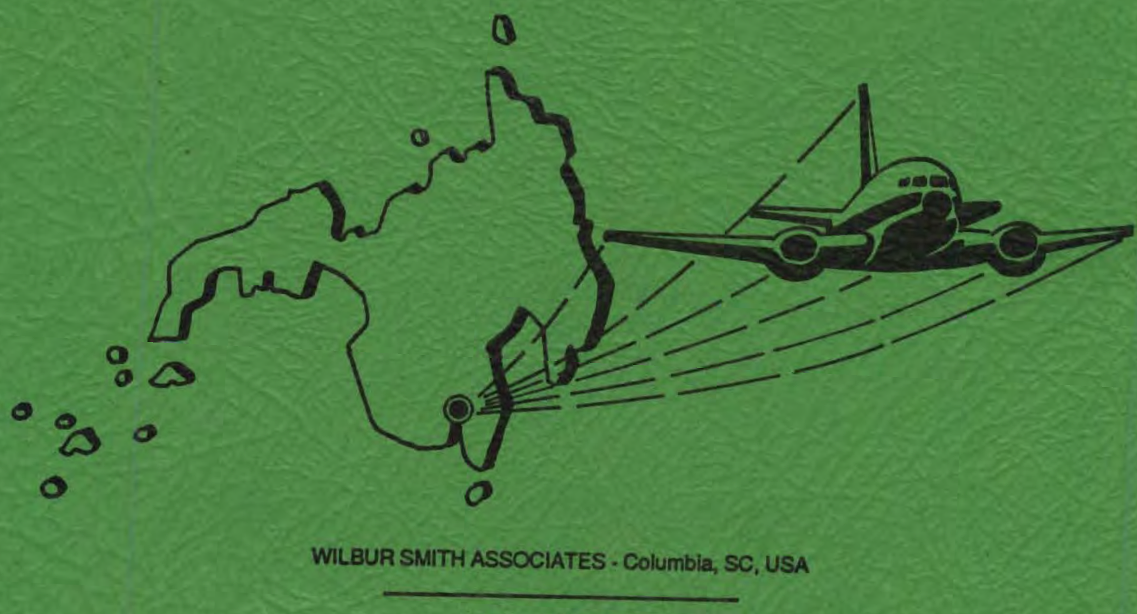
FY 1991- 4 - Philippines

US AGENCY FOR INTERNATIONAL DEVELOPMENT
in cooperation with
REPUBLIC OF THE PHILIPPINES
COMMITTEE ON OFFICIAL DEVELOPMENT ASSISTANCE

(USAID CONTRACT NO. 492-0452-C-00-0100-00)

GENERAL SANTOS CITY AIR SERVICE IMPROVEMENT FEASIBILITY STUDY

ENVIRONMENTAL ASSESSMENT/ ENVIRONMENTAL IMPACT STATEMENT



WILBUR SMITH ASSOCIATES - Columbia, SC, USA

In Association with
TCGI ENGINEERS - Manila, Philippines
SYCIP, GORRES, VELAYO & CO. - Manila, Philippines

May 1991

Wilbur Smith Associates, et al
General Santos City Air Service Improvement Feasibility Study
Environmental Assessment / EIS (Phil.) prepared for USAID Manila

FY 1991 - 4 - Philippines

Check List for Environmental Assessment Documents

EA/EIS CATEGORY		COMMENTS
Title Page	✓	
Table of Contents	✓	
Acronyms and Abbreviations	✓	
Weights and Measures	✓	
EXECUTIVE SUMMARY	✓	
CHAPTER 1:PROJECT DESCRIPTION 1.1. **PROJECT SETTING**		
1.1.1 Location	✓	good
1.1.2 Purpose	✓	"
1.1.3 Stage in Planning Process; relationship to AID agency policy, country strategy and economic development objectives	✓	relationship to AID excellent good
1.1.4 Summary of USAID and GOP environmental procedures	✓	excellent
1.2 **EXISTING FACILITIES AND CONDITIONS** (Where existing infrastructure/plant is to be improved, added to or otherwise significantly altered, a description of the relevant existing facilities, including energy and other utilities will be included.)	✓	good
1.3 **PROPOSED ACTIVITY/IMPROVEMENT/FACILITY(S)** 1.3.1 Layout and Description	✓	Summarized in columnar/table format and text - good
1.3.2 Construction Activities Schedule Labour and Base Camp/Housing Requirements Location of Project Activities and Support Facilities (provide map(s) at appropriate scale)	✓ ✓	ok not directly addressed ok
1.3.3 Operation and Maintenance Labour and Material Requirements (generally); refer to engineering and/or economic analyses for relevant figures;	✓	ok also contingency plans

a

1.3.4 Abandonment Plans (i.e. post-construction restoration of environmental conditions; relocation requirements for people/facilities; eventual decomissioning (as relevant)	✓	This section very relevant - old/new airports good!
1.4 **PROJECT ALTERNATIVES** (depending upon the project, this may be considered in several ways, e.g. "no action"; alternative sites; alternative types or scale of facilities/activities; alternative technologies; staged implementation.)		increased operations 7-8/day Davao Rd. Improvement - cargo Expand Buayan airport - relocation Apopong/Sinawal site - fatal flaws
CHAPTER 2 ENVIRONMENTAL SETTING **2.1 INTRODUCTION** 2.1.1 Field Study Methodology (Summary of approach, methods and data and other information constraints/limitations--elaborated in Appendix)		ok
2.1.2 Life of Project (relevant to baseline, monitoring data, indicators, impact significance)		ok
2.1.3 Definition of Study Area		good!
2.2 CURRENT LAND USE AND REGIONAL (SPATIAL) PLANNING		Very good!
2.3 SOCIO-ECONOMIC CONDITIONS OF THE PROJECT SITE 2.3.1 Demography and Migration Patterns		folk life, p. 38 ok - some avail.
2.3.2 General Character of the Economy and Principal Sources of Employment (including private/public division)		ok
2.3.3 Quality of Life Indices		not explicitly
2.3.4 Transportation, Telecommunication and Power Networks and Support (relation to the project)		good
2.3.5 Education, Health and Social Services		ok
2.3.6 Ethnic and Tribal Factors (where relevant)		Very little
2.4 PHYSICAL ENVIRONMENT 2.4.1 Climate		ok
2.4.2 Geology (including volcanology, seismology, etc.)		ok soils sandy, erosion prone

Energy & Power: likely to be a future constraint

NSO

See p.51 for comm

2.4.3 Air Quality and Noise	✓	ok; dust biggest problem due to soil
2.4.4 Water Supply and Quality		Sand good filter; limestone is not extremely deep gw table
2.4.5 Terrestrial Ecology	✓	Ipil-Ipil comment, p.58
2.4.6 Aquatic/Marine Ecology		
2.4.7 Solid and/or Hazardous/Toxic		A dump exists near site
2.4.8 Other Environmental Services (watershed, biodiversity, potential touristic, etc.) Wastes Pre-existing		none-mentioned
2.5 AESTHETIC AND CULTURAL CONDITIONS 2.5.1 Aesthetic elements of the environmental setting 2.5.2 Archaeological and Unique/Special Cultural Resources	✓	ok
2.6 FUTURE CONDITIONS WITHOUT THE PROJECT	✓	ok
CHAPTER 3 ENVIRONMENTAL IMPACTS **3.1 Land Use and Regional Planning Impacts**	✓	Very good: Figure 9 road legend not provided. ensure no squatters on land
3.2 Socio-Economic Impacts 3.3.1 Demographic and Migration Impacts	✓	ok. not very in-depth on migration
3.3.2 Economic and Employment (including private/public sectors and cross-sectoral impacts)	✓	
3.3.3 Quality of Life Impact	–	indirect
3.3.4 Transportation, Telecommunication, Power and Energy Impacts → power problem but airport not signif	✓	heavy trucks, p.72 – congestion of secondary impact – GVC-Mactan rd. Also turning
3.3.5 Education, Health and Social Service Impacts	–	no mention except strange Nipa huts/set blast
3.3.6 Ethnic and Tribal Impacts	✓	
3.4 PHYSICAL ENVIRONMENT 3.4.1 Climate	–	
3.4.2 Geology and Hydrogeology		
3.4.3 Air Quality and Noise	–	dust. noise above permissible standards for 10 hours. grow the plan
3.4.4 Water Supply and Quality	–	who does water quality testing; see p.93 – undeveloped state
3.4.5 Terrestrial Ecology		
3.4.6 Aquatic/Marine Ecology		
3.4.7 Solid and/or Hazardous/Toxic Wastes		

3.4.8 Other Environmental Services (watershed, biodiversity, potential touristic, etc.) Pre-existing		
3.5 AESTHETIC AND CULTURAL CONDITIONS 3.5.1 Aesthetic and Amenities 3.5.2 Archaeological and Unique/Special Cultural Resource Impacts	Th –	 uncertain
3.6 ASSESSMENT OF OVERALL IMPACTS 3.6.1 Short and Long Term Impacts on Resource and Environmental Productivity 3.6.2 Cross-sectoral Impacts and Effects on Other Projects (USAID, host country and/or other donors) 3.6.3 Cumulative and Irreversible Impacts	✓ ✓ ✓	good discussion "developability" ? good good
CHAPTER 4 COMPARISON OF ALTERNATIVES AND RECOMMENDATION	✓	good discussion
CHAPTER 5 MANAGEMENT, MITIGATION AND MONITORING (Environmental Plan of Action) **5.1 MITIGATION AND MONITORING OF PHYSICAL IMPACTS**	✓	AID should review fulfillment of special zoning ordinance provisions
5.2 MITIGATION AND MONITORING OF SOCIO-ECONOMIC IMPACTS		
5.3 MITIGATION AND MONITORING OF CULTURAL IMPACTS	✓	recommends archaeological survey
5.5 MITIGATION AND MONITORING OF CUMULATIVE IMPACTS	✓	encroaching out-landers
5.6 ENVIRONMENTAL PLAN OF ACTION (include scheduling requirements where necessary)	✓	good
APPENDICES **A. Methodologies**		
B. Contact Lists		
C. References		
D. Technical information		

E.	**Summary of Scoping Reports and Other Public Comment**		
F.	**List of Assessment Preparers**(qualifications, experience, contact addresss, etc.)		

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Rec'd
6-19-91

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ACRONYMS AND ABBREVIATIONS

ADB: Asian Development Bank
ANR: Agricultural and Natural Resources (Strategy)
ATO: Air Transport Office

CEB: Mactan International Airport at Cebu
CFR: Crash, Fire and Rescue (Building)
CGY: Cagayan de Oro Airport
CODA: Committee on Official Development Assistance

DENR: (RP) Department of Environment and Natural Resources
DME: Distance Measuring Equipment (NavAid)
DOTC: Department of Transportation and Communications
DOTFAA: (US) Department of Transportation, Federal Aviation Administration

EA: Environmental Assessment
ECC: Environmental Compliance Certificate
EIS: Environmental Impact Statement
EMB: (RP) Environmental Management Bureau

FAA: (US) Foreign Assistance Act
FBO: Fixed Base Operator

GA: General Aviation
GES: General Santos City Airport

HIRL: High Intensity Runway Lights (Navaid)

ICAO: International Civil Aviation Organization
INM: Integrated Noise Management Model

MITL: Middle Intensity Taxiway Lights (NavAid)
MDP: Mindanao Development Project
MNL: Ninoy Aquino International Airport at Manila

NAIA: Ninoy Aquino International Airport
NavAid: Navigational Aid
NEDA: (RP) National Economic Development Administration
NEPA: (US) National Environmental Policy Act
NEPC: (RP) National Environmental Protection Council
NPC: National Power Corporation

PAL: Philippine Airlines
PAPS: Philippine Assistance Program Support

ROW: Right of Way
RP: Republic of the Philippines
RVR: Runway Visual Range (NavAid)

SGV: Sycip, Gorres, Velayo and Co.

V/C: Volume-to-Capacity (Ratio)
VOR: Very High Frequency Omnidirectional Radio Range (NavAid)
WSA: Wilbur Smith Associates, Inc.

USAID: United States Agency for International Development

WEIGHTS AND MEASURES

Centimeter: 0.01 meter, 0.3937 inch
dBA: A-weighted decibel
Hectare (ha): 10,000 m^2, 2.47 acres
Kilometer (km): 1,000 meters, 3,280 feet, 10 inches
Kilovolt (kv): 1,000 volts
Kilowatt (kw): 1,000 watts
L_{dn}: Day-Night Averaged Noise Level
Megavolt Amperes (MVA): 1 million volt-amperes
Megawatt (MW): 1 million watts
Meter (m): 39.37 inches
Square meter (m^2): one meter x one meter area
Cubic meter (m^3: one meter x one meter x one meter volume

PROJECT DESCRIPTION

The proposed project is a Feasibility Study to Improve Air Service to General Santos City. It is a project of the United States Agency for International Development (USAID) in cooperation with the Republic of the Philippines (RP) Committee on Official Development Assistance (CODA) and the Department of Transportation and Communications (DOTC) for the Philippine Assistance Program Support (PAPS) project.

The purpose of the Feasibility Study is to determine air service requirements to the design year 2015 for the General Santos City influence area (South Cotabato Province), and the most effective and feasible means of meeting those requirements on the basis of engineering, economic, environmental and socio-cultural considerations.

The purpose of the ultimate air service improvement project is to support future agricultural and industrial development of General Santos City and the surrounding area of South Cotabato Province, Mindanao, as planned by the RP.

The current airport not only cannot meet existing cargo demand, its service capabilities fall short of projected 1995 daily passenger (roughly 300) and cargo (23 metric tons) demand. The condition of airport facilities is such that existing service may not be sustainable for any length of time, even with planned improvements. The project is thus needed to accommodate existing and future air service demands of the General Santos City influence area.

General Santos City is located in South Cotabato Province, the southernmost province of Mindanao, in the Republic of the Philippines. The existing airport is located near the City's eastern boundary with the Municipality of Alabel, adjacent to the Buayan River, which forms the boundary.

The proposed airport site is located in in the southwest portion of the City in upper Tambler (now Fatima), near its border with Barangay San Jose, and is about six kilometers (km) from the National Highway, which roughly follows the Sarangani Bay coastline. The site occupies roughly the center of a government-owned parcel leased for pasture by the Alcantara Family (Alsons Development and Investment Corp.). The Banwalan River is to the south, and the Makar River is to the north. The project site crosses the road to San Jose, requiring its relocation. The proposed access road alignment runs in an almost straight line from the National Highway to the center of the proposed site, near the proposed location of the airport terminal building. The alignment passes south of Mindanao State University (MSU) and the Upper Tambler Resettlement Area. The site has rolling terrain, and is unmanaged pasture with no structures except a ranch house, well and ancillary buildings near the approximate centerline of the proposed runway alignment.

The airport is one of three USAID/PAPS infrastructure projects under the Mindanao Development Project. The other two are the Makar Wharf expansion and an agro-industrial/fish processing plant near the mouth of Banwalan River at Sarangani Bay in Tambler. The MDP project summary states that each capital subproject will be studied to determine whether it is independently feasible on technical, financial, economic and environmental grounds. The findings of the Preliminary Report are that the project would be independently feasible. However, operating costs would not be covered by revenues, because of an outdated tariff structure (primarily the fees charged to Philippine Airlines for airport use), which is of lesser significance with PAL operating as a government owned utility. If PAL is sold and must operate on a private basis, as is being discussed, a rational tariff structure would be critical. The Final Report of the Feasibility Study (WSA, 1991) addresses potential approaches to achieving that end.

Investigations of cargo markets for the Preliminary Report identified substantial potential for expanded and new production of perishable agricultural commodities, aside from fish, such as cut flowers, asparagus and broccoli. Because adequate means (air cargo capacity) does not exist to rapidly deliver such goods to market, production has not taken place.

Taken singly, the airport project would meet the goal of the MDP to support private-sector-led growth in General Santos City/South Cotabato Province; taken together with other MDP projects, that support is strengthened.

PROJECT CHARACTERISTICS

The project, an airport designed to international standards, has been designed in two phases to meet near-term and long-term demand. While the study period would not extend beyond the year 2015, the Master Plan developed as part of the Feasibility Study addresses potential requirements so that land control planning for future potential expansion can be incorporated. Phase I is 1995 (the first year of operation) to 2000, and Phase II is 2000 to 2015. Airport construction for Phase II could occur anytime during the period, and would depend on the need for the associated improvements.

Phase I - 1995 to 2000

The Phase I facility would have one runway, two taxiways and an apron, a terminal and other buildings and a parking lot. The project site intercepts the road to San Jose and thus requires the relocation of that road. A 6-km access road from the National Highway would also be part of the project. The project would include a septic sewer system of three tanks, a drain field, a drainage collection system, a well for potable domestic water, construction of a transformer in an as-yet undetermined location, extension of electricity to the site, and a backup diesel generator. The terminal building would have flood lights mounted on it and directed at entryways for security. Initial navigational aids for the airport would include Precision Approach Path Indicator (PAPI) lights for both runway approaches, a Very High Frequency Omnirange/Distance Measuring Equipment (VOR/DME) facility and wind direction indicators at each end. All would be located on site. The PAPI lights are only visible at high altitudes.

The runway would be 2,400 m long and 45 m wide, with an apron and two taxiways. The parking lot would have 96 parking spaces.

The airport would have seven buildings: the terminal building; a two-story flight service station; a cargo building; a maintenance building; a generator building; cold storage; and a Crash, Fire and Rescue (CFR) building to house up to four fire trucks and one ambulance and staff. Buildings would be steel, wood and concrete structures with spread concrete footings. A refueling facility (tank farm) with three double-walled, 10,000-gallon, above-ground tanks would be installed. The tanks would be set into a spill containment structure, and surrounded by a fire wall. Piping would be stainless steel, and the tanks would have underground piping out to the aircraft parking apron to allow refueling of aircraft directly from the tanks. The refueling facility would be similar to that at the Davao Airport. The refueling facility would be built, operated and maintained by PAL or a private company (fuel supplier fixed base operator, or FBO). Construction, operation, maintenance and inspection of the tank farm would be in conformance with the National Fire Protection Association Code. The maintenance building would be equipped with a drain leading to a fuel/water separator. Fuel or oil waste would be collected and stored until it could be disposed of properly.

Space for food service facilities would be provided within the terminal building, although there may also be canteens located on the east side of the terminal building (outside), as at the current airport.

The new facility would be completely fenced with chain link fencing around the perimeter. Additional security fencing would be located within the perimeter to control access to the runway.

An access road of about 6 km would be constructed from the National Highway to approximately the center of the site, where the terminal building would be located. The access road would be a two-lane, paved road with shoulders. The proposed right-of-way (ROW) is 60 m to allow the possibility of future widening. Drainage would either be rock- or concrete-lined ditches.

Phase II - 2000 to 2015

In Phase II, a cargo ramp and expansion to the terminal building would be constructed to accommodate increased cargo and passenger demand levels. The parking lot would be expanded to provide a total of 168 spaces. Other potential additions include a 4,000-gallon, above-ground Avgas supply system, depending on the demand for general aviation facilities, hangars taxiways to the hangars. Such hangars would be steel and sheet metal with concrete floors.

Phase III - 2015+

Phase III concerns airport facilities as they might look after the Master Plan planning year horizon of 2015. While this report does not address the impacts of such development, because it is beyond the scope of the project, some effort has been made to address potential facility needs in order to determine how much area around the airport site should be protected or reserved by the government for future airport development. This is sound airport planning practice. Control or reservation of additional area does not require its purchase, and does not require that the land lie undeveloped, only that such development as does occur be compatible with very long-term airport requirements.

For this reason, although projections show that 263 hectares (ha) is adequate for the foreseeable future, the Master Plan recommmends the set-aside or development control over additional land around the airport site, a total of 600 ha, including the airport. This would accommodate the maximum expansion of a second runway.

Projected construction past the year 2015 includes a control tower, runway extension of 600 m (to 3,000 m); additional hangars; taxiways to the hangars; a General Aviation

(GA) FBO; and Category I navigational aids (instrument landing system: localizer, RVR, outer and middle marker, glideslope unit, simple approach lights) and high intensity runway lights and medium intensity taxiway lights.

CONSTRUCTION ACTIVITIES

Construction for Phase I would be the most intensive and is projected to last about 24 to 36 months, including the road. Temporary structures during construction include those associated with the construction camp: security fencing; security shed at the construction camp entrance; equipment and materials storage sheds; construction headquarters trailer(s); and day use buildings or temporary housing for workers. Construction vehicles would be stored on the site when not in use, and several generators would be brought to the site to provide needed power for equipment. It is assumed that an aggregate crusher plant and concrete batch plant would be established on the site to provide these types of construction materials.

Construction is assumed to occur 24 hours per day, with two 12-hour shifts. Maximum construction employment is estimated at about 260 workers in a 24-hour period, and minimum at about 24. The average number of workers over a 24-hour period is estimated to be about 150. The General Santos City area labor pool is expected to be able to supply the required workers, although some highly technical positions, such as concrete paving machine, batch plant and crusher operators, may need to be brought in from Manila.

Phase II construction is estimated to require a total of six months, assuming all improvements were installed at one time. In fact, improvements could occur at different times within the Phase II period between 2000 and 2015.

Locally available construction materials include embankment borrow materials, fine and coarse aggregates, base course materials, lumber, water, etc. Materials such as reinforcing steel, precast concrete items or corrugated metal pipe and lighting fixtures would normally come from Manila or from overseas, while cement would be obtained from Davao. The City has adequate supplies of fuel and lubricants and repair shops. It is assumed that the Makar River Quarry would be the source of sand and aggregate.

OPERATION AND MAINTENANCE

Operation

The Feasibility Study and Master Plan can only address actual physical facilities associated with the project. Operation and maintenance would be the responsibility of the Air Transport Office (ATO) or possibly a private contractor. Nonetheless, this report addresses these issues to the extent they can be reasonably foreseen.

The airport would operate seven days per week during daylight hours; the design does not include lighting for nighttime operations.

Currently, airport operations include two to three flights per day, total 19 per week, of the 54-seat Fokker-50 aircraft, which carries passengers (an average of 42 per flight) and minor amounts of cargo, about 455 kilograms (kg). The flights operate between General Santos City, Iloilo and Cebu, where connections can be made to Manila. Airport conditions, such as limited runway length and strength, poor pavement condition, small terminal building located in the clear zone, and lack of refueling facilities, do not permit the use of larger, heavier aircraft than the Fokker-50.

The new facility would be constructed to accommodate the Fokker-50, Airbus 300, Boeing 737 and C-130 aircraft.

Future daily flights and annual operations were estimated on the basis of passenger and cargo demand. In 1995, three flights per day are projected; in 2000, five are projected; and in 2015, seven are projected. Note that one flight equals two operations: landing and take-off. Annual flight operation projections are 2,190 in 1995, 3,650 in 2000, and 4,610 in 2015. Annual cargo demand is projected at 8,300 metric tons (MT) in 1995, 17,095 MT in 2000, and 26,195 MT in 2015.

Airport employment is projected to increase from the current 34 to approximately 85 ATO or other airport operator in 1995; to about 94 in 2000; and to about 118 in 2015. This does not include employees of airlines operating from the airport (PAL now had 13 employees at the General Santos City Airport).

Maintenance

Maintenance would be the responsibility of ATO or a private contractor. The recommended project design is, however, based on the recognition of limitations on local maintenance resources and observations of local capabilities and practices.

Runway maintenance is most critical for an airport facility in terms of its ability to operate safely. Runway and other paved areas are proposed to be constructed of Portland Cement Concrete Paving (PCCP) because of the familiarity and capability of the local workforce with concrete construction practices and its low maintenance requirements.

The Terminal, CFR and Flight Service Station buildings would be similar in construction to the existing terminal building, which is a combination of concrete block, metal and wood. The cargo, cold storage, generator and maintenance buildings would most likely be concrete and/or metal structures. All buildings would thus be expected to require only routine minor maintenance, and be well within local maintenance capabilities.

The perimeter fence is proposed to be of chain link, which is available locally. The primary problem with maintenance of the fence is its length, but regular surveys would overcome this.

Control of eroson on nonbuilt areas would be by a combination of vegetative groundcover and a drainage control system. The runway and roadway edges would be covered with a Double Bituminous Surface Treatment (DBST) to reduce erosion and dust generation.

SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Table 1, following, lists environmental impacts by topic, and any mitigation mesures. No significant adverse effects that cannot be mitigated have been identified for the project. Noise from construction of the access road would adversely affect about 10 residents and several businesses along a portion of the alignment near the National

Highway, but this could be mitigated by limiting construction of this section of the road to daylight hours.

Dust generated during construction could adversely affect surrounding uses, but this could be mitigated by watering down areas where earthmoving was occurring and covering bare soils with mulch, providing a Double Bituminous Surface Treatment for construction roads, and other measures.

Traffic on the access road and aircraft operations would significantly increase ambient noise levels, because current ambient levels are very low, reflecting the rural nature of the area. A change of five dBA is usually considered significant. While the increase would be significant, no adverse impact from air operations would occur because of the limited number of flights and the distance to sensitive receptors. No existing uses would be significantly adversely affected by traffic noise increases. However, if future residential development occurred along the access road, it could be subject to noise in excess of National standards. This could be mitigated by establishing a commercial zone along the access road in which residential development was not permitted. This and other recommended land use planning/zoning revisions would not substantially alter the amount of land designated for residential uses.

The project would contribute to several adverse impacts from cumulative development. By the year 2015, congestion could begin to occur at the intersection of the access road with the National Highway. Turning movements at this intersection could generate congestion in earlier years. Both of these conditions could be mitigated by restriping the intersection to favor the access road as the primary route, if it represents the major movement, or other intersection geometry changes.

The project would contribute to existing power shortages and solid waste disposal problems. The project would carry risks relating to crash landings and fuel spills. These are unavoidable impacts of the project but are not significant because of their limited nature.

Table 1: Summary of Environmental Impacts and Mitigation Measures

Impact	Mitigation	Residual Impact
<u>Land Use and Regional Planning</u>		
Potential encroachment of incompatible land uses could occur near the airport that could interfere with air navigation by generating smoke, dust, glare, or emissions of electromagnetic interference. A potential hazard to flight operations could occur if structures that violate height restrictions in flight patterns are built. High investment or permanent type development could occur in the area that may be needed for future airport expansion.	Identified[1]: A recommended land use plan has been developed that defines a special permit district on and around the airport, and revises land use planning and zoning districts in the site vicinity. It is recommended that General Santos City amend its Comprehensive Plan and Zoning Ordinance to incorporate this plan, and establish an airport special permit district. Applications for development in the district would be reviewed to ensure that only compatible uses were developed around the airport. Within the expansion reserve area, permanent, high-investment uses would be prohibited. Residential and related uses would be prohibited in the special permit district.	Not significant. Monitor
Residential uses are now permitted in the area that would be adjacent to the access road, although the area currently contains little development. Future residential development could be subjected to noise levels in excess of National standards.	The recommended land use plan incorporates a commercial district along the access road in which it is recommended that residential uses be prohibited.	Not significant.
Runway incursions by people, livestock or other domestic animals entering aircraft ground operational areas could occur.	Proposed[2]: the project site would be surrounded by a chain link fence.	Not significant.
Without careful and comprehensive planning, inappropriate uses could be established at the Buayan airport site after the opening of the airport at Tambler.	Identified: It is recommended that the Buayan site be turned over the General Santos City for development of residential (particularly human resettlement), agricultural and fishing-related uses.	Not significant.
<u>Transportation</u>		
Construction truck traffic would cause congestion at the intersection of the airport access road with the General Santos City-Maitum (GSC-Maitum) Highway.	Proposed: Flagmen would be stationed at the intersection to manage traffic flow.	Not significant.
Airport traffic turning movements could result in congestion at the intersection during airport operation.	Identified: DPWH should monitor traffic flow and, if congestion occurs, should apply traffic engineering or traffic management techniques.	Not significant.

[1] Identified: Identified by this Report [2] Proposed: Proposed as Part of the Project

Table 1: Summary of Environmental Impacts and Mitigation Measures, Continued		
Impact	Mitigation	Residual Impact
Transportation (Continued)		
The project would generate 400 vehicle trips in 1995, 600 in 1000 and 1,230 in 2015. Existing travel in the area (MSU, Upper Tambler, San Jose) would probably divert to the airport access road. This traffic is estimated to be about the same as that from the airport. Other development would occur along the access road in future. Cumulative development (airport, existing diverted and new development) would contribute to congested conditions at the intersection of the access road with the Highway and on the Highway itself in 2015.	Identified: See the measure identified above concerning monitoring of the intersection for congestion and implementing traffic engineering techniques.	Not significant.
The project would result in decreased travel distances of 8 to 16 km for airport-related trips from the north and west of the City, and increased travel distances of the same lengths for airport-related trips from central and east areas of the City. Traffic from the north and west would no longer need to travel through the congested central city area to reach the airport.	None identified.	Not significant.
The project would provide improved access via a paved road for MSU and possibly the Upper Tambler Resettlement Area and San Jose.	None needed.	Beneficial.
Climate, Meteorology and Air Quality		
Project construction would generate dust from earthmoving, road construction and construction vehicles moving over unpaved surfaces from the quarry site and along the proposed access road. The airport site and quarry are located distant from development. Prevailing winds are from the north and south, and no development is located north or south of the quarry and airport sites. Thus windborne dust would be unlikely to affect development.	Proposed: Construction areas would be sprinkled to reduce dust. Exposed soils would be covered with mulch, silt fences would be used, and graded areas would be revegetated as soon as possible.	Not significant.
Dust from construction of the access road could affect adjacent development.	Identified: A double bituminous surface treatment should be placed on the airport access road during construction. This would later be replaced with a concrete surface. Advance notice should be given to occupants of areas near construction of when construction is about to begin and the likely duration.	Minor adverse.

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Table 1: Summary of Environmental Impacts and Mitigation Measures, Continued		
Impact	Mitigation	Residual Impact
<u>Climate, Meteorology and Air Quality (Continued)</u>		
Engine exhaust emissions from aircraft operations would be negligible. Dust and vehicle emissions would occur on the access road. The vehicle fleet in General Santos City is largely lacking in adequate emissions control devices. This problem cannot be addressed by the project.	None identified.	Not significant.
<u>Noise</u>		
Noise generated by construction of the airport, which would be 24 hours daily, would not be disturbing because of the distance (a minimum of 1 km) from the nearest adjacent development. Construction of the portion of the access road near the GSC-Maitum Highway could be disturbing to residents there.	Identified: Construction of the access road near the Highway, within 100 m of adjacent development, should not take place during nighttime hours.	Not significant.
Aircraft operations would change ambient noise levels but would not produce noise in excess of 65 dBA. All uses are considered compatible with noise below 65 dBA.	None identified.	Not significant.
If residential development occurred along the access road, it could be subjected to nighttime noise levels from traffic from cumulative development in excess of National standards (the airport would not operate at night).	Identified: The recommended land use plan identifies a strip of commercial zoning along the access road in which residential uses would be prohibited.	Not significant.
<u>Socio-Economic Conditions</u>		
Demography and Migration: The project would induce in-migration for construction and, indirectly, through the stimulus it would provide by supporting overall economic growth. Some of this in-migration could be take the form of squatter development. The project would not result in the conversion of residentially designated land, and changes proposed in the recommended land use plan would not reduce the amount of residentially designated land. The project would release 62 ha of land at the existing airport. Control of squatters would be the responsibility of government agencies.	None have been identified for the project. It is recommended that at least some portion of the vacated airport land be used for human resettlement.	Not significant.

Table 1: Summary of Environmental Impacts and Mitigation Measures, Continued		
Impact	Mitigation	Residual Impact
Socio-Economic Conditions (Continued)		
Economy and Employment: The project would directly provide numerous jobs during construction and a small increase in jobs for operation. Indirectly, by supporting growth in the overall economy and stimulating development in the area, it would generate increased economic activity and employment opportunities at the local and regional levels.	Identified: It is recommended that, after current airport employees, residents of the Upper Tambler Resettlement Area be given training and priority for airport jobs, and that a training program be established so that these residents can develop the required skills for airport-related jobs.	Not significant.
Utility and Communications Infrastructure: The project would enhance electric utility service in the area and improve vehicular access. The project would improve air service for the South Cotabato Region.	None needed.	Beneficial.
Health, Education and Social Services: The project would enhance the potential for emergency medical evacuation. As an indirect effect as a result of growth in the region, social service demands would increase. conversely, increased property tax and other revenues would help offset the cost of these services.	None needed.	Not significant.
Energy		
The project would consume more energy than the current airport and would contribute to the region's continuing energy supply problem. Consumption would only be 0.4% of total municipal energy use in 1989 and would be minimal considering the site sizes. Jet fuel production is almost at capacity, but producers are expanding capacity and no problems are expected.	None needed.	Not significant.
Hydrology and Drainage		
Quarrying operations could affect water quality in the Makar River. Construction-generated dust could cause siltation.	Proposed: Settling ponds and a filtering device would be used to reduce turbidity at the quarry site. See the erosion control measures under Air Quality.	Not significant.

Table 1: Summary of Environmental Impacts and Mitigation Measures, Continued		
Impact	Mitigation	Residual Impact
Hydrology and Drainage (Continued)		
Site soils are well suited to leaching effluent. Runoff from site facilities would contain urban contaminants like grease and oil. Major spills at the refueling facility could contaminate soils. For safety purposes, however (to reduce the potential for fires), the spill containment area would have a soil floor. Domestic water would be from a deep well. The groundwater table is very deep, and appears to be quite large and contain water of high quality. Because the groundwater table is so deep, contaminants are not expected to reach it.	Proposed: The project would include a drainage system to control and store runoff for settling of pollutants. The maintenance shed would drain to a fuel separator.	Not significant.
Geology and Soils		
Construction would disturb topsoil and expose subsurface soils. Topsoil would be stockpiled and reused on graded surfaces. Runoff from the project could increase erosion. Paved and built surfaces would lose agricultural potential. While site soils are fertile, they are excessively well drained; even if irrigation was available, large quantities would be required to overcome the excessive drainage. Only about 5% of the site would be covered with impermeable surfacing.	Proposed: The project would include a drainage system to control runoff. The site would be revegetated to minimize erosion. See also the measure under Terrestrial Ecology for tree planting. This would help to anchor soils.	Not significant.
Terrestrial Ecology		
The project would result in clearing of most site vegetation. No special status or special value species exist on the site.	Proposed: The project site would be revegetated with native grasses and ornamental landscaping would be placed in the terminal area. Identified: Small trees removed from the site should be transplanted along the access road to provide habitat for birds displaced from the site and for other benefits.	Not significant.

Table 1: Summary of Environmental Impacts and Mitigation Measures, Continued		
Impact	Mitigation	Residual Impact
Aesthetics and Cultural Conditions		
Aesthetics: The project would not be very noticeable in views from existing development because of its distance, its low-scale profile and the rolling terrain, which interrupts views. The access road would not be a major visual element. In the long term, the project would support additional development in the area, and the appearance of the area overall would change from rural to urban. This would be likely to happen with or without the project, but perhaps over a more extended period.	Proposed: The project would include landscaping. See also the measure identified above. Trees planted along the access road would improve its appearance.	Not significant.
Archaeological and Cultural Resources: The potential for cultural resources to occur on the site is not known. The site has never been the subject of a recorded survey.	Required by Law: In the event artifacts are encountered, construction would be halted and the National Museum notified for development of a resource preservation recovery program. Identified: It is recommended that a survey be conducted to determine the potential for occurrence of resources. If it determined to be high, it is recommended that an archaeologist monitor excavation and earthmoving activities. In the event artifacts are uncovered, the archaeologist, in consultation with the National Museum, would develop a resource management program.	Not significant.

SUMMARY OF PROJECT ALTERNATIVES AND RECOMMENDATION

NO PROJECT

This alternative corresponds to Scheme O, No Action, in the Final Report, Feasibility Study. Under this alternative, no improvements would occur at the existing General Santos City Airport in Buayan other than those undertaken by ATO. Existing service consists of a maximum of three flights per day, with 19 flights per week, providing service to Cebu and Iloilo.

The airport would remain a "trunkline" airport in the overall national system. Facilities and support infrastructure would be maintained only as necessary to maximize their useful life. DOTC/ATO propose to add a two-inch overlay to the existing 1,504-m-by-30-m asphalt portion of the runway and the taxiway and apron. Even with this overlay, runway thickness would still be 1.5 inches less than technically structurally needed for Fokker-50 service. The overlay will be placed full width at only the end and center 100-m portions of the runway. The remainder of the runway will only be paved 18 m wide. The taxiway and apron will be fully overlaid. Other improvements currently in progress include construction of a Flight Service Station, and installation of additional landscaping.

The improvements, primarily cosmetic in nature, will permit short-term continuation of existing service. No significant change in cargo handling capacity would be possible because the runway cannot accommodate larger planes, and it is not economical to ship cargo in small batches, even if many of these could be arranged by more frequent Fokker-50 flights.

Conditions would continue as they are at present for several years, at which time an additional overlay would be needed. It is believed, however, that eventually the runway will deteriorate to a point that cannot be remedied by additional overlays. At that point, major reconstruction would be required to make the runway operational. If that did not occur, the airport could become inoperational. Major reconstruction could take the form of rebuilding the runway to its existing configuration, or one of the alternatives evaluated in the Preliminary Report.

In the longer run, without major reconstruction, the airport could be forced to cease operations. Airport closure would result in job loss for employees and canteen operators and most likely in negative effects on the larger economy. In that case, all airport users would be forced to travel to Davao. The road is in a seriously deteriorated condition and increased traffic would contribute to the deterioration, although probably not significantly, given the level of traffic associated with the airport.

Closure of the airport could mean that the land would be released for other uses. Resulting environmental effects would depend on the nature of the use. It is also possible that the site could remain unused and reserved until funds could be secured to reconstruct the runway with the necessary improvements. If it is reserved, all impacts associated with the airport would cease, including traffic and noise, until reconstruction.

With major reconstruction, the airport would most likely have to be closed during construction. It is assumed that reconstruction would be of a runway of similar dimensions to the existing one; on the basis of this assumption, impacts would be similar to those of the existing airport.

This alternative was not identified as preferred because 1) it does not address the basic project objective to improve air service to General Santos City; 2) it does not address the need for air cargo service; and, 3) it does not avoid the problem of eventual deterioration of the runway.

SERVICE CHANGES

This alternative addresses improving air service at the existing General Santos City Airport without any <u>major</u> construction improvements to the airport facilities. Because of strength and length limitations of the existing airport runway, taxiway and apron, aircraft larger than the Fokker-50 cannot currently use the airport.

Even with the previously mentioned DOTC/ATO overlay project, the adequacy of the strength of the asphalt pavement after an asphalt overlay of only a portion of the existing, badly deteriorated surface is suspect. It is doubtful that the runway surface would remain intact for any appreciable length of time. The ability to improve service by using larger aircraft would thus not be possible. Increasing the frequency of operations would be the only feasible way to improve service.

It is assumed that the airport could accommodate a maximum of seven to eight daily flights (14 to 16 operations) in the 10-hour daylight period.

Under this alternative, the airport could, in the short run, experience an almost constant level of activity during daylight hours. Traffic on the airport access road would be more at any one time than at present, generating more noise and dust on the airport access road. Crossing the runway would be more hazardous than at present both to the people attempting to cross and to flights operations, since there would be fewer periods without flights.

Aircraft noise would be experienced by adjacent residents more often than at present. This alternative could have the effect of generating some pressure for conversion of land zoned for and in agricultural use around the airport. Energy use would increase slightly. Effects described for the preferred alternative would not occur.

Because it is believed that the existing runway cannot continue to be of service as is, and cannot continue to be repaired through overlays, the effects described here would be in the short term. Higher use levels would result in faster deterioration of the runway, and eventually, the same situation described under the previous alternative would occur: either the airport must cease operation or major runway reconstruction must take place.

This alternative was not identifed as the preferred alternative because 1) it does not address the need for air cargo service; and 2) it does not avoid the problem of eventual deterioration of the runway.

NEW RUNWAY AT BUAYAN

This alternative consists of expansion of the existing General Santos City Airport to the extent necessary to accommodate the forecast aviation demand in accordance with the regulations of the ICAO and/or the USDOTFAA.

None of the existing facilities at the Buayan airport could be reused in accommodating the projected service level. The existing runway is too short and narrow, the apron, parking lot and terminal building are too small, and the terminal building is an obstruction. Renovation and expansion of existing facilities was examined, but the analysis showed that it was more cost-effective and safer to build new facilities. The needed facilities parallel those described for the preferred alternative.

The existing airport covers 62 ha. The expanded airport would require more (the preferred alternative would occupy 263 ha). It would be necessary to acquire land on the west, east and north sides of the airport, move the National Highway further north of the site (and move the bridge over the Buayan River to accommodate the new alignment), and extend the runway into Sarangani Bay. The site area after acquisition of adjacent land would be roughly 150 ha. The site could not accommodate any further extension of the runway; the steep dropoff of the shelf in Sarangani Bay limits it on the south, and the Buayan River, which turns west north of the airport, limits it to the north.

The existing runway, apron and terminal building would continue to be used during the construction period at current service levels (Fokker-50 service to Cebu and Iloilo).

This alternative represents expansion of an existing use, but because it is located so near to residential development, it cannot be considered entirely compatible with surrounding uses. An expanded airport could generate pressure for additional land conversion around the site, resulting in greater losses of agricultural uses.

This alternative involves a significant level of displacement. Approximately 250 families would require relocation. Commercial coconut groves and nipa swamps would be removed from active production if not eliminated entirely, and several prawn ponds and salt drying beds would be reduced in size or taken out of production. Small stores serving the residential areas would also be displaced.

This alternative would displace all employment and livelihood associated with uses between the river and the airport. Some of those livelihoods, for example, the fishing families, are subsistence level and would be difficult to replace unless relocation was to a similar area with similar resources.

Traffic operations during construction would be most heavily affected by the hauling of aggregate for roadway and runway sub-base, base and pavement. Construction trucks carrying aggregate would travel through congested areas and would aggravate this condition for a period of 24 months or longer.

Traffic generation by airport activities would be the same as projected for direct airport-related movements for the preferred alternative.

Major economic development infrastructure projects of the General Santos City area are being located on the west side of the City.

The Buayan site is not as well located with respect to airport trips originating on the north side of the central city (from Polomolok) and the south or west sides (from Makar Wharf, Dole Pier, the proposed agro-processing center, or trips from the direction of Maitum). Trips from these areas, largely cargo truck trips, would travel through the

City on the northern edge of Dadiangas, increasing the potential for conflicts with slow-moving vehicles, more numerous in the central city area.

Because residential development would be directly adjacent to the access road, emissions would be experienced by residents. The access road would be paved, reducing dust generation.

Aircraft emissions would contribute very little to ambient air pollutant levels. The long-term impact of airport emissions and fuel on water quality is minimal. The impact of unburnt hydrocarbon is minimal due to the wide area of dispersion.

Construction noise would generate significantly higher noise impacts at Buayan than at Tambler, due to the proximity of densely settled urban communities, and the proposal to carry out construction round the clock. The construction period at Buayan would be longer than at Tambler, because of the need for relocation and more site clearance, as well as relocation of the National Highway and bridge over the Buayan River and extending the new runway into the Bay. Construction noise impacts would thus be generated over a longer period.

Since aircraft noise levels are expected to remain below 65 L_{dn}, no adverse impacts from aircraft operation noise would occur at Buayan after areas of the north and east were cleared of development.

Vehicular noise impacts are not expected to be substantial given the limited number of flights. No new development would be supported along the road to the Buayan airport. The road would receive more truck (cargo) traffic than at present.

Improved drainage and wastewater facilities would reduce the potential for water pollution. Removal of residential activities on the east would eliminate a probable source of water pollution through discharge of wastewater effluent and solid waste.

The runway extension into Sarangani Bay would require fill and could generate siltation at both the borrow site, if it is near or in water, and in the Bay. Sand, gravel and fill materials quarried from Buayan or another river would increase the suspended solids concentration and turbidity. Washing of sand and gravel would increase colloidal concentrations in the water. Downstream users and aquatic life could be adversely affected.

This alternative could result in wind and water erosion of soils during construction and operation. Site soils would be compacted, creating waterlogged areas and/or flooding in the immediate environment and would eliminate the agricultural potential of the soil. Site soils are clayey and less stable than desirable. Soil engineering would be necessary for stabilization. Any non-reusable soils, if not disposed of properly, could cause sedimentation in Buayan River and Sarangani Bay.

No special status species would be affected. Interruption of existing siltation and current flow patterns by extension of the runway could generate a buildup and scouring on either side of the extension. Because the extension would project only into the shallow shelf area, deep current patterns should not be affected.

Under this alternative, Muslim cultural resources would be severely disrupted and their continuous association with the area since 1839 broken.

This alternative would meet the basic project objective of improving air service to General Santos City. This alternative was not identified as preferred because it has substantially higher costs (see the Feasibility Study, Final Report), and substantially greater environmental impacts than the preferred alternative.

IMPROVE ROAD TO DAVAO

This alternative assumes "No Project" conditions at the existing General Santos City Airport. The roadway to Davao would be improved to National Highway standards to speed trips between General Santos City to Davao for access to Davao International Airport and a direct flight to Manila. One assumption is that such roadway improvements would reduce the length of time required to transport passengers and cargo to Davao (from about 3.5 hours to two).

Residences have been built in the road rights-of-way and would require relocation. Sufficient land is available nearby for relocation sites.

Construction of improvements to the road to Davao would avoid the impacts of construction noise at either Buayan or Tambler, but in turn would create construction noise on the road to Davao. Due to the length of highway that would have to be improved, it is likely that a higher noise impact, on a larger number of receptors, over a longer time period, would be experienced with the Davao road construction alternative.

In the short term, airport operations at Buayan would probably continue as at present, with no change in effects. In several years, without major reconstruction, the airport in General Santos City may no longer be serviceable. The overall effect would be to increase road traffic to Davao, and increase use of that airport. With increased travel distances, more fuel energy would be consumed, and more air pollutants generated. The level of traffic, as demonstrated in the preferred alternative analysis, would not be substantial, however, and air pollutant, traffic and noise level increases would not be discernible from normal growth.

Additional traffic on the road would generate vehicle-related pollutants that could wash into adjacent waterways. This would be a negligible increase over existing conditions. This scheme would be unlikely to impact wildlife or habitat.

The additional air traffic could be accommodted at the Davao airport. This alternative would not provide adequate speed for transport of perishable goods such as cut flowers and vegetables, it would not support the development of these industries and the associated economic growth.

This alternative was not identifed as preferred, however, because it would not meet the basic project objective of improving air service to General Santos City.

RECOMMENDATION

Of the alternatives evaluated, only two would fully meet existing and projected air passenger and cargo demand for the General Santos City area, thus best fulfilling the basic project objective of improving air service to the area. These are the preferred alternative; a new airport in Tambler, and Alternative 5.3, construction of a parallel runway at Buayan. The latter alternative would result in significant social and community disruption, and a higher level of environmental impact than the development of a new airport at Tambler. For this reason, the recommendation of this report is that development of a new air facility at the Tambler site be pursued if the project is implemented.

1. INTRODUCTION

This report describes the environmental effects associated with construction of a new airport in General Santos City in South Cotabato Province in Southern Mindanao, Republic of the Philippines. The project, a Feasibility Study to Improve Air Service to General Santos City, is being evaluated by the United States Agency for International Development (USAID), in coordination with the Committee on Official Development Assistance (CODA) and the Department of Transportation and Communications (DOTC) under the Philippine Assistance Program Support (PAPS) project. This document is presented as a combined Environmental Assessment (EA) and Environmental Impact Statement (EIS) in conformance with the requirements of the US and Republic of the Philippine (RP) governments.

While this document, the EA/EIS, is a companion document to the Final Report of the Feasibility Study (Wilbur Smith Associates, 1991, hereby incorporated by reference), it is intended to be comprehensible on a stand-alone basis. However, much of the basis for assumptions concerning passenger and cargo demands, presented in great detail in the Final Report, are not reproduced here in the interest of paperwork reduction. For a thorough discussion of the engineering, economic and airport planning analyses that provide the basis for airport design, the reader is referred to the Final Report.

1.1 BACKGROUND OF PROJECT PLANNING

Identification of the "preferred alternative" for improvement of air service to General Santos City represents the culmination of a series of studies sponsored by USAID and CODA on desirable intervention actions to support growth in the area as planned by the RP.

It is clear from an examination of the South Cotabato area that development potential exists but is severely constrained by the lack of adequate infrastructure, including transportation and communication facilities. Further, alternative growth centers to Metro Manila are desperately needed as that area reaches saturation and infrastructure services begin to break down. General Santos City and South Cotabato Province have been identified by the RP, the World Bank and the Asian Development Bank, as well as other agencies, as an appropriate place to redirect major urban development. Recognizing that the Philippines is made up of islands, adequate air transport facilities are essential for communication, access and economic well-being.

The project represents one component of USAID/Philippines Mindanao Development Project (MDP). According to the USAID Project Summary, "[the MDP] is a six-year, $75 million project to support private-sector-led growth in the General Santos City/South Cotabato Province area in accordance with Philippine-United States Multilateral Assistance Initiative/Philippine Assistance Program objectives. The purpose of the project is to accelerate that growth through a mechanism for funding costs of major capital infrastructure subprojects, commodities, studies and technical assistance." Subprojects identified for the first (current) phase of the MDP include:

1. General Santos City Airport Improvement (this project)
2. Makar Wharf Improvement

3. Agro-Processing Center
4. Marketing/Promotion Activities
5. The Growth Plan

The first three subprojects were identified in a study entitled "Mindanao Area Development Study, Project Development and Support, Draft Final Report," November 1990, by UPLB Foundation, Inc.

The UPLB study, hereinafter referred to as the Prefeasibility Study, concluded that these three projects would be feasible. It evaluated four alternatives for the airport: 1) upgrade Buayan Airport to support Boeing-737 and C-130 aircraft, closing the airport during construction; 2) the same as 1), but with construction of a temporary facility at Barangay Apopong; 3) develop a new "semi-international" airport (as at Davao or Zamboanga) at a new site, leaving Buayan for general aviation or military use; and 4) construction of a new parallel runway at Buayan to accommodate Boeing-737, C-130, and Airbus-300 aircraft (this last alternative was recommended in a previous USAID-funded study "General Santos City Agro-Industrial Development Project" by Angel Lazaro, Jr., 1990).

On the basis of the Prefeasibility Study, USAID contracted with Wilbur Smith Associates (WSA), in joint venture with TCGI and SGV Consultants, to prepare a Feasibility Study to improve air service to General Santos City. The Feasibility Study has the following components:

1) Scoping Report
2) Preliminary Report
3) Environmental Assessment
4) Final Report

The purpose of the Preliminary Report was to determine air cargo and passenger service needs in General Santos City/South Cotabato Province on the basis of future land use, population, economic conditions of the area and, in light of the model that emerged, determine which of several alternatives could best and feasibly meet those air service needs. The Report examined eight alternatives for economic, engineering, financial and environmental feasibility, as follows:

Scheme O, No Action.

Scheme I, Non Construction Improvements; improve air service by improving efficiency of operations.

Scheme II, Extend the runway at Buayan Airport; divert air traffic to another airport during construction.

Scheme III, Same as Scheme II, but instead of diverting air traffic, construct a temporary facility elsewhere in the City to handle air traffic during construction at Buayan.

Scheme IV, Construct a parallel runway at Buayan that would extend into Sarangani Bay. Current air service could continue during construction.

Scheme V, Construct a new airport at a new location. Two sites were identified and designated as subalternatives: Scheme VA, Apopong/Sinawal; and Scheme VB, Tambler (the preferred alternative). (Barangay Tambler was split into two in March 1991, and the project site is now located in Barangay Fatima; this report will continue to use the Tambler designation for consistency with earlier reports and the associated Final Report.)

Scheme VI, improve the road to Davao, maintain Buayan Airport as at present.

The Preliminary Report conclusion is that construction of a new, international facility at Tambler (Scheme VB) is the most feasible alternative, and is best suited to meet current and projected air service needs of General Santos City/South Cotabato Province. The Final Report includes an Airport Master Plan that will serve as the project description for the preferred alternative.

1.2 STAGE IN THE PLANNING PROCESS

The project has several development stages. A Prefeasibility Study was conducted in November 1990. The current stage is a Feasibility Study consisting of several steps:

1. Preliminary Report: This included an analysis of eight different approaches to improving air service to General Santos City. This report led to the recommendation of one alternative, development of a new airport at the Tambler site (Scheme VB in the Preliminary Report).

2. Master Plan: This includes development of planning standards and guidelines for airport facilities to the year 2015.

3. Feasibility Study (Final Report): This incorporates the relevant findings of the Preliminary Report and provides the engineering, design and economic foundation for implementation of the Master Plan.

4. Environmental Assessment (EA/EIS): This is based on the Master Plan and the Feasibility Study, and presents the environmental impacts of implementing at least the beginning stages of the Master Plan, and identifies mitigation measures to eliminate or lessen the impacts.

The Prefeasibility and Preliminary Reports have been completed. The remaining three documents are currently in process. Once the Feasibility Study is complete, project approvals must be obtained and engineering and architectural drawings developed.

The project is thus in the middle stages of the planning process.

1.3 SUMMARY OF US AND RP ENVIRONMENTAL PROCEDURES

As a joint US/RP proposal, the Feasibility Study is subject to environmental procedures of both governments. In the US, each federal agency establishes its own guidelines for complying with applicable laws and regulations. In the case of USAID, these are set forth in AID Handbook 3, Appendix 2D, October 9, 1980, "Environmental Procedures." In the RP, the Department of Environment and Natural Resources (DENR), Environmental Management Bureau (EMB) establishes these procedures.

USAID

Sections 117, 118 and 119 of the Foreign Assistance Act of 1961, as amended (the FAA), establish general procedures to be followed by USAID to ensure that environmental factors and values are integrated into the USAID decision-making process, specifically environment and natural resources, tropical forests, and endangered species. The procedures are consistent with Executive Order 12114, issued January 4, 1979, entitled "Environmental Effects Abroad of Major Federal Actions," and the National Environmental Policy Act of 1970, as amended (NEPA). Within the framework of USAID activities, relevant policies of USAID's are to:

1) Ensure that the environmental consequences of USAID-financed activities are identified and considered by USAID and the host country prior to a final decision to proceed and that appropriate environmental safeguards are adopted; and

2) Define environmental limiting factors that constrain development and identify and carry out activities that assist in restoring the renewable resource base on which sustained development depends.

Under USAID procedures (22 CFR Part 216), there are four categories of activities:

1) Exemption; no Environmental Assessment (EA) required.

2) Categorical exclusion; 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.

Projects normally requiring an EA or EIS include new lands development and agricultural land leveling.

An environmental assessment (EA), which USAID has concluded must be prepared for this project, is a detailed study of the reasonably foreseeable significant effects, both beneficial and adverse, of a proposed action on the environment. The purpose of the EA is to provide USAID and host country decision-makers with a full discussion of significant environmental effects of a proposed action. It includes alternatives that would avoid or minimize adverse effects or enhance the quality of the environment so that the expected benefits of development objectives can be weighed against any adverse impacts upon the environment or any irreversible or irretrievable commitment of resources.

Once a determination has been made that an EA is required, the scoping process begins. This is the identification of issues associated with the project. A Scoping Report is prepared that identifies, among other things, the scope and significance of issues to be analyzed in the EA, including direct and indirect effects, and identification and elimination from detailed study issues that are not significant.

The EA is to be based on the Scoping Report and address the following elements:

1) Summary: This should stress major conclusions, areas of controversy, if any, and issues to be resolved.

2) Purpose: A brief identification of the underlying purpose and need to which USAID is responding in proposing the alternatives included in the proposed action.

3) Project Description: Usually a set of alternatives; in this case a "preferred alternative" has been identified and is the focus of the document.

4) Alternatives to the Project: Different approaches to achieving project objectives that may result in elimination or reduction of project effects, to always include the "No Action" alternative.

5) Relationship of the Project to other USAID/PAPS Projects: The manner in which the project affects or is affected by other developments within USAID's programs.

6) Affected Environment (Setting): The environment of the areas to be affected or created by the project. Data and analyses in the EA are to be commensurate with the significance of the impact with less important material summarized, consolidated or simply referenced.

7) Environmental Consequences (Impacts): This is a discussion of the environmental impacts of the proposed project; any adverse effects that cannot be avoided if the project is implemented; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources that would be involved in the proposal if it is implemented. Also to be discussed as applicable will be direct and indirect effects, possible conflicts between the project and land use plans, policies and controls for the areas concerned; energy requirements and conservation potential; natural or depletable resource requirements and conservation potential; urban quality; historic and cultural resources and the design of the built environment; biodiversity (especially endangered species); forest reserves; and watershed management.

8) Mitigation Measures and Environmental Management Plan: These are measures to mitigate adverse environmental effects, and a program for implementing the measures, including appropriate scheduling.

6) List of Preparers: These are the names and qualifications (expertise, experience, professional disciplines) of the persons primarily responsible for preparing the EA.

USAID procedures call for consultation between the host government both in the early stages of preparation and on the result and significance of the completed assessment. USAID also encourages the host government to make the EA available to the general public.

ENVIRONMENTAL MANAGEMENT BUREAU

Presidential Decree No. 1586, June 1978, established an Environmental Impact Statement system, and gave the National Environmental Protection Council (NEPC) the role of issuing rules and regulations implementing the system. Under these regulations, non-exempt projects must obtain an Environmental Compliance Certificate (ECC), which is issued by the President or authorized representative. The ECC certifies that the project would not result in unacceptable environmental impacts and that the proponent has complied with the requirements of the EIS system. The ECC can be denied, or can be granted with conditions. The NEPC carries out procedural processes of the EIS system and makes recommendations on the granting of the ECC on the basis of the findings of the EIS Review Committee. The Committee is composed of specialists in disciplines such as noise, sociology, ecology, etc. The EIS Review Committee bases its findings on the environmental impact statement (EIS) prepared for the project.

The requirement for an EIS is based on the type (environmentally critical) and location (environmentally critical area) of the project. Environmentally critical project types include: a) resource extractive, mining, logging, etc.; b) infrastructure, dams, highways, etc.; and c) heavy industries, copper smelters, fertilizer plants, pulp and paper mills, etc. Environmentally critical areas include:

1) national parks, watershed reserves, wildlife preserves and sanctuaries;
2) aesthetic potential tourist areas;
3) areas that 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 (geological hazards, floods, typhoons, volcanic activity, etc.);
7) areas with critical slopes (40% or more);
8) areas classified as prime agricultural lands;
9) recharge areas or aquifers;
10) waterbodies;
11) mangrove areas; and
12) coral reefs.

The EMB does not have a scoping process similar to that of USAID. However, it does encourage early consultation with affected agencies and groups. Upon completion of the EIS, the EMB disseminates a project description to pertinent agencies and interested parties for comments. The NEPC Secretariat may require the project proponent to reply to any comments. Also, if the project is expected to have substantial environmental impacts, the NEPC may call a public hearing.

The content of an EIS is similar to that of an EA, with a few exceptions. Some of these are "future conditions without the project," and "contingency and abandonment plans." The EIS also places heavy emphasis on social and socio-economic effects. In the US, a distinction is made between social and physical environmental effects and, while these may be, and sometimes are required to be, considered, the environmental review process is focused on physical environmental effects.

Both USAID and EMB require an environmental management plan that describes mitigation measures, means to monitor their implementation, and scheduling of implementation.

This report is intended to satisfy both USAID and EMB requirements, and is therefore presented as a combined EA/EIS.

2. PROJECT DESCRIPTION

2.1 PROJECT SETTING

2.1.1 PROJECT PROPONENT

The proposed project is a Feasibility Study to Improve Air Service to General Santos City. It is a project of the United States Agency for International Development (USAID) in cooperation with the Republic of the Philippines (RP) Committee on Official Development Assistance (CODA) and the Department of Transportation and Communications (DOTC) for the Philippine Assistance Program Support (PAPS) project.

2.1.2 PROJECT PURPOSE AND NEED

Purpose

The purpose of the Feasibility Study is to determine air service requirements to the design year 2015 for the General Santos City influence area (South Cotabato Province), and the most effective and feasible means of meeting those requirements on the basis of engineering, economic, environmental and socio-cultural considerations.

The purpose of the ultimate air service improvement project is to support future agricultural and industrial development of General Santos City and the surrounding area of South Cotabato Province, Mindanao, as planned by the RP. See also the discussion in Section 2.1.4, Relationship of the Project to Other USAID Projects.

Need

Current General Santos City Airport facilities at Buayan support Fokker-50 passenger service, but a number of limitations prevent the use of larger planes that would accommodate more passengers or cargo loads of sufficient size to be economically feasible. At present, almost all cargo loads to be shipped by air must be trucked to Davao (about 16 metric tons per day). Even then, shippers frequently find that their loads have been "bumped" due to inadequate capacities and perishable cargos are lost. Further, no direct flights to Manila are available. The uncertainties and time lengths involved in shipping have resulted in disincentives to agro-industrial development.

Limitations associated with the current airport include:

- uneven, poorly maintained runway surface constructed of different materials;
- small terminal building located within the clear zone;
- poor soil conditions, including poor drainage, that affect the integrity of the runway;
- the Very High Frequency Omnidirectional Radio Range (VOR) beacon, which is also in the clear zone, has only three of 360 possible radials operating because of surrounding obstructions;

- limited runway length and width (1,704 x 30 meters); and

- development constraints to expansion including the National Highway and Buayan River to the north, residential and agricultural development to the west, north and east, and Sarangani Bay to the south.

The condition of the runway is such that, without attention, it will deteriorate in a short time to a point where it will no longer be able to accommodate even Fokker-50 service. The DOTC and Air Transport Office (ATO) have a project to add a two-inch asphalt overlay over the taxiway and apron and the 1,504-meter asphalt portion of the runway. This overlay would be placed full width only at the end and center 100-meter sections of the runway; the width over the remainder of the asphalt portion would be only 18 meters. Even with this, it is doubtful that the runway surface will remain intact for any length of time. At any rate, the overlay is only cosmetic; with it, the total pavement thickness would be 1.5 inches less than structurally needed for Fokker-50 operation.

The current airport not only cannot meet existing cargo demand, its service capabilities fall short of projected 1995 daily passenger (roughly 300) and cargo (23 metric tons) demand.

The condition of airport facilities is such that existing service may not be sustainable for any length of time, even with planned improvements. The project is thus needed to accommodate existing and future air service demands of the General Santos City influence area.

2.1.3 PROJECT LOCATION

General Santos City is located in South Cotabato Province, the southernmost province of Mindanao, in the Republic of the Philippines. The City itself is located at the northern end of Sarangani Bay (Barangays Dadiangas East, West, North and South), while the municipality extends to the north and west, and southwest along the Bay (see Figure 1). The existing airport is located near the City's eastern boundary with the Municipality of Alabel, adjacent to the Buayan River, which forms the municipal boundary.

The proposed Tambler site is in the southwest portion of the City, in Barangay Tambler (now Fatima). Barangay Tambler stretches to Sarangani Bay on the east (lower Tambler) and to Barangay San Jose on the west (upper Tambler). Barangays Apopong and Siguel border Barangay Tambler on the north and south, respectively.

The proposed airport site is located in upper Tambler, near its border with Barangay San Jose, and is about six kilometers (km) from the National Highway, which roughly follows the Sarangani Bay coastline. The site occupies roughly the western portion of the Alcantara Family (Alsons Development and Investment Corp.) pasture lease holding (PSLA No. 2476). The Banwalan River is to the south, and the Makar River is to the north. The project site crosses the road to San Jose, requiring its relocation. The proposed access road alignment runs in an almost straight line from the National Highway to the center of the proposed site, near the proposed location of the airport terminal building (see Figure 2, page 13). The alignment passes south of the Mindanao State University (MSU) facility and the Upper Tambler Resettlement Area/Provincial Action Center. The site is crisscrossed by barbed wire fencing and dirt tracks, and has

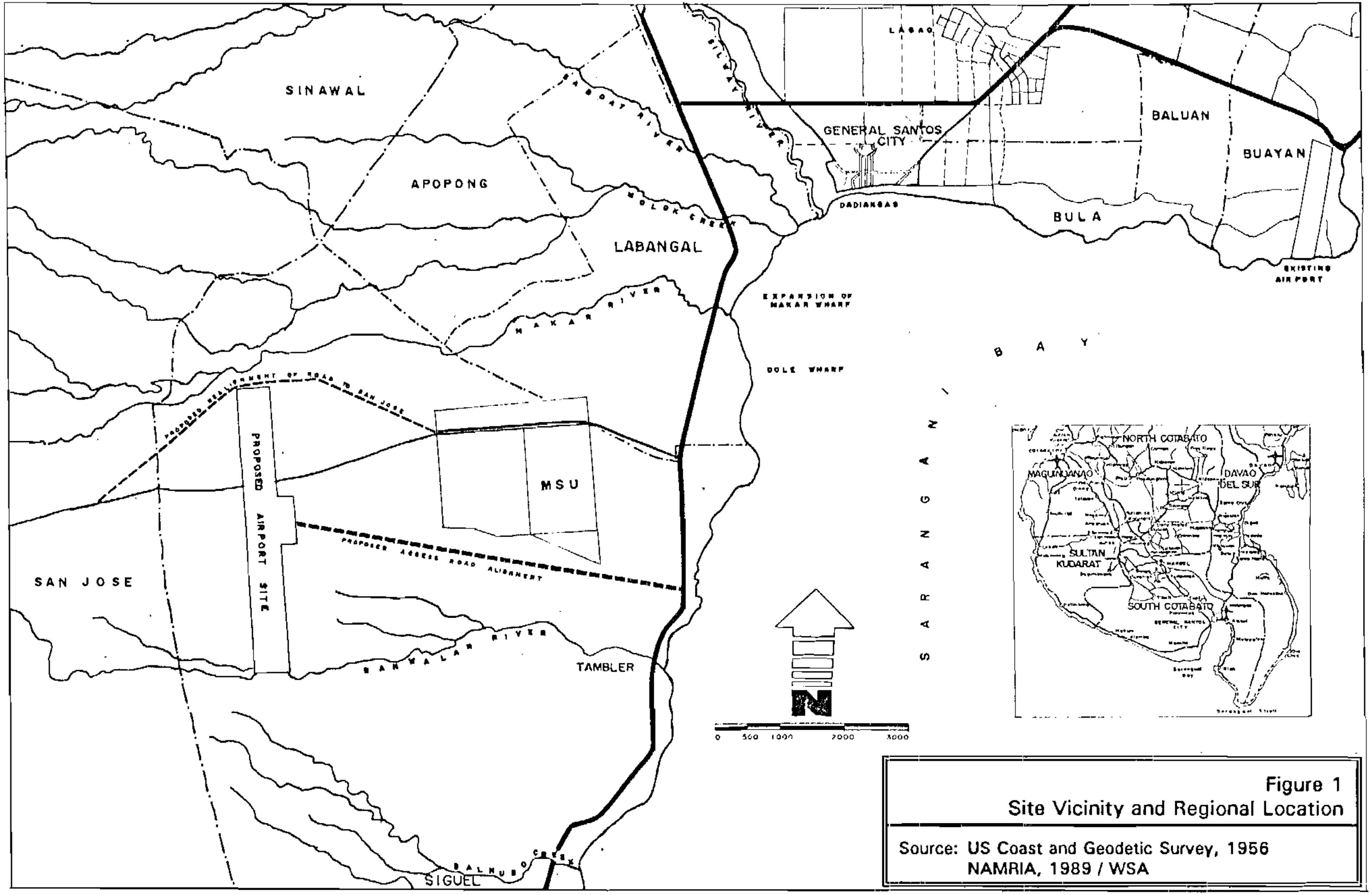


Figure 1
Site Vicinity and Regional Location

Source: US Coast and Geodetic Survey, 1956
NAMRIA, 1989 / WSA

a ranch house and well near the approximate centerline of the proposed runway alignment. The site has rolling terrain, and is unmanaged pasture with no structures except the house and ancillary buildings.

2.1.4 RELATIONSHIP OF THE PROJECT TO OTHER USAID PROJECTS

The proposal to improve air service to General Santos City is one of several USAID projects in Mindanao under the Mindanao Development Project (MDP). One of the policy statements guiding the MDP and other USAID actions is the Agricultural and Natural Resources (ANR) Strategy in response to the Philippine Assistance Strategy (PAS) for USAID. The goal of the five-year (1991-95) PAS is to "promote broad-based, sustainable economic growth through the active partnership of the public and private sectors...". Within the framework of this goal, USAID's overall program focuses on five objectives: policy/institutional framework stimulating private sector growth; open and competitive markets; infrastructure that facilitates expanded private sector activity; more efficient delivery of essential services; and effective and sustainable management of the natural resources.

As noted in Section 1.1, the airport is one of three infrastructure projects in the MDP. The other two are the Makar Wharf expansion and an agro-industrial/fish processing plant near the mouth of Banwalan River at Sarangani Bay in Tambler. The MDP project summary states that each capital subproject will be studied to determine whether it is independently feasible on technical, financial, economic and environmental grounds. The findings of the Preliminary Report are that the project would be independently feasible. However, operating costs would not be covered by revenues, because of an outdated tariff structure (primarily the fees charged to Philippine Airlines for airport use), which is of lesser significance with PAL operating as a government owned utility. If PAL is sold and must operate on a private basis, as is being discussed, a rational tariff structure would be critical. The Final Report of the Feasibility Study (WSA, 1991) addresses potential approaches to achieving that end.

The airport would support activities of the other two projects, as well as current and future potential private sector business ventures dependent on improved air service. Viability of the airport is not dependent on the other two projects, however. Investigations of cargo markets for the Preliminary Report identified substantial potential for expanded and new production of perishable agricultural commodities, aside from fish, such as cut flowers, asparagus and broccoli. Because adequate means (air cargo capacity) does not exist to rapidly deliver such goods to market, production has not taken place.

Taken singly, the airport project would meet the goal of the MDP to support private-sector-led growth in General Santos City/South Cotabato Province; taken together with other MDP projects, that support is strengthened.

2.2. PROJECT CHARACTERISTICS

2.2.1 LAYOUT AND DESCRIPTION

Airport Master Plan

The project is an airport designed to international standards. It has been designed in two phases to meet near-term and long-term demand. An Airport Master Plan describing project development to the year 2015 has been developed as part of the Feasibility Study. While the study period would not extend beyond the year 2015, the Master Plan addresses potential requirements so that land control planning for future potential expansion can be incorporated. The Master Plan is part of the Feasibility Study and is hereby incorporated by reference. The Master Plan addresses three development stages: 1995, the estimated first year of airport operation, 2000, the near-term, and 2015, the long term. Phase I is 1995 to 2000, and Phase II is 2000 to 2015. It should be noted that airport construction for Phase II could occur anytime during the period, and would depend on the need for the associated improvements.

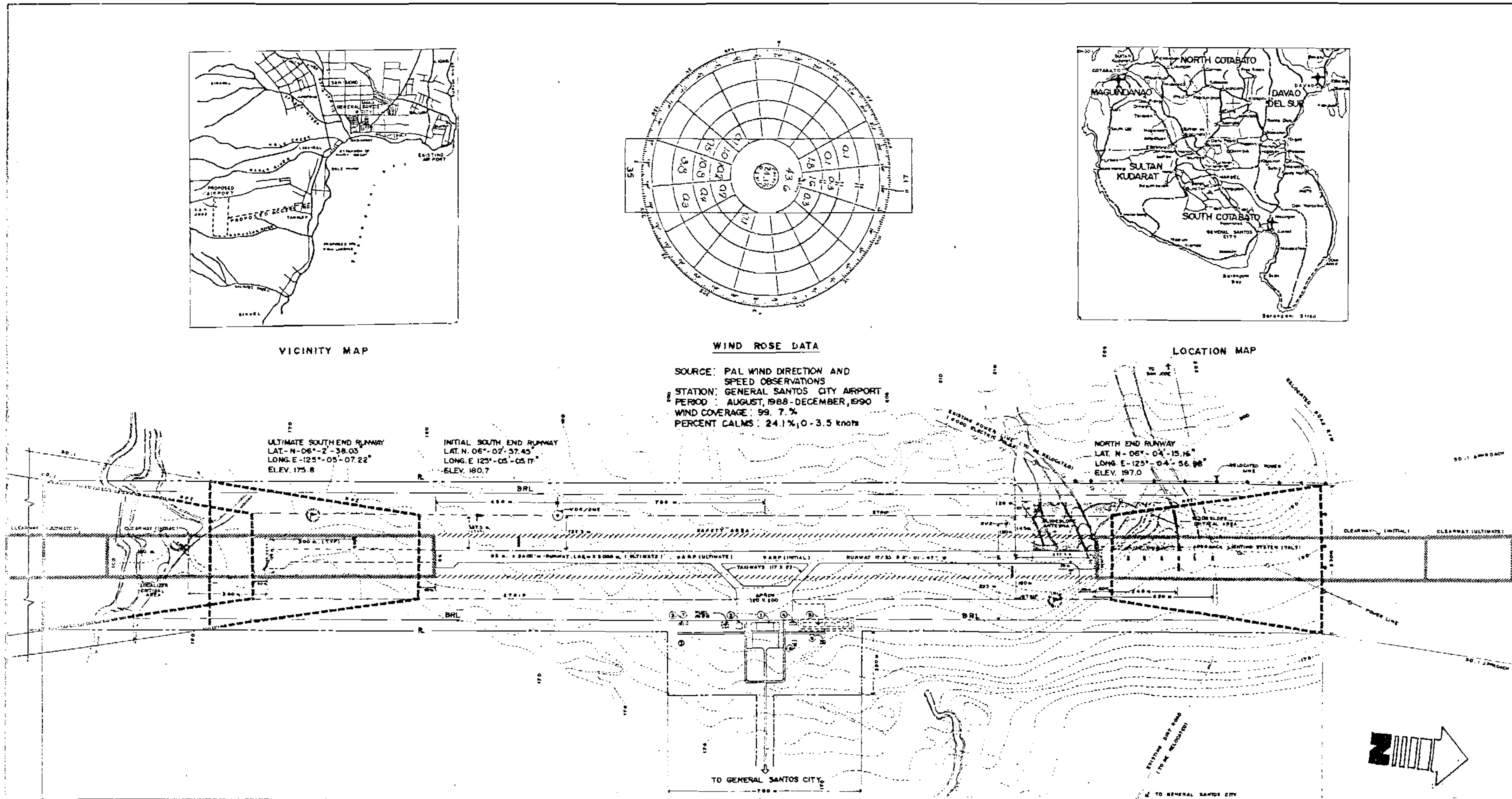
Phase I - 1995 to 2000

The Phase I facility would have one runway, two taxiways and an apron, a terminal and other buildings and a parking lot (see Figures 2 and 3). The project site intercepts the road to San Jose and thus requires the relocation of that road. A six-km access road from the National Highway would also be part of the project. Facility specifications are listed at the end of this section. The project would include a septic sewer system of three tanks with a total capacity of about 13 cubic meters, a drain field, a drainage collection system, a well for potable domestic water, construction of a transformer in an as-yet undetermined location, extension of electricity to the site and a back-up diesel generator. The terminal building would have flood lights mounted on it and directed at entryways for security. Initial navigational aids for the airport would include Precision Approach Path Indicator (PAPI) lights for both runway approaches, a Very High Frequency Omnirange/Distance Measuring Equipment (VOR/DME) facility and wind direction indicators at each end. All would be located on site. The PAPI lights are only visible at high altitudes.

The runway would be 2,400 m long and 45 m wide, for a total of 108,000 square meters (m^2). The apron and taxiways would be 24,000 m^2 and 5,382 m^2, respectively. The 5,100-m^2 parking lot would have 96 parking spaces.

The airport would have seven buildings: a 1,950-m^2 terminal building; a 175-m^2, two-story flight service station; a 250-m^2 cargo building; a 255-m^2 maintenance building; a 45-m^2 generator building; 150-m^2 cold storage facilities; and a 576-m^2 Crash, Fire and Rescue (CFR) building to house up to four fire trucks and one ambulance and staff. Buildings would be steel, wood and concrete structures with spread concrete footings.

A refueling facility (tank farm) with three double-walled, 10,000-gallon, above-ground tanks would be installed. The tanks would be set into a spill containment structure, and surrounded by a fire wall. Piping would be stainless steel, and the tanks would have underground piping out to the aircraft parking apron to allow refueling of aircraft directly from the tanks.



RUNWAY DATA TABLE		
ITEM	RUNWAY 17/35	
	INITIAL	ULTIMATE
AVERAGE RUNWAY GRADIENT (%)	.68 %	.71 %
WIND COVERAGE (%), 10.5 KNOTS	99 7 %	99.7 %
RUNWAY CATEGORT	NON PRECISION	PRECISION - CAT I
PAVEMENT STRENGTH	165,000 kg DT	165,000 kg DT
APPROACH SURFACES	50:1/50:1	50:1/50:1
RUNWAY LIGHTING	NONE	HIRL
RUNWAY MARKING	NON-PRECISION	PRECISION - CAT I
VISUAL APPROACH AIDS	PAPI-4, WIND DIRECTION INDIC.	LIGHTED WIND DIR. INDIC., ROTATING BEACON

AIRPORT DATA TABLE			
ITEM		INITIAL	ULTIMATE
AIRPORT ELEVATION (METERS) (ARP)		193.0	189.0
AIRPORT REFERENCE POINT (ARP)	LATITUDE	N06°-05'-56.31"	N-06°-03'-26.39"
	LONGITUDE	E-125°-05'-01.06"	E-125°-05'-02.10"
AIRPORT REFERENCE CODE (ICAO)		4 D	4 D
MEAN ANNUAL TEMPERATURE		28.75°C	28.75°C
NAVIGATIONAL AIDS		VOR / DME	SALS, LOCALIZER, GLIDE SLOPE UNIT, OUTER and MIDDLE MARKERS, RVR
TAXIWAY MARKINGS / LIGHTING		℄ STRIPE	MITL
AIRPORT PROPERTY		262 Ha.	600 Ha.

LEGEND		
INITIAL	ULTIMATE	ITEM
		AIRPORT PROPERTY LINE (℄)
		FACILITIES
160		GROUND CONTOURS (METERS)
		BUILDING RESTRICTION LINE (BRL)
		RUNWAY PROTECTION ZONE (RPZ)(300 X 762 X 530 m.)
		THRESHOLD LIGHTS
	(LIGHTED)	WIND DIRECTION INDICATOR
		4- BOX PAPI
		LOCALIZER CRITICAL AREA
		GLIDE SLOPE UNIT CRITICAL AREA
		ROTATING BEACON
		RUNWAY VISUAL RANGE FACILITY
		VOR / DME
		RUNWAY SAFETY AREA
		CLEAR WAY 1.25% SLOPE (1200mX150m INIT.)(500m X 150m ULT.)
		STRIP

BUILDING TABLE			
NO.	BUILDING DESCRIPTION	INITIAL	ULTIMATE
1	TERMINAL BUILDING	30 X 65	30X98
2	CRASH, FIRE, RESCUE BUILDING	24 X 24	-
3	FLIGHT SERVICE STATION / TOWER	10 X 15 (FSS)	5X5 (TOWER)
4	CARGO BUILDING	10 X 25	-
5	HANGARS	14 X 86	14 X 172
6	MAINTENANCE BUILDING	15 X 17	-
7	GENERATOR BUILDING	6.5 X 7	-
8	COLD STORAGE FACILITIES	10 X 15	-

Notes: (1) For location of existing buildings, fences, drinking troughs, etc. to be demolished on property to be developed for airport, see Plan/Profile Drawing in Planning and Engineering Appendix, Feasibility Study to Upgrade Air Service to General Santos City, June, 1991, Wilbur Smith Associates.

(2) For additional approach details, see Sheet 2, Airspace Drawing and Sheet 3, Runway Protection Zone Drawing.

Figure 2
Airport Layout Plan

Source: WSA

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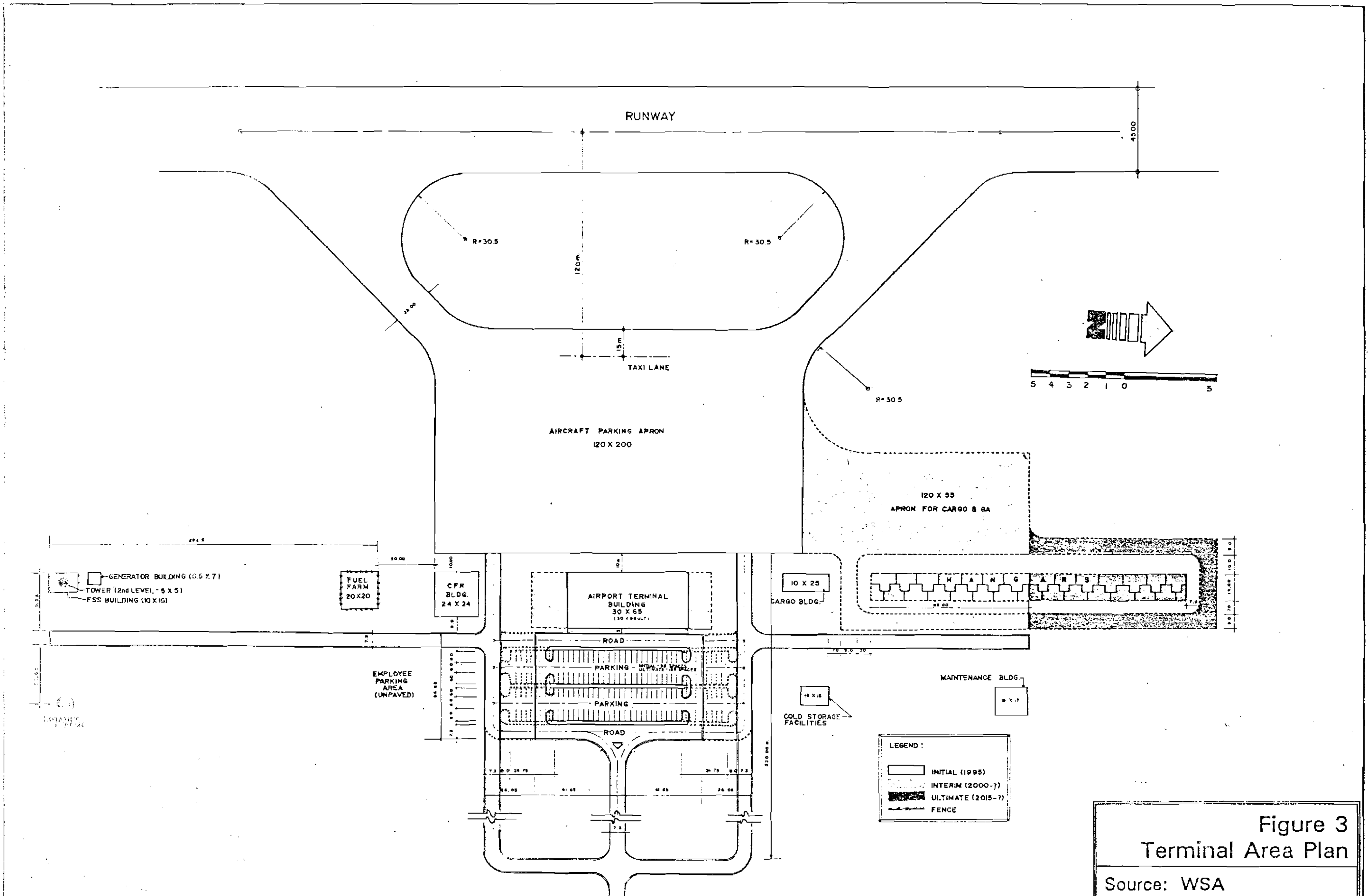

Figure 3
Terminal Area Plan

Source: WSA

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The refueling facility would be similar to that at the Davao Airport. The refueling facility would be built, operated and maintained by PAL or a private company (fuel supplier fixed base operator, or FBO). Construction, operation, maintenance and inspection of the tank farm would be in conformance with the National Fire Protection Association Code. The maintenance building would be equipped with a drain leading to a fuel/water separator. Fuel or oil waste would be collected and stored until it could be disposed of properly.

Space for food service facilities would be provided within the terminal building, although there may also be canteens located on the east side of the terminal building (outside), as at the current airport.

The new facility would be completely fenced with chain link fencing around the perimeter. Additional security fencing, probably chain link, would be located within the perimeter to control access to the runway.

An access road of about 6 km would be constructed from the National Highway to approximately the center of the site, where the terminal building would be located. The access road would be a two-lane, paved road with shoulders. The width of the travel lanes would be 3.65 m each, and the shoulders would 3.05 m wide. The proposed right-of-way (ROW) is 60 m to allow the possibility of future widening. Drainage would either be rock- or concrete-lined ditches.

Phase II - 2000 to 2015

In Phase II, a 6,600-m^2 cargo ramp and 990-m^2 expansion to the terminal building (for a total of 2,940 m^2) would be constructed to accommodate increased cargo and passenger demand levels. The parking lot would be expanded by 2,500 m^2, to 7,600 m^2, for a total of 168 spaces. Other potential additions include a 4,000-gallon, above-ground Avgas supply system, depending on the demand for general aviation facilities, hangars totalling about 1,200 m^2, and 1,180 m^2 taxiways to the hangars. Such hangars would be steel and sheet metal with concrete floors.

Phase III - 2015+

Phase III concerns airport facilities as they might look after the Master Plan planning year horizon of 2015. While this report does not address the impacts of such development, because it is beyond the scope of the project, some effort has been made to address potential facility needs in order to determine how much area around the airport site should be protected or reserved by the government for future airport development. This is sound airport planning practice. Control or reservation of additional area does not require its purchase, and does not require that the land lie undeveloped, only that such development as does occur be compatible with very long-term airport requirements.

Airports have large land requirements and are long-term transportation infrastructure investments. Numerous examples exist of airports being established in relatively undeveloped areas, only to find themselves years later pressed in on all sides by development, constrained in expansion efforts by this development and complaints of noise conflicts. For this reason, although projections show that 263 hectares (ha) is adequate for the foreseeable future, the Master Plan recommmends the set-aside or development control over additional land around the airport site, a total of 600 ha including the airport (see Figure 9 in Section 4.1, Land Use and Regional Planning). This would accommodate the maximum expansion of a second runway.

Projected construction past the year 2015 includes a control tower, runway extension of 600 m (to 3,000 m); additional hangars (1,200 m^2); taxiways to the hangars (1,550 m^2); a General Aviation (GA) FBO (150 m^2); and Category I navigational aids (instrument landing system: localizer, RVR, outer and middle marker, glideslope unit, simple approach lights) and high intensity runway lights and medium intensity taxiway lights.

PROJECT PHYSICAL CHARACTERISTICS

PHASE I, 1995

Paved Areas

	Runway	Taxiway	Apron
Length (m)	2,400	2 @ 117	200
Width (m)	45	23	120
Thickness (cm)			
Surface	37	37	37
Base	15	15	15
Composition			
Surface	PCCP[1]	PCCP	PCCP
Base	Cement stablized crushed aggregate		

Access Road: 6 km length

Width:		Composition:		
Travel Lane	2 @ 3.65 m	Surface	20 cm	PCCP
Shoulder	2 @ 3.05 m	Base	20 cm	aggregate base
Right-of-Way	60 m	Subgrade	30 cm	compacted subgrade

Parking Lot: 5,100 m^2, 96 spaces

Buildings

	Terminal	Flight Service Stn.	CFR	Cargo	Maintenance	Generator	Cold Storage
Area (m^2)	1,950	1st Flr, 150 2nd Flr, 25	576	250	255	45	150

[1] PCCP: Portland Cement Concrete Pavement

(Continued)

Navigation Aids

Type	Number	Location
PAPI (4 box)	2	300 m from each end of runway
VOR/DME	1 ea	Co-located on airport property
Wind Direction Indicators	2	Each end of runway

Utilities

Septic Tanks (3)	Electricity (extended from new substation near National Highway)
Water Well	Backup Diesel Generator

Other

Jet Fuel Refueling Station: 3, 10,000-gallon, self-contained above-ground tanks; Spill containment vessel; Perimeter fire wall

Landscaping: Ornamental around terminal building; low-growing, drought-tolerant groundcover and native grasses in non-paved, non-gravelled areas.

Exterior Lighting: Building Perimeter Floodlights Casting Downward
Drainage: rock or concrete-lined ditches; rock-lined detention basins
Perimeter Fence: Chain link

Total Site Area:	263 Hectares (excluding access road ROW)
Total Paved/Built Area:	143,700 m^2 (excluding access road, 43,800 m^2)
Percent of Site:	~ 5%

PHASE II - 2000 TO 2015

Cargo Ramp:	120 x 55 m, 6,600 m^2
Terminal Expansion:	990 m^2 (total 2,940 m^2)
Parking Lot Expansion:	2,500 m^2 (total 7,600 m^2), total 168 spaces
AVGAS Fuel Facility (optional):	4,000-gallon above-ground tank system
Hangars (optional):	1,200 m^2
Taxiway to Hangars (optional):	1,180 m^2

PHASE III - 2015+
(Not Included in this Project)

Control Tower:	(not sized)
Runway Extension:	600 x 45 m, 27,000 m^2
Additional Hangars:	1,200 m^2
Taxiways to Hangars:	1,548 m^2
General Aviation FBO:	150 m^2
Category I Navaids	

Instrument Landing System:	localizer, middle and outer markers, glideslope unit, RVR, MITL, HIRL, Beacon

Total Project and Reserved Site Area: 600 Hectares (accommodates second runway)

2.2.2 CONSTRUCTION ACTIVITIES

Phase I construction would be the most intensive and is projected to last about 24 to 36 months, including the road. Temporary structures during construction include those associated with the construction camp: security fencing; security shed at the construction camp entrance; equipment and materials storage sheds; construction headquarters trailer(s); and day use buildings or temporary housing for workers. Construction vehicles would be stored on the site when not in use, and several generators would be brought to the site to provide needed power for equipment. It is assumed that an aggregate crusher plant and concrete batch plant would be established on the site to provide these types of construction materials.

Construction is assumed to occur 24 hours per day, with two 12-hour shifts. Estimated construction scheduling and employment is shown below. Constructions periods would often overlap and are thus not additive. Employment shown is total *per shift* of the two shifts; total employment per construction period would thus be two times the number shown. Maximum construction employment is estimated at about 260 workers in a 24-hour period, and minimum at about 24. The average number of workers over a 24-hour period is estimated to be about 150. Both skilled and unskilled labor would be required. Skilled labor would include supervisors, carpenters, masons, concrete finishers, drivers and equipment operators. The General Santos City area labor pool is expected to be able to supply the required workers, although some highly technical positions, such as concrete paving machine, batch plant and crusher operators, may need to be brought in from Manila.

Construction Activity	Months	Workers
Site clearance and preparation	3	24
Utilities brought to site	11	48
Site grading, drainage system construction	9	72
Foundations	12	72
Pavement, marking, lighting	12	72
Seeding, turfing, security fence	4/3	24/24
Building finishing	6	48

Phase II construction is estimated to require a total of six months, assuming all improvements were installed at one time. In fact, improvements could occur at different times within the Phase II period between 2000 and 2015.

The types of construction equipment include the following: bulldozer; loader; dump trucks; backhoe; scrapers (pans); motorgrader; auger drill rig; crane; various types of rollers; in-place mixers; pavement finishing machine with spreader; trencher; and hydroseeder.

Construction materials include concrete, aggregate stone, wood, steel and other metals. Water would also be used, as well as diesel fuel, gasoline and electricity. Locally available construction materials include embankment borrow materials, fine and coarse aggregates, base course materials, lumber, water, etc. Materials such as reinforcing steel, precast concrete articles or corrugated metal pipe and lighting fixtures would normally come from Manila or from overseas, while cement would be obtained from Davao. The City has adequate supplies of fuel and lubricants and repair shops. To obtain aggregate materials, it would be necessary to undertake one or more of the following operations: stripping or removal of overburden, excavation or extraction, screening, crushing to size, washing, blending and stockpiling. Several aggregate supply sites have been identified, including the Buayan River Quarry, the Makar River Quarry, and the Siguil River Quarry. Further testing would be needed to assure adequate quality of materials, although it is assumed that the Makar River Quarry would be used.

Construction vehicles would consist of concrete mixer trucks, asphalt tank trucks, water and staff trucks, and materials hauling and shipping vehicles (semi-trucks). Erosion and dust generation control during construction would consist of sprinkling areas of earthmoving activities, including the access road, lining exposed ditches with straw bales, and covering bare areas and stockpiled earth materials with loose straw or other appropriate mulch, and installing silt fences and rock riprap.

2.2.3 OPERATION AND MAINTENANCE

The Feasibility Study and Master Plan can only address actual physical facilities associated with the project. Operation and maintenance would be the responsibility of the Air Transport Office (ATO), a regional authority or possibly a private contractor. Nonetheless, this report addresses these issues to the extent they can be reasonably foreseen.

<u>Operation</u>

The airport would operate seven days per week during daylight hours; the design does not include lighting for nighttime operations. Sunrise to sunset is an approximately 10-hour period within the 12-hour period between 6 a.m. and 6 p.m.

Currently, airport operations include two to three flights per day of the 54-seat Fokker-50 aircraft, which carries passengers (an average of 42 per flight) and minor amounts of cargo, about 455 kilograms (kg). The flights operate between General Santos City and Cebu, where connections can be made to Manila. In April 1991, flights were instituted between General Santos City and Iloilo, continuing on to Cebu. The airport has a total of 19 flights per week. Airport conditions, such as limited runway length, low pavement strength and poor condition, small terminal building located in the clear zone, and lack of refueling facilities, do not permit the use of larger, heavier aircraft than the Fokker-50.

The new facility would be constructed to accommodate the following aircraft:

Aircraft	Passenger Capacity (seats)	OR	Cargo Hold Capacity (kilograms)
Fokker-50	54		5,685
Airbus 300	246		32,770
Boeing 737	141		15,625
Lockheed Hercules 100 (C-130)	--		19,000

Future daily flights and annual operations, shown in Table 2, were estimated on the basis of passenger and cargo demand (see Table 3). Actual future operations will depend on factors that cannot be determined at this time, such as the number of airline companies that might be operating in the future, the requirements for interactions with other airports and connecting flights, and economic or other changes that could affect future passenger and cargo demand levels and aircraft operating costs.

In 1995, three flights per day are projected; in 2000, five are projected; and in 2015, seven are projected. Note that one flight equals two operations: landing and take-off. Annual flight operation projections are 2,190 in 1995, 3,650 in 2000, and 4,610 in 2015. Annual cargo demand is projected at 8,300 metric tons (MT) in 1995, 17,095 MT in 2000, and 26,195 MT in 2015.

Airport employment is projected to increase from the current 34 ATO employees to about 85 in the year 1995 (for ATO or other airport operator), to about 94 in 2000, and to about 118 in 2015.

Table 2: Projected Daily Flights and Annual Operations by Type of Aircraft and Route

	1995		2000		2015	
	Daily Flights	Annual Operations	Daily Flights	Annual Operations	Daily Flights	Annual Operations
GES/MNL[1]	1	730	1	730	2	1,460
A-300	--	--	2	1,460	3	2,190
C-130						
GES/CEB[1]						
F-50	2	1,460	2	1,460	--	--
B-737	--	--	--	--	2	1,460
TOTAL	3	2,190	5	3,650	7	5,110

[1] Abbreviations refer to Air Transport Office (ATO) airport designations: GES = General Santos City Airport; MNL = Ninoy Aquino International Airport (NAIA) in Manila; CEB = Mactan International Airport at Cebu.

Source: Wilbur Smith Associates, 1991

Table 3: Daily and Annual Projected Passenger and Cargo Demand						
	1995		2000		2015	
	Daily	Annual	Daily	Annual	Daily	Annual
Passengers	287	104,722	428	156,342	910	331,992
Cargo (metric tons)	23	8,330	47	17,095	73	26,195
Source: Wilbur Smith Associates, 1991						

Maintenance

As noted, maintenance would be the responsibility of ATO or a private contractor. The recommended project design is, however, based on the recognition of limitations on local maintenance resources and observations of local capabilities and practices.

Runway and Other Paved Surfaces

Runway maintenance is most critical for an airport facility in terms of its ability to operate safely. Runway and other paved areas are proposed to be constructed of Portland Cement Concrete Paving (PCCP) because of the familiarity and capability of the local workforce with concrete construction practices and its low maintenance requirements. Specifications for pavement preparation are designed to improve upon local practices (using crushed rock as opposed to rounded pebbles to improve subsurface material adhesion).

Terminal and Other Buildings

The terminal, CFR and Flight Service Station buildings would be similar in construction to the existing terminal building, which is a combination of concrete block, metal and wood. The existing building shows some signs of wood rot, but is otherwise in excellent condition. The cargo, generator, cold storage and maintenance buildings would most likely be concrete and/or metal structures. All buildings would thus be expected to require only routine minor maintenance, and be well within local maintenance capabilities.

Perimeter Fence

The perimeter fence is proposed to be of chain link fencing, which is available locally. The primary problem with maintenance of the fence is its length, but regular surveys would overcome this.

Non-Built Areas

Non-built areas (areas with neither pavement nor buildings) would be subject to natural erosion and that from increased runoff from built areas. This is intended to be controlled by a combination of vegetative groundcover and a drainage control system. Groundcover would be a low-growing, drought-tolerant species, preferably native, and native grasses, that would require little attention. Such groundcover would be in addition to any landscaping for aesthetic purposes. The runway edges and road shoulders would have Double Bituminous Surface Treatment (DBST), which is a crushed aggregate base with a thin layer of asphalt as a binder) to reduce erosion and dust generation.

Utility Systems

The airport would have a well, septic sewer system and drain field, electricity and backup diesel generator, and a drainage system. All of these are commonly found in the area, and maintenance expertise and parts are readily available. The drainage system would be a combination of concrete pipe and channels and rock-lined ditches directed, where appropriate, to grass-lined detention ponds to hold runoff on site until it evaporated or could be safely released. Drainage along the road would either be concrete channels or rock-lined ditches. The center of the road would be the highest point, to direct water into the ditches, where it would be collected for evaporation, drainage, or discharge to Sarangani Bay, depending on expected volumes.

2.2.4 CONTINGENCY PLANS

Accident or other hazards during construction would be associated primarily with construction equipment and exposure to high particulate levels during earthmoving activities. Training in proper equipment operation and safety procedures, wetting down the site, covering piled earth and providing dust masks should adequately address these risks.

Hazards associated with operation include aircraft crashes, fires, and fuel spills during emergency landings or fueling operations. Project safety and emergency response procedures would include a fire house that would accommodate up to four rescue and fire fighting vehicles; three are recommended by International Civil Aviation Organization (ICAO) standards. The building would also house an ambulance and staff. (As noted earlier, the Master Plan can only address physical features of the airport. Operation would be determined by the ATO or a private contractor.) ICAO standards are that all vehicles be fully supplied with water and fire suppressant agents, and have engines started during each flight operation. Four vehicles would have a foam solution discharge rate of 7,200 liters per minute.

Fuel ejected during emergency landings would be most likely be ejected over water. At any rate, jet fuel evaporates rapidly in the atmosphere and little would be expected to reach the surface. The approach path to the Tambler site is undeveloped and is likely to remain so for some time, given its distance from development and infrastructure, including water, power, and transportation access.

The fuel tank farm would be above-ground and within a spill containment structure surrounded by a fire wall. Jet fuel is kerosene-based, and is very stable in comparison to diesel or gasoline. The tank farm would be inspected annually.

The maintenance shed would be equipped with a fuel/oil separator, for separation and storage until these materials could be disposed of properly.

2.2.5 ABANDONMENT PLANS

New Airport

The airport would have a design life of approximately 50 years, although in actuality it would probably operate for a longer period. The General Santos City Airport Master Plan addresses facility development through the year 2015, although the accuracy declines as the planning period is extended. Airport master plans are typically revised every five years, and it is by this means that the plans are made to reflect current conditions. There is, therefore, no proposal for abandonment of the new airport in the foreseeable future.

The access road would be constructed as one of the first items, although not with a finished surface, and would be used for construction access. The road would then be finished; it is not proposed for abandonment. The portion of the existing road to San Jose within site boundaries would be eliminated. A new road would be provided about 400 meters north of the existing alignment.

Temporary structures during construction include those associated with the construction camp: equipment sheds, construction headquarters and possibly day use buildings and temporary housing for workers, and perimeter fencing. All these structures would be temporary and would be removed when no longer needed, as would the concrete batch and aggregate crusher plants. Presumably, all reusable materials would be gathered by the construction contractor and reused.

Existing Airport

The Buayan Airport would continue to operate until the new facility opened, projected for 1995. At that time, the existing airport would be abandoned. Future use of the site would be determined by the RP, as the land is under public ownership. Whether existing structures would be removed or reused would be based on the site's final disposition. In this report, it is assumed that the site is turned over to General Santos City by the RP for infill development similar to that abutting the airport, a combination of residential, agricultural and fishing uses.

2.3 PROJECT ALTERNATIVES

The following outlines actions evaluated as alternatives to the proposed project. Eight altenatives were considered in the Preliminary Report of the Feasibility Study (WSA, March 1991). A comparison of the impacts of feasible alternatives to the project is contained in Section 5.

2.3.1 NO PROJECT

This alternative involves no change in existing airport conditions or operations. Scheduled maintenance activities, necessary for continued airport operation, would occur. No improvements would be made as part of the project, however.

2.3.2 NON-CONSTRUCTION ALTERNATIVES

Service Changes

Under this alternative, either the type of aircraft or the frequency of operations at the existing airport would be changed. As part of the analysis for the Preliminary Report, it was determined that, because of runway strength and size limitations, it would not be feasible to operate aircraft larger than the Fokker-50 at the Buayan Airport. Increasing frequency would be the only way to improve service.

Since the terminal building and apron cannot accommodate more than one Fokker-50 (or similarly sized aircraft) and its related passenger level at one time, flights could not be increased beyond one operation per hour. Allowing accommodation for unscheduled delays, etc., it is assumed that the airport could safely accommodate seven or eight flights (14 to 16 operations) per day.

Davao Road Improvement

Under this alternative, the road to Davao would be improved to allow faster, more convenient travel to the airport at Davao, which has direct flights to Manila. The General Santos City airport would operate as at present. Currently, about 16 MT of cargo are trucked to Davao daily for shipment to Manila. Less than 3% of passengers from General Santos City also make the approximately three-hour trip to use the Davao airport. There is no reasonable alternative for cargo shipments needing transport by air; existing service at General Santos City cannot accommodate the cargo loads.

2.3.3 DIFFERENT SITES

The Preliminary Report examined two sites in addition to Tambler: expansion of the existing airport at Buayan, and construction of a new airport at a site in Barangays Apopong and Sinawal.

Buayan Site

Several expansion schemes were examined for this site. The most feasible was that referred to in the Preliminary Report as Scheme IV. Under this alternative, a new runway would be constructed east of the existing runway. In order to build the required length, the National Highway north of the site would be realigned further north and a new bridge constructed across the Buayan River to meet the new alignment. This would provide additional space on the north. On the south, the runway would be extended about 400 meters into Sarangani Bay. A new terminal building and parking area would be constructed. All the area between the airport and the Buayan River would be vacated, as would some of the area to the north for highway relocation. This would mean the relocation of approximately 250 to 260 families, and the removal of portions of existing prawn farms and agricultural uses. The airport would continue to operate as at present until the new facilities were opened.

Apopong/Sinawal Site

The northeast end of this site lies just west of the Matna River Gorge where it meets the National Highway northwest of the City. The site stretches to the Saboay River

Gorge, which forms the southwest boundary. This site was determined to have fatal safety and approach flaws. The gorges, both deep, wide indentations, are hazardous formations at either end of the runway in the event of runway overruns. In addition, Mt. Matutum, a dormant volcano, elevation 2,293 m, is in the approach path. Because of these fatal flaws, this alternative is infeasible and will not be examined in this report.

Phasing

In addition to the alternatives above, the potential for an even greater level of phasing than currently proposed was examined. Under the earlier phasing scheme, presented in the Preliminary Report, a runway of 2,000 m to accommodate the B-737 aircraft would have constituted Phase I, with the 2,400-m runway for the A-300 aircraft constituting Phase II. On the basis of projected 1995 cargo and passenger demand, however, the B-737 would be too small to provide the needed service. This phasing scheme, therefore, is not considered feasible and will not be examined in this report.

3.1 INTRODUCTION

3.1.1 FIELD STUDY METHODOLOGY

Information pertaining to the sites in the areas examined in this report were gathered in four ways: 1) site visits (reconnaissance); 2) interviews with staff of government and other agencies; 3) review of available printed data; and 4) public meetings.

Site visits were conducted beginning in January 1991 through April 1991. City and local Barangay officials were instrumental in determining the location of the airport site within Barangay Tambler. All specialists associated with the preparation of this report personally inspected the site and its environs. In addition, noise measurements and soil samples were taken on the site and in its vicinity, and plant samples collected, dried and pressed for identification.

Extensive interviews were conducted with knowledgeable government and non-government agency staff. A complete listing of the agencies, organizations and individuals contacted is presented in Appendix 7.3. National, regional and local government agencies were contacted, as were business and religious leaders and utility providers. In addition, a perception study was conducted (see Appendix 7.5).

Literature review included geologic, farming, land use, archaeological, meteorological and sociological data. In addition to these, previous studies on USAID PAPS projects in the area were consulted. A complete listing of printed references used in the preparation of this report appears in Appendix 7.4.

Public meetings were also helpful in gathering information. A discussion of these meetings in contained in Appendix 7.5.

3.1.2 LIFE OF PROJECT

The Master Plan and Feasibility Study, and hence this report, address facility planning to the year 2015. However, the airport service life is likely to be in excess of 50 years. Obviously, the life of the project would be affected by maintenance and use practices. By comparison, the Buayan airport has been in existence in one form or another since 1944. In its current incarnation, it has been in operation since 1986. Poor construction and maintenance practices have resulted in the Buayan airport's inability to accommodate larger aircraft than the Fokker-50, and the airport is occasionally completely closed due to pavement failures. The life of the project is thus dependent on quality control during construction and sound maintenance practices.

3.1.3. DEFINITION OF STUDY AREA

Study area boundaries differ somewhat depending on the focus of the analysis being conducted. For example, the Transportation Setting section describes the regional roadway network, while the Impact analysis focuses on the access road and nearby highway. Figures included in some sections graphically depict study areas.

The development pattern around the site defines the study area for many topics. That is, The Upper Tambler Resettlement Area, a three-parcel tract east of the site that contains housing and MSU, is the largest development in the site vicinity. The San Jose community west of the site is the next biggest development in the vicinity. These developments define the study area for some analyses. The socioeconomic impacts analysis, on the other hand, focuses on this area, but also considers the larger municipality. Biological and soils effects concern largely just the site proper, while drainage concerns the site and downstream areas. Land use and planning concerns relate to the site itself and its immediate environs, but also to the municipality and adjoining areas.

Study area boundaries are thus on three levels:

1. the site
2. the site vicinity
3. the region.

In this case, the region is defined as the General Santos City Municipality and Polomolok, including the Dole Philippines agricultural holdings, because they are potentially a major market for the project's cargo facilities.

3.2 CURRENT LAND USE AND REGIONAL PLANNING

3.2.1 REGIONAL PLANNING STRATEGY

In 1989, major overseas donor agencies and governments met with Philippine government agencies to establish a strategy for channeling funds from the Multilateral Assistance Initiative into projects for poverty alleviation. The strategy included the concentration of funds and development efforts into five regions. The strategy is that concentrated, coordinated and targeted funds invested in specific regions produce a higher level of overall benefits than a policy of distributing efforts more broadly. Another underlying principal of the strategy is to strengthen the ability of several selected regions to act as growth centers providing alternatives to continued concentration of economic activity and population growth in the Metro Manila area. Metro Manila suffers from a strain on infrastructure systems, shortage of housing, increasing traffic congestion, and conditions that are leading toward an overload and breakdown in urban structure.

One of the five regions identified for special development projects is General Santos City/South Cotabato Province in Mindanao. Two of the objectives established for the special development activities are as follows:

- to channel resources to rural areas and lay the foundation for a balanced and well-dispersed agro-industrial economy; and,

- to give priority to high value-added products, preferably using indigenous raw materials, with immediate export potential.

A key project in establishing the framework for investments in the South Cotabato area will be a Growth Plan, to be funded by the USAID Mindanao Development Project (MDP). The Growth Plan will serve as a guide for future infrastructure investment, will pinpoint those productive sectors in the region with the greatest growth potential and will identify infrastructure investments likely to support those sectors. The Growth Plan will examine in detail the economic and environmental linkage effects of an overall package of investments for both rural and urban areas of South Cotabato.

Although the Growth Plan has not yet been prepared, several basic infrastructure projects are recognizable as potential contributors to overall economic growth for the region. These projects have been identified through the process of assessment of local sentiment and support for the most needed projects, and have been evaluated at least through the preliminary feasibility stage. These projects include:

- Air service improvement (this project);
- Expansion of Makar Wharf;
- Development of an Agro-processing and Fish Landing Center; and
- Improvement of the telecommunications systems.

Thus, in terms of economic growth, improved air service is identified as part of the overall development strategy. Without a physical development strategy plan that represents locational factors or development patterns that would provide a framework for the siting of projects, the project site can only be evaluated within the context of local development plans, and its relationship to other planned projects. The following discussion describes existing land uses in the site vicinity, Comprehensive Plan and zoning designations for the area, and proposals for future related infrastructure projects.

3.2.2 EXISTING LAND USE PATTERN

In comparing impacts and evaluating alternatives, a knowledge of the existing land use patterns surrounding both the Tambler and Buayan sites is needed. Land use surrounding the Buayan site is described and summarized in Section 5.1.1 and is not repeated here. The following is a description of land uses in the vicinity of the Tambler site.

Generalized existing land use in the area of the Tambler site is illustrated in Figure 4. Major activity centers include the industrial and processing uses between the waterfront and the highway, the commercial and light industrial uses along the highway, the campus of Mindanao State University and the residentially oriented uses of the Upper Tambler Resettlement Area. Secondary activity centers include the low density and scattered residential areas west of the highway, and the residential/agricultural community of San Jose, west of the proposed airport site.

Major transportation-infrastructure-related uses in the area include Makar Wharf, Dole Pier, and General Milling Corporation Pier (described in greater detail in Section 3.4.1, Transportation). These are all on the waterfront near the highway. Makar Wharf, located immediately north of the mouth of the Makar River, is the major commercial port of the region, handling passengers and cargo. Dole Philippines Pier, about 2 km south of the Makar Wharf, handles only cargo, mostly outbound pineapples and bananas, for Dole Philippines. General Milling Corporation Pier is about 1 km south of Dole Pier and handles primarily grain and cereals.

Makar Wharf and Dole Pier are exclusively transport intermodal interchanges between road and sea transport. General Milling operates not only its shipping facility but also a grain storage and processing plant, and is thus primarily an agro-industrial use.

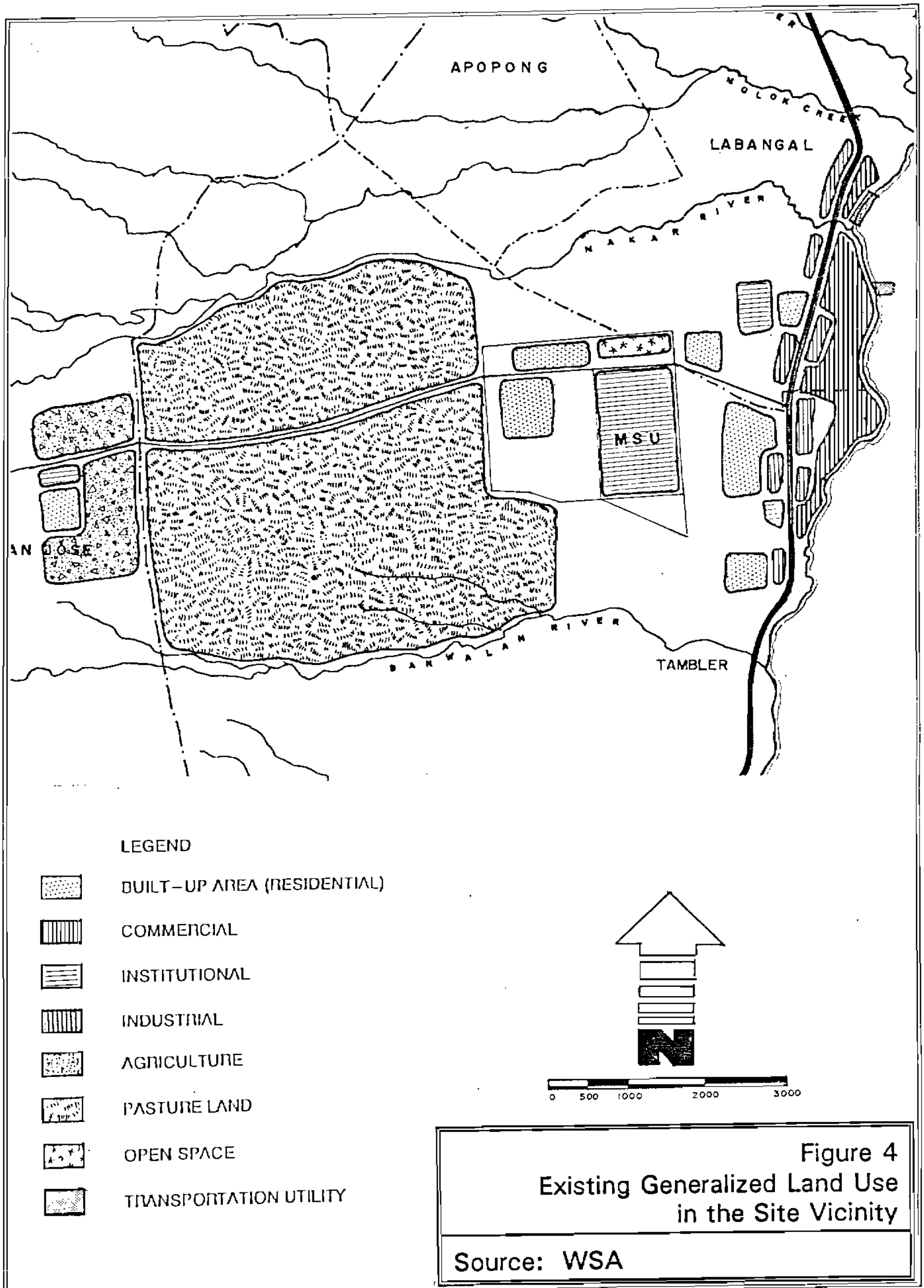

Figure 4
Existing Generalized Land Use
in the Site Vicinity

Source: WSA

Land between the highway and the waterfront varies in width from only about 200 m near the mouth of the Banwalan River to about 1,100 m near the intersection of the San Jose-MSU unpaved service road intersection. Thus, for the most part there is sufficient land area between the highway and the waterfront to accommodate industrial, processing, or other heavy uses. In fact, this area is generally in extensive use by industrial establishments, processing and assembly uses and commercial uses. Except for the southernmost edge of the land use study area shown on Figure 4, just north of the mouth of the Banwalan River, there are no large, vacant tracts available for industrial, agro-industrial or processing uses. These uses, in the future, would have to be developed west of the highway, with any new uses east of the highway in the form of infill development.

The western frontage of the highway is more sparsely developed than the eastern side. Land for a depth of several hundred meters westward from the highway is developed with a mixture of commercial, light industrial and residential uses. There is an elementary school fronting the highway, about 1 km south of the intersection of the San Jose-MSU service road with the highway.

Behind the mixed uses fronting the west side of the highway, about 1 km north of the San Jose-MSU road intersection, there is a zone approximately 0.5-km wide in which occur scattered, low-density residential development and some residentially related uses, such as a sports complex. Approximately 500 families live in this area, which is about 7 km from the site.

Along the San Jose-MSU road, east of the MSU campus, there is a scattering of uses including boarding houses probably related to the campus, and small commercial establishments.

The MSU campus, located about 3 km east of the site, is a major activity center. It is located 1.5 km west of the highway and covers an area of 150 ha in a rectangular site approximately 1,000 m wide and 1,500 m deep. MSU currently serves a student body of about 2,500 but enrollment is growing rapidly and is expected to reach capacity, about 4,000 students, within several years. The campus includes classroom, laboratory and other instructional facilities, administrative and office areas, student dormitory housing and faculty/staff housing.

To the west and north of the MSU campus lie the residential areas of the Upper Tambler Resettlement Area. This area was originally conceived in the early 1980s as an area for relocation of squatter families and housing for municipal government employees. It originally consisted of 556 ha. Of that, 150 was allocated for MSU. An additional 95 ha was reserved for open space uses. A muslim cemetery (4 ha) and a Christian cemetery (26 ha) account for another 30 ha area just north of the MSU campus. Of the remaining 281 ha for residential uses, 60 ha are devoted to housing areas for the government employees and 221 ha are available for general resettlement. Currently, about 2,850 families occupy the area.

Further west, beyond the Upper Tambler Resettlement Area, the land containing the recommended airport site is now used for pasture. The land is government owned, alienable and disposable and currently under a pasture lease that expires 30 June 1992. The overall size of the pasture lease area containing the airport site is 1,467 ha, but adjacent parcels are also used for pasture. Pasture is thus the largest land use in the area in terms of land coverage. Most of the pasture land is open range land, fenced into several sections. The proposed airport site has a ranch house and several small ancillary structures. The house is not used as a permanent residence but as an occasional residence by ranch workers. The airport site is approximately 6 km west of the highway.

Further west beyond the airport site, about 10 km from the highway, is the agricultural community of San Jose. The community contains several hundred residents and is oriented to farming. An irrigation project in the area supports agricultural activities.

Land areas to the north and south of the proposed airport site are open land. They are used principally for cattle grazing and as forest lands, with a few scattered agricultural uses.

There are no concentrations of existing development near the airport site. The nearest developed land uses are in the San Jose community, which is about 2.5 km from the runway location. The next nearest are the residential areas in the western portion of the Upper Tambler Resettlement Area, which are about 3 km from the runway location.

3.2.3 EXISTING COMPREHENSIVE PLAN/ZONING

A Comprehensive Plan for General Santos City was prepared by the Office of the City Planning and Development Coordinator, with technical assistance from the Housing and Land Use Regulatory Board, and adopted by the City in March 1990. At the same time a Zoning Ordinance was prepared and adopted. The description of the Comprehensive Plan that follows is based on the March 1990, Plan. The Plan, however, undergoes continuous review and refinement. In March 1990, the Tambler site for the airport had not yet been identified, and the Comprehensive Plan assumed continued location of the airport at Buayan. Figure 5 shows existing Comprehensive Plan designations (1990 through 2000). Since zoning boundaries shown on the Zoning Map are identical (with two exceptions) to land use patterns shown on the Comprehensive Plan, Figure 5 shows combined Comprehensive Plan and zoning designations in the vicinity of the site. One difference between the Comprehensive Plan and the Zoning Map is that the Plan shows a strip of commercial use on the north side of the road leading into MSU that is not shown on the Zoning Map. The commercial strip is included on the map in Figure 5. The other difference is that the Zoning Map shows three categories of industrial use (light, medium and heavy) while the Comprehensive Plan consolidates these into a single industrial category. Figure 5 shows only the single category as per the Comprehensive Plan.

The proposed airport site is in the west quarter of a 1,400-ha area planned and zoned for industrial use (shown as light industrial on the Zoning Map). In addition to the industrial land around the proposed site, the Comprehensive Plan designates tracts of industrial and agro-industrial land just south of the Banwalan River (about 800 ha), between the highway and the waterfront (about 300 ha), and on land of the Espina Estate, in Barangay Labangal, north of the Makar River (about 900 ha).

Commercial land in the vicinity is shown on the Comprehensive Plan as being concentrated in a strip on the west side of the highway.

Institutional uses include the MSU campus, the sports complex west of the highway and north of the MSU entrance road, an elementary school fronting the highway south of the MSU entrance road, and the government and public use area of the San Jose

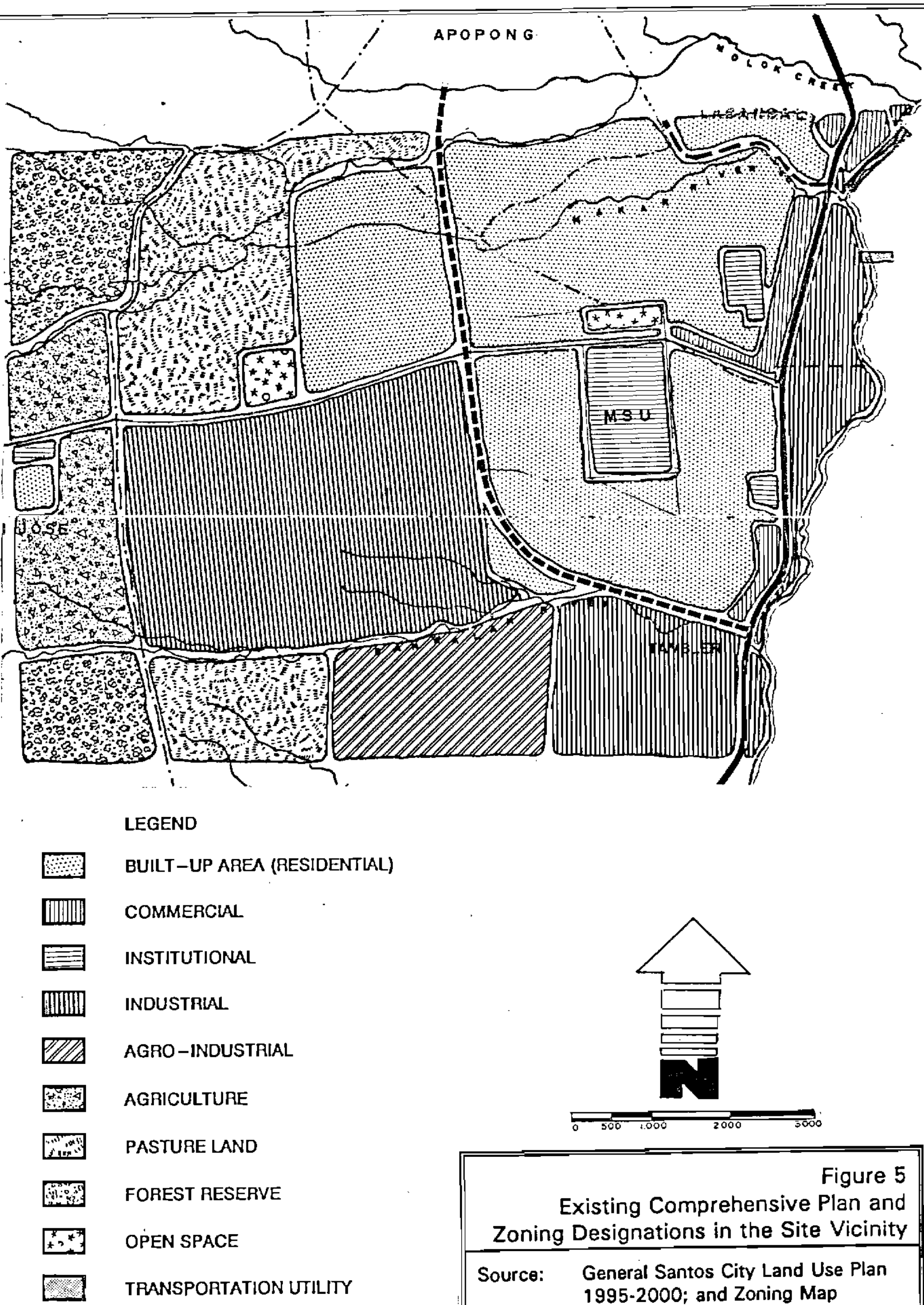

Figure 5
Existing Comprehensive Plan and Zoning Designations in the Site Vicinity

Source: General Santos City Land Use Plan 1995-2000; and Zoning Map community. All of these occupy small land areas except the MSU campus, which covers 150 ha.

Open space and buffer land in the Comprehensive Plan take the form of open space strips, cemeteries and recreation areas. The Plan designates open space strips along each of the major rivers and creeks (Makar, Banwalan and Balnubo) of about 50 to 100 meters in width (these are too narrow to be shown on Figure 5). The existing cemetery is shown (about 30 ha just north of MSU). An open space/recreation area is designated north of the road between MSU and San Jose. This is a rectangular area of 25 ha, reportedly intended for a park, or possibly a golf course.

The Comprehensive Plan anticipates construction of a circumferential road before 2000 (this is a proposed bypass road discussed further in Section 3.4.1). Within the circumferential road, the Comprehensive Plan designates uses that are predominantly residential and institutional in character, except for a commercial strip along the highway. Most of the residential uses shown on the Plan in the airport site vicinity lie within the circumferential road (about 1,700 ha of land), with the exception of one residential area of about 450 ha that is situated in the northwest quadrant of the intersection of the circumferential road and the MSU-San Jose Road.

The Plan designates the areas north and south of the future industrial zone that encompasses the airport site as pasture land, a continuation of the existing use. All of the land in Barangay San Jose (with the exception of the San Jose community itself) is designated by the Plan as agricultural or forestry use. Land within about 1 km to the north of the San Jose community and 2.5 km south are designated agricultural use, with land further north and south designated as forest reserve areas.

The land areas of various uses designated by the Comprehensive Plan, as shown in Figure 5, are as follows:

Recommended Use	Area (ha)
Built-Up Area, Residential	2,260
Commercial	170
Institutional	210
Industrial	2,060
Agro-Industrial	400
Agricultural	470
Pasture Land	1,080
Forest Reserve	670
Open Space/Buffer	70
Transportation Utility	20
TOTAL	7,410

3.2.4 PROPOSED DEVELOPMENT PROJECTS

Proposed development projects in General Santos City (and South Cotabato Province) are shown in Figure 6 on page 35. The projects outlined are those that are proposed or under active consideration by public agencies, overseas development assistance agencies, or the local government. There are undoubtedly other projects under investigation or planning by the private sector, but no such projects have been identified during this investigation. Major sources of funding and promotion of projects are the Municipal government, USAID through the PAPS project and the Rural Infrastructure Fund (RIF) project, and the Asian Development Bank through the Philippine Regional Municipal Development Project (PRMDP).

Road and Street Improvements

One road project in the site vicinity is the previously mentioned "circumferential road" (RIF funded). This proposal has been considered as part of an overall road improvement package for South Cotabato Province. It is proposed to alleviate future potential congestion and traffic problems on the General Santos City-Maitum (GSC-Maitum) Highway, while providing a circumferential route around the perimeter of the city, linking the highways toward Maitum, Polomolok, Davao, and Glan. Such a circumferential road would allow incoming traffic on these highways to bypass the congested city area. At present, traffic passing through the General Santos City area to other cities of the region is funneled into the central area, where streets are congested. The circumferential route would facilitate the flow of regional traffic and reduce congestion experienced by local traffic.

At present the route has been dropped from further consideration under the RIF feasibility studies because of the difficulty in identifying rights-of-way (ROW) that can be acquired. Even though traffic flow justification exists and economic feasibility has been established in preliminary analyses, ROW acquisition problems appear at this stage to be serious enough to halt the project, or at least delay it indefinitely. For purposes of this study, it has been assumed that the circumferential road will not be built.

Improvement of the GSC-Maitum Highway has also been considered under the RIF project. The northern end of the highway is paved and is adequate to carry projected traffic far beyond the next 10 years. However, the segment beginning just south of the intersection of the proposed airport access road is unpaved. This highway links all of the farming and fishing communities along the southwest coast with General Santos City, and improvement of the highway would improve transportation access to markets, stimulating production in the area.

Reconstruction of the Lower Silway Bridge is being recommended by the PRMDP. The old structure is not suitable for carrying trucks and modern vehicles. Connecting roads are also in very poor condition. Reconstruction of the bridge would facilitate movement of local traffic from the downtown area across the Silway River, but additional crossings of the Saboay River and the Molok Creek would be needed to connect to the main highway. Also, on the city side of the Silway River, the route would lead into the main road along the waterfront, which is very congested with local commercial traffic, and opening the Lower Silway Bridge would not offer any relief to truck traffic seeking to avoid downtown congestion.

The need for improvement of street surfacing on central area streets has become acute. Improvement or paving of street surfaces in many locations would make the street system more continuous and would facilitate traffic flow. A city streets improvement project is being recommended by PRMDP.

The PRMDP also identifies the San Isidro neighborhood as a prime area for residential growth. In order to facilitate this, the PRMDP recommends a street improvement northward from the National Highway, identified as the San Isidro Diversion Route.

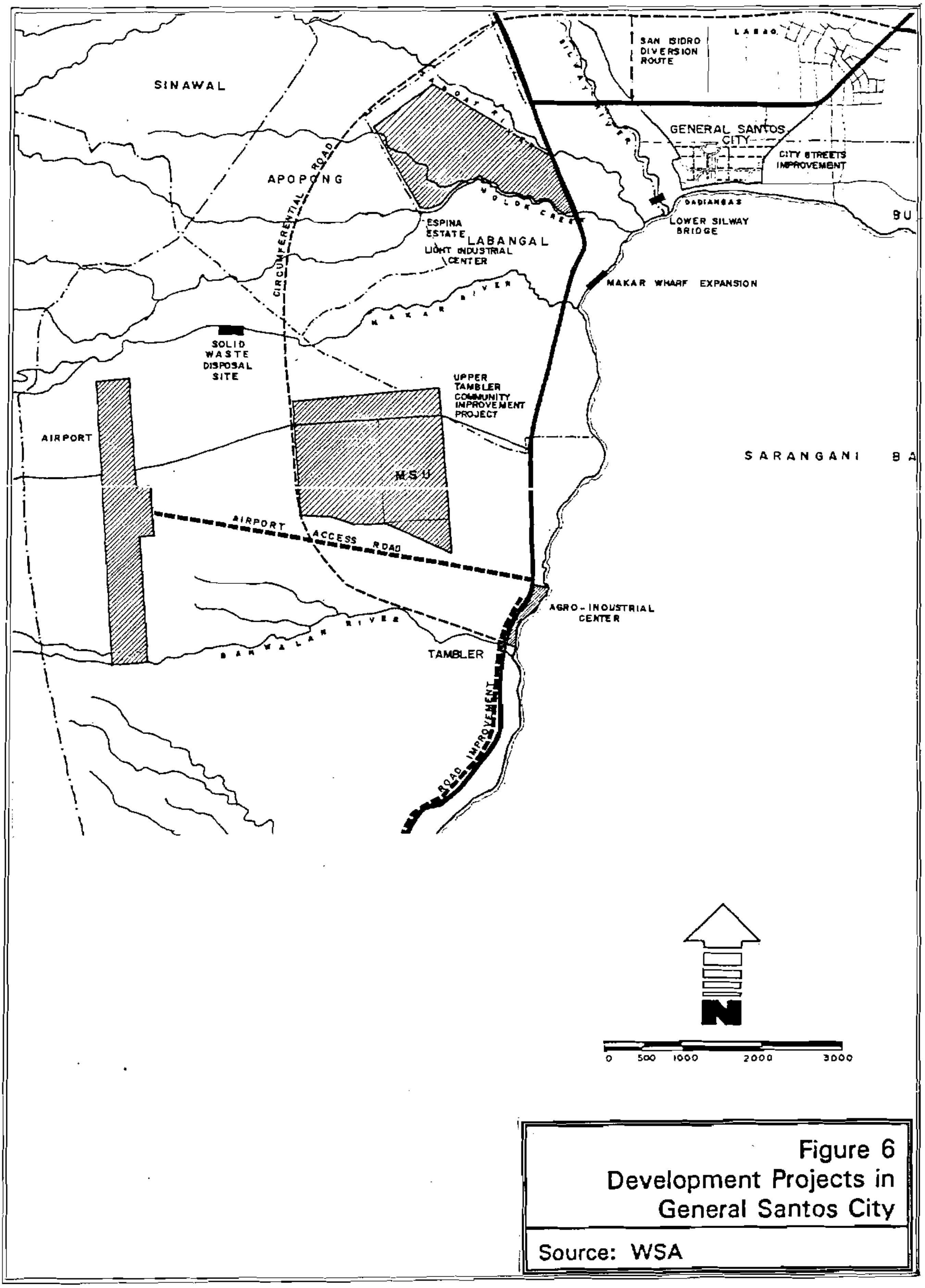

Figure 6
Development Projects in General Santos City

Source: WSA

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Port and Waterfront Improvements

Port and waterfront improvements currently under consideration include expansion of Makar Wharf and moving fish-landing activities from the beach of Dadiangas to a new agro-processing facility on west shore of the bay.

With proposed increases in agro-processing and other manufacturing, expansion of the general cargo port of Makar Wharf would be necessary to handle expected increases in cargo traffic, both for inter-island markets and for export. The port is not yet congested, but peak seasonal traffic may soon lead to delays. On the basis of traffic forecasts made for the USAID Mindanao Area Development Study, and based on current trends, an increase in total cargo from 880,000 tons in 1989 to 1.6 million tons is expected by the year 2000. On the basis of historical growth rates and current throughput capacity, Makar Wharf will become congested by 1994. Currently, the port has a wharf length of 561 m, accommodating six berths, three public transit sheds with total area of 6,480 m^2, and open storage of 25,000 m^2. Proposed improvements would extend the wharf by 221 m, adding three berths, provide for land reclamation required for the extension, develop additional open storage and backup areas, install portable grain handling equipment, and improve container handling facilities.

The principal fish landing area, particularly for tuna boats, is the beachfront of Dadiangas. There are no waterside facilities, no wharfs or piers. The tuna boats maneuver into shallow water and tuna must be off-loaded by throwing the fish overboard, where they are picked up and carried out of the water to the beach by hand. Inspection and grading, weighing and buying by fish processors takes place at stalls along the beachfront with no supporting infrastructure such as ice plants. The fish are then loaded onto trucks and moved through the congested downtown waterfront area to processing houses or shipped out to Davao. Very limited amounts of tuna are shipped out by air from the General Santos City Airport, due to the lack of cargo capacity on the Fokker-50 and the lack of direct service to Manila.

A proposal exists to move the fish landing to a modern, efficiently designed landing and processing port on the west side of Sarangani Bay, near the mouth of the Banwalan River. This facility is envisioned as part of an agro-processing center that would handle various fishing and agricultural products produced in the region. The agro-processing center is described in the following section.

Agro-Processing and Industrial Centers

The site identified for the agro-processing center is a 32-ha parcel on the waterfront just north of the mouth of the Banwalan River, extending from the waterfront to the highway. The portion of the complex related to fishing is anticipated to include three fish landings, auction and market halls, ice plants, cold storage plants, bonded warehouses, and support facilities. The agro-processing center is under study for funding through the PAPS program, and it appears likely that Japan would also provide assistance, specifically for the fishport component of the project.

In addition to the need for modernization of facilities and processes related to the fishing industry, there are similar needs for processing improvements for other parts of the area's agricultural sector. This is particularly true of the need for small producers to bring their products to an area where they have access to buyers and where buyers and processors can share facilities that can operate on an efficient scale. This applies to producers of fruits, vegetables, livestock and related products, such as flowers.

The agro-processing facility now under study would include a livestock complex with two abattoirs, a meat processing plant, and a bone meal plant and feed mill. Crop processing would include a fruit and vegetable processing plant, vegetable oil extraction plant and a cannery. Support infrastructure for the facility would include power, water, cold storage, ice making, waste disposal, maintenance facilities and roads. Because of the many diverse facilities and activities to be accommodated, it has become apparent during pre-feasibility investigation that the identified 32-ha site would not accommodate all of the uses, and expansion or back-up sites are being sought.

One such site that has been identified is Hacienda Espina, or the Espina Estate. This property is in Barangay Labangal, lying west of the National Highway extending from the Saboay River on the north to Molok Creek on the south. The parcel encompasses an area of just over 900 ha. The municipal government has moved to acquire the site (and may have already done so) with intentions of developing it for light industrial and residential uses. It could serve to accommodate agro-processing uses that consume too much land to be located in the agro-processing center (such as open storage or grain processing), or uses that may conflict with adjacent activities, such as a slaughterhouse. The 900-ha site size should make enough land available for all such uses, and also serve to absorb demand for other light industrial and processing uses.

Community Facilities Development

Of the five municipal community development or resettlement areas, and five areas established by NGOs, the only one with remaining undeveloped area is the 556-ha Upper Tambler Resettlement Area, described previously. It contains the MSU campus, two cemeteries, housing for government employees, and resettlement housing. Proposed for future inclusion in the development are a hospital or health clinic and a high school. Extension of new residential development on the 39-ha portion of the Resettlement Area (Lot 3) lying immediately south of the MSU campus is proposed to begin soon.

One other community development support facility is proposed near the airport. A 7-ha site on the Makar River about 2 km northeast of the airport site is proposed to be used as a solid waste disposal site. Land areas in the vicinity are already being used as dump sites, but the proposal includes improved techniques of landfill management, in conjunction with an improved program of solid waste management for the city, as part of the PRMDP.

Infrastructure Systems Improvements

Several infrastructure improvement and support systems projects are in the proposal or prefeasibility stages in the General Santos City area. They do not relate directly to the airport but would contribute to overall economic growth. Those projects include:

- Telecommunications Systems Improvements (PAPS).
- Water Treatment and Distribution System (PAPS).
- Sanitary Sewage Collection and Treatment System (PAPS).
- City Equipment and Motorpool Improvement (PRMDP).
- Drainage Improvements (PRMDP).

o Solid Waste Management Improvements (PRMDP).

3.3 SOCIO-ECONOMIC CONDITIONS

This section is intended to serve as the "Social Soundness" analysis portion of the Feasibility Study, in addition to providing socio-economic information required as part of the EA/EIS. The baseline data presented herein derive from primary (field) investigations and the report, *1989 Socio-Economic Profile, General Santos City* (Office of the City Planning and Development Coordinator, General Santos City, 1989). In addition, a perception study was conducted. The survey form and results are detailed in Appendix 7.5.4.

3.3.1 DEMOGRAPHY AND MIGRATION PATTERNS

The number of households in the city in 1989 was estimated at 26,068, with an estimated six persons per household.

Baseline data on population density indicates that the 1989 population of Barangay Tambler is 4,579 over a 78.5-square-kilometer (km^2) area, or a density of 58 persons per km^2. Tambler is the least densely populated of the 14 rural barangays in General Santos City (see Table 4).

The number of births by sex in Tambler is consistent with the demographic profile of the City and country as a whole. More males are born (59%) than females (46%). No data exist on the number of registered births and deaths by sex at the barangay level, but for the city as a whole, male infant mortality is higher, at about 60% of total mortality. The data do not show the survival ratio of male to female children in the 0-5 age bracket. For the city, there are slightly more males (51%) than females (49%). The average annual birth rate over the five-year period from 1985 to 1989 is about 34 per 1,000 and the average annual death rate is about six per 1,000, for a natural increase rate of about 28 per 1,000, or about 14%.

The project site, owned by the RP, Department of Environment and Natural Resources, is near the 556-ha Upper Tambler Resettlement Area, which was declared in 1983. Because it is a resettlement area, most of the residents can be considered "assisted migrants"; most of them were resettled in the area from foreshore or other areas near Sarangani Bay.

The Upper Tambler Resettlement Area has seven churches. Each purok (a division of the Barangay) has a chapel and there is a church of the Iglesia ni Cristo. Television provides the main source of recreation for the residents (50 of the households own televisions). Residents stated in interviews that the primary peace and order problems in the area are drunkenness, drug addiction (stick-inhalation), theft, and neighborhood fighting (violent confrontation among neighbors).

The community, led by the women organizers (mostly mothers) have established a "Mothers' Club" in each purok, and the spirit of cooperative endeavor is slowly taking root. In general, folklife in the community is no different from that of other villages in the country.

There are 10 B'laan families living in the resettlement area. The B'laan are originally inhabitants of the southern tip of Cotabato and the interior of southern Davao. They are divided into four separate subgroups. Their culture and ornamentation are similar to the T'Boli of Lake Sebu. These residents practice slash and burn (Kaingin) farming in the hills and use their houses in the area only for sleeping, spending most of their time in the mountains.

Table 4: 1989 Population Density by Barangay, General Santos City

Barangay	Population		Land Area		Population Density (Persons/km²)
	Number	% Share	Area (km²)	% Share	
Urban	**156,407**	**63.03**	**50.48**	**9.42**	3,098
Bula	26,042	10.49	3.23	0.60	8,058
Dadiangas	70,100	28.28	3.24	0.61	21,632
Labangal	22,929	9.24	24.95	4.65	919
Lagao	37,256	15.01	19.06	3.56	1,955
Rural	**91,748**	**36.97**	**485.58**	**90.58**	189
Apopong	6,018	2.43	19.77	3.69	304
Baluan	6,054	2.44	11.64	2.17	520
Buayan	6,550	2.64	5.28	0.99	1,239
Conel	11,706	4.72	74.05	13.81	158
Katangawan	8,413	3.39	19.76	3.69	426
Ligaya	5,128	2.07	6.38	1.19	804
Mabuhay	8,312	3.35	40.46	7.55	205
San Isidro	9,651	3.89	14.45	2.69	668
San Jose	5,816	2.34	67.01	12.50	87
Siguel	3,321	1.34	24.09	4.49	138
Sinawal	5,413	2.18	63.39	11.83	85
Tambler	*4,579*	*1.85*	*78.52*	*14.65*	*58*
Tinagacan	6,385	2.57	35.51	6.26	180
Upper Labay	4,394	1.77	25.28	4.72	174
TOTAL/AVG	248,147	100.00	536.06	100.00	463

Source: National Census and Statistics Office; General Santos City.

3.3.2 ECONOMICS AND EMPLOYMENT

Agriculture and fishing are large and growing industries in General Santos City. Canned pineapple, fresh and dried pineapple, fresh bananas, canned tuna, fresh frozen tuna, Philippine mahogany lumber, cotton seeds, bat guano, fresh asparagus and scrap copper are exported to foreign countries such as Japan. Approximately 54% of the work force is actively involved in the fishing and forestry sectors of the economy.

In 1989, General Santos City had a working age population of 137,866, or 55.6% of the city's total population. Table 5 shows the labor force by age. The labor force consists of 95,447 people, or 69% of the economically active population. Of these about 85,600, or 62% of the working age population, are employed. About 9,900 are unemployed. The employment rate is thus about 90% of the labor force. While the level of employment is reportedly high, underemployment is expected to be prevalent.

Table 5: 1989 General Santos City Labor Force Characteristics

Age	In the Labor Force		Not in the Labor Force	Total Working Age Population
	Employed	Unemployed		
15-19	9,320	2,097	15,377	26,794
20-24	15,791	4,032	7,055	26,878
25-34	25,859	2,675	10,998	39,532
35-44	18,286	385	3,272	21,943
45-54	10,139	137	1,507	11,783
55-64	4,377	525	1,576	6,478
65-over	1,824	--	2,634	4,458
Total	85,596	9,851	42,419	137,866
% Share	62%	7%	31%	100%

Source: Office of the City Planning and Development Coordinator, General Santos City

Employment opportunities in Upper Tambler are limited. Fishermen who live in the Resettlement Area are also engaged in farming, although they derive their main livelihood from Sarangani Bay and the City's fishing grounds. Some "maestros" (head fishermen), cooks and assistant "maestros" live in Upper Tambler.

3.3.3 UTILITY AND COMMUNICATION INFRASTRUCTURE

Public transportation in the site vicinity includes the long chassis public utility jeeps (jeepneys) locally known as the "Lawin"; tricycles; and public utility trucks and vans. Table 6 shows the distance of the barangays to Poblacion Dadiangas (the central city area) and regular fares to General Santos City. The road network serving the site vicinity is described in Section 3.4.1. Public utility buses are used for travel into and out of the City, while trucks, utility vans and other vehicles are used to carry freight. Air travel is provided to Iloilo and Cebu, as described in Section 2.2.3, and sea travel is provided through passenger lines docking at Makar Wharf (see Section 3.4.1).

The communication network consists of eight private radio stations (AM and FM) and television relay stations (Channels 5 and 7), 10 telegraph stations, two national commercial networks (RCPE and PT&T), and the Bureau of Telecommunications. It may be inferred that residents living in the area partake of the benefits resulting from the communication systems situation in the city, although in a very limited way. There is no telephone service in the project site area. Hand held radios are the primary means of long-distance communication. The city receives newspapers of national circulation and has several local weekly publications. Postal facilities are located in the City and at MSU.

The City uses four garbage collection areas. The city landfill site is adjacent to the Makar River north of the site. Sanitation and scavengers are ongoing problems.

Table 6: Distance of Various Barangays to Dadiangas and Regular Fares, 1989			
		Regular Fare (Pesos)	
Barangay	Distance (km)	Jeepney/Ford Fiera	Tricycle
Bula	3.5	-	1.00
Lagao	3.5	1.00	1.50
Sinawal	16.0	7.00	-
Apopong	5.0	2.75	2.75
Labangal	6.0	3.00	3.00
Mabuhay	11.0	4.00	4.00
Buayan	8.0	-	3.00
Baluan	6.0	-	2.50
Tinagacan	13.5	4.00	3.50
San Isidro	5.5	-	2.50
Katangawan	10.0	-	3.50
Conel	13.0	5.00	5.00
San Jose	17.5	7.00	-
Tambler	16.5	4.00	4.00
Ligaya	9.0	-	3.00
MSU Tambler	16.5	3.00	3.00
MSU Siguel	23.5	7.00	-
Source: Office of the City Planning and Development Coordinator, General Santos City			

Water supply in the City is from a combination of deep and shallow wells, pitcher and jetmatic pumps, and artesian wells. A few rural barangay residents still rely on water supply from rain, dugwells and rivers that are not potable. Through the PAPS program, USAID and CODA are proposing to conduct a feasibility study of a water supply and wastewater treatment system for at least the urban sectors of General Santos City. That study should begin in mid-1991.

The water supply system in the Upper Tambler Resettlement Area is Level I, as is true for most of General Santos City (see Table 7). However, 20 ha of the area are proposed to soon have drainage, septic tanks and a Level II water system. Currently, there are eight deep wells that are 180 to 250 feet deep. Only five of these are functional. The residents pay 0.25 pesos per gallon of water.

Table 7: General Santos City Water Facilities by Level, 1990												
Water Districts	Level I						Level II		Level III			
	1	2	3	4	5	6	7	8	9	10	11	12
Dadiangas												
Dadiangas Poblacion	40	19,821	2,028	13,124	1,925	11,550	-	-	-	-	-	-
Apopong	6	7,530	18	4,160	-	-	-	-	-	-	1	456
Sinawal	9	227	3	102	-	-	1	203	-	-	1	212
Lagao												
Lagao	56	27,231	1,221	8,423	1,257	16,952	-	-	-	-	-	-
Katangawan	22	3,340	69	723	49	1,176	-	-	-	-	-	-
Tinagacan	15	780	52	1,560	38	1,760	-	-	-	-	-	-
Upper Labay	4	460	-	-	-	-	1	1,201	-	-	-	-
Bula												
Bula	25	16,401	645	5,808	364	4,368	-	-	-	-	-	-
Buayan	21	3,276	46	1,380	36	1,004	-	-	-	-	-	-
Baluan	21	1,722	73	765	54	948	-	-	-	-	-	-
Ligaya	28	1,341	43	659	36	424	-	-	-	-	-	-
San Isidro												
San Isidro	18	3,128	114	1,912	149	1,735	-	-	-	-	-	-
Mabuhay	4	645	-	-	-	-	2	4,918	-	-	-	272
Conel	34	4,081	105	642	31	248	1	2,021	-	-	-	-
Labangal												
Labangal	36	34,570	230	2,103	149	2,384	2	6,747	-	-	1	2,270
Tambler	24	3,653	12	249	-	-	1	4,784	1	2,754	-	-
Siguel	16	1,198	4	117	2	74	-	-	-	-	-	-
San Jose	2	336	-	-	-	-	1	1,906	-	-	-	-

Legend:
1 = LI Public deep well
2 = Population served
3 = LI Private deep well
4 = Population served
5 = LI Private shallow well
6 = Population served
7 = LII Public well
8 = Population served
9 = LIII Public well
10 = Population served
11 = LIII Private well
12 = Population served

Note: Level I = people go directly to source; Level II = standpipe from well located in community; Level III = water piped to building.

Source: Office of the City Health Officer, General Santos City

3.3.4 EDUCATION, HEALTH AND SOCIAL SERVICES

Educational services in General Santos City are provided by both the public and private sectors. In 1989, government schools consisted of a total of 50 schools: 42 elementary; five high schools; one state university (MSU); and two vocational schools. The City has six school districts: General Santos City North, West and South, Bula, Cahilsot and Buayan. Tambler is part of the Cahilsot District. In general, the City lacks adequate supplies and classrooms facilities to serve the public school population. Private schools, of which there are 30, consist of: 12 elementary schools; 12 secondary schools, three colleges; and three vocational or technical schools. Adult and continuing education courses are also offered in the City. The Department of Education, Sports and Culture sponsors classes as part of its Non-Formal Education program. These include literacy and livelihood/skills development classes.

An elementary school near the National Highway serves the project site area. A high school is proposed in the Resettlement Area, although there are no firm plans for its implementation; the MSU High School is located along the National Highway near the city center.

Health services are provided by the Department of Health through the City Health Office and the General Santos City Emergency Hospital, in cooperation with the private sector.

The number one cause of morbidity in the City in 1989 was upper respiratory tract infection (42.9%), while diarrhea was second (16%). Pneumonia was the leading factor in mortality (27.5%), with accidents of all classes the second leading factor (14.1%).

In addition to the 85-bed public hospital, outpatient medical services are provided at the City Health Office and in 11 barangay health units. The private sector offers two hospitals with a total of 175 beds and four in-patient clinics with 45 beds. Hospital facilities include X-ray services, operating and delivery rooms, intensive care units, laboratories, EKG and ultrasound units, pharmacies and ambulance services. In addition, there are 26 private medical clinics, 12 private dental clinics, and 15 private optical clinics. The City offers immunization and other health service programs, including water sampling and disinfection.

In 1989, health care providers numbered 13 public health doctors, 23 public health nurses, 21 public health midwives, and four dentists. There are also nine sanitation inspectors, and 633 barangay health workers. On the basis of National standards, the City lacks an adequate number of health professionals.

Health care facilities in Tambler are limited. A hospital is proposed for the Upper Tambler Resettlement Area but, like the proposed high school, no firm plans exist for its construction. Health data for Tambler show head injury (accidents), asthma related illnesses, uremia, measles, sepsis, pneumonia, tuberculosis and cardio-vascular accidents as common health-related problems.

Social services in the City include nutrition programs that provide food and nutritional education at the barangay level; population programs including family planning; and welfare and emergency assistance.

3.4 PHYSICAL ENVIRONMENT

3.4.1 TRANSPORTATION

Figure 7 shows the existing major elements of the transport system serving the General Santos City area as well as proposed improvements or additions.

Existing Road Network

Two paved highways (National Highway segments) provide regional highway access to General Santos City. One of these leads from General Santos City to Cotabato City via Koronadal, and continues northwest, linking the provinces of South Cotabato, Sultan Kudarat and Maguindanao. In addition to passenger travel, this highway provides access to rich agricultural areas around Koronadal and to the Dole Plantation in the municipality of Polomolok.

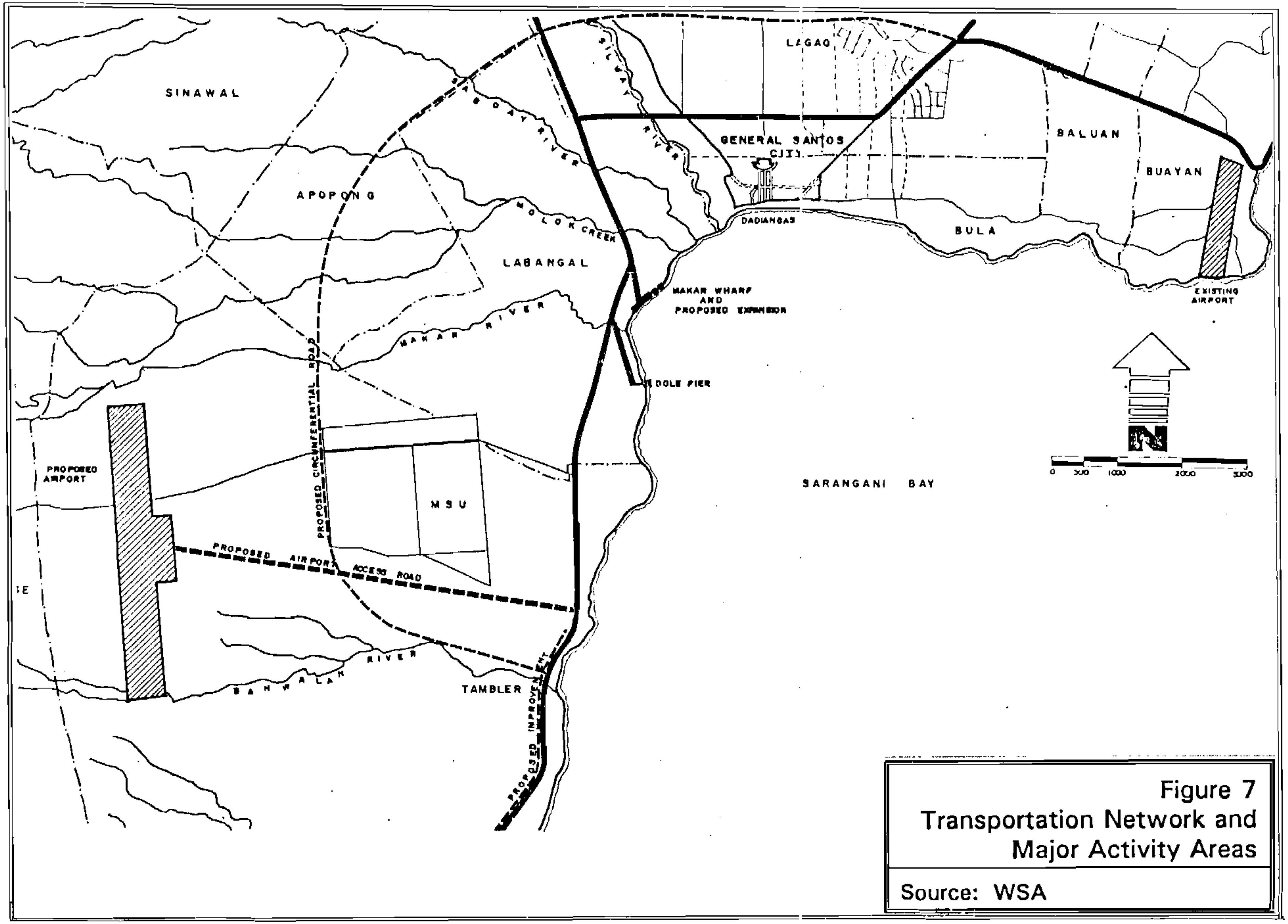


Figure 7
Transportation Network and
Major Activity Areas

Source: WSA

The other main paved highway leads northeast from General Santos City to Davao via Digos. This highway is in very poor condition for a large part of the route between General Santos City and Digos. In addition to the paved highways, an unpaved road follows the coastline from General Santos City south and west along the coastline through Maasim, Kiamba and Maitum to Palimbang, and southeast, along the coastline from General Santos City to Alabel, Malapatan and Glan.

About 8 km of the General Santos City-Maitum (GSC-Maitum) Highway is paved, to a point just south of the location of the proposed airport access road (south of the RFM plant). This road segment has a right-of-way width of 30 m and is paved 7.3-m wide with Portland cement concrete pavement.

In all, South Cotabato province has a total road network of 5,163 km (1989), administered as follows:

National	730 km
Provincial	1,013 km
City	214 km
Municipal	512 km
Barangay	2,694 km
Total	5,163 km

The pavement characteristics of these roads are as follows:

Portland cement concrete pavement (PCCP)	155 km
Asphalt paved	25 km
Total paved	180 km
Gravel surfaced	1,193 km
Dirt, unimproved	3,790 km

Within General Santos City, 214 km of roads are administered by the City and an additional 195 km are administered by various Barangays within the City. The pavement characteristics of these City and Barangay roads are listed below:

PCCP	16 km
Asphalt paved	17 km
Total paved	33 km
Gravel surfaced	376 km

In the immediate vicinity of the Tambler site, the major access is the paved section of the GSC-Maitum Road. Only one existing road passes near the site. This is a road leading westward from the National Highway, providing access to the MSU Compound, the Upper Tambler resettlement area, and Barangay San Jose. The road section between the highway and MSU is partially graveled, and is roughly 6 m wide. Past MSU, the road narrows, changes to unimproved dirt, and is badly rutted. The section beyond MSU receives little traffic.

An additional dirt road leads into the MSU compound. It is unimproved and in poor condition. In addition, several dirt tracks lead westward from the highway to the southern edge of the MSU compound, but these tracks provide only marginal access.

Proposed Improvements

As previously discussed, a by-pass route has been proposed as part of the USAID Rural Infrastructure Fund (RIF) Project. One route that has been studied and identified as a preferred route is shown in Figure 7. On the north end, it begins at the Polomolok Highway in the Apopong area, north of the Espina Estate, is routed west and south to cross the Makar River and run between the MSU compound and the proposed airport site, through the Tambler area, and eastward to intersect with the GSC-Maitum Highway just north of Banwalan River, near the southern end of the proposed agro-processing center.

At present, this route is only proposed, and its construction has not been assumed by the airport analysis. Preliminary feasibility studies of the route indicate that the improvement is feasible. However, right-of-way identification has proven difficult. Several alternative alignments have been examined. The project has been put on inactive status with regard to further analysis. If this by-pass route were constructed, it would improve access to the proposed airport site vicinity.

Another proposed road improvement in the vicinity of the airport site is the paving and rehabilitation of the GSC-Maitum road, beginning at the end of the existing pavement in the Tambler area, and extending approximately 120 km along the coastline to Maitum, and then onward to Malisbong (see Figure 7). The proposal is to improve alignment and pave the road to a width of 7.3 m, thus improving access from the agricultural and fishing areas along the coast.

Vehicle Characteristics and Ownership

According to data from the Land Transport Commission of General Santos City, registration of motor vehicles in the City in 1989 was as follows:

Motorcycles	3,191
Cars and Jeeps	3,178
Vehicles for Hire (includes tricycles and jeepneys)	2,631
Trucks and Buses	970
Government Vehicles (all types)	172
Trailers	88
Total	10,230

The number of registered vehicles is currently increasing at a rate of about four percent per year. The vehicle type that is increasing most rapidly is motorcycles, which increased by 15.6% from 1988 to 1989. Vehicle ownership in 1989 was as follows:

Private, for private use	7,427
Private, for hire	2,631
Government	172

Traffic Operations

Throughout the City, street and road widths are generally adequate to handle existing traffic levels, and there are no serious congestion problems caused by roadway design. Most of the congestion that occurs is caused by poor pavement surfaces, access interruptions, slow-moving vehicles, including tricycles and trucks, as well as occasional ox-carts, and by the frequent stopping movements of jeepneys and tricycles during loading and unloading of passengers. Other than a recently installed traffic light at the intersection of Pioneer and Magsaysay Avenues, there is no traffic control system; signage is minimal and is generally ignored by drivers.

Traffic volumes were counted in the General Santos City area in June 1990 as part of the USAID Rural Infrastructure Fund Project (Louis Berger International, Inc., et al., November 1990). Traffic volumes at that time on the GSC-Maitum Highway near the proposed airport site were as follows (24-hour average annual daily traffic, AADT):

	AADT
Car, taxi	91
Jeep, pickup, van	503
Jeepney	672
Minibus	12
Big bus	6
Two-axle truck	207
Three-axle truck	66
Articulated truck	5
Other (tricycles, motorbikes)	999
Total	2,561

Port and Waterfront Facilities and Operations

Port and waterfront facilities in the vicinity of General Santos City include:

- Makar Wharf
- Dole Philippines Pier
- General Milling Corporation Pier
- Several small private company docks
- Fish landing and shipping ports at General Santos City, Glan and Kiamba

Major commodity and passenger movements occur through Makar, Dole and General Milling.

Makar Wharf is located on the west side of Sarangani Bay, about 2 km southwest of Dadiangas. It has 561 m of berthing length, 15 ha of land area, three transit sheds and six private warehouses. It serves South Cotabato, Sultan Kudarat, parts of Davao del Sur and Maguindanao. In 1988, Makar Wharf had 707 ship calls, handling 834,000 MT of cargo and 125,000 passengers.

Dole Philippines (Dole-Phil) Pier is about 2 km south of Makar Wharf. Commodities handled include primarily pineapples and bananas. There is space for the berthing of two vessels. In 1989, there were 171 ship calls, and 328,000 MT of cargo were handled.

General Milling Corporation (GMC) Pier is about 1 km south of Dole Pier. It has one berth for handling of grain and cereals. It received 44 ship calls in 1988, handling 113,000 metric tons of cargo.

USAID is currently conducting, through the PAPS program, a Feasibility Study and Environmental Assessment on an expansion of Makar Wharf. Although no firm recommendations or decisions have been made, the main improvements under consideration include extension of the existing wharf by about 180 m, construction of a new 41-m long finger pier, reclamation of over 4 ha to serve as additional backup and service area, installation of a roll-on, roll-off ramp, installation of bulk grain handling equipment, and construction of a container freight station.

Airport Facilities and Operations

The existing airport at Buayan provides air service to General Santos City and South Cotabato Province, with a total of 19 flights per week. Flights are to Iloilo and Cebu via Fokker-50 aircraft. The airport is located about 8 km from the City Center (Dadiangas), and has a land area of approximately 62 ha. Operations are daytime only, from sunrise to sunset, and no airfield lighting is provided. Navigation aids include a VOR/DME, and a wind cone. Additional features are listed below.

Airside facilities:
- One runway, 1,704 m x 30 m (1,504 m asphalt, poor condition; 200 m concrete, good condition)
- Exit strip taxiway
- Apron, 50 m x 50 m
- Fire and rescue building and one truck

Groundside facilities:
- Terminal building, 672 m^2, ticket counter, waiting lobby, holding room, baggage claim area, cargo area, administration and airline offices, restrooms, no telephone service
- Parking area
- Concessions area (canteens)

Airport operations in 1990 are shown in Table 8.

Table 8: 1990 Operations, General Santos City Airport

	Commercial	General Aviation	Military	Total
Aircraft Operations	1,358	1,062	42	2,462
Passengers	58,400	1,855	347	60,602
Cargo Movements (MT)	618,142	124,503	--	742,645

SOURCE: General Santos City Airport

Rail Service

Rail service is currently not available in Mindanao, although feasibility studies for a rail network have been undertaken by the Philippines National Railway. In 1988, the National Economic Development Administration (NEDA) approved funds for a feasibility study of a rail system for Mindanao. The studies generally consider the possibility of linking General Santos City with Davao, and under some schemes, with Cotabato City, and also consideration of an integrated rail network for the entire island. These studies have so far not proceeded beyond the concept stage, and in this report it is assumed that no rail service will be available to General Santos City during the planning period.

3.4.2 CLIMATE, METEOROLOGY AND AIR QUALITY

Climate and meteorology are discussed insofar as they relate to air quality. More specific aspects of wind conditions, cloud cover and weather conditions that may affect air navigation are discussed in the Feasibility Study.

Climate and Meteorology

Climate in the Philippines is mainly affected by two principal air streams that cross the country. One is the "northeast monsoon" that originates from cold air rotation over the continent of Asia during the northern hemisphere winter (October through March). The other is the southwest monsoon that originates from the northern portion of the Indian Ocean during the southern hemisphere winter (March to October). Winds from this system cross the equator and move in the direction of the thermally induced low pressure areas that form over Asia, passing over the Philippines from a southwesterly direction.

Because of the mountain topography of Mindanao, northeast winds from October to March are redirected locally to become northerly winds, while the southwest monsoons are redirected to become southerly winds. Table 9 shows climatological data for the General Santos City area, based on weather records for the period 1951 to 1985. The table indicates that wind speeds average three meters per second (equivalent to 6.7 miles per hour) in each month of the year; seven months from the north and five months from the south. This means that air movement over General Santos City provides good dispersion of particulate matter and other pollutants under reasonably constant and reliable conditions year round. It also means that prevailing air currents do not bring in concentrations of pollutants from surrounding areas. For seven months of the year air moves in from across the high altitudes and forest areas of the mountains. For the other five months, winds blow in from the ocean. The highest wind speed ever recorded in General Santos City is 20 mps (44.6 mph) in January 1982.

General Santos City lies south of the typhoon belt. The mountain topography to the north also isolates the area from heavy monsoon rainfall. Rainfall is fairly evenly distributed throughout the year, with minor peaks in June and July and minimums in March. Monthly averages range from a low of 39.5 mm in March to 112.5 mm in June with a year-round total of 955 mm and a year-round monthly average of 80 mm. The largest 24-hour rainfall recorded is 309 mm on 9 July 1983.

The annual mean temperature of General Santos City is 27.1 °C. The warmest month is April, with a mean of 28.0°C. The mean annual maximum temperature is 32.2°C. The lowest monthly mean minimum temperature occurs in January, with 21.5°C. The mean annual minimum temperature is 22.0°C. Extremes of temperature are highs of 38.0°C recorded on 19 March, 20 April and 12 May 1983, and a low of 16.9°C observed on 9 March 1963.

The mean annual relative humidity is 80%. The lowest monthly mean is March, with 75%, and the highest monthly mean is 83%, occurring in July and August.

Table 9: General Santos City Climatological Data[1]											
			Temperature (°C)				Prevailing Wind			Days With	
Month	Rainfall (mm)	# Rainy Days	Max	Min	Mean	Relative Humidity (%)	Direction	Speed (mph)	Cloudiness OKTA[2]	Thunderstorm	Lightning
Jan	64.1	9	32.6	21.5	27.0	76	N	3	5	1	4
Feb	73.2	8	32.9	21.6	27.2	76	N	3	6	2	5
Mar	39.5	7	33.6	21.8	27.7	75	N	3	5	2	5
Apr	50.5	8	33.7	22.4	28.0	77	N	3	5	4	9
May	87.5	12	32.7	22.7	27.7	80	N	3	6	6	13
Jun	112.5	14	31.4	22.3	26.8	82	S	3	6	4	11
Jul	104.3	13	31.0	22.0	26.5	83	S	2	6	4	8
Aug	87.2	13	31.0	21.9	26.4	83	S	3	6	4	9
Sep	80.6	12	31.4	21.9	26.6	82	S	3	6	4	9
Oct	94.4	12	31.8	22.0	26.9	81	S	3	6	4	10
Nov	87.0	12	32.4	21.9	27.1	81	N	3	6	4	10
Dec	74.1	11	32.5	21.7	27.1	79	N	3	6	3	7
Annual	954.9	131	32.3	22.0	27.1	80	N	3	6	42	100

[1] Data collected at General Santos City Station, Coordinates 06 07 N 125 11 E, for period 1951-1985.
[2] OKTA = "eighths" of the monthly period.

Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration

Air Quality

In general, the major air pollutants in the General Santos City area are blowing dust from natural sources, dust stirred up by vehicles, vehicle exhaust emissions, combustion products from burning agricultural and solid wastes, and combustion products and odors from industrial and processing uses.

At the proposed airport site in Tambler, the major air pollutant under current conditions is blowing dust from natural sources. The Tambler area is characterized by shallow topsoil underlain by unconsolidated sand and limestone formations. Because the soil is porous and the subsurface strata are absorbent sands or partially cavernous limestones, rainwater percolates very rapidly. The result is that the top layer of soil is often very dry and dusty, especially during summer. Vegetation in the area is generally limited to grasses, but large areas have completely lost their vegetation cover, exposing the topsoil. The continuously blowing winds pick up the arid topsoil and suspend it in the air as blowing dust.

The dust situation is worse in areas where vehicles travel on unpaved roads. This is particularly true along the unpaved portion of the National Highway south of Tambler, along the unpaved road to MSU-San Jose, and local unpaved area roads.

To establish existing ambient concentration of dust or other pollutants at the proposed project site it would be necessary to take air samples on the site. However, because a power supply is not available to operate the sampling instruments on the site, samples were collected instead near the Agrotex and Sancanco factory sites near the National Highway. Two samples each were taken at the guardhouses of these industries, near the highway, and at the back of industry compounds, near the seashore, on 13 and 14

March 1991. The results of the sampling are given in Table 10. It is believed that the contribution of factory emissions with respect to suspended solids in the air was minimal in proportion to the dust generated from vehicular traffic and windblown soil.

Table 10: Ambient Total Suspended Particulates In Barangay Tambler			
	Sample 1	Sample 2	Average
Station	(micrograms per cm^2)		
At the Agrotex, Inc., guard house, along the Kiamba-Makar National Highway	747	915	831
At the back of Agrotex, Inc., compound at the shoreline	221	371	296
At the Sancanco guard house along the Kiamba-Makar National Highway	742	853	788
At the back of Sancanco Compound at the shoreline	296	261	278
Note: Each sample was collected over a one-hour period. Sampling was done during the daytime and the wind was due north for the duration of sampling. Sampling at Agrotex was done on 13 March and at Sancanco on 14 March 1991.			
Source: Department of Environment and Natural Resources, Davao Branch			

The sampling results show that, along the Highway, the average particulate concentration at Agrotex was 813 micrograms per square centimeter (mcg/cm^2) and at Sancanco, 788 mcg/cm^2. These levels are much higher than the national Ambient Air Quality Standards (see Table 11). National standards are 180 mcg/cm^2 for 24-hour exposure and 250 mcg/cm^2 for one-hour exposure. Thus suspended particulate along the highway at the measurement point exceeds the standards by multiples of over four for 24-hour exposure and over three for one-hour exposure. However, at the rear of the industries, near the seashore, readings of 296 and 278 mcg/cm^2 were recorded. These readings still exceed National standards for 24-hour exposure by 64% and 54%, respectively, and exceed one-hour exposure standards by 18% and 11%, respectively. However, the very large drop in suspended particulate concentrations over a rather short distance indicates that most of the particulate was dust from the highways, and also it was were readily dispersed. On the basis of these factors, it is likely that air pollutants over the airport site are likely to consist mostly of windblown soil, and that dust from this source would disperse quickly.

Other air pollutants in the area come from factories and industrial uses in the form of odors and combustion products such as carbon monoxide, sulfur dioxide, unburned hydrocarbons and nitrogen oxides. However, considering the relatively small number of such point sources, the open areas of the countryside and Sarangani Bay, and the prevailing air currents, air pollutants from factories or other point sources are likely to be readily dispersed, with resultant low ambient concentrations.

Table 11: National Ambient Air Quality Standards				
Pollutant	Exposure Time (Hours)	Concentration Microgram/cm^2	Milligrams/cm^2	PPM[1]
Suspended particulate matter	24 1	180 250		- -
Sulfur Dioxide	24 1	369 850		0.14 0.30
Photochemical Oxidants	1	120		0.06
Nitrogen Dioxide	1	190		0.10
Carbon Monoxide	8 1		10 35	9 30

[1] PPM-parts per million

Source: Air Quality Standards, Table 2, Chapter II, Section 62, Official Gazette, 5 June 1978, Vol. 74, No. 23

3.4.3 NOISE

The noise environment around the site and in General Santos City was determined through noise measurements.

The most prevalent source of noise in the General Santos City urban area is traffic noise. This is mostly from tricycles, trucks and jeepneys operating without adequate muffler systems, and from horn blowing.

The proposed airport site at Tambler is currently used as pasture. It is not easily accessible to vehicles, and there are no significant noise sources on the site. The nearest road is an infrequently travelled dirt road passing through the northern end of the proposed runway location.

Noise measurements made at the Tambler site on 19 to 21 February 1991 showed background daytime levels of 40 to 45 dBA. These noise levels are characteristic of uninhabited rural areas.

Other than cattle and birds, no sensitive receptors are located on the site itself. Settled residential areas of the Upper Tambler Resettlement Area are 2 km from the site, as is the San Jose settlement area.

Sensitive receptors along the proposed airport access road alignment potentially include the residential areas of the Upper Tambler Resettlement Area, the institutional and residential areas of MSU, and the residential and commercial areas adjacent to the GSC-Maitum Highway, through which the proposed road alignment passes.

MSU is at least 0.5 km from the proposed alignment and the Tambler Resettlement Area is at least 1 km from the proposed alignment. Only the residential and commercial area near the Highway are immediately adjacent to the proposed road alignment. The as-yet unsettled 39-ha Resettlement Area lot south of MSU is within 0.5 km of the proposed alignment.

3.4.4 ENERGY[1,2]

Power, which is primarily hydroelectrical, is provided in Southern Mindanao by the National Power Corporation (NPC). The NPC, which is connected to the Mindanao Grid, has a 30-megawatt (MW) power plant at Calumpang and a diesel-powered generator in the event of a general failure of the Mindanao Grid.

Power distribution facilities in General Santos City are provided by SOCOTECO II, which has a distribution capacity of 35 megavolt-Amperes (MVA). In addition to the City, SOCOTECO II's service area includes Polomolok, Tupi, Malungon, Kiamba, Maasim, Alabel, Glan and Malapatan.

SOCOTECO II's maximum allotment from the NPC is 14.4 million kilowatt hours (kwh) per month. Because of the hydroelectric nature of the power supply, supply is negatively affected by current drought conditions. Between February and April, a load curtailment of 10% was in effect. Currently, with Lake Lanao in Lanao del Sur, the primary hydroelectric source, at 698.09 m (the critical level is 699.15 m), a 35% load reduction is in force. NPC has advised SOCOTECO II that normal loads could probably be resumed in August. Brownouts are regularly scheduled in morning hours on weekdays, and most of the day on weekends. The RP government has recently ordered three power generator barges to Mindanao to help offset the low power supplies. One of these, a 230-MW barge, is assigned to the General Santos City Area

The nearest distribution facilities of NPC and SOCOTECO II to the project site are at MSU (a line runs from the Sports Complex to MSU), and an elevated 69-kilovolt (kv) transmission line west of the site. Expansion of distribution facilities takes place on the basis of an annual work plan submitted to the National Electrification Administration (NEA) by SOCOTECO II, subject to approval and granting of needed loans by NEA. Otherwise, new developments must fund the construction of needed power infrastructure expansion. A 5 MVA substation is shown as proposed near the Bay south of Calumpang on SOCOTECO II's facilities map.

A large source of geothermal power for Mindanao has been identified at Mt. Apo. An EIS was prepared on development of this resource, but project implementation has not proceeded as a result of continuing environmental and other concerns. Other hydroelectric facilities are also awaiting resolution of environmental concerns. USAID is also assisting the RP in a feasibility study (nationwide) for "power buy back," wherein power is purchased from small suppliers and made available in the larger supply grid to be sold to other users. In the absence of new sources and/or increased hydroelectric power storage, however, the area is likely to continue to experience increasing power shortages in the face of expanding development and annual drought conditions.

The existing airport at Buayan is served by a 13.2-kv line and a 50-kva transformer. Electrically powered equipment at the airport is minimal; the airport lacks such basic facilities as electric typewriters and other office equipment. The airport consumes an average of 900 kwh per month under curtailment and about 2,500 kwh per month at other times.

NOTES - Energy

[1] General Santos City Office of Planning and Development Coordination, *1989 Socio-Economic Profile*, 1989.

[2] Engineer John R. D. Alcasid, Operations Manager, SOCOTECO II, interview, 23 April 1991.

3.4.5 HYDROLOGY AND DRAINAGE

The Tambler site area is drained by channels, gullies and swales that are dry during summer months. The area is characterized by shallow topsoil and unconsolidated sand and limestone formations.

Because of the limited topsoil, the area is primarily sparse grassland with isolated shrubs and trees. In some sections, the topsoil has eroded, exposing sand layers. The limited vegetation cover has resulted in the formation of gullies and accelerated erosion of topsoils and ravines. Details of the area's soil and geology are presented in Section 3.4.5.

Conditions were dry at the time of the field visit in February, and no water samples could be taken. (The area is known locally as Barangay "Uhaw" or "thirsty" due to a lack of surface water resources.) However, on the basis of soil cover, vegetation and topography of the area, runoff during the rainy season could contain high concentrations of suspended solids and settleable solids. Since the soil is sandy with low concentrations of clay and humus, solids in the water would settle rapidly. The colloidal system formed by the rain water and the soil would be unstable and dominated by mixtures of fine sand and water that separate easily by gravity or when water flow is non-turbulent.

The sandy soils at the site provide good leaching action for effluent from septic tanks, drain fields and pit privies. Organic materials are easily absorbed. Dissolved organic materials are oxidized in the aerobic zone of the soil. The sandy layer provides good filtration of residual organic and micro-organisms. In some locations, however, the limestone formation was noted to extrude above the sand layer.

Limestone is pitted with holes due to natural dissolution of the calcium carbonate by the carbonic acid found in natural rainwater. The holes in the limestone can transmit wastewater from septic tanks and toilets to far distances with minimal change in composition, unlike in sandy soil, where effective filtration and biodegradation take place.

The water table in Tambler is very deep. Little data exists on groundwater resources but, although deep, the supply of groundwater appears to be quite large and of very high quality. The well at the Alcantara ranch house on the site has a pumping water level of 164 m. The static water level is at 146 m. The well is dug to a 300-m depth. No water sample could be taken since the overhead tank was empty at the time of the site visit but no problems have been recorded.

3.4.6 GEOLOGY AND SOILS

The information in this section is taken largely from the report, *General Santos City, Physical Land Resources*, Volume I, Land Resources Evaluation Project, Department of Agriculture, Bureau of Soils, 1985. In addition, soils samples were taken at the site by means of test pits.

In general, the project area is a homogeneous region lying on a vast alluvial plain that constitutes the Buayan Valley in the central part, the volcanic plain to the southwest, and the low to high relief hills in the northeastern extremities. The isolated volcanic cone (dormant) of Mt. Matutum, el. 2,293 m, lies north of the site area. To the east are mountains forming part of the Sarangani Mountain Ranges. Mt. Parker, another dormant volcano, el. 2,065 m, lies to the northwest.

The proposed site is characterized by a slightly to moderately dissected Piedmont plain (Lower Footslope) consisting of a level to gently sloping and undulating topography with slopes ranging from 0.0% to 8.0%. The terrain gradually slopes down in a westerly to easterly direction towards the National Highway and Sarangani Bay.

The soils of the Piedmont plain (Footslope) dominate the area. These are formed mainly by the volcanic ejecta made up on volcanic sand, ash, cinder mixed with volcanic tuff, bombs and other volcanic debris. Dominant soil types are sandy loam and sandy clay loam underlain by a slightly compact, moderately shallow to deep, light to medium textured sub-soils. External drainage is good and moderately well drained internally. Figure 8 illustrates soils in the site vicinity.

Surface soils are mainly dark gray, sandy loam, sandy clay loam, slightly sticky, slightly plastic and friable, angular blocky breaking into fine sub-angular blocky structure with few small soft and hard rock fragments. Subsoils are slightly compact gray, dark brown, sandy loam, silty clay loam and sandy clay loam mixed with gravel, stones and rock fragments. Substrata are unconsolidated hard gravel, stones and rocks.

The soil pH is very strongly acid to neutral with values ranging from 4.8 to 7.0. The organic matter content indicated a moderate to moderately high level with a high cation exchange capacity (CEC).[1] While site soils are fertile, the lack of water is a serious constraint to intensive agriculture. Even if water was available, the soils' excessive drainage characteristic means that agricultural operations would require much more water than areas where the soils are not so excessively well drained.

The project area is slightly to moderately eroded. This is reflected by the thin surface soil in the site. This phenomenon is mainly due to the light-textured surface soils, poor vegetation cover and gently sloping topography.

A study conducted by the Bureau of Soils and Water Management in the area east of the proposed project site area, which is represented by the Upper Footslope, indicated that the soils are prone to erosion.[1]

On the basis of the terrain classification study conducted by the Bureau of Soils for the General Santos City municipality, the project site falls under 0.0% to 7% slope category, which is generally suitable for urban development - residential, commercial, industrial - and intensive agriculture.[2]

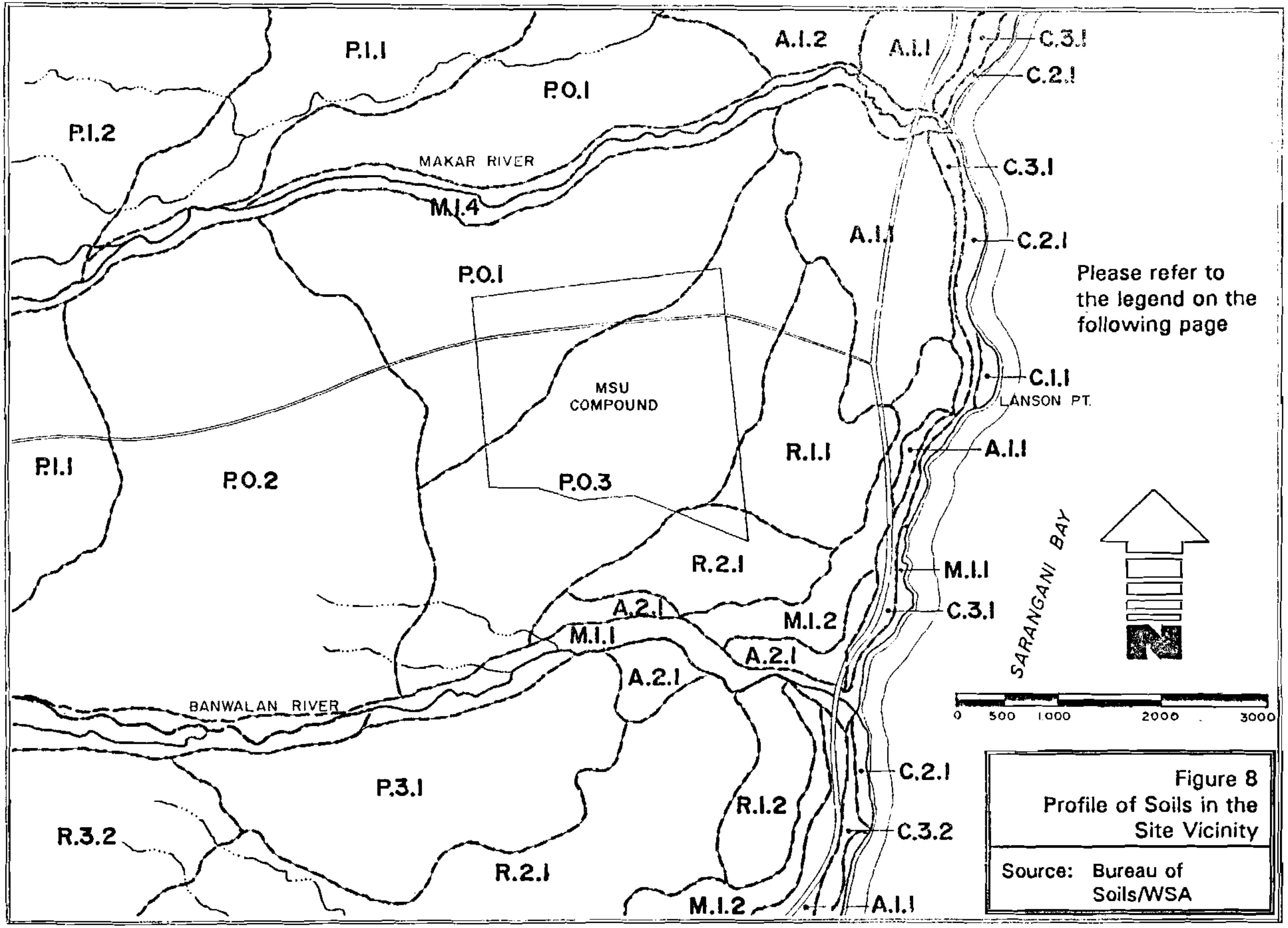


Figure 8
Profile of Soils in the Site Vicinity

Source: Bureau of Soils/WSA

Legend for Figure 8, Soils Map			
Landform and Code	Physiography	Land Mapping Unit	Description
C. Coastal	C.1 Tidal Flat	C.1.1	Mangrove or nipa.
	C.2 Beach Ridges and Swales	C.2.1	Beach ridges & swales.
	C.3 Marine Terrace	C.3.1	Low-level marine terrace (old tidal flat) well drained, light textured.
		C.3.2	Low-level marine terrace (old tidal flat) somewhat poorly drained to well drained, medium to heavy textured, slightly flooded.
A. Alluvial	A.1 Alluvial (Broad Plains)	A.1.1	Broad plain, level to gently sloping, well drained, light textured, not flooded.
		A.1.2	Broad plain, well drained, light to medium textured, not flooded.
	A.2 Infilled Valleys	A.2.1	Infilled valley (narrow), well drained.
R. Residual Terraces	R.1 Level to Gently Sloping	R.1.1	Sedimentary residual terrace slightly to moderately dissected, light to medium textured soils.
		R.1.2	Low limestone terrace, level to gently sloping, light to moderately dissected.
	R.2 Sloping and Undulating	R.2.1	Limestone terrace, sloping to undulating, moderately to severely dissected.
	R.3 Sloping and Undulating	R.3.1	Volcanic/pyroclastics, sloping to undulating, moderately dissected, medium to heavy textured.
		R.3.2	Volcanic/pyroclastics, sloping to undulating, severely dissected, medium to heavy textured.
P. Piedmont (Footslope)	P.0 Lower Footslope (level to nearly level and gently sloping)	P.0.1	Lower footslopes, nearly level to gently sloping, slight to moderately dissected, medium to heavy textured.
		P.0.2	Lower footslopes, nearly level to gently sloping, slight to moderately dissected, light to medium textured.
		P.0.3	Lower footslope, nearly level to gently sloping, moderately dissected, light to medium textured.
	P.1 Upper Footslope (gently sloping, undulating to rolling)	P.1.1	Gently sloping to undulating, moderately dissected, light to medium textured.
		P.1.2	Undulating to rolling, severely dissected, medium to heavy textured.
		P.1.3	Undulating to rolling, severely dissected, light to medium textured.
M. Miscellaneous Land Types	M.1 Gully, Rubble Land and Escarpment	M.1.1	Gully and gully escarpments.
		M.1.2	Rugged or rubble lands escarpment.
		M.1.3	Terrace escarpments.
		M.1.4	Braided riverbeds, sand bars and deltas.
Source: Bureau of Soils and WSA			

NOTES - Geology and Soils

[1] Department of Agriculture, Bureau of Soils, Land Resources Evaluation Project, *General Santos City, Physical Land Resources*, Volume I, 1985.

[2] Office of the City Planning and Development Coordinator, *General Santos City 1988 Development Report*, 1988.

3.4.7 TERRESTRIAL ECOLOGY

Vegetation on the project site is predominantly grasses used as fodder for stock animals. The area is currently used as pasture land.

In the grassland savannah of the site, dominant species of grasses are fewer (as to number of species) due to extreme physical factors (little or no water at all). The more adverse and extreme the climatic conditions, the less diversity will be apparent among species and the fewer the number of species will be, because not many will have adaptations necessary for survival. The number and types of species at the site have remained constant for a number of years. While the grasses observed at the site are generally weeds capable of existing in any type of environment, they are ecologically dominant on the site, despite, or because of, the adverse conditions. The same is true of the tree and bush species. They are tolerant of extreme conditions. The trees are randomly scattered at great distances from each other, indicating those areas of favorable conditions and their ability to compete successfully with grasses for survival.

Identification of plant species in the project area revealed three types of grasses and three species of non-dipterocarps scattered over the site. The three species of grasses include: Marakuayan *(Brachiaria reptans)*, Koro-korosan *(Chloris barbata)*, and Kangaroo grass *(Themeda triandra)*, all of which are good fodder for stock animals. The non-dipterocarp species of trees are: Aroma *(Acasia farnesiana)*, Ipil-ipil *(Leucaena leucocephala)*, and Kamachile *(Pithecellobium dulce)*.

The bark of the Aroma is a source of gum similar to gum arabic, while the flowers produce essential oils for perfume and pomade. The bark, young fruits, young leaves and flowers all have medicinal value.

Wood from Ipil-ipil is good for firewood and charcoal. The bark produces brown dye and leaves are used as supplementary animal feed. The seeds can be a coffee substitute and have medicinal properties. The tree is important in reforestation and for use in buffer zones between differing types of uses.

Kamachile fruits are edible and the bark is a major source of dye for tanning purposes. Wood can be used for building and construction and as fuel (firewood). The leaves, bark, roots and seeds have medicinal properties, and the tree is used for hedges, shade or as an ornamental tree.

Most of the grass plants are dried (manifested by pale brown stems and leaves) and photosynthetic productivity is relatively low. This could be attributed to the climatic conditions (dry season) in the area at the time of the site visit. However, even during the rainy season, General Santos City does not receive much rain and the soil type allows a higher rate of water percolation, leaving little water available for plants. The area becomes green at the start of rainy days but stabilization is not reached because of climatic and soil factors. Some Ipil-ipil trees, which are sources of firewood, were observed to have been scavenged of branches, presumably for fuel. The resulting broom sprays at the site of breaks limit plant productivity and these trees are therefore of low economic importance.

The six species of plants previously mentioned are all native to the area. ~~Field observation~~ and consultation with the Science Faculty at MSU revealed that there ~~are~~ no introduced or special status species in the area.

Ipil-Ipil is an introduced species from C. America

Due primarily to climatic factors, and to a lesser extent to almost continuous grazing activities, no undisturbed, rare, unique vegetation of special economic, historic, social or scenic value has been identified on the site.

The grassland savannah is currently used as pasture for domesticated cows. On several visits to the site a few birds were found perching on the grasses. These were the Pipit-cogon *(Cisticola exilis semirufa)*, known to help in the control of insect populations including those that destroy rice plants and other crops. No other domesticated animals were observed using the area as habitat. No introduced species were observed or are thought to occur because of extreme climatic conditions. Further, no undisturbed, rare or unique animal life of special economic, historic, social or scenic value has been identified at the site.

3.5 AESTHETICS AND CULTURAL CONDITIONS

3.5.1 AESTHETICS

The site is part of a vast rolling plain set against a backdrop of distant hills. Trees and bushes tend to be concentrated along ephemeral water courses, appearing as linear green trails interrupting the light brown sandy terrain of the site. Wood and wire fences crisscross the site, as do ribbons of dirt tracks made by people and animals. Eroded gullies and drainage channels cross the site, generally in a west-east direction, reflecting overall drainage in the area.

The ranch house appears from a distance as an area of thicker vegetation because of the trees around it. Sarangani Bay is visible from the site, beyond the gently descending terrain to the east. The central city area is also visible in the distance. Because of the rolling terrain, surrounding development is not always visible from the site, although there are occasional views of the large "Y" building of MSU and some of the red-roofed housing structures there. The Upper Tambler Resettlement area is only rarely visible because an elevated area at the east side of the site blocks this view.

3.5.2 ARCHAEOLOGY AND CULTURAL RESOURCES

The South Cotabato Province area of southern Mindanao is believed to be originally inhabited by members of the B'laan, Manobo, Maguindanao and Tagabili tribes. Muslims are believed to have begun settling in the 15th Century, and Muslims from Maguindanao migrated to the area of the existing airport in 1839, which may have been named Buayan after the former home of the ruling Datu of the time.

The Tambler area was even more sparsely settled than at present before the establishment of the 556-ha Upper Tambler Resettlement Area, including 150 ha for MSU. At present, the makeup of settlers includes both Christians and Muslims of Tausog, Cebuano, Ilongo, Visaya and other origins; about 10 B'laan families are estimated to reside there. In 1989, the population of T'boli and B'laan in Barangay Tambler were estimated at 1,100 and 100, respectively.[1] The lack of water appears to be the primary impediment to settlement. The City developed eight wells for existing settlers of the area, but only five are operational. The 39-ha lot south of MSU is awaiting development of wells before it can be settled. The City is currently applying for loans for this purpose.[2]

The Anthropology and Archaeology Departments of the National Museum, and faculty of the Sociology Department of MSU were contacted to determine what cultural resources might be associated with the site.[3,4] The site has never been the subject of a recorded survey, and no cultural associations are known. However, archaeological resources have recently been discovered in Tambler near Sarangani Bay as part of a study done for the Agro-Fish Processing Complex. While archaeological resources are most commonly associated with water bodies and the site is quite dry, it may be that prior to recorded history, but still within the age of humans, the site was in or near water.

NOTES - Aesthetics and Cultural Conditions

[1] Office of the Southern Cultural Communities, General Santos City, South Cotabato, Statistical Data on Cultural Communities, 1989.

[2] Rebecca Magante, Head I, General Santos City, Office of Social Services Development, interview, 24 April 1991.

[3] Jesus T. Peralta, Ph.D., Curator, and Eusebio Z. Dizon, Ph.D., Archaeology Division, Republic of the Philippines, Department of Education, Culture and Sports, National Museum, interviews, 1 March 1991.

[4] Prof. Virginia Buhisan, Sociologist/Anthropologist, and Domingo Non, Ph.D., Social Science Department, College of Arts and Sciences, and Norberto Andies, Vice Chancellor for Academic Affairs, Mindanao State University, interviews, 22 February 1991.

3.6 FUTURE CONDITIONS WITHOUT THE PROJECT

Without the project, the site is expected to continue in its use as pasture lease. No major changes are expected to occur on the site. Minor changes would include continued exposure of the soil to natural agents of erosion such as wind and rain, with eventual decrease in fertility due to loss of productive topsoil. Consequently, the agricultural potential of the area would likewise be decreased, and the vegetation cover would be expected to become even more sparse.

Airport service as provided at the Buayan site would continue. See the discussion of Alternative 5.1 for a description of future conditions at the Buayan site without the project.

Development is expected to occur in the site vicinity. The primary area of development would be continued settlement of the Upper Tambler Resettlement Area and areas near the National Highway east and south of MSU.

Implementation of other projects currently being evaluated in the area, such as the Makar Wharf expansion and the agro-fish processing plant, and residential and commercial development in Upper Tambler and near the National Highway would increase traffic and noise levels in the area, but only substantially along the National Highway.

Other than these changes, conditions in the future are expected to remain much the same as described in sections 3.1 to 3.5, above.

4.1 LAND USE AND REGIONAL PLANNING

Land use and planning effects of a new airport at the Tambler site fall generally into the categories of changes in land use patterns in the Tambler area, reuse of the existing airport site, and changes in interrelationships among projects, as discussed below.

4.1.1 CHANGES IN OVERALL LAND USE PATTERNS

The direct impacts of location of a new airport at the Tambler site would be conversion of site uses from pasture land to aviation and use of currently undeveloped land for construction of an access road. The airport site would cover about 263 ha of land that is now used for pasture and likely would continue to be used for cattle grazing until construction was initiated, proposed to begin in 1992. The Comprehensive Plan designation for the site, however, is light industrial. Therefore, in direct terms, the project would result in conversion of 263 ha of pasture to aviation, and a change in planned use from Light Industrial to Transportation Utility.

The proposed access road alignment is across land that is currently undeveloped for a length of about 3 km, and across another 3 km of land now used for pasture. With a 60-m-wide right-of-way (ROW), this would represent a conversion of 18 ha of land from vacant land to ROW, and 18 ha from pasture to ROW.

In addition to these changes, the location of a major activity center such as this project would stimulate growth in adjacent areas, and affect basic land use relationships. Incompatible land uses could occur around the site and along the access road. A common occurrence in airport development is that the airports are established in remote areas that later become intensely developed. The uses may consist of structures that penetrate clear zones or emit smoke or produce glare that affect visibility, or produce other safety risks for airport operations. Particularly in the case of sensitive land uses such as schools, residences and hospitals, the adjacent uses may begin to experience or perceive negative effects such as noise or safety hazards, and complaints arise. In addition, airport expansion, which may not be needed until much later, is often constrained by these uses and made much more difficult if not impossible.

Primary land use planning considerations for the project are thus three-fold:

1) The need to protect uses around the airport from adverse impacts generated by the airport;

2) The need to protect the airport from encroaching incompatible uses; and,

3) the need to reserve adequate land for future airport expansion.

The basic task of planning for land use development and regulation in the vicinity of an airport is to address the three considerations identified above, and to do so in a way that would not substantially reduce the amount of land available to the city in current land use designations (specifically residential and industrial).

A land use plan for the area is the best means to reflect appropriate land use relationships, and regulatory mechanisms are necessary to ensure plan implementation. A recommended land use plan and regulatory mechanism is described below, and the recommended land use plan is illustrated in Figure 9. The recommended land use plan recognizes the particular need to maintain the supply of residentially zoned land, since housing area (particularly resettlement area) is limited compared to demand.

Recommended Land Use Plan

Protection of Adjacent Uses from Project-Generated Effects

Two characteristics of airports require careful attention with respect to effects on adjacent uses, namely noise and vehicular traffic. The project includes installation of an access road that would not necessitate the circulation of traffic through existing residential neighborhoods, or through congested areas. Traffic circulation aspects of site development are discussed in Section 4.3.1. The analysis indicates that the airport access road would accommodate vehicular traffic well beyond the planning period with no congestion. The recommended land use plan shows the location of the access road, on a generally straight alignment from the airport terminal to the highway. In terms of noise, airport-related traffic alone would not result in noise levels incompatible with most uses. Traffic from cumulative development, however, could result in noise levels that would exceed National standards for residential development. The primary protection required for uses adjacent to the airport-related improvements, therefore, is to ensure that future residential development is not exposed to high noise levels from traffic along the access road. The recommended land use plan shows a strip of commercial zoning along the access road in which residential and related uses would be prohibited.

On the basis of the aircraft noise analysis conducted for the project (see Section 4.3.3), noise levels predicted for the airport are within a range that would be compatible with any use, including schools, hospitals and residences. It is thus not necessary to establish restrictive zoning on the basis of aircraft noise.

Regulation of Adjacent Land Uses

In order to assure safety of aircraft operations, the following activities and characteristics must be controlled around the airport:

- generation of dust, smoke and glare.
- generation of electromagnetic disturbance.
- heights of structures.
- runway incursions.

The principal means proposed to regulate these characteristics is establishment of a special use permit district surrounding the airport, to be implemented as part of the Zoning Ordinance of General Santos City. The area and location of the district, shown in Figure 9, is proposed to be a rectangular area extending 1 km outward from the boundaries of the airport site and the area reserved for expansion (described in the following section).

The Zoning Ordinance already contains the basic mechanisms needed to implement the recommendation. The Zoning Ordinance requires issuance of a Certificate of Zoning

Compliance prior to erection of any structure, establishment of any use, or change in characteristic of use. Article VI, Section 5, of the Ordinance establishes performance standards to regulate such characteristics of use as smoke, dust and glare. Article IX, Section 4, sets up procedures for issuance of special use permits.

Within the airport special permit area, the types of uses allowed would be the same as normally allowed under each respective zoning district, except that residential and related uses would be prohibited. This would aid in keeping humans, livestock and domestic animals from entering the airport and reduce the potential for complaints concerning the airport in the future. The permit issuance process would allow the Zoning Administrator to review permit applications with special attention to specific activities that may create smoke, dust, glare or electromagnetic emissions. If there were reason to suspect a potential problem, the Zoning Administrator could confer with specialists from DOTC, ATO or the airport operator before issuance or denial of the permit.

The Zoning Ordinance contains height regulations that apply to structures in each respective zone. The area around the airport needs special consideration of height of structures that may pose a hazard to aircraft operations. The Feasibility Study, Final Report (WSA, 1991) fully describes the horizontal and vertical dimensions of a series of "obstacle limitation surfaces." These are imaginary surfaces at various heights, through which structures and other objects should not project, in order to allow for safety of aircraft operations during landings and takeoffs. The surfaces that would need to be protected by the special permit process include the conical, inner horizontal, inner approach, approach and transitional surfaces. These surfaces are either horizontal or sloping and vary in height. Some of the surfaces (the approach surfaces) extend outward as far as 15 km from the proposed airport site. However, at a distance greater than 1 km from the runway ends, the surfaces are higher (20 m) than would be encountered with most structures except those of exceptional height, such as telecommunications transmission towers. Structures and obstacles that cannot be removed are identified and marked or lighted through a procedure of establishing and protecting navigation routes, administered through DOTC.

The Zoning Administrator would be provided with Airport Master Plan drawings that illustrate obstacle limitation surfaces so that applications for permits within the special permit zone can be reviewed for compliance with height restrictions.

Airport Expansion Needs

The land area that has been referred to throughout this report as the "airport site" is an area of approximately 263 ha, composed of two contiguous rectangular areas. The largest of these is the strip of land needed to accommodate the runway and its associated cleared areas and navigation aids. This strip is approximately 530 m wide and 4,650 m long, with its long axis oriented almost north-south (about 6° west of north). On the east side of this strip, adjoining and near the center, is a projecting rectangular area of land for the terminal building, parking and entrance area. This area is about 230 m wide and 710 m long. The land area described above would provide for airport facilities foreseen to be needed through 2015, plus a runway extension for operation of large aircraft that may be needed after 2015.

Engineering plans for the airport allow for the possible construction of a second runway, parallel to the proposed first runway. This second runway, if needed, would be built to the east of the first runway, giving an airport configuration of two parallel runways with a terminal between. This layout would necessitate reorientation of the access road, but it is a commonly used layout for two-runway airports.

Some provision must be made to reserve this land early in the airport development process, preferably at the same time as land acquisition needed for the airport site needed without the expansion. The reserved land should be adjoining, parallel to, and east of the airport site. The reserved strip needs to be about 760 m wide and the same length (about 4,650 m) as the airport site. The recommended reserved area is shown in Figure 9.

There are alternatives to ownership of the reserved land. The area could be transferred to ownership of the airport operating authority, or to DOTC, or retained by DENR. In any event, use of the land should be controlled to prevent incompatible land uses from occurring, and to prevent high-investment uses from being developed that would encumber the future clearing and use of the land for a second runway.

The special permit district described above could be used to accomplish this. Within the special permit district, permits would be granted only for uses that are compatible with airport operations, and within the reserved land area, permits could be granted only for uses that would facilitate conversion of the land to airport use.

In the recommended land use plan, land within the special permit district is designated as pasture and as open space. The location and size of the designated open space as shown in the General Santos City Comprehensive Plan is approximately the same as in the recommended plan. The recommended plan shows all of the land around the perimeter of the airport site, with the exception of the open space parcel mentioned above, as pasture.

The recommended land use and zoning plan shown in Figure 9 addresses specific airport-related requirements outlined above, as well as a recommended overall land use pattern to appropriately integrate the airport use into the development patterns of the surrounding area. Features of the plan are summarized below, beginning with the airport site itself.

The plan shows the airport site in the location recommended by the Feasibility Study, as determined by site size, topography and air navigation constraints. The site is approximately 263 ha in size and is about 4.6 km long and 530 to 760 meters wide. The airport is shown on the plan as "Transportation Utility."

The land surrounding the airport site is shown as "Pasture Land", with the exception of an area located along the northeastern boundary of the airport that is designated as Open Space. The recommended plan thus maintains the areas around the airport in pasture use. The open space use is shown on the General Santos City Comprehensive Plan at a slightly different location, fronting the north side of the San Jose-MSU service road, and slightly smaller in size. It is relocated in the recommended plan to the south side of the road because the road must be relocated as part of the project.

West of the airport site, the recommended plan shows pasture uses extending to the boundary between Barangays Tambler and San Jose. The recommended land use plan retains current land use designations in Barangay San Jose, that is, agriculture, forest reserve and the residential and institutional center of the San Jose community.

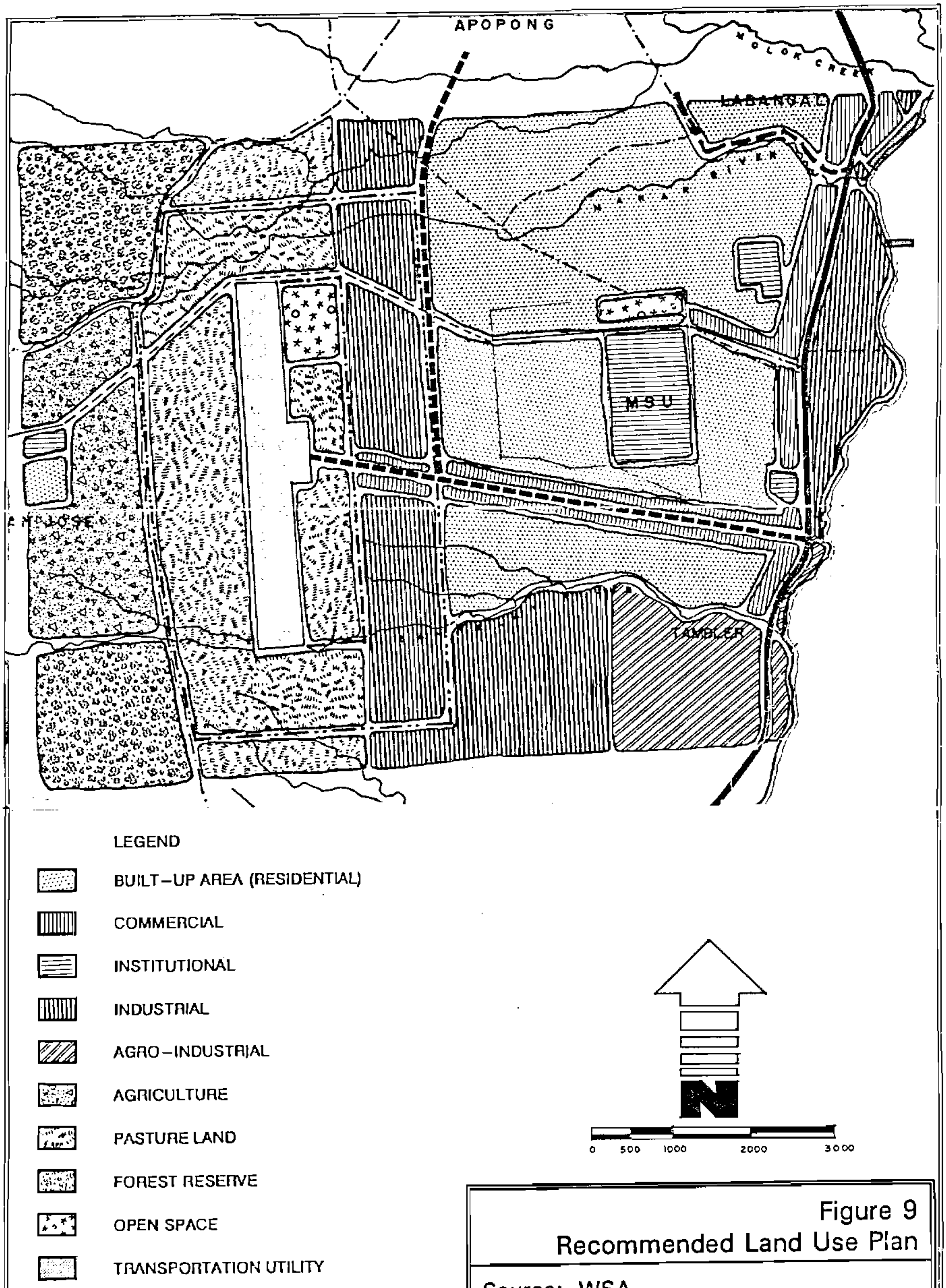


Figure 9
Recommended Land Use Plan

Source: WSA

East of the airport site, a strip of land approximately 760 m wide shown as pasture and open space (discussed above), and bordered on the east by a proposed industrial zone, constitutes the airport expansion reserve zone as described earlier. It is recommended that this land, currently in public ownership and under pasture lease, be held in reserve to accommodate possible airport expansion that could be needed beyond the 2015 horizon year planning period. The area of this proposed reserve is as established in the Feasibility Study and described above.

The General Santos City Comprehensive Plan designates the land around the proposed airport site as light industrial. The recommended plan repositions the industrial land, in a band about 1 km wide and situated between the airport expansion reserve zone and the proposed circumferential road. This would retain industrial growth potential, but protect against encroachment of uses into land needed for potential future airport expansion.

It appears likely that the airport access road would be built before the circumferential road. Therefore, the airport access road is shown in the recommended plan as being substituted for the east-west portion of the circumferential road. Also shown is a strip of commercial development along both sides of the access road. This area would probably accommodate a mixture of commercial and light industrial uses. This zone would serve the function of screening and buffering residentially designated areas from the access road. (It should be noted at this point that even though a 60-m ROW would be acquired to permit construction of a multi-lane road, if needed in the future, only one side, or 30 m would be used initially. It is recommended that the reserved strip for future use be planted with suitable tree species to identify it as reserved public area; to provide shade; to serve as a buffer between traffic noise and air pollution and adjacent development; and as a visual, aesthetic buffer.)

On the southern edge of the area shown in the recommended plan, south of the Banwalan River, industrial and agro-industrial uses are shown. These are the same as the areas shown in the Comprehensive Plan except that the positions of the industrial and agro-industrial tracts has been reversed. The Comprehensive Plan was prepared before the studies of the proposed agro-processing center were instituted. The arrangement shown in the recommended plan would allow the land nearer the waterfront to be used in conjunction with the agro-processing center.

The land use pattern for the area from the Banwalan River northward, and from the circumferential road eastward, that is the residential areas, MSU, highway-oriented commercial areas, and industrial land between the highway and waterfront, have been left essentially the same as shown in the Comprehensive Plan.

The effect of these changes on expected or recommended land use patterns may be summarized as follows:

1) Construction of the airport at the recommended site would change existing pasture land use to aviation use.

2) Land immediately adjacent to the airport, now zoned Light Industrial, would be rezoned to Pasture and Open Space/Recreation to provide a land reserve area for future airport expansion.

3) Since the access road would probably be built before the circumferential road, it could serve as a substitute for a portion of the circumferential road.

4) The siting of the airport at the recommended location, and the reservation of expansion land, would preempt the use of this tract for light industrial uses as designated in the Comprehensive Plan.

The net result in terms of changes to the General Santos City Comprehensive Plan is as follows: a slight increase in pasture land to account for the airport site and its expansion area; a decrease in industrial land, and repositioning of the proposed light industrial area to the east of the airport site; rearrangement (but no significant change in area) of residential uses; movement of the circumferential road by about 700 m to the west to help establish a more appropriate relationship among airport, industrial and residential uses; and, an increase in commercial/light industrial uses, principally because of the commercial district along the access road.

Table 12 provides a comparison of land use distribution between the Comprehensive Plan and the recommended plan for the area shown in Figure 9.

Table 12: Comparison of General Santos City Comprehensive Plan and Recommended Land Use Plan by Type and Amount of Designated Land Uses

	Comprehensive Plan	Recommended Plan	Change
	(approximate hectares)		
Residential	2,260	2,180	-80
Commercial	170	310	+140
Institutional	210	210	0
Industrial	2,060	1,670	-390
Agro-industrial	400	410	+10
Agriculture	470	440	-30
Pasture Land	1,080	1,200	+120
Forest Reserve	670	630	-40
Open Space	70	90	+20
Transportation Utility	20	270	+250
TOTAL	7,410	7,410	

Source: Wilbur Smith Associates, 1991

The largest changes would be increases in Transportation Utility and Pasture, a decrease in industrial land, and an increase in commercial land. The decrease in industrial land would be offset somewhat by the increase in commercial land, since there is considerable overlap in the types of uses permitted in these zones. In fact, given the large amount of industrially designated land in the City, a decrease of several hundred hectares would not be significant.

The western sector of the City, from the Silway River west and south (the quadrant in which the proposed airport site is located) has about 4,000 ha of land allocated for industrial use in the Comprehensive Plan. In very general terms, 4,000 ha of industrial land should be enough to serve a population of over two million people. The General Santos City population in the year 2000 is projected to be less than 400,000, reaching about 500,000 sometime between 2005 and 2010, so the land area set aside for industrial use is perhaps four times what may be needed by 2000.

Because industrial land has to meet the most difficult suitability requirements of any land use category, it is sound planning policy to set aside adequate reserves of industrial land as early as possible. However, given that a very large proportion of land is allocated to future industrial use, and that the use characteristics of an airport site are similar to those of an industrial site, a change of industrial land to airport use is not a significant change in land use.

4.1.2 REUSE OF THE BUAYAN AIRPORT SITE

The existing airport at Buayan occupies a land area of approximately 62 ha. If the airport were moved to Tambler, the Buayan site could be released for redevelopment and reuse. In terms of physical reuse capability, the soils, geological characteristics and drainage of the site would support most types of urban or agricultural uses. The site has good accessibility. It is adjacent to the National Highway, it is accessible from the City via a local street system, and it has ocean access via a beach and shallow water area. It is near enough to the city center to be very desirable as a residential area, it has productive capability as agricultural land, and it is situated so as to be attractive to fishing families.

There are no identified projects that would offer good potential for reuse of the entire site. There is not enough general aviation demand locally to retain the site as a general aviation facility in addition to an airport at Tambler. As public land, it could be held out of development as vacant land, but this does not appear likely. If it were to be held as vacant land, it would probably be gradually occupied by squatters and consumed by informal, unplanned uses. It appears appropriate for the public authorities concerned, DOTC and General Santos City, to effect a transfer of the land to the municipality, and for the municipality to prepare a unified plan of development for reuse of the land.

There is a high demand locally for resettlement areas to be used for residential purposes. Many of the families needing resettlement are fishing families. It seems appropriate to suggest reuse for a combination of maritime-related, agriculture and resettlement uses. Some appropriate combination of a selection of the following uses appears to fit both the physical site situation and local land utilization demands:

- Residential resettlement in general.
- Resettlement of fishing families.
- Schools, religious institutions, small commercial establishments serving local residents.
- Agricultural cultivation, plantations, livestock raising.
- Prawn farms.
- Salt drying beds.
- Small boat construction and repair, small establishments serving the needs of artisinal (small scale) fishermen.

4.1.3 RELATIONSHIP TO CUMULATIVE DEVELOPMENT

It appears that the proposed air service improvement, and the location of the airport at the proposed site in Tambler would have a positive and mutually reinforcing effect on other currently proposed projects and upon the overall development of the South Cotabato region. Other projects of USAID, in coordination with other major donors and investors, have been targeted for the South Cotabato region to pursue a policy of concentrated and integrated development.

One of the basic requirements for this desired form of balanced economic growth is the availability of an integrated and well functioning multimodal transportation system. The existing Buayan Airport is not now serving the air transport system demand adequately, and the gap between service and demand continues to grow. From the standpoint of cumulative effects of an economically integrated system of project investments, improvement in air service for the South Cotabato area is a key element in a program of balanced investment in basic transport infrastructure for the region. The importance of adequate air transportation is compounded in a discontinuous island country like the Philippines.

One objective of the concentrated investment program is to stimulate and facilitate private sector investment in the area's economy. With respect to the location of the airport at Tambler, the site's proximity to other major economic development projects (existing and proposed) on the west side of General Santos City would reinforce the development stimulus of those other projects and would contribute to the airport's functions, particularly in the role of cargo movement. The Tambler site is within 8 km of Makar Wharf, 7 km of Dole Pier, 6 km of the proposed agro-processing center, and 8 km of the proposed Espina Estate industrial development. All of these centers of development activity are joined by the National Highway with access to the airport from the highway via the proposed airport access road. They would reinforce one another in generating/serving passenger traffic and cargo movement and support service development.

The cumulative effect of the location of these developments on the west side of General Santos City would be substantial growth in demand for residential, commercial and support-type activities related to employment and servicing of the respective development projects. A similar growth in demand would occur for infrastructure and urban service support including electricity, water, sewage collection and treatment, solid waste management and streets and roads. However, since the proposed airport is only one of four or five major development stimulators, most of this growth would occur whether or not the airport were located at Tambler.

Part of the growth in residential demand would undoubtedly be in the form of squatter-type development. Attraction of squatters would further burden limited supplies of resettlement area.

In addition to the general relationships outlined above, there are several specific project interrelationships that would arise among the airport and other development projects. The circumferential road is an example. If the airport access road is built first, then the access road could substitute for a segment of the circumferential road, running east-west or northeast-southwest from the highway, as shown on the recommended plan. If the circumferential road is built first, then a segment of the road would substitute for the airport access road.

The airport itself would generate a modest amount of new growth in the surrounding area. Employment at the airport is expected to be 85 in 1995, 94 in 2000 and 118 in 2015. There would be some demands for outside supply of food and concessions and some maintenance, repair and miscellaneous support activities, including the cold storage, but these are not large scale. What may stimulate more growth may be a perception by local businesses and providers of goods and services that proximity to the airport is desirable because of the activity generated by it and traffic along the access road. Growth of this type is expected to occur (and is accommodated by the recommended plan) along the access road.

The cumulative effect of economic development projects in the western sector of the City may put some development and support pressure on the Upper Tambler Resettlement Area. Upper Tambler is now in a relatively isolated situation. MSU and the employment centers along the waterfront are the main activity centers. The agro-processing center, expansion of Makar Wharf, Espina Estate, and the airport would put Upper Tambler in a less isolated and more central position to absorb growth. This factor is accommodated in the recommended plan by allocating large amounts of land to residential use and substantial amounts to commercial and other support uses.

4.2 SOCIO-ECONOMIC CONDITIONS

4.2.1 DEMOGRAPHY AND MIGRATION PATTERNS

The project is not likely to have a substantial permanent direct effect on population characteristics. Changes in the demographic picture at the barangay level follow logically from the assumption that there would be more females actively involved in the informal sector of the economy, such as food vending, while more men would be involved in the construction and operation phases of the project. Participation of unskilled workers in these phases would be large, although their participation could be of relatively short duration. Some in-migration would undoubtedly occur. Some workers attracted to the area for temporary construction work would make General Santos City and possibly the Tambler area their home.

The project is likely to result in faster development of the area, including residential as well as commercial and industrial uses. Migration into the area is expected to increase because the presence of the project and its cargo handling component would encourage the development of support services and other informal economic activities consisting of small industries or businesses run by lower-income groups in the area, composed mostly of women.

Squatters are a potential problem, especially near the highway along the access road and possibly in the Resettlement Area. The lack of water and other services along the road would make it a less attractive location than the Resettlement Area, but squatters in the Resettlement Area would attract more negative attention. While the residents and City would police the Resettlement Area, the Resettlement Division of the Office of Social Service Development, in concert with property owners and the Department of Public Works and Highways would be responsible for dealing with squatters along the road or in its right-of-way.

The airport project would most likely not substantially directly benefit the majority of ordinary villagers. Its primary direct benefits would be to larger business concerns that would profit from improved cargo services. Nevertheless, the barangay residents' expectations from the project are very high, especially in terms of perceived increased income (see Appendix 7.5.4, for results of the Perception Survey). The project would provide improved access roads, and electric power facilities. It would be likely to stimulate development, and indirectly increase employment opportunities. Nonetheless, the project would not be likely to lead to any structural change in the deeply rooted problems of the present social organization of the community; e.g., perennial joblessness of the villagers, drought, and peace and order.

4.2.2 ECONOMY AND EMPLOYMENT

Construction and operational activities would result in employment for skilled and semi-skilled workers. The 34 ATO (or other airport operator) and 13 PAL employees would be transferred to the site, as they are willing, and to the extent they are qualified for the new positions. Total airport operating employment is projected to increase to about 85 in 1995, to about 94 in 2000, and to about 118 in 2015. This does not include employment at PAL or other airline that may operate at the airport. Food service would be provided by concession at the new facility, but it is not known if the same canteen operators at the existing airport would continue at the new facility. Some employment transfer may occur since existing employees live near the Buayan site and may prefer to switch to jobs nearer their homes.

To the extent cargo operations support new industrial and agricultural developments, the economy would benefit on a general level. Secondary economic and employment opportunities would also be supported.

4.2.3 UTILITY AND COMMUNICATION INFRASTRUCTURE

The project would directly facilitate better communications through faster and more convenient air travel. The project would include road and electric power infrastructure improvements. Such improvements would stimulate development in the area, increasing the demand for other urban services such as telephone services. Road improvements would facilitate access to places at lower transportation costs for residents as well as improving the movement of goods and services and transport of products to the market.

Project water and septic sewer systems would be on-site and would not accommodate any users other than the airport.

4.2.4 EDUCATION, HEALTH AND SOCIAL SERVICES

The project would not have any direct effect on health, education or the provision of social services. Short-term effects on health could occur as a result of dust generated during construction. In the long-run, the project would result in lower dust levels from road travel by the provision of a paved access road. Noise from aircraft operations or airport-related traffic would not adversely affect adjacent uses.

In the future, if residential development occurred within 30 m of the access road, national ambient noise standards could be exceeded with potential negative health impacts. Traffic-related air pollutants are not expected to be sufficient to adversely affect health. Medical emergency evacuation would be accommodated better at the new facility than at the existing one.

4.3 PHYSICAL ENVIRONMENT

4.3.1 TRANSPORTATION

Construction

During construction of the airport and access road (possibly from 1992 to 1995), construction vehicle trips would occur to transport construction workers who may live off-site, and to transport construction materials. Most construction worker trips would be by jeepney, but much of the construction materials would be carried by heavy trucks.

hauling aggregate

In terms of volume of material and number of vehicular trips, hauling of aggregate for use in making concrete for paving of the runway and access road would probably account for the largest number of trips, as about 140,000 cubic meters would have to be hauled. Most of this would probably come from a quarry on the Makar River, about 5 km north of the site. Aggregate haul trucks would be heavily laden, slow-moving vehicles, as would trucks loaded with cement and steel. The movement of aggregate trucks could reach 100 loads per day during peak construction, or 200 vehicle trips, as the trucks would return empty to the quarry. It is not likely that transport of other construction materials would generate as many trips, but could amount to another 50 trips per day. If construction worker trips are added, construction traffic during peak activity could amount to 300 to 400 vehicle trips per day.

Loaded aggregate trucks and construction materials trucks would be slow in making turns and would not accelerate rapidly if stopped on the highway, and congestion would probably occur at the intersection of the access road with the highway. Flagmen to manage traffic would probably be needed during this period.

Road Network

Construction of a new airport at the Tambler site would not necessitate changing the existing road network. Construction of an access road from the existing GSC-Maitum Highway, however, would be required. This road would lead west from the highway into the airport site, on an approximately straight alignment, for a distance of 6 km. If the circumferential by-pass route described under Road Network, Setting, were constructed, the access road would lead west from the by-pass for a distance of approximately 2 km. For purposes of this study, it has been assumed that the by-pass road would not be constructed.

Access Patterns

Indirect changes in access patterns would probably occur in the immediate vicinity of the airport site due to the existence and availability of the proposed paved access road. The airport access road would probably become the principle access for MSU, since both existing access roads to MSU are unpaved.

A similar change could occur with respect to the Upper Tambler Resettlement Area and the San Jose community. Access is currently via an unimproved dirt road that is in very poor condition. Even though the airport access road would not provide direct access to the Tambler resettlement area and San Jose, the road would allow trips to and from these communities to bypass a portion of the unimproved road, substituting slightly longer travel distances, but over a greatly improved road surface. The airport access road would not be directly accessible from these areas; a drainage channel and a fence separate the road alignment from the Upper Tambler Resettlement Area. It is possible that these obstacles could be overcome, although this is not part of the project. For the purposes of worst case analysis, it is assumed that residents establish some means to access the airport access road and travel on it rather than on the existing road to San Jose. This approach also addresses access road traffic if it becomes a portion of the circumferential road.

Access patterns would change for passengers, airport employees and cargo movements to and from the airport. Movements to or from the city center area would travel along the GSC-Maitum Highway to the new airport site at Tambler, rather than along the existing access route of the National Highway toward Davao, the Highway toward Glan and the existing airport access road. The distance from Dadiangas to the existing airport is about 8 km, while the distance from Dadiangas to the proposed airport site at Tambler is about 16 km. Therefore, travel distance for these trips would be increased by about 8 km. The entire trip would be on paved road surfaces as contrasted with the 1 km unpaved surface section of the Buayan airport access road.

Cargo movements to and from the airport originating elsewhere than the city center area would also use an altered travel pattern. Cargo movements from the agricultural areas of Polomolok would not have to move through the congested city area, but rather would move directly down the National Highway from Polomolok and onto the GSC-Maitum Highway and to the airport. This would be an increased travel distance of about 5 km, but with an avoidance of the congested central area, and over paved roads for the entire route.

A significant improvement in travel pattern would occur with cargo movements originating from the areas of Makar Wharf, the Dole Pier, the proposed agro-processing center and the industrial and processing establishments located along the GSC-Maitum Highway. These cargo movements would have more direct access to the airport, directly via the GSC-Maitum Highway and the airport access road, without traversing the central city area. This would represent a savings in travel distance of approximately 10 to 14 km, depending on the location of the establishment, along with an avoidance of the congested city center.

Traffic Volumes on the Airport Access Road

Traffic on the airport access road would be both generated traffic (generated by the airport) and diverted traffic (existing traffic transferring to the access road).

For generated traffic, vehicular traffic volumes were projected in five-year increments for each major activity category that generates traffic, by vehicle types, then summed to give total volumes. The activity categories include:

- air passenger movements
- airport employee trips
- cargo movements
- airport servicing (deliveries, etc.)

Vehicle types for which projections were made include:

- private vehicles (generally passenger autos)
- tricycles
- jeepneys

- buses
- other (mostly motorcycles)
- hotel vehicles/vans
- cargo trucks (half-ton, five-ton and 10-ton)

The general methodology was to prepare traffic generation projections separately for each activity and accumulate the results. Traffic from passenger movements, which accounts for 85% to 90% of trips, was estimated based on passenger demand projections derived from population projections (see the Feasibility Study, Final Report, WSA, 1991) and from vehicle types and occupancy rates obtained from an origin/destination survey of passengers traveling to and from General Santos City. A detailed description of the methodology is given in Appendix 7.1.2, Transportation Analysis Methodology.

A summary of generated daily vehicle trips is as follows:

	Autos	Other Passenger Vehicles	Trucks	Total
1995	236	134	30	400
2000	373	171	52	596
2015	948	217	64	1,229

Trips with the purpose of transporting air passengers to and from the airport would account for about 85% of total trips in 1995, increasing to over 90% by 2015. Trips with the purpose of transporting cargo to and from the airport would account for only about five percent of total trips in 1995, decreasing to three percent by 2015. Cargo trips do not decrease in number, and passenger trips grow at a proportionally higher rate.

Peak-hour generated traffic flows would relate to flight operations, with heaviest traffic concentrated by arrival and departure of passengers shortly before and after each flight. Projections of peak-hour traffic volumes were made by distributing passenger and cargo trips at flight times, employee trips before the first flight and after the last flight each day, and service trips uniformly over the day. This distribution indicated very low peak-hour generated traffic volumes as follows:

	Vehicles Per Peak Hour
1995	140
2000	130
2015	190

The slight drop in peak-hour traffic from 1995 to 2000 is due to the projected operation of a larger number of aircraft flights, spreading out passenger movements. While not expected to be necessary, if two flights occurred in the same general time period, peak-hour traffic would be as follows:

	One Flight	Two Flights
1995	140	260
2000	130	241
2015	190	358

With a capacity of at least 45,000 vehicles per day, even the activity from two nearly simultaneous flights would not impact access roadway operation. Because of this, because simultaneous activity is unlikely, and because the analysis methodology already incorporates a conservative approach, this analysis is based on non-simultaneous flight operations.

In summary, vehicular traffic generated by airport activities is projected to be very low, beginning at about 400 trips per day and increasing to about 1,200, with peak-hour traffic volumes never exceeding 200 vehicles per hour.

Diverted traffic may result from diversion of travel off of the unimproved road now serving MSU, Upper Tambler and San Jose. These trips would involve trips by family members to and from Tambler and San Jose and trips by on-campus and off campus students, faculty and staff of MSU. Summary projections indicate daily and peak-hour diverted vehicle trips as follows:

	Average Daily Vehicle Trips	Peak-Hour Vehicle Trips
1995	430	40
2000	610	60
2015	1,040	100

Table 13 shows total daily and peak-hour trips, including generated and diverted, on the airport access road.

Table 13: Generated and Diverted Vehicle Trips, Airport Access Road

	Average Daily Vehicle Trips		
	Generated	Diverted	Total
1995	400	430	830
2000	600	610	1,210
2015	1,230	1,040	2,270
	Peak-Hour Vehicle Trips		
	Generated	Diverted	Total
1995	140	40	180
2000	130	60	190
2015	190	100	290

SOURCE: Wilbur Smith Associates

In addition to the generated and diverted traffic discussed above, it is likely that some traffic would be generated by new growth along the access road. That growth could be considered as partly composed of normal growth that is now occurring in the area, such as the planned residential settlement of the 39 ha of land south of MSU, and induced growth, or more rapid growth that may be stimulated by the airport and the existence of the access road. There is no reliable way to quantify this potential growth, nor to project traffic volumes that would result. However, there is some growth now occurring near the highway, which is not a part of the Upper Tambler Resettlement Area. It is reasonable to expect that this would continue, and possibly accelerate, as a result of the airport. Also, the existence of a paved road (the airport access road), 6 km in length, would stimulate development on adjacent land as a result of the improved access. The land through which the proposed airport access road alignment passes is zoned "Built Up Area" (residential) and "Light Industrial." Once the access road was constructed, and particularly after the airport began operation, growth pressures for development of residential, commercial and industrial uses would probably occur.

Because of uncertainty of the type, magnitude and timing of new development, it is not possible to accurately project traffic volumes. However, because of the existing scale of developments that may contribute diverted traffic to the access road, and the conservation assumption that all of the traffic in San Jose, the Upper Tambler Resettlement Area and MSU would divert to the access road, it is unlikely that traffic from new growth would exceed the volume of diverted traffic. Therefore, if traffic due to new growth is assumed to be equal to diverted traffic, and added to generated and diverted volumes, total traffic on the access road would be as follows:

	1995	2000	2015
Total daily vehicle trips	1,260	1,820	3,310
Total peak-hour trips	220	250	390

Traffic Circulation and Movement

One potential impact is traffic congestion or decongestion on the proposed airport access road, the GSC-Maitum Highway between the airport and Dadiangas, and on the route between Dadiangas and the existing Buayan Airport. These impacts may be derived from volume-to-capacity (v/c) relationships (ratios) and from turning movements.

The airport access road should continue to function through 2015 without any congestion. It is proposed to construct the airport access road with a 7.3-m paved section (one lane in each direction) and 3.05-m shoulders. The nominal capacity of this roadway would be 72,000 vehicles per day (36,000 each way) on the basis of a 24-hour day. On the basis of a 15-hour day, the nominal capacity would be 45,000 total vehicles, 22,500 each way.

One means of evaluating congestion on a roadway is volume-to-capacity relationships, or v/c ratio. The v/c ratio is the traffic volume (number of vehicles) moving on a roadway over a period of time or at a given time, expressed as a proportion of the traffic-carrying-capacity of the roadway. Traffic capacity is determined primarily by the cross-section of the roadway (lane width, shoulder width, medians, etc.) and is also affected by such factors as type and proximity of adjacent developments, sight distances, curb cuts, etc.

The analysis presented below is in terms of nominal capacity, assuming straight, flat roads without modifying conditions, paved 7.3 m wide (two lanes, no median), with 3-m shoulders. Roadways can operate at virtually free-flow conditions (no congestion) carrying traffic equal to 50% or 60% of capacity (v/c ratio of 0.50 or 0.60). Some congestion sets in above that point, and by 70% capacity (v/c ratio of 0.70), major traffic flow improvements or alternate routes should generally be considered. It is not unusual, however, for urban arterial streets to operate at above 100% of their rated capacity. Even though roads may carry traffic for 24 hours per day, it is often useful for evaluation purposes to assume that all of the traffic is concentrated into a shorter period. In the case of this report, 15 hours is also used as the period of roadway operation.

The volume/capacity relationship of the access road, with generated plus diverted plus induced traffic, is shown in Table 14. As shown in the table, the airport access road would operate far below capacity, without congestion, even accounting for frequent jeepney stops for loading and unloading passengers.

Table 14: V/C Ratios, Airport Access Road

	1995	2000	2015
Capacity, 15-hour day	45,000	45,000	45,000
Daily traffic volumes	1,260	1,820	3,310
V/C ratio, average daily	0.03	0.04	0.07
Capacity, hourly	3,000	3,000	3,000
Peak-hour traffic volumes	220	250	390
V/C ratio, peak hour	0.07	0.08	0.13

SOURCE: Wilbur Smith Associates

The GSC-Maitum Highway from the entrance point of the proposed airport access road toward General Santos City is paved to a width of 7.3 m, and generally has 3-m shoulders. It therefore has the same cross section and same nominal capacity as the airport access road would have. Louis Berger International, Inc. (LBII) and TCGI Engineers have carried out traffic counts and made projections of future traffic volumes on the GSC-Maitum Highway in connection with proposed highway improvements under the USAID Rural Infrastructure Fund (RIF) Program. The proposed road improvements would make the agricultural production areas and fishing villages along the southwest coast of South Cotabato Province more accessible to markets and other transport modes in General Santos City, and thus these improvements would induce traffic growth if they are implemented.

Traffic volume projections were made for the highway without the improvements westward toward Maitum, and with the improvements. Table 15 shows the traffic volume result and the effect on volume/capacity ratios of introducing traffic from the airport access road onto the GSC-Maitum Highway, both with and without the proposed highway improvements. (It should be noted that this analysis treats all trips as new, and does not subtract existing trips to the airport, although some of these are generated from the area. All the trips would be new to the access road, as this road does not now exist. This analysis also does not subtract cargo truck trips currently traveling to the Davao airport.)

If the highway were not improved to bring additional traffic from the direction of Maitum, the section between the airport access road and General Santos City would continue to operate at well below congestion levels at least through 2000, and probably on to 2015. On a 24-hour basis, the v/c ratio would be about 0.43 by 2015. On a 15-hour basis, the v/c ratio would go up above 0.60, meaning a congested condition. It should be noted that traffic loaded onto the highway from the proposed airport access road would contribute significantly to the congestion condition, as removing the airport traffic lowers the v/c ratio by only about 0.07. This means that while direct airport-related traffic would not affect congestion levels, other traffic along the road would.

If the highway is improved to bring more traffic from the direction of Maitum, then the highway plus airport traffic still would not produce traffic congestion through 2000. However, some congestion would have set in by 2015, with a v/c ratio of about 0.60 on the basis of a 24-hour day, and a v/c of over 0.90 on the basis of a 15-hour day. Therefore, if the highway is improved to bring more traffic from the west, it would appear desirable to construct a multi-lane road. This potential congestion also supports construction of the proposed by-pass route. Direct, airport-generated traffic, however, would not adversely affect roadway operations.

Table 15: GSC-Maitum Highway, Average Daily Operations with Airport Access Road Traffic

	1995	2000	2015
Without Highway Improvement			
Highway traffic	3,830	6,620	27,540
Added access road traffic	1,260	1,820	3,310
Total Traffic	**5,090**	**8,440**	**30,850**
Highway capacity, 15-hour day	45,000	45,000	45,000
V/C ratio	**0.11**	**0.19**	**0.68**
Highway capacity, 24-hour day	72,000	72,000	72,000
V/C ratio	**0.07**	**0.12**	**0.43**
With Highway Improvements			
Highway traffic	5,510	9,560	40,100
Added access road traffic	1,260	1,820	3,310
Total traffic	**6,770**	**11,380**	**43,410**
Highway capacity, 15-hour day	45,000	45,000	45,000
V/C ratio	**0.15**	**0.25**	**0.96**
Highway capacity, 24-hour day	72,000	72,000	72,000
V/C ratio	**0.09**	**0.16**	**0.60**

SOURCE: Wilbur Smith Associates

In a similar manner, peak-hour traffic should operate without congestion on the highway through 2000, but would probably become congested by 2015, as shown in Table 16. Again, traffic generated directly by the airport would not contribute significantly to highway traffic congestion. Airport traffic would constitute less than 10% of the traffic on the highway. Potential peak-hour congestion in the year 2015 supports construction of the by-pass route.

Table 16: GSC-Maitum Highway, Peak-Hour Traffic Operations with Airport Access Road Traffic			
	1995	2000	2015
Without Highway Improvement			
Highway peak-hour volume	383	662	2,754
Airport peak-hour volume	220	250	390
Total volume	603	912	3,144
Capacity	3,000	3,000	3,000
V/C ratio	0.20	0.30	1.05
With Highway Improvement			
Highway peak-hour volume	551	956	4,010
Airport peak-hour volume	220	250	390
Total volume	771	1,206	4,400
Capacity	3,000	3,000	3,000
V/C ratio	0.26	0.40	1.47
SOURCE: Wilbur Smith Associates			

Increased congestion is not the only potential impact, because changes in access patterns would remove traffic from some routes and contribute to decongestion. All of the airport-related traffic movements would be taken off of the routes leading out of Dadiangas toward Buayan Airport. All of the cargo movements originating in Polomolok or the industrial and commercial areas near Makar Wharf, Dole Pier and the agro-processing center would travel directly to the airport instead of passing through the central city area.

Airport relocation would result in a change in turning movements. Traffic outbound from Dadiangas or from Polomolok, Makar Wharf and Dole Pier would make right turns in and left turns out of the airport access road. Traffic from the direction of Maitum and the agro-processing center would make left turns into and right turns out of the airport access road. These turning movements would result in some congestion at the intersection of the airport access road with the GSC-Maitum Highway, particularly at peak hours. This indicates the desirability of traffic engineering treatments at the intersection to lessen turning movement congestion. These may include signalization, installation of protected turn lanes, intersection channelization or installation of a roundabout. In a similar manner, the removal of traffic and turning movements from the intersection of the Buayan Airport access road and the Glan Highway, and the Glan Highway-GSC to Davao Highway intersection would result in decongestion and reduction of turning movements at those intersections.

Summary of Transportation Impacts

Transportation impacts may be summarized as follows:

1. Some congestion would occur along the GSC-Maitum Highway and at the intersection of that highway with the airport access road during construction. This

congestion would be largely attributable to heavy trucks hauling aggregate from a quarry on the Makar River.

2. The airport would generate directly only small volumes of traffic. Average daily volumes of airport-generated traffic would range from about 400 vehicles per day in 1995 to about 1,200 per day in 2015. Peak-hour airport-generated traffic would range from about 140 vehicles per peak hour in 1995 to about 190 per peak hour in 2015.

3. Even though the GSC-Maitum Highway may approach congestion conditions by 2015, no more than four percent of daily traffic volume, and no more than six percent of peak-hour volume would be attributable to the airport.

4. The airport access road would operate at far below capacity throughout the planning period, even though the road would carry both airport-generated, diverted and induced traffic.

5. A decrease in travel distance of eight to 16 km would be experienced for airport trips originating on the north side of the central city (from Polomolok) and the south or west sides (from Makar Wharf, Dole Pier, the proposed agro-processing center, or trips from the direction of Maitum).

6. Improved access via a paved road would result for MSU and its vicinity, and possibly for the Upper Tambler Resettlement Area and San Jose.

7. An increase in travel distance of eight to 16 km would be experienced for airport trips originating in the central area (Dadiangas) or the east side of the central area (from Davao or Glan).

8. Some traffic congestion could occur at the intersection of the airport access road with the GSC-Maitum Highway as a result of turning movements.

4.3.2 CLIMATE, METEOROLOGY AND AIR QUALITY

No impacts are anticipated on climate or meteorology. Air quality impacts may arise from construction of the airport, construction of the access road, operation of the airport and vehicular traffic on the access road, as described below.

Airport Construction

Construction of the airport is considered here to encompass construction of runways and taxiways, terminal building and other airport structures and relocation of a short section of the road to San Jose. Sources of air pollution are likely to be dust from construction and vehicle movement, and vehicle engine exhaust emissions. The total construction period would be about 24 months, although site preparation, which would create most of the dust, would be completed in about 12 months.

Construction activities would include quarrying and hauling of aggregate from the Makar River. Although, to provide a conservative approach to analyzing transportation impacts, it was assumed that the aggregate hauling route would be along the highway, it is more likely that aggregate would be hauled cross-country from the quarry to the airport. Dust would be generated by the movement of aggregate hauling trucks over a dirt road. This is not expected to create any particular problem since the haul route would be north-south, prevailing winds are north-south, and there are no receptors to the north or south of the haul route.

Grading and site preparation, over a period of about 12 months, would also create dust, but because of the location of the site, the prevailing wind directions, and the lack of development north and south of the site, dust generation during construction is not anticipated to be a problem. Even when cross winds occur, the nearest developed areas at San Jose (2.5 km from the runway) or Tambler community (3 km from the runway) are not likely to receive significant concentrations of dust. In addition, the construction contractor would use dust control measures during some operations to protect equipment and workmen. Water trucks would be used to reduce the amount of dust generated by vehicle traffic along haul routes.

Vehicle emissions from construction equipment and passenger vehicles on the site are considered very minor temporary sources and such emissions would be thoroughly dispersed before reaching any developed areas.

Access Road Construction

The access road would be constructed progressively with work on any one section of the road probably continuing for three to six months. Vehicle exhaust emissions are not expected to create any significant impacts during that time.

There would, however, be considerable dust generated during grading and placement of base and subbase courses. As mentioned above, this would occur over a period of three to six months at any one point. The conditions that prevail at present along the unpaved section of the GSC-Maitum highway are likely to be similar to those that would prevail along the access road during construction and before final paving. There would be movements of trucks carrying construction materials as well as passenger vehicles carrying workers, over a gravel surfaced road. These conditions would continue for approximately 24 months. At points near the roadside, National standards for suspended particulates would probably be exceeded.

Dust and vehicle emissions would impact commercial and residential uses now located near the highway. The other developed area that may receive dust is the southern portion of the MSU campus. The distance from the access road to the southern edge of the MSU campus varies from 400 to 800 meters, so some of the dust would have been dispersed before it reached the campus. Also, prevailing winds are from the north for about seven months of the year, and would blow dust away from the campus. In summary, the southern edge of MSU would probably receive blowing dust, dispersed over a distance of 400 to 800 meters, for about 10 months out of a 24-month airport construction period.

The contractor would be required to use dust control measures. The overall effects of this impact would be influenced greatly by wind patterns. During those months of the year when winds are from the north, most of the dust would be blown away from developed areas.

Dust would also be generated by construction vehicles going to and from the airport site via the access road during airport construction. The sequence of work on the access road would be grading and laying of gravel subbase initially. Final courses and paving on the access road would be done near the end of the airport construction period so that construction vehicles would not damage the final surface. Even though aggregate hauling would probably not be done via the access road, other construction materials would be brought in via the access road, and workers would move in and out of the site on the access road. The surface would be gravel rather than dirt, but some dust would nevertheless be generated by this traffic.

Operation

Air quality impacts may arise from airport operations as a result of aircraft engine exhaust emissions, vaporization or spills of fuel, operation of vehicles or terminal operations.

Aircraft Engine Emissions

Aircraft engine emissions produce relatively small amounts of pollutants if engines are of recent design and properly maintained. Major changes in engine design were made by engine manufacturers in 1981, in response to air pollution regulations in the United States and European countries. For example, the class of engines used in Boeing 707, 727, 737 and 747 was permitted to produce 4.3 pounds per 1,000 thrust hours per cycle of carbon monoxide before 1 January 1981. After that date, permitted emissions were reduced to 0.4 pounds, or a reduction of 91%. The PAL airfleet has an average age of five years, indicating that most of the aircraft have engines manufactured after 1981.

The number of flights operating from the airport would be small, three per day in 1995, increasing to seven per day by 2015. Highest concentrations of engine exhaust emissions occur during takeoff, but this is also the time in flight when most air turbulence is created behind the aircraft, so pollutant mixing and dispersion are highest during takeoff. Flight patterns during takeoff and landing would be over predominantly undeveloped areas, in straight lines north and south from the runway ends. Landings and takeoffs are usually made into the wind, so that factor also contributes to dispersion.

Refueling Facilities

The airport would have a refueling facility composed of three 10,000-gallon, aboveground tanks, set in a spill containment structure and surrounded by a fire wall. Underground piping to the apron would allow aircraft to be refueled directly from the tanks. Construction, operation, maintenance and inspection of the tank farm would be in conformance with the National Fire Protection Association Code.

Fuel to be processed through this facility would be approximately 1.5 million gallons annually in 1995, increasing to about 2.2 million gallons in 2015. The fuel would be supplied by boat to Makar Wharf, then by tank truck to the airport. Using 10,000-gallon tanker trucks, one truck load would be required each two to three days in 1995 and one truck load each one to two days by 2015.

There would be some evaporation of fuel from the fuel tanks and minor spills occurring as a part of normal operations. Evaporation and spills result in the release of hydrocarbons into the air. There is some risk of an accident involving a tanker truck, which could also spill fuel. It should be noted that the scale of operations of the refueling facility, and the type of activity occurring, is approximately equivalent to that of a large automobile service station. However, the operation of the fuel farm would probably be safer and result in less spillage than at a service station, because of the specialized training of the crew and safety precautions and fewer operations (although larger volume of fueling).

Vehicle Emissions

Automotive vehicles would operate on the site, entering the airport terminal area, picking up and discharging passengers and cargo, parking and maneuvering. These vehicles would release engine exhausts typical of local vehicles operating in urban traffic areas. These are discussed further in relationship to vehicles operating on the access road.

Terminal Operations

Air pollutants likely to be released by terminal and terminal-related activities would probably be odors and combustion products from food service concessions and perhaps exhaust emissions from electric power generators. These are all expected to be small in scale or quantity and readily dispersed.

Aircraft Dust and Jet Blast

Questions were raised during public meetings concerning dust from aircraft takeoff and landings, and the potential effect of jet blast on adjacent structures.

The runway would be concrete pavement with bituminous shoulders to a width of 60 m, with grass ground cover beyond. There would probably be a small amount of dust occurring as a result of landings and takeoffs, but the paved runway and treated shoulders would minimize this. Also, nearest residents or developed areas are over 2 km from the runway.

Some concern was expressed that jet blast from aircraft landing and takeoff may destroy houses of lightweight nipa construction. The airport special permit zone should prevent residences from being built up to the airport site property line. However, if structures were to be built to the property line, they would be no closer than 820 m from the end of the runway and no closer than 245 m from the edge of the runway. USDOTFAA Advisory Circular 150/5300-13, *Airport Design*, gives jet blast velocities for various aircraft types. According to that publication, the jet blast velocity 820 m to the rear of a B-727 would be undetectable (jet blast velocity from the B-727 was used for a worst-case analysis because it is higher than that of any of the aircraft that are projected to use the airport). At a distance of 245 m, the B-727 jet blast would be about 15 miles per hour, or 6.7 meters per second (mps). Average wind velocity is three mps, and natural wind velocities of well over 6.7 mps occur frequently in the General Santos City area, with maximum velocities 20 mps having been recorded. Also the 6.7 mps velocity would only occur at the point near the terminal where an aircraft would turn off the runway onto the taxiway.

Vehicular Traffic on the Access Road

Sources of pollution related to vehicle operations on the access road would consist of engine exhaust emissions and dust. The vehicle fleet in the General Santos City area in general has high engine exhaust emissions, particularly those with diesel engines. This is due to lack of adequate emissions control equipment, operation in very dusty conditions, overloading, and poor maintenance, resulting in badly worn engines. The existing problem of blowing dust from windborne soil and from dust caused from vehicular movement is described in Section 3.4.2, Setting.

After construction, the access road would be paved and tree planting and landscaping would be carried out. After the end of airport construction, traffic volumes would begin to increase, moving from about 1,300 per day in 1995 to about 3,300 per day in 2015. These traffic volumes compare to 1990 volumes of about 2,600 per day on the GSC-Maitum Highway near the airport access road entrance point. The roadway design for the airport access road would be similar to that of the paved section of the existing GSC-Maitum Highway. About 10 years (2005) after the opening of the airport, traffic conditions, and air quality conditions, would probably be similar to existing conditions on the GSC-Maitum Highway. These conditions are likely to be relatively high concentrations of suspended particulates immediately along the roadside, rapidly dispersing with distance from the road. As time goes by there would be an increasing number of roadside receptors of these pollutants, as development occurred adjacent to the access road.

There would be, however, an offsetting condition. As discussed in more detail in transportation impacts, some traffic from San Jose, Upper Tambler and MSU would probably be diverted from the existing unpaved road serving those communities, onto the paved airport access road. Thus, dust exposure experienced by drivers and vehicle passengers as well as roadside developments would be decreased to the extent that traffic is diverted onto a paved road.

Cumulative development in the area of the access road would also generate dust. While the access road itself would be paved, roads into development not fronting directly on the access road would most likely not be paved. While the project would attract development in its vicinity, the impact of dust from roads serving future development cannot be attributed directly to the project.

4.3.3 NOISE

For purposes of this analysis, noise impacts have been categorized as those arising from airport construction, access road construction, vehicular traffic, and aircraft operations. As will be shown in the analysis herein, no adverse impacts are anticipated to arise as a result of noise from aircraft operations. The only anticipated noise impacts are those from construction of the access road and vehicular traffic, and those impacts are expected to be heard only by a small number of residents living near the intersection of the access road and the highway.

Airport Construction

Most noise from airport construction would originate from construction equipment operation. Construction activities that would generate the most noise, grading, construction of foundations and buildings, and paving, would occur over a period of about 18 months. The expected noise generation from various types of construction equipment expected to be used on the site at 15 and 30 m is presented in Table 17. Most construction activities for runway paving, where the highest noise levels would occur, would take place no nearer than 230 meters from the property line, and most construction activities related to building of the terminal would occur no closer than 100 meters from the property line. Typical airfield construction noise occurrences would be 45 to 50 dBA with occasional occurrences of 65 to 70 dBA. Typical noise levels at the property line near terminal construction activities would be 55 to 60 dBA with occasional levels of 65 to 70 dBA. Since existing ambient noise at the site is 40 to 45 dBA, this would represent a significant increase in noise level due to construction. However, the site is currently zoned for light industrial use, and national standards for maximum allowable noise level in light industrial areas are 70 dBA daytime, 65 dBA morning/evening, and 60 dBA at night. Therefore, national noise standards would probably be exceeded only by some occasional nighttime levels, if construction occurs at night, as planned. National noise standards are given in Table 18.

Table 17: Typical Noise Emissions in dBA from Construction Equipment, at 15 and 30 Meters from the Source

Equipment	15 meters	30 meters
Air Compressor	75-87	69-81
Backhoe	71-92	65-87
Compactor	72	66
Concrete Mixer	75-88	69-82
Concrete Pump	82	76
Cranes	76-88	70-80
Front Loader	72-81	66-75
Generator	72-82	66-76
Grader	80-93	64-87
Jack Hammer	81-97	75-91
Paver	87-88	81-82
Pile Driver	95-105	89-99
Pumps	70-90	64-84
Tractors, Bulldozers	78-95	72-89
Trucks	83-93	77-87
Vibrators	68-81	62-75

Source: Wilbur Smith Associates

While project construction could generate noise levels in violation of standards, noise disturbance to receptors (persons living or working nearby, or livestock) is not expected to be significant, because of the distance of living and working sites from the construction locations. The nearest receptors to construction noise would be the residences and other uses at San Jose community, and these would be 1 to 2 km away from the construction activity. At those distances, noise from construction would be below 40 dBA, which is equivalent to the ambient noise level of the area. The effect of noise from construction on livestock is not expected to be significant. Cattle are currently accustomed to the occasional loud noise of jeepneys, trucks and tricycles in the area. Because construction noise is likely to be more frequent, adjustment would take place more rapidly. Further, because of the large areas available to them, cattle can move off when disturbed. Therefore, it is expected that no disturbance would occur from airport construction noise.

Table 18: Environmental Quality Standards for Noise in General Areas				
		Maximum Allowable Noise Level (dBA)		
Class	Area	Day[1]	Morn/Eve[1]	Night[1]
AA	Hospital, school	50	45	40
A	Residential	55	50	45
B	Commercial	65	60	55
C	Light-industrial	70	65	60
D	Heavy industrial	75	70	65

[1] The divisions of the 24-hour period are as follows:

Morning	5 a.m. to 9 a.m.	Evening	6 p.m. to 10 p.m.
Daytime	9 a.m. to 6 p.m.	Nighttime	10 p.m. to 5 a.m.

Source: National Pollution Control Commission, *Rules and Regulations of the National Pollution Control Commission*, Official Gazette, No. 23, Vol. 74, 1978.

Access Road Construction

Most noise generated by access road construction would come from operation of construction equipment. Similar pieces of construction equipment would be used for road construction as would be used for runway construction and paving. In the case of the road, the "property line" would be the right-of-way line of the road, or 30 m on either side of the center line. Construction equipment would operate at points up to the ROW, generating typical noise levels of 65 to 70 dBA and occasional noise levels of 80 to 85 dBA. These would represent a significant increase over ambient noise levels.

Most of the construction activities that would generate significant noise, including grading and paving, would occur over a period of about six months. Clearing and grading would be done for the entire length of the road as a unit. However, paving would be done progressively, with only about 1 km under construction at any one time, over a period of about three months. Therefore, at any given point along the road, most noise would occur over a period of about six months.

In terms of regulatory requirements the land along the access road is zoned as follows, with the indicated allowable noise level.

	Percent of Alignment	Allowable Noise Levels (dBA) Day	Morn/Eve	Night
Residential	60%	55	50	45
Commercial	10%	65	60	55
Light Industrial	30%	70	65	60

Therefore, much of the noise generated by access road construction would be significantly above the allowable noise levels during the temporary construction period of about six months, at any one point.

In terms of receptors, approximately 90% of the length of the access road passes through undeveloped land with no adjacent receptors. The receptors that do adjoin the road consist of commercial and residential uses near the highway. There are approximately 10 residences and two or three commercial uses within a distance of 100 meters of the centerline of the road. Few animals are located in this area. During a period of about six months, these residences and business would be receptors of typical construction noise that exceeds the normally acceptable maximum by about 20 dBA.

Vehicular Noise on the Access Road

As an aid in calibrating an estimate of roadside noise on the access road, noise was measured on several existing road segments expected to have similar vehicular traffic characteristics to those of the proposed airport access road, including locations along the highway near the existing airport, locations along the highway leading north from the central area toward Polomolok, and near the existing terminal building during peak activity periods. On the basis of those readings as related to traffic volumes, vehicle mix, and operating characteristics expected to occur on the access road, the following vehicular traffic noise levels are anticipated:

	Distance from Roadside	
	10 m	30 m
1995	55-60 dBA	50-55 dBA
2000	55-60	50-55
2015	60-65	55-60

These noise levels would represent a significant increase over existing noise levels.

With respect to the impact of vehicular noise on receptors, it is necessary to consider that, even though most of the route is currently not developed or inhabited, it is likely that various uses would be developed along the route as the airport begins operation. Expected land uses would include residential, commercial and light-industrial uses along the road. In addition, residential uses are proposed for the 39-ha lot south of MSU. On the basis of noise levels shown above, daytime standard noise levels would not be exceeded for commercial and industrial uses, but could be exceeded for residential uses.

Estimates have not been made for nighttime traffic noise levels. However, the airport would not operate at night, so airport-related vehicular traffic would not move along the access road at night. Diverted traffic and traffic from new development (as defined and discussed in Section 4.3.2, Transportation), would continue to move along the road at night, but at normally reduced nighttime volumes. It is possible that nighttime noise levels from the road could exceed the national standard of 45 dBA for residential areas. If the mitigation measure recommended in Section 6.1, Mitigation, Land Use and Regional Planning, is implemented and only commercial and industrial structures are permitted directly adjacent to the road, commercial and light-industrial structures intervening between residential uses and the roadway would provide noise attenuation. In that event, it would be unlikely that nighttime noise levels at residential sites 30 m from the road would exceed the National standard. At a distance of 80 m from the road, even with no intervening structures, the nighttime noise levels from vehicular traffic would be less than the 45 dBA standard.

The road alignment would be between 150 m to 200 m from the 39-ha resettlement lot south of MSU. At this distance, it would not experience any noise in violation of National standards from the road.

It has been noted that numerous livestock, including cattle, goats, pigs and chickens, are grazed directly adjacent to the National Highway in densely developed areas of the City with no apparent ill effects. No existing livestock would be located this close to the access road. As noted in the following discussion, livestock farming is considered compatible with moderately high noise levels.

Aircraft Operations

Aircraft noise is generally the issue of greatest concern for aviation-related projects. As noted earlier, however, the analysis presented herein, which, for purposes of worst-case analysis, used four times the number of flights projected for the end of the planning period (2015), determined that noise from the airport would be low enough to be compatible with all uses, including residential development.

The principal analytical tool used to predict aircraft noise is the Integrated Noise Model (INM), developed by the US Federal Aviation Administration as a planning analysis requirement for airport development. The structure and operation of the INM, and the noise measurement and prediction methodology on which the INM is based, is summarized below. Supplemental information is provided in Appendix 7.1.3, Aircraft Noise Methodology.

The most commonly used noise measure is the decibel (dB), which is a measure of sound pressure. The human ear perceives certain frequencies more than others, and a weighting system ("A"-weighting) has been developed related to human sound perception. The A-weighted sounds are presented as dBA. The decibel scale, however, measures sound at a point in time. As a means of describing the noise environment, which is an accumulation of sounds generated over a period of time, other measures were developed. The L_{dn} is one such measure that describes the cumulative effect of noise. The INM predicts cumulative aircraft noise in L_{dn}, which is a day-night averaged noise level, with nighttime noises weighted an additional 10 dBA to account for the greater annoyance of nighttime noise. The output from the INM, in L_{dn} units, should not be confused with the widely used noise descriptor, dBA.

The INM is a computerized model with an extensive data base that includes information on noise produced by 81 different aircraft types under various operating conditions of climb, thrust, turns, etc. To operate the model, a description of the airport is entered giving altitude, runway orientation, etc. Flight paths, and conditions for engine thrust settings, climb angles and related items for aircraft operations are described. For each type of aircraft, the daily flight frequency and operations are input. The model integrates this input data with its data base, and produces a prediction of aircraft noise.

The output of the model is given as contour (or isobar) lines showing boundaries between various noise levels of L_{dn}. These contours indicate areas on the ground in which certain noise levels would be experienced. The standard units of analysis are usually the boundaries of 65, 70 and 75 L_{dn}. All uses are considered compatible with 65 L_{dn}. Higher noise levels are generally considered compatible only for such uses as manufacturing. Table 7.2.3 in Appendix 7.2 presents a full description of noise compatibility. A summary of noise compatibility of certain major uses is listed below.

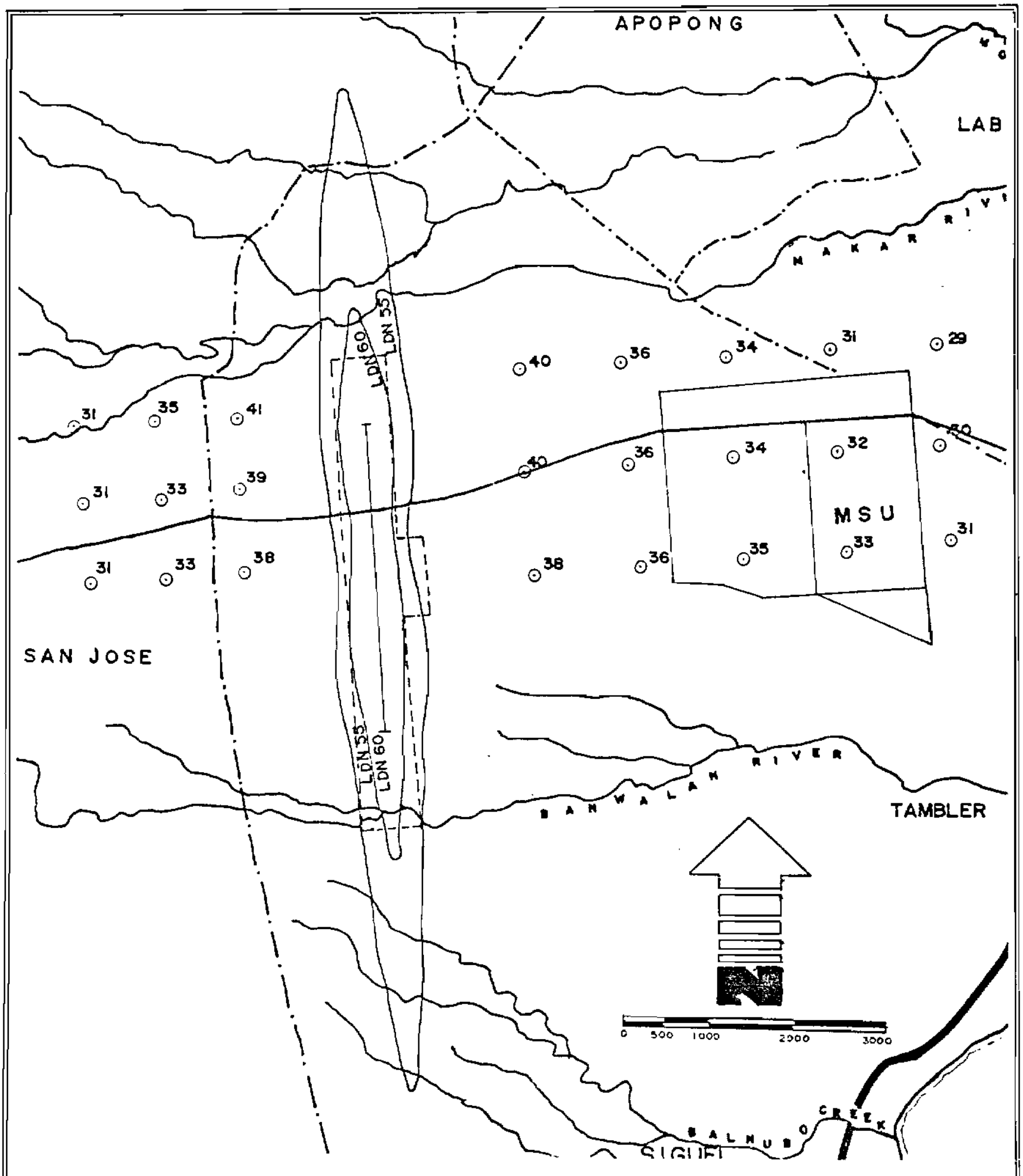
L_{dn} Level	Compatible Uses
below 65	Residences, schools, hospitals, churches, auditorium, amphitheaters
65-70	Nature exhibits, zoos
70-75	Government services, offices, communication, livestock farming, outdoor sports
75-80	Retail trade
80-85	Wholesale trade, utilities, manufacturing
Over 85	Transportation, agriculture, forestry, mining, fishing

The INM model inputs were set up for the Tambler airport site using projected aircraft operations for the year 2015. This included seven commercial flights per day by Fokker-50, A-300, B-737 and C-130 aircraft. With this information, the model produced no noise contours higher than 50 L_{dn}, indicating that aircraft operations in 2015 would not produce any incompatible noise impact throughout the planning period. In fact, the model produces more statistically reliable results when operated with input of a larger number of aircraft operations. Therefore, the model was run again, with the number of aircraft operations multiplied by four. This gives a very large sensitivity margin for computation and substantially overstates the amount of noise likely to be produced. This also would account for noise produced by general aviation aircraft, which is not normally computed by the model.

With this overstatement of the number of operations, the highest L_{dn} contour produced by the model was 60 L_{dn}; a 55-L_{dn} contour was also produced. These contours are shown in Figure 10. The 60-L_{dn} contour is a band centered along the runway, approximately 500 m wide and 5 km long, tapering to a point at each end. The 55-L_{dn} contour, also centered along the runway, is about 800 m wide at its widest point, and approximately 9.5 km long, tapering to a point at each end. Neither the 60-L_{dn} or 55-L_{dn} contours extend over any developed areas. They extend only over pasture or agricultural land.

In order to further examine noise impact on developed community areas, an additional analysis was done using the INM, to calculate noise levels at specified points extending over the San Jose and Tambler communities and MSU campus. The noise levels calculated at these points are also shown on Figure 10. These calculations showed aircraft-generated noise levels of 31 to 40 L_{dn} over San Jose, 36 to 40 L_{dn} over the Upper Tambler Resettlement Area, and 30 to 35 L_{dn} over MSU. It should be recalled that these noise predictions are in L_{dn}, not dBA. An L_{dn} of 65 is considered compatible with residential, hospital and school uses. Even after multiplying 2015 projected flight operations by four, the model indicated L_{dn} levels of less than 45 over the nearest developed areas.

In conclusion, noise generated by aircraft operations would not adversely affect the developed environment of the airport through the 2015 planning horizon, and no noise reduction buffers are needed. Land use controls related to development restrictions and buffer areas are discussed in Section 4.1, Land Use and Regional Planning.



LEGEND

LDN 55 - NOISE CONTOUR BOUNDARIES
⊙ 40 - dBA LEVELS FROM AIRPORT OPERATIONS AT POINTS INDICATED

Figure 10
Aircraft-Related Noise Contours and Noise Levels in the Site Vicinity

Source: WSA

Summary of Noise Impacts

No significant adverse noise impacts are expected from airport facilities construction, vehicular traffic, or aircraft operations. Construction of the airport access road would create noise levels significantly above ambient noise levels for a period of approximately six months, affecting about 10 residences and several commercial establishments. Any housing built within 30 m of the access road could be exposed to nighttime noise levels in excess of National standards.

4.3.4 ENERGY

During construction, on-site energy would be supplied by diesel generators. Diesel would also be used for power equipment and most construction vehicles.

For operation, power lines would be extended to the site, either from MSU or from a location near the National Highway, where the SOCOTECO II map shows a proposed substation. It may be that installation of the substation would occur as a result of the project. Power capacity demand of the airport is projected to be 300 kva, compared to 50 kva at the existing airport. In 1995, monthly electrical consumption is projected to average 32,670, or about 400,000 kwh annually. This is about one percent of all industrial consumption for the City in 1989, and 0.4% of total 1989 municipal consumption. Consumption in 2000 and 2015 would not be substantially larger since the majority of fixtures using energy would be installed in Phase I. Because of recurring annual droughts and the impact these have on the power supply capability of NPC, it is not expected that all of the airport's power needs would be supplied by NPC through SOCOTECO II. The project would include one or more backup diesel generators as a supplemental power source.

The project would contribute to the continuing problem of inadequate power supply on Mindanao. This is considered to be an unavoidable, but not significant, effect of the project, since energy consumption at the airport is minimal considering the size of the facility.

Annual jet fuel consumption is projected to be about 1.5 million gallons in 1995 and 2000, and about 2.2 million gallons in 2015.[1] The projected volume, which is about the same as the current level at the Cagayan de Oro airport, would be adequate to attract suppliers. Currently, Jet A-1 production in the Philippines is near capacity. The projected fuel consumption at the new airport would be about one percent of existing capacity. However, Petron and Shell are expanding capacity and supply is not expected to be a problem.

Other Utilities

Concern has been expressed in public meetings over the potential contribution of any project in General Santos City to contribute to existing solid waste and water pollution problems. The nature of the project is such, however, that it does not generate substantial amounts of solid waste or wastewater, and the site location, in the dry tableland of Upper Tambler, mediates against the creation of water pollution problems.

In terms of solid waste, the existing airport generates an average of 140 kg/week, or about 7,300 kg/year. For this analysis, passengers are used as a unit for waste generation, since passengers correlate with general service increases at the new airport.

At about 60,000 passengers per year, current waste generation is about 0.12 kg/passenger. For the project, waste generated would be about 13,000 kg in 1995 (104,700 passengers); about 19,000 kg in 2000 (156,300 passengers); and about 40,000 kg in 2015 (332,000 passengers). Again, while it would contribute to an existing problem, this would not be considered significant. The city has proposed a new solid waste facility at the Makar River, where there is an existing dump, that would incorporate improved sanitation techniques.

Potential effects by the project on water quality are addressed in Section 4.3.5, following.

NOTE - Energy

[1] Information on jet fuel consumption is from Ed Anqui, Sr., Philippine Airlines, Fuel Management Office, letter dated 9 May 1991.

4.3.5 HYDROLOGY AND DRAINAGE

Construction

Sand, gravel and fill materials are expected to come from the Makar River Quarry. Quarrying in wet periods would increase the suspended solids concentration and turbidity. Washing of the sand and gravel would increase the colloidal concentration in the water. Project construction techniques would include a settling pond and use of a cloth or other filter to prevent siltation away from the quarrying operation.

Increase in suspended solids concentration would affect uses of the water. Suspended solids could settle and block irrigation canals. Without treatment, turbid water would be unsuitable for consumptive uses such as bathing and washing clothes. High turbidity also affects sunlight penetration and indirectly affects algal photosynthesis and the aquatic food chain dependent on the algae. Suspended solids could cover the river bed bottom and kill or dislocate benthic organisms. Because of the existing dump site, quarry operation and generally low water volumes, few sensitive aquatic life forms are expected to exist in the river.

Depending on the mineralization at the quarry site some minerals such as iron may be dissolved or suspended in the water. Iron causes discoloration of drinking utensils and clothes. Dissolved iron tends to oxidize and form ferric oxide coating in fish and prawn gills, which could be lethal. Because the quarry is existing, and because of the settling techniques, mineralization is not expected to be a problem.

Operation

The long-term impact of an airport project on water quality is minimal. Long-term impact of unburnt hydrocarbon is minimal due to the wide area of dispersion.

Water quality at the Upper Tambler Resettlement Area may be affected indirectly by sewage discharge. The airport would have septic systems that would discharge treated effluent to drainfields for leaching. Site soils are well suited to leach fields, so long as limestone is avoided, and groundwater is so deep that leachate would be scoured by the time it reached groundwater. The Biological Oxygen Demand (BOD) of the effluent from the septic tanks is expected to be less than 30 milligrams per liter (mg/l). After processing through the leach field, the water would be suitable for landscape irrigation, and BOD is expected to be from 10 to 20 mg/l. The leaching process would remove up to 99% of *E. Coli* bacteria. Effluent at this point would satisfy EMB requirements.

Domestic water supply would be from a deep-water well or wells. These would have to be dug to 300 m. Because of the distance to the Bay, elevated ground saltwater intrusion is not expected to occur. By law, water provided for public use must be continuously monitored and analyzed for bacterial contamination and changes in chemical and physical properties. Bacterial analysis would be required weekly.

In an emergency, forced dumping of excess fuel by aircraft prior to emergency landing may be necessary as a means of reducing the risk of fire. Excess fuel is most often dumped over the ocean where the potential risk and damages to humans and structures are minimal. When dumped, aircraft fuel is released over a wide area, and is normally dispersed in the atmosphere within a short period.

Grease and oil from paved surfaces could be a pollutant source. The amount of these materials from vehicles in the parking area and from aircraft on the runway would be minimal. The maintenance shed would be equipped with a fuel separator to contain any materials generated by equipment used.

Accidental spills from the tank farm could occur. However, the refueling facility would have a spill containment structure. While the fuel may soak into the ground, the depth to groundwater is such that it would be unlikely that spilled fuel would reach it without considerable dispersement or filtering.

4.3.6 GEOLOGY AND SOILS

Construction activities for the proposed project would involve the use of heavy machinery for grading, and cutting and filling including leveling. These activities would cause a slight modification of the existing site topography, since the area is gently sloping and undulating. Construction activities such as earthmoving and driving over open soils would increase the potential for soil erosion caused by surface run-off and wind. If construction occurred during wet periods, eroded soils in runoff could generate siltation and sedimentation in adjacent drainage ways. On the other hand, during very light rains, wind erosion would be minimized.

Grading, cutting, filling, leveling and dumping of soil materials would disturb topsoils and expose sub-soils. Soils in areas adjacent to the construction site may also be disturbed by heavy machinery movement, resulting in soil compaction that could promote flooding in the affected areas. Topsoils would be stockpiled for placement later on final graded surfaces.

Wind and water erosion of the highly erodible area upslope to the west of the site could result in deposition of eroded soils on the construction site and airport property after construction. Introduction of large areas of impermeable surfacing on the site would reduce soil moisture content, decrease soil aeration and potentially alter the soil's physical, chemical and biological condition by compaction. Because of the intent for the site to remain in long-term airport use, and because of the soils low agricultural potential with respect to water, this would not be a significant effect.

Spillage of aviation fuel, oil and lubricants would add chemicals to soils through leaching, and runoff-from paved surfaces would affect the chemical and biological properties of the soils in the area. The refueling facility would be constructed within a spill containment basin. If the floor of this structure was sand, spills would percolate into the soil. If concrete or other impermeable surface, fuel would be contained until it could be siphoned off or evaporated. For safety reasons, to reduce the potential for the spilled fuel to catch fire, a soil floor is preferred. The depth to groundwater is such that it is highly unlikely any fuel or other spills would ever reach the groundwater. Excavation of contaminated soil would be possible in the event of a major spill.

A drainage system would be installed to direct, control and store runoff. In the event of minor spills, no action would be necessary. In the event of a major spill, remediation would be required. Operation, maintenance and inspection of the facility would be in accordance with applicable rules and regulations.

4.3.7 TERRESTRIAL ECOLOGY

The project would displace most of the vegetation within the 263-ha site as part of site clearing and grading. The six dominant species on the site are quite common in the area and the displacement would not be significant. Replacement vegetation would most likely be with the same types of trees around the terminal area since they are suited to the site's adverse climatic conditions. Grasses would continue to occur over much of the site as weeds, since less than 10% of the site would be covered with impermeable surfacing. The intent is to replace grassland in areas near buildings and the runway with a low-growing groundcover, possibly a vine, that would not need mowing or tending.

Little vegetation exists along the runway alignment. Although the project would include planting of trees and other landscaping around buildings, there would be a net reduction in the number of trees in the area and a consequent loss of habitat for birds. The project would not affect any special status plant or animal species.

4.4 AESTHETICS AND CULTURAL CONDITIONS

4.4.1 AESTHETICS AND LIGHTING

The project would replace the mostly open space vista with low-profile buildings in a cluster and the paved runway area. Less than 10% of the project site would be developed with structures or pavement, but the site would be largely flattened, where it is now gently rolling. The perimeter fence and building roofs would be the most visible feature of the airport. Vegetation around buildings would emphasize the building cluster, and soften the view. The access road would introduce a relatively flat, dark linear structure into the light brown, gently rolling landscape. This, and the vehicles that used it, would be the most visible feature of the project. The project site is relatively distant from surrounding development. The low profile of project structures would not present an incompatible or intrusive change in the view or an unaesthetic effect.

The only lighting at the site likely to be visible would be perimeter floodlights on the terminal building, to provide security lighting. These lights would be pointed downward toward the building and would appear as distant, non-intrusive points of light where they were visible at all. Runway navigational aid lights would be designed to be visible to aircraft, not from the ground, and would not in any case be operational at night, at least to the end of the planning period.

4.4.2 ARCHAEOLOGICAL AND CULTURAL RESOURCES

Because the site has never been the subject of a recorded survey, the potential for resources cannot be determined. Since resources have been discovered in other sites in General Santos City, and because the site has not been surveyed, the possibility exists that resources are contained on the site and would only be discovered by closer examination.

No cultural resources have been identified through the literature search as being associated with the site. Unless archaeological resources are encountered on the site to establish a relationship, the site is not considered to be especially sensitive, at least with respect to cultural resources of recorded history.

4.5 OVERALL IMPACTS

4.5.1 SHORT- AND LONG-TERM IMPACTS ON RESOURCE AND ENVIRONMENTAL PRODUCTIVITY

In the short term, construction of the project would require materials, labor and energy. Aside from energy, these would be renewable resources. In its use of these resources, the project would reduce the amount available to other users. Some of the construction materials, such as steel, may not be available locally and must be imported from Manila or more distant places. The largest material use, however, would be aggregate and concrete. The General Santos City area has numerous quarries, and the amount of aggregate is not expected to be a problem. Concrete would be mixed at the site, but some of the ingredients may have to be imported from Manila or Davao. Energy would be supplied by diesel-powered generators and would not impact the NPC power supply. In general, materials use is not expected to adversely affect the local market.

Employment during construction would fluctuate with the construction staging, as with materials, paving is expected to require the most time, considering the length of the road, as well as the runway and other paved areas. It is expected, however, with the level of unemployment and underemployment, that the local labor force would supply most of the needed workers, with only highly skilled equipment operators and superintendents having to be brought in. It may be that, during peak employment periods, expected to be roughly three-month periods in the middle and near the end of construction, workers may need to be brought in from further away than Koronadal or Polomolok. Alternatively, if labor force (or materials) needs cannot be met in peak periods, the result would be a lengthening of the construction period.

The site area is not substantially productive at present, and construction of the project would render it less so, as grazing was discontinued and the sparse vegetation cleared.

In the long term, the airport would have only minimal demands on non-renewable resources. Vegetation would be replaced on the site, but grazing is not proposed to be allowed because of the hazard stock animals and the birds that accompany them would present to flight operations.

The existence of an airport with the capability for greater cargo loads and direct service to Manila would most likely result in increased production or establishment of production of perishable market items, such as cut flowers and vegetables. This would mean greater productivity in General Santos City and nearby municipalities. The airport would make it easier to market high-grade fresh tuna products, such as sashimi. While supply of tuna in Philippine waters appears to be leveling off, the advent of improved agro-processing facilities would improve the quality of handling and production, thereby increasing the value of export grade sashimi. This higher grade volume is seen as leveling off in the future as well. Other types of export products would gradually become larger, replacing the volume of tuna.

Use of the site as an airport of course precludes its use for other purposes, including grazing. The project thus represents a net loss of grazing land. Because of the arid nature of the site, it is not especially productive pasture land, and grazing activities may hasten natural erosion of the highly erodible soils.

Because of the need to protect the airport from encroaching incompatible development, the project would optimally include an area around it in which development would be strictly controlled (see the recommended land use plan presented in Section 4.1). This could mean simply excluding sensitive uses such as schools and housing, as well as tall buildings, or, in the case of reserving land for a second runway, if this is determined to be needed, prohibiting any kind of permanent development on the east of the site (agriculture would be a permitted use). Restricted use of land immediately around the airport must be considered against the offset of increased developability of other lands. In addition, use of the site would release 62 ha of land at the existing airport.

In sum, the project would not have a significant adverse effect on short- or long-term resource use, and would probably have a beneficial effect on environmental productivity.

4.5.2 CROSS-SECTORAL IMPACTS AND IMPACTS ON OTHER PROJECTS

The relationship between the airport and other proposed economic development projects is discussed in Section 3.2.4, Proposed Development Projects. The significant relationships are summarized below, along with general cross-sectoral impacts.

IMPACTS ON OTHER PROJECTS

Circumferential Road (RIF): The airport access road could facilitate the development of the circumferential road if it was substituted for the southern end of the road. Alternatively, the circumferential road could, if developed first, substantially reduce the amount of new access road that would need to be developed for the airport.

Improvement of the GSC-Maitum Highway (RIF): Location of the airport in the southwestern quadrant of the city would stimulate traffic flow on the GSC-Maitum Highway and would further justify its improvement. The improvement would facilitate access to the airport if it were implemented at the Tambler site.

Makar Wharf Expansion (PAPS): In combination with the project, expansion of the Makar Wharf could stimulate development of the Tambler area. Traffic between the two would be facilitated.

Agro-Fish Processing Complex/Relocation of Fish Landing (PAPS/Municipal). The project would benefit agro-fish processing activities by providing cargo capacity. The Tambler location for the airport would be more accessible than a similar facility at the existing airport site.

Espina Estate (Municipal): The airport could render the Espina Estate more attractive to potential investors because of its proximity. The airport, the Espina Estate and the Agro-processing center would be mutually reinforcing in terms of development.

Upper Tambler Resettlement Area: Growth in the vicinity of the airport would affect the quality of life in the Upper Tambler Resettlement Area, including MSU, as the level of overall activity would increase. Residential and commercial development, occurring relatively slowly at present, would probably be hastened. Along with this urbanization, which would bring more dust and noise, the residents would have better access to commercial services, transportation and employment.

CROSS-SECTORAL IMPACTS

The project would have varying levels of effects on different sectors of the local economy, as described below.

Manufacturing

- Indirect effects of increased demand for manufactured products due to general stimulation of economic growth.

- Improved availability of transportation for manufactured products and access to parts/accessories.

Construction

- Short-term increase in demand for construction services and increase in construction employment.

- Long-term increase in demand for construction services due to stimulation of economic growth.

- Improved availability of specialty items used in construction and capable of being transported by air.

Retail and Wholesale Trade

- Improvement in wholesale trade among buyers and processors of products moved by air such as tuna, vegetables, fruit and flowers.

- Increase in retail and wholesale trade because of stimulation of economic growth.

Finance, Insurance and Real Estate

- Increased demand for capital for local development projects.

- Increased demand for real estate services due to growth stimulated by the project and cumulative development.

Services

- Increased demand for business services related to trade.

- Increased demand for professional and personal services related to population growth due to overall economic growth.

Transportation and Communications

- Improvement in air transport services.

- Improved availability of modal interchange among air, land and water modes.

- Transportation impacts of increased movement of vehicles in the area; change in traffic flow patterns.

- Increased demand for communications services.

Government

- Increased demand for government services related to operation, regulation and administration of the airport.

- Increased demand for government services in general due to increased development levels.

Utilities

- Increased demand for water, refuse disposal and electric power related directly to the project and indirectly due to secondary development.

Agriculture

- Improved access to markets via air transportation for high-value perishable products such as fruit, flowers and vegetables.

- Growth in agricultural production, employment and land use due to improved market accessibility.

4.5.3 CUMULATIVE AND IRREVERSIBLE IMPACTS

Land Use/Growth Inducement

Development of the site as an airport would be considered irreversible for paved and built areas. Most of the site, however, would remain undeveloped. Along with other proposed developments in the site area, the project would contribute to development of what is now largely pasture. Because the site area is zoned for development, this would not, in and of itself, be an adverse impact. Inappropriate juxtaposition of incompatible uses (such as residential and heavy industrial) and the attraction of squatters could occur. Mitigation measures have been identified to promote the compatibility of airport-related development with existing and potential future uses of the area.

Preventing squatters is extremely problematic and cannot be addressed solely by the project. While the city is rich in land, very little is available for resettlement. Further, because they are not permitted development, squatters often settle in areas that are inappropriate (such as could occur along the access road) or hazardous. Vigilance would be required to discourage any initiation of squatter development; once established, such development is costly and time-consuming to eliminate. While the project cannot directly address the problem of insufficient supplies of available resettlement land, it would not result in a reduction of the amount of land zoned for or in use as residential, and the recommended land use plan would likewise not reduce the amount of residentially zoned land. One measure available to the RP to address this problem would be to declare all or some portion of the existing 62-ha airport site a resettlement area once the new airport were to open.

Socio-Economic Conditions

With other development, the project would support regional economic growth, which would result in new and enhanced business and employment opportunities. One aspect of that growth would be the attraction of in-migrants, some of whom would be indigent and would further burden social services and housing resources and, as discussed above, result in squatter-type development.

Drawbacks of growth include contribution to such problems as inadequate and unsanitary refuse collection and disposal, inadequate wastewater treatment and disposal and resulting water quality problems. The City is proposing a study on improving landfill techniques, and USAID/CODA are undertaking a feasibility study through the PAPS program on water supply and a wastewater collection and treatment system, at least for the central city area.

Cumulative impacts migration

Benefits of growth, aside from business and employment opportunities, are increased property and sales taxes and other revenues that can be used to defray costs of infrastructure improvements and public services..

Physical Environment

Transportation

Conflicts with turning movements from the access road and the GSC-Maitum Highway could occur, and the project would contribute to congestion resulting from cumulative development beginning in about the year 2015 on the GSC-Maitum Highway. Indirectly, overall growth induced by cumulative development would contribute to existing congestion primarily in the central city area. A mitigation measure has been identified to alleviate congestion, if it occurs, on the access road intersection with the National Highway. Congestion in the central city area could be addressed through standard traffic engineering techniques, for example, the institution of signals and signs (assuming they are observed) and establishing set points for pick up and drop off of jeepney and tricycle passengers and, where possible, pull-outs for passenger loading and unloading and improving street surfaces. A signal has been installed in the City at the intersection of Pioneer and Magsaysay Avenues by an NGO. A street surfacing project is undergoing evaluation. The City would have ultimate responsibility for addressing such problems as they are beyond the scope of this report.

Climate, Meteorology and Air Quality

The project and cumulative development would most likely result in an increase in dust generation. While new major roads would be paved, new smaller developments would be served primarily by dirt roads, as they commonly are at present. The airport itself would be served by a paved road that would permit access to MSU, resulting in a net decrease in dust generation.

Cumulative development, including the project, would result in increased air pollutant emissions. Aircraft emissions would be negligible and not cumulative. Pollutants of concern are those from vehicles. The existing vehicle fleet is largely deficient in adequate pollution control systems, especially tricycles. It is assumed that, with economic growth, the population will become more affluent overall, and the level of ownership of private vehicles will increase and the number of tricycles will decrease. In addition to this, General Santos City's location by the Bay means that it is almost constantly subjected to breezes that disperse vehicular air pollutants (although at the same time, they result in dust generation in undeveloped areas). The project itself would not significantly contribute to air pollutant levels. Emissions controls on the vehicle fleet must be addressed at the National level.

Noise

Aircraft noise would not significantly affect ambient levels at the nearest developments. Traffic from the project and cumulative development would generate noise levels higher than ambient levels on the access road, and a mitigation measure has been identified for this impact. Traffic levels on the National Highway would have to double before a significant change in noise occurred.

Energy

The project and cumulative development would contribute to existing seasonal energy supply problems and would be an irreversible commitment of resources. Excess power demand would be supplied by backup diesel generators. The energy supply problem affecting all of Mindanao is currently being addressed by the National government. Other sources exist, but environmental and other considerations must first be addressed.

Hydrology and Drainage

Because the project would include a drainage system to prevent the generation of excess and uncontrolled runoff, and because the amount of new impermeable surfacing on the site would be minimal, the project would not contribute to cumulative drainage effects.

There is no information on the size of groundwater supplies available to the area, but the deep aquifer appears to be quite large and to contain high quality potable water. The project would, at any rate, have only a minimal demand for water.

Geology and Soils

The project would result in a reduction in erosion; it would not contribute to cumulative erosion effects. The project would contribute to the cumulative reduction in pasture (agricultural use) land. This is not considered significant because the quality of the pasture land is marginal (as active agricultural land it is even less productive) and it is zoned for industrial uses. The agricultural value of site soils that were compacted and built over or paved would be considered irreversibly lost.

Terrestrial Ecology

The project would have only minimal effects on terrestrial ecology, and could result in greater quantity of vegetation than at present. It would not significantly reduce the levels of wildlife present (primarily cattle, birds and insects).

Aesthetics and Cultural Conditions

Aesthetics

The airport itself would be hardly visible from most surface vantages. Cumulative development along the access road would result in an ultimate change from a rural to suburban or urban appearance for the area. This would not necessarily be an adverse effect, but is considered irreversible. The project cannot address design controls on citywide development.

Cultural Conditions

The likelihood of the existence of cultural resources has not been determined. The project includes a mitigation measure to address cultural resource impacts on the site and along the access road. If the project turns up any evidence of cultural sensitivity, the government may wish to take steps to ensure that any other development in the area addresses the potential for resources to occur and for their protection.

The alternatives analyzed below all involve the existing airport site at Barangay Buayan. For this reason, it is necessary to provide a description of existing conditions at that site. This alternative "setting" is described below under the No Project Alternative.

5.1 NO PROJECT

BUAYAN SITE SETTING

In addition to aviation uses, the existing airport property contains a small military reservation at the north end, rice paddies and other cultivated areas along its western edge, and about eight canteens lining the parking lot. Goats graze around the edges of the runway. Oxen graze in the rice paddy areas, which are fenced off from the runway. South of the airport is Sarangani Bay. East of the airport, between the Buayan River and the airport, are a small, long-established Muslim community (also including some Christians), coconut plantations, nipa swamps, and a densely settled community of fishing families along the foreshore. Approximately 240 families, with an estimated six persons per household, reside east of the airport. The residential communities are served by religious and educational institutions, as well as small sari sari (variety) stores.

North of the airport is the National Highway, beyond which is a mixture of residential (approximately 10 families) and agricultural uses including coconut plantations. Some sections of coconut trees in this area are being cleared for conversion to commercial and industrial uses. West of the airport, across the access road, are agricultural uses (rice paddies and livestock grazing), the Buayan Townsite, prawn farms, and salt drying beds. The townsite is a City-designated resettlement area, the residents of which have not been granted property title by the National Government pending resolution of airport expansion. Residences are also located along the foreshore area and near the salt ponds (approximately 10 families).

The airport is shown as Transportation Utilities on the zoning map. Adjacent to the airport, the area on the east is zoned Agriculture (Ag), and Built Up Area (residential); on the north, Agriculture; and on the west, from the townsite south, Built Up Area and Fishpond/Prawn Areas. North of the townsite, between it and the National Highway, is an area of Commercial (C) zoning.

The airport has 35 employees and 12 canteen licensees. The employees also farm on the airport for supplemental income. Thirteen people are employed by PAL. Several families operate stores in the residential areas on both the east and west sides of the airport.

Fishing families occupying foreshore areas fish the bay in front of their homes and make their livelihood from the catch. A number of residents on the east conduct farming on their homesites and depend on this for their livelihood. The coconut plantations and nipa swamps are occupied and operated by owners or relatives of the owners.

On the west, a number of employees at the salt beds/prawn farms live adjacent to these uses.

A two-lane unpaved dirt road from the National Highway provides primary vehicle access to the airport. Residents of Buayan townsite adjacent to the road have erected temporary barriers, presumably to slow traffic for safety and possibly less dust generation. A path extends east from the south end of the access road into the south end of the airport, where the fence discontinues. People cross the airport property, including the runway, via this path. People, livestock and pets are commonly observed traveling along or across the runway. Another road, partially paved, extends from the southwest end of the airport, where the access road terminates, and extends west into the City, joining up with P. Acharon Boulevard. This is the main road paralleling the downtown waterfront.

The National Highway north of the airport (Buayan road) passes from the City to the east, over the Buayan River, toward Glan. Traveling west from the airport, one can take the north fork onto the road to Davao or continue southwest toward the City on Lagao Road. From this road, one can proceed into the heart of town or turn west onto the road that passes through the north part of the city, leading to the road to Apopong (north) or Tambler (south).

West of the Davao turnoff on the National Highway, traffic is relatively constant during the day. To the east, to the airport and beyond, the road carries relatively light traffic. The primary and secondary airport access roads are very lightly traveled.

Most of the vehicle fleet in General Santos City is not equipped with emissions control devices. This, combined with a lack of tuned engines, poor road conditions and slow speeds, results in often severe air pollutant emissions levels by many of the vehicles.

Air quality at the Buayan site is generally good, because of the limited traffic and almost constant breezes. What traffic there is generates dust while traveling the dirt roads, and exhaust emissions. Dust appears to be a much larger problem than exhaust emissions. Aircraft emissions are negligible.

Noise sources at the Buayan site are commercial aircraft operations (PAL-operated Fokker-50), one to three times per day, and vehicles. Observed noise levels just in front of the terminal building when there were no aircraft operations ranged from 50 to 60 dBA during a typical day. Within the housing community east of the runway, noise levels ranged from 50 to 55 dBA during the daytime. Along the side of the National Highway at the north end of the runway, the readings were slightly higher, 55 dBA when there were no passing vehicles and 70 to 75 dBA with passing motor vehicles.

Because of the infrequency of aircraft operations, very limited noise level measurements during a PAL aircraft engine start-up and take-off were made during the period. The measured noise level approximately 60 m from the aircraft during engine start-up was 97 dBA. During take-off at 150 m from the center of the runway, the noise level was 88 dBA. This should not be confused with the L_{dn} standard by which aircraft noise levels are compared.

The site is water rich in comparison to the Tambler site, and is capable of supporting intensive agriculture. Site soils support crops tolerant of clayey, moist to poorly drained boggy conditions. On the airport itself rice is grown as well as other vegetables, and livestock, including cattle, carabao, goats and fowl, are raised. As noted, other agricultural activities around the site include coconut plantations, nipa swamps, commercial fruit trees, vegetable gardens, rice paddies, and prawn and salt beds. Large livestock are also raised.

Buayan River runs east of and roughly parallel to the existing runway. Its banks are swampy. The river flows continuously throughout the year. Part of the flow is from seepage and discarded irrigation water from the surrounding area. The main irrigation ditch runs parallel to the National Highway connecting the city proper to the airport.

The river carries heavy silt loads. A quarry site is located just north of the bridge, and could be a source of silt, as are probably the agricultural operations along the river's length. Sarangani Bay is doubtless the repository of untreated waste from agricultural operations and domestic and industrial/commercial wastewater, as well as solid waste. The airport generates domestic wastewater, solid waste and organic loads from agricultural waste. Hydrosols in site soils prevent proper leaching and stabilization of the septic tank effluent. The marsh provides a fertile breeding ground for insect vectors. The depth to groundwater is two to five meters.

Soils on this site consist of broad alluvial plain (lowland plains and river terrace) and marine terrace. Soils of the broad alluvial plain were mainly formed by the accumulation of unsorted and unconsolidated deposits of clay, silt, sand, gravel and boulder-sized fragments of mixed volcanic and sedimentary origin, eroded and water-laid from surrounding upland areas.

The site is level to nearly level, with a gradual downward slope to the river. The shore slopes down past the property fence, and a shallow, descending shelf extends about 650 meters out before a steep dropoff.

Partial inventory of the most common vegetation in the vicinity of the site showed 15 dominant species of plants: nine species of non-dipterocarps, three species of grass, two species of bamboo and one species of palm. The palm is the most abundant and therefore ecologically dominant in terms of vegetation cover. Ecological succession in the area can be considered secondary level as the area has been populated for some time and most plants are introduced species. Most of the coconut trees are cultivated for income production. Most bamboo plants are found within the coconut plantations, and grasses abound along roadsides as well as within the plantations themselves. The different species of non-dipterocarps are cultivated in yards and in the coconut plantations. Some of these non-dipterocarps are fruit-bearing trees able to withstand any soil type and low levels of salinity.

Most animals in the area are domesticated. This includes dogs, cats, carabaos, cows, and pigs owned by householders. Some of these animals were observed straying at the south end of airport. No endangered species were observed or are likely to occur on the site.

The adjacent coastal habitat is currently lacking in most marine macroorganisms. Aside from the notable presence of migratory waterfowls like the egret, swifts and the "tawis", some silversides (cf. *Atherinids*) and slipmouths (*Leiognathids*) are also caught occasionally by artisinal fishermen in this locality. It is difficult to identify a community of diverse marine organisms due to the present silty muddy substrate together with fluctuating estuarine to marine conditions of the area. In the months of January and February (northeast monsoons) shrimp larvae (cf. *Penaeus* spp.) are caught and some gleaning for shellfish occurs.

The shelf is composed of a coral community, no longer viable, overlaid by silt deposits. Onshore development may have resulted in the removal of mangroves. Without this stabilizing influence, the area eroded, depositing large amounts of material on the coral. Further, the Buayan River, which is heavily silted, empties into the Bay just east of the airport. Bay currents, moving counter-clockwise, deposit these silts in the river delta and west in front of the airport. The deposits, which most likely resulted in the death of the coral, may be a source of beach nourishment west of the river.

Known cultural associations include the settlement by Muslim immigrants beginning in 1839. Before that, the area was sparsely populated by members of the B'laan Tribe. The Muslims have remained to this day, on the east side of the airport property. A mosque and four cemeteries, one of which reportedly contains the remains of at least one of the early settlers, are located within the community, as is an Arabic School.

The site vicinity is thought to have been the landing place of General Paulinho Santos' Christian Filipino settlement party in 1939. The airport was the site of a Japanese air base in World War II.

DESCRIPTION OF THE ALTERNATIVE AND IMPACTS

This alternative corresponds to Scheme O, No Action, in the Final Report, Feasibility Study. Under this alternative, no improvements would occur at the existing General Santos City Airport in Buayan other than those undertaken by ATO. Existing service consists of a maximum of three flights per day, with 19 flights per week, providing service to Cebu and Iloilo.

The airport would remain a "trunkline" airport in the overall national system. The assumptions of this alternative are: aviation demand would not appreciably increase, therefore the need to expand the facilities would not exist; airline service would not appreciably change in terms of new airlines, larger aircraft or more frequency of operations; the airport's runway, taxiway, aircraft parking apron, terminal building, ground side facilities and support infrastructure would be maintained only as necessary to maximize the useful life of these facilities. No expansion or other aviation activity enhancement measures would be undertaken. DOTC/ATO propose to add a two-inch overlay to the existing 1,504-m-by-30-m asphalt portion of the runway and the taxiway and apron. The overlay will be placed full width at only the end and center 100-m portions of the runway. The remainder of the runway will only be paved 18 m wide. The taxiway and apron will be fully overlaid. This will have been completed prior to the implementation of any measures recommended by this study. Other improvements currently in progress include construction of a Flight Service Station, and installation of additional landscaping.

The improvements will permit short-term continuation of existing service, and the overlay is in fact primarily cosmetic, since the resulting runway thickness would still be 1.5 inches less than technically structurally needed for Fokker-50 operation. No significant change in cargo handling capacity would be possible because the runway cannot accommodate larger planes, and it is not economical to ship cargo in small batches, even if many of these could be arranged by more frequent Fokker-50 flights.

In essence, conditions would continue as they are at present for several years, at which time an additional overlay would be needed. It is believed, however, that eventually the runway will deteriorate to a point that cannot be remedied by additional overlays. At that point, major reconstruction would be required to make the runway operational. If that did not occur, the airport could become inoperational. Major reconstruction could take the form of rebuilding the runway to its existing configuration, or one of the other alternatives evaluated in the Preliminary Report. (For an evaluation of construction of a new runway, see the discussion under 5.3, New Runway at Buayan.)

Short-term effects of this alternative would be very similar to current conditions, with the potential of a few additional flights. This alternative would not affect existing land uses. Traffic, noise, air quality and other effects would be as at present. Interruption of drainage for farming on the airport proper results in waterlogged soils that impair the stability of the runway, and this condition would continue. Livestock at the airport would continue endangering the safety of flight operations. In addition to livestock, herons that eat ticks and other insects on the Carabao and oxen present a hazard to flights.

In the longer run, without major reconstruction, the possibility exists that the airport could be forced to cease operations. Airport closure would result in job loss for employees and canteen operators and most likely in negative effects on the larger economy. In that case, all airport users would be forced to travel to Davao. The road is in a seriously deteriorated condition and increased traffic would contribute to the deterioration, although probably not significantly, given the level of traffic associated with the airport (see also the discussion under 5.4, the Davao Road alternative).

Closure of the airport could mean that the land would be released for other uses. In that event, the environmental impacts around the Buayan siet would be the same as if the airport were closed after completion of a new airport at Tambler. Resulting environmental effects would depend on the nature of the use. It is also possible that the site could remain unused and reserved until funds could be secured to reconstruct the runway with the necessary improvements. If it is reserved, all impacts associated with the airport would cease, including traffic and noise, until reconstruction.

With major reconstruction, the airport would most likely have to be closed during construction. It is assumed that reconstruction of the runway would be to similar dimensions as the existing one. On the basis of this assumption, impacts would be similar to those of the existing airport. Extension of the length necessary to accommodate larger aircraft are not possible under safety and operational guideines recommended by the manufacturers, DOTFAA and ICAO, due to the restrictions imposed by the Bay and the National Highway.

This alternative was not identified as preferred because 1) it does not address the basic project objective to improve air service to General Santos City; 2) it does not address the need for air cargo service; and, 3) it does not avoid the problem of eventual deterioration of the runway.

5.2 SERVICE CHANGES

DESCRIPTION OF THE ALTERNATIVE

This alternative addresses improving air service at the existing General Santos City Airport without any major construction improvements to the airport facilities. Because of strength and length limitations of the existing airport runway, taxiway and apron, aircraft larger than the Fokker-50 cannot currently use the airport.

Even with the previously mentioned DOTC/ATO overlay project, the adequacy of the strength of the asphalt pavement after an asphalt overlay of only a portion of the existing, badly deteriorated surface is suspect. It is doubtful that the runway surface would remain intact for any appreciable length of time, given the minimal overlay thickness and the apparent lack of quality in asphalt paving construction methods and asphalt paving materials available in the vicinity of General Santos City. Therefore, the ability to improve service by using larger aircraft would not be possible. Increasing the frequency of operations would be the only feasible way to improve service.

To increase the frequency of operations, PAL would have to increase the number of flights or new airlines such as Aerolift or charter services would have to commence operation at the airport. Cargo service with C-130 aircraft was conducted at one time by the Aboitiz Company; however, it suspended service due to a lack of sufficient runway strength to carry full cargo volumes necessary to operate the C-130 at a profit. Cargo would have to be carried by the smaller aircraft the existing airport is capable of accommodating.

Additionally, the existing terminal building ticketing area, departing passenger holding area and arriving passenger baggage claim area would be over capacity for multiple simultaneous operations of a fully loaded Fokker-50. Terminal renovations within the existing framework of the building to accommodate this operation may be possible but the cost and the necessity to maintain continuous operations would be prohibitive. Therefore, operations could increase only to the level that could be reached with a single F-50 or similarly sized aircraft at the terminal at a time. Because of this, and to incorporate an allowance for delays, it is assumed that the airport could accommodate a maximum of seven to eight daily flights (14 to 16 operations) in the 10-hour daylight period.

IMPACTS

more trips because small aircraft

Under this alternative, the airport could, in the short run, experience an almost constant level of activity during daylight hours. Traffic on the airport access road would be more at any one time than at present, but, instead of trips occurring for one to three daily flights (one to three periods of activities), they would occur in seven or eight periods of activity. This would have the effect of more noise and dust on the airport access road. Crossing the runway would be more hazardous than at present both to the people attempting to cross and to flight operations, since there would be fewer periods without flights.

Aircraft noise would be experienced by adjacent residents more often than at present. This alternative could have the effect of generating some pressure for conversion of land zoned for and in agricultural use around the airport. Other land use impacts would be similar to those described for the "No Project" alternative. Energy use would increase slightly, primarily in terms of aircraft fuel.

Effects described for the preferred alternative would not occur; effects at Tambler would be as presented in Section 3, Environmental Setting.

Because it is believed that the existing runway cannot continue to be of service as is, and cannot continue to be repaired through overlays, the effects described here would be in the short term. Higher use levels would result in faster deterioration of the runway, and eventually, the same situation described under the previous alternative would occur: either the airport must cease operation or major runway reconstruction must take place.

This alternative was not identified as the preferred alternative because 1) it does not address the need for air cargo service; and 2) it does not avoid the problem of eventual deterioration of the runway.

5.3 NEW RUNWAY AT BUAYAN

DESCRIPTION OF THE ALTERNATIVE

This alternative consists of expansion of the existing General Santos City Airport to the extent necessary to accommodate the forecast aviation demand in accordance with the regulations of the ICAO and/or the USDOTFAA (see Figure 11).

None of the existing facilities at the Buayan airport could be reused in accommodating the projected service level. The existing runway is too short and narrow, the apron, parking lot and terminal building are too small, and the terminal building is an obstruction. Renovation and expansion of existing facilities was examined, but the analysis showed that it was more cost-effective and safer to build new facilities. The needed facilities parallel those described for the preferred alternative (see Section 2.2, Project Characteristics).

In terms of land area, the existing airport covers 62 ha. The expanded airport would require more (the preferred alternative would occupy 263 ha). It would be possible to construct facilities described to the Phase II (to 2015) planning period by acquiring land on the west, east and north sides of the airport, moving the National Highway further north of the site (and moving the bridge over the Buayan River to accommodate the new alignment), and extending the runway into Sarangani Bay. The site area after acquisition of adjacent land would be roughly 150 ha. The site could not accommodate any further extension of the runway; the steep dropoff of the shelf in Sarangani Bay limits it on the south, and the Buayan River, which turns west north of the airport, limits it to the north.

The existing runway, apron and terminal building would continue to be used during the construction period at current service levels (Fokker-50 service to Cebu and Iloilo).

IMPACTS

In terms of land use, this alternative in and of itself represents an expansion of an existing use. As a small facility where agriculture is permitted, it is compatible with surrounding uses, notwithstanding that the type of agricultural activities are not compatible with the airport use. The blocked drainage creates waterlogged soil that seriously undermines the runway foundation, and livestock presents a serious hazard to flight operations. Because this is a relatively "wet area" of General Santos City where intensive agriculture is possible, because of the dense residential development, some of which would have to be displaced to accommodate airport expansion, because of the safety risks to the surrounding population in the event of a landside crash, and because of the potential noise effects, this alternative cannot be considered entirely compatible with surrounding uses. An expanded airport could generate pressure for additional land conversion around the site, resulting in greater losses of agricultural uses.

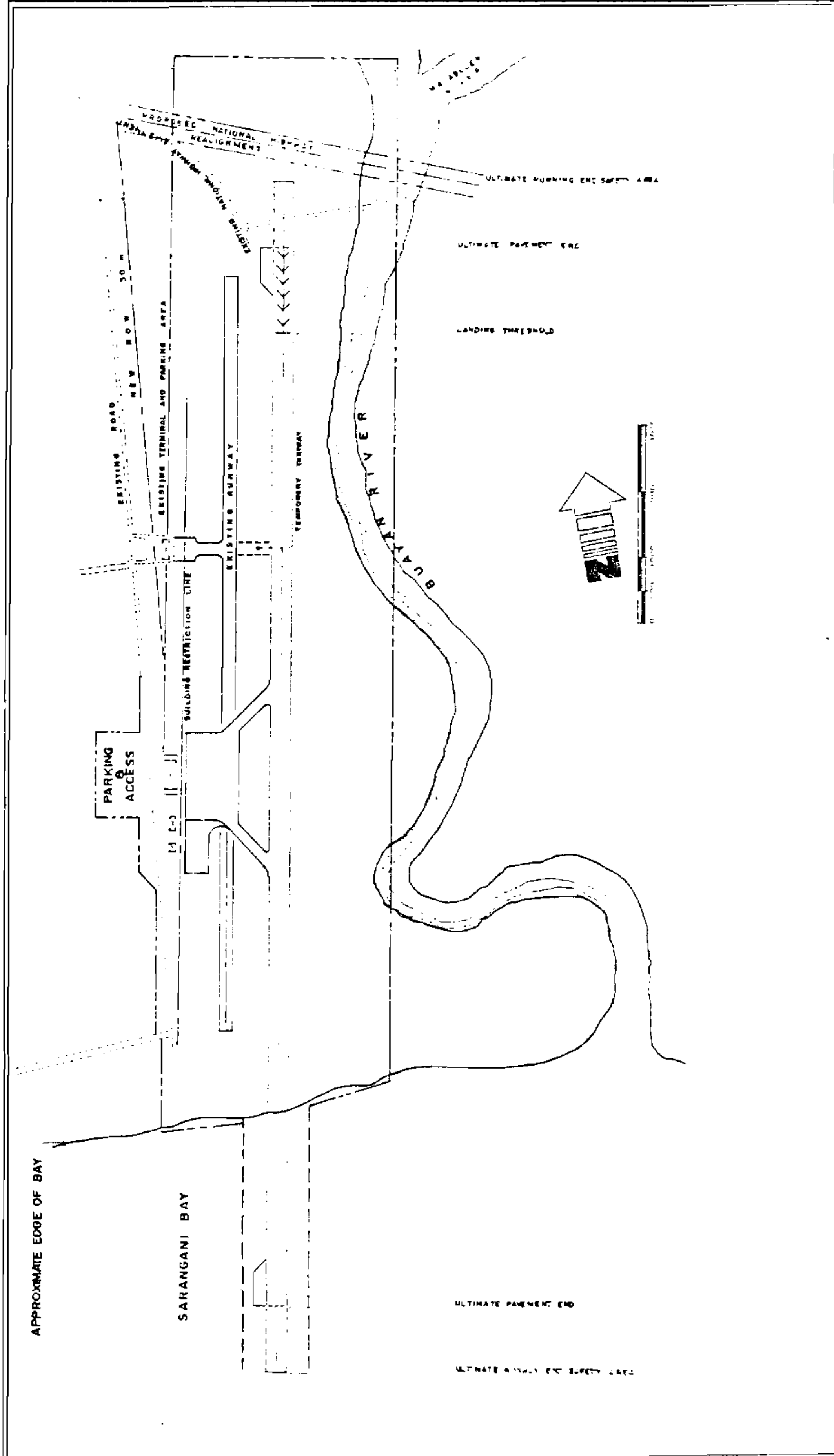


Figure 11
Alternative 5.3
New Runway at Buayan
Layout Plan

Source: WSA

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This alternative would expand transportation utility uses into residential, agricultural and fishpond/prawn farm zones. The National Highway, the Buayan River and Sarangani Bay would provide buffer areas between the site and other uses, primarily agricultural, but, on the west, only the access road would separate residential development from the facility. The airport designation would be compatible with remaining uses except for the townsite residential use. It could result in pressure for rezoning from agricultural designation to commercial or industrial in its vicinity.

This alternative involves a significant level of displacement. Approximately 250 families would require relocation, contributing to the City's existing problem of inadequate supply of suitable residential resettlement areas. Commercial coconut groves and nipa swamps would be removed from active production if not eliminated entirely, and several prawn ponds and salt drying beds would be reduced in size or taken out of production. Small stores serving the residential areas would also be displaced.

Expansion of the existing airport at Buayan would entail removal of existing development east of the river. Although, this alternative does not actually require all of the land between the airport and the river, it would have the effect of cutting off overland access to the southern portion of this area. Rather than leave access-isolated inhabited areas, the entire area would be purchased and cleared.

Relocation of the road north of the airport would require removal of the limited agricultural and residential development there.

A strip of land west of the access road would be used for the expansion, including a portion of prawn farms and salt drying beds. The foreshore area on the west side, where there are a number of fishing family residences, may or may not be required.

This alternative would displace all employment and livelihood associated with uses between the airport and the river. Some of those livelihoods, for example, the fishing families, are subsistence level and would be difficult to replace unless relocation was to a similar area with similar resources. Families operating small stores would suffer livelihood loss, as would employees of dislocated salt farms and prawn beds. New jobs would be created at the airport, and jobs would also be created in the larger economy as the airport accommodated greater cargo loads.

Traffic operations during construction would be most heavily affected by the hauling of aggregate for roadway and runway sub-base, base and pavement. Aggregate would probably come mostly from a quarry site on the Buayan River, about 5 km north of the existing airport. This would necessitate hauling along the National Highway from the direction of Davao, then turning left and hauling along the highway toward Glan. The area up to the turnoff for the airport and Glan is congested, and aggregate hauling would aggravate this condition for a period of 24 months or longer.

The amount of traffic generated by airport activities would be the same as projected for the preferred alternative, including passenger movements, employee trips, cargo transport and service trips.

The principle differences between the Buayan and Tambler sites, with respect to ground transportation, are site location and corresponding differences in travel distance. Major economic development infrastructure projects of the General Santos City area are being located on the west side of the City. Among these are the expansion of Makar Wharf, the Dole Pier and other waterfront developments, the proposed agro-processing center, the proposed Espina Estate development for industrial and commercial uses, and the industrial and processing establishments located along the GSC-Maitum Highway. All of the developments, which represent major assets for development of the local economy, are located 12 to 18 km from the Buayan Airport, on the opposite side of the urban area.

The Buayan site is not as well located with respect to airport trips originating on the north side of the central city (from Polomolok) and the south or west sides (from Makar Wharf, Dole Pier, the proposed agro-processing center, or trips from the direction of Maitum). These trips would travel through the City on the northern edge of Dadiangas. These would be largely cargo truck trips. The potential for conflicts with slow-moving vehicles, more numerous in the central city area, would increase under this alternative.

Routes on the east side of town (through Lagao and toward Davao) are more congested than routes on the north and west sides of the central area, and it is these congested routes that would receive the increased traffic moving to and from the Buayan site.

In terms of air quality, the area would experience emissions from construction machinery and dust generation from earthmoving activity during construction. The hauling of aggregate along the route described through the urban area would generate some dust along the route, as well as traffic noise. Grading and paving of the roadway to the terminal would create dust during construction.

In the long run, increased traffic would generate increased emissions, but the increase in the average number of vehicles per day would not generate a significant increase in emissions over existing levels. Because residential development would be directly adjacent to the access road, emissions would be experienced by residents. The access road would be paved, reducing dust generation.

Aircraft emissions would contribute very little to ambient air pollutant levels. Only emissions generated at very low levels (takeoff and landing) are of concern, since those emitted at higher altitudes are readily dispersed. Although take-off and landing emissions are at high rates, the timeframe is very short, and emissions are thoroughly dispersed before another plane can land and create cumulative effects. In addition, aviation fuel has almost no sulfur content and generates very little sulfur dioxide, unlike emissions from land transport vehicles, especially those using diesel fuel.

The long-term impact of airport emissions and fuel on water quality is minimal. The impact of unburnt hydrocarbon is minimal due to the wide area of dispersion.

Construction noise would generate significantly higher noise impacts at Buayan than at Tambler. This is due to the proximity of densely settled urban communities near the runway and terminal at Buayan, and the proposal to carry out construction round the clock. Also, the construction period at Buayan would be longer than at Tambler, because of the need for relocation and more site clearance, as well as relocation of the National Highway and bridge over the Buayan River and extending the new runway into the Bay. Construction noise impacts would thus be generated over a longer period.

Under this alternative, the airport would accommodate flight operations as projected for the preferred alternative, and noise from aircraft operations at Buayan would be approximately equivalent to that projected for the preferred alternative. Since these noise levels are expected to remain below 65 L_{dn}, no adverse impacts from aircraft operation noise would occur at Buayan after areas of the north and east were cleared of development.

Vehicular noise impacts at the Buayan site would be greater than those at the Tambler site because of the proximity of residential areas to the entrance road. The Townsite area, immediately adjoining the entrance road on the west, is densely settled, and development extends to the edge of the roadway. A number of residences are located within 20 m of the entrance road, where traffic noise is expected to be 50 to 55 dBA in 1995 and 2000, and 55 to 60 dBA by 2015, as compared to the National standard of 55 dBA for daytime in residential areas. Those residences within 10 m of the road may experience daytime noise levels of 55 to 60 dBA in 1995 and 2000 and 60 to 65 dBA by 2015.

Cessation of farming activities on the airport site would occur. An improved drainage system would be installed, where pollutants from aircraft and vehicles such as grease and oil, washed into drainage facilities from runway, apron and parking areas could be controlled. Wastewater treatment and solid waste collection facilities would be improved, reducing the potential for pollution from these sources. Removal of residential activities on the east would eliminate a probable source of pollution through discharge of wastewater effluent and solid waste.

The runway extension into Sarangani Bay would require fill and could generate siltation at both the borrow site, if it is near or in water, and in the Bay. Sand, gravel and fill materials quarried from Buayan or another river would increase the suspended solids concentration and turbidity. Washing of sand and gravel would increase colloidal concentrations in the water. Downstream users could be affected. Suspended solids could settle and block irrigation canals. Without treatment, turbid water would be unsuitable for consumption, bathing and washing clothes. Turbid water also reduces the penetration of sunlight, indirectly affecting algal photosynthesis and the aquatic food chain dependent on the algae. Suspended solids could cover the river bed bottom and kill or dislocate benthic organisms.

Depending on the mineralization at the quarry site, some minerals such as iron may be dissolved or suspended in the water. Iron causes discoloration of drinking utensils and clothes. Dissolved iron tends to oxidize and form ferric oxide coating in fish and prawn gills that could be lethal. Siltation of the Buayan River could also occur during other construction phases such as road relocation, and removal of vegetation for clear zones.

This alternative could result in wind and water erosion of soils during construction and operation. Site soils would be compacted, altering the soil structure, depth and drainage, and could create water logged areas and/or flooding in the immediate environment. The agricultural potential of the soil, which is high, would be irretrievably lost in paved and built areas. Pressure could also be generated for conversion of agricultural soils in the airport vicinity to commercial and industrial uses. Site soils, especially to the east near the river, are clayey and less stable than desirable. Soil engineering would be necessary for stabilization. Any non-reusable soils, if not disposed of properly, could cause sedimentation in Buayan River and Sarangani Bay.

Agricultural operations would cease and livestock would be eliminated from the airport. Vegetative cover would be removed on the airport and to the north, east and west during construction. Mature stands of coconut palms would be almost entirely removed, as would fruit trees, landscaping and the small livestock maintained by residents. Removal of vegetation would eliminate small animal habitat.

The area has been disturbed for many years, and the vegetation and wildlife reflect that disturbance. No special status species have been recorded or were observed in the site environs, and the potential for their presence is considered remote. The disturbance created by this alternative would be to introduced and common species of vegetation and wildlife.

Vegetation clearing and excavation at a fillsite, if near or in water, could result in additional siltation that could affect aquatic life forms.

Runway extension activities in the Bay could generate minor amounts of siltation in the area, which could adversely affect marine macroorganisms. The population is limited, however, because of past sediment deposit from the Buayan River. This effect would be temporary and limited in significance. Increased sewage and solid waste loads would be an ongoing problem. Site soils are inferior at Buayan in terms of leaching action.

Interruption of existing siltation and current flow patterns by extension of the runway could generate a buildup on the east side of the runway and cause a scour or coast line erosion on the west side. Because the runway would be on the shallow silted shelf located off the coast south of the airport, and much of this area is exposed at low tide and not affected by currents, the siltation/scouring effect could be quite limited. It may also be that the opposite could occur: scouring on the east and an area of siltation on the west, directly adjacent to the extension as a result of eddying. Without modeling, actual effects cannot be projected. Because the extension would project only into the shallow shelf area, deep current patterns should not be affected.

The possibility also exists that, if the extension did affect currents, the change could result in directing damaging waves toward the land during storms. In addition to risk to property and lives, massive water movement could also cause serious coastal scouring. The extraordinary evenness of the weather renders this a remote possibility, even if the extension were capable of generating this phenomenon.

Under this alternative, Muslim cultural resources would be severely disrupted and their continuous association with the area since 1839 broken.

This alternative would meet the basic project objective of improving air service to General Santos City. This alternative was not identified as preferred because it has substantially higher costs (see the Feasibility Study, Final Report), and substantially greater environmental and social impacts than the preferred alternative.

5.4 IMPROVE ROAD TO DAVAO

DESCRIPTION OF THE ALTERNATIVE

This alternative assumes "No Project" conditions at the existing General Santos City Airport. Accordingly, in order to accommodate any future increase in aviation facility requirements (passenger and cargo) the roadway to Davao would be improved to National Highway standards to speed trips between General Santos City and the Davao International Airport and a direct flight to Manila. One assumption is that such roadway improvements would reduce the length of time required to transport passengers and cargo to Davao. Initial indications of the passenger survey conducted for this study are that the majority of the traveling public desire to continue to use General Santos City Airport instead of driving to Davao. Further, the reduction in time, from approximately 3.5 hours to two, is probably the best that could be accomplished.

IMPACTS

As reported in the Louis Berger International, Inc. (LBII) report, "Rural Infrastructure Fund Project," October 1990, residences have been built in the road rights-of-way and would require relocation. The report indicates that sufficient land is available nearby for relocation sites. Otherwise, land use and planning impacts would be similar to those for the "No Project" alternative.

Construction of improvements to the road to Davao would avoid the impacts of construction noise at either Buayan or Tambler, but in turn would create construction noise on the road to Davao. Due to the length of highway that would have to be improved, it is likely that a higher noise impact, on a larger number of receptors, over a longer time period, would be experienced with the Davao road construction alternative.

In the short term, airport operations at Buayan would probably continue as at present, with no change in effects. In several years, without major reconstruction, the airport in General Santos City may no longer be serviceable. The overall effect would be to increase road traffic to Davao, and increase use of that airport. With increased travel distances, more fuel energy would be consumed, and more air pollutants generated. The level of increased traffic, as demonstrated in the preferred alternative analysis, would not be substantial, however, and air pollutant, traffic and noise level increases would not be discernible from normal growth.

Additional traffic on the road would generate vehicle-related pollutants that could wash into adjacent waterways. This would be a negligible increase over existing conditions.

This scheme would be unlikely to impact wildlife or habitat.

Given the limited number of flights necessary to accommodate air passenger and cargo demand in General Santos City, the additional air traffic could be accommodated at the Davao airport. Because this alternative would not provide adequate speed for transport of perishable goods such as cut flowers and vegetables, it would not support the development of these industries and the associated economic growth.

On the other hand, an improved road to Davao would support economic activities not dependant on fast travel to Manila and, in and of itself, would be valuable in linking South Cotabato Province to neighboring areas. This alternative was not identified as preferred, however, principally because it would not meet the basic project objective of improving air service to General Santos City.

5.6 RECOMMENDATION

Of the alternatives evaluated, only two would fully meet existing and projected air passenger and cargo demand for the General Santos City area, thus best fulfilling the basic project objective of improving air service to the area. These are the preferred alternative, a new airport in Tambler, and Alternative 5.3, construction of a parallel runway at Buayan. The latter alternative would result in significant social and community disruption, and a higher level of environmental impact than the development of a new airport at Tambler. For this reason, the recommendation of this report is that development of a new air facility at the Tambler site be pursued if the project is implemented.

6.1 LAND USE AND REGIONAL PLANNING

OPERATION

Proposed as Part of the Project

- The project would include a chain link perimeter fence that would reduce the potential for runway incursions by people, livestock and other domestic animals.

- The project includes, as part of the Implementation Plan (see the Feasibility Study, WSA 1991), the development of a Height and Hazard Control Zone amendment to the General Santos City Zoning Ordinance to protect airport approach and departure paths. Because of other potential impacts related to land use both on the project and from the project, additional mitigation is recommended that pertains to this or a related amendment to the Ordinance (see the discussion below, under Measures to be Implemented by General Santos City).

Identified by this Report

- For measures concerning landscaping as a means of providing visual and aesthetic buffers, see the mitigations listed in item 6.4 of this section. The planting of trees along the access road is also recommended as a means of preserving the reserved ROW alignment for future road expansion.

Measure to be Implemented by General Santos City

- In order to mitigate the potential for encroachment of incompatible land uses around the airport, to control, for airport operating safety purposes, heights, smoke, dust and glare generation, and production of electromagnetic interference; to reduce the potential for runway incursions; and to reserve land for potential future airport expansion, the Comprehensive Plan and Zoning Map should incorporate the recommended land use plan (see Figure 12), and a special permit zone designated around the airport. The recommended plan and zone would be implemented by means of an amendment to the General Santos City Zoning Ordinance. The plan would incorporate a commercial zone along the airport access road to shelter potential future residential development from noise levels that could exceed National standards. Other elements of the plan and special permit zone are as follows:

    - The land reserved for future airport expansion would adjoin, be parallel to, and east of the airport site. The reserved strip would be about 760 m wide and the same length (about 4,650 m) as the airport site. The recommended reserved area is shown in Figure 12.

      The area could be transferred to ownership of the airport operating authority or DOTC, or retained by DENR. Use of the land should be controlled to prevent incompatible land uses from occurring, and to prevent high-investment uses from being developed that would encumber the future clearing and use of the land for a second runway.

- Land within the special permit district is designated as pasture and as open space. The area and location of the district, shown in Figure 12, is proposed to be a rectangular area extending one km outward from the boundaries of the airport site and the area reserved for expansion. Within the special permit area, the types of uses allowed would be the same as normally allowed under each respective zoning district, except that residential and related uses would be prohibited. This would aid in keeping humans, livestock and domestic animals from entering the airport and reduce the potential for complaints concerning the airport in the future. To assure safety of aircraft operations, the following activities and characteristics would be controlled around the airport:

  - generation of dust, smoke and glare.
  - generation of electromagnetic disturbance.
  - heights of structures.
  - runway incursions.

  Within the special permit district, permits would be granted only for uses that are compatible with airport operations, and within the reserved land area, permits would be granted only for uses that would facilitate conversion of the land to airport use.

  Currently, the Zoning Ordinance requires issuance of a Certificate of Zoning Compliance prior to erection of any structure, establishment of any use, or change in characteristic of use. Article VI, Section 5, of the Ordinance establishes performance standards to regulate such characteristics of use as smoke, dust and glare. Article IX, Section 4, sets up procedures for issuance of special use permits.

  Under the permit issuance process, the Zoning Administrator would review permit applications with special attention to specific activities that may create smoke, dust, glare or electromagnetic emissions. If there were reason to suspect a potential problem, the Zoning Administrator could confer with specialists from DOTC or ATO before issuance or denial of the permit.

- The Zoning Ordinance contains height regulations that apply to structures in each respective zone. Structures proposed around the airport should be reviewed in terms of the "obstacle limitation surfaces." These are imaginary surfaces at various heights, through which structures and other objects should not project, in order to allow for safety of aircraft operations during landings and takeoffs. The surfaces to be protected by the special permit process include the conical, inner horizontal, inner approach, approach and transitional surfaces. Structures and obstacles that cannot be removed would be identified and marked or lighted through a procedure of establishing and protecting navigation routes, administered through DOTC.

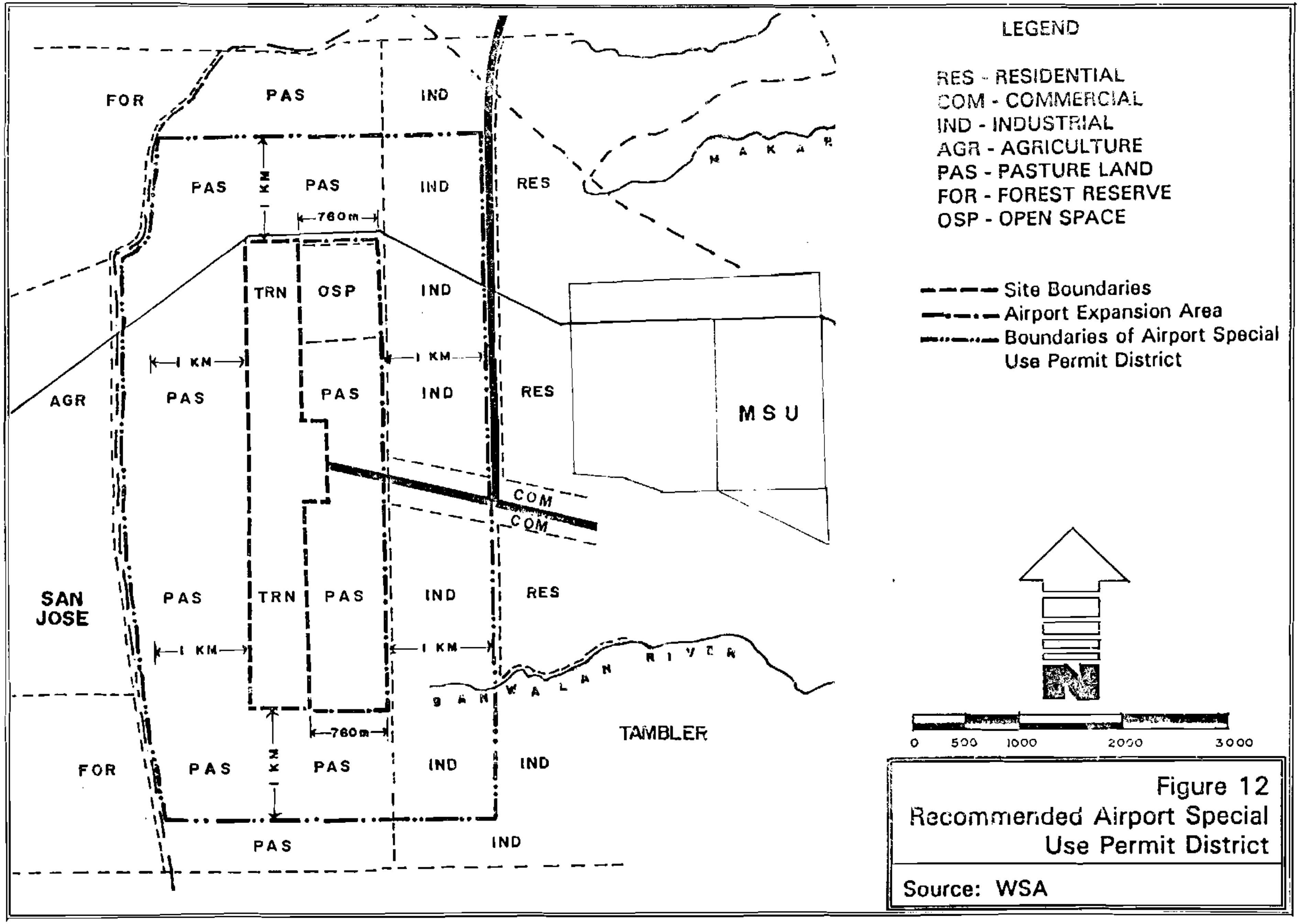

Figure 12
Recommended Airport Special Use Permit District

Source: WSA

The Zoning Administrator and Planning and Development Coordinator and permitting offices would be provided with Airport Master Plan drawings that illustrate obstacle limitation surfaces so that applications for permits within the special permit zone can be reviewed for compliance with height restrictions.

6.2 SOCIO-ECONOMIC CONDITIONS

6.2.1 DEMOGRAPHY AND MIGRATION PATTERNS

No impacts have been identified; no mitigation measures are needed.

6.2.2 ECONOMY AND EMPLOYMENT

While the project would be unlikely to have substantial direct negative or beneficial effects on the residents of the Upper Tambler Resettlement Area, it would indirectly support increased development in the area. To ensure that residents of the area have the opportunity to participate in and reap benefits from the project and related development, the following measure is recommended.

Identified by this Report

- After existing airport employees, residents of the Resettlement Area should be given priority in terms of hiring for airport construction and operation positions. An apprentice training program should be instituted for positions requiring higher skill levels.

6.2.3 UTILITY AND COMMUNICATION INFRASTRUCTURE

No adverse effects have been identified; no mitigation measures are needed.

6.2.4 EDUCATION, HEALTH AND SOCIAL SERVICES

No adverse effects have been identified; no mitigation measures are needed. See the measure under Land Use and Regional Planning to prevent exposure of potential future residential uses to noise levels in excess of National standards along the airport access road.

6.3 PHYSICAL ENVIRONMENT

6.3.1 TRANSPORTATION

The only transportation-related impact that has been identified as requiring monitoring and mitigation is traffic congestion at the intersection of the proposed airport access road with the GSC-Maitum Highway during construction and Phase II (some time between 2000 and 2015) of airport operation.

6.3.3 NOISE

No specific requirements for noise monitoring have been identified. The anticipated noise impact is that of construction noise during work on the access road. The time during which access road construction would create most disturbance is at night.

Construction

Identified by this Report

- Night construction of the access road should not occur within 100 m of the scattered residential development near the National Highway and the access road entrance.

Operation

Measure to be Implemented by General Santos City

- In the event that the recommended land use plan for a commercial district along the access road in which housing is prohibited is not adopted, any housing is proposed to be constructed adjacent to the access road should be required as a condition of permit approval to include a solid wall or other noise attenuation measure to reduce noise from the road.

6.3.4 ENERGY

No impacts have been identified; no mitigation measures are needed.

6.3.5 HYDROLOGY AND DRAINAGE

Construction

Proposed as Part of the Project

- Erosion control measures would be instituted to reduce the potential for sedimentation during construction. These would include silt fences and straw or other mulch covers on bare earth surfaces.

Identified by this Report

- A holding pond should be constructed downstream of the quarrying operation to allow settlement of suspended solids before releasing water used in washing quarry materials.

Operation

Proposed as Part of the Project

- A drainage system would be installed to channel and store site and roadway drainage to prevent downstream effects. The drain field would be constructed to avoid limestone formations.

6.3.3 NOISE

No specific requirements for noise monitoring have been identified. The anticipated noise impact is that of construction noise during work on the access road. The time during which access road construction would create most disturbance is at night.

<u>Construction</u>

Identified by this Report

- Night construction of the access road should not occur within 100 m of the scattered residential development near the National Highway and the access road entrance.

<u>Operation</u>

Measure to be Implemented by General Santos City

- In the event that the recommended land use plan for a commercial district along the access road in which housing is prohibited is not adopted, any housing is proposed to be constructed adjacent to the access road should be required as a condition of permit approval to include a solid wall or other noise attenuation measure to reduce noise from the road.

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6.3.5 HYDROLOGY AND DRAINAGE

<u>Construction</u>

Proposed as Part of the Project

- Erosion control measures would be instituted to reduce the potential for sedimentation during construction. These would include silt fences and straw or other mulch covers on bare earth surfaces.

Identified by this Report

- A holding pond should be constructed downstream of the quarrying operation to allow settlement of suspended solids before releasing water used in washing quarry materials.

<u>Operation</u>

Proposed as Part of the Project

- A drainage system would be installed to channel and store site and roadway drainage to prevent downstream effects.

Identified by this Report

- Although the water quality is probably suitable without treatment, it is recommended that domestic water supplies be chlorinated with a powdered hypochlorite solution. Well water should be chlorinated to 0.5 mg/l of residual ~~chlorine.~~

- Well water should be analyzed for physical and chemical parameters once every six months. Water quality parameters are pH, color, turbidity, suspended solids, dissolved solids, chloride, hardness, nitrate and alkalinity.

6.3.6 GEOLOGY AND SOILS

Construction

Proposed as Part of the Project

- All excavated soil materials are proposed to be reused on site, so would be sited and compacted in place. To control erosion during construction, silt fences would be used, straw bales would be placed over excavated areas, and loose straw other mulch would be placed on exposed soils and earth piles. Water trucks would sprinkle construction areas to control wind erosion and surface disturbance by vehicles. The watering would be enough to hold soils but not so much as to generate runoff.

Operation

Proposed as Part of the Project

- All non-graveled, non-built areas would be planted with a low-growing, drought-tolerant groundcover (in addition to aesthetic landscaping) and native grasses to reduce wind and water erosion. Road and runway shoulders would have DBST surfaces.

- A drainage system would be installed to control runoff flows for both the airport and access road.

Measure to be Implemented by Public Agencies

- Vegetative control measures should be implemented to control erosion onto the site from the erosion-prone area at the outlying western portion (Upper Footslope) adjacent to the project site. Such measures would be the responsibility of the Bureau of Soils and Water Management and/or DENR.

6.3.7 TERRESTRIAL ECOLOGY

Proposed as Part of the Project

- Exposed areas of the site would be replanted with plant species suitable to the soil type. Ipil-ipil and Kamachile trees would be planted in areas near buildings.

Identified by this Report

- A buffer zone of trees should be planted along the proposed road alignment to the airport entrance to provide additional replacement of trees lost due to site clearing activities. In addition to providing replacement habitat for birds, the trees would serve to demarcate the ROW to protect it until it is needed in the future. The trees would also provide a buffer zone between the road and adjacent uses. The trees should be Ipil-ipil and Kamachile. These are well suited to area conditions, easily transplanted and require no tending or irrigation once established. The services of a qualified horticulturist should be obtained to develop a program for transplanting and maintenance until trees are established. Small seedling trees could be carefully removed from the site during clearance activities and transferred to the road alignment. Trees should be watered regularly until established (twice a week for four months, then once a week for three additional months; this could be done at the same time as construction site sprinkling to reduce dust). Even if some of the trees are lost, they would reseed and the Ipil-ipil grows rapidly, and would eventually provide the desired buffer, especially if seedlings are planted along the ROW at the beginning of the construction period.

6.4 AESTHETICS AND CULTURAL CONDITIONS

Aesthetics

Proposed as Part of the Project

- Landscaping would be placed around the areas of buildings. The Ipil-ipil tree would reach 10 m, while the Kamachile would reach three to four m.
- Building security lighting would be directed downward onto the building and would not be directed outward.
- Runway lighting would be placed to be visible to incoming aircraft, not from the ground. Flight operations would be daytime-only through the planning period, and runway night-lighting is not proposed.

Identified by this Report

- Trees, preferably those removed from the project site in clearing and grading operations, should be planted along the access road to provide a visual buffer between the road and adjacent development.

Archaeological and Cultural Resources

Proposed as Part of the Project

- In the event resources are encountered during construction operations, especially excavation and grading, construction activities would be halted. Any buried cultural material discovered during construction would be treated in accordance with Presidential Decree No. 374 (1974) amending certain sections of Republic Act. No 4846, known as "The Cultural Properties Preservation and Protection

Act," which contains mandatory procedures for chance finds during construction as follows:

> 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 contract would include provisions prescribing the procedures to be followed in case of cultural, archaeological or other discoveries.

Identified by this Report

- An archaeological site survey should be conducted by a qualified archaeologist to determine the archaeological sensitivity of the site. The survey scope and methodology should entail gridding of the entire site and access road alignment; surface reconnaissance for archaeological materials; and test excavations in sample areas. In the event the site is determined to be archaeologically sensitive, an archaeologist should be retained to monitor construction impacts. In any event, if resources are encountered, an impact assessment study should be conducted. This study would describe the resource(s) in detail, and assess the nature and extent of impacts expected. On the basis of this assessment, a program would be developed to determine the most appropriate manner to manage the resource in light of the identified impacts.

6.5 CUMULATIVE IMPACTS

- See the mitigation measures under Land Use and Regional Planning for mitigation of land use impacts arising from cumulative development (protection of residential development from traffic noise, and protection of the airport from encroaching development).

- See the measure under Transportation, Identified by this Report, Phase II Operation, for mitigation of cumulative traffic impacts at the intersection of the airport access road and the National Highway in the year 2000 or beyond.

6.6 ENVIRONMENTAL PLAN OF ACTION

This section specifies the timing, recommended methods and monitoring requirements for implementing the measures listed in Sections 6.1 through 6.5. Both measures proposed as part of the project and measures identified by this report are addressed. The order of the section follows the stages of project implementation rather than the listing of topics in the EA/EIS. The earliest stage of project implementation following approval is drafting contract documents. A number of the identified measures should either be carried out at this stage and/or included as provisions in the construction contract. Monitoring can be achieved by means of periodic reports or checklists, terminated at the completion of implementation of the mitigation measure.

CONSTRUCTION CONTRACTING PERIOD

The services of a horticulturist should be obtained prior to the start of construction activities to develop a program for transplanting Ipil-ipil and Kamachile trees from areas of the site to be graded to the access road ROW.

Prior to beginning project construction, it is recommended that the services of a qualified archaeologist be obtained to conduct an archaeological survey to determine the likelihood of the presence of artifacts. If the survey results show high sensitivity, it is recommended that a qualified archaeologist monitor excavation activities. In this case, the archaeologist should submit a report at the cessation of his/her duties detailing the results of the monitoring. If artifacts are encountered, a report should be submitted describing the mitigation program and disposition of artifacts. Since it is required that the Director of the National Museum be notified of any finds, the Director should receive a copy of any reports generated in compliance with this measure.

The construction contract should include a provision for avoidance of impacts to any cultural resources encountered during excavation.

The construction contract should include a provision that suitable mulch will be used to prevent erosion of bare or piled earth, and that residents of MSU, the Upper Tambler Resettlement Area and other occupants of the area are to be notified before earth moving activities begin near their properties and the likely duration of same.

The construction contract should also include provisions that the contractor will cause to have a minimum of two water trucks to water down areas of earthmoving activities a minimum of twice per each 12-hour construction shift.

Inclusion of identified provisions in the construction contract should be the responsibility of the contracting officer.

PROJECT CONSTRUCTION

The construction contractor should submit periodical checklists or reports verifying:

- watering down and mulching activities;
- resident notification; and
- observance of transplanting operations according to measures identified in the horticulturist's transplanting program.

PROJECT OPERATION

Recommended responsibilities for implementation and monitoring of the recommended land use plan are as follows. Revised land use and zoning maps and adoption of amendments to the Zoning Ordinance would signal completion of the implementation of this measure.

1) Establishment of an airport expansion reserve area: DENR, with current responsibility for the land, in cooperation with DOTC as the future responsible agency.

2) Implementation of regulations to prevent use of the land for high-investment uses incompatible with future conversion to airport use: General Santos City Zoning Administrator through the airport special use permit process.

3) Establishment of airport special use district: the Municipal Council of General Santos City, through amendment to the Zoning Ordinance, with advice of the City Planning and Development Coordinator and DOTC.

4) Implementation of regulations established through the airport special use permit process: General Santos City Zoning Administrator, with advice from DOTC.

7. APPENDIX

TABLES

APPENDIX 7.1.1 - SOCIAL SCIENCE METHODOLOGY

The social science methodologies that were used for this report are as follows:

1. Secondary analysis of existing documentary data.

2. Institutional linkages with local and church officials, ordinary residents (tao), representatives of non-governmental organizations or with private voluntary associations were made.

3. Development of new data. Primary data at the barangay level were sought through village contacts.

   - Key informants or knowledgeable sources were interviewed on a face-to-face basis.

   - FGDs (Focussed Group Discussions: Participants in a community meeting were asked to discuss topics relevant to the project.

   - Field sites trips: Identification of Primary Impact Zones (PIZ).

   - Participant observatons in critical community activities. For example, attendance at the meeting with the mayor at her office at City Hall, as well as village meetings with the barangay captains and purok chairpersons.

4. Development of social parameters.

APPENDIX 7.1.2 - TRAFFIC ANALYSIS METHODOLOGY

PROJECTION OF VEHICULAR TRAFFIC VOLUMES RELATED DIRECTLY TO AIRPORT ACTIVITIES

INTRODUCTION

Vehicular traffic volumes were projected in five-year increments for each major activity category that generates traffic, by vehicle types, then summarized to give total volumes by vehicle type. The activity categories for which traffic was projected include:

- Air passenger movements (enplanements and deplanements) (PAX)
- Cargo movements (CAR)
- Airport employment (EMP)
- Airport servicing (deliveries, repairs, etc.) (SER)

Vehicle types for which projections were made include:

- Private vehicles (PV); generally includes private passenger automobiles.
- Tricycles (TR); the motorized three-wheel vehicles commonly used as for-hire transport as taxis.
- Jeepneys (JP); the larger open, usually for-hire passenger vehicles.
- Buses (BS); meaning small vans usually owned by companies for transporting employees and visitors in groups.
- Hotel vehicles (HV); vans operated by hotels for transporting guests and baggage.

  (NOTE: Buses and hotel vehicles were listed separately in the passenger origin and destination surveys, but because they are the same or similar vehicle type, they are combined in some of the traffic projection tables.)

- Other (OT); composed mostly of motorcycles.
- Cargo Trucks:

  half-ton (0.5T); light utility trucks, two axles
  five-ton (5T); medium size trucks, two axles
  ten-ton (10T); heavy trucks, two or three axles

The general methodology was to prepare traffic generation estimates separately for each activity and accumulate the results. Traffic from passenger movements, which account for 85% to 90% of trips, was estimated based on passenger demand projections derived from population projections and vehicle types and occupancy rates obtained from an origin-destination (O/D) survey of passengers traveling to and from General Santos City. A more detailed description of the methodology is given below. A summary of traffic projections is given in Table 7.1.1.

SUMMARY RESULTS

Vehicular traffic generated by airport activities is expected to total about 400 trips per day in 1995, increasing to about 1,200 trips per day by 2015. Trips with the purpose of transporting air passengers to or from the airport would account for about 85% of the total trips in 1995, increasing to over 90% by 2015. Automobiles would account for about 60% of vehicle trips in 1995, increasing to about 75% by 2015. Other types of passenger vehicles would account for about 35% of trips in 1995, decreasing to about 15% in 2015. The number of truck trips is predicted to increase from about 30 per day in 1995 to over 60 per day by 2015, but the proportion of truck trips to total trips would remain relatively constant, at about 5% to 8%.

Peak-hour traffic flows would relate to flight operations, with heaviest traffic concentrated by arrival and departure of passengers shortly before and after each flight. Estimates of peak-hour traffic volumes were made by distributing passenger and cargo trips at flight times, employee trips before the first flight and after the last flight each day, and service trips uniformly over the day. Peak-hour traffic volumes generated by airport activities would be as follows:

1995: 140 trips during peak hour	2010: 130
2000: 130	2015: 190
2005: 170	

METHODOLOGY FOR PROJECTIONS

Passenger trip projections were based on trip rates produced by relating air passenger movements to vehicle types and occupancy rates. Air passenger movements were projected on the basis of population projections (see "Commercial Airline Passenger Forecast", Chapter IV, *Preliminary Engineering Report*, Wilbur Smith Associates, et al., March 1991). Passenger movements are as follows:

Daily Air Passenger Movements

1995: 287	2010: 595
2000: 428	2015: 909
2005: 582	

Vehicle Type and Occupancy

Vehicle Type	% of Total Trips	Number of Air Passengers Per Vehicle
Private Passenger	60	1.5
Tricycle	17	1.0
Jeepney	10	1.5
Bus/Van	7	1.0
Hotel Vehicle	4	2.0
Other	2	1.0

The trip rates shown in Table 7.1.2 were developed according to the following assumptions:

1. Private passenger automobiles, hotel vehicles and "other" vehicles would drop off or pick up passengers, but not both (would be empty of passengers in one direction).

2. Tricycles, jeepneys and bus/vans would drop off departing passsengers and pick up arriving passengers.

3. The use of tricycles as a means of passenger transport would gradually decrease while private passenger automobile use would gradually increase. This is based on the fact that private automobile ownership will increase over time as a result of increasing affluency in the area. Also, tricyles emit high levels of noise and air pollution and are not legally permitted to operate on the National Highway (although this is not currently enforced). It is assumed that, in the future, enforcement of emissions controls and National Highway access prohibitions will occur. For this reason, by the Year 2015, tricycles are assumed to no longer be a component of the vehicle mix of direct airport-generated traffic. This assumption results in a higher number of trips since private vehicles are assumed to be occupied by a passenger for only one trip (to or from the airport, but not both), while tricyles are assumed to be occupied by passengers both ways.

The trip rates in Table 7.1.2, multiplied by the number of daily air passengers, gives the air passenger related vehicle trips shown in Table 7.1.1.

Vehicle trips related to transport of cargo to the airport were projected by dividing the projected cargo volumes by the capacities of typical cargo transport trucks used for each commodity. The daily tonnage of cargo movement for each type of commodity is shown in Table 7.1.3. This was obtained from the Preliminary Report (see Air Cargo Volume Estimates, Chapter IV). The types of vehicles used to estimate tonnage and trips were as follows:

Tuna and other fish	5-ton trucks
Prawns	Half-ton trucks
Citrus fruit	Half-ton trucks
Other agricultural products	10-ton trucks

Employee trips were estimated based airport employment projections (rounded) of 90 in 1995, 100 in 2000 and 120 in 2015. It was assumed that 10% of employee trips would be by private passenger auto at an occupancy rate of 2.0, and remaining trips would be by jeepney at an occupancy rate of 5.0. Applying these vehicle types and occupancy rates to the number of employees gives employee trips as shown in as shown in Table 7.1.1.

Service trips are included to reflect the fact that trips would be made to the airport to deliver supplies, make repairs to equipment and carry out other miscellaneous support activities. There is no reliable empirical way of projecting these trips for a small facility. This study makes the following assumptions: 10 trips per day in the near term, increasing to 20 trips per day in the long term, and trips are made by half-ton trucks. The result in shown in Table 7.1.1.

Table 7.1.1: Summary of Daily Vehicle Trips by Trip Purpose and Vehicle Type

	PV	TR	JP	BS	OT	0.5T	5T	10T	Total
1995									
PAX	230	49	19	31	11	--	--	--	340
CAR	--	--	--	--	--	10	8	2	20
EMP	6	--	24	--	--	--	--	--	30
SER	--	--	--	--	--	10	--	--	10
Total	236	49	43	31	11	20	8	2	400
2000									
PAX	365	56	29	47	17	--	--	--	514
CAR	--	--	--	--	--	24	10	6	40
EMP	8	--	22	--	--	--	--	--	30
SER	--	--	--	--	--	12	--	--	12
Total	373	56	51	47	17	36	10	6	596
2005									
PAX	528	52	39	64	23	--	--	--	706
CAR	--	--	--	--	--	24	10	10	44
EMP	10	--	20	--	--	--	--	--	30
SER	--	--	--	--	--	15	--	--	15
Total	538	52	59	64	23	39	10	10	795
2010									
PAX	579	24	40	64	24	--	--	--	731
CAR	--	--	--	--	--	24	10	10	44
EMP	12	--	20	--	--	--	--	--	32
SER	--	--	--	--	--	17	--	--	17
Total	591	24	60	64	24	41	10	10	824
2015									
PAX	934	--	61	100	36	--	--	--	1,131
CAR	--	--	--	--	--	24	10	10	44
EMP	14	--	20	--	--	--	--	--	34
SER	--	--	--	--	--	20	--	--	20
Total	948	--	81	100	36	44	10	10	1,229

Source: Wilbur Smith Associates, 1991

Table 7.1.2: Trip Rates for Air Passenger Movements by Vehicle Type							
	PV	TR	JP	BS	HV	OT	Total
1995	0.800	0.170	0.067	0.070	0.040	0.040	1.187
2000	0.853	0.130	0.067	0.070	0.040	0.040	1.200
2005	0.907	0.090	0.067	0.070	0.040	0.040	1.214
2010	0.973	0.040	0.067	0.070	0.040	0.040	1.230
2015	1.027	0.000	0.067	0.070	0.040	0.040	1.244
Source: Wilbur Smith Associates, 1991							

Table 7.1.3: Projection of Commodities Shipped by Air, In Metric Tons Per Day					
	Tuna and Other Fish	Prawns	Citrus Fruit	Other Agricultural Products	Total
1995	17.6	1.4	0.8	3.1	22.8
2000	20.1	4.1	1.2	21.4	46.8
2005	21.6	4.1	1.2	42.5	69.4
2010	22.6	4.1	1.2	43.8	71.8
2015	22.6	4.1	1.2	43.8	71.8
Source: Wilbur Smith Associates, 1991					

PROJECTION OF DIVERTED TRIPS

Because the project would provide a well-designed paved road into an area now served by unpaved roads, it is likely that at least some existing traffic would divert to the new road. A conservative approach was used to estimate this traffic volume, by assuming that all traffic from the San Jose Community, the Upper Tambler Resettlement Area, and MSU would use the airport access road.

For San Jose and Tambler, it was estimated that 80% of the families would generate one person trip out and one person trip in each day (two person trip ends), and that trips would be by jeepney, with an occupancy rate of 10 persons per jeepney. Observations of vehicle occupancy recorded during traffic counts for the RIF study indicated an average jeepney occupancy rate of 15 persons.

MSU would be the largest source of diverted traffic. In this case, one-half of on-campus (resident) students, staff and faculty, and all of the off-campus (nonresident) students, faculty and staff would each generate two person trip ends per day. Further, the current student population of about 2,500 was assumed to double, to 5,000, by 2015. Trips were assumed to be by jeepney (10 persons per vehicle), although there are some private vehicles and trucks associated with the campus. Trips were also assumed to occur at this rate over a seven-day period, although in fact, nonresidents would be unlikely to travel to the campus on weekends.

The use of low vehicle occupancy rates for jeepneys and the assignment of MSU traffic for seven days per week produces a high projection of traffic, so that traffic capacity of the access road could be tested under worst-case conditions.

Peak-hour trips were estimated to be equal to 150% of daily average hourly trips, which were assumed to occur over a 15-hour day.

NOISE EXPOSURE PREDICTION

A computer-based mathematical model was used to predict noise impact associated wth the projected operation of the airport. The USDOTFAA's Integrated Noise Model (INM) is the standard prediction analysis tool to which all computer-based airport noise exposure models are compared. The INM calculates the total impact of aircraft noise at or around airports. This noise exposure level can be presented in contours of equal noise exposure for any one of several noise measures. For this analysis, the L_{dn} measure is used because it is the accepted standard except under unusual conditions that do not apply to the project.

The INM is accompanied with sets of aircraft noise and performance information, but information on airport geometry and aircraft movements (flight paths, frequency and operations, etc.) is also necessary. The model integrates this input data with its data base and produces a prediction of aircraft noise.

The output of the model is given in the form of coordinate points of equal L_{dn} levels, and from this output, contour lines can be drawn that show boundaries between various levels of L_{dn}. The standard units of analysis are usually the boundaries between L_{dn} 65, 70 and 75. All forms of development including such noise-sensitive uses as residences, schools and hospitals are considered compatible with noise levels of 65 L_{dn}. Higher levels can be tolerated by other uses. Appendix Table 7.2.2 gives a full description of noise compatibility.

For this report, it is assumed that all flights would arrive from and depart to the north. All traffic patterns would occur to the east of the airfield due to the presence of the Parker Volcano and associated hills to the west. The INM model inputs were set up for the Tambler airport site, using year 2015 projected daily aircraft operations of two A-300 flights, two B-737 flights, and three C-130 flights. Using these, the INM produced only L_{dn} levels below 50. This indicated that aircraft operations in 2015 would produce noise levels compatible with any type of land use. As a sensitivity measure, and to account for noise that may be produced by general aviation operations (not normally calculated), the number of flight operations were increased by a multiple of approximately four, as follows:

Aircraft	Daily Operations
A-300	8
B-737	8
C-130	8
Lear 35*	10

* Since the INM data base does not include the Fokker-50, the Lear 35, with similar operating characteristics, was used as a substitute.

With this overstatement of flights, the highest L_{dn} contour produced by the model was L_{dn} 60. The model was also operated to produce the L_{dn} 55 contour. The noise contour lines are shown on Figure 10, Section 4.3.3.

In order to further examine noise impact on developed community areas, an additional analysis was done using the INM. The model was used to calculate noise levels at specified points on a grid extending over the San Jose and Tambler communities and the MSU campus. The L_{dn} levels calculated at these points are also shown on Figure 10. These calculations showed noise levels of L_{dn} 31 to 40 over San Jose, 36 to 40 over the Upper Tambler Resettlement Area west of MSU, and 30 to 35 over MSU, with the multiplied flight operations as described above.

On the following pages, the computer output for the INM for the analyses described above has been reproduced. In Section 7.2, additional technical information related to noise is presented.

Note that the model often gives noise levels in L_{eq}. L_{eq} is similar to L_{dn}, without the 10 dBA nighttime weighting penalty. Since airport operations would not include night flights, for purposes of this analysis, L_{dn} and L_{eq} are the same.

INTEGRATED NOISE MODEL - ECHO REPORT

S E T U P

********** OUTPUT FROM THE INPUT MODULE*********
*** PROCESSING SETUP SECTION
*** PROCESSING AIRCRAFT SECTION
*** PROCESSING TAKEOFF SECTION
*** PROCESSING LANDING SECTION
*** PROCESSING PROCESS SECTION

TITLE ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

ALTITUDE 170. FT.
TEMPERATURE 549.3 R 89.6 F 32.0 C

NOISE METRICS

EQUIVALENT SOUND LEVEL (LEQ) - THE 24 HOUR AVERAGE OF AN ENERGY SUMMATION OF INTEGRATED A-WEIGHTED LEVELS.
DAY-NIGHT AVERAGE SOUND LEVEL (LDN) - BASED ON LEQ, WITH NIGHTTIME OPERATIONS WEIGHTED BY A 10 DECIBEL PENALTY.
NOISE EXPOSURE FORECAST (NEF) - THE 24 HOUR AVERAGE OF AN ENERGY SUMMATION OF EFFECTIVE PERCEIVED NOISE LEVELS.
TIME ABOVE A SPECIFIED THRESHOLD OF A-WEIGHTED SOUND (TA) - MINUTES THAT A DBA LEVEL IS EXCEEDED IN 24 HOURS.

INTEGRATED NOISE MODEL - ECHO REPORT

R U N W A Y S

Report 2

NAME	HEADING	UNITS	STARTING COORDINATES X	STARTING COORDINATES Y	ENDING COORDINATES X	ENDING COORDINATES Y	RUNWAY LENGTH
01	14	FT	32808.	32808.	40682.	32808.	7874.
		M	10000.	10000.	12400.	10000.	2400.
		NMI	5.400	5.400	6.695	5.400	1.296
19	194	FT	40682.	32808.	32808.	32808.	7874.
		M	12400.	10000.	10000.	10000.	2400.
		NMI	6.695	5.400	5.400	5.400	1.296

A I R C R A F T

Report 3

NAME	CATEGORY	NOISE CURVE NAME	APPROACH PARAMETER NAME	STAGE1	STAGE2	STAGE3	STAGE4	STAGE5	STAGE6	STAGE7
				T A K E O F F	P R O F I L E	N A M E S				
A300	JCOM	2CF650	AP25	TOP138	TOP139	TOP140	TOP141			
737300	JCOM	CFM563	AP72	TOP235	TOP236	TOP237	TOP261			
C130	PMIL	T56A15	1043	TOP186	TOP186	TOP186	TOP186	TOP186	TOP186	TOP186
LEAR35	JGA	TF7312	AP38	TOP181	TOP181	TOP181	TOP181	TOP181		

APPROACH PROFILES

Report 6

NAME	SEGMENT	ALTITUDE(FT)	THRUST			
STD3D	1	.00				TAXI
			REV	STOP		
	2	.00				FINSP
			3DLND	-1002.56	-305.58	-.17
	3	1000.00				FINSP
			3DAPFS	18076.40	5509.70	2.97
	4	3000.00				FINSP
			3DAPFS	56234.50	17140.31	9.26
	5	3200.00				FINSP
			3DAPFS	60050.30	18303.37	9.88
	6	4000.00				TERMSP
			3DAPTS	75313.50	22955.60	12.40
	7	6000.00				TERMSP
			.00	113471.00	34586.04	18.67
GA3D	1	.00				32.00
			3DLND	STOP		
	2	.00				FINSP
			3DLND	-1002.56	-305.58	-.17
	3	1000.00				FINSP
			3DLND	18076.40	5509.70	2.97
	4	3000.00				FINSP
			3DLND	56234.50	17140.31	9.26
	5	3200.00				FINSP
			3DLND	60050.30	18303.37	9.88
	6	4000.00				FINSP
			3DLND	75313.50	22955.60	12.40
	7	6000.00				FINP
			.00	113471.00	34586.04	18.67
MIL3D	1	.00				32.00
			3DLNO	STOP		
	2	.00				FINSP
			3DLND	-1002.56	-305.58	-.17
	3	1000.00				FINSP
			3DLND	18076.40	5509.70	2.97
	4	3000.00				FINSP
			3DLND	56234.50	17140.31	9.26
	5	3200.00				FINSP
			3DLND	60050.30	18303.37	9.88
	6	4000.00				FINSP
			3DLND	75313.50	22955.60	12.40
	7	6000.00				FINP
			.00	113471.00	34586.04	18.67

TAKEOFF - TRACKS

Report 9 - PART A

TRACK	RUNWAY	INITAL HEADING	SEGMENT	DIRECTION	LENGTH (NMI)	TURN ANGLE (DEG)	RESULTANT HEADING (DEG)	TURN RADIUS (NMI)
TR1	01	14	1	STRAIGHT	6.50		14	
			2	LEFT		24	350	2.00
			3	STRAIGHT	50.00		350	
TR2	19	194	1	STRAIGHT	6.50		194	
			2	LEFT		204	350	2.00
			3	STRAIGHT	50.00		350	

TAKEOFF - OPERATIONS

Report 9 - PART B

TRACK	RUNWAY	AIRCRAFT	CLASS	PROFILE	OPERATIONS DAY	EVENING	NIGHT
TR1	01	A300	COM	TOP138	4.00	.00	.00
		737300	COM	TOP235	4.00	.00	.00
		C130	MIL	TOP186	4.00	.00	.00
		LEAR35	GA	TOP181	5.00	.00	.00
TR2	19	A300	COM	TOP138	4.00	.00	.00
		737300	COM	TOP235	4.00	.00	.00
		C130	MIL	TOP186	4.00	.00	.00
		LEAR35	GA	TOP181	5.00	.00	.00

T A K E O F F - D I S T R I B U T I O N

Report 9 - PART C

		OPERATIONS DAY	EVENING	NIGHT
COMMERCIAL	-	16.0	.0	.0
GENERAL AVIATION	-	10.0	.0	.0
MILITARY	-	8.0	.0	.0

		PROPORTIONS								
		COMMERCIAL			GENERAL AVIATION			MILITARY		
TRACK	RUNWAY	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT
TR1	01	.50	.00	.00	.50	.00	.00	.50	.00	.00
TR2	19	.50	.00	.00	.50	.00	.00	.50	.00	.00
	TOTAL	1.00	.00	.00	1.00	.00	.00	1.00	.00	.00

L A N D I N G - T R A C K S

Report 10 - PART A

TRACK	RUNWAY	INITAL HEADING	SEGMENT	DIRECTION	LENGTH (NMI)	TURN ANGLE (DEG)	RESULTANT HEADING (DEG)	TURN RADIUS (NMI)
TR3	01	14	1	STRAIGHT	5.20		14	
			2	LEFT		24	350	2.00
			3	STRAIGHT	50.00		350	
TR4	19	194	1	STRAIGHT	5.20		194	
			2	LEFT		204	350	2.00
			3	STRAIGHT	50.00		350	

T A K E O F F - O P E R A T I O N S

Report 10 - PART B

TRACK	RUNWAY	AIRCRAFT	CLASS	PROFILE	OPERATIONS DAY	EVENING	NIGHT
TR3	01	A300	COM	STD3D	2.40	.00	.00
		737300	COM	STD3D	2.40	.00	.00
		C130	MIL	STD3D	2.40	.00	.00
		LEAR35	GA	GA3D	3.00	.00	.00
TR4	19	A300	COM	STD3D	5.60	.00	.00
		737300	COM	STD3D	5.60	.00	.00
		C130	MIL	STD3D	5.60	.00	.00
		LEAR35	GA	GA3D	7.00	.00	.00

L A N D I N G - D I S T R I B U T I O N

Report 10 - PART C

		OPERATIONS DAY	EVENING	NIGHT
COMMERCIAL	-	16.0	.0	.0
GENERAL AVIATION	-	10.0	.0	.0
MILITARY	-	8.0	.0	.0

		PROPORTIONS								
		COMMERCIAL			GENERAL AVIATION			MILITARY		
TRACK	RUNWAY	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT
TR3	01	.30	.00	.00	.30	.00	.00	.30	.00	.00
TR4	19	.70	.00	.00	.70	.00	.00	.70	.00	.00
	TOTAL	1.00	.00	.00	1.00	.00	.00	1.00	.00	.00

P R O C E S S E S

```
VERIFY

EXECUTE

GRID
   METRIC = LDN
   STARTING POINT = 26247.  29527.
   STEP =      984.  656.
   SIZE =      2     3
   REPORT

GRID
   METRIC = LEQ
   STARTING POINT = 26247.  29527.
   STEP =      .0
   SIZE =      1     1
   REPORT
   DETAIL

CONTOUR
   LEVELS = 65.00   75.00
   METRIC = LDN
   TOLERANCE = 1.00
   REFINEMENT = 6
   WINDOW = -50000. -50000.  50000. 50000.
   REPORT
   PLOT
      X AXIS      11.0
      Y AXIS       8.5
      SCALE    25000.0
      AUTOMATIC CENTERING

RETRIEVE
   DEFAULT LEVELS
   NAME
   DEFAULT WINDOW
   REPORT
Stop - Program terminated.
```

X	Y	LDN	X	Y	LDN
26247.	29527.	43.6	27231.	29527.	43.8
26247	30183.	46.1	27231.	30183.	46.2
26247.	30839.	49.0	27231.	30839.	49.2

0 WARNING MESSAGES WERE PRODUCED BY THE COMPUTATION MODULE

INTEGRATED NOISE MODEL - STANDARD GRID ANALYSIS REPORT
ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

X	Y	LEQ	X	Y	LEQ
26247.	29527.	43.6			

DETAILED GRID ANALYSIS REPORT

X = 26247.	Y = 29527.
METRIC LEQ	TOTAL = 43.6

AIRCRAFT	PROFILE	APPROACH PARAMETER	NOISE CURVE	FLIGHT TYPE	TRACK	RUNWAY	SEL	O P E R A T I O N S DAY	EVENING/NIGHT	CONTRIBUTION
C130	TOP186	AP43	T56A15	T	TR2	19	82.5	4.0	.0	.39104E+02
A300	TOP138	AP25	2CF650	T	TR2	19	81.3	4.0	.0	.37884E+02
LEAR35	TOP181	AP38	TF7312	T	TR2	19	78.6	5.0	.0	.36195E+02
737300	TOP325	AP72	CFM563	T	TR2	19	77.3	4.0	.0	.33879E+02
C130	STD3D	AP43	T56A15	A	TR4	19	71.7	5.6	.0	.29736E+02
A300	STD3D	AP25	2CF650	A	TR4	19	70.1	5.6	.0	.28147E+02
737300	STD3D	AP72	CFM563	A	TR4	19	68.0	5.6	.0	.26100E+02
C130	TOP186	AP43	T56A15	T	TR1	01	61.8	4.0	.0	.18434E+02
A300	TOP138	AP25	2CF650	T	TR1	01	61.8	4.0	.0	.18378E+02
LEAR35	TOP181	AP38	TF7312	T	TR1	01	58.7	5.0	.0	.16322E+02
LEAR35	GA3D	AP38	TF7312	A	TR4	19	57.2	7.0	.0	.16271E+02
737300	TOP235	AP72	CFM563	T	TR1	01	59.2	4.0	.0	.15822E+02
A300	STD3D	AP25	2CF650	A	TR3	01	56.6	2.4	.0	.10970E+02
C130	STD3D	AP43	T56A15	A	TR3	01	52.9	2.4	.0	.72690E+02
737300	STD3D	AP72	CFM563	A	TR3	01	50.4	2.4	.0	.48337E+01
LEAR35	GA3D	AP38	TF7312	A	TR3	01	36.9	3.0	.0	-.77633E+01

PEAK LEVEL = 82.5

			DECIBELS BELOW 83 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
NUMBER OF FLIGHTS		-	1	1	0	0	1	1	0	0	0	0
NUMBER	DAY	-	4	4	0	0	5	4	0	0	0	0
OF	EVENING	-	0	0	0	0	0	0	0	0	0	0
OPERATIONS	NIGHT	-	0	0	0	0	0	0	0	0	0	0

NOISE COMPUTATION MODULE SUMMARY

REFINEMENT LEVEL	NO.OF RCTNGLS	NO.OF NODES	NO.OF TRIANGLES
3	64	289	
			0

RECTANGLE ENVELOPING MAP MOSAIC.
LOW LEFT & UPPER RIGHT CORNERS
XMIN= -.500000E+05 YMIN= -.500000E+05
XMAX= .500000E+05 YMAX= .500000E+05

---

0 WARNING MESSAGES WERE PRODUCED BY THE COMPUTATION MODULE

ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

METRIC NAME

LDN

CONTOUR LEVEL　　　CONTOUR AREA (SQ. MILES)

CN 3 *WARNING: LDN 65.00 CONTOUR DOES NOT EXIST

65.00　　　.00

CN 3 *WARNING: LDN 75.00 CONTOUR DOES NOT EXIST

75.00　　　.00

---

2 WARNING MESSAGES WERE PRODUCED BY THE CONTOUR MODULE

INTEGRATED NOISE MODEL - CONTOUR ANALYSIS REPORT

C O N T O U R - ------

ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

LEVEL = 65.0 DB AREA = .00 METRIC = LDN

C O N T O U R - ------

ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

LEVEL = 75.0 DB AREA = .00 METRIC = LDN

---

0 WARNING MESSAGES WERE PRODUCED BY THE COMPUTATION MODULE

NOISE COMPUTATION MODULE SUMMARY

REFINEMENT LEVEL	NO.OF RCTNGLS	NO.OF NODES	NO.OF TRIANGLES
3	64	289	
4	12	44	
5	24	82	
6	28	100	
			192

RECTANGLE ENVELOPING MAP MOSAIC.
LOW LEFT & UPPER RIGHT CORNERS
XMIN= -.500000E+05 YMIN= -.500000E+05
XMAX= .500000E+05 YMAX= .500000E+05

ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

METRIC NAME

LDN

CONTOUR LEVEL	CONTOUR AREA (SQ. MILES)
55.00	1.57
60.00	.79

---

0 WARNING MESSAGES WERE PRODUCED BY THE CONTOUR MODULE

INTEGRATED NOISE MODEL - CONTOUR ANALYSIS REPORT

C O N T O U R - ------

ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

LEVEL = 55.0 DB AREA = 1.57 METRIC = LDN

ISLAND	PNT	X	Y	PNT	X	Y	PNT	X	Y
1	1	25000.	33600.	2	25725.	33650.	3	25781.	33652.
	4	25843.	33655.	5	26563.	33719.	6	27177.	33761.
	7	27344.	33767.	8	27522.	33772.	9	28125.	33810.
	10	28643.	33857.	11	28906.	33871.	12	29193.	33880.
	13	29688.	33913.	14	30126.	33936.	15	30469.	33951.
	16	30864.	33989.	17	31250.	34020.	18	31503.	34122.
	19	32031.	34188.	20	32652.	34214.	21	32813.	34255.
	22	32944.	34244.	23	33594.	34170.	24	34114.	34114.
	25	34375.	34093.	26	34690.	34060.	27	35156.	34003.
	28	35518.	33955.	29	35938.	33912.	30	36428.	33885.
	31	36719.	33868.	32	37009.	33884.	33	37500.	33909.
	34	37922.	33953.	35	38281.	33999.	36	38745.	34058.
	37	39063.	34092.	38	39237.	34111.	39	39844.	34164.
	40	40481.	34231.	41	40625.	34242.	42	40797.	34203.
	43	41406.	34188.	44	41933.	34120.	45	42188.	33994.
	46	42617.	33946.	47	42969.	33904.	48	43262.	33887.
	49	43750.	33852.						
2	1	43750.	31763.	2	43273.	31727.	3	42969.	31710.
	4	42605.	31667.	5	42188.	31621.	6	41940.	31497.
	7	41406.	31427.	8	40787.	31412.	9	40625.	31374.
	10	40490.	31385.	11	39844.	31451.	12	39318.	31505.
	13	39063.	31523.	14	38756.	31556.	15	38281.	31615.
	16	37912.	31662.	17	37500.	31705.	18	37021.	31729.
	19	36719.	31746.	20	36416.	31728.	21	35938.	31702.
	22	35527.	31660.	23	35156.	31612.	24	34679.	31554.
	25	34375.	31523.	26	34123.	31502.	27	33594.	31446.
	28	32934.	31372.	29	32813.	31361.	30	32662.	31400.
	31	32031.	31428.	32	31496.	31496.	33	31250.	31595.
	34	30875.	31625.	35	30469.	31664.	36	30117.	31679.
	37	29688.	31702.	38	29203.	31734.	39	28906.	31744.
	40	28633.	31758.	41	28125.	31805.	42	27533.	31842.
	43	27344.	31848.	44	27167.	31855.	45	26563.	31896.
	46	25853.	31959.	47	25781.	31963.	48	25716.	31966.
	49	25000.	32016.						

INTEGRATED NOISE MODEL - CONTOUR ANALYSIS REPORT

C O N T O U R - ------

ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

LEVEL = 60.0 DB   AREA = .79   METRIC = LDN

ISLAND	PNT	X	Y	PNT	X	Y	PNT	X	Y
1	1	43750.	33075.	2	43468.	33094.	3	42969.	33181.
	4	42626.	33251.	5	42188.	33289.	6	41413.	33587.
	7	41406.	33589.	8	41406.	33593.	9	41393.	33594.
	10	40625.	33769.	11	39967.	33717.	12	39844.	33705.
	13	39743.	33694.	14	39063.	33645.	15	38586.	33594.
	16	38290.	33585.	17	38281.	33584.	18	38272.	33584.
	19	37500.	33561.	20	36762.	33550.	21	36719.	33552
	22	36675	33550.	23	35938.	33562.	24	35165.	33585.
	25	35156.	33585.	26	35148.	33585.	27	34862.	33594.
	28	34375.	33645.	29	33700.	33700.	30	33594.	33711.
	31	33461.	33726.	32	32813.	33783.	33	32072.	33594.
	34	32034.	33591.	35	32031.	33582.	36	32017.	33580.
	37	31250.	33384.	38	30707.	33356.	39	30469.	33319.
	40	30149.	33274.	41	29688.	33254.	42	29267.	33233.
	43	28906.	33168.	44	28397.	33085.	45	28125.	33062.
	46	27889.	33049.	47	27344.	32961.	48	26601.	32851.
	49	26563.	32848.	50	26530.	32845.	51	26349.	32813.
	52	26530.	32780.	53	26563.	32777.	54	26601.	32774.
	55	27344.	32662.	56	27886.	32574.	57	28125.	32560.
	58	28401.	32537.	59	28906.	32453.	60	29263.	23288.
	61	29688.	32366.	62	30154.	32346.	63	30469.	32301.
	64	30702.	32264.	65	31250.	32236.	66	32027.	32035.
	67	32031.	32034.	68	32032.	32032.	69	32042.	32031.
	70	32813.	31831.	71	33449.	31886.	72	33594.	31903.
	73	33710.	31915.	74	34375.	31969.	75	34978.	32031.
	76	35151.	32036.	77	35156.	32037.	78	35162.	32037.
	79	35938.	32059.	80	36679.	32071.	81	36719.	32070.
	82	36759.	32072.	83	37500.	32061.	84	38275.	32037.
	85	38281.	32037.	86	38287.	32037.	87	38474.	32031.
	88	39063.	31968.	89	39733.	31921.	90	39844.	31909.
	91	39980.	31895.	92	40625.	31845.	93	41400.	32025.
	94	41406.	32025.	95	41411.	32026.	96	41422.	32031.
	97	42188.	32331.	98	42630.	32370.	99	42969.	32439.
	100	43464.	32527.	101	42750.	32547.			

INTEGRATED NOISE MODEL - STANDARD GRID ANALYSIS REPORT
ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

---NOISE LEVELS WEST OF THE NORTHERN HALF OF THE RUNWAY AROUND SAN JOSE---

X	Y	LEQ	X	Y	LEQ
36089.	34449.	48.8	38550.	34449.	50.5
41011	34449.	53.1	43472.	34449.	51.4
36089.	36910.	38.0	38550.	36910.	38.9
41011.	36910.	41.2	43472.	36910.	41.5
36089	39371.	32.9	38550.	39371.	33.3
41011.	39371.	34.9	43472.	39371.	35.4
36089.	41832.	29.2	38550.	41832.	29.6
41011.	41832.	30.8	43472.	41832.	31.2

0 WARNING MESSAGES WERE PRODUCED BY THE COMPUTATION MODULE

INTEGRATED NOISE MODEL - STANDARD GRID ANALYSIS REPORT
ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

-------------NOISE LEVELS FROM THE RUNWAY EAST THROUGH MSU---------------

X	Y	LEQ	X	Y	LEQ
38714.	14764.	30.5	41995.	14764.	29.5
45276	14764.	28.6	38714.	18045.	32.9
41995.	18045.	32.0	45276.	18045.	31.0
38714.	21326.	35.0	41995.	21326.	34.3
45276	21326.	33.5	38714.	24607.	36.1
41995.	24607.	36.4	45276.	24607.	36.0
38714.	27888.	38.3	41995.	27888.	40.0
45276.	27888.	40.0			

0 WARNING MESSAGES WERE PRODUCED BY THE COMPUTATION MODULE

INTEGRATED NOISE MODEL - CONTOUR ANALYSIS REPORT

C O N T O U R - ------

ANNUAL AVERAGE EXPOSURE AT GENERAL SANTOS CITY AIRPORT

LEVEL = 55.0 DB AREA = 2.07 METRIC = LDN

ISLAND	PNT	X	Y	PNT	X	Y	PNT	X	Y
1	1	22966.	33421.	2	21513.	33293.	3	20505.	33099.
	4	18820.	32809.	5	20505.	32517.	6	21511.	32324.
	7	22966.	32195.	8	25420.	31990.	9	25426.	31990.
	10	25429.	31989.	11	25430.	31989.	12	25441.	31988.
	13	27887.	31832.	14	28460.	31797.	15	29117.	31747.
	16	29553.	31724.	17	29956.	31718.	18	30347.	31706.
	19	30665.	31684.	20	30963.	31656.	21	31386.	31578
	22	31509.	31555.	23	31578.	31544.	24	31802.	31503.
	25	32193.	31420.	26	32305.	31410.	27	32808.	31388.
	28	33089.	31420.	29	33787.	31495.	30	34038.	31528.
	31	34144.	31543.	32	34195.	31552.	33	34399.	31578.
	34	35269.	31674.	35	35714.	31727.	36	35884.	31748.
	37	35970.	31755.	38	36321.	31783.	39	36499.	31796.
	40	37104.	31787.	41	37114.	31787.	42	37122.	31786.
	43	37156.	31783.	44	37729.	31731.	45	38826.	31601.
	46	38933.	31587.	47	38960.	31584.	48	38975.	31583.
	49	39038.	31578.	50	40190.	31451.	51	41062.	31459.
	52	41420.	31442.	53	41721.	31478	54	42117.	31578.
	55	42651.	31699.	56	44061.	31813.	57	44728.	31861.
	58	45111.	31884.	59	45382.	31898.	60	46256.	31988.
	61	47572.	32157.	62	49072.	32308.	63	50032.	32547.
	64	51365.	32809.	65	50032.	33068.	66	49068.	33307.
	67	47572.	33458.	68	46234.	33629.	69	45376.	33717.
	70	45111.	33730.	71	44737.	33753.	72	44083.	33800.
	73	42651.	33916.	74	42107.	34039.	75	41716.	34137.
	76	41420.	34173.	77	41068.	34156.	78	40190.	34163.
	79	39055.	34039.	80	38979.	34032.	81	38960.	34031.
	82	38927.	34028.	83	38795.	34011.	84	37729.	33885.
	85	37173.	33834.	86	37125.	33830.	87	37114.	33829.
	88	37100.	33829.	89	36499.	33820.	90	36303.	33834.
	91	35966.	33861.	92	35884.	33868.	93	35721.	33888.
	94	35269.	33942.	95	34387.	34039.	96	34190.	34064.
	97	34140.	34073.	98	34038.	34088.	99	33795.	34120.
	100	33118.	34192.	101	32808.	34228.	102	32308.	34205
	103	32193.	34195.	104	31791.	34110.	105	31578.	34071.
	106	31512.	34061	107	31395.	34039.	108	30963.	33960.
	109	30669.	33932.	110	30347.	33910	111	29963.	33898.
	112	29557.	33892.	113	29117.	33869.	114	28455.	33818.
	115	27887.	33784.	116	25460.	33629.	117	25435.	33627.
	118	25431.	33627.	119	25426.	33626.	120	25412.	33624.
	121	22966.	33421.						

APPENDIX 7.1.4 - VEHICULAR NOISE ANALYSIS METHODOLOGY

A mathematical model was used to predict the average vehicular traffic noise along the access road 10 meters from its centerline. The formula used in the simulation is as follows:

$L_a = L_w - 8 - 20 \log_{10} + 10 \log_{10} C$

where $L_w = 86 + 0.2V + 10 \log_{10} (a_1 + 8 a_2)$

L_a = average traffic noise at receptor, dBA

L = average sound power level of vehicle, dBA

C = pi (x/d) + tanh 2 (pi) (x/d)

pi = 3.14159

a_1 = ratio of light vehicles

a_2 = ratio of heavy vehicles

x = distance of receptor from road centerline (m)

d = average distance between vehicles (m)

= 1000 V/N

V = average speed (km/hr)

N = number of vehicles per hour

An average vehicle speed of 40 km/hr was used in the simulation.

7.2.1 NOISE MEASUREMENT AND ASSESSMENT

This section is adapted from US Department of Transportation, Federal Aviation Administration (DOTFAA), Advisory Circular 150/5020-1, "Noise Control and Compatibility Planning for Airports," August 5, 1983.

NOISE FUNDAMENTALS

Sound

This section provides a conceptual description of the acoustical metrics that comprise the DOTFAA approved system for aircraft noise measurement. The sound experienced in our everyday lives is the result of objects or bodies being set into vibration. This vibration causes a motion in the surrounding air resulting in a minute variation in atmospheric pressure called "sound pressure." This sound pressure forms the basis to measure sound and is usually expressed as a sound pressure level in decibels, which are units expressing logarithmically the ratio of two values (i.e., between a measured quantity and a referenced value).

Another important characteristic of sound is its "frequency." The human ear is sensitive to frequencies ranging from 20 to 20,000 hertz (cycles per second). The simplest of all sounds are those composed of a single frequency, called pure tones. However, the sounds to which people are usually exposed are much more complex, since they are composed of many frequencies, each occurring simultaneously at its own sound pressure level.

Decibels

Sound pressure level is a measure of the amplitude of the sound, while frequency relates to the sound's pitch. The range of sound pressures of interest is represented on the low end by the threshold of hearing of normal young people and on the upper end by the noise of gunfire at close range. Table 7.2.1 presents a subjective assessment of how easily recognized sounds are perceived. Stated in physical terms, this sound pressure range is approximately from 0.00002 to 2,000 pascals. It is clear that this is a tremendous range of sound pressures. An analogous problem would be that of measuring lengths ranging from 25 mm to 2,500 km. Because acoustics deals with the effects of small changes near the threshold of hearing as well as the effects of small changes near the upper end of the scale, a proportional scale is more appropriate than a linear scale to handle this wide variation in sound pressure. The simplest mathematical scale available for this purpose is the lograrithmic or decibel scale. A decibel (dB) is defined as 10 times the logarithm (to the base 10) of a power or intensity ratio.

Sound Pressure Levels

Sound pressure level is expressed as 10 log (P^2/P_o^2), where P_o is the reference pressure and P is differential pressure of a sound over that of ambient pressure. This is equivalent to 20 times the logarithm of the ratio of the pressures. It is also important to note that the reference pressure has been internationally standardized as 0.00002 pascals, which is approximately the threshold of human hearing. Because of the logarithmic nature of the decibel scale, a sound pressure level of 60 dB corresponds to a pressure, not 60 times the reference pressure, but 1,000 times the reference pressure. Thus 20 log (1,000) = 20(3) = 60.

Table 7.2.1: Comparisons of Sounds, Subjective Evaluation and Corresponding Decibel Levels

Examples	Subjective Evaluations	Decibels
Near jet engine	Deafening	140
Threshold of pain	Deafening	130
Hard Rock Band	Deafening	120
Accelerating motorcycle	Deafening	110
Noise urban street	Very loud	90
Noisy factory	Very loud	85
Range of speech	Moderate to loud	48-72
Average office	Moderate	50
Soft music in apartment	Faint	40
Average whisper	Faint	20

Source: M. David Egan, *Concepts in Architectural Acoustics*, McGraw Hill, 1972.

A-Weighted Sound Pressure Levels (dBA)

Sound is a physical phenomenon that affects many things besides people. However, when sound is measured in order to relate to the reactions of people, it is necessary to use a measure that relates to the way human beings hear sound. It has been found that people are more sensitive to higher frequencies (treble) than lower frequencies (bass). That is, the human ear discriminates against lower frequencies. To measure sound in a way that corresponds to the way people hear sound, the ear's discrimination must be duplicated. This is accomplished electrically using a device called a "weighting network." Because unweighted sound pressure level does not correlate well with human assessment of the loudness of sounds, weighting networks were added to sound level meters to attenuate low and high frequency noise to approximate the response of the human ear to sound. One of these weighting networks was designated "A". It is measured in decibels that are usually designated "dBA". A-Weighted Sound Level has been found to correlate well with people's subjective judgment. Its simplicity and superiority over unweighted sound pressure level in predicting people's response to noise have made it the most widely used metric for assessing the impact of aircraft noise and for comparing that noise with other community noise sources.

Definitions

A-Weighted Sound Level (dBA). The A-Weighted Sound Level is sound pressure level that has been filtered or weighted to reduce the influence of low and high frequency noise. It was designed to approximate the response of the human ear to sound.

Yearly Day-Night Average Sound Levels (L_{dn}L). The 24-hour average sound level, in decibels, for the period from midnight to midnight, obtained after the addition of 10 decibels to sound levels for the periods between midnight and 7 a.m. and between 10 p.m. and midnight, local time, as averaged over a span of one year. It is the DOTFAA standard metric for determining the cumulative exposure of individuals to noise. While people respond to the noise of single events (particularly to the loudest single event in a series), the long-range effects of prolonged exposure to noise appear to best correlate with cumulative metrics. Such a unit provides a single number that is equivalent to the total noise exposure over a specified time period. Thus, cumulative noise units are based on both time and level. The day-night average sound level (L_{dn}) specified as the noise metric for cumulative exposure is such a unit. Specifically, the L_{dn} is the yearly average of the A-weighted sound level integrated over a 24-hour period. It also incorporates a 10 dB step function weighting to aircraft events between 10 p.m. and 7 a.m. to account for the increased annoyance to noise during the night hours.

Noise Exposure Map. A scaled, geographic depiction of an airport, its noise contours, and surrounding area.

Noise Contour. A continuous line on a map of the airport vicinity connnecting all points of the same noise exposure level, usually the L_{dn} 65, 70 and 75 levels.

Airport Noise Compatibility Program. A program reflected in local and/or national regulations, including measures proposed or taken by the airport operator or other responsible agency to reduce existing noncompatible land uses and to prevent the introduction of additional noncompatible land uses within the area.

INTERPRETATION OF NOISE EXPOSURE MAPS

Note that it is possible that the process of plotting noise contours onto locally generated land use maps to introduce a degree of charting imprecision, especially relative to property lines on the land use map. These functions are inseparable from the ultimate land use control and planning responsibilities of local government. Therefore, the responsibility for the detailed overlaying of noise exposure contours onto the map of adjacent properties on the surface rests exclusively with the airport operator submitting those maps, and/or with those public agencies and planning agencies with jurisdiction over the airport site area.

LAND USE COMPATIBILITY

L_{dn} contours indicate the boundary lines between areas of acceptable or unacceptable noise exposures for various land uses. The contours do indicate the trend in relative noise levels. However, vegetation, land contours, and the position of buildings or walls may often affect the impact of noise on the human users at a specific site.

L_{dn} levels may vary somewhat above or below the predicted levels for a particular location, depending upon local topography and vegetation, and upon final aircraft loadings and operations. All land uses may be considered as normally compatible with noise levels less than 65 L_{dn}. Local needs and values may dictate further delineation based on specific local requirements or determinations as well as low ambient levels. Other local noise sources may often contribute as much as or more than aircraft to the total noise exposure at a specific location.

Tables 7.2.2 and 7.2.3, following, provide, as general reference material, information on noise generated by various types of construction equipment, and the compatibility of various uses with different noise levels.

Table 7.2.2: Noise Levels (dBA) Expected from Various Construction Equipment at Selected Distances

	Meters				
	30	50	100	200	400
Air compressor	69-81	65-77	59-71	53-65	47-59
Backhoe	65-87	61-83	55-77	49-71	43-65
Compactor	66-68	62-64	56-58	50-52	44-46
Concrete mixer	69-82	65-78	59-72	53-66	47-60
Concrete pump	76-78	72-74	66-68	60-62	54-56
Crane	70-80	66-74	60-68	54-62	48-56
Front Loader	66-75	62-71	56-65	50-59	44-53
Generator	66-76	62-72	56-66	50-60	44-54
Grader	74-87	70-83	64-77	58-71	52-65
Jackhammer	75-91	71-87	65-81	59-75	53-69
Paver	89-99	85-95	79-89	73-83	67-77
Pump	64-84	60-80	54-74	48-68	42-62
Tractor, bulldozer	72-89	68-85	62-79	56-73	50-67
Truck	77-87	73-83	67-77	61-71	55-65
Vibrator	62-75	58-71	52-63	46-57	40-51

Source: Wilbur Smith Associates

Table 7.2.3: Land Uses Normally Compatible With Various Noise Levels

Land Uses	Yearly Day-Night Average Sound Level (L_{dn}) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, Other Than Below	Y	N	N	N	N	N
Mobile Home Parks	Y	N	N	N	N	N
Transient Lodgings	Y	N	N	N	N	N
Public Use						
Schools, Hospitals, Nursing Homes	Y	5	10	N	N	N
Churches, Auditoriums, Concert Halls	Y	5	10	N	N	N
Governmental Services	Y	Y	5	10	N	N
Transportation	Y	Y	Y	Y	Y	Y
Parking	Y	Y	Y	Y	Y	N
Commercial Use						
Offices, Business and Professional	Y	Y	5	10	N	N
Wholesale	Y	Y	Y	Y	Y	N
Retail, Building Materials, Hardware	Y	Y	Y	Y	Y	N
Retail, General	Y	Y	5	10	N	N
Utilities	Y	Y	Y	Y	Y	N
Communications	Y	Y	5	10	N	N
Manufacturing and Production						
Manufacturing General	Y	Y	Y	Y	Y	N
Photographic and Optical	Y	Y	5	10	N	N
Agriculture and Forestry	Y	Y	Y	Y	Y	Y
Livestock Farming and Breeding	Y	Y	Y	N	N	N
Mining and Fishing	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor Sports Arenas, Spectator Sports	Y	Y	Y	N	N	N
Outdoor Music Shells, Amphitheaters	Y	N	N	N	N	N
Nature Exhibits, Zoos	Y	Y	N	N	N	N
Amusements, Parks, Resorts, Camps	Y	Y	Y	N	N	N
Golf Courses, Riding Stables, Water Recreation	Y	Y	5	10	N	N

Notes:

Y - Yes, the use is compatible with the indicated noise level.
N - No, the use is not compatible with the indicated noise level.
5, 10 - Land use and related structures are generally compatible but measures to achieve noise levels reductions of 5 or 10 L_{dn}, outdoor to indoor, beyond that obtained by normal construction, should be incorporated into design and construction of structures.

Source: US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5020-1, *Noise Control and Compatibility Planning For Airports*, August 5, 1983.

APPENDIX 7.3 - CONTACT LISTS

UNITED STATES

USAID

Office of Capital Projects	Alex Sundermann, Project Development Officer Michael Kingery, Manager, Mindanao Development Project James Starnes, Mission Environmental Officer James Tarrant, Environmental Specialist

REPUBLIC OF THE PHILIPPINES

Department of Natural Resources

Environmental Management Bureau	Beta Balagot, Acting Director Engr. Mariano Desquitado, Assistant Director Romeo Tarray, EIS Section Head

Department of Education, Culture and Sports

National Museum	Jesus T. Peralta, Ph.D., Curator Eusebio Z. Dizon, Ph.D., Archaeology Division

National Census and Statistics Office	Antonio F. Flores

General Santos City

Office of the Mayor	Honorable Rosalita T. Nunez, Mayor
City Council	Honorable Alice V. Posadas, Chairwoman, Office of the Sanggunian Panlungsod
Office of the City Planning and Development Coordinator	Manuel Sales, City Planning and Development Coordinator Katrina J. Acharon, Planner II
Office of Social Service Development Human Settlement Division	Rebecca V. Magante, Head I Josefina Aloba, Resettlement Specialist Henry Moreno, Administrative Assistant Emily G. Baru, OSSD Worker, San Roque, Calubihan
City Agriculturist's Office	Idelfonso O. Lambosa, City Agriculturist
Bureau of Internal Revenue	Rafael Garay, Sr., Assistant Administrator
Assessor's Office	Angel Daproza, Chief Assessor Denissa Gubaton, Assistant Assessor
Fire Department	Capt. Virgilio Tobias, Station Commander
General Santos City Airport	Eduardo Batonbalones, Airport Manager

Mindanao State University	Norberto Andies, Vice Chancellor for Academic Affairs
Social Sciences Department, College of Arts and Sciences	Prof. Virginia Buhisan Domingo Non, Ph.D.
High School Department	Bernardita B. Ruiz, Coodinator of Student Activities
Health Department	Dr. Mely Penaflorida, Medical Health Officer II U.S. Ramirez, Assistant Health Officer
Sanitation Department	Florentino Membrado, Sanitation Inspector II, Buayan Ernesto Arancon, Sanitation Inspector II, Tambler Virgilio Flores, Sanitation Inspection Engineer I, Buayan Danilo A. Canencia, Sanitation Inspector III

<u>Barangay Officials and Residents</u>	Jacinto Acharon, President, Bgy. Captains Association Rogelio Solis, Buayan Antonio Fernando, Tambler (Fatima) Antonio Olarte, Sinawal Delia Rabanes, Apopong Eduardo Baladion, Puro, IV President, Apopong Editha Fernando, President, Purok I, Tambler Eliza Penuelas, Zone 7, Block 3, Tambler Entoy Quipo, Purok President Luzviminda O'Beta, Upper Tambler, Uhaw, Healer Bonifacio Lota, New Anggas Woodcraft, Resident Remy Catalan, Resident Danilo T. Francisco, Soldier (Upper Tambler) Benjie Tan, Soldier (Upper Tambler) Daniol Piodeno, Soldier (Upper Tambler) Eddie Amantilla, Kagawad, Asinan, Buayan Renato Manlangit, Purok Chairman, Asinan, Buayan Bing Vergara, Purok 2 Chairwoman and Secretary, Buayan Mr. & Mrs. Patricio Amadeo, Residents, Buayan Eduardo Amadeo, Resident, Buayan
<u>SOCOTECO II</u>	Engr. John R.D. Alcasid, Operations Manager
<u>Clergy</u>	Father Gabriel Baldostamon, OP, Our Lady of Good Voyage Bro. Robert McGovern, Business Resource Center, Notre Dame of Dadiangas, General Santos City Father Raul R. Vale, Sts. Peter and Paul Parish

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APPENDIX 7.5 - SUMMARY OF PUBLIC PARTICIPATION

Public participation on the Feasibility Study to date has been both formal (scheduled public meetings) and informal (contacts to obtain information or otherwise). Contacts for data collection are listed in Appendix 7.3. Formal public meeting presentations are described here.

7.5.1 BARANGAY CAPTAINS MEETING

On 6 February 1991, a meeting was held with the Association of Barangay Captains in General Santos City. Also in attendance were representatives of the City Mayor's Office. The purpose of the meeting was to outline the intent of the study, identify the sites and alternatives under analysis, present the anticipated scheduling of the study, and learn what concerns the Captains had. The Captains were also requested to communicate the information presented at the meeting to their constituencies, and to assist study participants in data collection and information dissemination, and to prepare inhabitants of the subject barangays (Buayan, Apopong, Sinawal and Tambler) for visits by study team members.

The Captains of Barangays Apopong, Tambler and Buayan expressed a desire to have the airport in their respective barangays and gave reasons why they believed their barangays were suitable for airport development. They indicated that they believed the airport would be beneficial particularly in terms of employment opportunities to barangay residents. The Captain of Barangay Buayan expressed his peoples' fears concerning dislocation and adequate compensation. The Captains also questioned if the project was a loan or a grant. In addition, the issue of potential noise impact was raised.

7.5.2 SCOPING SESSIONS

In conformance with USAID requirements, two Scoping Sessions were held on the project, one in General Santos City, and one in the Metro Manila area. The purpose of the sessions was to describe the alternatives, present findings to date, information on the process and schedule, and solicit comments concerning issues that should be addressed in the EA/EIS.

The first Scoping Session was held on 20 February 1991 in General Santos City. Seventy-four individuals attended, representing government agencies, non-governmental organizations (NGOs), academics, business and commercial interests, and private individuals. In addition to invitations, local radio stations and newspapers were notified, and notices were posted at City Hall. All notices and invitations were presented in both English and Pilipino. Invitations included a handout describing the alternatives, the scope and scheduling of studies, the proposed processing of environmental documentation, identification of issues and a description of the proposed contents of the environmental document.

The second session was held in Quezon City on 1 March 1991. This session was scheduled as a convenience to government and non-government agencies located in the Metro Manila area. The sessions were held before a preferred alternative had been identified. Some of the comments therefore dealt with impacts that could have occurred only at the Buayan site, such as those associated with a marine environment.

The majority of comments relating to environmental issues concerned noise, specifically aircraft noise and its effects on residents, children, livestock and fish. Other points concerned alternative sites (Koronadal and the Mindanao State University [MSU] compound in Barangay Tambler); reservation of space at the airport for national security purposes; alternative transportation improvements (rail service); recycling; noise and air quality impacts from new traffic; water quality effects from dredging coral or other fill material and emplacement; use of coral as fill; encroachment of tall buildings or incompatible land uses, including squatters, into the airport clear zones; restriction on development because of the need for height and hazard control; potential for inappropriate use of prime land for infrastructure when it should be reserved for residential use; impacts on crocodiles in Buayan River; and the potential for a runway extension into the Bay that could result in a storm directing water towards the city.

Many of the comments were directed to the project itself, rather than the scope of the environmental assessment. Commentators were by and large in favor of the project, with some expressing preference for a particular site and the project's importance to the development of General Santos City; and some posing such questions as whether or not a site had already been selected; whether the program was a loan or a grant; and who would the airport serve.

During the question and answer period, a number of these concerns were addressed, as follows:

- Funding for the Feasibility Study is a grant, not a loan.
- There are no crocodiles in Buayan River; the river was named for the place of origin of one of the early Muslim settlers, not for "Buaya", which means crocodile in the local dialect.
- The use of coral as embankment material did not appear cost effective.

7.5.3 MSU MEETING

On 25 April 1991, a meeting was held at the Mindanao State University (MSU) compound in Tambler (Fatima) with faculty, staff and students of MSU, and residents and officials of the surrounding Upper Tambler area to discuss the latest findings of the study, to describe the layout of the airport and access road, and to hear concerns of those present.

The meeting was attended primarily by faculty, staff and students at MSU, and Fatima Barangay officials and residents of the Upper Tambler Resettlement area. In addition, the meeting was attended by staff of various city offices, and officials and residents from other Barangays, including Tambler and Buayan.

The issues raised were as follows: hazards such as crash landings, oil and fuel spills, jet thrust knocking over buildings, emergency response procedures, damaging noise from aircraft, especially for children, and in the future with more aircraft operations, and dust generated by aircraft landings and takeoffs; the possibility of imported labor crews and preferential hiring during construction and operation for residents of the Upper Tambler Resettlement Area; active contribution of the project proponent to improvement of community resources in the Upper Tambler Resettlement Area and infrastructure such as roads, power and water supplies; who would benefit from the airport and who would bear its costs; the establishment of buffer zones, including the planting of trees, between the airport and adjacent uses; loss of housing settlement area to the airport, especially in the future; what assurances could be made for no night flights in the future and no international operations; movement of the proposed access road alignment to bypass the 39-hectare resettlement area south of MSU (Lot 3); and the need to reserve a four-lane right-of-way for the road for future traffic levels. A request was made for an opportunity to review the EA/EIS. A group consensus was reached favoring the airport at the recommended location, with their efforts to be concentrated on assuring that the facility was a "good neighbor," both in the short and long term.

7.5.4 PERCEPTION SURVEY

A total of 190 respondents were included in the perception study. Half of these (51%) are residents of communities near the location of the proposed project site, both the Upper and Lower Tambler. The study likewise sought the opinions and perceptions of 78 students and employees from MSU. Fifteen respondents were from the City.

A structured interview schedule was used to facilitate the interviews (the questionnaire is included at the end of this section). The research instrument was designed to elicit the respondents' knowledge and assessment of changes in their community as well as their awareness of expectations and opinion regarding the proposed project. The results of the survey are presented below.

<u>Observed Changes in the Community</u>

Almost all of those interviewed (94.7%) mentioned having observed certain changes in their community/town during the past five years. Three out of four (75.8%) indicated the construction/setting up of more factories and industries, while two out of three (66.8%) mentioned the increased fish and shellfish harvest in the city. A slightly lower proportion of the respondents (62.1%) said that there are more fishing grounds now than before. One-fourth cited less flooding of low areas in the city. On the negative side, some respondents mentioned having observed the increasing water (17.4%) and air pollution (33.7%) in their locality. Also, two out of every five respondents (42.2%) noted the decreasing forest cover (25.3%) in General Santos City.

Many respondents consider the progress of General Santos City as reflected in the increased number of factories and industries and in the improved fish and shellfish harvest as very important for them and their community. Only a few see the negative effects of urbanization and industrialization such as pollution and deforestation as significant changes.

When asked to indicate what industries and projects were set up in their area, two-fifths of those interviewed (41.1%) mentioned the construction of facilities and infrastructure related to fishing such as the fish/tuna processing plant, ice plant and fishing port that indicates the growing fishing industry in the city. Other infrastructures and industries mentioned were factories (35.2%), power plant (8.9%), schools (1.6%), water system facilities (1.6%), supermarkets and department stores (1.1%), Dole plantation (1.1%), and roads and bridges (0.5%).

Awareness and Perception of the Proposed Project

Almost nine out of 10 respondents (88.9%) are aware of the proposed airport project. Half of them (49.5%) heard about the project from barangay officials. Others learned about it through the radio (20.5%), family members (5.8%), other people (4.2%), friends (3.7%), fellow students (4.7%) and other sources (see Table 7.5.1).

Table 7.5.1: Awareness of Project and Source of Information

	Aware of Project				
	Yes	Percent	No	Percent	Total
	169	88.9	21	11.1	190

Source of Information	Total	Percent[1]
Barangay Official	94	49.5
Radio	39	20.5
Family Member	11	5.8
Other people	8	4.2
Friends	7	3.8
Other Establishment	5	2.6
Co-students	9	4.7
Others	3	1.6
Co-workers	2	1.1
Co-faculty	2	1.1
Print media	1	0.5
No Answer	22	11.6
TOTAL	190	-

[1] Multiple responses. Percentages do not add to 100%.

Source: General Santos City Air Service Improvement Feasibility Study, Perception Survey, April 1991.

Many of those interviewed (96.3%) welcome the construction of the airport in their community because of its expected positive effects on their city. Slightly less than nine-tenths (87.4%) of them see the employment opportunity the airport can provide to some residents of General Santos City, while four-fifths (81.6%) see it as an additional source of income. Three out of five respondents (61.1%) believe that it will help improve their power supply, while one out of two see its positive impact on housing opportunities. Two-fifths (40.5%) of the sample believe that the airport will also help improve community solidarity (see Table 7.5.2).

On the other hand, more than half of the respondents (51.6%) also see some negative effects that the project may bring about. The most negative perceived effect of the airport project concerns the threat it poses to human health. Other negative effects mentioned by the interviewees include water pollution (11.1%), depletion of the forest cover (6.8%), decrease in fish harvest (5.8%), noise (5.8%), decrease in crop harvest

(4.2%), flooding (3.2%), salt water intrusion (1.6%), traffic (0.5%), soil erosion (0.5%), and displacement of residents (0.5%) (see Table 7.5.2).

Table 7.5.2: Perceived Positive and Negative Effects of the Project

	Number[1]	Percent[1]
Positive Effects		
Employment Opportunity	166	87.4
Source of Income	155	81.6
Power Supply	116	61.1
Housing	95	50.0
Community Solidarity	77	40.5
Water Facilities	4	2.1
Transportation/Business Profit	1	0.5
None	7	3.7
Negative Effects		
Human Health Hazard	70	36.8
Water Pollution	21	11.1
Depletion of Forest Cover	13	6.8
Decrease in Fish Harvest	11	5.8
Noise	11	5.8
Decrease in Crop Harvest	8	4.2
Flooding	6	3.2
Others	4	2.1
Salt Water Intrusion	3	1.6
Traffic	1	0.5
Soil Erosion	1	0.5
Displacement of Residents	1	0.5
None	92	48.4

[1] Multiple responses. Numbers and percentages do not add to 190/100%.

Source: General Santos Air Service Improvement Feasibility Study, Perception Survey, April 1991

Despite these perceived negative effects, nine out of 10 (91.6%) respondents see the proposed airport as a great help to local residents and the community. Only a few (2.6%) believe that the project will do more harm than good to their community (see Table 7.5.3). In fact, almost four-fifths (78.9%) of those interviewed indicated that they are willing to work in the constructon or operation of the airport (see Table 7.5.3).

Table 7.5.3: Perceived Benefit of and Willingness to Work at Project		
Perceived Degree of Benefit of the Project to the Community	Number	Percent
Help the community and local residents a great deal.	174	91.6
Help the community and local residents only a little.	11	5.8
Harm the community and local residents.	5	2.6
TOTAL	190	100.0
Willingness of Respondents to Work at the Airport During Construction and Operation	Number	Percent
Yes	150	78.9
Not Sure	27	14.2
No	13	6.8
TOTAL	190	99.9
Source: General Santos City Air Service Improvement Feasibility Study, Perception Survey, April 1991		

PERCEPTION STUDY FOR ENVIRONMENTAL IMPACT STATEMENT[1]

Part I. Environmental Change

1. Have you observed any changes in your environment (community, town or province) in the past five years?

   ______ yes (proceed to #2) ______ No (Probe)

2. The observed changes include (circle M for more, L for less):

RANK	Items	Degree of Change	
____	Factories/Power Plants/Industries	M	L
____	Fishing/Shellfish Harvest	M	L
____	Fishing Grounds	M	L
____	Water Pollution	M	L
____	Air Pollution	M	L
____	Forest Cover	M	L
____	Flooding in Lowland	M	L

3. Using the RANK column in question #2, ask respondent to rank the three most important items with #1 as the most important.

Part II. Awareness of the Proposed Project

4. For the past 10 years, what industries/projects/factories/power plants were put up/constructed in this town?

5. Are you aware of the proposed airport project and the project sponsor?

   ____ Yes (proceed to #6)

   ____ No (Interviewer: Briefly describe the project, focusing on physical facilities and changes, and possible environmental effects. Then proceed to #7.)

6. How did you learn of the proposed project? Identify below.

Radio	Family Member	TV
Parish Priest	Barangay Officials	

Others (specify) ______________________________

7. What do you think will be the effects of the project on your community/town/ province? Check the major item and circle specific parameters.

______ POSITIVE EFFECTS

a. employment
b. income
c. power supply
d. community solidarity
e. housing
f. others (specify):

______ NEGATIVE EFFECTS

a. decrease in fish/shellfish harvest
b. water pollution
c. salt water intrusion
d. decrease in crop harvest
e. flooding
f. depletion of forest cover
g. human health/hazard
h. others (specify):

8. In your opinion, the proposed project will

______ help the community and local residents a great deal.

______ help the community and local residents only a little.

______ not help the community and local residents.

______ harm the community and local residents.

Part III. Aspiration

9. If given the opportunity to work at the airport, during construction and/or operation, would you take the opportunity?

______ Yes. Why?

______ No. Why?

______ Not sure. Why?

Signature of Interviewer ______________________________

Respondent No. ______________

Barangay ______________

Interviewer ______________

Date of Interview ______________

[1] Prepared by the Environmental Impact Assessment (EIA) Section of the Environmental Management Bureau (EMB) to assist project proponents in addressing the need to focus the relevant issues in a perception survey.

APPENDIX 7.6 - LIST OF ASSESSMENT PREPARERS

This Environmental Assessment/Environmental Impact Statement was prepared by Wilbur Smith Associates in Joint Venture with Sycip, Gorres and Velayo, Inc. The following individuals participated in preparation of the document.

Avril Tolley, Project Manager, Environmental Planner, BA, Economics. Ms. Tolley has 11 years experience in environmental analysis encompassing federal (US) and state (California) environmental documentation on a broad range of projects, including agricultural, industrial, commercial and residential. In addition to her many years of private consulting for federal, state, local and private clients, Ms. Tolley served as the Environmental Planner for a large metropolitan city in the US. Ms. Tolley has extensive experience in project management and is familiar with a wide variety of environmental assessment techniques in numerous disciplines including traffic, noise, air quality, land use and socio-economics.

John G. Wyndham, Urban and Transportation Planner, MA, Regional Planning, BS, Economics and Management. Mr. Wyndham has 29 years professional experience in the fields of economic development, urban and regional planning and environmental assessment. He has worked for public agencies in the US in the management of urban development. Most of his career has been as a consulting planner. He has managed projects for airport-related land development and land use controls in Bolivia and the US. He has been responsible for environmental assessments for airports, highways, ports, transit systems, industrial parks, and agro-processing facilities in Egypt, Singapore, Chile, Nigeria, and the US. He has conducted urban planning and site development studies in Indonesia, Papua New Guinea, Panama, the United Kingdom and the US. He has served on the faculty of the School of Law at the University of South Carolina, lecturing on land use controls.

Luzviminda B. Valencia, Social Scientist, EdD, Social Studies, MA, Sociology, BSE, Social Studies. Dr. Valencia has 25 years experience practicing and teaching in the social sciences in the Philippines, the US and India. In addition to her duties as Professor of Sociology at the University of the Philippines, Diliman, Quezon City, Dr. Valencia has acted as visiting faculty at the Harvard Medical School, as Temporary Advisor and Visiting Expert to the World Health Organization (WHO), and as Social Scientist for the Tropical Disease Research Foundation. Dr. Valencia teaches a seminar on Human Ecology with special emphasis on environmental health, and on techniques of Social Impact Analysis. Some of her consulting activities include participation in a study of the financial feasibility of potable water to rural areas for USAID/RP Ministry of Local Government, and the project, Development of National Planning Guidelines for Sponsored Community Participation in Water Supply and Santitation Projects, WHO/NEPC. Dr. Valencia has co-authored numerous professional publications.

Jorge G. de las Alas, Noise Control Specialist, PhD and MS, Meteorology, BS, Civil Engineering. Dr. de las Alas has 25 years experience in the specialized fields of mathematical modelling; air pollution meteorology; numerical weather prediction; and dynamic meteorology and oceanography. At the University of the Philippines, Diliman, he is Chairman of the Department of Meteorology and Oceanography and Professor of Meteorology, College of Science. He is a member of the Executive Advisory Council, Natural Science Research Institute. Dr. de las Alas has served as Visiting Scientist, Lecturer and Scientific Director for training and scientific programs in Sri Lanka, Taipei, Thailand and the US. His consultant activities have included the following: noise pollution studies for Pilipinas Shell Petroleum Corporation; the Tiwi-Makban Geothermal Power Plant Project; and environmental assessments for the Tagaytay Highlands Project, the FSE project of Lepanto Consolidated Mining Corp., and the North Davao Mining Project; and an environmental management plan for the Hetura Meja Forest Development. Dr. de las Alas is co-author of many professional publications.

Artemio Bernardino, Air Quality Specialist, ME, Environmental Engineering, BS, Chemical Engineering, Licensed Chemical Engineer. Mr. Bernardino has 19 years experience. His education and experience include the Philippines, Japan, Belgium, and Thailand. He is president of Total Consultancy Service, Inc., and is a member of the Technical Review Board of the Environmental Management Bureau. Mr. Bernardino has managed several EISs including: Ortigas Extension Project; IndoPhil Pentaerythritol Plant in Batangas; and the Lead Smelter Plant in Marilao. His consultant experience includes analyzing air quality impacts on the following projects: Solder Dip Operations of Motorola Phil.; Cebu Terminal Complex, NPC; and the Tantuco Coal Mines, Pasig. He has also participated on numerous projects involving solid waste and wastewater considerations.

Ely A. Ouano, Water Quality Specialist, Postdoctoral Fellow, Chemical Engineering, Doctor of Engineering (Environmental), ME, Environmental Engineering, BS, Chemical Engineering, Licensed Chemical Engineer. Dr. Ouano has 15 years experience in the study of water quality and wastewater systems. His education and consulting experience include the Philippines, Brunei, Austrialia, Thailand, Indonesia and Sri Lanka. Dr. Ouano has been involved in the analysis and design of numerous wastewater collection and treatment sytems, including: WHO/SEARO Integrated Sanitation Project Feasibility Study, Indonesia; WHO/PEPAS study on sewage and refuse disposal in slum areas, Malyasia; Intercepting Sewer and Lift Station, Pepsi Cola Bottling Plant, Cebu; and the Philips Component Wastewater Treatment Plant. He served as in-house consultant for review of drainage feasibility studies, detailed engineering design and construction of USAID-funded projects for the Economic Support Fund Secretariat, Philippines. Dr. Ouano's experience in water supply projects includes: Water Distribution System, Independent Realty Corporation; Phase II Feasibility Study, Cagayan de Oro System; and Economic Support Fund, Office of the President, water supply, drainage and solid waste management studies. Dr. Ouano has authored several professional books and other publications.

Bernardo Valenzuela, Soil Scientist, BS, Agriculture. Mr. Valenzuela has 10 years experience. He is currently Chief, Soil Survey and Land Classification Division, National Irrigation Administration. In this position, he evaluates soils and land resources data with respect to crop production and irrigation projects; interprets physical and chemical properties of soils; and identifies and classifies areas of land suitability, limitations such as saline and alkali soils, drainage and topography. His education and experience include the Philippines, Indonesia and Japan. He served as a soils scientist for the Soil Survey Division, Bureau of Soils, Manila. He participated in the Arakan Valley Rehabilitation Project and Nationwide Land Resources Pre-feasibility Studies for NEDA and the National Irrigation Administration.

Porfiro Alino, Marine Biologist, PhD, MS and BS, Marine Biology. Dr. Alino has 10 years experience. In addition to his consulting activities, Dr. Alino is an Assistant Professor at the Marine Science Institute at UP Diliman. He is research assistant for various projects undertaken at the Institute including: EIA, Marinduque Copper mine tailings outfall monitoring; EIA, Batanes Port; and NPC, Bioaccumulation of Trace Metals on Marine Organisms, Tiwi Geothermal Plant. Dr. Alino has served as project leader on a number of other projects including: Tropical Dynamics and Fisheries Yield on Coral Reefs; Recovery and Recolonization of Damaged Reefs and Rehabilitation by Coral Transplantation; and Stability of Coral, Fish and Soft Bottomed Communities. Dr. Alino has authored and co-authored numerous professional articles and publications.

Julito Baldissimo, Terrestrial Ecologist, MSc, Environmental Engineering, BS, Ed/Biology. Mr. Baldissimo has 11 years experience. He is Assistant Professor, Department of Biology, De La Salle University. He conducted an EIA on Community Water Supply projects in various communities. He also participated in assessments on the planning and management of solid wastes for Cebu, the UNEP project on Regional Seas Program, and the Canlubang Industrial Estate. Mr. Baldissimo has authored and co-authored a number of professional publications.