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ENVIRONMENTAL ASSESSMENT
PANAMA RURAL ACCESS ROADS PROJECT

environment consultants, inc.

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ENVIRONMENTAL ASSESSMENT:

PANAMA RURAL ACCESS

ROADS PROJECT

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Environment Consultants, Inc.

14325 Proton Road
Dallas, Texas 75240

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I. INTRODUCTION

A. PROJECT IDENTIFICATION

The Government of Panama (GOP) has recognized that an adequate transportation network is a necessity to assist economic development throughout the country. Although the GOP has undertaken a program to update transportation, efforts have been hindered by inadequate rural road planning and by inadequate road maintenance. Thus, this rural road project was developed to expand and strengthen the GOP's ability to properly plan, upgrade, and maintain rural access roads.

B. REQUIREMENTS AND PURPOSE FOR THE ENVIRONMENTAL ASSESSMENT

The relationship between the Agency for International Development (AID) and a prospective foreign borrower (or grantee) is different from agencies participating in an intra-US governmental project, and final decisions are the responsibility of the government of the host country.

It is the policy of AID to conform with the spirit, intent, and objectives of the National Environmental Policy Act of 1969 (NEPA) in all development activities abroad which are financially assisted with US funds. Coordination with the participating country and its agencies is necessary to insure that project analyses, planning design, and implementations reflect consideration of environmental factors and alternatives. There is no intent to impose US standards, priorities, or solutions upon a foreign government through this procedure. Rather, it is intended to fulfill the objectives of the NEPA while affording recognition of the bilateral nature of the decision-making process. Missions are encouraged, therefore, to promote environmentally sound development through:

i) assurance that assessment of environmental impacts is undertaken early in project identification and formation so that consideration of environmental impacts becomes an integral part of the project development, planning, and design;

ii) assurance that information relating to environmental impacts and potential consequences of project development is received, understood, and considered by the borrower/grantee country;

iii) assurance that there is mutual agreement between the borrower/grantee country and AID on environmental considerations and safeguards to be included in the development project; and

iv) assurance that the project minimizes adverse environmental impacts.

This Environmental Assessment is in conformance with procedures established under Regulation 16, US Agency for International Development Environment Procedures.

C. METHODOLOGY FOR ENVIRONMENTAL ASSESSMENT

An interdisciplinary approach was utilized to investigate the potential effects of the Panama Roads Project. The base team in Panama was composed of a civil engineer and a tropical ecologist/forester. This base team was supported by a hydrologist/soils engineer, ecologist/agronomist, aquatic biologist, anthropologist, sociologist/economist, and several technical personnel. The team's initial effort involved a thorough literature investigation and familiarization with project documents and plans. The files of the US AID Mission in Panama and many libraries, including those of the Smithsonian Tropical Research Institute and the Canal Zone Library, and pertinent data from GOP offices, were researched for relevant background material.

Information was provided by representatives of various Government Ministries, including the Ministry of Agricultural Development (MIDA) and the Ministry of Public Works (MOP). Other local experts in agriculture, archaeology, ecology, forestry, history, and wildlife conservation were contacted for assistance. Visits to the National Museum, Canal Zone Museum, and the Summit (Botanical/Zoological) Gardens provided additional information and data on the historical and natural resources of the country.

A site inspection to a representative rural site--Capira-Monte Oscuro and Altos de Campana National Park areas--was conducted by the field team. During this trip, interviews were conducted with Panamanian personnel familiar with the project. Field observations of plants, wildlife, ecosystems and agriculture were conducted. The characteristics, capabilities, and customs of the government officials, road personnel, and farmers who would benefit from this project were studied. Subsequent to the field inspection, but prior to preparation of the Final Report, a series of analyses and evaluations were made. Field notes were used to determine ecosystem characteristics. A series of interdisciplinary meetings were held to ascertain the probable direct and secondary impacts of the road project under various conditions.

During the development of the project, environmental considerations were given a high priority. Selection criteria were formulated to insure the roads to be improved were not penetration type roads, but would benefit existing farm areas. Inspection forms were developed to provide detailed information on roads which passed the initial stage of selection. Included in the inspection forms was a part relating specifically to the environment. Information would be obtained which could be utilized to initially eliminate roads whose improvement might result in a significant adverse impact. To insure expertise is available to correctly complete the environmental portion of the form, technical assistance will be provided to train Panamanian personnel.

One of the major problems associated with existing roads in Panama is erosion, therefore special attention was given to minimizing that potential. Strict maintenance requirements were developed to insure erosion was kept at a minimum. An audio-visual presentation will be used to demonstrate the required maintenance. At the same time, present plans call for presenting information regarding threatened and endangered species, hopefully creating an awareness of the need for environmental protection at the local level. Thus every effort was made during the planning process to mitigate or minimize potential adverse environmental effects.

D. ACKNOWLEDGEMENTS

Special thanks are extended to all individuals and organizations who helped in the acquisition of information and data used in this assessment. Appreciation is especially acknowledged to representatives of the Government of Panama who took valuable time to assist the field team. In addition, information and suggestions were provided by Dr. Ira Rubinoff, Director, Dr. A. Stanley Rand, Assistant Director, Dr. Neal Smith, Ornithologist, and Dr. Nicholos Smyth, Mammalogist, of the Smithsonian Tropical Research Institute; Dr. Alan A. Lawrence, President, and Dr. Nathan B. Gale, Scientific Chairman, of the Panama Audubon Society; and Dr. Eustorgio Mendez, Mammalogist, of the Gorgas Memorial Laboratory.

Appreciation is also given to Bob Otto and Ben Severn of AID/Washington; to Etna de Burgos, Bud Donato, Robert Mathia, Charles Moseley, Sandy Ray, Jesus Saiz, Lila de Shaw, Jane Stanley, Josefina de Stanziola, and Charles Weinberg of USAID/Panama; and to Norman Ward, agricultural/economics consultant to USAID/Panama.

II. PROJECT DESCRIPTION

A. PURPOSE AND GOALS

The purpose of the project is to improve the capacity within the Government of Panama (GOP) to inspect, evaluate, and select rural access roads for improvement in a rational manner, and to institutionalize a system to maintain the rural roads utilizing labor intensive methods when possible. A subpurpose of the project is the improvement of the Government's capacity to design and build minimum standard roads that mitigate potential impacts on the environment. The overall goal is to improve the level of welfare among the rural poor. The project will facilitate progress toward the goal by alleviating the transportation constraint which hinders the small rural farmer from receiving reasonable social and economic benefits and by reducing interference with the Government's ability to provide such benefits.

B. PROJECT COMPONENTS

The Rural Access Roads Project components, or specific actions proposed, are: (1) the upgrading of approximately 820 km of tertiary roads and trails to conform with minimum engineering standards permitting all-weather use; (2) the establishment of a selection committee comprised of representatives of USAID/Panama, Ministry of Public Works (MOP), Ministry of Agricultural Development (MIDA), and Ministry of Planning and Economic Policy (MPPE); (3) the institutionalization of a rural road maintenance program in MOP and (4) the provision of technical assistance and training to the GOP in areas of road materials selection and testing, development of improved construction planning and construction procedures which minimize adverse environmental effects, and community organization and motivation for public works. Specific expertise required under the technical assistance portion of the project includes a materials engineer, a sociologist or anthropologist, and an environmentalist (preferably with a civil engineering background). Additionally the Government of Panama (GOP) desires training outside Panama in the administration of environmental areas.

C. SELECTION PROCESS

The physical and financial resources of the Government of Panama limit the amount of road construction and maintenance which can be undertaken during any designated time frame. As the number of access roads requiring improvement is extensive, it was necessary to develop a process whereby each road nominated for improvement could be analyzed and compared with a set of criteria. This would provide a means of eliminating roads which did not serve the designated target group of small farmers, did not provide benefits in excess of costs, or which would result in significant adverse environmental impacts. A complete discussion of the selection process is contained in Exhibit A, and will only be summarized herein. A flow chart of the selection process is shown on Figure 1.

Requests for road improvements may be submitted to the Government of Panama (GOP) by local communities or may originate within agencies of the GOP. In-

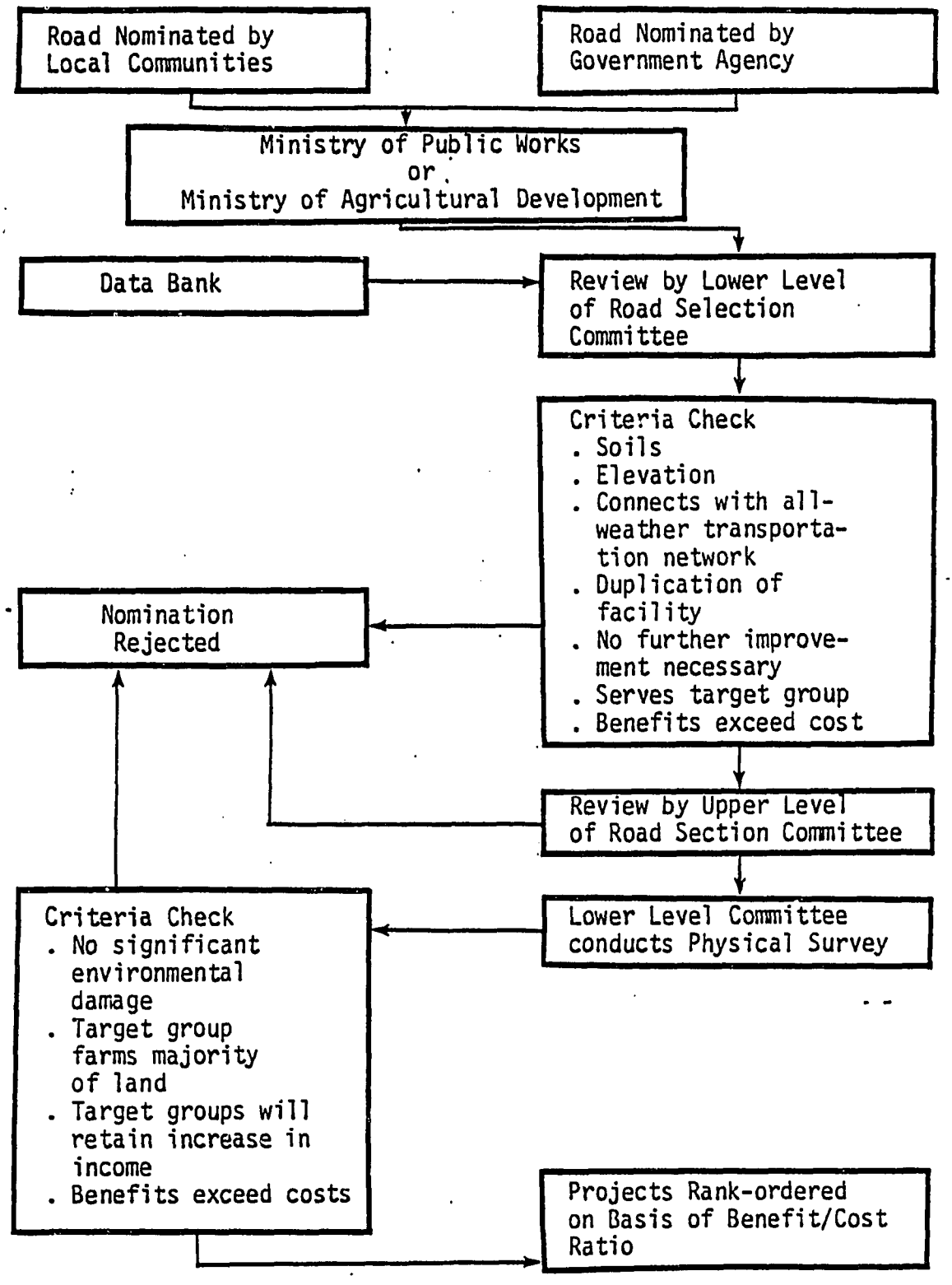

FIGURE 1. FLOW DIAGRAM OF SELECTION PROCESS FOR CONSTRUCTION OF RURAL ACCESS ROADS IN PANAMA.

formation to be submitted must be in sufficient detail to allow the Selection Committee to locate the road on specialized maps. Additionally, information must be submitted on the number and size of farms in the area and the principle crops grown.

The Selection Committee will be made up of two levels. The lower level will review the request for accuracy, and provide additional information from a Data Bank. The bank will be a resource library containing extensive information on Panama. Using this information, the committee's lower level will then compare the road with selection criteria. This will insure the road is in the previously designated project area, the majority of farmers are in the target group, the road will connect with an all-weather transportation route, and the preliminary benefit-to-cost ratio is greater than one.

If the road meets these criteria, it will be recommended to the upper level of the Selection Committee. That level will insure that improvement of the roads under consideration would not conflict with other on-going programs or the Government's overall development plans.

If the upper level approves a road, a physical survey will be requested. During the survey, a four-part road inspection form will be completed (see Exhibit A). The general areas to be covered during the inspection include engineering, agriculture, sociology and the environment. Completion of this form will provide the data necessary to insure the road meets specific economic, social and environmental criteria. Subsequently, the road will be placed on a rank ordered list of roads scheduled for construction. The position of each road will be based on its benefit/cost ratio. Sub-projects will be placed in "priority groups" to allow construction of ranked roads in an area, rather than move all the construction equipment a long distance.

D. DESIGN STANDARDS

Represenatives of USAID/Panama and the Government of Panama collaborated in establishing simple, acceptable, low-cost, all-weather design standards. In developing the standards and construction procedures, consideration was given to insuring adverse environmental impacts would be minimized.

The roadway surface will be 5 meters wide with 0.5 meter shoulders and with drainage ditches at least 50 cm deep on each side. Where existing features limit the width of the right-of-way, the shoulders will be eliminated. Any borrow material required for the road embankment will be taken from the side ditches to avoid long haulage. A 15-cm wearing surface of local select granular material will be placed over an improved subgrade and compacted to support an 8-ton axle load. The surface will be crowned to insure water drains to the edges of the road rather than longitudinally. This will serve to reduce the severe erosion of wheel tracks, a common occurrence on existing access roads. Traffic turnouts will be strategically located to permit the passing of vehicles. Drainage will be provided by means of side ditches with frequent ditch turnouts, and transverse drainage will consist of concrete pipe and box culverts as required to accommodate projected storm runoff. Ditches will be sodded to protect the soil during

periods of heavy runoff. Check dams will be utilized as required to reduce flow velocities and act as sedimentation traps. For streambed crossings, extensive use will be made of concrete masonry pipe fords which lend themselves to labor-intensive construction methods. Such bridges as may be required will be approximately 3.75 m clear width and will be constructed using unskilled labor to the maximum extent possible.

E. INSTITUTIONAL ARRANGEMENTS FOR IMPLEMENTATION

The Ministry of Public Works (MOP) will have primary responsibility for project implementation and for coordinating the inputs of two other GOP Ministries; the Ministry of Agricultural Development (MIDA) and the Ministry of Planning and Economic Policy (MPPE). These three Ministries will be responsible for the selection of the roads to be improved by the project through a Rural Roads Selection Committee.

The lower level of this committee, which will conduct a staged analysis of candidate roads, will be staffed by an engineer and an anthropologist from MOP, and an agronomist from MIDA. The upper level of the committee--which will be charged with review and implementation of the lower level's recommendations and with coordination between Ministries--will be made up of the Director of Planning of MOP, a designated representative of MIDA, and the chief of the Transportation Section of MPPE.

Through its Department of Planning, the MOP will be responsible for the technical preparation and direction of this road project. The Engineering Division of MOP will develop the necessary plans and specifications for the project through its Directorate of Special Projects (DPE), which has been expanded recently to include this road program. The DPE is currently staffed by professional engineers, technicians and other staff from the National Department of Construction which was recently dropped from the MOP as part of a reorganization. Full capacity and staff experience exists within the DPE to carry out the construction although technical training and assistance will be provided for the following: road selection processing, materials selection and testing, development of specific design standards and specifications, and environmental assessment.

MOP presently has an equipment pool of almost 1,900 units for construction and maintenance; however, only about 33 percent of the units are in good working order, and the average age of the units is almost eight years. Through a loan from the IBRD (International Bank for Reconstruction and Development), much of the equipment will be overhauled or replaced. A capital labor mix analysis was carried out in which findings were based on financial and economic costs, availability of labor, employment generation, financial resources of the GOP, and the impact of a rainy season on partially completed roads. That analysis indicated that a moderate labor intensive system should be used in the construction process. Under the analysis carried out, labor costs on a financial basis (per km of road) amounted to 22 percent of total costs; on an economic cost basis, labor amounted to 16 percent of the total.

The MOP thus has the basic capability and experience to construct rural access roads. With the technical assistance and additional experience to be provided

by this project, this capability should be significantly increased. At the same time, the small farmers will receive significant socio-economic benefits.

As the lead implementing agency, MOP will be responsible for:

- developing a four-year construction and maintenance plan for project implementation;
- developing plans, specifications and costs for the roads to be improved;
- negotiating and monitoring contracts with small contractors for road construction;
- constructing fords and bridges by force account;
- negotiating with local communities for provision of manpower for maintenance, and
- managing a labor-intensive preventive maintenance program.

In addition to being involved in the road selection process, MIDA will be responsible for improvement, by force account, of approximately 10 percent of the roads selected.

Local communities will be involved in both the construction and maintenance of the roads, particularly the latter. This is necessary because of the limited resources available to the GOP. USAID/Panama will be responsible for the monitoring and evaluation of all project activities.

F. RELATIONSHIP TO PANAMA'S DEVELOPMENT PLANS

In the early 1970's, the GOP began an extensive program of constructing a network of primary and secondary roads in the most populated sections of the country. At the same time, the Government took a strong interest in the rural sector, especially the small farmers, by improving existing socio-economic programs such as extension services, schools, housing, and health facilities. Although the Government's programs are now meeting the needs of the small farmers living near the primary and secondary road network, the needs of the more rural small farmers have not been met. Roads and paths in the rural sectors are frequently used only by animal-drawn vehicles, and are usually passable only during the dry season. Consequently, many of the planned Government programs have not been implemented as desired and the economy of the rural farmers has not improved. Both the Government and the small farmers have realized the problem and have taken steps to correct it. The Ministry of Agricultural Development (MIDA) and the Ministry of Public Works (MOP) are striving to construct new tertiary roads and improve existing trails, but their efforts are minimized because maintenance is inadequate and the roads often have a lifespan of just one dry season. Because the road system is vital to the Panamanian economy, new construction and upgrading of all-weather rural roads must be continued. Additionally, an adequate level of maintenance is essential. This rural access roads project is designed to insure that the roads improved under the project do not conflict with the GOP's on-going programs or with overall development plans. Conversely, the project will enhance GOP and AID programs in many sectors.

III. BACKGROUND OF THE REPUBLIC OF PANAMA

A. LOCATION

The Republic of Panama forms the narrowest and lowest portion of the isthmus that links North and South America (Figure 2). Shaped like the letter S, the country extends west to east about 650 km, varies in width from about 50 to 190 km, and occupies approximately 7,565,000 ha. Panama lies between the Caribbean Sea on the north and the Pacific Ocean on the south, connecting the countries of Costa Rica and Colombia.

The most prominent geographic feature of Panama is the continental divide between Costa Rica and the Panama Canal, it is generally called the Cordillera Central. From Costa Rica, it runs eastward for about 180 km, with a maximum elevation above 2,000 m. It decreases in elevation to a series of low hills and ridges across the area of the Panama Canal, then rises toward the Cordillera de San Blas, eventually reaching an elevation of more than 1,500 m at the Colombian border.

B. PHYSICAL RESOURCES

1. Climate

Panama, located between 7° and 10° N latitude, has a warm tropical climate. Only the highlands of the west and east have cool conditions for part of the year. Temperatures are uniformly high and there is virtually no seasonal variation. Panama has a mean temperature of 27 C, with a range of 23 to 31 C. Temperatures on the Pacific side are slightly lower than on the Atlantic side.

Rainfall varies from about 1,000 mm to more than 7,000 mm in some areas. Rain falls almost entirely during the rainy season (April to December). In general, rainfall is much heavier on the Atlantic side (average=4,040 mm) than on the Pacific side (average=1,778 mm) of the continental divide. The dry season extends about five months, but on the Atlantic side it may only last two or three months. Relative humidity is high, with an annual average of about 80 percent.

No data are available on air quality, therefore, the ambient conditions can only be discussed in general terms. Over 40 percent of the population and almost 69 percent of the vehicles can be found in the Province of Panama, most in Panama City and its suburbs. Therefore, the greatest potential for air pollution exists in Panama City. During excessively humid periods, pollution is noticeable, resulting from vehicle emissions, open burnings and industry. Frequent rains and sea breezes generally keep pollutional episodes to short-term incidents. Throughout the rest of the country, slash-and-burn agricultural practices are the only significant source of air pollution.

2. Soils

Most of the soils of Panama are latosols or a combination of latosols and lithosols, which probably cover 85 to 90 percent of the country. At isolated locations, various other types of soils exist: alluvials, regosols, andosols, planosols, low-humic gley and tidal swamps and flats. Latosols occur on hills on rough broken land, primarily along the lower slopes of the country. They are deep, strongly-weathered, well-drained soils developed on consolidated

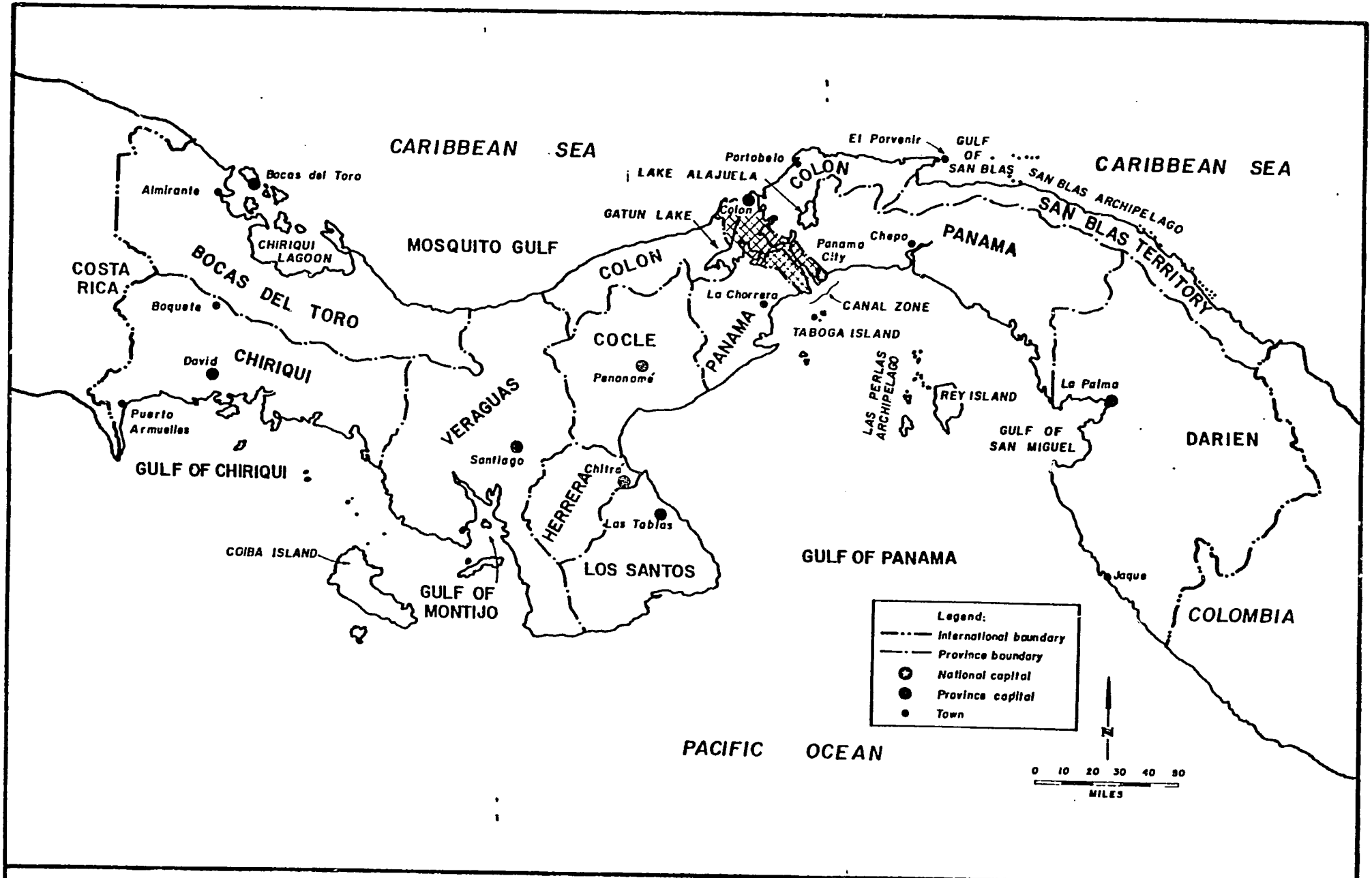

FIGURE 2. GENERALIZED MAP OF PANAMA.

rocks. However, they are low in fertility and easily eroded. The latosol-lithosol combinations are found on the higher elevations. Alluvial soils are normally located in the flat to undulating alluvial plains adjacent to streams or wetlands, or on terraces adjacent to volcanos. The remaining soils are distributed in small areas throughout the country.

3. Geology

Detailed geological studies have been carried out for less than 10 percent of Panama. It is generally accepted that the area of present day Panama was once a seaway between the Atlantic and Pacific Oceans, and a general uplift about two million years ago created the present land bridge. The country has a long history of volcanic activity, although no eruptions have occurred in recent times. Earthquakes are not uncommon, but are usually not severe. As might be expected, most rocks are igneous in origin. Minerals occur throughout the county, but contribute little to the economy.

4. Water Resources

The rivers in Panama are characterized by their relatively short length, particularly on the Atlantic side of the continental divide, and by their high number. On the Pacific side of the country, more than 300 rivers are found (Weil et al. 1972). The largest river is the Turia in Darien Province, which drains essentially all of Darien. It is navigable by launches for about 130 km above La Palma. The second largest river is the Bayano (also called the Chepo), located in eastern Panama Province; it is the site of a large hydroelectric facility.

Limited water quality data indicate that surface waters exhibit typical physical characteristics. Stream pH values range from 6.6 to 7.2. Total dissolved solids are normally less than 250 miligrams per liter (mg/l), sulfates less than 20 mg/l and chlorides less than 50 mg/l.

In an estimated 80 to 90 percent of the country, groundwater of meager quantities (less than 50,000 litters/day) can be obtained from depths of 10 to 100 m and from springs. Generally, these groundwater resources are suitable for individual water supply, and in some locations village or city supplies are obtained from deep wells (15 to 300 m) which yield up to 50,000 liters/day. Most of the groundwater is hard due to high concentrations of calcium carbonate.

C. NATURAL RESOURCES

1. Vegetation

The terrestrial plants of Panama are perhaps the best known in all of tropical America. Despite this knowledge, plant species are still being described and little is known of the distribution of individual species.

In general, Panama can be divided into two basic floristic regions, separated by latitudinal and altitudinal differences in climate and delineated by the continental divide. On the Atlantic slopes, dense forest prevails and savannas are absent. On the Pacific slopes, forests are less dense and savannas are present. A map delineating the floristic regions and climatic, altitudinal and vegetational types is provided in Figure 3. This map is based on

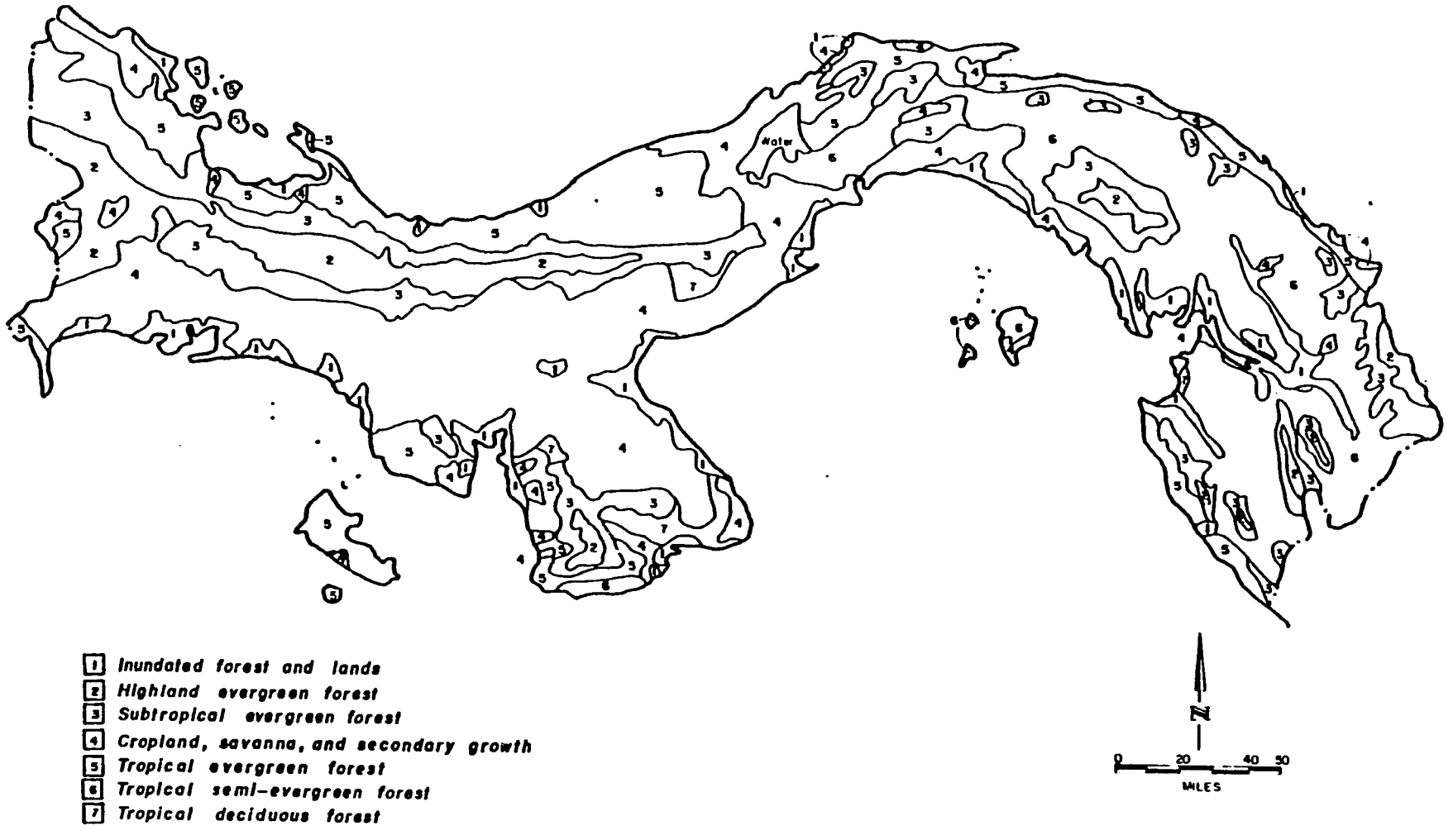

FIGURE 3. FLORISTIC REGIONS OF PANAMA.

1967 and 1975 atlas data published by the Government of Panama. The seven floristic regions shown on this map are listed below; detailed descriptions of these types of vegetation are found in a Technical Working Paper which is available through the USAID Mission, Panama or USAID/Washington:

(i) highland evergreen forests;
(ii) subtropical evergreen forests;
(iii) tropical evergreen forests;
(iv) tropical semi-evergreen forests;
(v) tropical deciduous forests;
(vi) cropland, savanna and secondary growth; and
(vii) inundated forests and lands.

2. Wildlife

Because Panama has been used by animals as a land bridge between North and South America, the richness in variety of wildlife is great. The country abounds with many kinds of amphibians (143 species), reptiles (214 species), birds (883 species), mammals (225 species) and freshwater fishes (207 species). Likewise, the surrounding ocean teams with large numbers of marine fishes. Details concerning the wildlife of Panama are contained in a Technical Working Paper available from USAID.

3. Endangered and Threatened Species

Thirty-seven Panamanian species of wildlife--5 reptiles, 1 amphibian, 10 birds, and 21 mammals--are considered endangered or threatened. In all, 21 species are recognized as being endangered by the US Department of the Interior in accordance with the Endangered Species Act of 1973 (Table 1).

Of the six species of amphibians and reptiles, the American Crocodile is found in the river system on the Atlantic side. The four sea turtles are known from the coastal regions, especially sand beach areas. The Panamanian Golden Frog is restricted to humid forests of the Altos de Campana National Park and Biological Reserve in western Panama Province and to the El Valle area.

Of the three species of birds, the Resplendent Quetzel--now restricted to the highlands (above 1,525 m) of western Chiriqui--and the Harpy Eagle--now primarily known from the forested, little-settled areas of Darien--are least common. The Brown Pelican--although rare throughout most of its range--is abundant along the Pacific coast but less numerous along the Atlantic coast. Another possible endangered bird species, the Least Tern, is an accidental visitor from North America. Its Panamanian subspecific identification is questionable, however.

Of the 13 species of endangered mammals, the West Indian Mantee is perhaps the rarest. It formerly lived in the lower river drainage systems on the Caribbean coast, but in recent years it has only been recorded from the isolated rivers of Bocas del Toro Province. Nine were introduced in 1964 into Gatun Lake. The five species of cats--the Costa Rican Puma, Jaguar, Ocelot Margay and Jaguarundi--are all rare or uncommon but all probably occur throughout Panama. Of the three monkeys, the Spider Monkey is uncommon and is found at lower elevations possibly throughout Panama. The Howler Monkey is only locally abundant throught Panama from sea level to at least 1,825 m.

TABLE 1. ENDANGERED AND THREATENED SPECIES

Group and Scientific Name	English Name	Status[a]	Source[b]
AMPHIBIANS AND REPTILES			
Crocodylus acutus[c]	American Crocodile	E	1
Chelonia mydas	Green Sea Turtle	P	2
Lepidochelys kempii	Atlantic Ridley Sea Turtle	E	1
Eretomochelys imbricata	Hawksbill Sea Turtle	E	1
Dermochelys coriacea	Leather Back Sea Turtle	E	1
Atelopus various zeteki[c]	Panamanian Golden Frog	E,P	1
BIRDS			
Tinamus major[c]	Great Tinamou	P	2
Crypturellus sovi[c]	Little Tinamou	P	2
Pelecanus occidentalis	Brown Pelican	E	1
Dendrocygna autumnalis[c]	Black-bellied Tree Duck	P	2
Cairina moschata[c]	Muscovy Duck	P	2
Harpia harpyja[c]	Harpy Eagle	E,P	1,2,4
Crax rubro[c]	Great Curassow	P	2
Penelope purpurasceus[c]	Crested Guan	P	2
Chamaepetes unicolor	Black Guan	P	2
Pharomachrus mocinno mocinno (or costoricensis)	Resplendent Quetzal	E,P	1,2,3,4
MAMMALS			
Felis (=Panthera) onca[c]	Jaguar	E	1
Felis pardalis[c]	Ocelot	E	1
MAMMALS (continued)			
Felix wideii[c]	Margay	E	1
Felis yagouroundi panamensis	Jaguarundi	E	1
Trichechus manatus	West Indian Manatee	E,P	1,3,4
Tarpirus bairdii[c]	Central American Tapir	E,P	1,2
Oclocoileus virginianus chiriquensis[c] (also O.v. rothechildi and O.v. truei)	White-tailed Deer	P	2
Mazoma americana[c]	Red Brocket	P	2
Mazoma gouzoubira[c]	Brown Brocket	P	2
Alouatta villosa (peliata)[c]	Howler Monkey	E	1
Saimiri perstedii[c]	Red-backed Squirrel Monkey	E	1
Ateles geoffroyi panamensis[c]	Spider Monkey	E	1
Saguinus oedipus[c]	Cotton-top Marmoset	E	1
Choleopus hoffmonni[c]	Two-toed Sloth	T	3
Cabassous centralis[c]	Naked-tailed Armadillo	T	3
Physeter catodon	Sperm Whale	E	1
Balaenoptera physalus	Finback Whale	E	1
Magaptera novaeangliae	Humpback Whale	E	1
Bassaricyon gabbi[c]	Olingo	T	3
Galictis allamandi[c]	Grison	T	3
Lutra annectens[c]	Long-tailed Otter	T	3

[a] E=endangered; P=Panamanian protected; T=Trade protected.

[b] 1=USDOI, Endangered Species Act of 1973; 2=Proteccion de la Fauna Silvestre Panama, 30 January 1967; 3=Convention on International Trade in Endangered Species of Wild Fauna and Flora of 1973; 4=International Union for the Conservation of Nature (1966).

[c] Species found within the Rural Access Roads Project area.

The Red-backed Squirrel Monkey is common, but is known only at low elevations on the Pacific coast of western Panama. The Central American Tapir is common at all elevations in eastern Panama and on the Caribbean coast, but is rare or absent on the Pacific coast of western Panama. The three whales are oceanic.

4. National Parks and Preserves

With regard to National Parks, Forest Reserves and other types of biological reserves, Panama, similar to most of Central America, has lagged behind much of the world in setting aside suitable areas. Since 1960, however, Panama has been making efforts to correct this situation. At present 21 National Parks, Forest Reserves, Nature Monuments and Wildlife Sanctuaries exist or are proposed in Panama (see Exhibit B). Of these, 15 are recognized by the GOP, 7 by the International Union for the Conservation of Nature (IUCN), 2 by the 1978 Panama Canal Treaty and 1 by a private conservation organization. Of the seven National Parks, only two--Altos de Campana National Park and Biological Reserve and Volcan Baru National Park--have been actually designated by the government. Of the 12 Forest Reserves, only four--Chagres River, La Fortuna, La Veguada and Alto Darien--have been implemented by the Government of Panama and one--Madden Forest Reserve--has been implemented under the 1978 Panama Canal Treaty. The single Nature Monument--Barro Colorado Island Research Laboratory--is also implemented by the Panama Canal Treaty. One Wildlife Sanctuary exists on privately owned land of the Florida Audubon Society. Implementation of these areas has been difficult, for the various sites are inadequately protected and frequently have been invaded by squatters. Recent Government of Panama legislation, however, has provided stricter conservation laws and the establishment of protected areas.

D. CULTURAL RESOURCES

1. Land Use and Ownership

The three dominant categories of land use in Panama are forest, urban areas and farmland. Approximately 60 percent of the country is covered by forests of various densities. East of the Panama Canal, excluding San Blas, about 80 percent of the area is forested. West of the Panama Canal, on the Atlantic side of the continental divide, 80 to 90 percent is in forest. The Panamanian definition of an urban area is very restrictive, and the amount of land in this category is a relatively low five percent of the country.

Almost 28 percent of the 7,565,00 ha of land in the Republic of Panama is farmland, and most lies on the Pacific side of Panama west of the Darien Province. Approximately 55 percent of the farm land is in natural or improved pasture. Ten percent of the farm area is used for annual crop production, five percent for production of perennial crops and ten percent is fallow. The remaining 20 percent consists of farmland that is classified as non-productive.

Farmland in Panama is owned, rented or farmed without title. An estimated 70 percent of all farms fall into the latter category, and are less than 50 ha. Conversely, almost 90 percent of farms containing 500 or more hectares have a valid title. In terms of land area, over 44 percent of all farmland has no title. The small farmers generally move onto land not being used, use the

slash-and-burn method, farm the land for a few years until it becomes low in fertility, and either move on or sell the land for pasture.

Historically, there has been a lack of land policy and an abundance of land in sparsely populated areas. (It is estimated that 85 to 90 percent of all land is owned by the government.) In 1963, the Agrarian Reform Commission was established to perform a rural cadastre which would involve 53 percent of the national territory, on which 95 percent of the population lives. This survey was to provide a basis for agrarian policy and land taxation. It was the Commission's goal (in 1966) to aid 70,000 families on small farms without land and with incomes of less than B/200 per year. By 1973, however, not more than one-fourth of this large number of families had benefited from the program (Merrill et al. 1975).

2. Population, Employment and Education

The first census was taken after Panama became independent in 1911, it indicated that the population of the country was 336,742. In 1970, the population was 1,428,082, representing an average annual growth rate of 2.48 percent. As shown in Table 2, there was a wide range of growth rates among the various provinces. In Bocas del Toro, the average growth rate was only 1.11 percent, while in the Province of Panama, it was 3.86 percent. These figures document the population shift to the metropolitan area of Panama City specifically and to urban areas in general. The 1977 population, extrapolated from the last census, is estimated to be 1,763,000.

The largest employment sector in Panama is agriculture, with almost 32 percent of the work force engaged in that activity in 1976 (Table 3). This is a decline from the 35 percent figure in 1970; the actual numbers of individuals declined by almost 6 percent in the same time frame. Other sectors of economic activity also have increased substantially. In particular, the services sector showed a marked increase of 27,000 or 2.9 percent. The percentage of women in the work force is now about 32 percent, mostly in the service industry. Most women leave the labor force after marriage.

Since 1970, unemployment has varied from 5.6 percent in 1974 to 7.6 percent in 1971, generally averaging around 6.5 percent. This is not truly indicative of unemployment, however. For example, the country's unemployment figure in 1969 was 6.6 percent. The rate was 9.4 percent in the metropolitan areas and only 3.6 in the rest of the country.

Education in Panama is free to all levels except at the University of Panama, and budget expenditures of the Ministry of Education is normally one of the highest of any Ministry. Attendance is compulsory between the ages of 7 and 15 or until nine grades of primary schooling is completed.

3. Economy

Between 1950 and 1971, the gross domestic product (GDP) of Panama grew at an average annual growth rate exceeding 8.0 percent. The early 1970's saw the rate decline to 6.5 percent in 1973, then to 2.6 percent and finally, in 1975 and 1976, the growth was negligible. Analyses of the economic sectors indicate that between 1973 and 1976 there was little growth (or even a decline) in the outputs from mining, manufacturing, construction and trade. The

TABLE 2. COMPARISON OF POPULATION, SELECTED YEARS

Province	POPULATION 1911	POPULATION 1960	POPULATION 1970	Increase 1960-70	Precent Increase 1960-70	Annual Growth Rate 1911-1970
Panama	61,855	372,393	576,645	204,252	55.8	3.86
Chiriqui	63,364	188,350	236,154	47,804	25.4	2.25
Veraguas	59,614	131,685	151,849	20,164	15.3	1.60
Colon	32,092	105,416	134,286	28,870	27.4	2.45
Cocle	35,011	93,156	118,003	24,847	26.7	2.08
Herrera	23,007	61,672	72,549	10,877	17.6	2.00
Los Santos	30,075	70,554	72,380	1,826	2.6	1.50
Bocas del Toro	22,732	32,600	43,531	10,931	33.5	1.11
Darien	8,992	19,715	22,685	2,970	15.1	1.58
TOTAL	336,742	1,075,541	1,428,082	352,541	32.8	2.48

TABLE 3. LABOR FORCE IN PANAMA BY SECTOR OF ECONOMIC ACTIVITY, 1970 AND 1976 (IN THOUSANDS)[a]

Sector of Economic Activity	1969	1976	Percent Change
Agriculture, forestry, hunting and fishing	157	149	-5.1
Mining and quarrying	--[b]	--[b]	--
Manufacturing	42	47	+11.9
Construction	20	30	+50.0
Electricity, gas and water	3	7	+133.0
Commerce	59	64	+8.5
Transport, warehousing and communications	16	25	+56.3
Services	92	119	+29.3
Banks, financial services, lending institutions	9	16	+77.8
Canal Zone	22	17	-22.7
TOTAL	420	472[c]	+12.4

[a] Adapted from Republic of Panama, Contraloria General de la Republica, Direccion de Estadistica y Censo. Panama en Cifras, 1968-1972 and 1972-1976.

[b] Less than 500.

[c] Column may not add due to rounding.

economic sectors which historically have contributed most to the GDP are agriculture, manufacturing, trades and services. For example, in 1976 these four sectors contributed nearly 60 percent of the GDP. Agriculture has increased in output, but has declined in percentage of GDP during the 1970's. During the 1960's, the growth of the agricultural labor force was less than one percent per year, and that trend has changed slightly, if any.

The average income in Panama consistently has been high compared to other Latin American countries. In 1975, the estimated average per capita income was $561 and the average family income was $1,770. However, on a national basis, urban income per capita is almost three times as high as rural income per capita. Also, income per capita among the provinces varies by a factor of 6, from B/881 for Panama to B/145 for Darien (Sahota 1972).

4. Archaeology

Archaeological evidence indicates that Panama was inhabited by people related to the Chibcha civilization of the Colombian Highlands, and probably represented the northern extent of that civilization. Cultural artifacts from what is commonly called "pre-columbian" have been found throughout the country, but primarily along the Pacific side of the continental divide. These remains show that the culture flourished in the 500-1500 AD era. Although subsisting on hunting, fishing and agriculture, considerable achievements were also made in ceramics and goldworking. The trading area of this civilization probably extended from southern Mexico to Ecuador.

E. TRANSPORTATION FACILITIES

The primary means of travel within Panama is by foot, cart or vehicle along the rather limited road network shown in Figure 4. It is estimated that in 1978 all the roads in Panama total 8,479 km (Table 4). Almost one-third (32 percent) of the roads are paved, either with concrete or bituminous surface treatment. Another 23 percent are covered with gravel or selected material. The remaining 45 percent are earth and are normally impassable during the rainy season. The better roads connect the major centers of population (e.g., provincial capitals), while the earth roads are primarily feeder roads or access roads to agricultural areas. The sparsely populated Provinces of Bocas del Toro and Darien have very few roads; those that are present are gravel or earth. The major agricultural provinces of Chiriqui, Veraguas, Cocle, Los Santos and Herrera; these Provinces contain 88 percent of earth roads, indicating the dependency of the farmer on dry-weather roads.

The major east-west road which essentially runs from the Costa Rican border through Panama City, is the paved Pan-American Highway. The major north-south route is the Trans-Isthmian Highway, a 75-km road from Panama City to Colon.

In 1976 there were 95,104 vehicles registered in Panama (divided into three categories): 64,164 private vehicles, 23,930 commercial vehicles and 7,010 official vehicles (Panama en Cifras 1972-1976). Almost 69 percent of the private and commercial vehicles were registered in the Province of Panama, and seven percent in Colon. Thus the area around the Panama Canal contains 76 percent of the vehicles. Conversely, there were no vehicles registered in the Darien Province and only 339 in Bocas del Toro. Most of the commercial vehicles are taxis or buses. The taxi fleet is large in the cities, while the buses provide much-needed intercity service.

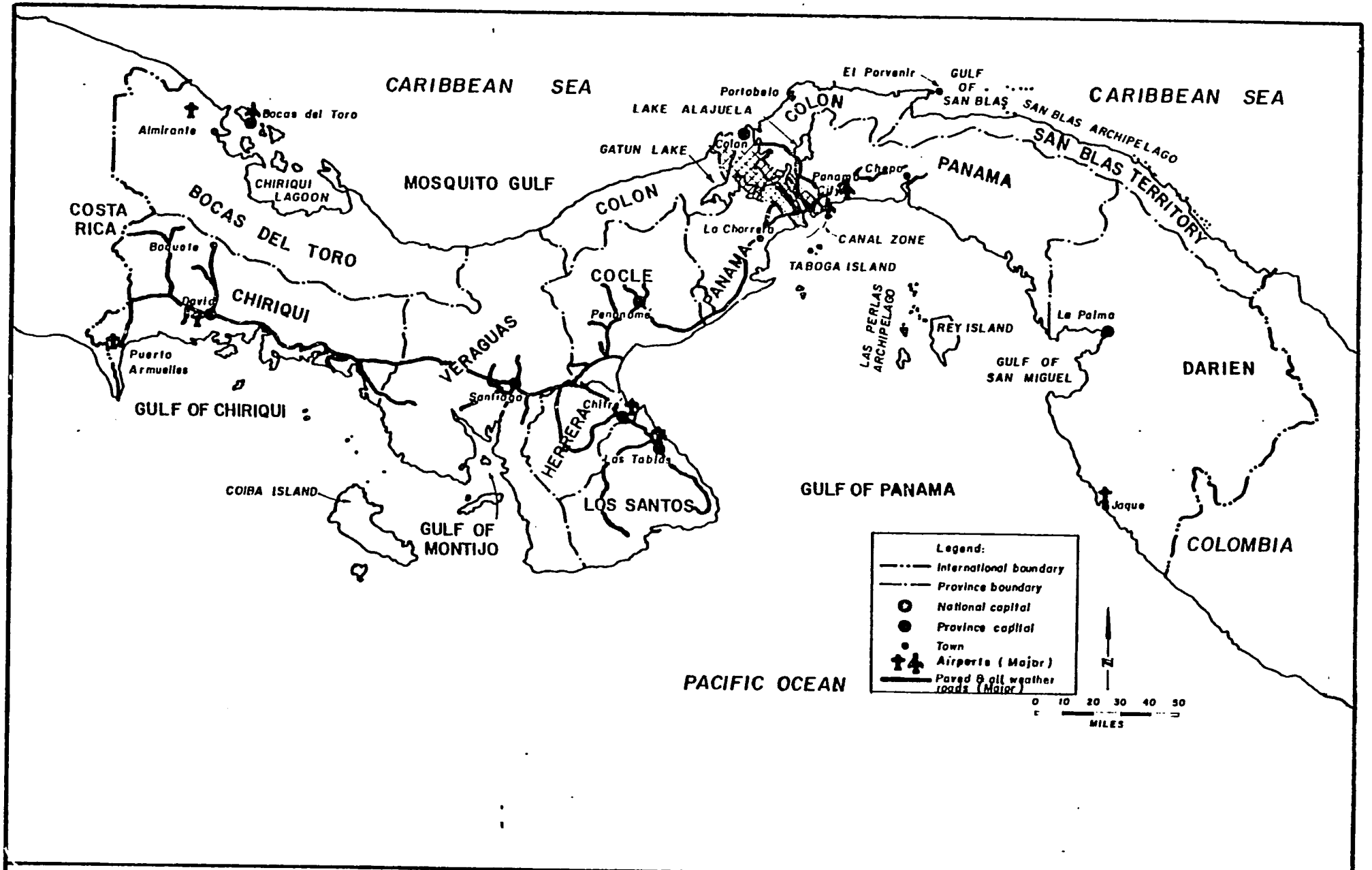

FIGURE 4. MAJOR ROAD NETWORK OF PANAMA.

TABLE 4. ROAD NETWORK, REPUBLIC OF PANAMA (IN KILOMETERS)[a]

Type of Surface	1972	1976	1978[b]
Paved	2,088	2,492	2,586
Gravel or Select Material	1,601	1,795	2,384
Earth	3,333	3,434	3,509
TOTAL	7,022	7,221	8,479

[a] Source: Consultant COMEC Road Inventory and National Directorate of Maintenance, MOP.

[b] Estimated.

In addition to roads, other important transportation modes include railroads, waterways and air travel. Several railroads provide service. The Panama Railroad Company has 76 km of main track and 120 km of siding. It annually carries about 1,000,000 passengers and 250,000 tons of freight, operating 12 to 14 trains daily between Panama City and Colon. Two other railroads primarily connect plantations with ports and carry freight; their tracks total about 370 km.

The only canal in Panama is that linking the Atlantic and Pacific Oceans; it is about 80 km long and carries 12,000 vessels each year at an average toll charge of over $14,000.

Air transportation is extremely well developed, with an estimated 240 airports, airstrips and landing fields; less than half of these are used commercially. All airports (except US military airfields) are owned and operated by the Direccion de Aeronautica Civil. About 25 towns have scheduled domestic flights. The principal international airport is at Tocumen, about 20 km east of Panama City. Three US military airfields are located near the Panama Canal.

F. AGRICULTURE

In 1970, almost 28 percent (2,098,062 ha) of Panama's total land area of 7,565,000 ha was used for agricultural purposes. Los Santos, Herrera and Chiriqui were the only Provinces with more than 50 percent of their total land area in agriculture in 1970; although between 40 and 50 percent of the land was in farms in Cocle and Veraguas Provinces. The smallest percentages of total land in agriculture were in Darien (1.6 percent) and Bocas del Toro (5.6 percent). In terms of total land, the Provinces with the largest areas in agriculture in 1970 were Veraguas (479,172 ha) and Chiriqui (477,179 ha) followed by Panama, Los Santos, Cocle and Herrera.

Just over 10 percent (213,607 ha) of the total area in farms in 1970 was used for production of annual crops; another five percent (110,764 ha) was used for perennial crop production. An additional 10 percent (217,437 ha) is fallow cropland, giving a total cropland of about 541,807 hectares. Thus, cropland represented slightly over 25 percent of the total farmland. Some 46 percent (964,758 ha) of the total farmland was devoted to improved pastures; an additional eight percent (176,037 ha) was used as natural pastures. The remaining farmland consisted of a combination of various categories.

Although Panama had over 105,000 farms in 1970, there were only a few dozen large farms using a high degree of technical development, and about 30,000 farms utilizing various degrees of modern farm practices for market production. The remaining majority were small subsistence farms still using traditional methods. In general, the productivity of land and agricultural labor is low. Therefore, the Government of Panama strives to stimulate the production of farm products.

The major agricultural food products are bananas (the leading export), rice and corn (mainly used in rural areas), all of which are the country's primary food staples. Other important farm products are sugar and beef (both of which are exported), coffee, beans, cacao, tubers, tabacco, tomatoes, citrus, other fruits and vegetables, eggs and poultry. Table 5 summarizes

TABLE 5. PRODUCTION OF SELECTED AGRICULTURAL PRODUCTS IN PANAMA FOR THE YEARS 1960, 1970 AND 1976

Product	Unit	Yield (x1,000)		
		1960[a]	1970[a]	1976[b]
Crops				
Bananas	Bunches	12,125.7	22,917.3	
Rice	Quintales	2,054.5	2,891.5	3,184.9
Corn	Quintales	1,402.1	1,243.8	1,410.3
Sugar	Quintales	658.3	18,413.6	43,459.9
Oranges	Units	21,928.3	30,309.2	
Yucca	Quintales	272.1	772.7	
Tomatoes	Quintales	290.2	404.8	593.2
Potatoes	Quintales	199.5	137.7	243.3
Beans	Quintales	108.8	135.1	72.7
Pineapples	Units	215.8	186.1	
Coffee	Quintales	74.0	97.8	103.1
Cacao	Quintales	18.1	9.8	
Tobacco	Quintales	10.9	22.6	28.3
Meat and Dairy				
Cattle	Head	748.0	1,200.0	1,361.2
Hogs	Head	224.0	174.0	179.0
Poultry	Each	2,700.0	3,000.0	4,276.7
Eggs	Dozen	8,666.0	9,416.0	
Milk	Quintales	961.4	1,541.9	1,609.7
Meat	Quintales	507.9	580.5	

[a] Adapted from Republica de Panama (1971), Weil, et.a (1972), and Merrill, et. al (1975).

[b] Adapted from Republica de Panama (1977).

production of selected agricultural products.

G. PUBLIC HEALTH

Recent data show that the principal causes of death in Panama are heart disease (14 percent) and malignant tumors (10 percent). The 1975 death rate was estimated to be 52 per 1,000 population, while the crude birth rate for that year was 32 per 1,000 population.

The rate of mortality from endemic diseases has steadily declined. Tuberculosis is now uncommon in urban areas, but is still prevalent among the lower income rural people in Colon, Darien, San Blas and Veraguas Provinces. Likewise, a similar situation exists for malaria. An organized effort at malaria control, aimed at elimination of the larvae of the mosquito vector, has virtually restricted its occurrence to Darien Province, the Baru District of Chiriqui Province, portions of the Gulf of Montijo, an area in the Central Isthmus between Gatun Lake and Madden Reservoir, and Chepo District to the east of Panama City. Yellow fever is no longer a problem in urban Panama, although it continues to be introduced occasionally by travellers in rural areas, especially in Darien, where it is harbored by wild animals from which it is transmitted to man.

Municipal governments in Panama City and Colon provide regular service for street cleaning and removal and disposal of trash. In addition, in 1976 approximately 82 percent of the population was served by drinking water supplies constructed by the Government of Panama; this included 100 percent of urban residents and 63 percent of rural residents. Also in 1976, almost 88 percent of the population was served by some type of sanitary wastewater disposal system; this included 97 percent of urban residents and 78 percent of rural residents. In most places, urban areas are served by piped sewerage systems, whereas 75 percent of the rural population uses latrines.

IV. DESCRIPTION OF THE PROJECT AREA

A. DEFINITION AND LOCATION OF PROJECT AREA

Criteria were developed to insure that the roads selected for improvement would be those which would benefit the agricultural sector of the country. Thus, the primary project area is generally restricted to the country's better agricultural soils and to elevations below 1,525 m. Additionally, the project area includes some soils which are not the most agriculturally productive, but which do support numerous asentamientos, or communal farms (see agricultural section for details). This secondary area was included because the improved roads will provide a means to continue and even upgrade the present GOP programs of credit, improved housing, and technical assistance for these asentamientos. This assistance program has encouraged individuals to remain on the asentamientos rather than engaging in slash-and-burn agricultural practices.

Figure 5 and Table 6 show that 2,624,100 ha or approximately 35 percent of Panama will be included in the project area. Almost 60 percent of the project area is within the agriculturally rich Provinces of Veraguas, Chiriqui, Panama, and Cocle.

Approximately 90 percent of the project area is located south of the continental divide. This southern portion of Panama has had a long history of high population concentrations and intense agricultural usage. This portion also contains many all-weather roads to which the access roads can connect as stipulated in the selection criteria. Most areas north of the continental divide are not used for farming and have no all-weather roads. This is especially true of the areas in the Bocas del Toro Province and in the San Blas Territory of the Cuna Indians, which are primarily coastal and accessible only by boat or small plane. Access roads in the north would be relatively short and would have to connect with the only all-weather route in that area--the sea.

B. PHYSICAL CHARACTERISTICS

Most of the project area lies south of the continental divide in the rolling plains and dissected hills physiographic regions of Panama. The plains are generally lower than 200 meters in elevation with 10 to 20 meters of local relief and slopes ranging up to 30 percent.

Rainfall in the area averages 1,778 mm per year, however, the region in Veraquas, Herrera, Cocle and Los Santos is commonly known as the "dry zone." In central Panama, the dry season lasts about 5 months. Except for that portion of the project area near the Panama Canal, most air pollution results from slash-and-burn agriculture.

Soils within the project area include latasols, latasol-lithosol combinations, and alluvium. The alluvial soils are the most productive, however, they are found in only a few percent of the project area. Although the majority of latasols in Panama have little fertility due to extensive leaching of silica and nutrients, the latasols and latasol-lithosol combinations in the

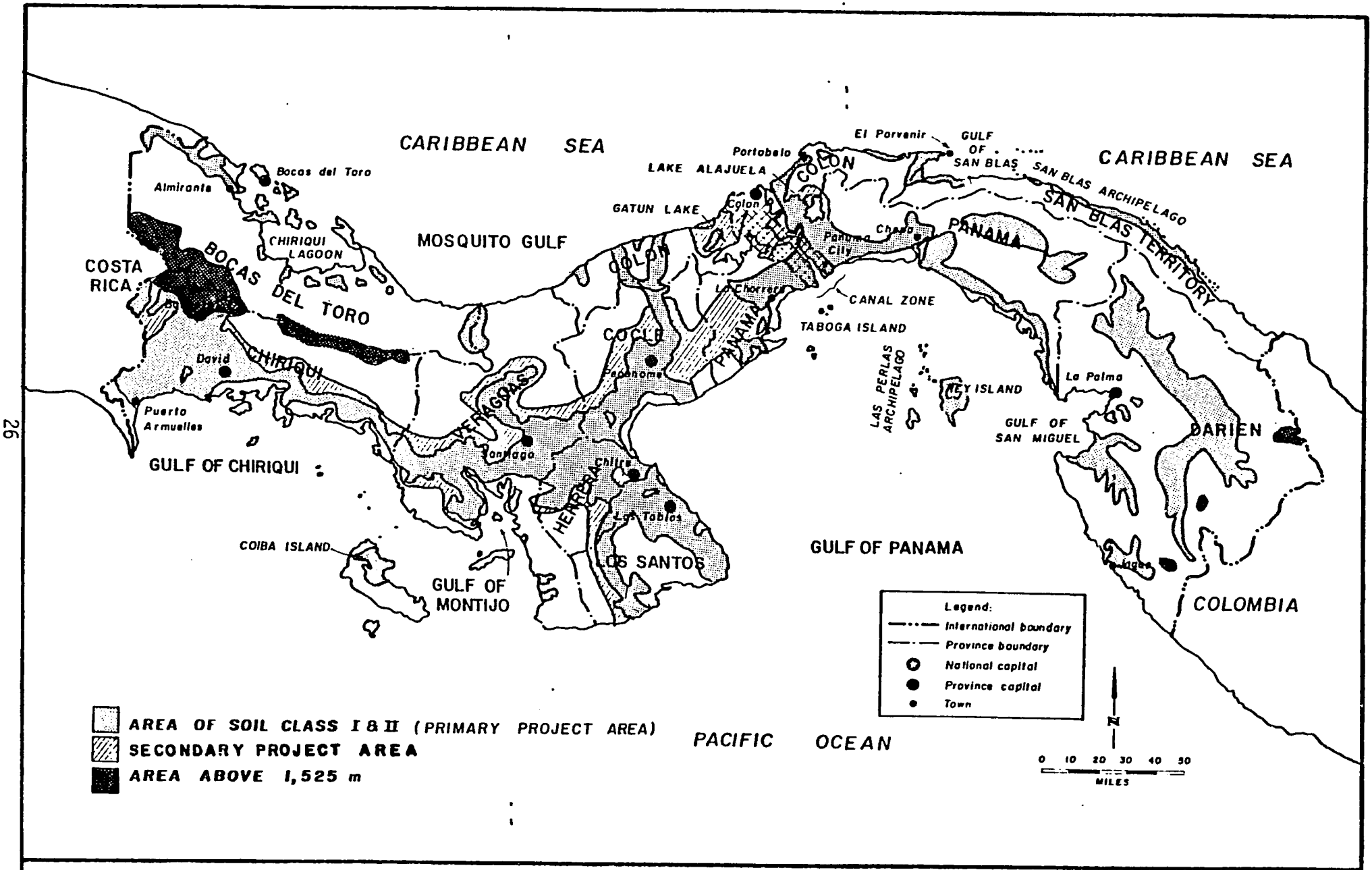

FIGURE 5. PROJECT AREA FOR CONSTRUCTION OF RURAL ACCESS ROADS IN PANAMA.

TABLE 6. DISTRIBUTION OF THE RURAL ACCESS ROADS PROJECT AND AGRICULTURE, BY PROVINCE

Province	Area (ha) and Percent										
	Total	Agriculture[a] (1970)	Percent of Province	Percent of Agriculture	Soil Class I and II[b]	Percent of Province	Asenta-mientos[b,c]	Percent of Province	Total Project[b]	Percent of Province	Percent of Project
Bocas del Toro	891,700	49,543	5.6	2.4	53,500	6	--	0	53,500	6	2
Coclé	503,500	235,754	46.8	11.2	156,100	31	135,900	27	292,000	58	11
Colón[d]	746,500	83,964	11.2	4.0	156,800	21	29,900	4	186,700	25	7
Chiriquí	875,800	477,179	54.5	22.7	341,600	39	105,100	12	446,700	51	17
Darien	1,680,300	27,544	1.6	1.3	420,100	25	--	0	420,100	25	16
Herrera	242,700	167,330	68.9	8.0	143,200	59	34,000	14	177,200	73	7
Los Santos	386,700	283,611	73.3	13.5	181,700	47	38,700	10	220,400	57	8
Panama	1,129,200	293,965	26.0	14.0	304,900	27	90,300	8	395,200	35	15
Veraguas	1,108,600	479,172	43.2	22.8	288,200	26	144,100	13	432,300	39	16
Total Panama	7,565,000	2,098,062	27.7		2,046,100	27	578,000	8	2,624,100	35	

[a] Adapted from Republica de Panama (1971).

[b] Area rounded to nearest 100 ha.

[c] In addition to those on soil Class I and II.

[d] Area also contains the San Blas Territory.

project area are relatively fertile because they have developed on geologically young volcanic rocks and the weathering process is not as advanced.

Due to soil characteristics and topographic conditions soil erosion potential in the project area is great. Limited work has been performed to quantify the erosion potential of the soils within the region; however, a study conducted in 1971 and 1972 and reported in the Journal of Tropical Ecology (Daubenmire, 1972), reports erosion rates of similar soils in Costa Rica. It was estimated that as much as 5 millimeters of top soil is lost annually through erosion on lands cleared of natural forest cover. Considering that the topography of Costa Rica is generally less severe than that of Panama and that the rainfall is somewhat less, these estimates may be conservative.

C. NATURAL CHARACTERISTICS

The vegetation within the project area is grouped into three of Panama's seven floristic regions (see Figure 3). An estimated 80 percent of the project area is covered by Cropland, Savanna, and Secondary Growth, which is typically found on lands of medium to low elevation. In Chiriqui, Veraguas, and Cocle the savannas are burned over periodically and contain very sparse small, fire-resistant trees. Banana and plantain plantations are found on the alluvial soils in Chiriqui, Bocas del Toros and Darien; coffee plantations are frequent on lands of medium elevation in Chiriqui, Veraguas, Cocle, and Los Santos; cocoa plantations are located on the Atlantic coast and around Patino in Darien. About 10 percent of the project area is covered by Tropical Semi-evergreen Forests. These forests are limited to areas less than 600 m in elevation in central and eastern Panama and central Darien. The remaining 10 percent is covered by Subtropical Evergreen Forest, which is limited to small areas between 700 and 1,500 m elevation in the northwest portion of Chiriqui, the northcentral part of Cocle, the central portion of Los Santos, and in the Serrania Canazas northeast of the Gulf of San Miguel in Darien.

Although the majority of the project area has been disturbed by man or fire, there are some 42 characteristic trees and shrubs throughout the area. About 100 species of trees are found in association with good soils; among these trees are striking examples of *Bursera simarouba* (carate), *Ceiba penetrandra* (ceiba), and *Didymopanax morototoni*. On the poorer soils the number of species are less and there are more spiny legumes such as *Prosopis juliflora* and *Acacia farnesiana*, and fire-resistant species such as *Curatella americana* and *Xylopia frutescens*. Along lower streams *Anacardium excelsum* may be found. In Darien Province the lowland forest is dominated by *Cavanillesia platanifolia* (cuipo). Common mid and tall native grasses throughout the area include *Andropogon bicornis*, *Nuhlenberigia emeraleyii*, *Paspalum virgatum* (cabezone), and *Trachypogon secundus*. Common low-growing grasses, which develop ground mats and have rhizomes, stolons, and/or roots at the nodes, are *Axonopus compressus* (carpet grass), *Pennisetum clandestinum* (kikuyu), *Digitorio decumbens* (pangola), *Homolepis aturenses*, and *Panicum* spp.

Of the 1,672 species of amphibians, reptiles, birds, mammals, and fishes that are known from Panama, 816 species (or 49 percent) are found in the project area (Table 7). In general most species are disturbed throughout the

TABLE 7. WILDLIFE SPECIES IN THE PROJECT AREA

Vertebrate Group	Number of Species		
	Panama	Project Area	Percent
Amphibians	143	32	22
Reptiles	214	68	33
Birds	883	496	56
Mammals	225	131	58
Fishes	207	89	43
Total	1,672	816	49

project area although some are restricted to the eastern or western portion. Of particular importance is the fact that the project area excludes many of the wildlife species found in the heavily forested, undisturbed regions of Panama and especially those species restricted to the highland region above 1,525 m. These are further discussed in the Working Paper that accompanies this Environment Assessment.

Some 100 species of amphibians and reptiles are found in the area. Common among them are many frogs, toads, lizards, and snakes. Common birds among the 496 species found in the project area include two carrion feeders (Black Vulture and Turkey Vulture), two doves (Ruddy Ground-Dove and White-fronted Dove), the Orange-chinned Parakeet, the Rufous-tailed Hummingbird, the Red-crowned Woodpecker, and 13 birds of field and scrub (Fork-tailed Flycatcher, Tropical Kingbird, Social Flycatcher, Yellow-bellied Elaenia, Gray-breasted Martin, Tropical Mockingbird, Clay-colored Robin, Red-eyed Vireo, Boat-tailed Grackle, Blue Tanager, Palm Tanager, Blue-black Grassquit, and Variable Seedeater). The more common mammals, among the 131 species found in the project area, include several species of bats, marsupials, the Forest Rabbit (Silvilagus brasiliensis), and rodents (especially the Tree Squirrel, Sciurus grantensis, and the Paca, Agouti paca). Among the 89 species of fishes, the catfish group dominates.

Of the 37 species of wildlife that are considered endangered and threatened in Panama, 27 species are known from the project area (see Table 1). Of these 27 species, 13 species are listed as endangered by the U. S. Department of the Interior, 12 species are listed as endangered by the Government of Panama, 5 species are listed as endangered by the Convention on International Trade and 3 species are listed as as endangered by the International Union for the Conservation of Nature.

Although all 27 species are considered to be endangered or threatened, the most important ones are those which have international importance. These include the Panamanian Golden Frog, which is found in moist forests of low mountains. This species is found in Panama Province within the Altos de Campana National Park, where it and its habitat are protected, and in the El Valle area. Among the bird species, two are endangered internationally. The Brown Pelican is found along the coastal seashores, while the Harpy Eagle prefers dense forest situations. A third bird species--Resplendent Quetzal--is now primarily found in cloud forest above the 1,525 m elevation limit set by the project area selection criteria. Among the important mammals, the three monkeys--the Howler Monkey, Redbacked Squirrel Monkey, and Spider Monkey--are found in dense forest. Likewise, the four cat species--the Jaguar, Ocelot, Morgay, and Jaguarundi--are restricted primarily to dense forest. The Central American Tapir is found in the project area only on the Pacific coast of western Panama. Despite Panama's hunting regulations and wildlife projection ordinances which protects 16 species (see Table 1), hunting of these species still persists in some areas. No endangered or threatened species of plants are known to exist in the project area.

Of the 21 national parks, forest preserves, natural monuments, and wildlife sanctuaries recognized in Panama (see Exhibit B) one existing national park

(Altos de Campanas National Park in Panama Province) and two existing forest reserves (La Fortuna Forest Reserve in Chiriqui Province, and the La Veguada Forest Reserve in Veraguas Province) are located within the project area. A total ban on hunting exists within these parks. Five other proposed sites also exist within the project area.

D. CULTURAL CHARACTERISTICS

As a result of the selection criteria, land use in the project area is over 75 percent agricultural compared to the national statistic of 28 percent. One exception is Darien Province where most of the area is forested. Land is owned, rented, or farmed without title. The majority of small farms (less than 50 ha) fall into the latter category. The Government of Panama has instituted a program of establishing asentamientos, or cooperative farms to reduce the "squatter" type of land use.

The majority of Panama's estimated 630,000 farm population is located in the project area. Most farms are within one kilometer of some type of road--generally one that is unimproved. A survey conducted in the project area by AID personnel revealed a population density of approximately 70 individuals per kilometer of rural road. The average farm family consists of six people.

The agricultural economy of the project area is extremely poor compared to the most urbanized areas. A sample of small farms in the more productive region of Renacimienta revealed an annual per capita income of $355. In the less fertile region of Capira, small farm per capita income was only $259 per year while asentamiento farmers earned only $114 per year. In contrast, in a study conducted by the GOP (Sahota 1972), it was estimated that the urban per capita income was almost three times as high as rural per capita income, and income inequality was the highest in the southwestern provinces. Rural income was both lower and more unequally distributed than that in the urban sector. It is evident that many farmers are actually engaged in little more than subsistence farming.

The Government of Panama has continually emphasized education, but only some 80 percent of the population is classified as literate. Schools offering at least primary education are available to nearly all the rural population, but most secondary schools are located in urban areas. For the majority of the project area, local water supplies are often wells or nearby streams. If an area is established with permanent farms, residents may request assistance from the government in supplying water from a well or well field. The government digs the well(s) and provides the pipe; the community lays the pipe and pays a small monthly fee which creates a fund for maintenance and equipment replacement. Sanitation facilities are poor and consist of a latrine at best.

Because of economic, educational and public service disadvantages in the agricultural regions of Panama, rural to urban migration has become prevalent in recent years. Although the population of the country increased by 352, 541 (32.8 percent) between 1960 and 1970, 204,252 people or almost 58 percent of the decade growth was recorded in the urban Province of Panama which in 1960 contained only 34 percent of the country's population.

E. TRANSPORTATION

The primary means of transportation in the project area is by surface roads. The distribution and condition of roads by Province are displayed in Table 8. About 45 percent of all roads are earthen and the condition of 33 percent of all roads is classified as bad. Examples of typical roads in the project area are shown in Figures 7, 8 and 9.

The major road through the study area is the Pan-American Highway, which extends from the Costa Rican border to Darien Province. West of the Canal, the road is paved to the border; however, much of the road east of the Canal is gravel surfaced. Other all-weather roads connect the provincial capitals and/or urbanized areas. In the agricultural areas, however, all-weather roads are noticeably lacking. Many of the access roads to the farmed areas are little more than cart trails, cleared by local inhabitants. Because there is no drainage for these roads, the wheel tracks act as drainage ways. As the soil is easily eroded, the ruts deepen and the entire road may soon take on the appearance of a drainage ditch; the roads are practically impassible during the rainy season. The farmers are restricted to growing crops that can be marketed during the dry season, "walked" to market, or that do not spoil easily in wet weather.

Because a large portion of rural roads are earth tracks in poor condition, the access of farm families to markets and public services is severely restricted. Compounding the access problem is the cost of moving agricultural products to market. The poor road conditions substantially reduce vehicle life and the resulting high market transport costs average $1.50 per 100 pounds of produce.

A survey conducted by AID personnel on 17 typical rural roads which totaled 130 km indicated that two stream fords requiring a culvert crossing and less than one stream requiring a bridge crossing are encountered every 10 km. Based on these survey data and the minimum standard surfaced road design, it is estimated that the cost of road construction in the project area is $10,000-12,000 per kilometer.

F. AGRICULTURE

There are an estimated 83,000 small farms of greater than one hectare in the project area. About 80 percent of these farms produce only enough crops for local consumption, although they occupy 70 percent of available agricultural land. Because the small farmers lack access to markets and storage facilities, they generally cultivate less than they could and forego the use of improved inputs which would increase productivity. For example, although the climate is suited to double and perhaps triple annual planting of certain crops, this is an uncommon practice among the small farmers. Many farmers still practice slash-and-burn cultivation. After cutting and burning the cover, they cultivate the land for a few years until it is no longer productive and move to a new location. Old farms are left as pasture and often return to second-growth forests.

The size of small farms is variable, but family farms average between 6 and 20 hectares. Annual production obviously depends on the quality of

TABLE 8. INVENTORY OF ROADS, 1976 (in Kilometers)[a]

Province	Type of Surface												TOTAL
	Cement or Asphalt Concrete[b]			Bituminous Surface Treatment			Gravel			Earth			
	good	fair	bad	good	fair	bad	good	fair	bad	good	fair	bad	
Bocas del Toro	-	-	-	-	-	-	-	23	-	-	-	48	71
Cocle	93	15	-	36	162	37	60	43	-	86	220	300	1,052
Colon	42	6	-	7	3	75	7	42	-	35	84	134	435
Chiriqui	200	-	-	288	78	22	139	370	23	25	83	401	1,629
Darien	-	-	-	-	-	-	-	45	-	-	-	48	93
Herrera	10	-	-	151	8	-	213	43	-	16	41	297	779
Los Santos	-	-	-	113	219	23	233	40	-	30	94	422	1,174
Panama (West Highways)	32	52	25	15	131	46	46	73	-	42	189	203	854
Panama (East Highways)	49	32	-	9	90	31	19	47	-	16	40	-	333
Veraguas	122	-	-	173	80	17	273	56	-	95	143	395	1,354
TOTAL	548	105	25	792	771	251	990	782	23	345	894	2,248	7,774
	678			1,814			1,795			3,487[c]			7,774

[a]Source: Consultant COMEC Road Inventory and National Directorate of Maintenance, MOP.
[b]Includes some 30 km of asphalt concrete surface layed granular base course and 122 dm of asphalt concrete overlaying cement concrete pavements.
[c]Includes 456 km of roads officially classified as gravel.

FIGURE 6. ASENTAMIENTO (COMMUNAL FARM)

FIGURE 7. EXAMPLE OF EXISTING ACCESS ROAD, CAPIRA AREA.

FIGURE 8. EXISTING RURAL ROAD WITH FORD, LA CHORRERA AREA

FIGURE 9. ROAD/TRAIL PASSABLE ONLY IN DRY WEATHER

soil, inputs and crop selection; however, the following example for a 6-ha Capira farm is typical:

Crop	Hectares Planted	Annual Yield-lbs
Rice	0.50	1,800
Corn	0.50	900
Yuca	1.00	26,400
Otoe	0.50	11,000
Oranges	0.25	(21,000)
Plantain	0.50	8,800
Cowpeas	0.50	1,300
	3.75 ha in production	50,200 lb plus 21,000 oranges

A more complete listing of major food products for Panama includes bananas, rice, corn, sugar, beef, coffee, tobacco, eggs, poutry, fruits and vegetables. Table 5 (see Chapter III) lists the national annual production of these and other agricultural commodities.

To aid subsistence farmers, the GOP has established a program of communal farms. The two types of communal farming organizations established in 1969 are "asentamientos" and "juntas agrarias" (see Figure 6). These agricultural organizations were initiated by the Panamanian government in an attempt to improve the economy, particularly in isolated rural areas of the southern portion of the country. Their purpose is to organize the rural poor, who either have no land or who have very small plots of land whose cultivation is economically unfeasible, into cooperative enterprises. Organization of these programs is designed to concentrate the dispersed population and make it possible for the central government to provide them with basic facilities and services--water, electricity, roads, schools, and medical care. On a priority basis, credit and technical assistance are provided to the groups, and members are trained in skills needed to direct an autonomous and cooperative enterprise. Within the asentamientos and juntas agrarias there are both communal lands (including most of the land) where modern methods of production have been introduced, resulting in increased agricultural production, and small individual plots where farmers practice traditional methods of cultivation.

One of the project area selection criteria was directly related to the estimated agricultural production capability of the soil. For a road to be considered for improvement, it must be located in an area containing soils of IA, IP, IIA or IIP classification. These are the most productive soils in Panama. As previously discussed, some asentamientos outside the project area are not located on these soils, but have developed Class III soil areas for agriculture use. See Table 9 and Figure 5 for information on soil areas.

G. PUBLIC HEALTH

Chief causes of sickness among the rural population are enteritis, diarrhea, psoriasis, tumors, and anemia. Many of the arthropod diseases which have been almost totally eliminated in the urban areas may still be found among the lower income rural people. Chief among these is malaria, whose vector

TABLE 9 . LAND POTENTIAL CLASSIFICATION

Soil Type	Description
IA	Suitable for high production of annual crops.
IP	Suitable for high production of perennial crops.
IIA	Suitable for moderate production of annual crops.
IIP	Suitable for moderate production of perennial crops.
IIIFp	Areas with physical resources suitable for producing forestry products by commercial replanting; in farming activities, gives very low yearly yields per hectare; area in which extensive farming and forestry activities compete.
IIIEcb	Areas with physical resources suitable to permit continuation of commercial forestry management.
IIIFc	Areas with degradated physical resources which should be conserved through natural regeneration or planting of selected species.
IIICm	Areas for farm management with the aim of guaranteeing the permanence of irrigation and hydroelectric potentials.
IIIRm	Areas for national reserves, which after more detailed study, will be designated as biological reserves, parks, etc.
IIIL	Areas which are inudated or with the water table close to the surface most of the year.
IIIM	Areas of mangroves or forests of other halophytic species.
IV	Low physical production per hectare when used for farming activities.

is generally under control. Yellow fever occasionally occurs in the Darien region. The rate of mortality for children under 5 years of age is normally much higher than the national average. In the Capira District, for example, the rate is double the national average. (Yet Capira is only 40 km west of Panama City.) Many of the deaths are related to malnutrition because few of the families have proper dietary habits or have access to a balanced diet.

The Government of Panama has established hospitals, health centers and clinics throughout the country, and continues health programs for the rural areas. A study conducted in 1966 indicated that 83 percent of the population lived in localities within one hour travel time from a medical station. With the continued emphasis on health, it is likely that over 90 percent now have accessibility to such stations although the lack of year-round dependability of many access roads is a problem.

H. NOMINATED ROAD ANALYSIS

1. Introduction

The general project area includes an estimated 35 percent of the country. Theoretically, any dry-weather rural access road is a candidate for improvement under the program. Obviously, improvement of all such roads is not desirable nor feasible. The resources of the country would be strained to immediately improve all those facilities for which the potential benefits would exceed the costs. Additionally, it may be environmentally unsound to improve some roads. Therefore, a procedure was developed to insure that each road nominated for improvement is given equal consideration with other nominated roads, and those determined to be infeasible or unsound could be eliminated. The general selection process is discussed in Exhibit A. This section emphasizes the environmental aspects of the selection process.

2. Analytical Process

Any road can be nominated for improvement by a local community or political entity or by a governmental agency. Basic information regarding the location of the road must accompany the request. The estimated number and size of principal crops grown on the farms must also be provided. This information will be submitted to a two-level Rural Roads Selection Committee composed of representatives of the Ministries of Public Works (MOP), Agricultural Development (MIDA), and Planning and Economic Policy (MPPE). The lower level of this Committee will review the information for accuracy and will add data from a Data Bank--a resource laboratory containing physical, environmental, demographic, agricultural, and financial information.

Subsequent to the collection of all available data, the committee will compare each nominated road's characteristics with several criteria in this first phase of the process. This comparison insures that the road lies in the designated project area, that it connects with an all-weather transportation network, that it will not provide service similar to an existing all-weather route, that it serves the small farmer target groups, that it potentially has a benefit/cost ratio of at least 1:1.

From an environmental standpoint, this first phase provides the initial review of potential environment effects (but without quantification). If the nominated road meets the criteria, it traverses an area where agricultural development has occurred and where some type of transportation facility exists. This precludes construction of penetration-type roads and restricts the road to the access category. Additionally, it provides the initial indication of the magnitude of socio-economic benefits.

If the road meets the first phase criteria, it is recommended to the upper level of the Committee for review. The main function of that level is to insure that improvement of the road would not conflict with on-going or proposed development plans. This prevents duplication of effort and possible improvement of roads into areas which are to be set aside for other purposes.

Assuming that the road is approved by the upper level of the Committee, it is returned to the lower level for a physical survey. A three-member team will inspect the road and complete a four-part inspection form (Exhibit A), obtaining four categories of information: engineering, agricultural, social, and environmental. Information contained on the form will be used to compare the road with a second set of criteria. Those criteria required an analysis of social benefits, economic feasibility and environment impacts. For the road to be selected for improvement, those analyses must show that the majority of the population in the road's area of influence are small farmers, that the majority of land is farmed by that group, and that they will receive the increased income resulting from the road improvement. Furthermore, the benefits from the project must exceed the costs (assuming a project life of 10 years and a discount rate of 12 percent). A general methodology for analyzing benefits and costs has been developed and successfully tested in two model areas: Renacimiento in Chiriqui Province and Capira, about 50 km west of Panama City.

Part IV of the Inspection Form (Exhibit A) requires information which can be used for a basic environmental analysis. It was developed based on information obtained during this study, which indicated that there was a lack of trained personnel in Panama with a knowledge of environmental assessment. Also, no organized, easily accessible, environmental data bank exists in Panama. The form is relatively simple and can be increased in detail as the capability and awareness of problem areas increase.

In its present stage of development, the environmental inspection form requires the collection of data applicable to the road improvement area and relating to elevation, land use, and vegetation types. Information is also required on threatened and endangered species whose ranges may cover the area, type of habitat required for road modification and impact on parks, archaeological sites, and historical areas. Water resource impacts must also be considered. Finally, the form requires a judgement as to whether or not the road may result in <u>significant</u> damage to the environment.

Obviously, this form cannot be completed by untrained personnel; therefore, technical assistance and training will be provided. This assistance will serve to increase environmental awareness and concern at the governmental level.

Assuming that the road meets all the selection criteria, it is ranked in order according to the benefit-to-cost ratio. Roads which are contained on the final list are candidates for funding and, assuming that the selection process has been correctly followed, are those which have the highest potential for beneficial socio-economic impacts while minimizing adverse environmental impacts.

During analysis of the two previously mentioned model areas (Renacimiento and Capira), use of the selection criteria resulted in the deletion of almost half the roads nominated for improvement in the Capira area. Therefore the selection criteria procedure has been successfully tested.

V. PROBABLE IMPACTS OF THE PROJECT

A. INTRODUCTION

Before analyzing the impacts of the proposed project, the distinction between rural access road and rural penetration road construction in developing countries should be made. Whereas the purpose of the former is the placement or upgrading of facilities to improve access within or between already developed (populated) areas, the purpose or indirect effect of a penetration road is the exposure of a relatively virgin area to new development.

As a consequence, if the environmental conditions are constant, adverse impacts related to construction of a penetration road are more severe than those related to implementation of an access road. Similarly, due to the potential for uncontrolled development, the long-term adverse impacts of a penetration road are generally greater. Although both types of road may have an equal potential for providing socio-economic benefits, the need for an access road is usually existent at the time of its construction, thus the potential benefits are more accurately known and rapidly realized. Further discussion of the environmental characteristics of these two types of roads is provided in Exhibit C.

The development of this access road project included consideration of potential environmental impacts and procedures by which adverse impacts could be eliminated or mitigated. Mitigative procedures include proper construction and maintenance techniques, the development of road inspection forms which provide data on potential impacts and insure that a road qualifies for improvement, development of an economic feasibility methodology which ensures that potential benefits exceed cost, and the provision for technical assistance to train Panamanian personnel to conduct environmental analyses. As a result of the type of road, environmental inputs into project design and the mitigation measures which are contemplated, the adverse environmental impacts are minimal and the beneficial effects are quite significant.

The short-term impacts of the project are related to construction and maintenance of the roads and tend to be primarily physical and ecological rather than socio-economic in nature. These impacts include erosion, water quality degradation due to increased sediment, air and noise pollution, and disruption of aquatic and terrestrial wildlife.

Most long-term impacts of the project are beneficial. The major long-term benefits include the increased capability of MIDA and MOP to select and analyze candidate roads, the increased ability of MOP to improve agricultural access roads throughout Panama, improvements in the economic and social well-being of small farmers and asentamientos, and the improved environmental awareness of both government agency personnel and rural communities. The first two impacts are complementary since improvements in the ability to select and analyze candidate roads permit agencies within the GOP to better utilize their limited resources to implement projects with the greatest benefit to cost ratio.

The presence of dependable all-weather roads in this agricultural area will have secondary effects beyond those discussed below. Improved access will

make possible the consistent accessibility to extension agents, fertilizer, improved seed, equipment, agricultural and marketing information, and various other governmental programs. However, the availability of these inputs is not due primarily to the roads but to other GOP programs and they are not considered part of this project. Consequently, although the potential of these inputs should be recognized, an analysis of their impacts is not considered in this report.

B. CONSTRUCTION IMPACTS

1. Physical Impacts

Physical impacts which occur during construction include erosion, siltation, air pollution from equipment and fugitive dust, and increases in noise levels. To estimate the potential impacts, it is necessary to understand the construction process. The roads to be improved exist in some form, although frequently they are merely severely eroded cart tracks. These existing roads range from 3 to 7 meters in width, are at ground level with little or no drainage, and are virtually impassable in wet weather. The standard for the improved facility is a 5-meter roadway with 0.5-meter shoulders. Ditches will be a minimum of 50 cm in depth with turnouts to prevent overflow. In addition, transverse drainage will be provided where necessary and streams will generally be crossed using concrete masonry pipe. The frequency and position of ditch turnouts and transverse drainage pipes will be dependent upon local conditions such as terrain and rainfall and will be determined individually for each road segment. The size of concrete pipe and minor construction features of the stream crossings will also be determined on a case-by-case basis and will be located at sites of existing fords. The determination will include consideration of factors such as stream width and depth, rainfall, vegetation cover, drainage area, etc. During construction, extensive use of hand labor will be made.

Given these conditions, physical impacts should not be significant. Construction will occur during the relatively dry season, reducing the potential for heavy erosion during construction. Depending on location, the dry season ranges from 3 to 5 months with typically less than 10 percent of the average 1500 mm annual rainfall occurring in that period. Thus, limiting constructing to the dry season is a major method of controlling erosion. When rains occur during construction, minor amounts of sediment may be transported to nearby streams.

There should be no impact on groundwater, since the normal water table is at least 10 meters below the surface. Recharge areas for groundwater have not been investigated, but based on a review of existing geological and soils information, the road improvements should have a neglible effect on such areas.

Temporary air pollution will occur during construction both from machinery and fugitive dust. Pollution from machinery can be minimized by proper maintenance; however, at present much of the equipment is old and susceptible to greater emmissions than more modern equipment. Fugitive dust could be reduced by spraying but, because of the minimum amount of equipment, this may not always be feasible. No data are available on existing noise levels, but typical levels for rural areas range from 35 to 45 decibels

measured on the A-weighted scale. Temporary localized noise levels of up to 80 dBA can be expected within 30-meters of construction machinery. The extensive use of hand labor is expected to minimize the frequency of machine noise.

2. Ecological Impacts

Ecological impacts caused by construction result primarily from destruction of vegetation and wildlife habitat (both terrestrial and aquatic). Because the road improvements will follow existing roads, destruction of vegetation will be minimized. A worst case estimate of this destruction assumes that all construction takes place within undisturbed habitat. Construction of 820 kilometers of roads with an average width of about 10 meters (including shoulders and ditches) produces 820 ha of cleared land. The total project area covers 2,624,100 ha; thus under worst case conditions only 0.03 percent of the area would be cleared. A more reasonable estimate recognizes that the access roads will be constructed along the right-of-way of existing roads which are approximately 5 m wide. Consequently, improvements will entail additional clearing of 5 m per km at most, which totals only 410 ha. This is a negligible 0.015 percent of the total study area.

An additional factor to be considered is that the roads to be improved typically pass through agricultural land as opposed to undisturbed areas. The removal of 410 ha of undisturbed, mature forest would be more significant than removal of an identical area of early secondary growth or fallow land. Wildlife associated with mature forest would be extremely sensitive to human activity and removal of vegetation. However, wildlife likely to be inhabiting roadside areas are basically adapted to human activity and frequent disturbance. Widening existing roads will disturb these species but will not drive them from the area. The removal of 410 ha of habitat will not significantly decrease the availability of suitable habitat in the nearby area.

Impacts to aquatic life will result from siltation produced by construction of the roadway and ditches, and from streambed disturbance during the construction of stream crossings. Since the streams tend to be intermittent in the dry season, many crossings may be constructed while the streams are dry, reducing adverse impact. Construction damage tends to be temporary and aquatic habitat and communities will return to a natural state within a short period (1 to 2 months). The potential for direct damage to habitat is not great since analysis of 130 km of candidate roads in the study area reveals the frequency of stream crossing to be little more than 2 per 10 km.

3. Socio-economic Impacts

Potential socio-economic impacts during construction include dislocation of residents, aquisition of land, destruction of cultural resources, and economic benefits from construction wages. Since roads already exist in some form, the first two impacts are neglible. No people will be dislocated and little additional land will be required (about 410 ha). There is a possibility that some cultural resources may be discovered during earth moving operations. Supervisors should be made aware of that possibility and arrangements made to notify a designated government agency.

The capital expenditures for construction will provide a beneficial economic impact to the area, since local labor will be involved. Analysis of 130 km of candidate roads indicates that construction costs would be in the range of $10,000 to $12,000 per km of road with about 22 percent of the cost designated for unskilled labor. Based on this sample, the money entering the local economy ranges from $2,200 to $2,640 per km of road. The average cost per kilometer for the entire project is estimated to be about $15,000. Thus, the cost for unskilled labor will average $3,300 per kilometer. Additional benefits to the local economy will occur indirectly, but cannot be quantified at this time.

C. MAINTENANCE IMPACTS

1. Physical Impacts

Adverse impacts may result from maintenance activities or from a lack of such activities. Grading loosens soils and may result in sedimentation. It further creates temporary air pollution and high noise levels. Since most maintenance will be labor intensive, the impacts from the use of maintenance equipment will be extremely limited.

Lack of maintenance can lead to blockage at stream crossings, erosion of the roadway or slopes, or overgrowth of drainage ditches with excessive vegetation. Blockage at stream crossings has its most serious impact during and immediately after heavy rains. Toward the end of the rainy season when the ground is saturated, streams may rise several meters in a very short time following a heavy rain. Blocked stream crossings will cause serious localized overbank flooding, leading to erosion not only of the roadway, but also of the streambank and surrounding area. Failure to stabilize the roadway and slopes through grading and proper sodding will also lead to excessive erosion. Under these conditions, gulleys and water channels which are not repaired lead to more rapid and severe erosion after the next heavy rain. The soil eroded by whatever cause eventually enters streams increasing the sediment load and adversely affecting the water quality. Failure to keep excessive vegetation out of the drainage ditches reduces their capacity to function properly and increases the potential for road failures.

2. Ecological Impacts

Human activity and the use of machines during road maintenance may temporarily cause some wildlife to leave the immediate area. However, the majority of species are adapted to some human activity and will soon return. Maintenance will destroy virtually no additional habitat except for the small amount of groundcover provided by vegetation on the side slopes and drainage ditches.

Without proper maintenance of roads and structures, the resultant sedimentation and blocked stream crossings may adversely affect aquatic life. Increased sediment could cause decreases in benthic fauna by covering the substratum or decreasing water quality. Fish populations could be adversely affected by increased sediment, especially during spawning seasons. Blockage at stream crossings could cause serious local habitat destruction as well as increased sediment load from localized bank erosion.

3. Socio-economic Impacts

Project plans call for agreements with local communities to participate in the maintenance, either by providing labor or funds. Analysis of 130 km of candidate roads suggested an average maintenance cost of about $446/km annually. With a density of approximately 70 individuals per km the annual maintenance costs would average about $6.00 per person. In view of the expected economic benefits provided by the roads, this is not a significant adverse impact and in most instances would represent 2 to 3 days of volunteer labor per year.

Local commitment provides a mechanism for allowing improvement of more roads nationwide, while creating a community awareness of the need for caring for the road. Community involvement projects have been successful in Panama, and create an informal organization which may lead to other self-help projects to benefit the community.

D. LONG-TERM IMPACTS

1. Physical Impacts

Over the 10-year project life, long-term changes to the physical environment include increased air and noise pollution, decreased erosion, and increased water pollution due to a slight increase in the use of fertilizers and pesticides. With an all-weather road, traffic will increase, although traffic volumes should remain relatively low. There will be a slight increase in air pollution (from both emissions and fugitive dust) because of the vehicular traffic,and noise levels will increase near the roadway.

An indirect impact may result from the potential for increased fertilizer and pesticide use. The project does not contain a program to encourage increased use but this may happen spontaneously. Presently, little fertilizer or other chemicals are used in the project area. Estimates indicate that use could increase by 20 percent as a result of other GOP programs. Because of the heavy rains and significant runoff, much of the fertilizer used could enter the local streams and rivers, however, it is doubtful that the quantity of chemicals involved will significantly alter local water quality.

A relatively significant beneficial effect results from reduced erosion. Presently, roads in the area (which are candidates for improvements) are little more than dirt trails. They are impassable during much of the year because of heavy rains. The roads suffer from massive erosion since they are improperly built. A conservative estimate of erosion throughout the study area is a loss of 5 mm per ha annually. Applied to 820 km of dirt road (average width of 5 m) in the study area, this amounts to over 20,000 cubic meters of soil loss per year. This estimate of soil loss is considerably less than actual since it is based on sheet erosion losses. Erosion from the study area roads is a combination of sheet, rill and gully erosion. Rill and gully erosion are more effective than sheet erosion; consequently the actual amount of erosion in the area may be greater than estimated.

Road improvements as called for in this project include grading to a crown, surfacing, and vegetating cut slopes and drainage ditches. All of these procedures will help reduce the erosion potential from the roads. The

project should eliminate all but a few percent of the present erosion, thus reducing erosion by about 20,000 cubic meters per year.

2. Ecological Impacts

The clearing of land and increased activity associated with the project may have an adverse effect on the wildlife of the area. As the habitat decreases, the wildlife will also move, and may stress the wildlife population in adjacent areas. This impact, however, will be relatively minor since the total amount of habitat destruction is minimal, the quality of the habitat is poor and much similar habitat is found in the area. Some wildlife may be killed by traffic, but the likelihood is reduced because of low traffic volume and low speed necessary on such roads. Hunting of wildlife may also increase. With better road access, however, law enforcement personnel will be able to implement existing gun and hunting regulations.

Little likelihood exists that improvements to a candidate road would adversely affect any threatened or endangered species. Although the ranges of several species (see Chapter III and IV) overlap the project area, no critical habitats of these species are known to exist in the area. Because of increased access, wildlife conservation activists will be more readily available to properly inform the farmers as to the need for protection of these specific wildlife species and their habitats.

The ecological impacts of the proposed rural access roads on National Parks, National Forests, Nature Monuments, and Wildlife Sanctuaries will be minimal. Although several such parks (see Chapter III and IV) do exist in the project area, none of the proposed roads are known to traverse these parks. If future proposed roads do traverse any parks, the Environment Inspection Report will identify the area and the proper authority can be notified for coordination of activities. If roads do go through or adjacent to these areas, they would not necessarily be adverse, as access to the area could assist in studying and protecting the park or preserve.

The most significant long-term ecological effect is associated with decreased erosion as discussed above. Presently, most sediment derived from roadway erosion enters streams at localized stream sections. Road improvements will decrease sediment loads in those areas. Although the effect of reduced erosion may not be very large in terms of total stream sediment load, it will be a beneficial impact at specific points along the streams.

3. Socio-economic Impacts

The most significant long-term impacts of this project will be socio-economic and essentially all of these effects will be beneficial. It is estimated that 60,000 individuals on about 10,000 farms in the study area will be benefited by this project (about 12 percent of the project area population). The year-round access afforded by the 820 km of improved road is expected to encourage additional agricultural production and reduce the cost of marketing crops. These two factors will work together to substantially improve the income and quality of life of the small farmers.

During project development, farms in the project area were studied to facilitate estimations of the benefits produced by the road improvements. Because the study area is very large and distributed over much of the country, two areas were selected for study. The Renacimiento area in Chiriqui Province (near the Costa Rican border) was selected as one site. This region contains relatively fertile soil and farms tend to be larger (20 ha) than the average for the rest of Panama (less than 10 ha). The Capira area in Panama Province was the other region selected. In Capira, which is more representative of the total project area in terms of soil fertility and farm size, both small farms (6 ha) and asentamientos were studied.

In order to determine the potential reduction in prices charged for transportation of produce to market, farm gate costs along all-weather roads were compared to those along dry-weather-only roads. These data indicate that road improvements should produce a 1/3 to 1/2 decrease in transportation costs. Discussions with truckers indicate that the higher cost along dry-weather roads are due to decreased truck-life, increased frequency of breakdowns, and the high cost and long delays for repairs.

Reduced transportation costs and increased accessibility during the rainy season will stimulate increased farm production. It is estimated that agricultural production along improved roads may increase by as much as 50 percent. A small (20 percent) increase in fertilizer use will account for some of the increased production. However, the majority of increased production will be due to double cropping and a small increase in the area under production. Once all-weather roads are constructed farmers will be stimulated to increase production because reduced transportation costs will make it more profitable to sell produce and year-round access will ensure the ability to market excess produce.

Projected increases in both total farm and per capita income are significant. Analysis of small farms in the Renacimiento areas shows an increase of 125 percent while in the Capira area small farm income increases by 39 percent and income from asentamientos increases by 134 percent. Small farms in Renacimiento show a larger increase than those in Capira because of greater soil fertility and suitability for production of more profitable crops such as tobacco and coffee. The following table displays a more complete analysis of projected income increases:

Location	Income per Farm($)		Per Capita Income($)		Percent Increase
	Pre-Project	Post-Project	Pre-Project	Post-Project	
Renacimiento	2,129	4,805	355	800	125
Capira (small farms)	1,554	2,161	259	360	39
Capira (asentamientos)	681	1,600	114	267	134

Based on combined construction and maintenance costs over the 10-year project life, the average cost per beneficiary is estimated at $264. Assuming, conservatively, that the change in income resulting from this investment cost is $500/family, or $83/beneficiary, as in the Monte Oscuro-Capira example, the ten-year present value of these benefits would be $300. In other words, a $264 investment cost per farm beneficiary on the part of the GOP will lead to a $300 increase in the beneficiary's income (B/C ratio of 1.1). If we assume a less conservative, but probably more realistic, $1,000 change in farm family income, or $167/beneficiary, the $264 investment cost/beneficiary will lead to a $600 increase in the beneficiary's income (B/C ratio of 2.3). In other words, the project will significantly benefit the average subsistence farmer.

The project will have only minor impacts on population distribution. The construction of all-weather roads connecting to paved roads may stimulate some farmers to move their houses closer to the improved road. However, no large scale migration will be involved since most dwellings are relatively near existing roads. Also, the project will not significanly affect the local agricultural pattern. A minor amount of additional land clearing could be stimulated, but the impact would be minimal. Any additional clearing would be adjacent to areas presently in use and would probably involve land that had been previously cleared in the recent past.

There will also be a small beneficial effect on the level of social services in the area. Existing roads are essentially impassable during part of the year. Extreme hardship and long travel times are required to reach existing medical facilities and schools. This project does not contain programs to increase the number of medical centers or schools. However, all-weather roads would decrease travel times and increase access to existing services. In addition, other GOP programs designed to increase the number of medical centers, schools, sanitary facilities, etc. will be more easily implemented in areas containing all-weather roads. Access to the area by government representatives (such as extension agents) for informational services will also be improved.

The benefits from this project are not all directly related to improving an estimated 820 km of rural roads. The purposes of the project include establishing a capacity within the Government of Panama to inspect, evaluate and select rural roads for improvement in a rational manner and to institutionalize a system to maintain the improved roads utilizing labor intensive methods. Fulfillment of these purposes will have a long-term effect on the entire country. Considering the limited resources available to the Government of Panama, it is mandatory that road improvements be conducted in as efficient and cost effective a manner as possible. The technical assistance, training and experience provided by this program will improve the capability of the involved agencies in reviewing roads considered for improvement, determining their economic feasibility, assessing the potential impacts and selecting those yielding the greatest net benefits (considering all aspects).

Without this or similar projects, the capability of the government agencies to adequately maintain existing and future improved roads will be exceeded. Therefore, using labor intensive methods, the communities benefiting from the project will be trained to provide timely maintenance of the newly built roads.

VI. PROPOSED MITIGATION

A. INTRODUCTION

The primary mitigation measures for this project were incorporated during the development of the selection criteria and design standards. These are discussed in the following paragraphs along with construction and maintenance measures utilized to minimize adverse project effects.

B. PLANNING

Approximately 65 percent of Panama including a majority of its unspoiled tropical forests was eliminated from consideration during the planning of the project based on two selection criteria: either the area was not in the designated land potential class (Classes I and II or Class III on which an asentamiento is located), or the area is above an elevation of 1,525 m. Elimination of areas which do not meet these criteria restricts road improvement to areas best suited for agriculture.

The entire rural road selection process, as described in Chapter IV, provides a means for collecting information which is used to determine if adverse impacts are such that candidate roads should be eliminated from further consideration. In addition to the two primarily physical criteria which restrict the possible construction areas, other criteria used to determine the acceptability of a candidate road in the multi-stage selection process are:

- will the road connect with the existing all-weather transportation network?
- does an all-weather transportation facility already exist for the area in question, or is one planned during the life of this project?
- is the road already a candidate for which improvement beyond all-weather standards will be made during the life of this project?
- based on preliminary estimates, does it appear that the majority of the population to be served is in the target group (i.e., small farmers, asentamientos)?
- does the road show a potential for producing a benefit/cost ratio of at least one?
- will the physical presence of the road or the greater accessibility caused by it create significant adverse impacts to the environment or local population?
- is land tenure in the area to be served by the road such that the small farmers will retain the increased income resulting from the road improvement?

These criteria serve a dual function of maximizing potential project benefits and preventing construction which would result in significant ecological or social harm. Because some type of transportation facility must already exist, the amount of clearing is quite limited. There must be a significant amount of agricultural development in the area of influence of the road (within 2 km on each side of the road), thus minimum amounts of quality wildlife habitat will be directly or indirectly disturbed. Finally, an environmental evaluation of each candidate road is required to identify possible local sensitivities which could warrant rejection of the candidate road. Technical assistance will be provided to selected personnel of agencies of the Government of Panama in environmental analysis. Awareness of many of the possible detrimental effects of constructing a road will therefore be identified during the selection process and a candidate road can be excluded from consideration far in advance of detailed design and construction phases.

C. DESIGN AND CONSTRUCTION

A variety of socio-economic, physical and ecological impacts may be mitigated by proper consideration during the design and construction phases of the project. The major adverse socio-economic impacts are related to disruption of archaeological sites, displacement of dwellings, and the cost of construction and maintenance. The majority of these impacts may be eliminated or reduced during design. Sufficient data are collected during the selection process to allow road improvement design such that known archaeological sites are avoided and that existing dwellings are not displaced. Construction crews may be made aware of potential archaeological sites and can suspend operations and notify the proper authorities if such sites are impacted. The cost of construction and maintenance may be reduced to the lowest amount possible by proper consideration during the design phase. Again, information necessary for this will be gathered during an actual site inspection by trained engineering and environmental specialists.

Construction of road improvements will result in increased air and noise pollution. However, this project calls for extensive use of unskilled hand labor and limiting machine use reduces such pollution. Presently, much road construction machinery in Panama is old and in need of maintenance. Encouraging MOP to use new and/or properly maintained equipment will further reduce air and noise pollution.

A major adverse impact during construction is erosion but a variety of procedures can reduce the impact and amount. Roads will be steeply crowned so that rainfall quickly runs off into side ditches rather than down the roadbed itself. The roadside ditches and cut slopes will be planted with stoloniferous grasses such as tanner, signal or pangola grass, which are more efficient for erosion control than bunch grasses. The cut slopes that are necessary may be reduced in angle as much as possible to further limit erosion from adjacent areas as well as preventing roadbed failure. During construction, the use of check dams and other standard techniques can help reduce erosion and limit its impact. A major mitigation technique is the proper seasonal timing of construction, limiting the amount of roadbed under construction at any one time and immediate planting of grasses. Construction will take place in the dry season but relatively heavy rains still occur during this part of the year.

Proper design and construction procedures may also limit ecological damage. Destruction of roadside vegetation may be reduced by limiting the lateral distance for operation of machinery. This procedure ensures that only the amount of destruction of roadside vegetation which is necessary will occur. Vegetation destruction is also reduced because the design standards call for a basically single-lane road with occasional turnouts instead of a full two-lane road. Impacts to aquatic communities and habitat are also reduced by construction and design standards. All mitigation methods for erosion reduction help reduce stream sediment loads. Direct removal and disturbance of aquatic habitat will be reduced by limiting the size of stream crossings and bridges to that which is necessary. Also, the streambed character in the area of crossings and bridges will be retained as close to natural as possible. All of the above measures will limit damage to aquatic habitat as much as is feasible during construction. The use of adequate sized concrete masonry pipe at stream crossings will reduce the likelihood of blockage during high flows. Construction during the dry season will further reduce aquatic impacts since streams are at low flow during this period.

D. MAINTENANCE AND TRAINING

The expeditious maintenance built into the project plan will serve as a long-term form of mitigation to reduce the potential for adverse impacts. Immediate repair of erosion channels along the roadway will decrease sedimentation. Keeping ditches and culverts clear will aid in runoff and keep water from saturating the roadbed and inducing base failure.

To insure local communities understand the need for timely maintenance and are cognizant of proper procedures, audio-visual presentations will be prepared and shown to the communities involved. This training period will also be utilized to provide an audio-visual presentation on threatened and endangered species and the need for their protection in order to initiate an environmental awareness program at the local level.

VII. UNAVOIDABLE ADVERSE IMPACTS

Unavoidable but short-term adverse impacts will result from increased noise levels and air pollution during construction. Rains, which occur during the construction period and before grassed ditches and slopes are stabilized, will temporarily increase sediment loads in adjacent streams. Additionally, temporary increases in suspended solids will occur during construction of fords and bridges (although there will be few of the latter).

Some clearing of natural vegetation will occur during construction and as a result of the improved access. Assuming an increased road and ditch width of 5 m, improving 820 km of road requires clearing 410 ha. When the entire project area is considered, however, the amount of clearing which would be done as a direct consequence of the roads (less than 0.015 percent) is probably less than that which would result from the farmers moving to other areas and using the slash-and-burn method of clearing. Increased activity in the area may cause wildlife to move, or stress the wildlife that remains.

Noise and air pollution increases will occur from increased traffic on the improved roads, but this should be minimal since low traffic volumes and slow speeds are projected. Some land use changes may occur if residents move closer to the road and intensify agricultural use. Increased use of agricultural inputs may increase amounts of fertilizer, pesticides, and herbicides in the streams if adequate prevention information is not provided and put to use.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

There are a number of possible alternatives to the proposed project: various amounts of technical assistance and training, more or less road construction, other agencies accomplishing the work, and so forth. Practically, there is only one alternative--to maintain the status quo (no action). An inadequate amount of technical assistance, training, and road construction would have limited value; too much technical assistance, training, and road construction could waste time and financial resources.

While the total amount of rural access roads could vary (and may) the 820 km maximum was generally agreed upon by the agencies involved. It provides the amount of technical assistance and on-the-job training required, and provides needed transportation routes to rural agricultural areas. Other international agencies have already become involved in assisting the Government of Panama in its transportation planning and development. The agency (or agencies) which accomplishes the project is actually immaterial, the impacts should be similar. Thus, the only logical alternative which should be seriously considered is no action. This choice would result in the continued insufficient capability of the Ministry of Public Works (MOP) and the Ministry of Agricultural Development (MIDA) to maintain and upgrade the vital rural access roads throughout the country. Unless some action is taken within the immediate future, MOP and MIDA will continue to need more trained personnel, and will continue to operate at an efficiency lower than that desired to improve and maintain the country's tertiary road system. If the present level of efficiency continues (which is likely without some assistance) the entire rural road network could be adversely affected. Because the Panamanian economy is highly dependent on its agricultural sector and the road system is vital to the agricultural sector (especially to the rural small farmer), this lack of increased efficiency could adversely affect the entire economy.

Improved access is particularly important when the condition of the average small farmer is considered. His per capita income may be less than one-fourth that of an urban dweller, he has few modern conveniences, he is unable to sell or store many potentially valuable agricultural products, and his educational opportunities are low. Many of these problems are directly related to his relative isolation during the rainy season. Unless his life style can be improved, there will be a continued rural to urban migration and further reduction in agricultural productivity. In addition, many of those individuals who remain in agriculture will cling to the old system of farming--slash-and-burn. This will result in continued destruction of natural vegetation, depletion of soil fertility, and increased erosion. The capability of the agricultural extension agents to reach the small farmer would also remain limited. There are a limited number of extension agents available, and improved roads would allow them to visit more farms.

Furthermore, the rural roads would continue to be developed by the communities with little thought given to proper design or drainage. Erosion from this type of road is often extreme, and in some locations the road becomes a highly eroded ravine. Conservative estimates indicate that more than 50 m^3 of surface soil erodes annually from each unvegetated hectare of land in the area. This estimate is based on sheet erosion from land with gentle slopes. This means that over 20,000 m^3 per year is eroding from the existing, unpaved roads which would be improved by this project (820 km of road with an average width of 5 m).

Thus, failure to improve access routes for the small farmer will confine him to the low end of the economic scale, increase the potential destruction of natural resources, and increase the exposure of the easily erodible soils of the country.

IX. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENCHANCEMENT OF LONG-TERM PRODUCTIVITY

The short-term, localized use of man's natural environment due to the access road project includes the commitment of 820 ha of land to roadway and the adverse impacts resulting from this conversion. Air, noise, and water quality will be locally and temporarily degraded. A short-term commitment of capital, labor, and some natural resources will be necessary to facilitate road construction. Little private land will be taken and no persons displaced. Some wildlife habitat may be destroyed, but the amount will be minimal.

In contrast, the gains which would result from increased road maintenance and construction capability and improved transportation routes in agricultural areas are great. The economic and social well-being of the small farmers and the asentamientos will be improved. The amount of agricultural products available for domestic use and for export will increase. As a result, the long-term economic and social well-being of the entire country will be improved. Sub-programs built into the project will train individuals in environmental assessment and increase the environmental awareness of the rural communities; developing such an awareness will obviously have long-term beneficial effects. Finally, the project will result in a more efficient utilization of the limited resources of Panama.

X. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The irreversible and irretrievable commitment of resources resulting from this project involves the conversion of 820 ha of land to roadway and the consumption of capital, labor and materials to accomplish this work. The financial commitment to the project is $15 million, of which about $5 million will be provided by the Government of Panama. Categories and uses of materials which would be irretrievably or irreversibly lost include the following:

i) lumber--forms for bridges;

ii) sand, crushed rock and cement--concrete for culvert pipes and bridges, and select material for roadway;

iii) steel and other metals--concrete reinforcement;

iv) fuels and lubricants, gasoline, diesel fuel, oil, solvents and grease--vehicles during construction and maintenance, and for travel by traffic generated by the development; and

v) labor--the labor utilized during construction and maintenance.

Because the exact location of the roads and their existing condition varies greatly, it is virtually impossible to estimate quantities of materials required.

XI. COORDINATION WITH OTHER AGENCIES

An initial environmental examination for this project was completed March 20, 1978, and submitted to various US Government agencies for review and comment. Responses have been received from the Department of the Interior (Fish and Wildlife Service and the US Geological Survey), the Department of Agriculture, and the Department of Transportation. These responses are attached as Exhibit D. Comments and concerns expressed in these responses have been addressed in this document to the extent possible given the programmatic thrust of the project. Responses to specific comments are contained in Appendix D.

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GLOSSARY

Alluvial soil--Soils that are deep, dark-brown and black, clay or loam with a relatively high content of organic matter.

Andosol soils--Soils having a black loam surface with a high content of organic matter.

Annual crop--An agricultural plant that lasts one year or season.

Cadastre--An official register of the quantity, value and ownership of real estate used in apportioning taxes.

Floristic region--A region divided by floral or vegetation characteristics.

Halophyte--A salt-tolerant or salt-requiring plant that is able to live in areas with brackish or saline groundwater.

Igneous--Relating to, resulting from, or suggestive of the intrusion or extrusion of magma or the activity of volcanoes.

Latosol soils--Soils having a dark grayish-brown clay or clay loam surface with a moderate to fairly high content of organic matter.

Lithosol soils--The steep, stony, shallow or eroded phases of the Latosol and Andosol soils.

Low Humic-Gley soils--Soils with poor drainage and with a thin surface layer high to medium in organic matter overlying mottled light-gray loam to clayey leached subsoil.

Perennial crop--An agricultural plant persisting for several years.

Planosol soil--Gray to dark-gray, heavy, clayey soils with a subsurface horizon which are slowly permeable to water, air and roots.

Regosol soils--Deep, dark-grayish-brown to very dark-brown soils on relatively old alluvial materials.

Rhizome--An underground stem or branch which produces shoots above and roots below ground.

Slash-and-burn agriculture--Shifting agriculture involving the clearing of some forest, growing of crops for one to several years, and abandonment of the land when yields decrease.

Stolon--A horizontal branch from the base of a plant that produces new plants from buds at its tip or nodes.

Subsistence agriculture--Non-commercial agriculture to produce only enough to meet the immediate needs of the farmers.

Tidal Swamps and Flats--Soils that are either continuously submerged or inundated daily.

EXHIBIT A

SELECTION PROCESS AND RURAL ACCESS ROADS INSPECTION FORM

SELECTION PROCESS

There will almost certainly be more roads nominated for improvement under this program than can be improved. Some will not be feasible for improvement, either because of social, economic or environmental reasons. Part of this project is to improve the capability of personnel within specific agencies of the Government of Panama to analyze and select roads for improvement. Therefore, a standarized procedure was developed to determine which of the existing roads in Panama would be modified under the improved access roads program. The following paragraphs describe the criteria and the process by which the roads will be analyzed and selected.

The Ministry of Public Works (MOP) or the Ministry of Agriculture (MIDA) will receive requests from communities for road improvement. In addition, various government agencies, including MOP and MIDA, will generate requests as they carry out various projects and programs. For example, the Ministry of Planning and Economic Policy (MPPE) may request that a road be improved for one of the agro-industrial sub-projects under the AID-funded Rural Growth and Service Centers (URBE) Project.

The community or other entity submitting the request will be required to provide as much information as possible, but in order to be considered, the request must contain the following minimum amount of information:

(i) an adequate map of the candidate road that will permit it to be located on specialized maps, such as those showing potential soils suitability;

(ii) the road's length;

(iii) an estimate of the number and size of farms affected; and

(iv) a list of principal crops grown in the area of the road.

The request and accompanying information will be transmitted to the lower level of a Rural Roads Selection Committee, comprised of representatives of MOP, MIDA and MPPE. There the information will be reviewed for correctness and combined with additional information obtained from the Committee's Data Bank. The Data Bank will be a resource library which contains such things as land use capability maps, census data, climatological and topographic maps, maps of existing roads, investment plans of the various Ministries, project descriptions for international donor-funded projects, and prototypical farm budgets. Taking all information into consideration, the lower level of the Committee will then ensure that the following selection criteria are met:

(i) the road must be located in an area containing soils in the IA, IP, IIA or IIP classifications, or on class III soils on which asentamientos are located;

(ii) the area served by the road must be below the elevation of 1,525 m;

(iii) the road must connect with an all-weather transportation network;

(iv) an alternate all-weather transportation facility serving the same area does not exist, nor is one planned during the life of the project;

(v) the road is not a candidate for improvement beyond minimum all-weather standards during the life of the project;

(vi) based on preliminary estimates, it appears that the majority of the population is in the target group (small farmers); and

(vii) the road shows a potential of producing a benefit/cost ratio of at least one.

If the criteria above are met and all information needed is on hand, the lower level of the Committee passes the request and data to the upper level, which acts as a board of review. That level can either reject the road's candidacy based on its possible conflicts or duplication of effort under other programs, or it can approve the road's candidacy and return the request and data back to the lower level for a physical survey.

Some candidate roads which are marginal with regard to acceptance based on the seven criteria above, and which may be initially rejected, may have been found to be acceptable based on further study. However, it is expected that many more roads will be nominated than can be constructed under the program, and marginal roads would be given a low priority. An Inspection Report will be completed during the field survey which encompasses many environmental features of the area to receive construction. (A copy of the Inspection Report is attached). Using the information obtained during the physical survey, the lower level of the Committee will compare the candidate road with the following criteria for the second phase of the selection process:

(i) neither the physical presence of the road nor the greater accessibility created by it will cause significant adverse impacts to the environment or local population;

(ii) the majority of the population living in the road's area of influence must be in the target group, and a majority of the land in that area must be farmed by them;

(iii) land tenure is such that small farmers will retain the increased income resulting from road improvement; and

(iv) the candidate road's benefit/cost ratio is at least one.

If the candidate road meets all of the above criteria, it will be placed on a rank ordered list of roads scheduled for construction the following year. Although the road's position on the list will be based primarily on the size of its benefit/cost ratio, it may not be constructed strictly by the order on the list. The AID/Panama Mission and the Government of Panama have determined that it would be uneconomical to proceed with the

construction of a project strictly on a rank order basis. Instead, subprojects will be grouped as possible into aggregate "priority groups." Therefore, rather than move all equipment from the highest priority candidate road to the next highest priority, the contractors will construct all ranked roads in the "priority group" that are easily accessible from the highest ranked road, and only then move the equipment to the next highest "priority group" of projects. This approach would be the least costly and most practical order of construction.

One additional step will be taken immediately before construction begins. A request will be made to the Ministry of Public Works to prepare a maintenance plan for the road which will require a formally signed agreement with the local community before implementation. The local community will be required to contribute a certain percentage of the total maintenance cost and construction will not begin until the agreement is signed.

The cycle from the beginning of the road selection process to completion of construction covers a two-year period. The first year, the Selection Committee reviews, selects, and prioritizes the candidate roads as described above. Near the end of the first year, the agency in charge of construction reviews the prioritized list, and selects the maximum number of roads that can be supervised given the manpower available and the distances to the construction sites. This list becomes the construction plan for the second year. Roads not included in the construction plan are placed back on the Selection Committee's prioritized list for the following year. The construction plan is then submitted to AID. In the event that the plan or any subsequent modification thereof does not follow the priority listing, the construction supervisor must notify AID in advance of construction start-up and provide an explanation for the change.

A significant part of the selection process is the completion of the road inspection report. A unique aspect of this report is that it includes environmental considerations. Thus, to assist in understanding this portion, the process through which the environment inspection report was developed is now discussed.

DEVELOPMENT OF THE ENVIRONMENTAL INSPECTION REPORT

The environmental portion is only one of four parts of the Road Inspection Form; however, because it is an initial effort at requiring consideration of environmental aspects, a detailed discussion appears warranted. The environmental inspection report was developed in an attempt to insure that consideration was given to environmental values while improving the socioeconomic well-being of the agrarian sector of Panama. Taken into consideration during the development of these criteria were the following:

(i) there is a lack of available personnel in Panama with the environmental training and background to conduct an environmental assessment to the detail common in the United States;

(ii) there is a major need to improve the institutional capability of the Government of Panama to construct roads into much of the agricultural producing areas of Panama;

(iii) as much information as possible should be obtainable from maps, tables, etc., to reduce field study costs, and to allow personnel to conduct an environmental inspection while being trained;

(iv) this version of the inspection form is only a beginning, and as environmental training and awareness increases, the amount of detail and parameters considered can expand;

(v) the access roads are not being constructed in undisturbed areas, but in areas where roads of some type exist;

(vi) the criteria established for selecting roads to be improved eliminates many areas from consideration--areas that might be susceptible to environmental damage if roads were built into the area; and

(vii) environmental aspects were considered during the development of the construction and maintenance requirements for the rural roads.

Using these as a guideline, the environmental inspection form evolved into that contained in Part IV of the attached Rural Roads Inspection Report. The reasons for each item on the form, procedures for obtaining the required data, and how the assembled information should be considered are contained in the following discussion.

The general data, Section A, serves the purpose of identification, and also locates the road within physiographic and geographic boundaries. This becomes important when various ecological parameters are considered.

General environmental information is contained in Section B. Elevation is related to vegetation types, wildlife habitats, land use, etc., and can be obtained from topgraphic maps. The latest available land-use maps should be used to determine the general land use (crop, pasture, forest, etc.). Such maps are available from the Government of Panama. Even though the maps are acceptable for general categorization, the area should be field checked to determine if there are any localized variations, i.e., forest land in a pasture land use. Vegetation types may be delineated by various means, and the categorization shown in the form was developed by the Republic of Panama (1965, 1975). It can be plotted on a map or overlay and determined for any location. These parameters can be utilized to help describe the environment of the area. Additionally, they form a basis for habitat delineation.

Section C relates to threatened and endangered species, specifically those placed in that status by the U.S. Department of the Interior, the Government of Panama and the International Union for the Conservation of Nature. As accurately as possible, the range of all threatened and endangered species will be plotted on a map of Panama. When a road is being considered, the map can be consulted to determine if the range of any threatened or endangered species covers that area. If so, further analysis will be required. A chart should be prepared which will, as accurately as possible, describe each species and its habitat. The information contained in Section B can

be utilized to compare the existing wildlife habitat with the habitat required for the species. If habitat for a species exists, calculations are then made to determine how much might be destroyed during road improvements.

The Endangered Species Act of 1973 specifies that a significant portion of the range of a threatened or endangered species must be protected. Obviously what might be significant would vary with the species, and with the individual conducting the analysis. In attempting to develop a simple guideline to be utilized, an arbitrary decision was made that if the amount of habitat removed exceeded 10 percent of that available in the area of road improvements, further analysis should be conducted. Local inhabitants should be interviewed to determine if there have been any recent sighting of the species. Recognized authorities should be contacted for additional information and recommendations. Range maps and species information presently do not exist in a usable form. Therefore, technical assistance may be required to assemble and analyze available data to enable the above procedure to be easily followed. As additional data becomes available, the 10 percent figure can be modified, or developed for each species.

Section D requires consideration of potential impacts to proposed and existing national parks and forest preserves. These areas have been recognized by the International Union for the Conservation of Nature and by various agencies of the Government of Panama. Such areas could be identified and mapped and the initial determinations if the proposed road would go through or adjacent to the areas. If so, that is not necessarily adverse, as access to the area could assist in studying and protecting the park or preserve. The agency having jurisdiction over the park or preserve should be contacted and coordination instituted.

Similarly, if the proposed road improvement traverses an area known to contain archaeological resources, they should be noted. Further, if any suspected sites are found during construction authorities should be notified. Information is available to map known sites. Expertise within the country should be utilized to provide further information on archaeology and history.

Consideration must also be given to impact on water resources, siltation, change in drainage patterns, and draining wetlands. This is really a design consideration and should be addressed at that stage. Finally, any spoil areas should be planted to reduce erosion potential, and borrow areas should be addressed at that stage. Finally, any borrow areas should be located so as not to create any adverse situations.

TECHNICAL ASSISTANCE

Technical assistance will be provided to Panamanian personnel to develop and assemble the maps and charts required for the environmental portion of the inspection report. Land use maps exist but may require redrafting to the proper scale. (For ease of analysis, all maps or overlays should be at the same scale.) However, assistance should be provided in researching and mapping vegetation zones, ranges of threatened and endangered species, proposed and existing national parks and forest preserves, and archaeological and historical resources.

Vegetation types can be defined according to various criteria, and the most applicable can be determined and plotted. The classification suggested is that developed by the Republic of Panama (1965, 1975).

The most difficult to develop would be the threatened and endangered species. Ideally, extensive field study and verification would be utilized to accurately define the range of these species. However, this would not be feasible. For an initial delineation, literature research and interviews with recognized authorities should provide sufficient information for mapping. The maps must be supplemented by a chart of manual describing each threatened or endangered species in detail, its habitat and range, and, if possible, a colored photograph.

Information on existing and proposed national parks and forest preserves also exists, and can be plotted. (Exact boundaries may not be available, but the locations should be mapped as accurately as possible.)

The location of known archaeological and historical sites is also available, and can be plotted. These should be coordinated with governmental agencies and organizations to insure that this area is properly considered.

INSPECTION REPORT - RURAL ROADS

PART 1 - ENGINEERING

Date_____

Prepared by_____ Initials_____
In Collaboration with_____ Initials_____
_____ Initials_____
_____ Initials_____

A. GENERAL ROAD DATA

Province _____ District_____ Township_____

Name of the Road_____

Goes from_____ to_____ Distance Kms _____

Location on Map_____ Scale_____
Is it connected to an all-weather road? Yes___ No___ Which one_____

B. ROAD CLASSIFICATION

Horse trail_____ Penetration Road_____ Summer road_____

All-weather road_____ Other type_____

Mountainous terrain_____ Hilly_____ Slightly hilly_____ Plains_____

Road surface is in good condition_____ Regular_____ Bad_____

Width of the existing road_____ Shoulders_____ Right of Way_____

Road surface: Earth _____ Thickness_____ Clay_____ Thickness_____

Sand_____ Thickness_____ River gravel _____ Thickness_____

Select material_____ Thickness_____ Quarry Rock_____ Thickness_____

Other_____ Thickness_____

C. Other Factors

	None	Few	Many
Sharp curves	_____	_____	_____
Steep inclines	_____	_____	_____
Poor drainage	_____	_____	_____
Unstable foundation	_____	_____	_____
Rough surface	_____	_____	_____
Erosion areas	_____	_____	_____

	%	Average number of meters
Will require complete cut	_____	_____
" " one side cut	_____	_____
" " complete fill	_____	_____

D. Streams or Rivers that require bridges:

1. _____ Length _____

2. _____ " _____

3. _____ " _____

E. Streams or Creeks that require fords, box culverts or pipe culverts:

		Fords	Box Culverts	Pipe Culverts .90	.75	.60
1. _____	_____	_____	_____	____	____	____
2. _____	_____	_____	_____	____	____	____
3. _____	_____	_____	_____	____	____	____
4. _____	_____	_____	_____	____	____	____
5. _____	_____	_____	_____	____	____	____
6. _____	_____	_____	_____	____	____	____

F. Availability of Aggregate

Indicate type of material available for surfacing

_____

Where _____

Distance from the mid point of the road to be improved: _____ kms.

G. Actual Use Factors

1. Average weekly vehicle count _____.

2. Maximum load capacity of trucks ____ tons. 3. Maximum weight carried by these trucks ____ tons.

4. Usual number of rear axles for these trucks: _____.

5. Number of days per year when traffic occurs: _____ days.

6. List the months of the year that trucks cannot use the road _____

_____

7. Months when heavy rain occurs_____

_____

8. Average rainfall during those months:_____mm/month

9. Frequency of floods or washouts that leave the road closed:_____ times/year

10. Average number of small farms_____km.

11. Minimum recommended design standards:_____

_____

_____

12. Additional observations of an engineering nature:

_____

_____

_____

_____

_____

Estimated Cost for Construction

1 Cost per km for earth moving $_____

2 Ditches & formation of roadbed; Cost/km $_____

3 Installation of culverts and normal drains. Cost/km $_____

4 Placement of 0.15 meters of select material and at least 90% compaction -- Cost/km $_____

Total cost per km. $_____

5 Estimated cost of fords and culverts

(E-1)_____ $_____

(E-2)_____ $_____

(E-3)_____ $_____

(E-4)_____ $_____

(E-5)_____ $_____

(E-6)_____ $_____

Sub-total $_____

6 Estimated Cost of Bridges

(D-1)_____ $_____

(D-2)_____ $_____

(D-3)_____ $_____

Sub-total $_____

7 Total Cost to Improve the Road

(H) $_____ per km x _____ Kms. $_____

(5) _____ Sub-Total $_____

(6) _____ Sub-Total $_____

TOTAL $_____

INSPECTION REPORT - RURAL ROADS

PART II - AGRICULTURE

_____

Date of trip_____

Prepared by:_____Initials_____
In Collaboration with_____Initials_____
_____Initials_____
_____Initials_____

A. General Data

Province:_____District:_____Township_____

Name of the Road:_____

Goes from_____to_____Length kms_____

B. Area of Influence (The area where the population lives that uses the road as its principal pathway to the outside world).

1. Estimate

a. Total size of the area_____Km^2
b. Size of the cultivable land_____Km^2
c. Population_____persons
d. Population 5 years ago_____persons

2. What geographic restrictions (rivers, mountains, etc.) limit in a significant way the size of the road's area of influence?

_____

_____

3. Estimate the distance between the restrictions and the road._____

_____

_____

4. What is the longest distance from the road that the user population lives? km_____.

5. Indicate the use of cultivable land in the area:

Crops_____%
Pasture_____%
Forest_____%
Other_____%

C. Quantity and Description of farms:

1. In the road's area of influence there are approximately _____ farms of all classes.

2. The sizes of the farms varies from _____ hectares to _____ hectares.

3. The average size of the small farm is _____ hectares.

4. There are _____ large commercial farms or stations which have approximately the following sizes expressed in hectares:

_____

D. Description of a typical small farm

1. Type of home construction: _____

2. Number of rooms in the house _____

3. Number of persons living in the house _____ persons.

4. Composition of the family: nuclear _____.
   extended _____.
   joint: _____.
   Other: _____.

5. Total area of the small farm _____ hectares.

6. Total cultivable area _____ hectares.

7. Type of technology employed in cultivation _____

_____

8. Use of the cultivated land.

PRODUCT PLANTED	HECTARES PLANTED	PERCENTAGE OF THE CULTIVATED AREA
Total		

9. Area of the cultivable land in pasture: _____ hectares.

10. Area of the cultivable land not in use: _____ hectares.

11. Purchased production inputs that were consumed during the last production year:

a. Fertilizers: _____ CWT.

b. Seeds: _____ CWT.

c. Pesticides: _____ CWT.

d. Food for animals _____ CWT.

12. Use of production in the latest year.

Crop (plant and animal)	CWT. Produced	CWT Consumed by the family	CWT Consumed on the farm for seed or food for animals	CWT Sold or Available for sale

E. Market

1. _____% of sales sold on the farm. These were sold to: _____

_____

2. _____% of sales made to local markets.

3. _____ % of sales made to distant markets.

4. Local Markets

Name	Distance to the Midpoint of the Road
	_____ km
	_____ km
	_____ km
	_____ km
	_____ km

5. Prices received on sales during the latest year:

Crop (Plant and Animal)	Unit	Quantity	Place Sold

F. Cost of Transportation

Class of transportation	From/to	km.	Cost/ cwt-km	Time required for the trip
1. Human				
2. Animal				
3. Truck				
4. Bus				
5. Taxi				

G. Social Services

1. Number of visits/year of agricultural extension service: _____

2. Health center

   a. Location: _____

   b. Distance to the mid-point of the road: _____ km.

   c. Class and time of transportation actually used.

Class of Transport	Hours required from the mid-point of the road
On foot	
By horse	
By vehicle	

3. Schools:

Location	Grades	Distance to the mid-point	Most common class of transportation	Hours required for traveling to school
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

H. Miscellaneous

1. Estimated average income by a family on a typical small farm (do not include the value of goods produced on the farm and consumed there) $/._____

2. Average number of years of education received by children living on small farms:_____years of schooling.

3. In the opinion of small farmers what changes will occur if their road is improved so that it could be used year around. Ask various small farmers and local officials. Indicate the persons questioned and their replies.

   a. In terms of agricultural production:

   b. In terms of other effects

ROAD RECONNAISSANCE REPORT

PART III - SOCIAL

Date of Field Trip_____

Prepared by_____ Initials_____

In collaboration of: _____ Initials_____

_____ Initials_____

_____ Initials_____

A. General Data

Province_____ District_____

Township_____

Name of Road_____

From_____ to_____ length_____km.

B. Area of Influence (area in which local habitants use road as their principal way of access to the outside world)

1. Estimate:

   a. Inhabitants _____ persons

   b. Inhabitants over 5 years_____persons

2. Predominate types of dwellings in the area_____.

3. Indicate if they are scattered or grouped in settlements or villages

   _____.

4. Principal occupation of the families in the area_____

   _____.

5. Specify principal occupations of the women. (Indicate if handicrafts or small rural industries exist in the area)_____

   _____.

6. Health Center

   a. Location_____.

   b. Distance to mid-point of road_____km.

c. Class & type of actual transportation used _____

_____.

Class of Transportation	Time Required from mid-point of Road
On foot	_____
Horseback	_____
In car	_____

7. Where do women give birth to babies? _____

8. Schools

Location (Estimated number of students)	Grades	Distance to mid-point of road	Common Class of Transportation
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

9. Existing organizations for the solution of the problems of the community.

_____

_____

C. Description of a typical farm.

1. Size _____ hectares.

2. Total area cultivatable _____ hectares.

3. Type of dwelling _____ (indicate construction and number of rooms).

4. Number of persons living in the dwelling _____.

5. Family Composition:

Nucleous family _____

Extended Family _____

Joint Family _____

Other _____

6. Type of technology employed in the cultivation_____.

7. Average estimated family income (Do not include the value of the products of the farm consumed by the family): B/.

_____.

8. Average number of years of education actually received by children in the family (Indicate if differences exist between girls and boys).

_____years of school.

D. Inquire from farmers of small scale farms, of typical farms and from local officials. (Indicate persons interviewed and their responses).

1. What are the most urgent neccessities of the community. (health services, education, technical assistance, roads, legal titles, agricultural inputs, etc.).

_____

_____

2. Your opinion about the changes that will occur in the area if road is improved for all-weather conditions.

In terms of dwellings, education, health and income, etc.

INSPECTION REPORT - RURAL ROADS

Part IV - Environment

Date _____

Prepared by _____ Initials _____

In Collaboration With _____ Initials _____

_____ Initials _____

A. General Data

Province _____ District _____ Township _____

Name of the Road _____

Goes from _____ to _____ Distance kms. _____

Location on Map _____ Scale _____

B. General Environmental Information

1. Elevation

a. 0 to 500 meters _____

b. 501 to 1,000 meters _____

c. 1001 to 1,500 meters _____

d. over 1,500 meters _____

2. Land Use

a. Define the land use as shown on existing land use maps.

_____

b. Describe any localized variation in land use from that shown on the map.

_____

3. The road passes through the following vegetation types:

   a. Highland Evergreen Forest _____

   b. Subtropical Evergreen Forest _____

   c. Tropical Evergreen Forest _____

   d. Tropical Semi-evergreen Forest _____

   e. Tropical Deciduous Forest _____

   f. Cropland, Savanna, and Secondary Growth _____

   g. Indundated Forests and Lands _____

C. Threatened and Endangered Species

1. Is the road within the range of one or more threatened and endangered species? _____

2. If so, what are the potentially affected species?

   a. _____

   b. _____

   c. _____

   d. _____

3. Based on habitat descriptions for the species, and the environmental data contained in Section B, which of these species are likely to be affected?

   a. _____

   b. _____

   c. _____

4. For the species affected, approximately how many hectares of habitat exists within 10 kilometers on either side of the road?

   _____ ha

5. How many hectares of habitat would be removed by construction of the road?

   _____ ha

6. What percentage of habitat is being removed?

_____percent

NOTE: If the percentage exceeds 10 percent, interviews should be conducted with local inhabitants and recognized authorities to determine if the species actually exists in the area and if the amount of habitat destroyed is critical.

D. National Parks and Forests

1. Does the road go through or adjacent to an existing or porposed National Park, National Forest, Nature Monument, or Wildlife Sanctuary?

_____

2. What percentage of the park will be affected?

_____percent

NOTE: If a National Park, National Forest, Nature Monument or Wildlife Sanctuary is affected, coordination whould be instituted with the agency having jurisdiction over the area.

F. Archaeological and Historical Resources

1. Is the road in an area known to contain historical or archaeological resources?

_____

G. Other Considerations

1. Would the proposed improved road create any of the following changes in the water resources of the area?

a. Increase siltation_____

b. Change drainage patterns_____

c. Drain wetlands _____

2. Would borrow pits or spoil areas be required?

a. Borrow Pits_____

b. Spoil Areas _____

NOTE: If either borrow pits or spoil areas are necessary, plans should be made to properly locate and treat the areas.

H. Indicate below whether the physical presence of this road or its improvement to provide better access will cause significant damage to the environment. If so, describe the adverse effects that may occur:

_____

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EXHIBIT B

EXISTING AND PROPOSED NATIONAL PARKS, FOREST RESERVES, NATURE MONUMENTS, AND WILDLIFE SANCTUARIES

Number[a]	Name and Location	Source[b]	Comments
Existing National Parks			
1[c]	Altos de Campana National Park and Biological Reserve, Panama Province	1,2	Totally protected and supervised; area 2,600 ha; altitude 250-1,034 m; rugged terrain, cool wet climate; contains several ecological zones; Law No. 153, June 28, 1966.
2	Volcán Barú National Park, Chiriquí Province	1,2	Area 14,850 ha, altitude 1,600-3,475 m (highest point in Panama); varied topography, high rainfall; abundant montane fauna and flora; Law No. 40, June 24, 1976.
Proposed National Parks			
3	Las Perlas Islands, Panama Province	1	Area 2,550 ha; marine.
4	Bocas del Toro, Bocas del Toro Province	1	Area 6,300 ha.
5	Portobello, Colon Province	1	Area 12,600 ha; historic.
6	Fronteriza, Darién Province	1	Area 96,300 ha; in Alto Darien.
7[c]	Maje Island, Panama Province	1	Area not defined.
Existing Forest Reserves			
8	Chagres River Forest Reserve, Panama Province	1	Area about 70,000 ha; boundaries not defined; Law No. 45, January 30, 1973.

EXHIBIT B (CONT'D)

Number[a]	Name and Location	Source[b]	Comments
9[c]	La Fortuna Forest Reserve, Chiriquí Province	1	Area 20,675 ha; Law No. 68, September 21, 1976.
10[c]	La Veguada Forest Reserve, Veraguas Province	1	Area 40,500 ha; Law No. 94, September 28, 1960.
11	Alto Darién Forest Reserve, Darién Province	1	Area 80,000 ha; Law No. 84, May 8, 1972.
12	Madden Forest Reserve, Panama Canal area	3	Area 1,555 ha; Tropical lowland forest; contains section of Las Cruces Trails.
Proposed Forest Reserves			
13[c]	Bayana (River Basin) Watershed, Panama Province	1,2	Area 372,642 ha; humid tropical forest.
14[c]	El Montuoso, Los Santos Province	1	Area 7,500 ha.
15[c]	La Tronosa, Herrera Province	1	Area 20,529 ha.
16	Chepigara Forest Reserve, Darién Province	2	Area 262,640 ha; altitude 0-1,581 m; rugged terrain, wet cool climate; heavy vegetation, rich fauna.
17	Tacarcuna area, Darién Province	2	Area 137,915 ha; altitude 200-1,875 m; steep ridges, wet to very wet climate; good flora and fauna.
18[c]	Mountain massif of Azuero Peninsula, Veraguas and Los Santos	2	Area 134,965 ha; highest point 1,400 m; mountainous, damp and cool; subtropical forest.
19	Caimito River Basin, Colón Province	2	Area 26,000 ha; low altitude; hot high rainfall; humid tropical forest.
Existing Nature Monuments			
20	Barro Colorado Island Research Laboratory, Gatun Lake, Panama Canal	1,3	Area 1,460 ha; low altitude; lowland tropical flora and fauna; operated by the Smithsonian Institution.

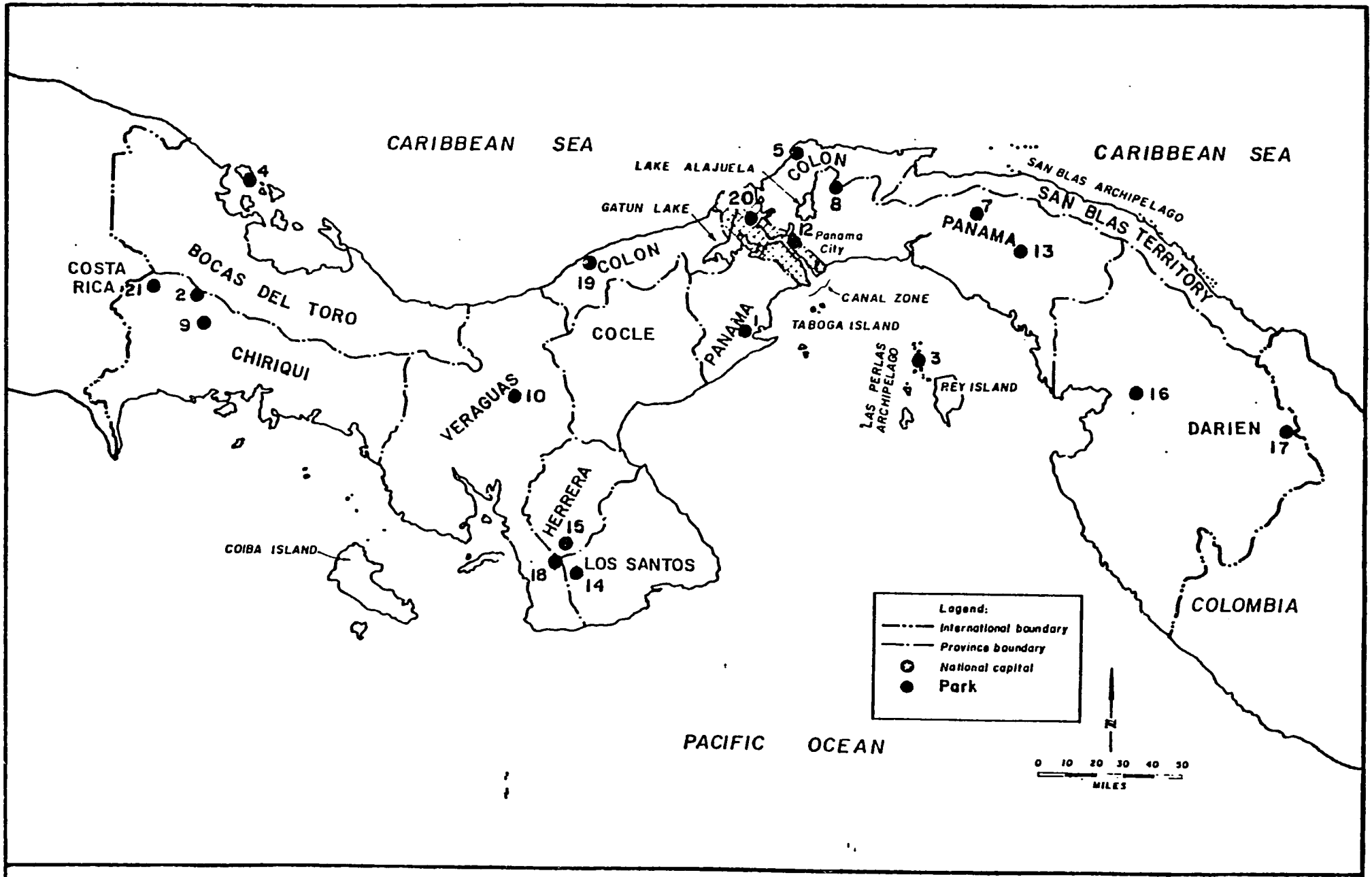
EXHIBIT B (CONT'D)

Number[a]	Name and Location	Source[b]	Comments
Existing Wildlife Sanctuaries			
21	Nueva Suiza Nature Center and Research Station	4	Highland tropical flora and fauna; owned by Florida Audubon Society, operated by Panama Audubon Society.

[a] See attached map.

[b] 1=RENARE, Government of Panama
2=IUCN (1971, 1972)
3=Panama Canal Treaty (1978)
4=Loftin (1968).

[c] Site located within the Rural Access Roads Project area.



LOCATION OF NATIONAL PARKS, FOREST RESERVES, NATURE MONUMENTS, AND WILDLIFE SANCTUARIES.

EXHIBIT C

GENERALIZED COMPARISON OF IMPACTS OF PENETRATION AND ACCESS ROADS

INTRODUCTION

Two major types of rural road improvements may occur in developing countries: penetration roads and access roads. A penetration road involves new construction in an area where little or no road exists and where little or no development has occurred, whereas an access road improves an existing facility and/or involves new construction to provide access to an area where development already exists. These are obviously generalized definitions, and subcategories could be developed for each; however, such definitions are sufficient to facilitate description of the potential impacts of each type of road. This section will first discuss the general impacts of penetration type roads, then the impacts of access roads. Finally, impacts of the two road types will be compared. Impact categories which generally apply to both types of construction are physical effects, ecological effects and socio-economic effects. Impacts are time dependent (short or long term) and may be either direct or indirect. Direct and indirect impacts are frequently referred to as primary and secondary impacts, respectively.

PENETRATION ROADS

Construction involving penetration roads may result in deleterious long term changes to the ecological structure. For every kilometer of road constructed, a ten-meter wide road will remove one hectare of existing vegetation. While this may be a small percentage of total wildlife habitat available in the area, it may be sufficient to cause some species to relocate. Migration routes may be disturbed. Hunting pressures increase. Accompanying traffic and development associated with the road can cause additional stress to the wildlife.

Depending upon the location of the road and the type of physical resources available, development may begin immediately. Generally, this takes place as agriculture or forestry activities. Land is cleared for agriculture or as a result of timber production. Without proper planning and control, unstable areas may be cleared, resulting in degradation of the land by erosion. Additional roads and trails may develop, providing access into formerly remote and undisturbed areas.

Impacts may also affect the aquatic ecosystems adjacent to or crossed by new roads. Clearing adjacent lowlands and crossing of streams permit increased erosion during rainfall or directly stirs up stream sediments. This added turbidity can adversely affect the feeding and breeding success of stream fish and the food organisms on which they feed. If downstream ponds or lakes become turbid for long periods during construction, light penetration is reduced and the entire food chain from the primary producers (aquatic algae and larger plants) to the fish is limited by reduced food production and inability to feed adequately. Once construction is completed, rights-of-way may become revegetated and turbid runoffs cease. If so, the aquatic ecosystems usually return to a preconstruction state within a relatively short time. If chemicals (fuels, lubricants, paints or solvents) enter the water during construction, more serious and long-term changes in the aquatic biota may result. In most instances, proper construction procedures minimize the chance of these types of

spill and thus minimize aquatic impacts.

Physical changes involve increased water or air pollution, increased noise levels and increased erosion. Water quality in streams receiving runoff can become turbid and can experience increased loads of nutrients, metals, pesticides and herbicides, or organic matter, depending on the nature of the watershed in which construction takes place, and on subsequent development. Groundwater resources are usually not severely affected by construction unless the water table is disturbed or a large groundwater recharge area is disturbed; however, development which may accompany the new road may adversely affect the quality and perhaps the quantity available for use.

Changes in air quality are primarily localized, consisting of increased dust and particulate matter, and increased hydrocarbons and exhaust gases from machinery. Proper maintenance and fuel usage and watering for dust control can mitigate serious air pollution problems during construction. Emissions from vehicular traffic after a road is open for use can increase ozone, nitrogen oxides, sulfur dioxide and hydrocarbons; however, in areas where traffic is only light to moderate, these increased levels are not significant with regard to public health nor do they greatly affect vegetation or wildlife.

One potential serious problem in areas of high rainfall is erosion, which may have adverse physical, ecological and social impacts. Not only does it contribute to degrading the quality of surface waters and secondarily affect wildlife, the process itself often makes roadbeds, supporting structures and adjacent rights-of-way aesthetically displeasing and sometimes hazardous. In most cases, serious erosion can be controlled by temporary dikes, matting, careful use of heavy machinery and avoidance of certain areas in the original route selection. Permanent revegetation occurs quite rapidly in subtropical or tropical climates. This is a substantial benefit in controlling erosion over the long term in areas that must originally be cleared for road construction, but requires proper planning and continuous maintenance.

Various socio-economic effects may result. A penetration road could result in the destruction of a unique area which in itself would be a source of pride to future generations. Historical and archaeological areas may be disturbed or destroyed. Native population may be displaced or adversely affected.

Conversely, new road construction also may have significant beneficial aspects. Formerly isolated areas of the country may have access to health and educational facilities, markets, technical assistance, etc. Most developing countries suffer from a lack of developed resources which makes them highly dependent on outside sources, and construction of a new facility may make available such resources as additional agricultural land to provide food for the country, timber and mineral resources for domestic and export use, and streams which can provide a source of power.

ACCESS ROADS

Although construction of access roads may occur in uncleared areas, this is normally not the situation. Access roads generally connect developed or developing areas with existing roads or trails which have developed through normal use by individuals moving themselves and their products to services and markets.

Much of the area will have been disturbed by development, so the effect on wildlife and habitat is less severe. The wildlife is accustomed to existing activities. However, improved access may lead to increased development, and more clearing of land, stressing the remaining wildlife. In agricultural areas, the use of fertilizers, herbicides and pesticides may increase, creating the potential for severe adverse impacts. Conversely, technical assistance may become more available, and the improper use of these materials can be limited.

Short-term ecological effects, especially to any adjacent aquatic communities, can result form road improvement if grading and realigning is not done carefully to prevent turbid runoffs. Most impacts affecting threatened or endangered species probably have already taken place, although timing of construction may help minimize impacts on nearby sensitive natural areas during breeding or migration seasons.

With improvement to existing roads, physiographic impacts and land use alterations are less significant than during new road construction. However, short-term increases in noise level, dust, machinery exhaust emissions, changes in stream water quality and erosion can be noticeable and significant if not dealt with properly. Socio-economic and cultural impacts from road improvement are virtually all beneficial rather than adverse. In most instances, little land is taken from production, few people, homes or business are displaced, and no cultural, educational or archaeological sites are further disrupted. In essence, the benefits accrue from better access for farmers, students and medical personnel, less need for vehicle maintenance, and better property values (and increased tax base). Many of these relatively direct impacts further result in secondary beneficial impacts, such as the greater availability of technical and other assistance to rural areas, increased marketability of produce, and reduced need for imports throughout the region.

SUMMARY

It is inaccurate to say all penetration roads are bad and all access roads are good. There are instances where the socio-economic benefits to a country may outweigh the adverse impacts to such a degree that in the decision to build penetration roads may be easily justified. Conversely, construction or improvement of an access road may have such a potential for adverse environmental effects that the socio-economic benefits are overshadowed. For that reason, each type of road and road project must be evaluated on its own merit.

In general, however, the potential for adverse environmental impact is greater with penetration type roads, while the potential socio-economic benefits are greater for access roads. Careful assessment and planning can minimize the adverse effects while maximizing the benefits from any project.

EXHIBIT D

COMMENTS AND RESPONSES ON THE INITIAL ENVIRONMENTAL EXAMINATION

ADDRESS ONLY THE DIRECTOR
FISH AND WILDLIFE SERVICE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

In Reply Refer to:
FWS/IA

April 26, 1978

Mr. Robert O. Otto
Environmental Advisor
LA/DR/EAD, Room 2252
Agency for International Development
Washington, D.C. 20523

Dear Mr. Otto:

I have reviewed the Initial Environmental Examination on a proposed Agency for International Development project for rural access roads in Panama, ER 78/317, forwarded to us by your letter of April 7, 1978.

I agree that the proposed project should be given a "Positive Determination" requiring further study in the form of an Environmental Assessment.

1 While agreeing in concept with the overall objectives and goals of the proposed project to raise the rural Panamanian campesino's income and to increase the amount of vital services provided to him, I am greatly concerned at the potential wildlife habitat destruction that could be anticipated with such a project.

2 The U.S. List of Endangered Species for Panama includes 15 species of birds, mammals, reptiles and amphibians. Nowhere in the Initial Examination is there any mention of the potential impact on these species or their habitats. For that matter, neither is there mention of any living natural resources, including plant species.

3 In order to conduct a proper review of the proposed project, information is needed on the wildlife resources present under existing conditions. An assessment must also be made to determine those wildlife resources anticipated under future conditions without the project. Included with this data should be information on the presence of endangered species and unique natural areas.

Land clearing will cause destruction and alteration of terrestrial wildlife habitat. Although impacts from the proposed project may be limited, specific right-of-way alignments must be identified before impacts on specific wildlife can be determined.

Clearing right-of-ways provides openings and changes in terrestrial habitat that can be beneficial for wildlife species also by providing a greater variety of habitat available. However, the presence of a road with its potential for increased vehicular traffic can divide home ranges of smaller species and be a death trap for those individuals crossing back and forth.

4 Improving the road system will result in greater accessibility to rural areas as pointed out in Section III A of the Environmental Examination. Besides discussing the impacts on soil conditions and agriculture use brought on by the potential clearing of increased amounts of lands for more intensive agricultural use, concern for the effects on wildlife populations and their habitat should also be brought out.

5 Crossing of streams and watercourses can have a disturbing and detrimental effect on aquatic habitat. Impacts include disruption at the construction site, possible stream diversion and increased tubidity. These effects can be mitigated somewhat by scheduling construction during low flow after major fish spawning has occurred, implementing stream protection measures, and leaving bottom habitat in the vicinity of the crossing site resembling the original habitat, as much as possible.

The U.S. Fish and Wildlife Service would appreciate receiving advance planning data on the proposed project as soon as they are available. We would also appreciate receiving a copy of The Environmental Assessment. This office is available to provide advice and details for loss prevention measures and to recommend a biologist to work with the planning team to incorporate wildlife concerns and enhancement features into the work plan.

Thank you for the opportunity to comment.

Yours sincerely,

Lawrence N. Mason

Lawrence N. Mason
Deputy Chief, International
Affairs Staff

US FISH AND WILDLIFE SERVICE

Response to the letter from US Fish and Wildlife Service, dated April 26, 1978.

1. This concern has been addressed in Chapter V. Direct destruction from road improvements total approximately 410 ha which is less than 0.015 percent of the project area.

2. Threatened and endangered species are discussed in Chapters III and IV. Potential impacts to these species and their critical habitat are discussed in Chapter V and were found to be minimal. The project contains components designed to heighten local awareness concerning such species.

3. Wildlife resources in the study area are described in Chapter III in terms of species and habitat requirements. More detailed discussions may be found in a working paper available from the US Agency for International Development.

4. Potential impacts on habitat alterations, roadkills and greater accessibility to rural areas are discussed in Chapter V. These impacts are not major and mitigation procedures are discussed in Chapter VI.

5. These concerns are thoroughly considered in Chapter V. While not all of the impacts mentioned are avoidable, mitigation procedures which can reduce these impacts are described in Chapter VI.

United States Department of the Interior
GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR

In Reply Refer To:
EGS-ER-78/317
Mail Stop 760

APR 27 1978

Mr. Robert O. Otto
LA/DR/EAD, Room 2252
Agency for International Development
Washington, D.C. 20523

Dear Mr. Otto:

We have reviewed the initial environmental examination for the rural access roads project in Panama as requested in your letter of April 7 to the Department of the Interior.

1 We note that the examination includes references to natural foundations, sources of construction materials, and various aspects of surface water. We suggest that the environmental assessment yet to be prepared should also evaluate potential impacts on ground water. The evaluation should present data on depth to the water table, range of water-table fluctuations, and level of seasonal high water table.

Thank you for the opportunity to provide suggestions.

Sincerely yours,

Acting Director

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

US DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY

Response to the letter from US Department of the Interior, Geological Survey, dated April 27, 1978.

1. Data on groundwater resources in Panama are extremely limited. Existing data indicate that depth to groundwater generally exceeds 10 m. During the rainy season the depth will be less, but the proposed project will not adversely affect the groundwater. Groundwater conditions are discussed in Chapter IV.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE - P.O. Box 2890
Washington, D. C. 20013

APR 28 1978

Mr. Robert O. Otto
Environmental Advisor
Bureau for Latin America
Department of State
Agency for International Development
Washington, D.C. 20523

Dear Mr. Otto:

In accordance with your letter of April 7, 1978, the Soil Conservation Service has reviewed the initial environmental examination for the proposed Rural Access Roads and Watershed Management Projects in Panama.

We have no substantive comments to offer.

Thank you for the opportunity to review the proposals.

Sincerely,

Acting Glen H. Loomis
Director
Environmental Services Division

US. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

Response to the letter from US Department of Agriculture, Soil Conservation Service, dated April 28, 1978.

No response is necessary.

DEPARTMENT OF TRANSPORTATION

ROUTE SLIP

DATE 4-28

TO: NAME	ORG/RTG SYMBOL
JERRY WEIN	
LA/DR/LEAD, ROOM 2252	
AGENCY FOR INTERNATION	
DEVELOPMENT	
WASHINGTON, D.C. 20523	

- [ ] PER YOUR REQUEST
- [ ] FOR YOUR INFORMATION
- [x] PER OUR CONVERSATION
- [ ] NOTE AND RETURN
- [ ] DISCUSS WITH ME
- [ ] FOR YOUR APPROVAL
- [ ] FOR YOUR SIGNATURE
- [ ] COMMENT
- [ ] TAKE APPROPRIATE ACTION
- [ ] PLEASE ANSWER
- [ ] PREPARE REPLY FOR SIGNATURE

OR _____

REMARKS:

ATTACHED IS A COPY OF COMMENTS WHICH WE DISCUSSED BY PHONE ON 4-28-78 CONCERNING YOUR PANAMA RURAL ACCESS ROAD SUBMISSION.

FROM	TELEPHONE NO.	ORG/RTG SYMBOL
DAVE BEAGER	426-9093	HSU-11

FORM DOT F 1320.9 (5-67) FORMERLY FORM OST F 1320.1 GPO 904-204

PANAMA RURAL ACCESS ROAD SUBMISSION FROM DOS

WE CONCUR IN THE RECOMMENDATION THAT FURTHER STUDY IS NECESSARY. IT IS
1 SUGGESTED THAT THE DARIEN GAP HIGHWAY PROJECT EIS BE UTILIZED AS A RESOURCE DOCUMENT.

WE ALSO HAVE THE FOLLOWING COMMENTS:

2 1. IMPACTS ON ENDANGERED SPECIES ARE NOT MENTIONED.

2. IT IS NOTED THAT ON PAGE 2 OF 9 OF
3 THE RURAL ROAD INSPECTION REPORT THAT RECOMMENDATION FOR PIPE CULVERT SIZES ARE INDICATED. NOTHING IS INDICATED ABOUT THE FISHERY RESOURCES WHICH WOULD BE AN IMPORTANT ITEM IN CONSIDERING CULVERT LOCATION AND SIZE.

3. CAUTION SHOULD BE USED IN THE SELECTION PROCESS. DETERMINING ROAD
4 USER COST SAVINGS FOR AN AREA OF PRIMITIVE ROADS MAY DIFFER CONSIDERABLY FROM U.S. EXPERIENCE.

4. NO MENTION IS MADE OF ALTERNATIVES ESPECIALLY THE "DO-NOTHING" ALTERNATIVE.
5 THE ENVIRONMENTAL ASSESSMENT SHOULD INCLUDE THIS ANALYSIS.

US DEPARTMENT OF TRANSPORTATION

Response to the letter from the Department of Transportation, dated April 28, 1978.

1. The Darien Gap Highway Project was utilized as a resource document for many aspects of the project development and the environmental assessment.

2. Impacts to threatened and endangered species are discussed in Chapter V. Potential impacts are not considered major.

3. The fishery resources and the use of adequate pipe culvert size are discussed in Chapters IV, V and VI. Proper consideration during design and construction can mitigate most potential impacts.

4. A complete description of the selection process and its ramifications is contained in Chapters II and IV and Exhibit A. Determination of user cost savings has been based upon local conditions and does differ from US experiences. It is based on the difference in farm gate prices paid along all-weather roads and those paid along dry-weather roads.

5. The "do nothing" or No-Action alternative has been analyzed in Chapter VI as one of the potential alternatives to this project. Long-term adverse effects from No Action are considered more severe than from those from the proposed project.