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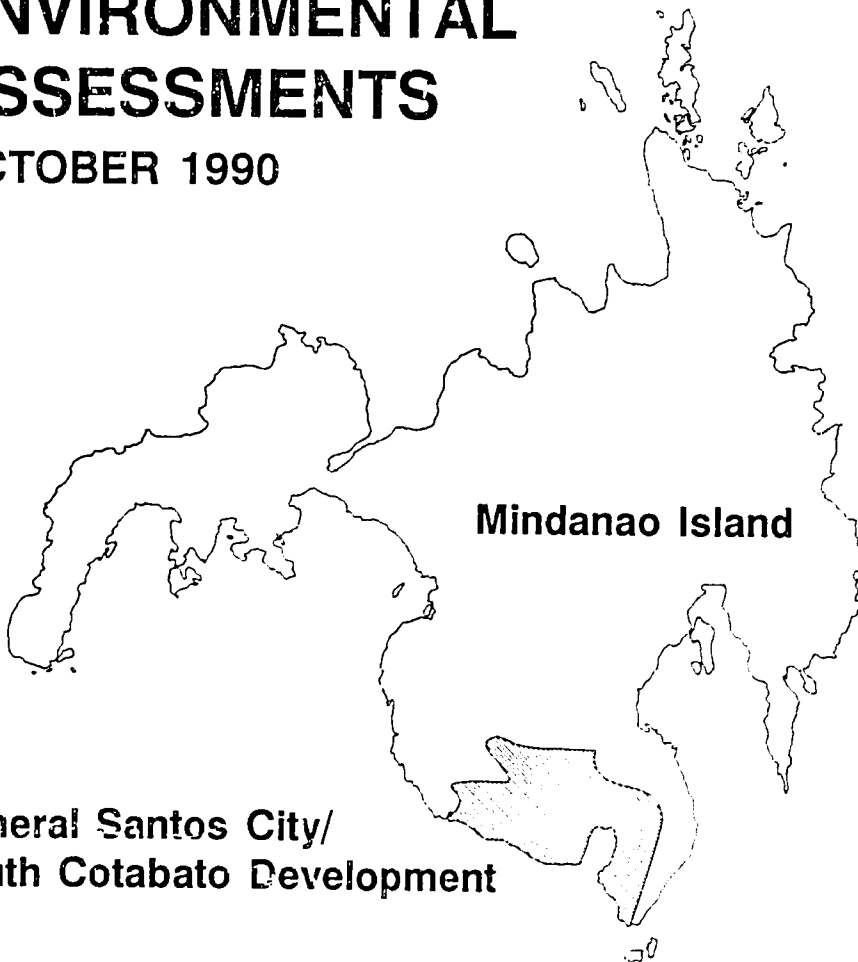
REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

RURAL INFRASTRUCTURE FUND PROJECT

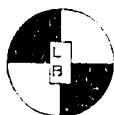
(USAID PROJECT NO. 492-0420)

ENVIRONMENTAL ASSESSMENTS

OCTOBER 1990



**General Santos City/
South Cotabato Development**



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VOLUME I

MASTER REPORT

VI. ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

1. PROJECT DESCRIPTION

The General Santos City/South Cotabato (GSC/SC) Project is a portion of the overall Rural Infrastructure Fund Project being undertaken by the Department of Public Works and Highways (DPWH) with funding from the United States Agency for International Development (USAID). The GSC/SC Project entails preparing feasibility studies for ten road improvement projects and final design for one road improvement project. Figure 6-1 illustrates the location of the eleven sub-projects; Table 6-1 lists the roads and their respective lengths.

All of the sub-projects, with the exception of Road Sectors 10 and 11, will entail the upgrading of gravel/dirt feeder roads to all weather roads. Road Sector 10 entails the construction of a bypass to General Santos City (GSC) while Road Sector 11 entails upgrading the National Highway between GSC and Davao City.

All of the sub-projects are in the Province of South Cotabato in Mindanao, with the exception of a 4.3 kilometer extension of Road Sector 11 (known as Sector 11B) into the Province of Davao del Sur.

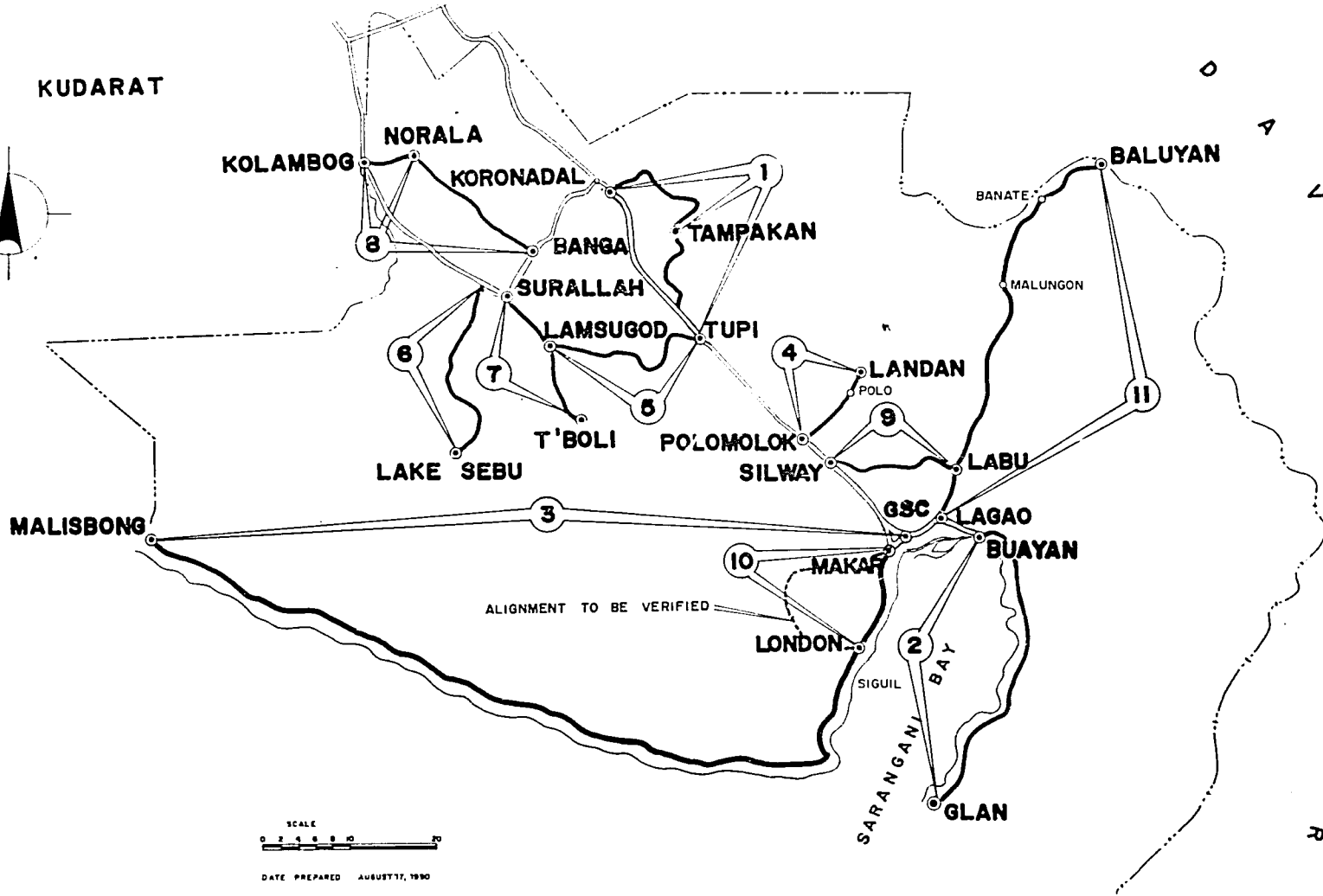
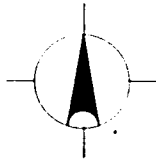
The environmental assessments are a part of studies which are being conducted to determine if the projects are feasible from an engineering, economic, social and environmental standpoint. If a road is considered feasible, specifications and terms of reference for the award of a contract will be prepared for a firm to undertake detailed plans and specifications and hire subcontractors to construct a combination of roads. The total length of roads to be constructed will depend on the available funding.

In the case of Road Sector 11, the road has already been found feasible and the final design has been prepared along with the environmental assessment. An additional 4.3 kilometer extension into Davao del Sur has been added to the road for which only preliminary design will be prepared due to its addition to the scope of work at a late date. However, the environmental assessment will include Sector 11B. Also, within Sector 11, a 2.9 kilometer Section known as 11A has been identified and a realignment has been recommended.

2. OBJECTIVE OF THIS REPORT

An individual environmental assessment has been completed for each of the Road Sectors shown in Figure 6-1 and listed in Table 6-1. Many of these assessments are very similar in nature given the similarities of the various Road Sectors. This report

SULTAN KUDARAT



DATE PREPARED AUGUST 17, 1990

D E L S U R



LOUIS BERGER
INTERNATIONAL INC.
IN JOINT VENTURE WITH
TCGI ENGINEERS
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FIGURE 6-1: LOCATION OF ROAD SECTORS

RURAL INFRASTRUCTURE FUND PROJECT
GENERAL SANTOS CITY / SOUTH COTABATO

DRAWING NO

TABLE 6 - 1
PROPOSED ROAD SECTORS

| SECTOR | LENGTH |
|--------------------------------|---------|
| 1. Koronadal-Tampakan-Tupi | 28.6 |
| 2. GSC/Buayan River-Glan | 47.4 |
| 3. GSC/Makar-Malisbong | 120.5 |
| 4. Polomolok-Landan | 15.5 |
| 5. Surallah/Lamsugod-Tupi | 35.3 |
| ✓ 6. Surallah-Lake Sebu | 21.5 |
| 7. Surallah-T'Boli | 21.4 |
| 8. Banga-Noralla-Kolambog | 23.2 |
| 9. Labu-Silway 8 | 19.5 |
| 10. GSC Bypass | unknown |
| 11. GSC/Lagao-Malungon-Baluyan | 62 |

will endeavour to describe the road projects in the context of the environment of the Province of South Cotabato, to identify common environmental implications of road projects and some of the possible mitigative measures, and to highlight the environmental issues related to the project.

B. REQUIREMENTS FOR ENVIRONMENTAL ASSESSMENTS

Requirements for Environmental Assessments (EA) are common to both the United States and the Philippines and, as the project is governed by legislation promulgated by both governments, the purposes of the (EA) was to fulfil the legislative obligations of both governments.

Over and above the legislative requirements, environmental assessments are a useful planning tool. The identification of potential environmental conflicts early in the planning process allows for incorporation of mitigation measures into the construction process and, when impacts are significant, alternatives to the project may be identified.

The Government of the Philippines (GOP) requires that Environmental Impact Statements (EIS) be prepared if a project is determined to be 1) environmentally critical and/or 2) located in an environmentally critical area. Environmentally critical projects include major roads and bridges. (Office Circular No.3(1983)) At this time only major urban road projects have been included in the category and, therefore the rural infrastructure projects are excluded from categorical project descriptions requiring an EIS.

While the GOP requirements do not call for an Environmental Impact Statement (as defined by GOP) for rural road improvements, the potential that any of the roads may impact an area that falls in one of the environmentally critical areas(as defined by GOP) exists.

Environmentally Critical Areas include:

1. national parks, watershed reserves, wildlife preserves and sanctuaries;
2. aesthetic potential tourist areas;
3. areas which constitute the habitat for any endangered or threatened species of indigenous Philippine flora and fauna;
4. areas of unique historic, archaeological, or scientific interest;
5. areas traditionally occupied by cultural communities or tribes;

6. areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc);
7. areas with critical slope (40% or more);
8. areas classified as prime agricultural lands;
9. recharge areas of aquifers;
10. waterbodies;
11. mangrove areas; and
12. coral reefs.

USAID policy stipulates that the environmental consequences of USAID-financed activities must be identified and considered and appropriate environmental safeguards adopted prior to final decision to proceed with any activity. An order of procedures is outlined for the examination of environmental effects. Under the procedures, there are four categories of activities:

1. Exemption - no EA required.
2. Categorical exclusions - no EA required
3. Classes of actions normally having a significant effect on the environment - EA is automatically required and possibly an Environmental Impact Statement (EIS).
4. "Gray areas" where an Initial Environmental Evaluation (IEE) is required to determine whether significant impacts are or are not likely and if an EA or an EIS is required.

Those "classes of actions normally having a significant effect on the environment" and automatically requiring an EA include: "penetration road building or road improvement projects" (Title 22, Code of Federal Regulations (CFR), Part 216). Therefore, in order to fulfill these requirements, Environmental Assessments were conducted for the GSC/SC Project.

Under USAID requirements, an EIS is required when a project will significantly affect: 1) the global environment or 2) the environment of the United States. Clearly, this is not the case in this Project and, therefore, it has been determined that an EIS is not required.

USAID has also produced a policy paper on Environment and Natural Resources which also provides guidance in the examination of development projects. The paper identifies Tropical Forests and Biological Diversity as special concerns. The U.S. Foreign Assistance Act (Section 118) further specifies that assistance be denied for the construction or upgrading of roads that pass through relatively undegraded forest lands.

Because an Environmental Assessment under USAID's requirements fulfills many of the requirements of an Environmental Impact Statement as defined by the GOP, a single document which combines the two was produced for each of the Road Sectors. These are referred to as Environmental Assessments (EA).

C. METHODOLOGY

1. LITERATURE REVIEW AND PERSONAL CONTACTS

A review of literature available on the Province of South Cotabato was undertaken and the relevant documents were collected for use by the Study Team. Where documentation on South Cotabato was unavailable, information on the Philippines was extrapolated and used. Additional information was gathered from the offices of the Department of Natural Resources and Environment (DENR) in both Manila and Koronadal (Provincial Office).

A list of references, both literature and personal contacts, is included in this Chapter.

2. SCOPING SESSION

A scoping session was held in GSC on July 25, 1990 as part of the overall environmental assessments of the GSC/SC project. The goals of the scoping session were:

- a. to identify the local environmental concerns related to the proposed rural improvements in the GSC/SC Project,
- b. to focus the more intensive work of the Environmental Assessment on the areas of greatest concern, and
- c. to identify those portions of the project that have little or no significant environmental effects.

Over 80 invitations were issued to a cross section of government organizations, non-government organizations, and knowledgeable individuals to attend the scoping session and/or to comment on the projects in writing. (A map of the project area with the proposed roads clearly defined was provided.). Of the 20 individuals that attended, six was from Louis Berger International and TCGI, and most of the remaining participants were representatives of NGOs operating in South Cotabato.

3. FIELD STUDIES

The first field studies consisted of aerial overflights of the entire area and the videotaping of the Road Sectors being considered for improvements.

As a result of these flights and comments received by USAID from NGOs in the United States connected with NGOs in the project

area, it was determined that Road Sectors 5, 6, and 7 were the most environmentally sensitive. An initial field visit by the terrestrial biologist confirmed that this was the case. Therefore, these three roads received the most attention.

During field studies observations were made and recorded on existing environment; specifically land use, presence of wildlife, habitat types, and present environmental conditions. In particular, presence of forest cover and mangroves were noted.

D. OVERVIEW OF SOUTH COTABATO

1. PHYSICAL ENVIRONMENT

a. Geology

The Province of South Cotabato is a rich and fertile agricultural zone surrounded by several youthful and mature volcanic mountain ranges. These include: the Southwest Coastal Range, fronting the Celebes Sea; the West Central Range, the Quezon Range to the Northeast; the East Range which divides the Provinces of South Cotabato and Davao del Sur; and minor ranges such as the Marulas and Roxas Ranges.

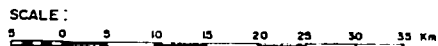
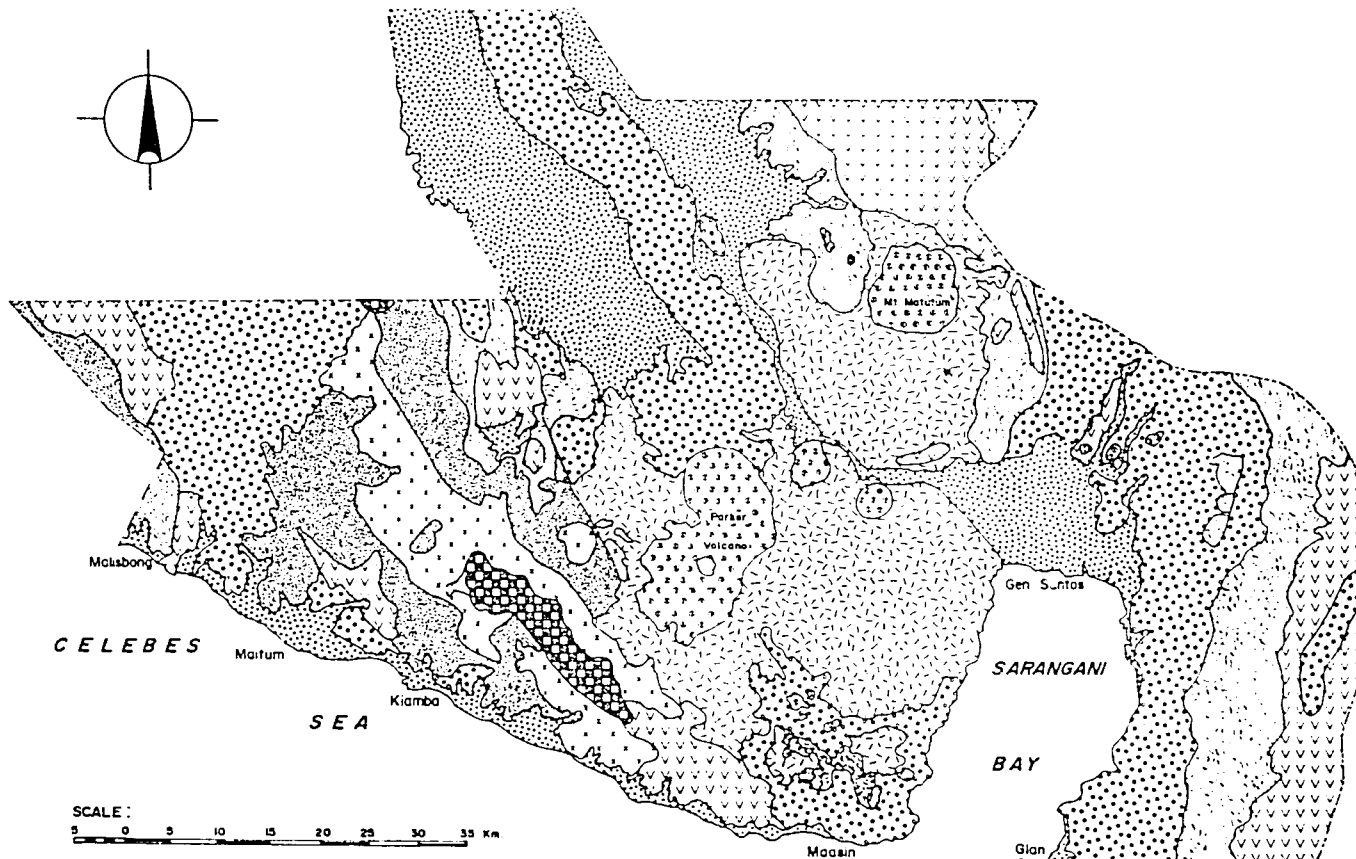
Mount Matutum, an isolated cone towering to 2293 meters, dominates the skyline of the West Central Range. There are several other prominent peaks nearby. Mount Busa (2064 meters) and Mount Parker (2064 meters), in the Southwest Coastal Range, are the next highest. Nine other peaks, ranging from 1128 to 1664 meters in height dominate in the several ranges. All of the mountain ranges are severely dissected with steep to very steep topography.

The geological formation of the Province has been affected by uplift, subsidence, faulting, marine transgressions, volcanic activity and water erosion. Consequently, the geology of South Cotabato is notable in its great diversity, especially for such a relatively small region. Basalt, andesite, rhyolite, agglomerates and similar materials form the base rock which is overlain with alluvium, much of which is of volcanic origin. Sedimentary rock is present in about 44 percent of the area of the Province. Figure 6-2 shows the geological map of the Province.

There are eight broad land form categories in South Cotabato and these are as follows:

i. Coastal or Littoral

This landform occupies a small proportion of the Project area, but is included in two important coastal roads, Sectors 2 and 3. The landscape is made up to tidal flats, fishponds, mangroves and some Nipa palm swamps. It is subject to daily tidal movements.



G E O L O G I C A L L E G E N D

| AGE | SYMBOL | DESCRIPTION | AGE | SYMBOL | DESCRIPTION |
|--------------------------|--------|---|----------------------|--------|---|
| RECENT | | ALLUVIUM: RIVER, LAKE & BEACH DEPOSITS | MIDL Y MIocene | | QUARTZ DIORITE & RELATED INTRUSIVE ROC |
| PLIOCENE-QUATERNARY | | NON-ACTIVE VOLCANIC CONES, GENERALLY OF PYROXENE ANDESITE | OLIGOCENE-MIOCENE | | ANDESITE/BASALT & PYROCLASTICS, WITH SEDIMENTS INCLUDING REEF LIMESTONE |
| PLIOCENE-QUATERNARY | | VOLCANIC SLOPE & PIEDMONT DEPOSITS | PALEOCENE-EOCENE | | DACITE/ANDESITE FLOWS & DIKES, SOME CLASTICS |
| PLIOCENE-PLEISTOCENE | | MARL, REWORKED TUFF, & TERRACE GRAVEL | CRETACEOUS-PALEOCENE | | UNDIFFERENTIATED SEDIMENTS & VOLCANICS |
| UPPER MIOCENE - PLIOCENE | | DACITE/ANDESITE FLOWS & PYROCLASTICS; INCLUDES THICK REEF LIMESTONE | CRETACEOUS-PALEOCENE | | ULTRAMAFIC ROCKS |

FIG. 6-2 SOUTH COTABATO PROVINCE GEOLOGICAL MAP

ii. Alluvial

This landform is concentrated in the plains, valley floors, stream beds and alluvial fans and consists of unconsolidated clay, silt, sand, pebbles, angular and rounded gravel mixed in a sand or clay matrix. It shows mixed characteristics of volcanic and sedimentary origin.

This landform is very extensive. It is found typically in the Marbel and Allah Valleys, and to the East of GSC in the lower Buayan Valley, west of Alabel. Several other alluvial deposits are found in the Province, appearing as river terraces, marshes, broad plains, and narrow in-filled valleys, such as near Lake Sebu.

Alluvial fans are found in many places between Maasim and Maitum. Scattered alluvial fans also appear in the Surallah, Lake Sebu, T'Boli and Tampakan areas.

iii. Residual Terraces

These landforms are derived from both sedimentary and igneous rocks and are observed throughout the Province. Sedimentary formations include limestone, shale, siltstone and conglomerates. Igneous formations are derived from quaternary volcanic pyroclastics, volcanic agglomerates, ultrabasic rock and metavolcanics.

iv. Volcanic Footslopes

The largest of these areas are found in GSC, Polomolok, Tupi, Tampakan, Surallah and T'Boli. Volcanic footslopes are composed of thick and extensive pyroclastics, consisting of various volcanic ejecta including lapilli, tuff, breccia, mixed with volcanic sand, ash and andesite boulders from the Mount Matutum and Apo Parker volcanoes.

v. Karst

This landform is made up chiefly of coralline limestone; sinkholes and other karst features are very common. This landform is found along the coastal roads between Alabel and Glan and in Maasim.

vi. Hilly Landscape

The landforms are composed of hills with significant relief having crests of less than 500 meters elevation. They are formed by warping and folding of sedimentary rocks, tectonic uplift and volcanic action and are found through the Province.

Limestone hills with low relief are located in the Southwest and Southeast coastal areas. Those with high relief are seen at Lake Sebu and Maasim. Shale sandstone hills occur east of Malapatan and Glan, and Northeast of Alabel and Malungon.

Volcanic hills derived from volcanic parent materials of different occurrence and stages, are scattered through the Province. They are mainly derived from volcanic lava flows, volcanic ash and volcanic sand, and have been severely dissected to various depths, by streams flowing in a radial drainage pattern from the center of the volcanos.

vii. Mountains

These landforms are formed by tectonic uplift caused by stress and divided into several types of mountains including Limestone, Sedimentary and volcanic mountains. These are found throughout the Province, particularly the Southwest and Southeast portions.

viii. Plateaus

These landforms can either be limestone or volcanic in nature. Plateau landforms are found in the northeastern portion near Malandag and above the southeastern coast in the Municipality of Maasim.

b. Soils

The soils exhibit the variability that is inherent in the variable geology of the Province. The rivers and streams in South Cotabato do not erode vertically to any significant degree but tend to horizontal erosion. Horizontal erosion and meandering of river traces through the years have caused significant mixing of soil types and particle sizes. Figure 6-3 shows the general soil types of South Cotabato.

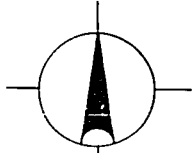
Road Sectors 1, 4, 5, 7, 8, and 9 all have predominantly alluvial soils overlying igneous and sedimentary formations. The soils vary from clay to silt, sand, gravel and boulders. California Bearing Ratio (CBR) values range from 7 to in excess of 35.

The soils of Road Sector 2 vary from sandy loams near GSC to terraced sand and gravel. CBR values range from 7 to in excess of 35.

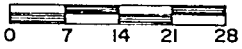
The soils of Road Sector 3 exhibit considerable variability from sandy loams, terraced gravel and silty clays. CBR values range from 5 to in excess of 50.

Soils of Road Sector 6 are like those of Sectors 1, 4, 5, 7, 8, and 9 for the first 10 kilometers, and then change to undifferentiated mountain soils ranging from silty gravel to gravel.

Soils of Road Sector 10 are predominantly sandy loams with CBR values from 5 to 10, indicating a greater amount of silt.








SCALE 1:700,000



GENERAL SANTOS CITY

SOUTH COTABATO

LEGEND

-  SANDY LOAM
-  LOAM
-  FINE SANDY LOAM
-  CLAY LOAM
-  MOUNTAIN SOIL UNDIFFERENTIATED

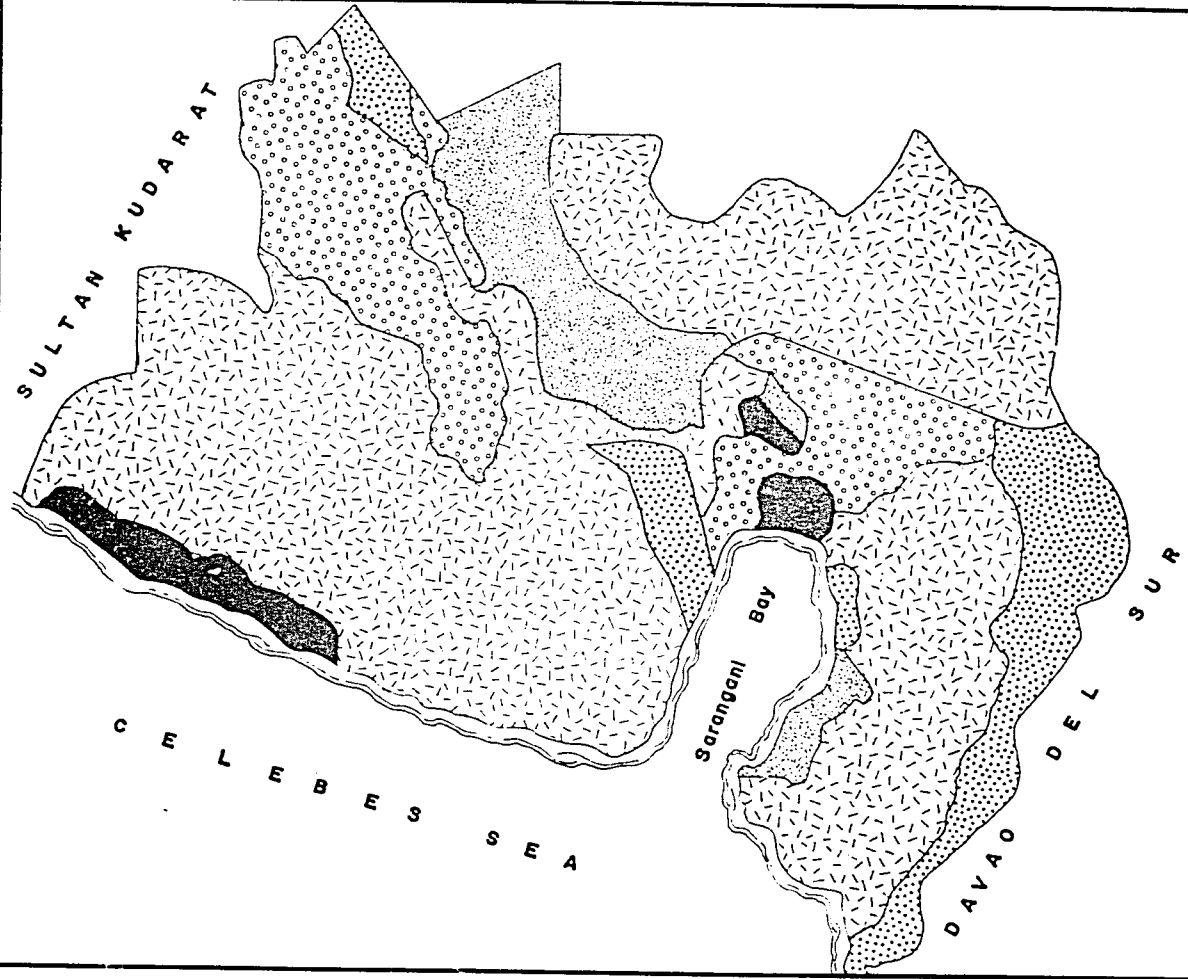


FIG.6-3 SOILS MAP

The soils of Road Sector 11 vary from alluvial volcanic silty sands in the valley bottoms to undifferentiated mountain soils at higher elevations.

c. Hydrology

There are several major watersheds in South Cotabato. The Allah River, the major Provincial river, has a total watershed area of 1,496 square kilometers, 41% of which is outside the Province. The Allah River originates in the peak of the Parker Volcano and flows north, being joined by the Banga and the Lanaon Rivers within South Cotabato.

Other significant watersheds include the Marbel, Siquil, Banga, Silway and Buayan Rivers. The Marbel River flows north in Buluan Lake while the Siquil, Silway and Buayan Rivers flow south or east into Sarangani Bay. Other rivers such as the Kalaong River and a number of lesser rivers flow south into the Celebes Sea. These rivers are characterized by steep slopes in the upstream portions of the watershed.

Most of the watersheds of South Cotabato are severely degraded due to the removal of forest cover, poor soil conservation practices and ongoing "kaingin" farming practices. This has resulted in considerable silt loading, particularly during the heaviest rains. Some restoration work has been undertaken by DENR with funds from the Asian Development Bank as an ancillary program to preserve the effectiveness of irrigation works. However, more watersheds require serious restoration measures, including those servicing GSC.

2. **NATURAL RESOURCES**

a. Vegetation

The vegetation of South Cotabato can essentially be classified into two categories, forest lands and cultivated lands. The most recent efforts to quantify and classify land cover and land uses were undertaken in 1987 by the Swedish Space Corporation (SPOT). The results were a "snapshot" of land uses in the Philippines in 1987. The following discussion is based on the data from that study.

In 1987, of the 455,000 hectares of land in South Cotabato, approximately 180,000 hectares were forest; the remainder was non-forest. Of the forested land approximately 36% was closed canopy dipterocarp forest and the remaining 64% was open canopy dipterocarp forest. The forest lands in South Cotabato were confined to the Southwest Coast Range, the Daguma Range, in an around Lake Sebu, and in the immediate vicinity of Mount Matutum.

The remainder of the land was under cultivation to varying degrees and will be discussed under Land Use. However, it should be noted that many of the mountainous areas of South Cotabato have been virtually denuded of native vegetation. This includes the Roxas Range, many of the footslopes of the forested volcanic

ranges, and the Southeast Coastal Range. The degradation of the Provincial watersheds continues to cause soil erosion and downstream flooding problems. Some efforts are being made to undertake watershed restoration projects which entail reforestation. The largest of these efforts took place in the Lake Sebu area as part of the watershed restoration that accompanied the development of the Allah Valley Irrigation Project.

It should be noted that a more detailed inventory of Forest resources conducted from 1980 to 1988 under the RP-German Forest Resources Inventory Project resulted in much lower figures for Dipterocarp forests in the Philippines than did the Swedish Satellite Corporation (SSC) survey. In fact, the amount of closed dipterocarp forest for the whole of the Philippines was found to be one-half of the estimates by the SSC project.

There are limited amounts of mangrove along the coast of Sarangani Bay. Many of these areas have been degraded as a result of clearing for the purposes of building aquaculture ponds. However, on the western side of Sarangani Bay some mangrove restoration projects are being undertaken. Mangroves are considered valuable areas for natural fish breeding and rearing.

There are few extensive wetlands within the Province, the most significant being Lake Sebu, which has been identified by the Asian Wetlands Bureau and is discussed further in the Environmental Assessment on Road Sector 6. Other smaller isolated wetland areas are evident but most of these landscapes have been modified and are utilized for irrigated rice cultivation.

b. Wildlife

In general, the Philippines supports a rich variety of marine and terrestrial flora and fauna. Mindanao, along with Luzon and Palawan, account for the largest portion of all species present in the Philippines and of single island endemics. However, there is a tendency for most fauna to be found at middle to high altitudes in forest environments. Also, primary forests generally have been the original habitats of many species, but as many as half can survive in moderately disturbed environments (World Bank 1988).

While no detailed field studies were undertaken of wildlife present in South Cotabato, it is clear that habitat diversity is limited and therefore, species diversity is limited over much of the Province. Much of the Province is now under intensive cultivation and even uplands areas undergo some cultivation. This provides only limited types of habitat for terrestrial vertebrates.

Forested areas, which typically support the greatest species diversity and those species considered rare or endangered are limited. Other specialized habitats such as wetlands are also

limited. The result is that those species found in the area are common to heavily utilized areas and are likely well adapted to human habitation.

c. Other Sensitivities

Limited coral reef development appears to be present in Sarangani Bay at present. Anecdotal information indicates that considerable degradation of coral reefs has resulted from dynamite fishing and other practices destructive to coral reefs. Also, heavy siltation as a result of degradation of watersheds in the area would have contributed to the destruction and lowered productivity of coral reefs.

Intensive fishing takes place in Sarangani Bay, but recently catches have declined substantially. This has prompted coral reef rehabilitation projects and the mangrove rehabilitation projects mentioned in the previous Section.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land Use

The total cultivated area in South Cotabato is 254,000 hectares. The breakdown of the cultivated areas is shown in Table 6-2 and the percentage for farming land use types is shown in Table 6-3. Upland cultivated areas account for 124,000 hectares or almost 50% and support an estimated farm population of 267,000 people.

The major crops are corn and rice. Coconut and pineapple plantations are also significant. In addition lesser amounts of cotton, coffee, cacao, banana, rootcrops, fruits and some legumes are produced in South Cotabato.

A number of cities service the Province of South Cotabato, including GSC, Koronadal, Surallah and Banga. Many other smaller cities service their immediate areas. Koronadal, the capital of South Cotabato, is centrally located, and is the center of government services.

b. Income And Employment

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represents a 6.5% total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.

TABLE 6 - 2

SPOT Cultivated Area Estimates, 1987
(Hectares X1000)

| Cultivated in Forest | Grass- Land | Mixed Extensive | Plantations | | Arable Crops | Crops and | | Fishponds |
|-------------------------|----------------|--------------------|-------------|--------|-----------------|-----------|--------|-----------|
| | | | Coconuts | Others | | Coconuts | Others | |
| 1 | 24 | 99 | 8 | 12 | 44 | 15 | 50 | - |

* Based on Swedish Space Corporation (SSC), Mapping of the Natural Conditions of the Philippines, 1988.
Computed from Land Use Areas give in SSC, 1988.
From World Bank, 1989

TABLE 6 - 3

Farming Land Use (Percentages)

| Total Land (1000 Has) | Total Cultivated | Upland/ Extensive | Tree Crops | Annual Crops | Fishponds |
|--------------------------|---------------------|----------------------|---------------|-----------------|-----------|
| 455 | 56 | 27 | 12 | 17 | - |

* Based on Swedish Space Corporation (SSC), Mapping of the Natural Conditions of the Philippines, 1988. From World Bank, 1989.

The majority of workers in South Cotabato are employed in the Agricultural industry (including fisheries). The agricultural Sector accounted for 64% of the workers in South Cotabato in 1986. The remainder were employed in sales, production, services and other (professionals, clerical, etc.) which accounted for 12%, 11%, 6% and 7%, respectively.

c. Cultural Minorities

According to the Office of Southern Cultural Communities (OSCC), there is a total tribal population of 285,779 in South Cotabato. Based on the 1989 population estimate for South Cotabato of 1,016,557, tribal people account for approximately 28% of the total population.

The B'laan comprise 145,810; the T'Boli, 131,285, the Klagan/Tagacnolo, 6,770; the Manobo/Ubo, 650; the Ubo 1,200; and the Tasaday, 64. In general, the B'laan are dispersed throughout the Province, with their greatest numbers being in the Municipalities of Glan, GSC, Polomolok, Tupi, Malapatan, Alabel, Malungon, and Maasim. The T'Boli are less widely dispersed with the greatest majority being in Lake Sebu, T'Boli, and Kiamba. The Klagan/Tagacnolo are found only in Malungon; the Manobo/Ubo, only in Glan; and the Upo and Tasaday, only in the Municipality of Lake Sebu.

There are also Muslim communities of varying sizes throughout South Cotabato. The largest communities are found along either coast of Sarangani Bay.

d. Archaeological And Historic Sites

The National Museum of the Philippines was consulted with regard to archaeological sites within South Cotabato. Their current records did not indicate any sites within the project area.

E. ENVIRONMENTAL EFFECTS AND MITIGATIVE MEASURES

Road construction entails a number of activities that may have effects on the surrounding environment. These effects can be broken down into two categories, those that directly affect the immediate environment, and those that have the potential to indirectly affect the immediate environment or even areas outside of the immediate area of the road. When considering environmental effects of road projects the following activities are taken into account: surveying, construction and operation of camps, use of borrow pits, road construction activities, bridge building, culvert design and installation, and operation and maintenance of the road after construction.

The following is a discussion of the potential environmental effects with some specific examples referring to the project roads in South Cotabato.

1. DIRECT EFFECTS

a. Soil Erosion and Slope Stability

Soil erosion and its effects on slope stability can be a major concern, particularly in the construction of new roads. However, where road improvements will entail alignment changes as is the case in some of the GSC/SC project roads, this has been considered carefully and mitigation alternatives have been suggested.

Within the project area, soil erosion is considered a concern on two specific types of roads. The first, and most obvious, are those built on steep grades, particularly those requiring realignments and extensive cutting and filling in order to bring the road alignment up to design standards. The second type are those built on extremely erodible soils that are subject to flooding. This latter type and appropriate mitigation measures will be discussed in the Section on Hydrology.

Road Sectors 5, 6 and 11 all occur on steep grades for portions of their alignment and require extensive realignments. Road Sector 3 also requires realignment towards its endpoint at Malisbong. Extensive alignment changes have been suggested for Sectors 5 and 6. The proposed changes would allow for a gentler grade and avoid the extensive filling that would be required to upgrade the existing alignment. Sector 11 also requires a realignment in a short 2.9 kilometer Section which has been named Sector 11A. Road Sector 3 also has a suggested realignment towards its endpoint, which would, in fact, require some cuts. However, the substrate in the area under consideration for this realignment is predominantly bedrock.

Mitigation measures to ensure the maintenance of slope stability during and after road construction have been recommended and can be incorporated into construction contracts. These include: mortared rip-rap, reinforced concrete supporting walls, and gabions. Table 6-4 shows mitigation measures that have been recommended, as well as others that may be used for these purposes. In addition, DPWH road standards construction containing a number of provisions for slope protection are being applied to the construction of these roads.

b. Effects on Hydrology

Hydrological impacts of roads result when roads either become barriers to the natural flow of water or become the stream channel and suffer considerable erosion.

All of the roads studied presently have hydrological structures, primarily pipe culverts, box culverts, and both Bailey and Concrete bridges. Road Sector 3 also has approximately 3 kilometers of concrete overflow structures and Road Sector 4 also has segments of concrete overflow structures.

TABLE 6 - 4 EROSION CONTROL MEASURES

VEGETATION

- Ground cover will be maintained whenever possible.
- temporarily devegetated areas will be prepared and planted with appropriate plant species, if necessary.

SLOPE PROTECTION

- Volume of soil removed during excavation will be minimized.
- Slopes will be contoured to maximize natural revegetation.
- Riprap, gablons, and appropriate drainage structures will be provided.

STREAM PROTECTION

- Activities in streams will be minimized.
- Unavoidable activity will occur during seasons of low flow.
- Streambanks will be stabilized with riprap or gablons.
- Temporary coffer dams and dykes will be constructed where necessary.

DRAINAGE

- Culverts and ditches will be installed to divert and disperse surface water surface water flows in a manner to prevent erosion and protect slopes.
- Structures will be designed based on flow rates, and will employ energy dissipators at discharge points to prevent erosion.
- Drainage structures will be periodically maintained to remove sediment and ensure continued effectiveness.

AIR QUALITY

- Exposed surfaces will be wetted or sprayed.
- Stored soils or borrow materials will be stabilized.
- Grading and compacting will be done periodically during construction to minimize aggregate segregation.

For the most part, the existing structures have been designed to adequately address the hydrological requirements of the Sector. However, a common requirement for most Sectors is the extension of culverts, as the roads being upgraded require widening.

The design standards for hydrological structures are a 10-year design flood for pipe culverts, a 25-year design flood for box culverts, and a 50-year design flood for bridges.

All the existing bridges have been carefully examined by the Engineering Team and those that require additional work to maintain slope stability have been identified. The mitigative measure recommended for bridge abutments and streambank protection is gabion placement.

Road Sectors 1 and 7, while in flat terrain, are situated on highly erodible soils and the road ditches in the past have been considerably eroded. Recommended measures to alleviate this problem are furrow ditching every 50 meters, and in some cases, concrete ditching. Concrete or gabion ditching is also recommended in cases where water flow must be directed away from bridge abutments such as in portions of Sector 11 where bridge approaches are on relatively steep grades.

Most of the Road Sectors also have recommended some form of ditching in Sections of the road where run-off may become problematic. This measure is both for maintenance and the prevention of downstream siltation.

c. Alienation of Forest Lands, Agricultural Lands and Mangroves

Construction of new roads results in the removal of all vegetation existing within the right-of-way of the new road. As the design right-of-way for the roads within the project area is 30 meters, the overall loss of land is generally considered insignificant.

Most of the Road Sectors under discussion exist within existing right-of-ways and therefore, little additional alienation of land is expected. Those roads with suggested realignments (Sectors, 1, 3, 5, 6, and 9) will require varying amounts of alienation of additional lands. However, all of these areas are within extensive areas of similar land use, thus no unique land cover will be lost.

There are no undegraded forest lands along any of the Sectors that would be directly impacted by improvements to the roads. A short segment along Sector 3 poses a concern for adjacent degraded mangrove areas where road curves require realignment. The proposed mitigative measure is to move the center line of the road away from the mangroves and expand the road away from the mangrove area if widening is necessary.

d. Displacement of Homes

Road improvements often require widening of existing right-of-ways and this is the case with many of the improvements slated for the project area. Also, any new alignments such as Sector 10 and those Road Sectors that have suggested realignment may require acquisition of new right-of-ways.

There is a propensity in the Philippines for building residential dwellings and commercial establishments immediately adjacent to existing roadways, hence within the right-of-way. Most of the Road Sectors require right-of-way expansion but because they are, for the most part, rural roads, displacement of dwellings will be minimal. The same will be true for those alignments requiring relocation. The exception is Road Sector 11 which requires widening of the right-of-way. The town of Banate is built right on the roadside with considerable numbers of commercial establishments as well as residential dwellings. This poses a traffic hazard on the road. When construction of this Road Sector is undertaken, these establishments will be displaced.

e. Cultural Resources

Road construction often requires a considerable amount of excavation. During this type of work, cultural resources may be unearthed and/or destroyed. The road improvements proposed for the project area are, for the most part, to take place on existing roads, or in areas already disturbed by humans. Also, a list provided by the National Museum of the Philippines of all known archaeological sites in the Philippines did not include any sites in South Cotabato. For these reasons, little new discovery of cultural materials is expected.

However, provisions exist within Philippine law and are included in the contract documents for saving cultural materials unearthed during construction work. These provisions are outlined in each of the environmental assessments. DPWH and the National Museum of the Philippines are also working on an agreement to determine how to preserve cultural materials that may be unearthed during the course of road building.

2. INDIRECT EFFECTS

a. Increased Access

One of the major purposes of road building and road improvements is to increase access to a particular area, thereby lowering transportation costs for the residents of the area, both for personal transportation, the transportation of goods and services, and the transportation of products to better markets. This is one of the major thrusts of all the roads in the GSC/SC Project.

Increased access can, on the other hand, impact the environment and cultural minorities. The difficulty in any environmental assessment is to try to determine if the benefits of the increased access outweigh any negative effects and if those negative effects can be mitigated.

One of the negative effects of increased access is the acceleration of the destruction of forest resources. This can either be the result of greater immigration of "kaingin farmers" or through greater illegal exploitation of forest resources. The Road Sector where this presents a potential problem is Road Sector 6 as its terminal point at Lake Sebu is near an area of continuous forest. The difficulty is in determining just how much of an impact the proposed road improvement would have in relation to the effect of the already existing gravel road. There is no practical way of quantifying these potential effects and estimates of impact are purely speculative.

However, this does not imply that since effects are unquantifiable, then there is no mitigation possible. Mitigative measures for these kinds of effects are less specific in nature and must address existing problems. In the case of "kaingin" farming, the presence of agricultural programs in the area designed to train farmers in sustainable methods of agriculture would mitigate this potential effects. Strong community associations charged with enforcing their own community standards, and a strong non-formal environmental education program could include measures that could counteract the negative effects of a road improvement. Also, a strong government presence where illegal logging is a problem would mitigate for increased access.

Increased access may also accelerate the exploitation of other natural resources such as fisheries. This again could apply to Road Sector 6, but it is also true of the two coastal roads, Sectors 2 and 3. The proposed road improvements along the coast of Sarangani Bay may encourage further exploitation of the fisheries resources within the Bay by making transportation of fisheries products easier. While this is admittedly one of the great advantages of the road for the existing fishing community, it may also provide incentive for new entries into the fishery which is apparently already over exploited. In view of the lack of regulation governing the fisheries of the Philippines, this kind of effect could negate any benefit achieved. Again, the only mitigation for this is the presence of ancillary programs aimed at educating the existing participants in the fishery, at encouraging their organization and self-enforcement and at finding alternative livelihoods for others that wish to live in those areas traditionally occupied by fishing communities.

Finally, the other potential negative impact of increased access is the effects on tribal peoples. This varies according to the vulnerability of the tribal peoples in any particular area. Those with Civil Reservations have some legal claim to the lands which they occupy. However, those without civil Reservations, such as in Lake Sebu, are somewhat more vulnerable

to exploitation and encroachment. Historically, tribal peoples have been exploited or displaced by newcomers and their ability to sustain themselves has decreased as a result of removal to less productive lands.

Road improvements also provide tribal peoples with new opportunities. On the other hand, if their agricultural productivity is limited by their land base, no amount of road improvements will allow them to produce more, as is the case in Landan (Road Sector 4) and is probably the case in Lake Sebu (Road Sector 6). In this case, only with additional programs that address other needs of the tribal peoples can potential benefits be accrued to them as a result of the road improvements.

In most of the other Road Sectors, while tribal peoples are present, the integration within the communities is so complete, that they cannot be treated as a separate entity and any effects of the roads, either negative or positive, are the same for all people within the zone of influence of the roads.

b. Siltation

Another potential indirect effect is increased siltation of watercourses, which could in turn, result in degradation of water supplies, mangroves, or coral reefs in Sarangani Bay. This is very difficult to assess given the current condition of most watershed in South Cotabato.

The entire Province has been virtually denuded, with the exception of the mountainous areas to the west and north of Road Sector 3, and to the south of Lake Sebu. Most of the existing rivers already run with a considerable silt load. The mangrove areas and coral reefs within and along the edges of Sarangani Bay are already very degraded so, again, it would be difficult to attribute their current condition to past road construction.

Measures suggested for the protection of slope stability, and the protection of hydrological integrity present additional mitigation for the effects of downstream siltation.

E. CONCLUSIONS

South Cotabato suffers from many of the environmental problems common to the Philippines as a whole. Forest resources are dwindling; intensive agriculture is being undertaken throughout the Province, including on steep slopes; watersheds have been severely degraded, resulting in erosion and unstable hydrological regimes; and coastal fisheries are declining.

The proposed road improvement projects are, for the most part, within existing road alignments and as such, will create little new disturbance. The impacts will be minimal, particularly when viewed in the context of the existing environment of South Cotabato. The types of impacts expected

such as soil erosion and drainage disruption can be minimized using common and effective mitigation measures.

Indirect impacts such as increased access are more difficult to quantify and also to mitigate. The potential effects of increased access on tribal peoples and forest lands may only be offset by concerted efforts to ensure the land tenure of tribal peoples and the enforcement of laws governing the protection of natural resources.

The Road Sector considered most sensitive is the Surallah-Lake Sebu Road (Sector 6). The major sensitivities are potential erosion effecting Lake Sebu, the increased access to a tribal domain where there are few legal rights to the land occupied by the tribal peoples, and potential for increased access to forested areas to the south of Lake Sebu. Mitigative measures for these issues have been proposed where possible. The expected benefits to be derived from an improved road are considered greater than the possible impacts, providing the aforementioned problems are addressed at the same time.

The other potentially sensitive project is Road Sector 3, because of its coastal nature and its extension into a forested area in the vicinity of Malisbong. Mitigative measures have been proposed that would alleviate most localized impacts. The benefits of this road far outweigh the insignificant impacts that have been identified.

The remainder of the Road Sectors generally lie in extensively utilized areas, and occur, for the most part, within existing road alignments. Where localized impacts have been identified, appropriate mitigation measures have been proposed.

In general, the proposed road improvements would not result in any significant environmental impacts and the benefits to local economies are considered significant for most of the roads.

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SECTOR 1

KORONADAL - TAMPAKAN - TUPI

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed road improvements from Koronadal to Tampakan to Tupi will occur on an existing road alignment. This road begins at the National Highway southeast of Koronadal proper, in Barangay Sto. Nino and extends northeast to Rotonda, then southeast to Tampakan and then southwest again to end at the National Highway just north of Tupi. It passes through a portion of the Municipalities of Koronadal, Tampakan and Tupi.

2. SCOPE

Currently, the existing road is the main thoroughfare of a network of poorly maintained gravel roads, none of which service the communities of the area adequately. The proposed improvements are designed to upgrade the existing gravel alignment to a two lane paved road throughout its length. The object of the project is to provide a better transportation route for the highly successful farming communities along the route thereby increasing access to markets and services and allowing for greater profitability.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

This alignment runs along gently sloping terrain throughout its length descending from 170 m to 60 m (MSL). The National Highway and the Roxas Range lie to the southwest of the road and to the immediate northeast lie the Quezon mountains that run northwest from Mount Matutum. The road itself remains on the valley bottom although in places, skirts the lower edge of these mountains.

2. GEOLOGY AND GEOMORPHOLOGY

For most of the road's length, the terrain consists of recent alluvial deposits overlying volcanic agglomerates and sedimentary formations, consisting of unsorted and unconsolidated heterogenous detrital assemblages of clay, silt, sand, gravel and sometimes boulders. The southern portion of the alignment from Tampakan to The National Highway at Tupi passes through the volcanic footslopes and piedmont deposits of the Pliocene-Pleistocene Age.

3. SOILS

The soils found on the broad alluvial plain are moderately shallow to very deep sandy loams, ranging from silt to sandy gravel and poorly graded gravel. The soils found on the lower

volcanic footslopes are shallow, well-drained coarse loams underlain by a stratified layer of thick volcanic ejecta.

4. SURFACE WATERS

The road alignment is located in the watershed of the Marbel River and has a run off volume of 2.1×10^8 cubic meters. The watershed originates on the northwest slopes of Mount Matutum and eventually flows northward to Lake Buluan. (Bureau of Soils, DA. 1988)

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April. Provincial rainfall data indicates that the entire alignment receives approximately 2000 mm of precipitation annually.

C. NATURAL RESOURCES

1. VEGETATION

There are no forested areas along this alignment. The lands along this alignment are entirely agricultural, the primary crops being corn and rice, interspersed with coconut, bananas and other fruit trees.

2. PROTECTED AREAS

There are no protected areas identified along this alignment.

3. WILDLIFE

No unique habitat types or habitat for rare or endangered species were found along this alignment, nor were any observations made. Wildlife present within the alignment is well adapted to the presence of man since the area is extensively used by humans. As a result, species along this Sector are unlikely to be sensitive to construction activities or increased road traffic.

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D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

The land throughout the alignment is classified as Alienable and Disposable by the Department of Environment and Natural Resources, Provincial Office and may therefore, be privately titled. The entire alignment is situated in agricultural lands that are classified on Land Cover Maps as Intensive Land Use areas of croplands and croplands mixed with plantations. (Figure 6-1) The major crops are corn and rice with some coconuts and fruit trees. In addition a considerable amount of livestock is raised.

2. INCOME AND EMPLOYMENT

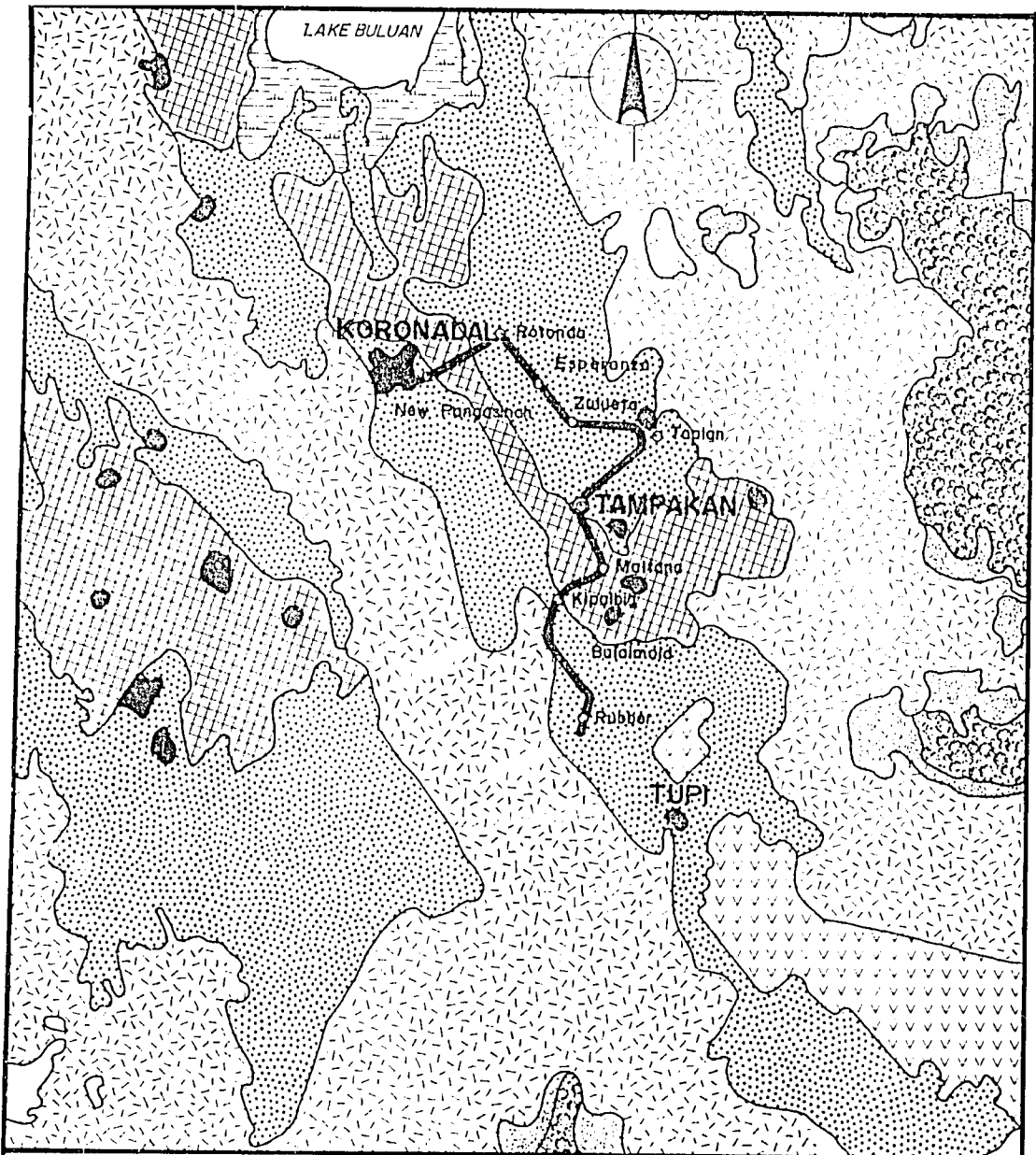
South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represent a 6.5% total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.

The economy of the Koronadal-Tampakan-Tupi road is almost entirely agricultural. Tampakan is illustrative of the portions of the Koronadal and Tupi Municipalities through which the road passes. The average annual rural income in Tampakan is P55,734, well above the annual averages for the Province, the Region and the Nation. However, this figure is skewed and does not adequately represent income distribution.

3. PUBLIC SERVICES












For the purposes of this discussion, only statistics from the Municipalities of Tampakan and Tupi will be included as the largely populated Municipality of Koronadal would skew statistics considerably. There is 1 hospital, 14 schools, 1 doctor, 1 dentist, 1 nurse, 5 midwives and 115 Barangay health workers in the Tampakan Municipality. There are 26 schools, 2 hospitals, 1 doctor, 1 dentist, 2 nurses, 7 midwives and 168 Barangay health workers in the Tupi Municipality. (Provincial Planning & Development Office, South Cotabato, 1988)

Electricity is supplied to users in the Province of South Cotabato by two electric cooperatives known as the South Cotabato Electric Cooperative or SOCOTECO I & II. SOCOTECO I supplies the Municipality of Tampakan and out of 7 Barangays, 5 are currently supplied. SOCOTECO II supplies the Municipality of Tupi.



LEGEND:



- | | |
|--|---|
|  DIPTEROCARP FOREST, CLOSED CANOPY > 50 % |  COCONUT PLANTATIONS |
|  DIPTEROCARP FOREST, CLOSED CANOPY < 50 % |  OTHER PLANTATIONS |
|  CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND |  ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
|  GRASSLAND COVERING > 70 % |  CROPLAND MIXED W/ COCONUT PLANTATIONS |
|  BUILT-UP AREA |  CROPLAND MIXED W/ OTHER PLANTATIONS |
|  MARSHY AREA | |

KORONADAL-TAMPAKAN-TUPI

SOURCE: PCGS 2551
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

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4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel roads to the National Highway, which are subject to flooding.

The nearest commercial airport is in General Santos City. Regular jeepney and bus service is available along the National Highway while jeepney and tricycles are available along the road itself.

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas. (World Bank, 1989) Overall indications are that net migration is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

Historically, the original inhabitants of this area were the Blaan tribal peoples. In the early 1900's, Mindanao became a destination for Visayan settlers and again in 1940, the Tampakan area was the site of a settlement project. The communities along the road are now well settled and possess an agricultural infrastructure indicative of a relatively affluent area.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along the Road Sector.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

There are over 6,000 Blaan tribal peoples in the Municipality of Tampakan. The overall trend in this area is that most of the tribal people, have been absorbed and integrated into the lowland farming communities while a small percentage have moved into the upland areas, well away from the road alignment.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

Although the topography in this Sector is gently sloping, the erodible soils in this area can create some problems. In

fact, in one Section between Taplan and Tampakan the road has eroded due to poor drainage to one and one-half meters below the surrounding grade. Road construction activities may directly aggravate this problem by creating unstable surface conditions. Cross drainage structures, and furrow ditching every 50 meters to the right-of-way line should be included in construction to alleviate localized road erosion.

Four materials sources have been identified by the Department of Public Works and Highways (DPWH) including the Palian River Quarry, Kipalbig River Quarry, Barangay No. 4 River Quarry, and Barangay No. 2 River Quarry (Sto. Nino Bridge). It is common practice to obtain borrow materials from riverbeds. However, contract specification should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provisions in the contract should be made for the contractor to notify Provincial representatives of the Department of Environment and Natural Resources (DENR) when construction activities begin so that their representatives may monitor activities, particularly the use of borrow sources and implementation of erosion control measures.

b. Hydrology

The road alignment has eight existing bridges including one Bailey bridge. The Bailey bridge will be replaced with a concrete bridge and one additional bridge will be added to the alignment. The remaining bridges will require some slope and stream bank upgrading, stabilization, and protection works. Hydraulic design capacity for bridges is to the 10 year design flood.

The existing alignment has 10 box culverts, one of which will be replaced with a pipe culvert. Box culverts are designed to the 25 year design flood.

The road improvement will include the repair or replacement of 26 pipe culverts. Pipe culverts are designed to the 10-year design flood.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. However, provisions will be made in the contract for maintenance of these structures.

c. Air Quality

Because this is a gravel road, air quality in the vicinity of the road is affected by fugitive dust. Some additional fugitive dust will be generated during construction activities effecting residents of Barangay immediately adjacent to construction areas. Mitigation measures may be used for those areas affected during construction. These include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally

safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract will be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes. Environmentally hazardous materials used during construction should be stored in designated area, which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The contractor will be required to notify the Provincial office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. **NATURAL RESOURCES**

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Field observation confirmed that habitat requirements for rare and endangered species in the Philippines are not met along the alignment. Based on the lack of suitable habitat, rare or endangered species are not expected to be present along this alignment. Since the area is already utilized by humans, the wildlife has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

3. **CULTURAL AND SOCIO-ECONOMIC RESOURCES**

a. Land use and Settlement Patterns

Based on the stability of the existing settlements along the alignment, no effects on land use or settlement patterns is expected.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The lowering of transportation costs will effect the local economy by reducing commodity prices and will also significantly aid the economic development of the entire route by reducing transportation costs to better markets in General Santos City.

c. Public Services

During construction there may be increased demand for food

and lodging by the labor force. Given the size and available services in Koronadal and Tupi, this is not expected to strain existing public services.

d. Displacement and Relocation

As the road improvements are to take place within an existing alignment, displacement of individual dwellings will be minimal. Alternative alignments requiring new right-of-ways, would result in additional displacements.

e. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

f. Tribal Filipinos and Ancestral Lands

No tribal Filipinos are expected to be directly affected by the proposed road improvements. However, benefits that are realized as a result of decreased transportation costs will also benefit tribal Filipinos.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

Without the proposed road improvements, it is expected that the road will continue to degenerate as a result of continued flooding. In addition, the farmers of the area will continue to pay unusually high transportation costs.

2. SITING ALTERNATIVES

The project consists of rehabilitation of an existing alignment for most of its' length. However, some alignment changes have been suggested in Chapter IV (Engineering Design). Effects on natural resources would be minimal with these changes but new right-of-ways would be required which could cause some displacements.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 2

GSC/BUAYAN RIVER - GLAN

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed road improvements from Buayan to Glan will occur, for the most part, on the existing road alignment. The existing road begins at the east side of the Buayan River and extends approximately 48 kilometers southward along the east coast of Sarangani Bay through the Municipalities of Alabel, Malapatan and Glan to Poblacion Glan.

2. SCOPE

Currently, the existing road is the only land transportation route between the communities in the Sector and GSC, the major Provincial commercial center. The proposed improvements are designed to upgrade the existing gravel alignment to a two lane paved road starting from the end of the concrete National Highway at Buayan River and ending in Glan. The objective of the project is to improve access to markets and services and reduce transportation costs between the communities along the Sector.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

This alignment traverses flat to moderately hilly terrain throughout most of its length to Glan. It crosses the lower slopes of the East Range of Sarangani Bay as well as periodically descending to the coast and skirting the shoreline.

2. GEOLOGY AND GEOMORPHOLOGY

From the Buayan River to the Lun Grande River and from Tanga Point to Glan, the terrain consists of recent Alluvium. These coastal plains consist of eroded, raised reefs, sand dunes and bars made up of sandy to silty poorly cemented materials, including coral and shale debris.

The remainder of the road and surrounding area is comprised of marine clastics consisting of tufaceous sandstone, siltstone and shale, interbedded with micro and macro conglomerates, and reef limestone of the Pliocene - Pleistocene age.

3. SOILS

The soils found in the alluvial deposits at the start of the Sector just east of GSC are silty sands, known as Dadiangas sandy loams while towards the Lun Padidu River, the soils change to new graded terraced sand and gravel. Near Malapatan, the soil changes to silty sand and sandy silt. Continuing to the

southeast from Malapatan, the road passes along the edge of formations of coral, calcareous marl, coralline limestone, tufaceous sandstone and outcropping of limestone.

4. SURFACE WATERS

The alignment traverses four major watersheds. The Sector begins at the Buayan - Malabulen watershed which has an annual runoff volume of 1.3×10^7 cubic meters. Between Alabel and Malapatan the major watershed is the Lun Grande river with a runoff volume of 5.2×10^6 cubic meters. Further south, the Malapatan watershed has a runoff volume of 1.9×10^6 cubic meters and finally, the watershed of the Big Glan River watershed has a runoff volume of 3.4×10^6 cubic meters (Department of Agriculture, 1988).

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes (South Cotabato Provincial Planning and Development Office, 1988). Flowing wells, found in the coastal areas of Malapatan and Glan, are believed to be from an inclined water bearing formations at lower elevations.

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and South Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April.

Rainfall distribution is generally influenced by elevation and aspect, the mountainous areas receiving the highest rainfalls. The first portion of the alignment lies within an area that receives an average annual rainfall of less than 1000 mm. The remainder of the alignment is within an area that receives 1000 mm to 1500 mm of rain annually in the coastal plane and up to 2000 mm in the highlands.

C. NATURAL RESOURCES

1. VEGETATION

There are no forested areas along this alignment. Small areas of mangrove are found scattered along the alignment between Buayan and approximately 10 kilometers past Malapatan. These areas are degraded and very restricted in size. There is evidence of mangrove destruction for creation of shrimp aquaculture facilities. In some cases, these facilities were never completed.

The lands along this alignment are entirely agricultural, the primary crop being coconuts with some rice, cotton, and corn.

2. PROTECTED AREAS

There are no protected areas identified along this alignment.

3. WILDLIFE

No unique habitat types or habitat for rare or endangered species were found along this alignment, nor were any observations made of rare or endangered species.

Wildlife present within the alignment is well adapted to the presence of man since the area is extensively used by humans. As a result, species along this Sector such as White-collared Kingfishers and tree sparrows are unlikely to be sensitive to construction activities or increased road traffic.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

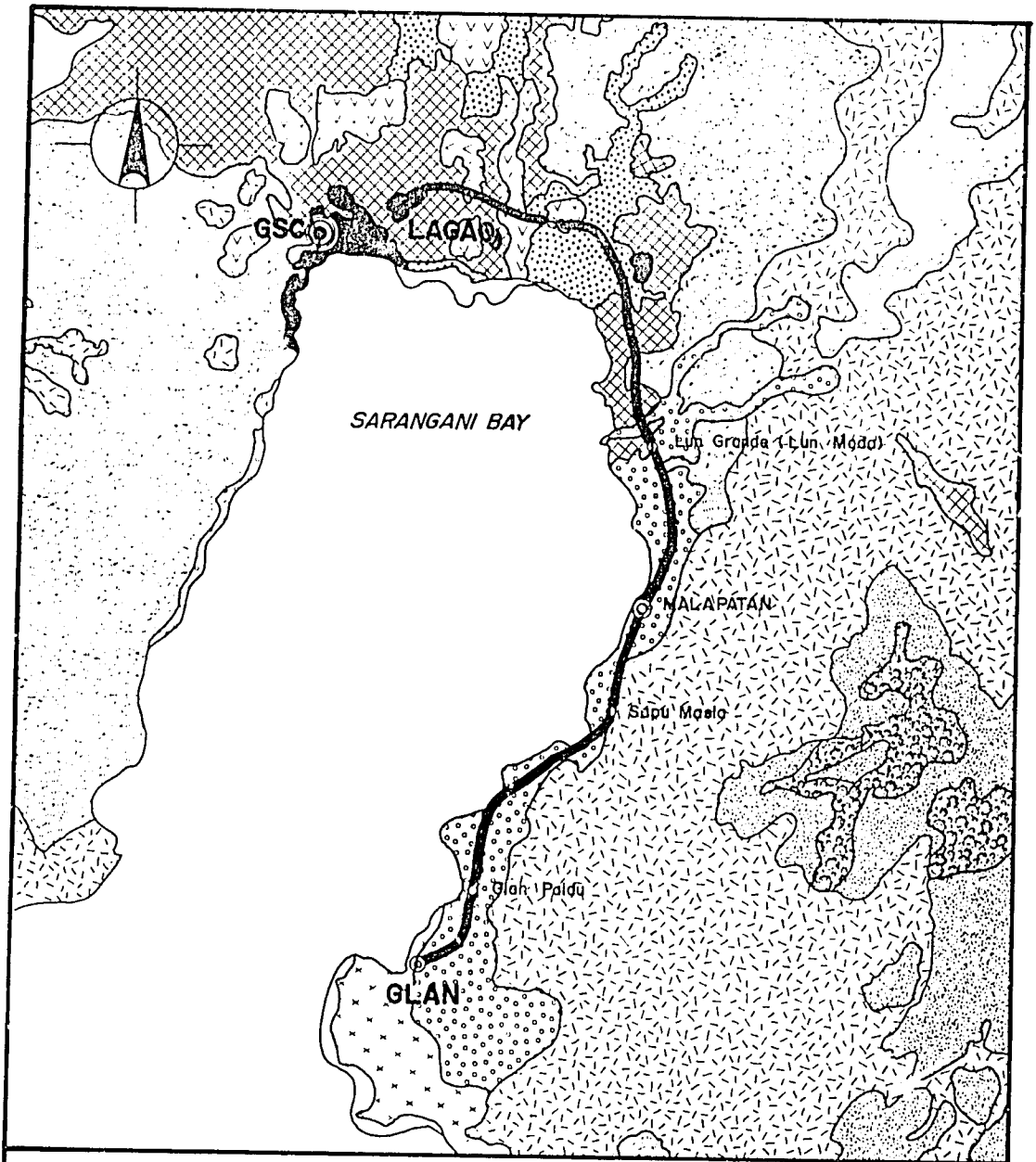
1. LAND USE AND SETTLEMENT PATTERNS

The land throughout the alignment is classified as Alienable and Disposable by the Department of Environment and Natural Resources (DENR), Provincial Office and may, therefore, be privately titled. Only one section approximately 5 kilometers north of Malapatan on the east side of the road is still classified as Forest Land, implying that, while the land is not forested, it is publicly owned.

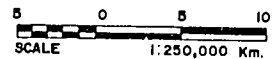
The entire road alignment is situated within agricultural lands that are classified on Land Cover Maps as intensive land use areas of crop land, plantations and fish ponds of which more than 70% is cultivated (Figure 6-1). The lands along the first few kilometers of the alignment, situated on the plain of the Buayan River are used as pasture or are cultivated with rice. The remainder of the alignment, passes through crop land mixed with coconut plantations.

2. INCOME AND EMPLOYMENT

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represent a 6.5% total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.



LEGEND:



- | | | | |
|--|--|--|---|
| | DIPTEROCARP FOREST, CLOSED CANOPY > 50% | | COCONUT PLANTATIONS |
| | DIPTEROCARP FOREST, CLOSED CANOPY < 50% | | OTHER PLANTATIONS |
| | CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND | | ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
| | GRASSLAND COVERING > 70% | | CROPLAND MIXED W/ COCONUT PLANTATIONS |
| | BUILT-UP AREA | | CROPLAND MIXED W/ OTHER PLANTATIONS |

GSC/BUAYAN RIVER - GLAN

SOURCE: PCGS 2551
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

The economy of the GSC/Buayan-Glan Road Zone of Influence (ZOI) is principally agricultural. Within the Municipality of Alabel, the major crops are corn, rice and coconuts. Some income is also derived from aquaculture and, because Alabel is essentially a suburb of GSC, salaried work. The average annual rural family income in this section is P54,450. In Malapatan and Glan, the predominant agricultural crop is coconut with smaller amounts of corn and rice. Some income is also derived from fishing in the communities along the Sector.

The average rural family income in Malapatan is P57,166 while in Glan, it is P49,590. The average urban family income in the Municipalities is P52,960. Throughout the alignment average family incomes are well above both the Provincial and national averages, which is indicative of the vibrant agricultural community present along this Sector.

3. PUBLIC SERVICES

There are 19 schools, 1 nurse, 5 midwives and 148 Barangay health workers in the Alabel Municipality. There are 20 schools, 1 doctor, 1 dentist, 1 nurse, 9 midwives and 86 Barangay health workers in the Malapatan Municipality. There are 36 schools, 1 hospital, 2 dentists, 5 doctors, 5 nurses, 8 midwives and 113 Barangay health workers in the Glan Municipality. (Provincial Planning and Development Office, South Cotabato, 1988)

Electricity is supplied to users in the Province of South Cotabato by two electric cooperatives known as the South Cotabato Electric Cooperative (SOCOTECO I and II). SOCOTECO II supplies the Municipalities of Alabel, Malapatan, and Glan.

4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel road from GSC. There is also some movement of goods, particularly fisheries products by boat from the fishing villages along the road.

The nearest commercial airport is in GSC. Regular jeepney service connects Alabel, Malapatan and Glan with GSC.

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas (World Bank, 1989). Overall indications are that net migration in recent years is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

Historically, the original occupants along this alignment would have been the Blaan Tribal peoples who were displaced by Muslim settlers. Following that, in the early 1900's, Mindanao became a destination for Visayan settlers. This ongoing evolution

appears to have stabilized given that most of the land along this alignment is privately owned and communities are well established.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along Road Sector 2.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

There are significant population of Blaan indigenous peoples in the Municipalities of Malapatan and Glan according to the Office of Southern Cultural Communities (OSCC). Statistics indicate that the Blaan comprise approximately 75% of the population of the Municipality of Glan and approximately 46% of the population of Malapatan. There are indication that the Blaan are well integrated within the ZOI population, but the large Blaan tribal communities within the three Municipalities are well removed from the road ZOI.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

The construction of the improved road should not create increased erosion since the alignment already exists and adjacent areas have previously been disturbed. Maximum grades of the existing road are 16 percent. These will be modified not to exceed 7 percent, thus reducing erosion potential. Sections of the road where the modified alignment will require new cuts and fills should incorporate some mitigation measures. Slope stability will be maintained by constructing side slopes to conform to the internal friction angle of the soils. Failing this, other measures such as gabions, dry land rubble masonry, and mortared rip-rap may be necessary. Maintenance of soil erosion control structures after completion of road construction will be required in order to ensure their continued effectiveness.

Where construction will take place adjacent to the mangroves, the mitigation measures outlined above will be incorporated into construction specifications to insure their maintenance and integrity. In addition, all weather signs should be erected explaining in Tagalog, the importance of mangrove for fisheries populations.

Seven materials sources have been identified by the Department of Public Works and Highways (DPWH) for road construction in this Sector. These sources include the Maribulan

River Quarry, Buayan River Quarry, Lun Padidu River Quarry, Lun Masla Quarry, two Quarries on the Glan River and the Pangyan River Quarry. It is common practice to obtain borrow materials from riverbeds. However, contract specification should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Contract provisions should be made requiring the contractor to notify Provincial representatives of DENR when construction activities begin so that their representatives may monitor activities, particularly the use of borrow sources and implementation of erosion control measures.

b. Hydrology

Currently, of the 13 bridges along this alignment, four are being replaced or will be in the near future by DPWH, four are in good condition and will not require replacement, and five are slated for replacement with new concrete bridges or concrete box culverts as a part of this project. Hydraulic design for bridges is to the 50 year design flood and to the 25 year design flood for box culverts. In addition, there are 46 reinforced concrete pipe culverts, of which 30 will require either some maintenance or replacement. Hydraulic design capacity for pipe culverts is to the 10-year design flood.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. Drainage structures have been designed to minimize the effects of runoff from the roadway surface and adjacent ground through proper utilization of natural watercourses. In addition, provisions should be made for maintenance of drainage structures after completion of road construction.

c. Air Quality

Because this is a gravel road, air quality in the vicinity of the road is affected by fugitive dust. Some additional fugitive dust will be generated during construction activities effecting residents of Barangay immediately adjacent to construction areas. Mitigation measures may be used for those areas affected during construction. These include covering stored materials, providing temporary paved parking areas for workers, spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract should be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes. Environmentally hazardous materials used during construction should be placed in designated areas which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The contractor should be required to notify the Provincial office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. NATURAL RESOURCES

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Construction activities result in little new surface disturbance and vegetation removal except for occasional alignment shifts to meet current design standards. Habitat requirements for rare and endangered species in the Philippines are not met along the alignment as there is no remaining primary forest. Based on the habitat available and the fact that the area is heavily utilized by humans, the wildlife found along the alignment has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land Use and Settlement Patterns

Upgrading the road will have little effect on the land use pattern along the route which is currently agricultural. The improvements may encourage development of beach resorts along portions of the coastal road.

No significant changes in agricultural practices, land settlement or land ownership is expected other than possible introduction of improved crop varieties.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The improved road will effect the local economy by reducing commodity prices and significantly aid the development of the entire Sector by reducing transportation costs to the markets in GSC.

c. Public Services

During construction there will be increased demand for food and lodging by the labor force. Because of the distance to the farthest point from GSC, in order to avoid travel time during the construction, workers should be accommodated in the towns along the route. This may generate a temporary boom for these small

towns which will stabilize once construction is complete. The improved road may also increase access to public services such as hospitals at either end of the road.

d. Displacement and Relocation

The alignment for the most part, will remain unchanged, and therefore, displacement of individual dwellings will be minimal.

e. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

f. Tribal Filipinos and Ancestral Lands

No tribal Filipinos are expected to be directly affected by the proposed road improvements. However, benefits that are realized as a result of decreased transportation costs may also benefit those tribal Filipinos residing near the existing road.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

No direct environmental impacts are likely if the proposed road improvements are not implemented.

2. SITING ALTERNATIVES

The project consists of improvements of an existing alignment and will make minor shifts in this alignment where such shifts improve traffic flow and safety. No siting alternative

was considered as no new construction is involved.

3. SHORT-TERM VERSUS LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 3

GSC/MAKAR - MALISBONG

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed road improvement from General Santos City/Makar to Malisbong will occur, for the most part, on the existing all weather gravel alignment connecting the coastal community of the Sector with the Provincial road network. The existing road traverses southward from Makar along the coast of Sarangani Bay, then continues in a northwesterly direction, following the coastline, and passing through the Municipalities of Maasim, Kiamba and Maitum respectively. It ends in Barangay Malisbong on the border between South Cotabato and Sultan Kudarat Provinces. The total length of the road is approximately 120.5 kilometers.

2. SCOPE

Currently, the existing road is the only land transportation route between the area coastal communities and the Provincial road network. The proposed improvements are designed to upgrade the existing gravel alignment to a two lane paved road from Makar to Malisbong, and eventually connect with the Province of Sultan Kudarat.

The objective of the project is to improve access to markets, reduce transportation costs and provide a transportation link with Sultan Kudarat to facilitate the transportation of goods from that Province to General Santos City (GSC).

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

The existing road alignment from Makar to Maitum is relatively flat to gently rolling. There are slight changes in elevation as the road travels from terraces to the coastal plain and vice versa. Beyond Poblacion Maitum, the road climbs steeply then descends onto the coastal plain climbing into a forested area at Barangay Maguling. Finally, the road descends and follows the coastline closely for the last 4 kilometers to Malisbong.

2. GEOLOGY AND GEOMORPHOLOGY

The portion of the alignment from Makar to the Siquil River consists of volcanic slopes and piedmont deposits of the Pliocene-Quaternary Age. This formation is composed of thick pyroclastics consisting of lapilli, tuff breccia, volcanic sand, ash and andesite.

From the Siquil River to Maasim, the alignment passes through andesite/basalt and pyroclastics interspersed with reef limestone formations of the Oligocene-Miocene age along with marl, reworked tuff and terrace gravel of the Pliocene-Pleistocene age.

The remainder of the alignment passes through recent beach and river alluvium overlaying marl, reworked tuff and terrace gravel of the Pliocene-Pleistocene age; quartz diorite and related intrusive rocks of the Miocene age; andesite and pyroclastics interspersed with reef limestone of the Oligocene-Miocene age, and undifferentiated sediments and volcanic of the Cretaceous age.

3. SOILS

The soils developed from the piedmont slopes are moderately deep to deep and well-drained fine sandy loams. The soils associated with the alluvial deposits of the coastal region are moderately shallow to deep fine loams underlain by gravel.

4. SURFACE WATERS

This road is intersected by a number of watercourses flowing from the mountains to the west and north of the alignment.

The watersheds along this alignment encompass either single river system watersheds or a geographical unit of smaller watercourses. Key watersheds include the Siquil River with a run-off volume of 2.2×10^8 cubic meters; and the Silway-Klinan Rivers with a run-off volume of 1.9×10^8 cubic meters. In addition, the watershed area of Maitum-Kiamba includes a number of smaller rivers which have a combined run-off volume 3.9×10^6 cubic meters. The watershed area of Maasim includes a number of small rivers with a combined run-off volume of 3.5×10^6 cubic meters.

5. GROUNDWATER

Of those households serviced by existing water supplies, 90% utilize well or spring water sources. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April.

Rainfall distribution is generally influenced by elevation and aspect, the mountainous areas receiving the highest rainfalls. Provincial rainfall data indicates that the entire

alignment receives 1500 to 2000 mm of precipitation annually.

C. NATURAL RESOURCES

1. VEGETATION

a. Forests

The alignment passes through forest in the last 4 kilometers of its length. While this is not evident from the Land Cover Map (Figure 6-1), this forest would be classified as Dipterocarp Forest with less than 50% cover. This area is all within a Timber Licence area which means it will be logged eventually barring legislation by the Government of the Philippines for a total logging ban.

b. Mangroves

The road is adjacent to some mangrove areas between the Siquil River and Tampakan Point (Figure 6-1). While most of the mangroves are degraded, there is a restoration project being undertaken.

c. Agriculture

The portion of the road from Makar to Maasim traverses extensive grass and brushland, some of which is used as pasture. Land Cover Maps classify this as grassland covering over 70%. On the coastal fringe below the road, coconuts are cultivated. Cotton is cultivated from the Siquil River to a few kilometers before Maasim. From Maasim, the road passes through coconut plantations, at times intercropped with cotton, or bananas.

From Maasim to Kiamba, irrigated rice is the primary crop interspersed with coconut plantations. Finally, the road passes through coconut plantations and then forested areas as it approaches Malisbong.

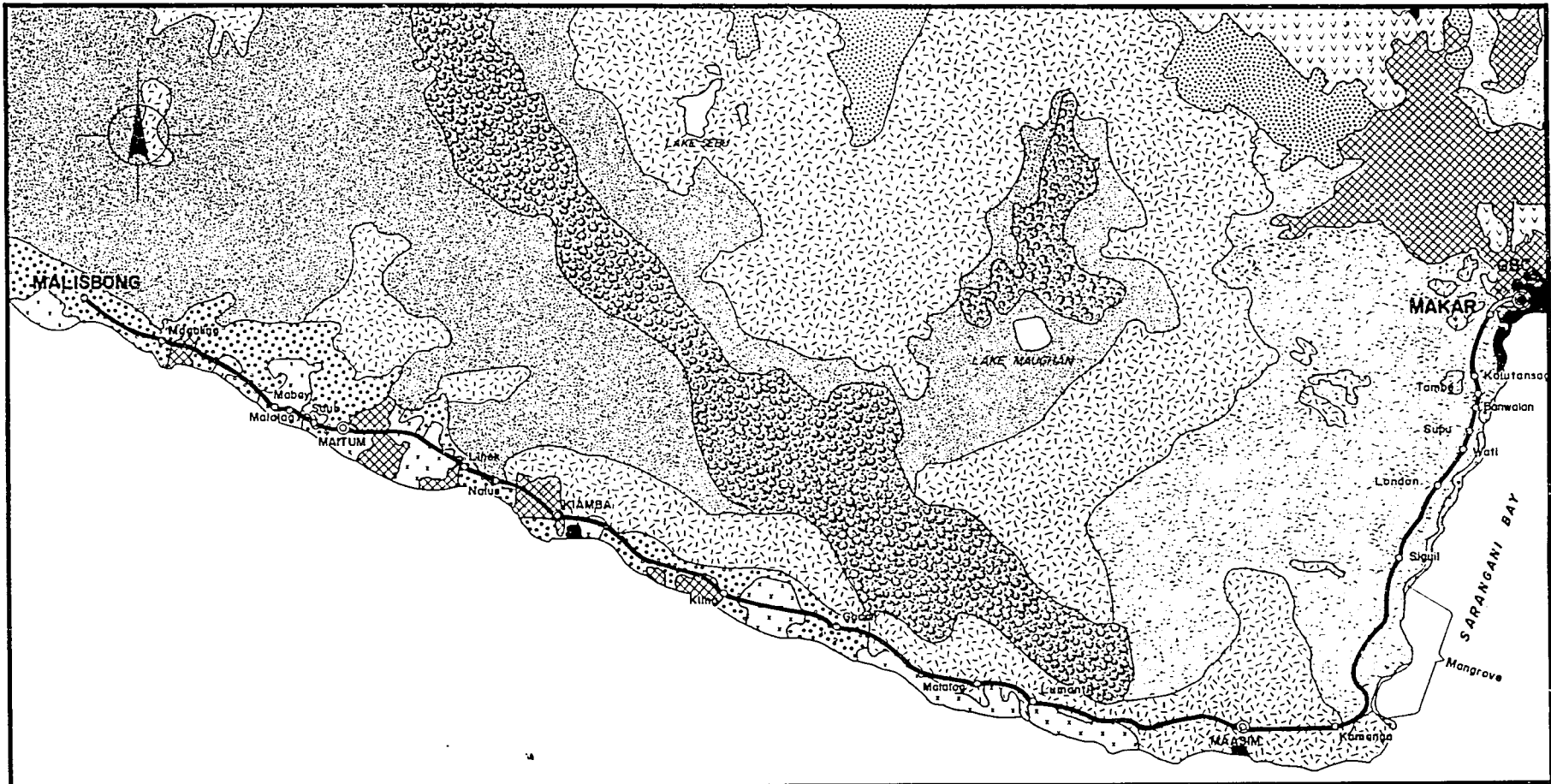
2. PROTECTED AREAS

There are no protected areas identified along this alignment.

3. WILDLIFE

Wildlife present within the alignment is well adapted to the presence of man since the area is extensively used by humans. As a result, species present along this sector such as doves, kingfishers and sparrows, are unlikely to be sensitive to construction activities or increased road traffic.

The only other wildlife observed along this sector was a Variable Malay Monitor (Varanus salvator) which is considered common throughout the Philippines but is listed under CITES (Convention on International Trade in Endangered Species),



LEGEND:

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|--|---|
| DIPTEROCARP FOREST, CLOSED CANOPY > 50% | COCONUT PLANTATIONS |
| DIPTEROCARP FOREST, CLOSED CANOPY < 50% | OTHER PLANTATIONS |
| CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND | ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
| GRASSLAND COVERING > 70% | CROPLAND MIXED W/ COCONUT PLANTATIONS |
| BUILT-UP AREA | CROPLAND MIXED W/ OTHER PLANTATIONS |

5 0 5 10
SCALE 1:250,000 Km.

SOURCE: PCGS 2331
National Mapping and
Resource Information
Authority, 1987

GSC / MAKAR - MALISBONG

FIGURE 6-1 LAND COVER MAP

Appendix II. Its habitat includes mangroves, cultivated areas and rainforests. Generally, undegraded tropical forest is the key habitat for rare and endangered species in the Philippines. The last portion of this alignment is the only section that closely traverses such habitat. Any further encroachment on the existing forests will have detrimental effects on those species unique to the habitat.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

Settlement patterns appear very stable in the immediate vicinity of the alignment with intensive agriculture being the predominant feature. The Land Cover Map (Figure 6-1) illustrates the specific types of land uses along this alignment. A major resettlement area is planned to the west of Makar port. Along the remainder of the Sector, the mountains to the north form a natural barrier to intensive settlement and cultivation. However, upland areas are often exploited by "kaingin" farmers.

From Makar to the Municipal border with Maasim, the lands in the immediate vicinity of the road are classified as Alienable and Disposable (A&D) by the Provincial office of the Department of Environment and Natural Resources (DENR). To the west of the road, the land is classified as Pasture land.

From the Municipal boundary between GSC and Maasim to the boundary between Maasim and Kiamba, a considerable amount of the land is classified as Timberland by DENR. Only a small portion, primarily on the coastal side of the road, is classified as A & D.

From the Municipal boundary between Maasim and Kiamba to the border between South Cotabato and Sultan Kudarat Provinces, the lands on either side of the road are classified as A & D. To the north of the road the land is Timberland, most of which is under timber licence.

2. INCOME AND EMPLOYMENT

South Cotabato province ranks 33 among the 74 Philippine provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represent a 6.5% total growth rate for the province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.

Average annual family incomes in Maasim and Kiamba for rural populations (P38,666 and P72,474 respectively) are well above provincial, regional and national average incomes. The average

annual family income in Kiamba is more than twice the national average of P32,521, reflecting the bustling commercial center and its productive agricultural sector. Average rural family incomes in Maitum (P28,248) are lower than the National, Regional and Provincial averages and may be a reflection of the relative isolation of this Municipality.

3. PUBLIC SERVICES

According to 1987 statistics, there are 19 schools, 1 doctor, 1 dentist, 5 midwives and 45 Barangay health units in the Maasim Municipality; 21 schools, 2 hospitals, 5 doctors, 2 dentists, 5 nurses, 8 midwives and 113 Barangay health workers in Kiamba Municipality; and 20 schools, 1 dentist, 1 doctor, 4 nurses, 3 midwives and 65 Barangay health workers in the Maitum Municipality.

Electricity in South Cotabato is supplied by an electric co-operative known as SOCOTECO I and II. SOCOTECO II has its headquarters in GSC and supplies electricity to Maasim, Kiamba and Maitum.

4. TRANSPORTATION

The movement of goods and services within the Sector is presently facilitated by the existing gravel road. There is also some movement of goods, particularly fisheries products, by boat from the fishing villages along the road.

The nearest commercial airport is in GSC. Regular jeepney service connects Maitum, Kiamba and Maasim with GSC, while tricycles ply shorter distances between and within settlements. There is also some jeepney service to barangay Maguling, however, past this point commercial traffic is not possible because of the condition of the road.

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas. (World Bank, 1989) Overall indications are that net migration is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

Because this Road Sector is coastal, it is assumed that settlements along this route are longstanding reflecting the desirability of settling along the coastal plain which provides the options of both fishing and agriculture as livelihoods.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along the Road Sector.

However, because this is a coastal location, the likelihood of archaeological sites is considered high. The types of artifacts expected would be trade items such as Chinese porcelain. (Personal Communications, Melchor Aquilera, National Museum, 1990).

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

According to the Office of Southern Cultural Communities (OSCC), there are significant populations of tribal people living in all three Municipalities. In Maasim, most are B'laan while in Kiamba and Maitum, most are T'boli. There are no Civil Reservations in the area for the protection of their ancestral or tenurial rights.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

The construction of this alignment may require mitigation measures to prevent soil erosion. The last 16 kilometers of the proposed road will contain segments which will require extensive realignment. The existing alignment cannot be upgraded to meet design standards due to extreme grades and curves. A new alignment is needed to complete final design. This would include a thorough investigation of soil stability in order to determine reinforcement measures to be incorporated for ensuring road cut stability.

Maintenance of soil erosion control structures after completion of the road construction should be required in order to ensure their continued effectiveness.

The nearest materials sources identified by the Department of Public Works and Highways (DPWH) for road construction are the Siquil, Kling, Datu Dani, Tambilil, Pangi, Saub, Kalaong and Luan Rivers. It is common practice to obtain borrow materials from riverbeds. However, contract specification should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provisions in the contract should be made for the contractor to notify provincial representatives of the Department of Environment and Natural Resources (DENR) when construction activities begin so that their representatives may monitor all activities, particularly the use of borrow sources and implementation of erosion control measures.

b. Hydrology

The preliminary design investigation has identified 386 pipe culverts and 70 box culverts on the existing alignment. Most of the culverts will be retained but some require cleaning, modification or replacement. There are a total of 29 existing bridges, six of which require replacement. Two of these six are scheduled for construction by DPWH. Construction of an additional three bridges will be necessary to complete the Sector. Hydraulic design capacity for pipe culverts is to the 10-year design flood, for box culverts to the 25 year design flood and for bridges to the 50-year design flood.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. The existing at-grade crossings that are present in frequently flooded areas will remain. However, provisions should be made in the contract for maintenance of these structures. Maintenance of drainage structures after completion of road construction should be required to ensure continued effectiveness.

c. Air Quality

Because this is a gravel road, air quality in its vicinity is affected by fugitive dust. Some additional fugitive dust may be generated during construction activities effecting residents of immediately adjacent Barangays. Mitigation measures should be used for those areas affected during construction. These include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract should be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes. Environmentally hazardous materials used during construction should be stored in designated areas, which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The contractor should be required to notify the provincial office of DENR regarding proposed locations of disposal and storage areas for hazardous materials.

2. NATURAL RESOURCES

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Those forests that are present near the alignment are already within Timber Licence areas. The road improvements may accelerate their exploitation by making hauling more expedient. There is some potential for increased in-migration. Given the limited, lowland areas available, forested areas to the north of the road may be threatened by new settlers and destructive "kaingin" practices.

Where construction will take place adjacent to the mangroves, measures to insure the maintenance and integrity of those areas should be incorporated into construction. If the road needs widening near mangrove areas, the centerline should be offset during final design so any widening will take place on the uphill portion of the alignment in order to prevent any infilling of the mangrove areas.

For most of the Sector, field observations confirmed that habitat requirements for rare and endangered species in the Philippines are not met along the alignment. Based on the lack of suitable habitat, rare or endangered species are not expected to be present along this alignment. Since the area is already utilized by humans, the wildlife has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

Forested areas, although already degraded to some extent, are the key areas of biological diversity in the Philippines. Given that these areas are already slated for logging, it will be impossible to attribute future negative effects to the road itself.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land use and Settlement Patterns

The settlement patterns along this Sector are governed by the limitations of geography, namely the restricted area of the coastal plain. Consequently, the densest settlements are confined to a narrow band along the coast where intensive agriculture and fishing are possible. This limits the potential for the area to absorb in-migration, therefore any new migrants an improved road might attract would move encroach onto the upland forest lands or into fishing communities. However, Sarangani Bay is now exploited to capacity. Agencies governing fishing activities should discourage any addition participation in the fishing industry.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The lowering of

transportation costs will effect the local economy by reducing commodity prices and significantly aid the economic development of the entire Sector by reducing transportation costs to better markets in GSC.

c. Public Services

During construction there will be increased demand for food and lodging by the labor force. Because of the distance from GSC, in order to avoid travel time during the construction, workers will be accommodated in the majors towns along the route. This may generate a temporary boom for these areas which will stabilize once construction is complete.

e. Displacement and Relocation

Where the alignment remains unchanged, displacement of individual dwellings will be minimal. Alignment changes may require some displacement of individual dwellings but this will not be determined until the final design.

f. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications should contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

g. Tribal Filipinos and Ancestral Lands

No major negative effects on Tribal Filipinos are expected as a result of the road. However, the benefits that would accrue to other residents along the Sector should also benefit Tribal Filipinos.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

No direct environmental impacts are likely if the proposed road improvements are not implemented.

2. SITING ALTERNATIVES

From Makar to Kalaong, few, if any, alignment changes are envisioned. However, beyond Kalaong some substantial alignment changes will be required. Specific alternatives are shown in Chapter IV (Engineering Design) of this Volume. No significant environmental effects are expected from possible alignment alternatives.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 4

POLOMOLOK - LANDAN

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed road improvements from Polomolok to Landan will occur, for the most part on an existing road alignment. This road which lies entirely within the Municipality of Polomolok, begins at the National Highway at Poblacion Polomolok and extends northeast to Polo and Landan for a total length of approximately 16 kilometers.

2. SCOPE

Currently, the existing road is the main access for the Dole Philippines (Dolefil) Plantation and Commerce Center and ultimately to Landan. The proposed improvements are designed to upgrade the existing gravel alignment to a two lane paved road throughout its length. The object of the project is to provide a better transportation route for the products and employees of Dolefil and plantation residents along the alignment. A further purpose of the project is to provide an all weather access road to Landan, which is currently isolated at times because of road conditions beyond the Dolefil plantation.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

This alignment slopes gently from the National Highway to Polo, extending through pineapple plantations, then continuing through steeply rolling topography where it descends steeply into watercourses and climbs steeply again into Barangay Landan over very rough roads.

2. GEOLOGY AND GEOMORPHOLOGY

The road lies entirely within the volcanic footslopes and piedmont deposits of Mount Matutum of the Pliocene-Quaternary Age. The geology of this area is volcanic ejecta consisting of lapelli and tuff breccia mixed with volcanic sand, ash and andesite boulders.

3. SOILS

The soils found on the lower volcanic footslopes of Mount Matutum are moderately deep to deep, well-drained fine sandy loams to sandy loams underlain by a stratified layer of thick volcanic ejecta.

4. SURFACE WATERS

The road alignment is located in the vast Silway-Klinan River watershed which encompasses General Santos City (GSC) and has a run off volume of 1.8×10^8 cubic meters. The watershed originates on the slopes of both Mount Matutum and Mount Parker and eventually flows southward into Sarangani Bay. The Silway and Klinan Rivers have mean annual discharges of 4.61 and 1.55 cubic meters/second respectively. (Bureau of Soils, DA. 1988)

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April. Provincial rainfall data indicates that the entire alignment receives 1500 mm to 2000 mm of precipitation annually.

C. NATURAL RESOURCES

1. VEGETATION

There are no forested areas along this alignment. The lands along this alignment are entirely agricultural, with the dominating feature being pineapple plantations with some corn and bananas. Closer to Landan, the topography becomes much more hilly and upland farming is undertaken with corn being the major crop with some upland rice and coffee.

2. PROTECTED AREAS

There are no protected areas identified along this alignment.

3. WILDLIFE

No unique habitat types or habitat for rare or endangered species were found along this alignment, nor were any observations made. Wildlife present within the alignment is well adapted to the presence of man since the area is intensively used by humans. As a result, species along this Sector are unlikely to be sensitive to construction activities or increased road traffic.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

The land throughout the alignment is classified as Alienable and Disposable by the Department of Environment and Natural Resources, Provincial Office, with the exception of the B'laan Civil Reservation in the vicinity of Landan. The entire alignment is situated in agricultural lands that are classified on Land Cover Maps as Intensive Land Use of plantations (pineapple) or croplands mixed with other plantations (Figure 6-1). Nearer to Landan, the land cover is classified as a cultivated area mixed with brush and grass. The major crops from Polomolok to Polo are pineapple with some corn and bananas, while in the area of Landan, the crops are mainly corn, with some upland rice and coffee.

2. INCOME AND EMPLOYMENT

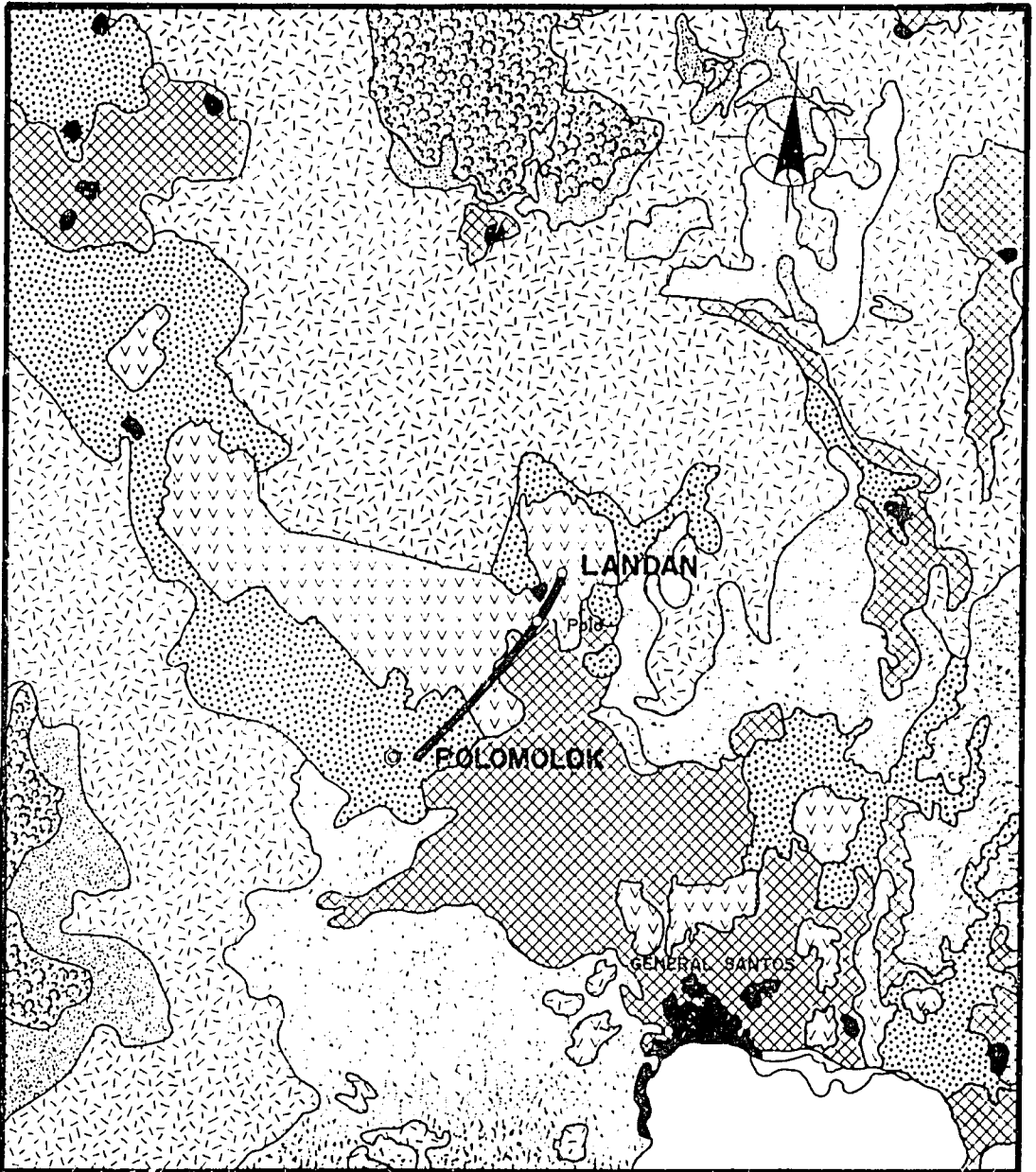
South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the Regional average of P30,061 and represent a 6.5% total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.

The economy of the Polomolok-Landan is dominated by the Dolefil Operations, either directly or indirectly. While Dolefil has only a small resident population, the presence of the company undoubtedly generates a considerable amount of support industries or businesses. Also, farmers near the road alignment may be contract growers for Dolefil. Most of Polomolok is also within the Zone of Influence of the National Highway. Landan, is much more isolated from this influence and as such has a depressed economy. Most of the residents in Landan are marginal upland farmers.

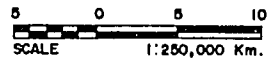
3. PUBLIC SERVICES











The Municipality of Polomolok has 13 schools, 3 hospitals, 1 doctor, 1 nurse, 1 dentist, 12 midwives, and 286 Barangay health workers. Poblacion Landan has one elementary school and no secondary school. Secondary school students generally commute to GSC, at a cost of approximately 10 pesos per day.

Electricity is supplied to users in the Province of South Cotabato by two electric cooperatives known as the South Cotabato Electric Cooperative or SOCOTECO I & II. SOCOTECO II supplies the Municipality of Polomolok.



LEGEND:



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|  DIPTEROCARP FOREST, CLOSED CANOPY > 50% |  COCONUT PLANTATIONS |
|  DIPTEROCARP FOREST, CLOSED CANOPY < 50% |  OTHER PLANTATIONS |
|  CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND |  ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
|  GRASSLAND COVERING > 70% |  CROPLAND MIXED W/ COCONUT PLANTATIONS |
|  BUILT-UP AREA |  CROPLAND MIXED W/ OTHER PLANTATIONS |

POLOMOLOK - LANDAN

SOURCE: PCGS 2551
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel road to the National Highway, which is subject to flooding particularly near Landan.

The nearest commercial airport is in GSC. Regular jeepney and bus service is available along the National Highway and between Polomolok and Polo.

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas. (World Bank, 1989) Overall indications are that net migration is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

Historically, the original inhabitants of this area were the B'laan tribal peoples. In 1961, the B'laan that occupied what is now the Dolefil plantation were moved to the vicinity of Landan and a Civil Reservation was created.

Now the stability of the major portion of the area is very much a function of the continued presence of the Dolefil operations whereas the stability of Landan is based on their historical and cultural traditions.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along the Road Sector.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

There are over 10,000 B'laan tribal peoples in the Municipality of Polomolok, 4,100 of which reside in Landan. The overall trend in this area is that some tribal people have been absorbed and integrated into the lowland communities while a number were moved into the upland areas, and have created a stable community within the B'laan Civil Reservation which also includes non-B'laan people.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

The topography in this Sector is gently sloping throughout

except for the section between Polo and Landan which has rolling and steep topography. The soils in this area are relatively erodible, particularly when flooding occurs as is evident by a number of severely scoured watercourses along this alignment.

Three materials sources have been identified by the Department of Public Works and Highways (DPWH) including the Polomolok Dry Creek Quarry, Silway 8 River Quarry and Matinao River Bridge Quarry. It is common practice to obtain borrow materials from riverbeds, however, contract specifications should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provisions in the contract should be made for the contractor to notify Provincial representatives of the Department of Environment and Natural Resources (DENR) when construction activities begin so that their representatives may monitor activities, particularly the use of borrow sources and implementation of erosion control measures.

b. Hydrology

The road alignment has one existing bridge which was recently reconstructed and included slope and stream bank upgrading, stabilization, and protection works. Hydraulic design capacity for the bridge is to the 50 year design flood.

The existing alignment has many at-grade crossings which should be replaced with box culverts. Box culverts are designed to the 25 year design flood. The road improvement will include the extension of existing pipe culverts and addition of a number of pipe culverts, the total number will be determined during final design stages. Pipe culverts are designed to the 10-year design flood.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. However, provisions will be made in the contract for maintenance of these structures.

c. Air Quality

Because this is a gravel road, air quality in the vicinity of the road is affected by fugitive dust. Some additional fugitive dust will be generated during construction activities affecting Barangay residents and commercial enterprises immediately adjacent to construction areas. Mitigation measures may be used for those areas affected during construction. These include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract will be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes. Environmentally hazardous materials used during construction should be stored in designated area, which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The contractor will be required to notify the Provincial office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. NATURAL RESOURCES

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Field observation confirmed that habitat requirements for rare and endangered species in the Philippines are not met along the alignment. Based on the lack of suitable habitat, rare or endangered species are not expected to be present along this alignment. Since the area is already utilized by humans, the wildlife has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land use and Settlement Patterns

Based on the stability of the existing settlements along the alignment, no effects on land use or settlement patterns is expected.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The lowering of transportation costs will affect the residents along the alignment between Polomolok and Polo minimally as their only concern would be personal transportation while it could have a more significant effect on the residents of Landan by making commodities more available and transportation of goods cheaper and more reliable.

c. Public Services

During construction there may be increased demand for food and lodging by the labor force. Given that the road is

relatively short, this could be accommodated by Polomolok and would not be expected to strain existing public services.

d. Displacement and Relocation

As the road improvements are to take place within an existing alignment, no displacement of individual dwellings is expected.

e. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

f. Tribal Filipinos and Ancestral Lands

The B'laan people of Landan would benefit from the proposed road improvements both through decreased transportation costs and an increase in access to goods and services. However, the development benefits that could be gained from the road improvement could only be realized with ancillary programs to help the local farmers diversify their agricultural activity.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

Without the proposed road improvements, it is expected that the road will eventually be upgraded from Polomolok to Polo by Dolefil, however, the road from Polo to Landan would continue to degenerate as a result of continued flooding, thereby ensuring the continued isolation of the community in Landan.

2. SITING ALTERNATIVES

The project consists of rehabilitation of an existing alignment for most of its length.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 5

SURALLAH/LAMSUGOD - TUPI

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed Surallah/Lamsugod-Tupi road follows the existing unpaved alignment and extends eastward to Lampari, from a T-junction at Lamsugod. From Lampari, it passes through the Roxas Range to Kalkam and finally to Tupi. The road traverses portions of the Municipalities of Surallah, Banga, and Tupi.

2. SCOPE

This proposed road improvement project is designed to upgrade the two-lane gravel road from Lamsugod to Lampari into a two-lane all weather paved road and extend it to include the existing track through the Roxas Range from Lampari to Kalkam, and onward to Tupi. Currently, the road from Lampari to Kalkam is impassable to vehicles and portions of the existing road become impassable during rainy periods and limit the transportation in the Sector.

The proposed improvements will increase access to better markets, including General Santos City as well as significantly reduce travelling time and cost of passenger and cargo transportation.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

The first Section of the road from Lamsugod to Lampari passes through flat to gently rolling terrain. From the Lampari it climbs steeply into the Roxas Range, reaching an elevation of 600 meters. From there it descends to the eastern foothills of the Roxas Range and through more flat to gently rolling terrain into Tupi.

2. GEOLOGY AND GEOMORPHOLOGY

The Section of the alignment within the Allah River Valley from Lamsugod to Lampari is comprised of sedimentary rock overlain by recent alluvial deposits. The predominant formation is the Banga Formation, formed of marine clastics consisting of tuffaceous sandstone, siltstone and shale, occasionally interbedded with micro and macro conglomerate, and reef limestone lenses intercalated within the formation.

The remaining Sections of the alignment are within the Roxas Range. These formations originate from volcanic agglomerates, andesites, tuff, breccia, ultra basics and pyroclastics.

3. SOILS

The soils within the first Section of the alignment are dominated by clayey, sandy, silts known as sandy loams. These soils are deep and highly erodible.

The soils characterized by the volcanic hills in the middle Section of the alignment are shallow to moderately shallow, coarse to fine loamy soils with moderate erodibility. Soils of the final Section are known as Tupi fine sandy loams and have high erodibility.

4. SURFACE WATERS

The alignment originates in the upper reaches of the northward flowing Banga River. These drainages have been classified as having potential for severe flash flooding (Bureau of Soils, 1988). Through the upper elevation of the Roxas Range, surface water is limited to seasonal streamcourses, due to the devegetation of the slopes. On the eastern side of the range toward Tupi, the alignment traverses the Palian River, another drainage subject to flash flooding due to watershed degradation. The watersheds on both the eastern and western slopes of the Roxas Range have been identified by DENR as watershed restoration areas.

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April.

Rainfall distribution is generally influenced by elevation and aspect, the mountainous areas receiving the highest rainfalls. However, Provincial rainfall data indicates that the entire alignment receives 1500 to 2000 mm of precipitation annually.

C. NATURAL RESOURCES

1. VEGETATION

No undegraded forests remain within this alignment. The first portion of the alignment traverses an area that has been

classified on Land Cover Maps as an area of Intensive Land Use comprised of cropland mixed with other plantations (Figure 6-1). Major crops cultivated are corn and irrigated lowland rice. Interspersed with these are mixed fruit trees and coconuts.

The central portion of the alignment through the Roxas Range from Lampari to Kalkam is classified on Land Cover Maps as an area of extensive land use for cultivation mixed with brush and grass. The hillsides are under mixed cultivation, dominated by corn, with some fruit trees. Some evidence of "slash and burn" agriculture as well as areas of cogon grass are visible.

2. PROTECTED AREAS

There are no protected areas identified along this alignment. However, DENR has proposed the upper reaches of the Banga watershed, and the Poliar watershed on the eastern and western slopes Roxas Range as Watershed Restoration Projects, which will entail some reforestation in the next five years. (Personal Communication, Manipon, 1990)

3. WILDLIFE

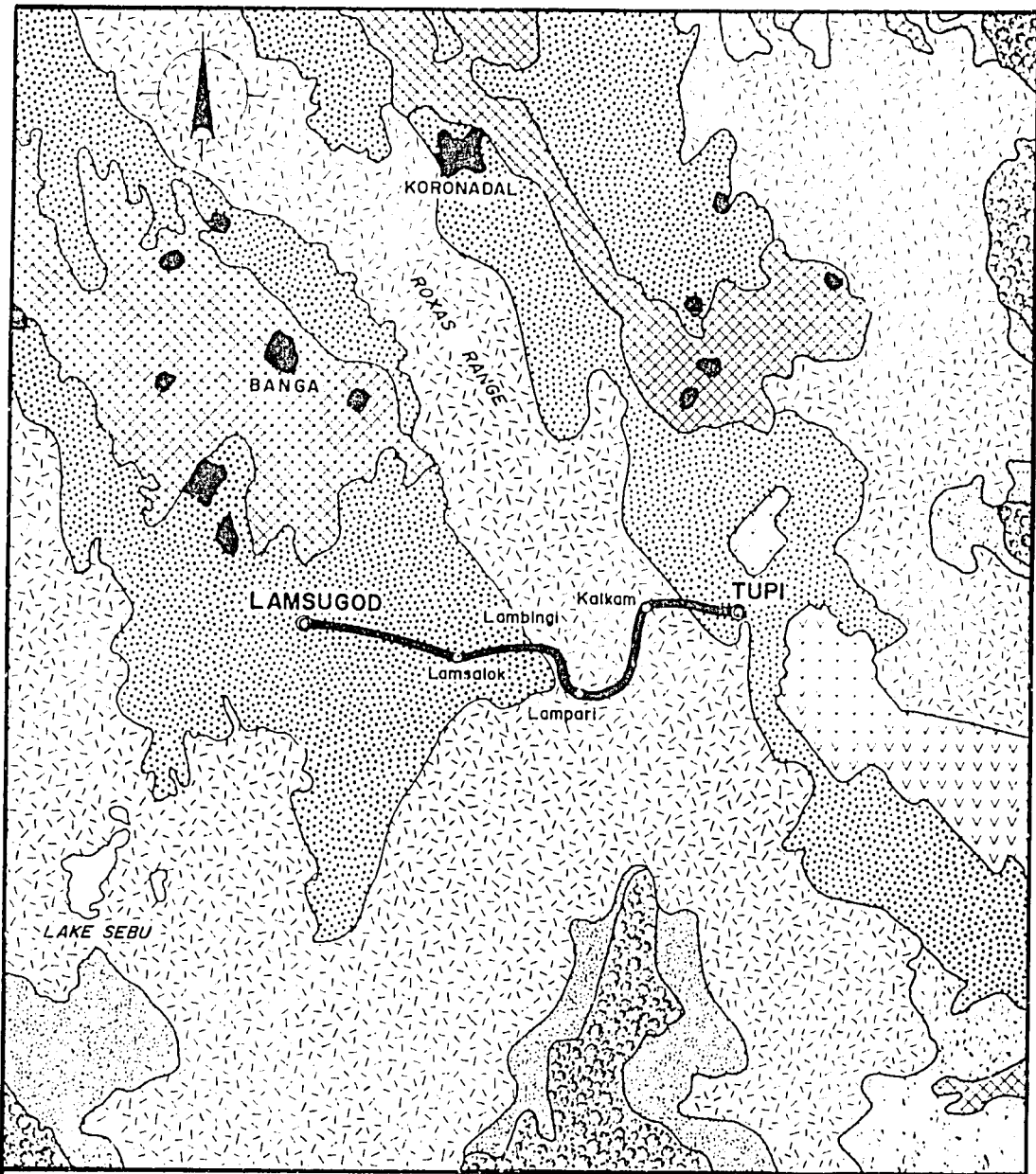
Wildlife present within the alignment is well adapted to the presence of man since the area is extensively used by humans. As a result, species present along this Sector are unlikely to be sensitive to construction activities or increased road traffic. No known habitats of rare, threatened or endangered species in the Philippines exist within the alignment nor were any observed during field visits.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

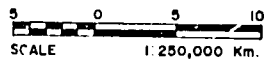
Major land use along the proposed alignment of the Surallah/Lamsugod-Tupi road is agricultural. The proposed alignment follows the route of the Surallah-T'Boli road to the Barangay of Lamsugod. This area is cultivated with rice in the vicinity of Surallah and is then dominated by intensive corn cultivation interspersed with upland rice and small stands of fruit trees as Barangay Lamsugod is approached. The road from Lamsugod eastward for 13 kilometers to Lampari at the western foothills of the Roxas Range is situated in a relatively flat valley with some rolling terrain. The land is intensively cultivated with corn and occasional stands of fruit trees. Land cover maps designate this area as intensive cropland mixed with other plantations.

The existing unpaved road ends at Barangay Lampari. The existing alignment through the Roxas Range consists of a steep and winding track which begin just before Barangay Lampari and extends to Kalkam. The area from Lampari to Kalkam is classified in land cover maps as extensively used crop land mixed with brush and grass. The Roxas Range on either side of the alignment is



LEGEND

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|--|--|--|---|
| | DIPTEROCARP FOREST, CLOSED CANOPY > 50% | | COCONUT PLANTATIONS |
| | DIPTEROCARP FOREST, CLOSED CANOPY < 50% | | OTHER PLANTATIONS |
| | CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND | | ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
| | GRASSLAND COVERING > 70% | | CROPLAND MIXED W/ COCONUT PLANTATIONS |
| | BUILT-UP AREA | | CROPLAND MIXED W/ OTHER PLANTATIONS |



SURALLAH / LAMSUGOD - TUPI

SOURCE: PCGS 2551
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

classified a pasture land by the Department of Environment and Natural Resources (DENR). Viewed from the western foothills of the Roxas Range, the higher elevations appear to be under mixed cultivation dominated by corn. Cogon grass is visible in some areas and there is evidence of slash and burn practices at some locations.

From Kalkam to Tupi the road widens slightly and is seasonally passable to vehicles. This portion passes through several "barrios" near the road. The area has coconut plantations intercropped with corn. Some coffee and other fruits trees are also cultivated in this area. Land cover maps classify this area as intensively cultivated crop land mixed with plantations.

According to the South Cotabato Foundation (SCF), the upland inhabitants of this Sector are participating in Integrated Social Forestry (ISF) and Sloping Agricultural Land Technology (SALT) projects. There are reportedly no forests remaining in the area except remnants along water courses. The western slopes of the Roxas Range have been identified by DENR as a watershed restoration area, reforestation will potentially be initiated within the next four years.

2. INCOME AND EMPLOYMENT

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office -NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represent a 6.5% total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.

The economy of the Surallah-Tupi road is almost entirely agricultural. Both rural and urban family incomes of the Surallah Municipality of P42,862 and P52,960 respectively, are higher than the Regional, Provincial and National Averages. This reflects the highly successful agricultural Sector that is present in this valley.

On the other hand the average annual rural family income in Tupi is P25,085, well below the Provincial, Regional and National averages.

3. PUBLIC SERVICES

There are 22 schools, 1 doctor, 3 nurses, 1 dentist, 11 midwives and 13 Barangay health units in the Surallah Municipality. There are 30 schools, 1 dentist, 2 nurses, 15 midwives and 318 Barangay health workers in the Banga Municipality. There are 26 schools, 1 dentist, 1 doctor, 2

nurses, 7 midwives and 168 Barangay health workers in the Tupi Municipality.

Of the 17 Barangays of Surallah, 13 are serviced with electricity, including Lamsugod and Lamian. Of the 22 Barangay in Banga, 18 are serviced with electricity including Lampari. The Municipality of Tupi is serviced by South Cotabato Electric Cooperative (SOCOTECH II).

4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel road from Lamsugod to Lampari and from Tupi to Kalkam. However, the road from Lampari to Kalkam is impassable to vehicular traffic.

The nearest commercial airport is in General Santos City. Regular jeepney service connects Lampari with Surallah, and regular bus and jeepney service connects Surallah with the rest of the major centers in the Province, Surallah being on the National Highway. From Kalkam to Tupi, transportation is irregular and unreliable.

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas. (World Bank, 1989) Overall indications are that net migration is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

The first portion of this alignment, from Lamsugod to Lampari appears to support a stable population as indicated by the productive agricultural Sector and ancillary services relating to the agricultural Sector such as solar driers and corn mills. The portion of the alignment through the Roxas Range also has a longstanding population as indicated by the existence of Integrated Social Forestry (ISF) projects which require that participants occupy the land used for ISF projects prior to 1981. However, because most of this land is public domain, an improved road could result in some minimal in-migration.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along the Road Sector.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

Tribal Filipinos in the vicinity of this alignment are found in the communities of Kablon, Linan, Lunen and Kalkam. While Kalkam, with a B'laan population of 2,500 is the only Barangay on the proposed alignment the other three communities comprising a population of 4,800 B'laan peoples could potentially be

affected by the road improvement.

Many of the upland tribal communities within the Roxas Range are organized into farmers associations assisted by the South Cotabato and Maguindanao Foundations. Some Integrated Social Forestry Projects are also underway in this area. The chief criteria for participating in this program is to have occupied the land prior to 1981. The participant are issued Certificate of Stewardship which entitles them to the use of the land for 25 years. Upon expiration the certificate may be reissued for consecutive 25 year period. The farmers are required to cultivate the land with a specific mix of forest trees, fruits trees and crops. The Certificate does not, however, give title to the land and therefore, precludes its sale.

Many residents of Kalkam including the B'laan, have titles to their land and others have had surveys and land assessment competed in anticipation of DENR declaring the lands in the area Alienable and Disposable.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This Section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

The construction of this alignment may require mitigation measures as it passes through highly erodible soils throughout most of its length and is complicated by steep denuded slopes through the central portion. Although the first Section of the alignment has a relatively flat grade, erosion problems are evident on either side of the road. Cross drainage structures and proper spacing of furrow ditches to direct drainage away from the roadway should be included in the construction specifications in order to mitigate localized erosion.

The central Section of proposed route, from Lampari to Kalkam, will entail major new realignment as the existing road cannot be upgraded according to standards due to extreme grades and curves. This, coupled with the erodibility of the soils, will require that mitigation measures, most probably gabions, be included to stabilize road cuts.

The final Section of the road, from Kalkam to Tupi, extends through areas susceptible to flash floods, and will require extensive drainage and slope protection structures to prevent erosion of the road itself. Provisions for mitigating soil erosion should be included in the final design for the road.

Materials sources identified by the Department of Public Works and Highways (DPWH). It is common practice to obtain borrow materials from riverbeds. However, contract specification

should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provincial representatives of the Department of Environment and Natural Resources (DENR) should be notified when construction activities begin so that their representatives may monitor all activities, particularly borrow sources and implementation of erosion control measures.

Maintenance of soil erosion control structures after completion of road construction will be required in order to ensure their continued effectiveness.

b. Hydrology

The Section from Lamsugod to Lampari will include the 11 pipe culverts, 1 box culvert and 4 bridges most of which will require extensions, replacements or repairs. Hydraulic design capacity for pipe culverts is to the 10-year design flood, for box culverts to the 25-year design flood and for bridges the 50-year design flood. The remaining Sections from Lampari to Tupi require realignment. Until a new alignment is determined, no estimates of drainage structure requirements is available.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. The inclusion of cross drainage structures may improve existing drainage. Maintenance of drainage structures after completion of road construction will be required to ensure continued effectiveness.

c. Air Quality

Because this is a gravel road, air quality in the vicinity of the road is affected by fugitive dust. Some additional fugitive dust will be generated during construction activities affecting residents of Barangays immediately adjacent to construction areas. Mitigation measures may be used for those areas affected during construction. These include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract will be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes.

Environmentally hazardous materials used during construction should be stored in designated area, which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The contractor will be required to notify the Provincial Office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. NATURAL RESOURCES

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Impacts to biological resources along the alignment are expected to be minimal as the area is already cultivated or used for pasture.

Field observation confirmed that habitat requirements for rare and endangered species in the Philippines are not met along the alignment. Based on the lack of suitable habitat, rare or endangered species are not expected to be present along this alignment. Since the area is already utilized by humans, the wildlife has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land use and Settlement Patterns

The proposed upgrading of the road segment between Surallah and Lampari should have little effect on the general land use pattern along the route as it is already being utilized to its maximum capacity. No significant changes in agricultural practices, land settlement, or land ownership is expected within the roads immediate zone of influence. The segment between Lampari and Tupi however could experience significant positive impacts. The specific communities which would be impacted in the Roxas Range region should be studied further when the final alignment of the road is decided upon as the existing alignment of the unimproved road renders construction technically and economically undesirable. Alternative alignments utilizing a more direct southern route through the Roxas Range are being investigated at this time. Any engineered, motorable road in this area would significantly improve the lot of its inhabitants as it would bring them out of isolation, give them access to new markets, and markedly reduce transportation costs for a region stretching from Surallah to General Santos. Some resettlement should be expected within the immediate vicinity of the improved road by area inhabitants desiring increased access and by roadside vendors. There should not be significant in-migration of population as land is marginal and limited, the road however would be used as a direct access from the Allah Valley region to GSC.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The lowering of transportation costs will effect the local economy by reducing commodity prices and will also significantly aid the economic development of the entire Allah Valley region by reducing transportation miles to better markets in GSC.

c. Public Services

During construction there will be increased demand for food and lodging by the labor force. Given the limited services in Lamsugod and Lampari, most of this demand will have to be accommodated by Surallah, for the construction of the western portion of the road and Tupi for the construction of the eastern portion of the road.

e. Displacement and Relocation

In the first Section of the road, from Lamsugod to Lampari, the road improvements are unlikely to result in significant changes in the settlement pattern of the area since it is already intensively utilized by the agricultural Sector. The same can be said for the Section from Kalkam to Tupi. Given that a new alignment would be required for the Section from Lampari to Kalkam, no assessment can be made at this time regarding potential displacements.

For Sections of the alignment that would remain unchanged, displacement of individual dwellings will be minimal.

f. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain Sections of Republic Act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the Director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum

of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

g. Tribal Filipinos and Ancestral Lands

The upgrading of the road from Lamsugod to Tupi would benefit the tribal people found in the Roxas Range, who are exclusively farmers, by allowing greater access to markets, and over all cheaper transportation cost.

The upland farmers are vulnerable to immigration as the land on which they are farming is within the public domain. Other than those individuals with ISF Certificates, tribal farmers have no security of tenure. Those people in Kalkam who have undertaken to survey and assess their lands are in a more secure position regarding potential encroachment by new settlers. However, the active involvement of knowledgeable Non-Government Organizations (NGOs) may mitigate any potential vulnerability.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

No direct environmental impacts are likely if the proposed road improvements are not implemented.

2. SITING ALTERNATIVES

The Project consists of upgrading the existing Road Sector from Lamsugod to Lampari. The existing alignment between Lampari and Tupi is to be studied for revision as the current route cannot be upgraded according to standards.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 6

SURALLAH - LAKE SEBU

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed Surallah-Lake Sebu road alignment follows the existing unpaved road and extends southward from a junction approximately 2 kilometers northwest of Surallah for 26 kilometers to Lake Sebu. The existing gravel road is currently the only access from the area to the Provincial road network.

2. SCOPE

This road improvement project is designed to upgrade the existing two-lane gravel road to an all weather paved road. Currently, portions of the existing road become impassable during rainy periods and limit the transportation of goods in and out of the area. The proposed improvements will ensure access to better markets and reduce cost of passenger and cargo transportation.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

The first four kilometers of this Sector passes through flat terrain. From the Allah Valley irrigation diversion structure it climbs slightly, passing through flat to gently rolling terrain. In the four kilometers preceding Lake Lahit, the road climbs steeply and the elevation rises from 275 meters MSL to 725 meters MSL. From Lake Lahit to the town of Lake Sebu the road is gently rolling, overlooking the two lakes.

2. GEOLOGY AND GEOMORPHOLOGY

The northern portion of the road, situated in the Allah River valley, is comprised of sedimentary rock overlain by alluvial deposits. The predominant geology is the Banga Formation, formed of marine clastics consisting of tufaceous sandstone, siltstone and shale, occasionally interbedded with micro and macro conglomerate reef limestone lenses intercalated within the formation.

As the road continues south toward Lake Sebu, areas of shale and sandstone outcropping occurs. This formation is intercalated with loosely consolidated conglomerates.

3. SOILS

The soils within the northern Section of the alignment are dominated by clayey, sandy, silts known as sandy loams. In the southern portion of the alignment and from the point where the

grade line rises, undifferentiated mountain soils are found characterized by silty gravel and poorly graded gravel.

4. SURFACE WATERS

The road alignment is situated within the valley of a minor tributary of the Allah River. The watershed has been designated a "watershed reserve" by the Department of Environment and Natural Resources (DENR), as a conservation measure, and in order to maintain the integrity of the irrigation structures downstream in the Allah Valley. While most of the east facing slopes above the Allah River have been denuded and are used for mixed cultivation, the upper slopes above Lake Sebu are still forested, thereby preserving some of the watershed's integrity.

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause higher rainfalls. This weakens between late February and late March while rainfall intensities increase during the month of April.

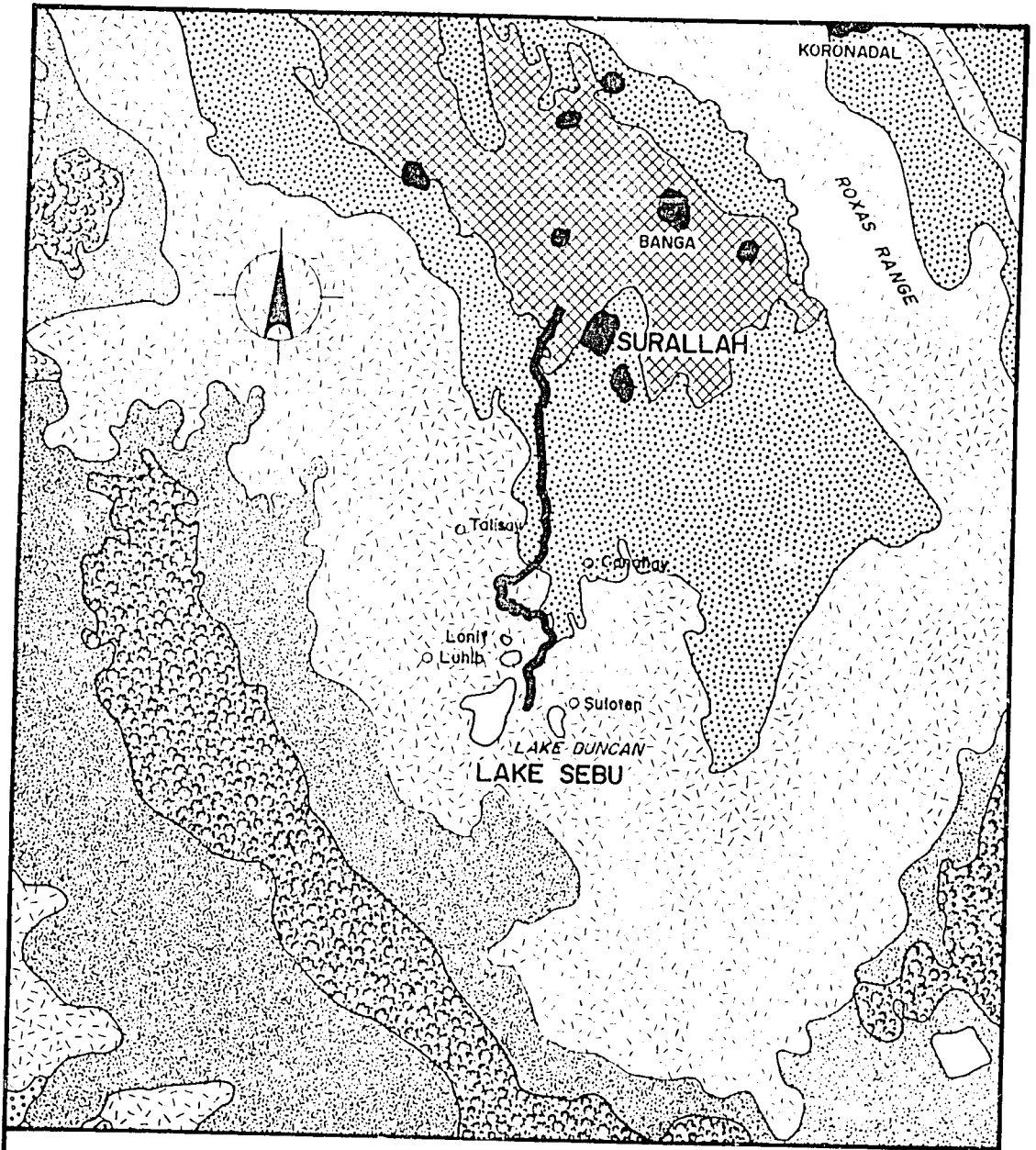
Rainfall distribution is influenced by elevation and aspect, the mountainous areas receiving the highest rainfalls. In the northern portion of the alignment Provincial rainfall data indicates that the average annual rainfall is between 1500 - 2000 mm while the southern half has average annual rainfalls of 2000 - 2500 mm.

C. NATURAL RESOURCES











1. VEGETATION

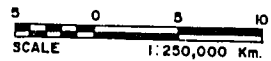
No undisturbed forest cover remains within the road alignment. The northern portion of the alignment traverses an area that has been classified as an area of intensive land use comprised of cropland mixed with other plantations (Figure 6-1). Major crops cultivated in the areas include corn and irrigated lowland rice. Interspersed with these are mixed fruit and coconut trees.

Beyond the Allah Valley irrigation diversion structure, the land is classified as extensively used cultivated area mixed with brush and grass. Major crops cultivated are corn and rice interspersed with fruit trees. As the sloped increase, some



LEGEND :

- | | |
|--|---|
|  DIPTEROCARP FOREST, CLOSED CANOPY > 50% |  COCONUT PLANTATIONS |
|  DIPTEROCARP FOREST, CLOSED CANOPY < 50% |  OTHER PLANTATIONS |
|  CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND |  ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
|  GRASSLAND COVERING > 70% |  CROPLAND MIXED W/ COCONUT PLANTATIONS |
|  BUILT-UP AREA |  CROPLAND MIXED W/ OTHER PLANTATIONS |



SURALLAH - LAKE SEBU

SOURCE: PCGS 2551
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

terracing is evident. Some stands of bamboo are found along the road. The residents of the area make extensive use of these for construction of housing and fish pens.

The mountains to the south and within view of Lake Sebu are forested, the lower slopes with Dipterocarp forest having a closed canopy of less than 50% while the uppermost slopes are forested with Dipterocarp forest having a closed canopy of greater than 50%.

2. PROTECTED AREAS

The Lake Sebu watershed has been designated a "watershed reserve" by DENR. This designation was instituted to preserve the watershed as a part of the Allah Valley irrigation project in order to ensure the continued effectiveness of the irrigation structures which were funded by the Asian Development Bank (ADB) (Personal Communication, Manipon 1990). The "watershed reserve" designation included a reforestation program resulting in replanting 10,500 hectares of forest lands from 1979 to 1989.

Lake Sebu is designated a wetland in the Directory of Asian Wetlands. While no conservation measures have been undertaken as a result of this designation, the Haribon Foundation has proposed that fish sanctuaries be established within Lake Sebu to protect the spawning grounds of both indigenous and introduced species.

In addition, Lake Sebu was included on a list of Candidate Sites for protected Area Status recommended by DENR-Haribon Society at a workshop on Integrated Protected Areas System for the Philippines and included in Philippines: Environment and Natural Resource Management Study (World Bank 1989). However, subsequent revisions of Proposals for Integrated Protected Areas System do not include Lake Sebu.

3. WILDLIFE

Wildlife present within the alignment is well adapted to the presence of man since the area is extensively used by humans. As a result, species present along this Sector are unlikely to be sensitive to construction activities or increased road traffic. No known habitats of rare, threatened or endangered species in the Philippines exist within the alignment nor were any such species observed during field visits.

The forested areas beyond Lake Sebu, by inference, can be considered habitat for some of the Philippines rare and endangered species as there is a tendency for the most fauna in the Philippines to be found within the middle to high altitudes in forest environments (World Bank 1989). Also, the old growth and residual Dipterocarp forests are considered to support the greatest degree of biodiversity of both flora and fauna.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

Major land use along the proposed alignment of the Surallah-Lake Sebu road is agricultural. The proposed alignment approximately follows the existing unpaved road which is the only artery between Lake Sebu and the Provincial road network.

The first segment of road, extending south from the concrete highway north of Surallah Municipality to the Allah Valley irrigation diversion structure, passes through flat topography which is intensively cultivated with rice and corn. The fields in this area are interspersed with fruit and coconut trees. South of the Allah Valley diversion structure, the road climbs slightly onto a flat to moderately sloping plateau. This area is also intensively cultivated with corn and rice, interspersed with fruit trees. Some terracing is evident in steeper areas.

At approximately the mid point between Surallah and Lake Sebu, the road and the surrounding terrain climb steeply. The land is terraced and cultivated, and corn is cultivated on the steep slopes above the road alignment. The road in this Sector is bordered by stands of large diameter bamboo. Isolated stands of bamboo are also visible in the general area. The final segment of road which overlooks Lake Lahit and Lake Sebu is within what has been turned the T'Boli tribal domain, but has no legal status. Several clusters of homes are visible by the road side in this area.

2. INCOME AND EMPLOYMENT

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represents a 6.5% total growth rate for the Province between the years 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional and expenditure survey to be performed by NCSO.

The economy of the Surallah-Lake Sebu road zone of influence has principally been and remains agricultural. The average annual family income of this Road Sector is P30,539 for rural families. Rural income is below the national average and only slightly above the Provincial median. This is a reflection of the marginal land in the Lake Sebu area and the high cost of commodity transport to and from the region.

3. PUBLIC SERVICES

There are 20 schools, 1 nurse, 4 midwives and 182 Barangay health workers in the Lake Sebu Municipality. There are 22

schools, 1 doctor, 3 nurses, 1 dentist, 11 midwives and 13 Barangay health units in the Surallah Municipality.

Electricity is supplied by an electric co-operative known as the South Cotabato Electric Co-operative or SOCOTECO I AND II. Both Surallah and Lake Sebu are service by SOCOTECO I. Of the 18 Barangays in Lake Sebu, 3 are serviced with electricity while of the 17 Barangays of Surallah, 13 are serviced with electricity.

4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel road. The nearest commercial airport is in General Santos City (GSC). Regular jeepney service connects Lake Sebu with Surallah, and regular bus and jeepney service connects Surallah with the rest of the major centers in the Province, Surallah being on the National Highway.

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant in migration, most probably from the more densely populated areas of the Central and Western Visayas. From 1975 to 1980 Region XI experienced the second highest net in-migration in the Philippines, of which two thirds were from outside the region (World Bank, 1989). Overall indications in the Philippines are that net migrations is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

Anecdotal information indicates that Lake Sebu has a considerable influx of people after the existing road was built and this influx did force some of the T'Boli peoples in the are to hillside.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sties of this nature along the road alignment.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

The Municipality of Lake Sebu is home to a major population of T'boli tribal people. Among a total population of 40,422, the Office of Southern Cultural Communities estimates that there are 30,782 native T'boli or 76% of the total population. In a joint study involving 10 of the 17 Barangay in Lake Sebu, the Office of Special Concerns of the Department of Agriculture (OS-DA) and the Government of the Netherlands found that while the T'boli comprise the majority of the population, non-T'boli control 80% of the land.

There is no civil reservation for T'boli in the Municipality. The Tasaday Manobo Special Forest Reserve is the only designated tribal area in the Municipality and its eastern border is 11 kilometers from Lake Sebu. Most of the T'boli people in the Municipality of Lake Sebu live below the poverty line. This is attributed to insecure access to land and encroachment by immigrants on tribal lands; low farm prices and expensive credit; weak or non-existent training and extension program; unsustainable upland farming and lake resources management; weak internal organizational structures in T'boli communities for agricultural and economic development; weak institutional co-ordination and, a complex situation of cultural and political conflicts between different interest groups (OSC-DA/Netherlands, 1990).

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This Section addresses the potential impacts of the proposed road on physical, biological, and cultural resources and provides recommendations for mitigation measures where appropriate.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

The northern portion of the alignment, to the Allah Valley irrigation diversion structure, while on erodible soils, is on flat terrain resulting in minor visible erosion. The same can be said for areas on the gently rolling terrain past the diversion structure. Once the alignment begins to gain elevation, the grade of the alignment and the slopes on which the road is built present some erosion control challenges. Also, the portion of the road from Lake Lahit to Lake Sebu may require stabilization to prevent siltation in Lake Sebu and protect housing on the downslope side of the alignment. Mitigative measures such as gabions, dry land rubble, masonry, and mortared rip-rap should be employed to stabilize the slopes on either side of the road. Specific provisions should be included in the detailed design specifications.

Materials sources have been identified by the Department of Public Works and Highways (DPWH). It is common practice to obtain borrow materials from riverbeds. However, contract specifications should include mitigation measures such as coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provincial representatives of the Department of Environment and Natural Resources (DENR) should be notified when construction activities begin so that their representatives may monitor all activities, particularly for borrow sources and erosion control measures.

Maintenance of soil erosion control structures after completion of road construction should be required in order to ensure their continued effectiveness.

b. Hydrology

Upgrading this Sector will include the construction or improvement of 36 pipe culverts, 2 box culverts and 5 bridges. Hydraulic design capacity is to the 10-year design flood for pipe culverts, to the 25-year design flood for box culverts, and to the 50-year design flood for bridges.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. The inclusion of cross drainage structures may improve existing drainage. Maintenance of drainage structures after completion of road construction should be required to ensure continued effectiveness.

c. Air Quality

Because this is a gravel road, air quality in the area along the road is affected by fugitive dust. Some additional fugitive dust may be generated during construction activities and residents of Barangays immediately adjacent to construction areas will be effected. Mitigation measures may be used for those areas effected during construction. These include: covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract, should be required to develop and implement a management plan for the duration of construction activities that ensures safe and appropriate handling of all solid wastes. Environmentally hazardous materials used during construction should be stored in designated areas which have been improved to accept such storage, and in containers designed to minimize spills and contain contaminated runoff.

The contractor should be required to notify the Provincial office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. NATURAL RESOURCES

The proposed road improvements will not result in any direct impact on forest cover as there is no undergraded forest within the alignment. Some bamboo, immediately adjacent to the present road will probably be removed but provisions should be made for its removal and use by local inhabitants.

There are no protected areas within the alignment that could be affected. However, the designation of Lake Sebu as a wetland and its identification as a significant natural resource indicate that it should be treated as a sensitive area. Since Lake Sebu was included in early proposals for the Integrated Protected Areas System, maintenance of the ecosystem in this area is important so as not to preclude its future incorporation.

Lake Sebu could be potentially effected during and after construction by erosion from the road cut between Lake Lahit and Lake Sebu. Increased silt loading could negatively impact both natural and cultivated fisheries that exist within the two lakes. Silt loading can impact fisheries both directly through physiological damage to soft tissues (gills) and indirectly, through decreasing light penetration and therefore, overall productivity of the lake.

Mitigation for potential increased silt loading is included in the soil erosion and slope stability Section. Construction activities should also be timed in order to avoid high precipitation periods.

Other more indirect potential impacts of the proposed road improvements may be increased exploitation of upland resources due to increased population. Historically, lowland immigrants have often pushed minority populations further back onto steeper slopes, where even traditional "indigenous" conservation practices have little effect on preventing degradation of soils.

The fact the surrounding mountains are classified as Forest Lands and no land tenure exists make them vulnerable to misuse should migration into the area be increased substantially by the proposed road improvements. Another indirect impact of the road improvements would be the increased ease of access to the surrounding forest lands, facilitating illegal logging operations. Mitigating these potential impacts is the designation of the area as a Watershed Reserve and the reforestation program that is being undertaken with funding from the Asian Development Bank.

However, it is impossible to predict to what extent any further migration into Lake Sebu would be attributed to the proposed road improvements over and above the natural trend to move to areas with available land. The only mitigation for this possibility is the awareness of the regulatory agencies and the preparedness of the Municipality to regulate newcomers.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land Use and Settlement Patterns

The proposed improvements of this Road Sector should have little effect on the general land use pattern along the route as it is already being utilized to its maximum capacity. No significant changes in agricultural practices, land settlement, or land ownership is expected within the road's immediate zone of influence. It is impossible to predict if the population of Lake Sebu significantly effected as a result of the road improvement. However, easier access to the forested area in this region may result in accelerated deforestation.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semi-skilled labor. Since agricultural production is at the maximum level which can be sustained by the land in the area, significant crop yield increases should not be expected. Alternatively, the reduction in input and product transportation costs which may include as much as 50% saving will significantly increase area income especially if this road is constructed in conjunction with the Surallah/Lamsugod-Tupi road which would give area producers a more direct route to the GSC market prices.

c. Public Services

During construction there will be increased demand for food and lodging by the labor force. Given the limited services currently in Lake Sebu, this could generate some new business interest.

d. Displacement and Relocation

In the northern portion of the road alignment, the road improvements are unlikely to result in significant changes in the settlement pattern of the area since it is already intensively utilized by the agricultural Sector. However, the proposed road improvements have the potential to facilitate additional in-migration into upland areas surrounding Lake Sebu that are presently classified as Forest Lands and are unpopulated.

The proposed alignment is, for the most part, within the existing right-of-way so displacements of individual dwellings will be minimal.

e. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain Sections of Republic Act No. 4846, otherwise known as

"The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

g. Tribal Filipinos and Ancestral Lands

The T'boli people in Lake Sebu, while eager for the opportunities that an improved road could bring, are vulnerable to further encroachment of their lands. The decreased transportation costs that would be the result of an improved road, would undoubtedly lower their input costs and therefore increase their production profitability. However, traditional in-migration from lowland areas could increase and negate any benefits accrued if further encroachment on tribal lands or degradation of upland areas occur.

In order to ensure the security of the T'Boli people in the area, land classification and subsequent surveying and titling of all T'Boli land is required. Other uplands development programs slated for the area and aimed at T'Boli peoples would also mitigate against the potential negative effects of an increased migrant population.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

No direct environmental impacts are likely if the proposed road improvements are not implemented.

2. SITING ALTERNATIVES

The project consists of rehabilitation of an existing alignment. Some shifts in this alignment may be made only to ensure design standards are met. This could include a new alignment from the Allah Valley Irrigation Diversion Structure to Lake Lahit.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefit to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal.

The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 7

SURALLAH - T'BOLI

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed Surallah-T'Boli road alignment follows the existing unpaved road and extends southward for 21.5 kilometers to T'Boli. The existing unpaved road is currently the only access from the area to the Provincial road network.

2. SCOPE

The proposed Surallah-T'Boli road improvement is designed to upgrade the existing two-lane gravel road to an all weather paved road. The proposed upgrading will improve ground transportation between all communities located on the road and reduce both passenger and cargo transportation costs and improve access to major Provincial markets. Currently, the unpaved road becomes impassable during rainy periods thus limiting the transportation in and out of the area. The objective of the road project is to give the T'Boli economy access to better markets for selling their produce, and reduce the cost of transportation of commodities as well as make provisions for the significant traffic which is being generated as a result of gold mining in the Municipality.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

The alignment follows the existing road through a relatively flat plain between the Allah and Sapali Rivers. In the last one third of its length, the road rises from the plain at 480 meters above sea level (MSL) until it ends in the town of T'Boli on the foothills of Mt. Malibao and the Parker volcano. The final road elevation is approximately 560 meters (MSL).

2. GEOLOGY AND GEOMORPHOLOGY

The northern portion of the alignment traverses a geological formation comprised of sedimentary rocks overlain by recent alluvium. The predominant formation is known as Banga Formation, formed of marine clastics consisting of tuffaceous sandstone, siltstone and shale, occasionally interbedded with micro and macro conglomerate reef limestone lenses intercalated within the formation.

Further south toward T'Boli the road alignment extends to the volcanic footslopes of Mt. Parker which are composed of deep and extensive pyroclastics. The geology of this area is volcanic ejecta consisting of lapelli, tuff breccia mixed with volcanic sand, ash and boulders of andesite.

3. SOILS

The fine grained alluvial soils in this area are dominated by clayey, sandy, silts known as sandy loams. On the upper terraces of the river courses, soils are deep to moderately deep to deep, well drained sandy loams interbedded with highly permeable sand deposits.

On the volcanic lower foothills characterized by the southern portion of the road, the soils are moderately shallow to deep, well drained, coarse loams underlain by loose pumice-like deposits.

4. SURFACE WATERS

The road alignment is situated in the upper reaches of the Allah and Banga watersheds. Both are major northward flowing drainages originating on Mt. Busa, the Parker Volcano, and Mt. Malibao. These drainage areas have been classified as having the potential for severe flash flooding by measuring the inherent variability of the river (Bureau of Soils, 1988). While the headwaters of the drainage basins are still forested, little forest still exists on the lower slopes, and consequently, flooding occurs regularly in the lower reaches of these rivers.

5. GROUND WATER

Most residents and Municipalities along the alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoons and south pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause higher rainfalls. This weakens between late February and late of March while rainfall intensities increase during the month of April.

Rainfall distribution is influenced by elevation and aspect, the mountainous areas receiving the highest rainfall. Provincial rainfall data indicates that in the northern half of the alignment the average annual rainfall is between 1500 - 2000 mm with a small area in the midsection receiving 2000 - 2500 mm. The southern portion encompassing the T'Boli Municipality receives more than 2500 mm annually. (Bureau of Soils, 1988)

C. NATURAL RESOURCES

1. VEGETATION

No forest cover of any type remains within the alignment of the Surallah-T'Boli Road. The entire alignment traverses an area that has been classified as an area of intensive land use comprised of cropland mixed with other plantations (Figure 6-1). Major crops cultivated are corn and rice (both upland and lowland). Interspersed with these croplands are mixed fruit trees (mango, banana, guava) and coconuts. Some pasture licenses exist adjacent to the road near T'Boli where cattle, horses and carabao are pastured.

Within the Municipality of T'Boli and within a few kilometers of the road are three small Integrated Social Forestry (ISF) projects. The criteria for participating in this program is that the land must have been occupied prior to 1981. The participants are issued a Certificate of Stewardship which entitles them to use of the land for 25 years. The certificate may be renewed on expiration. Since the certificate does not give title to the land, this precludes sale of the land by the certificate holder. The use of the ISF land is described specifically in terms of percent forest, crops and fruit trees.

2. PROTECTED AREAS

There are no protected areas on or near this alignment.

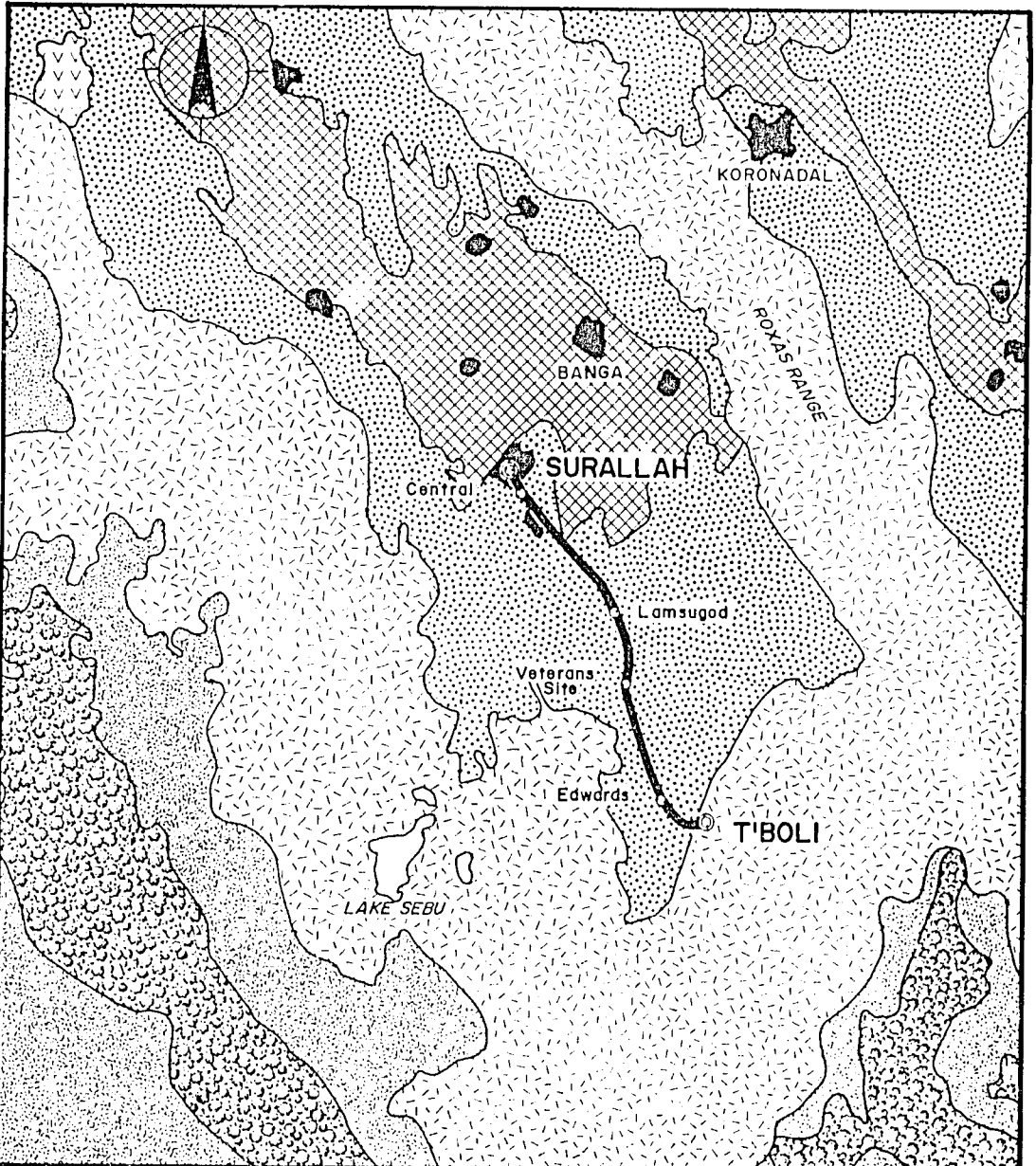
3. WILDLIFE

Wildlife present along this Sector is well adapted to the presence of man since the area is under intensive cultivation. As a result, species present along this road are unlikely to be sensitive to construction activities or increased road traffic. No known habitats for species considered rare, threatened or endangered in the Philippines exist along this alignment.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

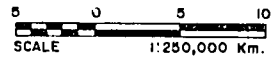
1. LAND USE AND SETTLEMENT PATTERNS

Major land use along the proposed route of the Surallah-T'Boli road is agricultural. The first 2.5 km from Surallah Municipality is cultivated with rice. From there on, up to the outskirts of T'Boli Municipality, the flat topography is dominated by intensive corn cultivation with some upland rice and interspersed stands of fruit and coconut trees. The existing unpaved road narrows and assumes a gentle upward incline within the last 6 km approaching T'Boli Municipality. The cultivation in this area remains dominated by corn and appears as productive as in the lower elevations.



LEGEND:

- | | |
|--|---|
| DIPTEROCARP FOREST, CLOSED CANOPY > 50% | COCONUT PLANTATIONS |
| DIPTEROCARP FOREST, CLOSED CANOPY < 50% | OTHER PLANTATIONS |
| CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND | ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
| GRASSLAND COVERING > 70% | CROPLAND MIXED W/ COCONUT PLANTATIONS |
| BUILT-UP AREA | CROPLAND MIXED W/ OTHER PLANTATIONS |



SURALLAH - T'BOLI

SOURCE: PCGS 2661
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

2. INCOME AND EMPLOYMENT

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (NCSO). This value falls slightly short of the national average of P32,521 for the same period but is above the regional average of P30,061 and represents a 6.5% growth rate for the Province in the years 1985 - 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 Regional Income and Expenditure Survey to be performed by NCSO.

The historic economy of the proposed Surallah-T'Boli road zone of influence has principally been agricultural. This domination has recently been challenged by the gold mining activities in T'boli which amount to revenues of approximately P340,000 per day. Average annual income in this proposed Road Sector is P40,800 for rural families. These figure reflects the rich agricultural resources of the area and do not include the increased income due to gold mining operations.

3. PUBLIC SERVICES

There are 28 schools, 1 nurse, 1 dentist, 5 midwives and 182 Barangay health workers in the T'Boli Municipality. There are 22 schools, 1 doctor, 3 nurses, 1 dentist, 11 midwives and 182 Barangay health workers in the Surallah Municipality.

Electricity is supplied by and electric co-operative known as the South Cotabato Electric Co-operative or SOCOTECO I and II. both Surallah and T'boli are serviced by SOCOTECO I. Of the 18 Barangays in T'Boli, 3 are serviced with electricity while of the 17 Barangays of Surallah, 13 are serviced with electricity.

4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel road. The nearest airport is in GSC. Regular jeepney services connects T'boli with Surallah, and regular bus and jeepney service connects Surallah with the rest of the major centers in the Province, Surallah being on the National Highway.

5. DISPLACEMENTS AND RELOCATION

Most of the area adjoining this alignment appears to support a stable population and has a degree of permanence indicated by the productive agricultural Sector and ancillary services relating to the agricultural Sector such as solar driers and corn mills. Conversely, the Municipality of T'boli has experienced a significant increase in population since 1987 (from 32,663 to 80,300 in 1990) attributed to the discovery of gold.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A review of a list of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no known sites of this nature along the road alignment.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

The Office of Southern Cultural Communities (OSCC) estimates that there are 27,589 native T'boli in the Municipality of T'boli. In 1987, the T'boli population comprised 84% of the Municipal population while in 1990, with a huge influx of population attributed to the discovery of gold in the area, the T'boli comprised only 34% of the population.

This change from a majority to a minority seems to be mitigated in part, by the facts that the mayor of the Municipality is a T'boli, the town is surrounded by ancestral tribal reserve and the only legal mining claim is held by the Tribal Mining Development Corporation. However, only a small percentage of T'Boli people are benefiting directly from these operations.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This Sector addresses the potential impacts of the proposed road on physical, biological and cultural resources and provides recommendations for mitigation measures where appropriate.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

Although the topography in this Sector is quite flat, the unstable soils in this area create a serious erosion problem. Road construction may directly aggravate this problem by creating unstable surface conditions. Cross drainage structures should be included in construction to alleviate localized road erosion.

Materials sources have been identified by the Department of Public Works (DPWH). It is common practice to obtain borrow materials from riverbeds. However, contract specifications should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provincial representatives of the Department of Environment and Natural Resources (DENR) should be notified when construction activities begin so that their representatives may monitor all activities, particularly the use of borrow sources and erosion control measures.

b. Hydrology

Upgrading the existing Surallah-T'Boli road will include the construction of 10 pipe culverts. Hydraulic design capacity for pipe culverts is to the 10-year design flood.

Construction of the proposed road is unlikely to result in any increase devegetation and deterioration of the watershed area. No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. The inclusion of cross drainage structures may improve existing drainage. Maintenance of drainage structures after completion of road construction should be required to ensure their continued effectiveness.

c. Air Quality

Because this is a gravel road, air quality in the area along the road is affected by fugitive dust. Some additional fugitive dust may be generated during construction activities and residents of Barangays immediately adjacent to construction areas will be effected. Mitigation measures may be used for those areas affected during construction. These include: covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products. The construction contractor, as a provision of the contract, should be required to develop and implement a management plan for the duration of construction activities that ensures safe and appropriate handling of all solid wastes. Environmentally hazardous materials used during construction should be stored in designated area, which have been improved to accept such storage, and in containers designed to minimize spills and contain contaminated runoff.

The contractor should be required to notify the Provincial office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. NATURAL RESOURCES

Since this road already exists and is well travelled, impacts to biological resources along the alignment are expected to be negligible. Most of the area is intensively cultivated or used as pasture. Minimal area disturbance will occur as very little of the alignment is expected to change.

Field observations confirmed that habitat requirements for the rare and endangered species identified by the Philippines are not met along the road alignment. Based on the lack of suitable habitat, presence of rare or endangered species is unlikely. The areas surrounding this alignment are intensively utilized by humans, wildlife found in the area has most likely adapted to human disturbance and any increase in activity during or after construction will not have significant impact.

3. CULTURAL AND SOCIO ECONOMIC RESOURCES

a. Land Use and Settlement Patterns

Upgrading this Road Sector will have little effect on the general land use pattern along the route as it is already intensively utilized. No significant changes in agricultural practices, land settlement, or land ownership is expected as all the lands near the existing alignment but a single pasture are classified as Alienable and Disposable (A & D) (i.e. are privately owned or will be) with the exception of a small pasture lease.

The population of T'boli will continue to be influenced mainly by the gold mining development. The road improvements are not expected to influence this significantly but will positively impact the agricultural economy by reducing commodity transportation costs.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semi-skilled labor. Since agricultural production is at the maximum level which can be sustained by land in the area, significant crop yield increases should not be expected in the area. Alternatively, the reduction in input and product transportation costs which may include as much as 50% saving and may significantly increase area income specially if this road is constructed in conjunction with the Surallah/Lamsugod-Tupi Road giving area producers a more direct route to the General Santos City (GSC) market prices.

The development of the gold mining enterprise would also increase significantly the local T'boli controlled economy thus requiring better access to GSC processing and handling facilities via the Surallah-T'Boli Road.

c. Public Service

The major drain of public services in the Municipality of T'Boli will come from dramatic increases in population as a result of the exploitation of gold resources.

During construction, there will be some increased demand for food and lodging by the labor force. This can be adequately serviced by Surallah and T'Boli.

d. Transportation

The proposed road improvements will reduce transport costs. This will benefit the agricultural Sector as a decrease in farm market costs will enable farmers to obtain a larger profit margin.

e. Displacement and Relocation

The proposed road improvements are unlikely to result in significant changes in the settlement pattern of the area since it is already intensively utilized by the agricultural Sector.

The proposed alignment is, for the most part, within the existing right-of-way so displacements of individual dwellings will be minimal. However, a small Section near Surallah may have to be realized in such a way that displaces a number of residential houses.

f. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain Sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

g. Tribal Filipinos and Ancestral Lands

The Municipality is undergoing considerable change as a result of the discovery of gold and any impacts on tribal Filipinos and ancestral lands from the road improvement will be insignificant by comparison.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

No direct environmental impacts are likely if the proposed road improvements are not implemented. However, the existing road is likely to deteriorate rapidly as mining activity in the T'Boli area will result in increased use of the road.

2. SITING ALTERNATIVES

The project consists of rehabilitation of an existing alignment. Minor shifts in this alignment will be made only to ensure design standard are met.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal.

The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 8

BANGA - NORALLA - KOLAMBOG

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed Banga-Norala-Kolambog road improvements will occur on an existing alignment. This road begins at the National Highway approximately 500 meters southwest of the the Banga River Bridge. It heads northwest to Poblacion Norala where it then turns westward to Kolambog and the intersection with the National Highway between Surallah and Sultan Kudarat. The road parallels the National Highway between Surallah and Kolambog, traversing the Municipalities of Banga and Norala and passing in close proximity to Santo Nino Municipality.

2. SCOPE

The proposed improvements are designed to upgrade the existing gravel alignment to a two lane paved road throughout its length. The object of the project is to improve the existing transportation route for the communities along the Sector, thereby increasing access to markets and services and allowing for greater profitability.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

This alignment runs along virtually flat terrain throughout its length, with the exception of minor depressions when the road crosses waterways.

2. GEOLOGY AND GEOMORPHOLOGY

The road is situated in the wide alluvial plain formed by the Banga and Allah Rivers. The entire alignment traverses terrain consisting of recent alluvial deposits overlying volcanic agglomerates and sedimentary formations, consisting of unsorted and unconsolidated heterogenous detrital assemblages of clay, silt, sand, gravel and sometimes boulders.

3. SOILS

The soils found on this broad alluvial plain appear shallow and are sandy loams known locally as Banga sandy loam. They are made up of fine-grained clay, silt and sandy silts.

4. SURFACE WATERS

The alignment is located between two major northwesterly flowing rivers, the Allah and the Banga. The area is irrigated throughout. The road lies within what is defined as the Banga watershed which has a Mean Annual Discharge of 8.45 cubic

meters/second and a run off volume of 2.7×10^8 cubic meters. (Bureau of Soils, DA, 1988)

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April. Provincial rainfall data indicates that the entire alignment receives 1500 mm to 2000 mm of precipitation annually.

C. NATURAL RESOURCES

1. VEGETATION

There are no forested areas along this alignment. The lands along this alignment are entirely agricultural, the primary crop being rice with some corn, interspersed with coconut, bananas and other fruit trees.

2. PROTECTED AREAS

There are no protected areas identified along this alignment.

3. WILDLIFE

No unique habitat types or habitat for rare or endangered species were found along this alignment, nor were any observed. Wildlife present within the alignment is well adapted to the presence of man since the area is extensively used by humans. As a result, species along this Sector are unlikely to be sensitive to construction activities or increased road traffic.

D. CULTURAL AND SOCJO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

The land throughout the alignment is classified as Alienable and Disposable by the Department of Environment and Natural Resources, Provincial Office and may therefore be privately titled. Most of the alignment is situated in agricultural lands

that are classified on Land Cover Maps as Intensive Land Use areas of cereal croplands with a small segment classified as croplands mixed with plantations (Figure 6-1). The major crops cultivated in this area are rice and corn with some coconuts and fruit trees.

2. INCOME AND EMPLOYMENT

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the National average of P32,521 for the same period, but is above the Region XI average of P30,061 and represent a 6.5 percent total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5 percent respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.

The economy of the Banga-Norala-Kolambog road is almost entirely agricultural. Both rural and urban income figure for all three Municipalities are almost double average family income in the Province, Region or the country. Since urban income is estimated to be lower than rural income, these statistics are indicative of the highly successful agricultural economy.

3. PUBLIC SERVICES

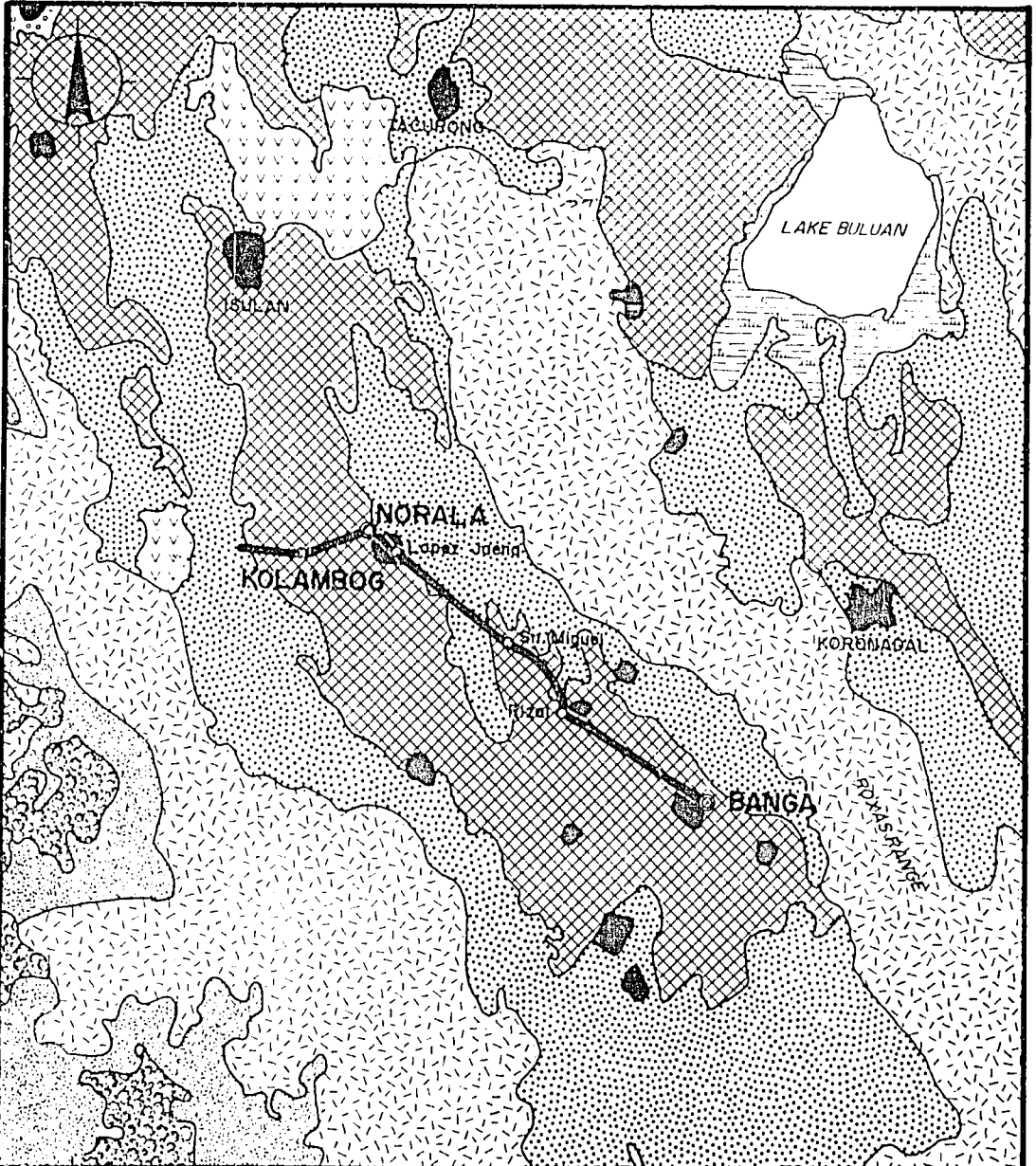
There are 2 hospitals, 30 schools (all elementary), 1 dentist, 2 nurses, 15 midwives and 318 Barangay health workers in the Banga Municipality. There are 23 schools (3 secondary), 2 hospitals, 2 doctors, 1 dentist, 4 nurses, 7 midwives and 125 Barangay health workers in the Norala Municipality. There are 18 schools, 2 hospitals, 1 doctor, 1 nurse, 1 dentist, 5 midwives and 50 Barangay Health worker in Santo Nino Municipality; (Provincial Planning & Development Office, South Cotabato, 1988).

Electricity is supplied to users in the Province of South Cotabato by two electric cooperatives known as the South Cotabato Electric Cooperative or SOCOTECO I & II. SOCOTECO I supplies both Banga and Norala. Of the 22 Barangay of Banga, 18 are serviced and of the 14 Barangay of Norala, 13 are serviced. All of Santo Nino is serviced by SOCOTECO I.

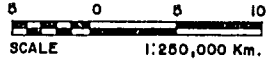
4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel road to the National Highway.

The nearest commercial airport is in General Santos City. Regular jeepney and bus service is available along the National Highway while jeepney and tricycles are available along the road itself.



LEGEND:



- | | |
|--|---|
| DIPTEROCARP FOREST, CLOSED CANOPY > 50% | COCONUT PLANTATIONS |
| DIPTEROCARP FOREST, CLOSED CANOPY < 50% | OTHER PLANTATIONS |
| CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND | ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
| GRASSLAND COVERING > 70% | CROPLAND MIXED W/ COCONUT PLANTATIONS |
| BUILT-UP AREA | CROPLAND MIXED W/ OTHER PLANTATIONS |
| MARSHY AREA | |

BANGA-NORALA-KOLAMBOG

SOURCE: PCGS 2551
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas (World Bank, 1989). Overall indications are that net migration is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

This area is intensively used for agriculture which precludes the expansion of residential areas or substantive changes in land use.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along the Road Sector.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

Banga has a significant tribal population of about 6,525 (5,595 T'boli, 930 Blaan). However, most of these people are living in upland Barangays, well away from the proposed road improvements. The Barangay of Puti in Norala has a T'boli tribal population of 550 but this Barangay is well removed from the influence of the road.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

This entire road alignment is very gently sloping and has relatively stable soils such that there are no significant erosion problems. The proposed road improvements will be designed according to specifications that will further stabilize the roadway and drainage works, and will ensure no localized erosion in the event that culverts are damaged.

Five materials sources have been identified by the Department of Public Works and Highways (DPWH) including the Banga River Quarry (NIA Dam), Allah River Quarry (Bo. Ambalgan), Allah River Quarry (Bo. San Andres), Allah River Quarry (Bo. Colongo), and Barrio 4 Quarry, Koronadal. These sources are described in detail in Chapter V of this Volume. It is common practice to obtain borrow materials from riverbeds. However, contract specification should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provisions in the contract should be made for the contractor to notify Provincial representatives of the Department of Environment and Natural Resources (DENR) when construction activities begin so that their representatives may monitor activities, particularly the use of borrow sources and implementation of erosion control measures.

b. Hydrology

The road alignment has five existing bridges. No additional bridges will be added but some bridge locations have waterway obstructions which must be cleared, and slope and stream bank stabilization and protection works will possibly be undertaken. Hydraulic design capacity for bridges is to the 50-year design flood.

There are 10 box culverts along the alignment. All will require extensions and most will require cleaning. Box culverts are designed to the 25 year design flood.

There are 61 existing pipe-culverts along the alignment. All require extensions, many will require cleaning and some replacements are required. In addition five new pipe culverts will be added. Pipe culverted are designed to the 10 year design flood.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. However, provisions should be made for maintenance of these structures.

c. Air Quality

Because this is a gravel road, air quality in the vicinity of the road is affected by fugitive dust. Some additional fugitive dust will be generated during construction activities effecting residents of Barangay immediately adjacent to construction areas. Mitigation measures may be used for those areas affected during construction. These include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract will be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes.

Environmentally hazardous materials used during construction should be stored in designated area, which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The contractor will be required to notify the Provincial office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. NATURAL RESOURCES

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Field observation confirmed that habitat requirements for rare and endangered species in the Philippines are not met along the alignment. Based on the lack of suitable habitat, rare or endangered species are not expected to be present along this alignment. Since the area is already utilized by humans, the wildlife has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land use and Settlement Patterns

Based on the stability of the existing settlements along the alignment, no effects on land use or settlement patterns is expected.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The lowering of transportation costs will effect the local economy by reducing commodity prices and transportation costs to better markets in General Santos City.

c. Public Services

During construction there may be increased demand for food and lodging by the labor force. Given the available services in Banga and Norala, this is not expected to strain existing public services.

d. Displacement and Relocation

As the proposed road improvements are to take place within an existing alignment, and no substantive changes are envisioned, displacement of individual dwellings will be minimal.

e. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in

accordance with Presidential Decree No. 374 (1974), amending certain sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

f. Tribal Filipinos and Ancestral Lands

No tribal Filipinos are expected to be directly affected by the proposed road improvements.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

The existing road is in reasonably good condition. With no improvements, the road will still be used as a transportation route for agricultural products, however, those residents along the road will continue to pay slightly higher prices. As the road deteriorates with time, these prices can be expected to increase.

2. SITING ALTERNATIVES

The project consists of rehabilitation of an existing alignment and no substantive changes in alignment are envisioned.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 9

LABU - SILWAY 8

VI. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed road improvements from Labu to Silway 8 (Sector 9) will occur on an existing road alignment. This road begins at the National Highway between General Santos City (GSC) and Davao, northeast of Poblacion GSC, in Barangay Labu and extends west to Barangay Silway 8, at the National Highway between GSC and Koronadal. The road traverses one Barangay in Polomolok Municipality and six Barangay in GSC Municipality.

2. SCOPE

Currently, the existing road consists of a poorly maintained gravel alignment which inadequately services the area communities. The proposed improvements are designed to upgrade the existing gravel alignment to a two lane paved road throughout its length. The object of the project is initiate the first stage of a ring road around GSC to bypass the center of the city and to provide a better transportation route for the farming communities along the route, thereby increasing access to markets and services and allowing for greater profitability.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

This alignment runs along essentially flat terrain throughout its length.

2. GEOLOGY AND GEOMORPHOLOGY

For most of the road's length, the terrain consists of recent alluvial deposits overlying volcanic agglomerates and sedimentary formations, consisting of unsorted and unconsolidated heterogeneous detrital assemblages of clay, silt, sand, gravel and sometimes boulders.

3. SOILS

The soils found in the broad alluvial plain are moderately shallow to very deep sandy loams, which range from silt to sandy gravel and poorly graded gravel.

4. SURFACE WATERS

The road alignment is located in the watershed of the Silway-Klinan Rivers and has a run off volume of 1.9×10^8 cubic meters. These rivers originate in the uplands to the north and to the west of GSC and flow in a southerly direction into

Sarangani Bay. (Bureau of Soils, D.A. 1988)

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April. Rainfall data indicates that this areas is the driest in the Province, receiving less than 1000 mm of precipitation annually.

C. NATURAL RESOURCES

1. VEGETATION

There are no forested areas along this Sector. The lands along this alignment are entirely agricultural, the primary crops being corn, cotton, and coconuts with some rice, sorghum, bananas, and other fruit trees.

2. PROTECTED AREAS

There are no protected areas identified along this alignment.

3. WILDLIFE

No unique habitat types or habitat for rare or endangered species were found along this alignment, nor were any observations made. Wildlife present within the alignment is well adapted to the presence of man since the area is extensively used by humans. As a result, species along this Sector are unlikely to be sensitive to construction activities or increased road traffic.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

The land throughout the alignment is classified as Alienable and Disposable by the Department of Environment and Natural Resources, Provincial Office and may therefore, be privately titled. The entire alignment is situated in agricultural lands that are classified as Intensive Land Use areas of croplands and

croplands mixed with plantations. (Figure 6-1) The major crops are corn and cotton with some rice, sorghum, coconuts and fruit trees.

2. INCOME AND EMPLOYMENT

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represent a 6.5% total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5% respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.

The economy of the Labu-Silway 8 Road is almost entirely agricultural. The average rural family income for the six Barangays within GSC Municipality is 21,099. This is well below National, Regional, and Provincial family income values and is also well below the average urban family income in GSC (estimated at P52,960).

3. PUBLIC SERVICES

According to 1988 statistics, the Municipality of GSC has 56 elementary schools (42 public, 134 private), 16 secondary schools (5 public, 11 private), 7 hospitals, 14 doctors, 22 nurses, 17 midwives, 2 dentists and 150 active Barangay health workers. According to 1987 statistics, Polomolok has 13 schools, 3 hospitals, 1 doctor, 1 nurse, 1 dentist, 12 midwives, and 286 Barangay Health workers. (Provincial Planning & Development Office, South Cotabato, 1988).

Electricity is supplied to users in the Province of South Cotabato by two electric cooperatives known as the South Cotabato Electric Cooperative or SOCOTEKO I and II. SOCOTEKO II supplies the Municipalities of GSC and Polomolok.

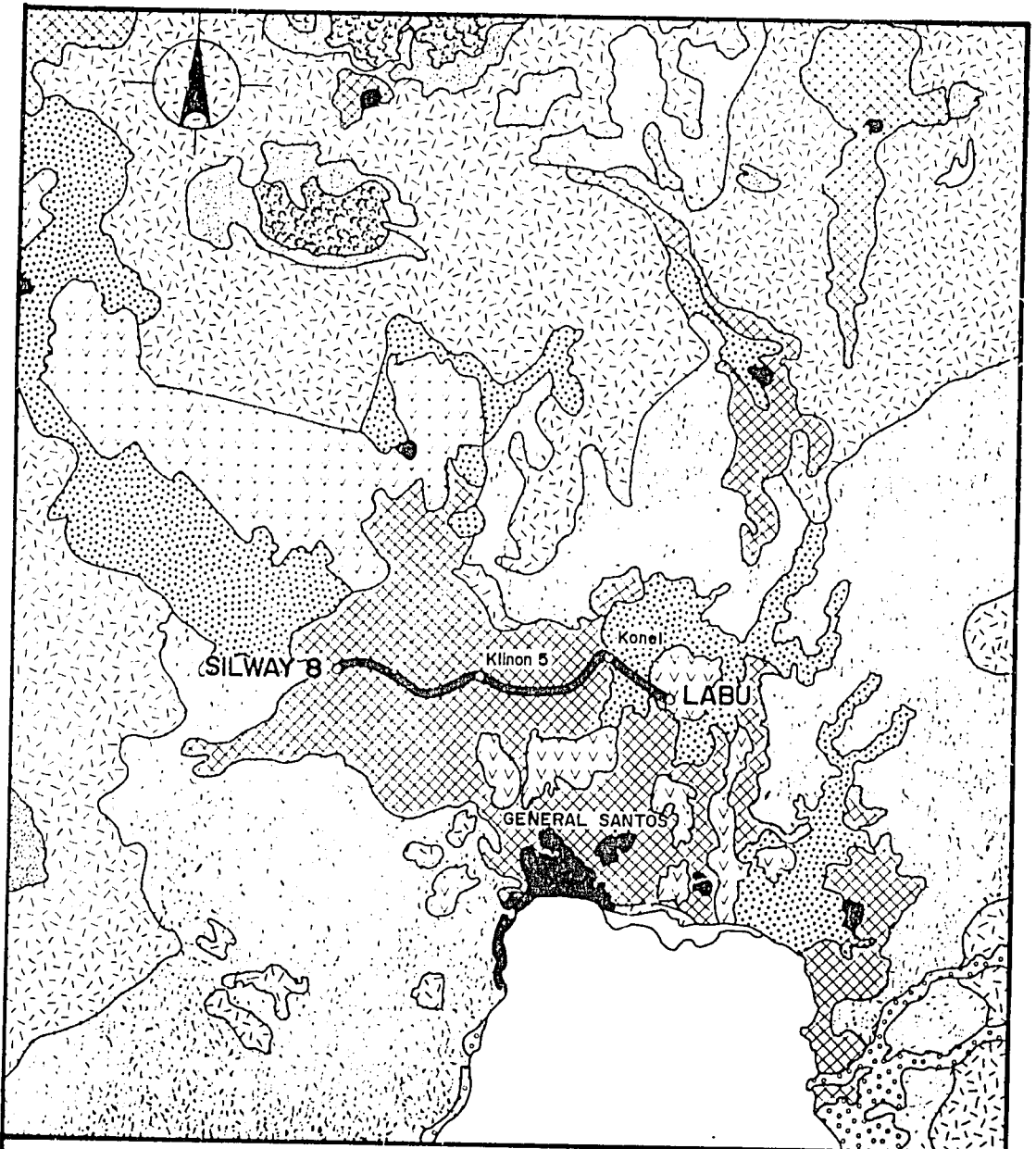
4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing gravel road to the National Highway at both the east and west end of the road.











The nearest commercial airport is in GSC. Regular jeepney and bus service is available along the National Highway while jeepneys are available along the road itself.

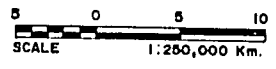
5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas (World Bank, 1989). Overall



LEGEND :

- | | |
|---|---|
|  DIPTEROCARP FOREST, CLOSED CANOPY > 50 % |  COCONUT PLANTATIONS |
|  DIPTEROCARP FOREST, CLOSED CANOPY < 50 % |  OTHER PLANTATIONS |
|  CULTIVATED AREA MIXED W/ BRUHLAND & GRASSLAND |  ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
|  GRASSLAND COVERING > 70 % |  CROPLAND MIXED W/ COCONUT PLANTATIONS |
|  BUILT-UP AREA |  CROPLAND MIXED W/ OTHER PLANTATIONS |



LABU-SILWAY 8

SOURCE : PCGS 2551
National Mapping and
Resource Information
Authority, 1987

FIGURE 6-1 LAND COVER MAP

indications are that net migration is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

This area is intensively used for agriculture which precludes the substantial expansion of residential areas or changes in land use. However, the proximity to GSC and the potential of becoming a bypass route may encourage more roadside development.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along the Road Sector.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

There are no significant numbers of tribal peoples within the Zone of Influence of this road.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This Section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

Although the topography in this Sector is generally flat, some erosion problems may occur at bridge approaches. Concrete or concrete lined ditches should be constructed to alleviate potential erosion problems by conveying road run-off to the river.

Four materials sources have been identified by the Department of Public Works and Highways (DPWH) including the Malinao River Quarry, Silway 8 River Quarry, Buayan River Quarry at Barangay Tinagakan and Buayan River Quarry in Barangay Ligaya. It is common practice to obtain borrow materials from riverbeds. However, contract specification should include methods such as construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provisions should be made for notification of the Provincial Office of the Department of Environment and Natural Resources (DENR) when construction activities begin so that their representatives may monitor activities, particularly the use of borrow sources and implementation of erosion control measures.

b. Hydrology

The existing alignment has a number of pipe and box culverts as well as two bridges, and a crossing that requires a bridge. However, a more direct alignment is preferable as it would

significantly decrease the road length, reduce the number of bridges to be constructed and would be continuous with the GSC by-pass (Sector 10). For these reasons, the alignment has been determined to be infeasible economically (Chapter X), and new alignments have been proposed for consideration (Chapter IV).

Pipe culverts, box culverts and bridges will be designed to the 10-year, 25-year and 50-year design flood respectively. No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. However, provisions will be made in the contract for maintenance of these structures.

c. Air Quality

Because this is a gravel road, air quality in the vicinity of the road is affected by fugitive dust. Some additional fugitive dust will be generated during construction activities effecting residents of Barangay immediately adjacent to construction areas. Mitigation measures may be used for those areas affected during construction. These include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract will be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes. Environmentally hazardous materials used during construction should be stored in designated area, which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The contractor should be required to notify the Provincial office of DENR regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. **NATURAL RESOURCES**

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Field observation confirmed that habitat requirements for rare and endangered species in the Philippines are not met along the alignment. Based on the lack of suitable habitat, rare or endangered species are not expected to be present along this alignment. Since the area is already utilized by humans, the wildlife has most likely accepted human disturbance and any

increase in activity during or after construction should not have a significant impact.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land use and Settlement Patterns

Diversion of significant amounts of traffic around GSC through this Sector may encourage some roadside commercial development. The overall permanence of the existing settlements will preclude any significant in-migration.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The lowering of transportation costs will effect the local economy by reducing commodity prices and will also significantly aid the economic development of the entire route by reducing transportation costs.

c. Public Services

During construction there may be increased demand for food and lodging by the labor force. Given the size and available services in GSC, this is not expected to strain existing public services.

d. Displacement and Relocation

If the road improvements are to take place within the existing alignment, some displacement of individual dwellings will be required at either end of the road, as there is some housing within the right-of-way. Alternative alignments requiring new right-of-ways, may also result in displacements.

e. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

f. Tribal Filipinos and Ancestral Lands

No tribal Filipinos are expected to be directly affected by the proposed road improvements. However, benefits that are realized as a result of decreased transportation costs will also accrue to tribal Filipinos.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

Without the proposed road improvements, no environmental impacts are expected. However, it is expected that the lack of a bypass to GSC will cause considerable congestion withing GSC.

2. SITING ALTERNATIVES

The proposed project consists of rehabilitation of an existing alignment for most of its length. However, in order to increase the feasibility of the project a new alignment has been suggested in Chapter IV (Engineering Design). Effects on natural resources would be minimal with these changes but new right-of-ways would be required which may require displacements of individual dwellings.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

If this alignment is selected, the short-term impacts of construction and the consumption of water, energy and other resources will not justify the minimal anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. While this consumption is of short-term duration and is not significant within the context of the national economy, it could be more easily justified with another alignment.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The project, even with a new alignment, will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. With an appropriate alignment, future social and economic benefits, and energy use savings, of the road render these losses negligible.

SECTOR 10

GSC BYPASS

VI. PRELIMINARY ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

The purpose of the General Santos City (GSC) Bypass Road is to allow traffic from the Makar wharf area and the future Agro-processing center to bypass the center of GSC and continue either northwest to Koronadal or Northeast to Davao, providing Sector 9 is constructed concurrently.

Due to the variety of suggested alignments proposed and the difficulty in ascertaining the status of right-of-way on a number of these proposed alignments, no single alignment for this Bypass has, as yet, been determined. Instead, a route selection will be undertaken separately from the General Santos City/South Cotabato project.

For these reasons, a complete environmental assessment has not been undertaken. However, the following is a brief description of the area where the proposed alignments are situated and the expected effects of the proposed road improvements.

B. PHYSICAL ENVIRONMENT

The proposed alignments lie to the west and north of (GSC) on the lower slopes of Mount Malibato and the Parker Volcano. The topography gently slopes to Sarangani Bay and immediately north of GSC, the topography is generally flat.

The geology of the area is dominated by the non-active volcanic cone of Mount Parker, generally consisting of pyroxene andesite. The soils are moderately shallow to shallow, well drained course loams underlain by pumice like gravel below 50 centimeters.

The hydrology of this area is dominated by the Silway and Klinan Rivers which have a combined runoff volume of 1.9×10^8 cubic meters annually.

The climate is influenced by the southwest monsoon and south Pacific trade winds during the months of June to October, causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This weakens between late February and late March while rainfall intensities increase during the month of April. GSC is the driest area in South Cotabato, receiving less than 1000 centimeters of rainfall annually.

C. NATURAL RESOURCES

The land cover in the area is almost entirely grassland. There is no existing forest cover nor are there any protected areas present in the area. There are no apparent unique habitat types or habitat for rare or endangered species in this general area. Wildlife present is well adapted to the presence of man since the area is extensively used by humans. As a result, species in this area are unlikely to be sensitive to construction activities or road traffic. However, once an alignment is selected, at least one site visit should be undertaken to confirm this preliminary assessment.

D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

There is some land classified as Alienable and Disposable immediately to the north of GSC but most of the land in the area is classified as pastureland by the Provincial Office of the Department of Environment and Natural Resources (DENR). All of the land cover has been classified as grassland and is used by number of cattle ranching operations. This area has also been identified as a potential resettlement area, particularly for people who will be displaced as a result of the Makar wharf development project.

The average rural family income in GSC is P21,099, well below the National, Regional and Provincial averages which are P32,521, P30,061 and P32,051 respectively. Urban incomes are somewhat higher and generally reflect salaried workers. GSC has a high urban-rural ratio with 77% of the population being classified as urban while only 23% are rural.

The area is near to GSC so all services available in GSC will be readily attainable. However, because of lack of access there are presently no jeepney routes and tricycles are limited to travelling routes.

The major tribal populations in the area are B'laan and as the case in many other parts of South Cotabato, they appear to be well integrated into the communities in which they live. There are no Civil Reservations in the area.

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature in this area.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This Section addresses the potential impacts of the proposed road on physical, biological and cultural resources. The effects of the proposed road are expected to be minimal and any potential negative effects can be mitigated.

Soil erosion and slope stability problems are expected to be minimal and design standards for this road will incorporate mitigative measures where soil stability is in question.

Bridges and culverts will be included where necessary and additional drainage works such as ditching will be undertaken where hydrological conditions indicate that it is necessary. Bridges will be designed to the 50-year design flood, box-culverts to the 25-year design flood, and pipe culverts to the 10-year design flood. Provisions should be made for maintenance of these structures. No impediments to existing natural drainage patterns would be created by the proposed construction which might endanger persons or property.

Air quality in the vicinity of the road will be affected by fugitive dust during construction activities. Mitigation measures may be used for those areas affected during construction which include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract, will be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes. Environmentally hazardous materials used during construction should be stored in designated areas which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

Since the area is already utilized by humans, any wildlife in the area has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

The construction specifications should contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures should they be required.

Land use, settlement patterns, and tribal peoples are not expected to be effected negatively. Any of the alignments will provide access to a presently inaccessible area. Part of the purpose of the GSC Bypass is to provide access to a new resettlement area. The increased access will benefit local residents by making their travel to GSC considerably easier. However, it is unknown at this time if it will significantly effect incomes.

Provisions should be made for notification of Provincial representatives of the Department of Environment and Natural Resources (DENR) when construction activities begin so that their representatives may monitor activities, particularly the use of borrow sources and implementation of erosion control measures.

F. PROJECT ALTERNATIVES

A number of alternatives exist for the GSC Bypass, all within the same physical and natural landscape. A route selection exercise has been recommended to determine the best possible alternative. The major limiting factor in the selection of the route will be right-of-way rather than any physical or biological limitations as mitigative measures are available for any anticipated impacts in the area.

SECTOR 11

GSC/LAGAO - BALUYAN - TAGANSUL RIVER

I. ENVIRONMENTAL ASSESSMENT

A. DESCRIPTION AND OBJECTIVES

1. LOCATION

The proposed road improvements from General Santos City (GSC)/Lagao to the Tagansul River will occur, for the most part, on the existing National Highway between GSC and Davao. The improvements to this road will begin on the National Highway at Barangay Lagao in GSC. The road heads northeast from Lagao to the Provincial border between South Cotabato and Davao del Sur and extends an additional 4.3 kilometers into Davao del Sur. The total proposed road will be approximately 62 kilometers in length. Through approximately the first half of its length Sector 11 passes through the GSC Municipality and then Malungon Municipality for the remainder of its length. The final 4.3 kilometers are within the Province of Davao del Sur; this Segment is known as Sector 11B. In addition Section 11A is a 2.9 kilometer Section of the road known as "the killer curve" that has been recommended for a new alignment. Figure 1-1 shows project road location and Figure 1-2 the location in terms of the road network in South Cotabato.

2. SCOPE

The existing National Highway between GSC and Davao City is a critical commercial route that links the Province of Davao del Sur with South Cotabato and ultimately Sultan Kudarat and North Cotabato. The road surface condition has deteriorated substantially since it was previously paved and, as such, does not provide an adequate transportation link between these two important cities. The proposed improvements are designed to upgrade the existing highway throughout its length and adjust the alignment in order to improve the safety of the road. The object of the project is to upgrade a critical transportation route between two of Mindanao's most important cities and onward to other Provinces on the western side of Mindanao. This critical route will improve the commercial links throughout southern Mindanao.

B. PHYSICAL ENVIRONMENT

1. TOPOGRAPHY

This Road Sector begins within the wide valley at the north of Sarangani Bay, then proceeds northeasterly through the Buayan River valley traversing flat to gently sloping terrain, gradually ascending to run along a ridge line to the Provincial boundary where it reaches an elevation of approximately 350 meters (MSL). From this point it continues in the same direction through a very hilly terrain, descending to the Tagansul River, approximately 4.3 kilometers north of the Provincial border.

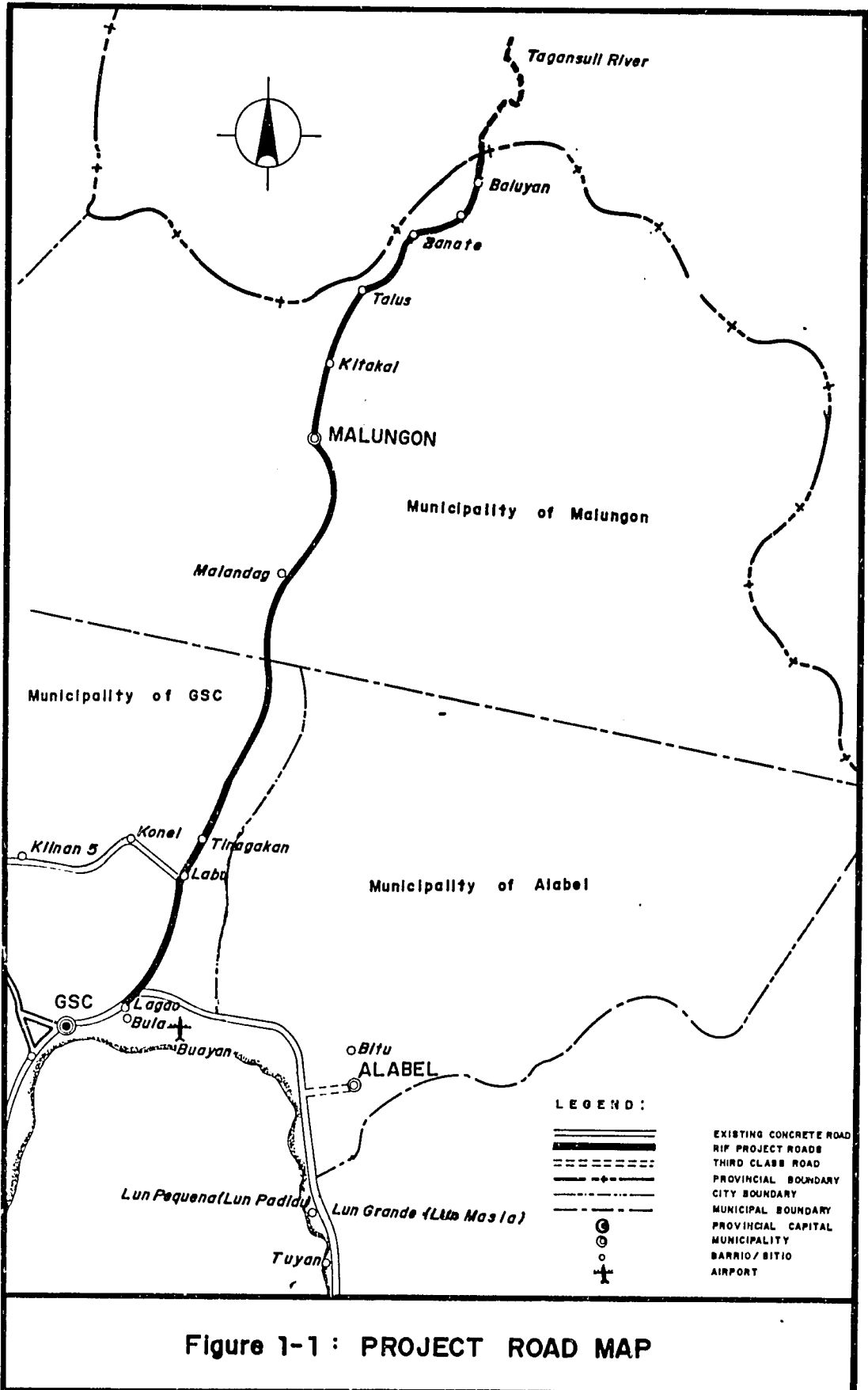


Figure 1-1 : PROJECT ROAD MAP

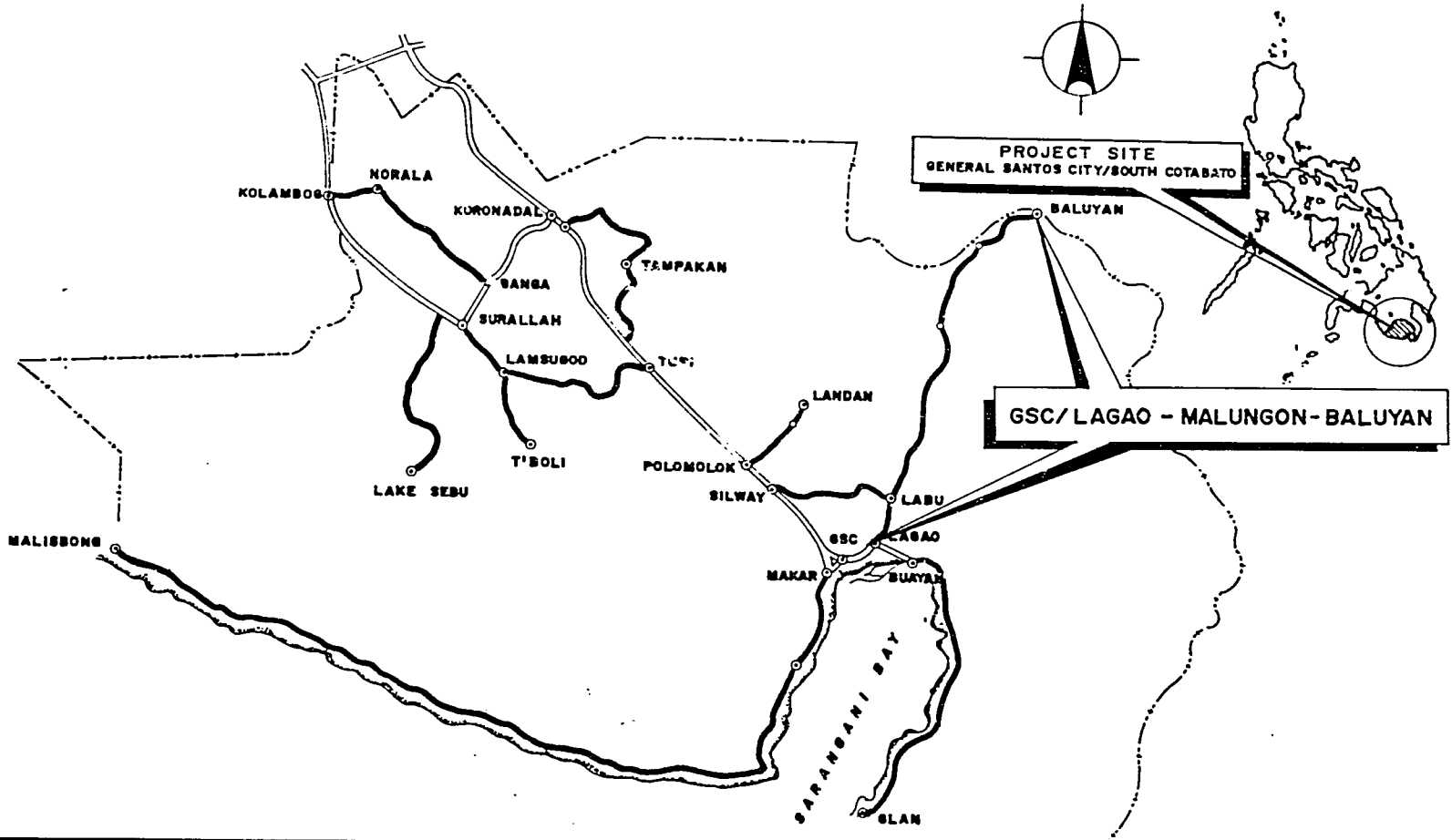


Figure: 1-2 PROJECT LOCATION MAP

2. GEOLOGY AND GEOMORPHOLOGY

The first portion of the road traverses recent alluvial deposits consisting of unsorted and unconsolidated heterogenous detrital assemblages of clay, silt, sand, gravel and at times boulders. The northern portion of the alignment within the Municipality of Malungon is within the shale/sandstone hills consisting of marl, reworked tuft and terrace gravels of the Pliocene - Pleistocene Age.

3. SOILS

The soils found on the broad alluvial plain are moderately shallow to very deep sandy loams, ranging from silt to sandy gravel and poorly graded gravel. The soils found on the Shale/sandstone hills vary from moderately shallow to moderately deep fine loams underlain by clay.

4. SURFACE WATERS

The road alignment is located almost entirely in the Buayan River watershed which combined with the Maribulan River, has a run off volume of 1.31×10^7 cubic meters. The watershed originates in the highlands at the boundary between South Cotabato and Davao del Sur and flows southwesterly into Sarangani Bay. (Bureau of Soils, DA. 1988)

5. GROUNDWATER

Most residents and Municipalities along this alignment utilize well or spring water sources for domestic and commercial purposes. (South Cotabato Provincial Planning and Development Office, 1988)

6. CLIMATE

During the months of June to October, the climate is influenced by the southwest monsoon and south Pacific trade winds causing high rainfalls. These rains gradually taper off by the end of November. During December and January, the northeast monsoons again cause increased rainfall. This subsides between late February and late March while rainfall intensities increase during the month of April.

Rainfall distribution is generally influenced by elevation and aspect, the mountainous areas receiving the highest rainfall. Provincial rainfall data indicates that the first quarter of the alignment nearest GSC, lies within the driest area of South Cotabato and receives less than 1000 mm of precipitation annually. The next quarter of the alignment receives between 1000 mm and 1500 mm annually. The third quarter receives approximately 1500 mm to 2000 mm annually while the last portion, and highest in altitude receives 2000 mm to 2500 mm annually.

C. NATURAL RESOURCES

1. VEGETATION

There are no forested areas along this alignment. The lands in the area of the alignment are entirely agricultural, both in the lowlying areas, and in the hillsides. In the lowland areas, the primary crops are coconuts and corn, while on the upland plateau, mango plantations intercropped with corn are in evidence. Hillside corn cultivation and some banana plantations are the main crops in the upland areas.

2. PROTECTED AREAS

There are no protected areas identified along this alignment.

3. WILDLIFE

No unique habitat types or habitat for rare or endangered species were found along this alignment. Wildlife present within the alignment is well adapted to the presence of man since the area is already extensively used by humans. As a result, species along this Sector are unlikely to be sensitive to construction activities or increased road traffic.

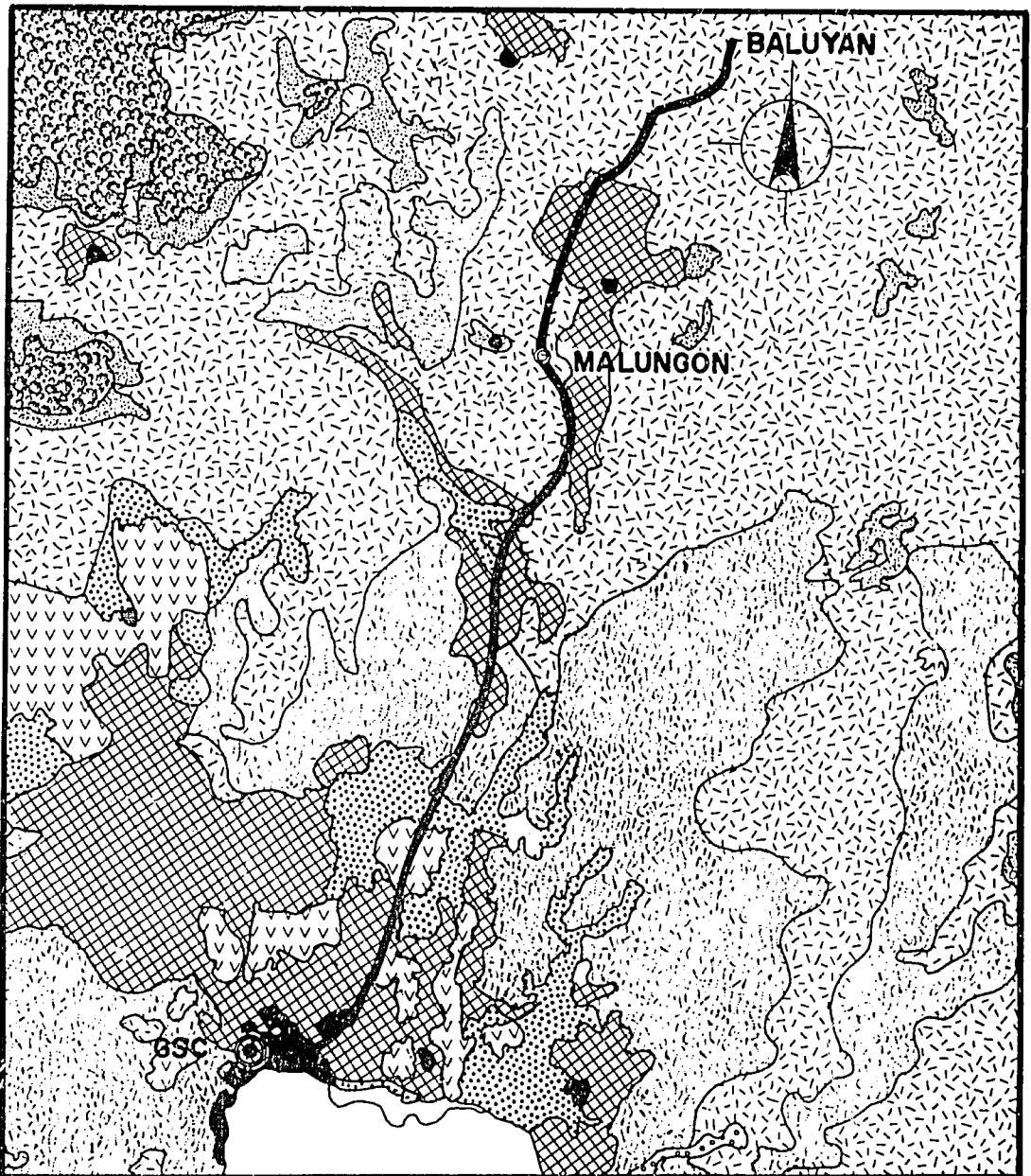
D. CULTURAL AND SOCIO-ECONOMIC RESOURCES

1. LAND USE AND SETTLEMENT PATTERNS

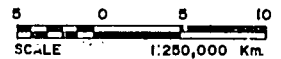
The entire alignment is situated in agricultural lands, most of which are classified as Intensive Land Use areas in land use maps as shown in Figure 1-3. The first portion of the road within GSC Municipality passes through areas of cereal cultivation dominated by corn, then through croplands mixed with coconuts and mango plantations. Within the Malungon Municipality, the road passes through cultivated areas mixed with brush and grassland. The major crops are corn with some fruit trees. Land use in Malungon and GSC is shown in Table 1-1.

2. INCOME AND EMPLOYMENT

South Cotabato Province ranks 33 among the 74 Philippine Provinces (including Metro Manila) with an average family income of P32,051 per year in 1988 (National Census and Statistics Office - NCSO). This value falls slightly short of the national average of P32,521 for the same period, but is above the regional average of P30,061 and represent a 6.5% total growth rate for the Province for the period 1985 to 1988. Provincial data indicates an acceleration of the annual economic growth during 1989 and 1990 to approximately 4.5 and 5 percent respectively. These values will be validated as part of the 1991 regional income and expenditure survey to be performed by NCSO.



LEGEND:



- | | | | |
|--|--|--|---|
| | DIPTEROCARP FOREST, CLOSED CANOPY > 50% | | COCONUT PLANTATIONS |
| | DIPTEROCARP FOREST, CLOSED CANOPY < 50% | | OTHER PLANTATIONS |
| | CULTIVATED AREA MIXED W/ BRUSHLAND & GRASSLAND | | ARABLE LAND, CROPS MAINLY CEREALS & SUGAR |
| | GRASSLAND COVERING > 70% | | CROPLAND MIXED W/ COCONUT PLANTATIONS |
| | BUILT-UP AREA | | CROPLAND MIXED W/ OTHER PLANTATIONS |

SOURCE: PCGS 2551
National Mapping and
Resource Information
Authority, 1997

GSC/LAGAO - MALUNGON - BALUYAN

FIGURE 1-3 LAND COVER MAP

TABLE 1 - 1
 LAND USES
 (IN HECTARES) 1989

| CLASSIFICATION | Malungon South Cotabato | | General Santos City South Cotabato | |
|------------------------------|----------------------------|-----------------------------|---------------------------------------|-----------------------------|
| | Area (In Has) | (%) over Total Land Area | Area (In Has) | (%) over Total Land Area |
| Cultivated Agricultural Land | 48320 | 50 | 25177 | 31 |
| Forest | 30100 | 31 | 4090 | 5 |
| Pasture | 16206 | 17 | 40647 | 51 |
| Residential | 133 | 0 | 1364 | 2 |
| Commercial/Industrial | 226 | 0 | 2257 | 3 |
| Others | 1010 | 1 | 6646 | 8 |

SOURCES: General Santos City in 1988, A Development Report, GSC South Cotabato, and Local Productivity Performance Measurement, Municipality of Malungon, South Cotabato, Municipal Planning and Development Office.

Average annual rural family incomes in GSC and Malungon are P21,099 and P20,056 respectively which is well below the Provincial, Regional and National averages. This may be a reflection of the fact that while the agricultural Sector in GSC Municipality is relatively productive, farm laborers and tenant farmers may make up a considerable portions of the population. In Malungon, the incomes may reflect the relatively low productivity of hillside farming.

3. PUBLIC SERVICES

According to 1988 Statistics, the Municipality of GSC has 56 elementary schools (42 public, 14 private), 16 secondary schools (5 public, 11 private), 7 hospitals, 14 doctors, 22 nurses, 17 midwives, 2 dentists and 150 active Barangay health workers. According to 1987 statistics, Malungon has 1 hospital, 39 schools, 7 doctors, 4 nurses, 1 dentist, 7 midwives and 153 Barangay health workers.

Electricity is supplied to users in the Province of South Cotabato by two electric cooperatives known as the South Cotabato Electric Cooperative or SOCOTECO I and II. SOCOTECO II supplies the Municipalities of GSC and Malungon.

4. TRANSPORTATION

The movement of goods and services is presently facilitated by the existing road but the current condition of the National Highway causes considerable time delay for traffic between GSC and Davao.

The nearest commercial airport is in GSC. Regular jeepney and bus service is available along the National Highway between GSC and Davao City.

5. DISPLACEMENT AND RELOCATION

Southern Mindanao has experienced significant migration, most probably from the more densely populated areas of the Central and Western Visayas. (World Bank, 1989) Overall indications are that net migration is from lowlands to uplands, as well as to cities; and from upland areas with high densities to those with low densities.

Settlement by Ilocano settlers began as early as 1914 along Sarangani Bay. A more significant influx began and in 1939 a number of settlers arrived led by General Paulino Santos, after whom GSC is named. The settlement of South Cotabato initially occurred along the coastline and valleys with upland migration occurring when tribal groups were displaced and as land in the lowlands became scarce. This settlement pattern is reflected in the present day where the valleys within GSC Municipality are fully utilized, whereas the uplands are considerably less densely settled. The population density in GSC Municipality is 438 persons per square kilometer while the population density in Malungon is 85 persons per square kilometer.

6. ARCHAEOLOGICAL AND HISTORICAL SITES

A preliminary review of existing archaeological sites prepared by the National Museum of the Philippines indicates that there are no sites of this nature along the Road Sector.

7. TRIBAL FILIPINOS AND ANCESTRAL LANDS

The numbers tribal peoples within the Zone of Influence (ZOI) of this Road Sector in GSC Municipality are minimal. Table 1-2 presents Barangay in GSC within the ZOI and the population of tribal people based on statistics from the Office of Southern Cultural Communities (OSCC).

In Malungon Municipality, OSCC statistics indicate there is a significant population of B'laan and small populations of Kalagan/Tagacnolo within Barangay along the road (Table 1-3).

There are no Civil Reservations for any of these tribal groups in either of the Municipalities.

E. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section addresses the potential impacts of the proposed road on physical, biological and cultural resources.

1. PHYSICAL ENVIRONMENT

a. Soil Erosion and Slope Stability

For the most part, Sector 11 will be improved within the existing alignment and little or no new cutting or filling will be required. However, Section 11A, a 2.9 kilometer Section known as the "killer curve", has been recommended for realignment and if this is undertaken, will require extensive earthwork. In addition, Section 11B is comprised of a number of very sharp curves which will require extensive rock cuts and some fill. However, materials are such that slope stability should not be of concern. For those areas requiring slope protection and reinforcement, the recommended method is gabions placements.

Five materials sources have been identified by DPWH including upstream of the Buayan River Bridge, Barangay Malandag; Buayan River Quarry, Barangay Tinagakan; Buayan River Quarry, Barangay Ligaya; Maribulan River Quarry, Barangay Maribulan and Buayan River Quarry, Barangay Buayan. It is common practice to obtain borrow materials from riverbeds. However, contract specifications should include methods such as the construction of coffer dams to reduce or eliminate additional siltation as a result of this practice.

Provisions should be made for notification of the Provincial Office of the Department of Environment and Natural Resources (DENR) when construction activities begin, so that their

TABLE 1 - 2
ESTIMATED POPULATION OF TRIBAL GROUP
PER BARANGAY, GSC, SOUTH COTABATO

| Municipality/Barangay | Population | | Percent (%) Over the Total Municipal Population in 1988 | |
|-----------------------|------------|--------|--|--------|
| | B'laan | T'Boli | B'laan | T'Boli |
| GENERAL SANTOS CITY | | | 248,147 ----- | |
| Apopong | 950 | 10 | 0.38 | 0.004 |
| Baluan | 110 | - | 0.04 | - |
| Buayan | 250 | - | 0.10 | - |
| Bula | 90 | - | 0.04 | - |
| Conel | 1,300 | - | 0.52 | - |
| Dadiangas | 1,200 | 50 | 0.48 | 0.02 |
| * Katangawan | 250 | - | 0.10 | - |
| Labangal | 800 | - | 0.32 | - |
| * Lagao | 50 | 20 | 0.02 | 0.008 |
| * Ligaya | 50 | - | 0.02 | - |
| San Jose | 3,400 | 250 | 1.37 | 0.10 |
| Siguel | 1,400 | 550 | 0.56 | 0.22 |
| Sinawal | 2,300 | 50 | 0.93 | 0.02 |
| Tambler | 1,100 | 100 | 0.44 | 0.04 |
| * Tinagacan | 100 | - | 0.04 | - |
| Upper Labay | 2,500 | 15 | 1.01 | 0.01 |
| Total | 15,850 | 1,045 | 6.39 | 0.42 |

* Barangay within Zone of Influence of the Road Sector.

Sources: Statistical Data on Cultural Communities
Office of the Southern Cultural Communities, GSC,
South Cotabato.
Population for GSC based on 1988 City Profile.

TABLE 1 - 3

ESTIMATED POPULATION OF TRIBAL GROUP
PER BARANGAY, MALUNGON, SOUTH COTABATO

| Municipality/Barangay | Population | | Percent (%) Over the Total Municipal Population in 1988 | |
|-----------------------|--------------|-----------------------|--|-----------------------|
| | B'laan | Kalagan/ Tagacnolo | B'laan | Kalagan/ Tagacnolo |
| MALUNGON | | | 81,723 ----- | |
| Ampon | 850 | 500 | 1.04 | 0.61 |
| Datalbatong | 1,200 | - | 1.47 | - |
| * Malandag | 3,490 | 50 | 4.27 | 0.06 |
| * Poblacion | 600 | 500 | 0.73 | 0.61 |
| * Banate | - | 400 | - | 0.49 |
| * Kawayan | - | 250 | - | 0.31 |
| Lower Mainit | - | 300 | - | 0.37 |
| Lutay | - | 150 | - | 0.18 |
| * Malalag Cogon | - | 300 | - | 0.37 |
| * Malungon Gamay | - | 500 | - | 0.61 |
| San Juan | - | 50 | - | 0.06 |
| San Miguel | - | 20 | - | 0.02 |
| San Roque | - | 250 | - | 0.31 |
| Talus | - | 300 | - | 0.37 |
| Tamban | - | 750 | - | 0.92 |
| Upper Bianga | - | 300 | - | 0.37 |
| Upper Lumabat | - | 1,200 | - | 1.47 |
| Upper Mainit | - | 950 | - | 1.16 |
| Total | 6,140 | 6,770 | 7.51 | 8.28 |

* Barangay within Zone of Influence of the Road Sector.

Sources: Statistical Data on Cultural Communities
Office of the Southern Cultural Communities, GSC,
South Cotabato.
Bureau of Agricultural Statistics Population Projection Data.

representatives may monitor activities, particularly the use of borrow sources and implementation of erosion control measures.

b. Hydrology

The present alignment has five existing bridges. One new bridge will be required in Section 11A if a new alignment is selected. Where bridges are located at the bottom of a slope, gabion reinforced ditching should be placed on either side of the road to accommodate and direct expected flows away from bridge abutments and to protect streambanks. Bridges will be constructed to the 50-year flood hydraulic design capacity.

There are 11 box culverts and 134 pipe culverts along the present alignment. Some will require replacement; of those retained, all will require extension as a result of increased right-of-ways; and most will require cleaning. Additional culverts may be required in Section 11B, where a thorough drainage inventory could not be completed. Box culverts will be designed to the 25-year designed flood and pipe culverts to the 10-year design flood.

No impediments to existing natural drainage patterns will be created by the proposed construction which might endanger persons or property. However, provisions will be made in the contract for maintenance of these structures.

c. Air Quality

Because this is a gravel road, air quality in the vicinity of the road is affected by fugitive dust. Some additional fugitive dust will be generated during construction activities effecting residents of Barangay immediately adjacent to construction areas. Mitigation measures may be used for those areas affected during construction. These include covering stored materials; providing temporary paved parking areas for workers; spraying exposed areas with water or environmentally safe chemical dust suppressants and vegetating or spraying dust suppressants on spoil areas.

d. Waste Management

Construction related impacts could occur as a result of improper disposal of solid waste (both construction debris and refuse generated in construction camps) and accidental spills of environmentally harmful materials such as petroleum products.

The construction contractor, as a provision of the contract should be required to develop and implement a solid waste management plan for the duration of construction activities that ensures safe and appropriate handling of all wastes. Environmentally hazardous materials used during construction should be stored in designated areas which have been improved to accept such storage, and in containers designed to contain spills and prevent contaminated runoff.

The Provincial office of DENR should be notified regarding proposed locations of disposal areas and storage areas for hazardous materials.

2. NATURAL RESOURCES

The proposed road improvements will not directly impact forested areas as there are none remaining within the alignment. Field observation confirmed that habitat requirements for rare and endangered species in the Philippines are not met along the alignment thus rare or endangered species are not expected to be present. Since the area is already utilized by humans, the wildlife has most likely accepted human disturbance and any increase in activity during or after construction should not have a significant impact.

3. CULTURAL AND SOCIO-ECONOMIC RESOURCES

a. Land use and Settlement Patterns

Based on the stability of the existing settlements along the alignment, no significant effects on land use or settlement patterns is expected.

b. Income and Employment

Construction activities will result in increased employment for unskilled and semiskilled labor. The lowering of transportation costs will effect the local economy by reducing commodity prices and will also significantly aid the economic development of the entire route by reducing transportation costs to better markets in GSC. In addition, the improvement of this road will facilitate transportation of passengers and goods between GSC and Davao, opening addition markets and supply sources for residents of South Cotabato.

c. Public Services

During construction there may be increased demand for food and lodging by the labor force. Most of these requirements could be met in GSC.

d. Displacement and Relocation

The road improvements are to take place for the most part, within an existing alignment. However, because a significant amount of development in the form of bamboo constructed buildings have taken place within the existing right-of-way, these structures will require removal. Specifically, Barangay Banate has been built up immediately adjacent to the roadway and becomes congested with traffic. This unsafe situation will be aggravated when the road is designed for higher speeds. The proposed improvements may require considerable displacement, but these buildings could be moved to a nearby location.

e. Archaeological and Historical Sites

Disturbance of artifacts is likely to be minimal since the route has been previously disturbed. Any buried cultural material discovered during construction will be treated in accordance with Presidential Decree No. 374 (1974), amending certain sections of Republic act No. 4846, otherwise known as "The Cultural Properties Preservation and Protection Act," which contains mandatory procedures for chance finds during construction projects whereby:

"When excavators shall strike upon any buried cultural property, the excavation shall be suspended and the matter reported immediately to the director of the National Museum who shall take appropriate steps to have the discovery investigated and to insure the proper and safe removal thereof, with the knowledge and consent of the owner. The suspension shall not be lifted until the Director of the National Museum shall allow it."

The construction specifications will contain provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries. In addition, a Memorandum of Agreement between DPWH and the National Museum is being formulated to coordinate the implementation of rescue and recovery procedures.

f. Tribal Filipinos and Ancestral Lands

The tribal Filipinos that may be directly affected by the proposed road improvements are upland farmers. Any benefits that are realized as a result of decreased transportation costs will also benefit those living adjacent or near the road including tribal people.

F. ALTERNATIVES TO THE PROPOSED PROJECT

1. NO ACTION ALTERNATIVE

Although no direct environmental impacts are expected if the proposed improvements are not implemented, the significance of this road to the economy of Southern Mindanao would indicate that continued deterioration is an unacceptable alternative.

2. BITING ALTERNATIVES

The project consists of rehabilitation of an existing alignment for most of its length. However, some alignment changes have been suggested in order to meet grade and safety standards. Effects on natural resources would be minimal with the exception of effects on slope stability for which mitigation measures have been proposed. New right-of-ways will be required which will necessitate displacements of individual dwellings, particularly in Banate.

3. SHORT-TERM VS. LONG-TERM PRODUCTIVITY

The short-term impacts of construction and the consumption of water, energy and other resources are minimal when compared to the anticipated economic and social benefits to be derived from the road improvements. Construction of the project will result in the consumption of fossil fuels by power construction equipment; building materials for the road, construction camps and yards; water and electric power. This consumption is of short-term duration and is not significant within the context of the national economy and benefits of the project.

4. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible or irretrievable commitments of resources to the project are expected to be minimal. The improvements will be to an existing road and most of the work will be confined to the existing right-of-way. The project will take very little new land and will not change existing land use patterns.

Petroleum products, steel, cement, sand, gravel and aggregate are resources to be used during construction that are resource commitments irretrievably lost to the future. Future social and economic benefits, and energy use savings, of the road render these losses negligible.