is Mt. Matutum Protected Landscape found in Malungon (35.6 $km^2$).

Aside from landscape protection, NIPAS also includes aquatic areas. The whole area of Sarangani Bay and the adjoining municipal waters of Maasim, Kiamba, and Maitum was declared as Protected Seascape by President Fidel V. Ramos on 5 March 1996 under Proclamation No. 756. It covers a total water area of 345 $km^2$.

In addition to the protected forest and seascape areas covered by the NIPAS, the provincial government of Sarangani has identified areas that limit the expansion of settlements for environmental considerations. These include second growth forest, mangrove forest, fish sanctuaries, and critical watershed areas (Table 2.10). The following is a more detailed listing of areas that have been considered for protection.

**Table 2.10. NIPAS and non-NIPAS protected lands per coastal municipality of Sarangani Province.**

| Municipality | NIPAS ($km^2$) | Non-NIPAS ($km^2$) |
|---|---|---|
| Alabel | 0.00 | 215.50 |
| Glan | 0.00 | 87.56 |
| Kiamba | 12.90 | 172.08 |
| Maasim | 0.00 | 57.87 |
| Maitum | 0.00 | 117.36 |
| Malapatan | 0.00 | 105.35 |
| Malungon | 35.60 | 111.00 |
| **Total** | **48.50** | **866.72** |

*Data from the Provincial Planning and Development Office 1997*

- National parks;
- Watershed reserves;
- Wildlife preserves and sanctuaries;
- Aesthetic potential tourist spots;
- Habitat for any endangered or threatened species of indigenous Philippine wildlife (flora and fauna);
- Areas of unique historic and archaeological or scientific interest;
- Areas traditionally occupied by cultural communities or tribes;
- Areas frequently visited or hard hit by natural calamities (geological hazards, flood, typhoon, volcanic activity, and others);
- Areas with critical slopes;
- Prime agricultural lands;
- Recharge areas of aquifers;
- Water bodies which may be tapped for domestic purposes or within the controlled and/or protected areas declared by appropriate authorities or which support wildlife or fishery activities;
- Mangrove areas with primary pristine and dense young growth or adjoining mouth of river system or near or adjacent to traditional productive fry or fishing grounds or which act as national buffers against shore erosion, strong winds, storm floods, and others; and
- Coral reef with 50 percent and above coral cover or spawning and nursery grounds for fish or act as a natural breakwater for the coastline.

**CLIMATE**

The prevailing wind direction in the area is the northeast monsoon from the months of November to March and the southwest monsoon from the months of June to October. There is no distinct dry and wet season observed for the area. Rainfall is evenly distributed throughout the year. The annual average rainfall for 1996 is 1,184 mm and 626 mm in 1997. The low annual average rainfall in 1997 was attributed to the El Niño phenomenon. The average temperature is around 27°C. Relative humidity is around 78 percent. Compared to 1996, it was expected that annual rainfall would increase in 1998 because of the La Niña phenomenon. Table 2.11 presents the meteorological data for Sarangani Province.

**Table 2.11. Average temperature, rainfall, and relative humidity per month in Sarangani Province.**

| Month | Average temperature (°C) | | Average rainfall (mm) | | Relative humidity (percent) | |
|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1996 | 1997 | 1996 | 1997 |
| January | 26.3 | 27.0 | 85.7 | 85.6 | 83.0 | 79.0 |
| February | 27.1 | 26.9 | 88.8 | 42.4 | 78.0 | 80.0 |
| March | 27.1 | 27.9 | 37.5 | 49.8 | 74.0 | 76.0 |
| April | 28.5 | 28.6 | 74.7 | 50.3 | 79.0 | 77.0 |
| May | 27.7 | 28.4 | 116.8 | 44.7 | 83.0 | 79.0 |
| June | 27.5 | 27.7 | 96.1 | 72.7 | 76.0 | 81.0 |
| July | 26.8 | 27.1 | 176.6 | 93.1 | 82.0 | 84.0 |
| August | 27.4 | 27.8 | 75.0 | 34.2 | 81.0 | 81.0 |
| September | 27.5 | 27.4 | 150.3 | 46.7 | 82.0 | 82.0 |
| October | 27.7 | 27.1 | 159.9 | 16.7 | 82.0 | 80.0 |
| November | 27.5 | 28.5 | 52.8 | 26.2 | 82.0 | 78.0 |
| December | 27.5 | 28.1 | 70.0 | 73.9 | 79.0 | 76.0 |

*Data from the Philippine Atmospheric, Geophysical, and Astronomical Services Administration of General Santos City 1996 and 1997*