

**FINAL ENVIRONMENTAL STATEMENT
HARBORS AND RIVERS IN
THE TERRITORY OF GUAM**



AGANA RIVER, GUAM

U. S. ARMY ENGINEER DISTRICT, HONOLULU

MARCH 1977

FINAL
ENVIRONMENTAL STATEMENT
AGANA RIVER FLOOD CONTROL
AGANA, GUAM

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SUMMARY

HARBORS AND RIVERS IN THE TERRITORY OF GUAM INTERIM REPORT ON FLOOD CONTROL AGANA RIVER, GUAM

() Revised Draft Environmental Statement (X) Final Environmental Statement

Responsible Office: US Army Engineer District, Honolulu, Hawaii
APO San Francisco 96558 Telephone (808) 438-1091

1. Name of Action: () Administrative (X) Legislative

2. Description of Action: The proposed plan of improvement is a combination of levee and channel improvements with pumping facilities for localized drainage near the Saylor Street river crossing. The plan consists of 1,750 feet of channelization between Saylor Street and Agana Bay, 4,900 feet of levees upstream of Saylor Street, a 360-acre flowage easement within the Agana Swamp, and a pumping plant near the left bank levee at Saylor Street.

3. a. Environmental Impacts: The proposed plan would provide standard project flood protection for all existing and future developments in the Agana River basin. Future development, in accordance with local land use plans would include commercial, residential, and recreation developments.

The project would require about 2 acres of riverbed and riverbank land and 12.5 acres of swamp or swamp-fringe lands, but about 360 acres would be permanently committed to open space use as flowage easement for the project. The channelization and levees will affect the physical, biological, and visual setting of the river estuary and the swamp.

b. Adverse Environmental Effects: Adverse effects are related to the structural features of the plan. The replacement of existing riverbed by a lined channel would result in adverse effects to the estuarine habitat near the mouth. The losses of swampland are considered comparatively small, but the uniqueness and scarcity of wetland habitat, make any loss of these lands an adverse one. Other adverse effects are those associated with the construction period and are expected to be temporary in nature.

4. Alternatives: Among the alternatives discussed are no action, non-structural measures, structural measures, and combinations of these. The combination measures studied in detail include levee-channel-flowage easement plans, and reservoir-channel plans. The reservoir-channel plans were considered with and without recreation development.

5. a. Comments Received (District Review):

US Advisory Council on Historic Preservation
US Department of Commerce
US Department of Health, Education, and Welfare
US Department of the Interior
 Bureau of Mines
 Bureau of Outdoor Recreation
 National Park Service
 Fish and Wildlife Service
 Geological Survey
US Environmental Protection Agency
US Department of Transportation, US Coast Guard
US Naval Forces, Marianas
Government of Guam Agencies
 Department of Commerce
 Guam Historic Preservation Officer
 Department of Land Management
 Department of Public Works
 Guam Environmental Protection Agency
 Public Utility Agency
University of Guam, Marine Laboratory

b. Comments Received (Departmental Review):

Department of Agriculture
Department of Commerce
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Environmental Protection Agency
Government of Guam
 Office of the Governor

6. Draft Statement to CEQ: 14 May 1975.
Revised Draft Statement to CEQ: 24 June 1976.
Final Statement to CEQ _____.

1. PROJECT DESCRIPTION.

A. Project Authority and Purpose.

1.1 The survey study of Harbors and Rivers in the Territory of Guam was authorized by Section 106 of the Harbor and River Act of 1970 (P.L. 91-611). The purpose of the study is to investigate the navigation, flood control, and related water resources problems of the territory and to develop plans to solve these problems.

1.2 This environmental statement has been prepared concurrently with and will accompany the Interim Report on Flood Control, Agana River, Guam. The interim report has been prepared in partial compliance with the survey authority. The results of the investigation of the territory's navigation and other flood control and related water resource problems will be discussed in separate reports.

1.3 Upon coordination, approval and authorization of this environmental statement and Interim Report on Flood Control, post-authorization studies will be conducted to reevaluate the findings and to prepare the detailed project design. Should the plan recommendations or anticipated impacts change as a result of post-authorization studies, a supplement to this statement will be prepared at that time.

B. History of Study.

1.4 The study was initiated in 1971, and a plan of investigation was completed and submitted for approval in April 1972. The initial scope of the study encompassed the entire territory and included evaluation of its present and future economic development trends, and identification of current and projected flood and related water resources problems and needs. The Guam Department of Public Works assisted in the identification of the territory's flood problems and needs by interviewing the commissioners of the various villages during 1972 and 1973. Their survey identified 56 flood and/or drainage problem areas around the island. Field investigation of these areas showed that all but six had either interior drainage problems which are a local government responsibility, or were areas of limited development for which improvements were clearly economically infeasible. The six areas where flood control improvements appeared warranted are Agana River, Togcha River, Tamuning, Geus River, Umatac River, and Fonte River. Because of its impact on the capital city of Agana, the solution of the flood and related water resource problems in the Agana Basin was given the highest priority. Detailed engineering and economic investigations were therefore limited to this basin which is on the west coast near the center of the island.

C. Project Features.

1.5 The proposed plan (plate 1) is a combination of levee and channel improvements with pumping facilities for localized drainage near the

Saylor Street river crossing. The levees would guide and contain flood-flows by low-level detention within the Agana Swamp, enabling the existing bridges and improved channel to accommodate the flood volumes. The required swamp storage volume is about 2,200 acre-feet and the channel downstream of the levees would be designed to accommodate a flow release of 7,500 cfs. The plan profile and cross sections are shown on plate 2.

1.6 The plan consists of the following features:

(1) A 450-foot-long, trapezoidal channel at the outlet of Agana River. The channel section, with a base width of 54 to 82 feet, would be lined with riprap at the upstream end, then transition to an unlined dredged channel at the river mouth.

(2) A 1,300-foot-long, 34- to 54-foot-wide, rectangular concrete channel between the trapezoidal channel and Saylor Street. A low flow channel and bankside landscaping will be incorporated to minimize adverse effects of concrete channelization.

(3) An earth levee system totalling 4,900 lineal feet upstream of Saylor Street and the channel improvements. The levees would confine floodwaters to a 360-acre flowage easement within the Agana Swamp. Maximum water surface elevation of the temporary impoundment would be 17.7 feet mean sea level (msl).

(4) A pumping plant located adjacent to the left bank levee, upstream of Saylor Street to prevent inundation due to local surface runoff. Required pumping capacity is estimated at 3,000 gallons per minute.

1.7 Based on a practical minimum time period for authorization of this proposed plan and funding, it is estimated that the project could be constructed by 1980. The estimated construction period is 18 months. Operation and maintenance of the completed project is the responsibility of the Government of Guam and would be performed in accordance with Federal regulations. Operation and maintenance includes adequate measures to prevent significant impairment of the design storage capacity of the flowage easements; periodic removal of expected silt and debris accumulations in the tidal channel reaches; pump maintenance and operation; and maintenance of the landscaping and beautification measures in a neat and attractive appearance. A summary of the analysis of benefits and costs of the project are presented in Appendix A.

2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT.

A. Location and General Description.

2.1 Guam is the largest and southernmost of the Mariana Islands. It is about 30 miles long, 4 to 8 miles wide, has about 209 square miles in land area, and is oriented NNE-SSW. The Agana River basin is located on the west coast, near the center of the island.

2.2 The Agana River basin drains a total of 10.4 square miles. The highest elevation within the basin is Mount Macajna which rises to elevation 709 feet on the western end of the basin. A second prominent feature near the lower end of the basin is the Agana Swamp which occupies an area of about 300 acres, below elevation 10 feet msl. Of the 300-acre total, 80 acres lie north of the powerline access road, and about 220 acres are located south of the road (plate 1). The swamp is the last remaining major wetland habitat on Guam.

2.3 Three main tributaries flow into the Agana Swamp, which is drained by the Agana River. The river flows in a northern direction through the commercial and downtown Agana area. Major highways which cross the study area and provide access to other areas of the island are Highway Routes 1, 4, and 8. Agana is the capital, business, and economic center of Guam.

B. Geology and Topography.

2.4 The island of Guam is divided into two main topographic regions. The northern portion is composed of limestone which forms a plateau bounded by steep cliffs. The southern portion is characterized by a range of volcanic mountains and hills. Between these two portions is the narrow "neck" of the island where elevations are generally less than 200 feet.

2.5 The Agana River drainage area is located within the transitional "neck" portion of the island. The hilly dissected area is bounded on the north-northeast by the limestone plateau of northern Guam, on the south by the low-lying alluvial valley floor of the Pago River, on the north by a narrow strip of coastal lowland, and on the southwest side by dissected sloping and rolling land as well as mountainous land.

2.6 The drainage area is further divided into three ecological units, or biotopes. The first unit is the wet land area where the water table of the low-lying land is either at the surface or close enough to it to make it wet. The second biotope is the dissected hilly land consisting of rolling hills and slopes that border the wet land regions. The river estuary is the third biotope and includes the zone of salt water mixing at the mouth of the Agana River.

2.7 Within the Agana drainage basin, major soil categories include plastic clay, silty clay, alluvial soils, and poorly graded sand. The wetland of the Agana marsh and swamp is underlain by a limestone basement. Borings in the swampy areas indicate that a layer of recent calcareous detrital material overlies the older limestone. The hilly land is developed upon exposures of the limestone on the southwest, southeast and northeast sides of the swamp. The estuary is situated on a coastal terrace that forms the northwest border of the swamp and marshland. Once composed of unconsolidated beach deposits, the terrace has been greatly disturbed and altered during the development of the city of Agana. A broad fringing reef flat extends about 2,000 feet offshore on either side of the man-made Paseo de Susana within Agana Bay. Topographic maps indicate that a narrow channel exists on the reef flat

along the eastern edge of the Paseo, but stops short of connection with the Agana River mouth.

C. Climate.

2.8 The climate of Guam is characterized by uniform temperature and humidity, with highly variable rainfall and wind conditions. The mean annual temperature is 81°F with a range of 70 to 95 degrees. The relative humidity averages 73 percent, although it may rise to over 90 percent during wet summer months. There are two primary seasons with transitional periods between them. The dry season extends from January through April while the rainy season lasts from July through November. The mean annual rainfall ranges from less than 90 inches per year in the vicinity of Apra Harbor to over 110 inches in the higher mountain areas. A summary of mean annual precipitation for the 16-year period of record at the National Weather Service's Agana recording gauge is 100.71 inches. Rainfall data for this station are summarized in the following table.

SUMMARY OF RAINFALL DATA AT NATIONAL WEATHER SERVICE ON GUAM^{1/}

<u>Rainfall in Inches</u>			
<u>Month</u>	<u>Mean Monthly</u>	<u>Maximum Monthly</u>	<u>Minimum Monthly</u>
January	5.57	11.93	1.99
February	4.19	9.47	.67
March	4.44	16.94	.59
April	4.65	19.55	.50
May	6.26	22.68	.90
June	6.19	11.53	1.52
July	11.25	20.00	4.74
August	13.41	23.07	3.87
September	15.78	22.28	6.78
October	13.51	25.32	6.89
November	9.23	18.14	4.83
December	6.23	16.19	2.51
Period of Record ^{2/}	100.71 ^{3/}	25.32	.50

1/ From Local Climatological Data, Annual Summary with Comparative Data, Guam, Pacific.

2/ 1956-1972, inclusive.

3/ Mean annual precipitation.

2.9 The island is also subject to typhoons which bring tremendous amounts of rain and violent winds. Between 1946 and 1970, twelve typhoons affected Guam. The most severe to hit Guam was Typhoon Karen which occurred on 11 November 1962 with winds of 150 knots.

D. Vegetation.

2.10 The marshland is dominated by a tall reed, Phragmites karka, which makes up about 62 percent of the vegetation, with the remainder being the fern, Acrostichum aureum. Along the periphery of the marsh, the wild sugarcane Saccharum spontaneum is present and abundant.

2.11 A Hibiscus tiliaceus swamp is found along the southwestern edge of the river basin, interspersed by stands of Phragmites karka. In the areas of open water, Hydrilla verticillata, Eichhornia crassipes, and Pistia stratiotes are found.

2.12 The hilly dissected lands surround the marsh and extend like fingers into the marsh area. The lands are rather extensively disturbed and have a variety of plant communities within the area. Along the most altered sections, various herbs and grasses are found with larger trees on the slopes. Leucaena leucocephala is by far the most common plant throughout this area. Private property and other developed areas have been cleared of original vegetation and have been replanted with food and ornamental plants.

2.13 The intertidal zone of the Agana River estuary is dominated by a lush growth of unidentified grass. In the estuary itself, the most dominant species is Enteromorpha compressa, a green alga. A red alga, Centroceras clavulatum is also abundant in the immediate vicinity of the river mouth. A complete checklist of vegetation as well as fish and wildlife of the three biotopes is available in Randall and Tsuda's Field Ecological Survey of the Agana-Chaot Basin and is reproduced as Appendix B.

E. Fish and Wildlife.

2.14 Following the rainy season, the river and marsh areas are abundantly populated by the native freshwater eel, Anguilla marmorata, which is often caught for local consumption. The most conspicuous fish in open water sections is the Tilapia mossambica. Other species found in the open water are Tilapia zilli and Macrobrachium lar, a freshwater shrimp.

2.15 In the vicinity of Agana Springs and throughout the marshy area, the toad, Bufo marinus, has become one of the more abundant organisms and is well established on the island in general.

2.16 The fauna in the steep valleys and valley slopes is diverse, with the African snail, Achatina fulica, being the most dominant organism. According to the Guam Division of Fish and Wildlife, Guam deer and wild pigs are also present in these areas.

2.17 In the estuary, schools of juvenile mullet (Mugil sp.) are frequently seen and Tilapia mossambica is also present, although much more abundant upstream. The dominant invertebrates in the estuary are the crustaceans and mollusks.

2.18 Several species of birds which are considered threatened or endangered by the Guam Division of Fish and Wildlife were once inhabitants of the Agana Swamp area. Their numbers have been drastically reduced over the years, and their presence today in the swamp is uncertain. The following list was provided by the Guam Division of Fish and Wildlife.

Threatened Species

Guam Rail, Rallus owstoni (Rothschild)
Micronesian Kingfisher, Halcyon c. cinnamomina S. Baker
Cardinal Honey-eater, Myzomela cardinalis saffordi Wetmore
Bridled White-eye, Zosterop c. conspicillata (Kittlitz)
Micronesian Broadbill, Myiagra oceanica freycineti Oustalet
Rufous-fronted Fantail, Rhipidura rufifrons uraniae Oustalet
White Tern Gygis alba candida (Gmelin)
Micronesian Starling Aphlonis opacus guami Momiyama

Endangered Species

White-throated Ground Dove, Gallicolumba x. xanthonura
Guam Gallinule Gallinula chloropus guami Hartert

In addition to these species, the last remaining individuals of the Nightingale Reed Warbler, Acrocephalus l. luscinia, may inhabit the area, although it is considered extinct by some experts.

F. Hydrology and Drainage.

2.19 The Agana River basin drains an area of 10.4 square miles. The river is poorly defined and silted in, except for the section between O'Brien Drive and the mouth where the river has been channelized through East Agana. Upstream of the O'Brien Drive bridge, the channel disappears into the thick growth of Phragmites karka reeds and floating Pistia stratiotes. Prior to the encroachment and overgrowth of vegetation within the silted river course, the river probably followed the route now marked by a wide shallow depressed zone of vegetation extending from O'Brien Drive to Agana Springs. This route was probably the one dredged during 1933-1934 in an effort to drain and create arable land within the swamp. Following completion of the dredging, the river level at Agana Springs dropped three feet and over two-thirds of the entire swamp area was drained free from surface water, with a considerable drop in the groundwater level as well. The source of the spring water is the compact jointed Alifan limestone which underlies the Agana argillaceous member of the Mariana Limestone.

2.20 In addition, a powerline right-of-way and adjacent roadway near the north end of the swamp has altered the original drainage pattern. Although there is probably some percolation of water through the limestone roadbed fill, the roadway essentially bisects the marsh and has cut off the free flow of water, except in the depressed area along the Agana River alignment. Thus, in terms of swamp habitat, the least disturbed swamp area today lies south of the powerline access road. North of the roadway, encroaching activities of man and the drainage alteration by the roadway itself have altered its value as swamp habitat.

2.21 The Agana drainage basin is underlain largely by argillaceous limestone, which abuts against volcanic rock along much of the southwestern boundary. The height of the water table in the limestone ranges from about 1 foot above sea level near the shore to about 5 feet in the Agana Swamp. The water table in the marsh fluctuates with the season and amount of rainfall. During the wet season, up to a foot or more of surface water covers the marsh. The largest area of permanent open water is the stretch of the Agana River channel between its mouth and the bridge on O'Brien Drive. The midstream depth along this reach ranges from 1.5 feet at the mouth to 3 feet at the O'Brien Drive bridge. The width at the mouth ranges from 35 feet during high tide to 27 feet during low tide, and from 36 to 28 feet between the estuary and the bridge on Saylor Street, beyond which the vegetation masks the river course. Estuarine conditions extend as far as 800 feet upstream at high tide. No recording gage is located on the Agana River, but a crest gage was installed in 1973 by the U.S. Geological Survey. No peak of any significance has been reported since its installation.

G. Water Quality.

2.22 The Standards of Water Quality for Waters of the Territory of Guam, April 1968, define various classes of waters and the uses for which they are to be protected. The nearshore coastal waters classification applies to the Agana River estuary. Consequently, these waters are to be protected for industrial water supply, propagation of fish and other aquatic life and wildlife, esthetic enjoyment, and recreation. The Agana River itself falls within the fresh waters category. Under this category, all fresh ground waters and all fresh water springs, streams, rivers, and impoundments are to be protected for public and domestic water supply purposes, and all surface waters are protected for industrial water supply, agricultural water supply, propagation of fish and other aquatic life and wildlife, esthetic enjoyment, and recreation.

2.23 Sampling of water quality is conducted by the Guam Environmental Protection Agency (GEPA). Data on temperature, dissolved oxygen, and fecal coliform counts are available for a one-year period for the Agana River mouth. Sampling stations upstream along the Agana River have only recently been instituted and limited information is available at this time. Water chemistry sampling is done on a quarterly basis.

2.24 Once a source of potable water, the Agana Springs is no longer suitable due to high fecal coliform counts. The limited studies (one sample date) available downstream of the Springs, along the river show highly variable counts, generally in excess of the limit set for recreation (200/100 ml).

2.25 The data available over a year period for the Agana River mouth show that the fecal coliform standard is exceeded for 88 percent of the samples. The water quality is also poor in terms of dissolved oxygen levels. The standard of 6 mg/l for propagation of fish and other aquatic life is met on only 3 of the 10 sampling occasions during the year for the Agana River mouth. For the limited number of samples taken along the river, dissolved oxygen readings as low as .2 mg/l were noted.

2.26 The limitations of the sampling program in terms of number of samples, duration of the program, and variability in the parameters taken for each station make conclusions about water quality preliminary in nature. However, the available data strongly indicates a high degree of fecal contamination and low dissolved oxygen levels along the river and at the mouth. Siltation of the river, overgrowth of vegetation, low streamflows, and discharge of wastes and debris from developments alongside the river probably all contribute to the overall poor water quality. During the dry season, the river is intermittent below the powerline access road which cuts the flow from the upper drainage area to the lower stream. Tidal interchange occurs near the mouth, but water within the stream between the tidal area and the access road is often stagnant.

2.27 Continued attention to water quality and assessment of available data will be conducted in cooperation with the Guam EPA as the study progresses. Efforts will be made to avoid compounding the poor water quality conditions and perhaps improve conditions through the flood protection design. Other than the monitoring program, no local programs specifically designed to improve water quality in the basin have been brought to attention.

H. Natural Resources.

2.28 Guam's significant natural resources include its tropical climate, scenic beauty, the ocean, and reef areas. Combined with its favorable geographic location, these assets are the basis of its phenomenal growth in tourism. The island's principal export commodities are eggs, bread, sportswear, bottled and canned drinks, scrap metal, and handicrafts. Although there are no important mineral resources, the abundance of various tuna species within the operating radius of Guam provides future potential for the development of a commercial fishing industry.

I. Human Resources.

2.29 Because of the insular character of the island of Guam and the centralization of commerce and government in the city of Agana, this city's activities generally affect the activities of other communities and rural areas on the island. Consequently, the discussion of human resources is based upon island-wide conditions, except where data specific to the Agana River basin is available.

(1) Population Characteristics.

2.30 Guam's historical population estimates reflect the combined effects of Spanish conquest and rule, natural catastrophes, and disease. The population prior to Spanish contact was estimated between 35,000 and 60,000, and was reduced to 1,576 by 1741. There has been a steady increase in population since the official Census began in 1901, and the 1970 Bureau of the Census figures show a total population of 84,996. Of this total, 17,952 were with the U.S. military. The current population is estimated to be about 105,000, and the native Chamorros constitute about half of the total.

2.31 The Agana Drainage basin encompasses portions of seven election (geographic) districts. The population of the districts are shown below.

POPULATION BY ELECTION DISTRICT

<u>Election District</u>	<u>Area Sq. Mi.</u>	<u>1970</u>	<u>1960</u>	<u>Percent Change</u>
Agana	1	2,119	1,642	29.0
Agana Heights	1	3,156	3,210	-1.7
Barrigada	9	6,356	5,430	17.1
Chalan Pago-Ordot	6	2,931	1,835	59.7
Mangilao	10	3,228	1,965	64.3
Mongmong-Toto-Maite	2	6,057	3,015	100.9
Sinajana	1	3,506	3,862	-9.2
TOTAL	30	27,353	20,959	30.5

Source: Guam Statistical Abstract, 1973, Vol. 4.

2.32 As projected by the Pacific Ocean Division, Corps of Engineers, the population of Guam is expected to increase from 85,000 in 1970 to 267,000 by 2020. The population projections were based on economic trend projections which were translated into employment and population growth. Detailed discussion of projecting population by this method is presented

in the report, "Economic Base Study, Territory of Guam", prepared by the Pacific Ocean Division in May 1973.

(2) Education.

2.33 Expenditures for the public schools represented almost 38 percent of the total 1973 operating budget for the Government of Guam. In addition to public schools, there are private schools, several manpower training programs of the Department of Labor, the University of Guam, and various training programs conducted by agencies of the government. Public school enrollment for the 1973-1974 year was 27,316. During the same year, total enrollment at the University of Guam was 3,430, and total enrollment in private schools was 4,659.

(3) Skills and Occupation.

2.34 According to the Bureau of Labor Statistics, Department of Labor, Government of Guam, figures for fiscal year 1973 show that the largest group of workers, both male and female, was the Government workers group. This group numbered 17,095 and constitute about 45 percent of the total labor force. Construction workers comprise about 20 percent and wholesale and retail trade workers account for about 15 percent.

2.35 Between 1960 and 1970 the employment patterns have undergone important shifts. The percentage of workers in professional, technical, and kindred works increased substantially. Other shifts indicate the economy is evolving into a more service-oriented structure.

2.36 With the rising level of economic activities, the level of employment has experienced a high rate of growth. The major expansion has been in the retail trade, services, and construction. In fact, the demand for workers has exceeded the manpower supply, and according to the Labor Market survey for April-June 1973, there were 9,600 openings. More recently, however, Guam was also affected by a lag in overall economy. In March 1975, employment was down by 7 percent, and the territory's unemployment rate rose to 9 percent. The unemployment situation is viewed by some Government of Guam officials as a temporary condition, and it is not considered to affect the long-term employment projections for the territory.

(4) Income.

2.37 A comparison of hourly wages for selected occupations on Guam with the same occupations in other areas indicates that Guam's rates are low. These rates, based on Area Wage Survey studies by the U.S. Department of Labor, Bureau of Labor Statistics indicate that Guam wages in 1971-1972 were, on the average, 69 percent of those in the Los Angeles and San Francisco areas. In comparison with Hawaii for the same period, Guam wages were about 85 percent of those in Hawaii.

2.38 Although the family incomes for Guam shifted upward significantly during the 1960's, these incomes are still generally below those in Hawaii and the United States. Based on U.S. Department of Commerce statistics, Guam's 1969 median family income of \$7,886 was 68 percent of the median income for Hawaii and 84 percent of the median income for the entire United States.

J. Historical and Cultural Resources.

2.39 The history and culture of the Agana River basin and Guam as a whole are characterized by variety and change. The original inhabitants were the Chamorros, but today the island population is a blending of many cultures including Spanish, American, Filipino, Japanese, and South Seas traditions. Following the landing of Ferdinand Magellan in 1521, the island was claimed by Spain and remained under Spanish rule until 1898 when it came under the administration of the U.S. Navy at the end of the Spanish-American War. With the enactment of the Organic Act in 1950, the U.S. possession was then placed under a civilian administration with a governor appointed by the President. The passage of the Organic Act initiated the modern era for Guam. The island and its people entered the mainstream of American life and expanded trade with the United States as well as with various Asian nations. The lifting of the Navy's security clearance requirements for entry into Guam in 1962 created the impetus for business expansion and the beginnings of a thriving tourist industry. Since that time, the territory has continued to grow both economically and politically. In 1971, the people of Guam were allowed to elect their own Governor, and in 1973 Guam sent its first non-voting member to the U.S. House of Representatives.

2.40 In addition to changes of administration and diversity of the population, the Agana basin history and culture have been affected by natural catastrophes such as typhoons and the devastation of World War II. Since the time of the Spanish regime and in the early American administration, numerous attempts had been made to drain and convert the large fertile swamp area into arable land. Attempts were made to divert the river course in the early 1800's, and large expenditures of time, money and effort over the years were unsuccessful in draining the swamp.

2.41 A ten-week island-wide survey of major known historical sites and structures was completed under the administration of the Department of Commerce, Government of Guam in 1974. As of February 1975, four sites in the Agana area have been listed on the National Register of Historic Places. The sites are shown on plate 3. Located on high ground above downtown Agana, Fort Santa Agueda is one of the best examples of the many small forts built by the Spanish on high places. It is not subject to flooding from Agana River due to its high elevation.

2.42 Two other sites in downtown Agana are within the Agana River flood plain. One of these sites, Plaza de Espana, is considered the best remaining example of Spanish architecture on Guam. This park has

been the site of the seat of government on Guam for 230 years and a repair project for the site is listed in the territory's Historic Preservation Plan, Vol. III. Another site in downtown Agana, the Agana Spanish Bridge, marks the former course of the Agana River, prior to its diversion to the east of the man-made Paseo de Susana.

2.43 The fourth historically important site is the Spanish dikes complex. The series of dikes in the heavy growth of the Agana Swamp were first constructed and maintained by Spanish governors for the purpose of growing rice. The lack of success led to abandonment of their use, and today the dikes are overgrown with vegetation and difficult to locate in the field.

2.44 A culturally important site that has served as an educational resource in recent years is the Agana Springs Nature Preserve which is located about one mile up the Agana River along the steep southern margin of the swamp. Spring water flows into a concrete reservoir with a maximum depth of 9 feet when measured to spillway height. The small pond once served as a major source of drinking water and as much as 80 million gallons a day were pumped from the springs in 1953, although pumpage rates decreased considerably in later years. It was abandoned in 1957 due to poor water quality. Following a period of neglect, the Guam Science Teachers Association initiated action to renovate the Springs and use the area as a nature preserve. Permission to use Navy lands for this purpose was obtained, and today the Springs serves as the major fresh-water field site for students from elementary to college level. The Springs are located on high ground, outside of the flood plain, and the site is not subject to flooding under existing conditions.

K. Recreation Resources.

2.45 Studies by the Government of Guam indicate that recreation will play an important role in the Territory's economic development. At present, the outdoor recreation potential on Guam is generally unexploited. Although the military maintains well-developed facilities for their personnel, these facilities are not available to local residents. The limited facilities provided by the local government and private interests are primarily for sports and games. The best beaches, dramatic waterfalls and most beautiful scenic areas are difficult to reach and often on private or military land. An island-wide survey by the Government of Guam indicated critical shortage of picnic, camping, and boating facilities as well as developed beaches and trails.

2.46 Existing recreational facilities in the Agana area include the Paseo de Susana, Latte, and Padre Palomo Memorial Parks, tennis courts and a swimming pool in the area north of O'Brien Drive designated for development of the Agana Central Park, a small boat harbor in Agana Bay, and neighborhood parks and playgrounds.

L. The Economy.

2.47 As in the discussion of human resources, the activities of Agana are recognized as interrelated with the activities of other communities and the rural areas. The economy of the island as a whole is reflected by the conditions which exist in Agana, the center of business and commercial activity.

2.48 The economy of the Territory of Guam is high compared to that of the other islands in the Marianas chain and the Trust Territory, but lags behind that of the United States in most respects. Development of the island's economy was largely the result of U.S. military activities. Although heavily dependent on the military, local government and the construction industry in the past, the island's economy has begun to shift with the emergence of the tourist industry which is broadening the economic base for future growth.

2.49 The territory experienced unprecedented growth between 1970 and 1973. During that time, its economy, as measured by gross business receipts, more than doubled, from \$227 million in 1970 to nearly \$500 million in 1973. Following this period of rapid growth, the economy began to show signs of maturity. The more significant signs of this maturity have been in the structural changes in the economy which have begun to occur, particularly a leveling off in the growth of both the construction and retail sectors, but continued expansion of the tourist industry and a dramatic growth of the financial sector. The leveling off of the construction industry is also viewed by some officials of the Government of Guam as a temporary occurrence attributed to the lag in the overall economy of the territory, the United States, and foreign nations such as Japan who contribute to Guam's economy. The lag in construction is seen by some government officials as a blessing that will help the territory's utilities and other public facilities to catch up with the unprecedented demand resulting from the rapid growth during the previous years. The Director of the territory's Economic Development Agency points to the increase in construction during the last half of 1973 and the first half of 1974 to a level approximately double that of the preceding twelve months as a strong indication that construction activity will again increase and possibly return to levels close to those experienced in the past.

M. Flood Problem and History.

2.50 Although their history has not been documented, floods are common occurrences within the Agana River drainage basin and have been reported to occur following moderate as well as heavy rain. All of the portion of the basin extending from the swamp to Agana Bay is subject to flooding. In the area north of the powerline access road, the 10-year flood would inundate about 245 acres consisting of approximately 60 acres of commercial properties, 15 acres of residential lots, 40 acres of public and semi-public lands, and 130 acres of recreation lands and marshlands. Because of the basin topography the area that would be inundated by the Standard Project Flood (280 acres)

would be only slightly greater than the area subject to inundation from the 10-year flood. However, the average depth of inundation would increase from about 1.5 feet for the 10-year flood to 5 feet for the Standard Project Flood (plate 4). Major improvements in the flood plain subject to damage include an extensive network of commercial and governmental buildings, modern shopping centers, improved highways, streets, and utility facilities. These improvements vary from medium-cost, low-rise structures to quality high-rise office buildings. In addition to new structures on previously vacant lands, old buildings are being demolished to make way for modern complexes. Indications are that developments and improvements will continue in the future, but at a slower rate than during the past few years. Vacant parcels of land in Agana are becoming limited in number and high in price. The appraised real estate values in the Agana municipality for 1963, 1968, and 1973, based on data from the Department of Revenue and Taxation are summarized as follows:

<u>Fiscal Year</u>	<u>Land</u>	<u>Buildings</u>	<u>Total</u>
1963	\$8,000,000	\$4,500,000	\$12,500,000
1968	9,900,000	8,000,000	17,900,000
1973	12,700,000	23,700,000	36,400,000

2.51 Although the Agana River flood plain has been repeatedly inundated by minor stream runoff, these floods primarily affected unimproved pasture lands and damages were reported to be nominal. Records of past floods are not available except for the flood of July 1971. Although post flood damage estimates from that flood were not made, the Department of Public Works reported that flooding in the downtown area was severe. It took the department several weeks to cleanup the affected areas. The flood of July 1971 is considered the most severe in recent years. Based on available accounts of this flood, the occurrence of a flood of comparable magnitude under existing conditions would cause estimated damages of about \$1 million.

2.52 Flooding is primarily attributed to the limited capacity of the Agana River. Inadequate interior drainage within the basin also contributes to flooding in Agana. Because of the relatively flat topography of the highly developed coastal area, and the lack of adequate drainage facilities, ponding occurs within the many depressions and low spots after moderate to heavy rain. Flooding begins near the northern end of the Agana Swamp along the powerline access road. The flood problem has arisen because of man's activities and his development of damageable structures within the flood plain. The river, altered considerably over the years to improve drainage, is far short of being adequate for flows associated with major floods. In addition, the unpaved powerline access road has altered the normal drainage pattern by cutting off the free flow of water.

2.53 During floodflow periods, floodwaters from the swamp cross over the powerline access road and fan out over the flat basin floor in a north-northwest direction toward the downtown area of Agana. The river reach through the undeveloped area between the powerline access road and O'Brien Drive is estimated to have a bankfull capacity of only about 300 cfs. Within the urbanized area along the riverbank downstream of Saylor Street,

the estimated flow at which flooding and subsequent damage begins is approximately 900 cfs. The flow capacities of the bridges at Saylor Street and Marine Drive are estimated to be approximately 3,500 and 2,700 cfs, respectively. A range of floods in terms of magnitude, recurrence interval, and frequency is summarized in the following table. It should be noted that the powerline access road and the swamp have a storage effect on floodflow conditions, as reflected by the figures under flood magnitude.

Flood Magnitude		Recurrence Interval (years)	Frequency (percent)
Swamp Inflow (cfs)	Swamp Outflow (cfs)		
5,000	670	2	50
9,500	3,000	10	10
15,000	7,500	50	2
17,300	11,500	100	1

N. Summary of Needs and Problems.

2.54 The flood control problem has been described in the previous paragraphs. Other needs and problems became apparent, however, in the study of the basin's physical, social and economic setting.

(1) Water Quality and Supply.

2.55 Water quality is a problem in the Agana River basin. The sampling program conducted by the Guam Environmental Protection Agency indicates a high degree of fecal contamination and low dissolved oxygen levels along the river and near the mouth. The poor water quality is attributed to siltation from the river, overgrowth of vegetation, low streamflows which contribute to stagnant conditions, and deposition of wastes and debris from developments along the riverbanks. Although the urbanized areas are sewered, cesspools are still found in isolated and scattered locations.

2.56 Based on the existing problems, continued monitoring of the quality of the waters in the study area, controls to prevent further degradation, and actions to improve the water quality are needed.

2.57 There are two basic sources of domestic water for the Agana area, groundwater and surface water. The groundwater source is provided by about twenty wells located within the Agana basin. The surface source is furnished by the Navy's Fena Reservoir System. The Government of Guam purchases the surface water directly from the Navy for distribution. Both sources are connected to the Central Agana Water District System.

2.58 Anticipated future needs are expected to be met by the Government of Guam's existing plans for extensive development of the groundwater source throughout the island. On an island-wide basis, there were only about 10 wells in 1965. Today, the Public Utilities Agency of Guam (PUAG) operates 65 wells. Future plans call for an addition of thirty to forty more wells to provide a total groundwater yield of about 20 million gallons a day which would be sufficient to meet the foreseeable needs of the island.

(2) Recreation.

2.59 In the past, the use of undeveloped or poorly developed recreation areas was generally satisfactory because of the uncomplicated, rural lifestyle of the island's residents. However, higher education, changing economic conditions related to rapid urbanization, and more leisure time are beginning to disrupt traditional recreation patterns and are generating the desire for more sophisticated recreational opportunities and facilities. In an effort to satisfy the need for more facilities for both residents and visitors, the Guam Department of Commerce initiated a recreation planning and development program for the territory, the basic goals of which are to:

- a. Preserve and maintain Guam's natural recreation resources.
- b. Stimulate and support Guam's economy through recreation.
- c. Provide recreation facilities that serve all population segments.

Under this program, plans are being made to improve and augment existing facilities, to develop needed new facilities, and to preserve various historical and cultural sites around the island.

2.60 According to the report, "Outdoor Recreation on Guam, 1973," plans for the Agana area through Fiscal Year 1979 include the following:

- a. Construction of the Agana Small Boat Harbor by the Corps of Engineers under the authority of Section 107 of the River and Harbor Act of 1960, as amended.
- b. Improvement of existing facilities at the Paseo de Susana Park.
- c. Improvement of drainage and landscaping at the Latte Park.
- d. Development of the Agana Central Park which is to be accomplished in two phases. The first phase consists of site improvement and construction of additional facilities to complement existing facilities (tennis courts and swimming pool) in the area north of O'Brien Drive. The second phase will consist of final construction of facilities north of O'Brien Drive and development of the area south of this highway.
- e. Construction of picnic facilities, shelters, restrooms, parking areas, and landscaping of two stretches of beach along Marine Drive.

f. Provision of additional park benches, enclosing an open drainage canal, and landscaping of the Padre Palomo Memorial Park.

2.61 Some of the water-related recreation needs of the Agana area would be met by the construction of the Agana Small Boat Harbor. Other water-related recreation needs would be met by the facilities to be developed within the Agana Central Park.

2.62 The Agana Swamp with its vast undeveloped area and open space has the potential for development of outdoor recreational facilities. The potential has been recognized and would be realized to some extent by the Agana Central Park development.

(3) Environmental Resources.

2.63 The principal natural elements of the Agana River basin are the Agana River estuary, the river itself, the Agana Swamp, and the flora and fauna within these areas. Urbanization has encroached on the coastal lowlands of the basin and threatens the remaining open areas including the swamp. Natural hazards such as flooding have imposed some limits on urban development, but the demand for developable lands will continue to threaten natural areas such as the swamp. Man-made alterations of the estuary, river, and swamp have reduced benefits to fish, wildlife, and vegetation. Unless properly controlled, more of the natural environment could be altered or lost. Consequently, the environmental need for the project area is the preservation and restoration of the existing resources, and the alteration of these resources only when necessary for human safety, and after careful consideration of the tradeoff involved.

(4) Human Resources.

2.64 The human resources problems and needs are closely related to the rapid growth of the island in recent years. The most prevalent problem in the past has been the acute manpower shortage. Although the current lag in the territory's economy has reduced the shortage, the manpower problem is expected to recur based on the growth and development of the island's economy. The island's labor force in the past has not kept pace with the demand for workers resulting from increased economic activity on the island. The Government of Guam has been concerned with the need for human resource development and has been expanding its vocational and manpower training programs as well as its formal secondary and academic programs. In addition to the Government of Guam's education system, the U.S. Navy plays an important role in manpower training. Over the years, many local residents have been trained in a wide variety of skills under the Navy's Apprentice Program.

2.65 The booming tourist industry has been transforming the once isolated island into a major cosmopolitan center. Although the island is now a blending of many cultures, its heritage has been preserved. The widely spoken Chamorro language, closely knit family ties, religious

devotion, and frequent family and village participation in fiestas, weddings, and wakes still play a major part in the lives of the Guamanian people. In view of the rapid urbanization and the impact of the tourist industry, retention of the existing social structure centered around family and village life is another human resource need of concern to the people of Guam.

(5) Navigation.

2.66 The anticipated urban growth and expansion of the tourist industry are expected to increase pleasure boating activities on Guam. The Government of Guam desires the development of a system of small boat harbors around the island to accommodate these craft. In response to their desires, the navigation needs of the territory are being investigated under the Harbors and Rivers in the Territory of Guam authority. As stated earlier, the results of this investigation will be discussed in a separate report.

2.67 The small craft navigation needs of the Agana area were investigated in 1973 under the authority of Section 107 of the River and Harbor Act of 1960, as amended. Although the analysis of boating requirements over a 50-year period showed the need for 730 boats by the year 2025, the capacity of the Agana Boat Harbor was limited to about 300 boats. This determination was based on evaluation of comments received from the general public and government officials who expressed concern about the traffic problem and undesirable environmental effects such as destruction of the fringing reef and popular surfing sites which would result from construction of a large harbor. Based on the results of the investigation, a plan for expanding the existing 32-boat Agana Harbor to accommodate about 300 boats and for alleviating existing navigation problems at this facility was developed by the Honolulu Engineer District. The harbor project has been approved for construction.

(6) Agriculture.

2.68 The agricultural industry has the potential of being a large contributor to the economy of Guam. Being an island community, the desirability that Guam be self-sustaining has been expressed by local interests. Although agricultural production has increased in recent years, it has not been able to keep up with population growth and demand. Heavy reliance on agricultural imports continues to provide justification for government emphasis on agricultural production. The Guam Department of Agriculture is presently directing considerable attention to commercially-oriented types of farm operations and services. Creation of a more agriculturally-oriented economy would broaden Guam's economic base, as well as provide a means to curb urban sprawl which has been encroaching on agricultural lands. Within the Agana drainage basin, there are approximately 2,000 acres of potential farmlands. Of the 2,000 acres, it is estimated that only about 100 acres are currently under cultivation. At the present time, the technology and management of the basin's cultivated areas could be greatly improved. Much of the potential farmland bordering the swamp is now in pasture with a wide variety of grasses

and shrubs. The Barrigada-Mangilao area with its relatively flat topography could play a major role in agriculture. The development of agriculture in Barrigada and Mangilao would also prevent infringement of residential development on agricultural lands as well as on the Agana River flood plain.

(7) Land Use.

2.69 The rapid urbanization and increasing level of economic activity over the past few years have not occurred without "growing pains." The Government of Guam realizes that orderly economic growth without damaging the quality of life will require large investments in the socio-economic sector as well as judicious management and use of its natural resources, particularly its limited land area. Effective land use controls are needed in order to permit continued development without creating problems such as flooding, inadequate drainage, and pollution, and without adversely affecting its natural scenic areas, open space, and flora and fauna.

2.70 Within the Agana drainage basin, the continued urbanization of Agana Heights, Chalan Pago-Ordot, Mongmong-Toto-Maite, and Sinajana is expected to be basically residential with related local services and supplies. The topography of these areas would prevent large-scale agricultural development, but has the potential to supplement residential requirements stemming from increased commercial and economic activity in Agana. Other future economic growth, such as manufacturing, international trade, and the tourist industry, are not anticipated to influence the basin's direction of development significantly. These activities are located and will be expanded in other parts of the island, such as the Harmon area, Tamuning, Tumon Bay, and the Apra Harbor area.

2.71 Development of the Agana area has been and will continue to be influenced by the fractional lot problem which is one of the most complex problems in Agana today. After World War II, the U.S. Navy laid out a new city to replace that devastated during the war. The Navy provided for new streets and utilities in Agana. Unfortunately, after construction was completed, it was found that the new streets divided the property lines in such a way that many areas became unusable due to plural ownership and/or small lot size. Although this problem has been partially resolved, its impact has retarded development in Agana and generated development in the neighboring Tamuning area. Consolidation of lots and resurveys are being accomplished by the Government of Guam in an effort to resolve the problem and to facilitate future land acquisition.

3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS.

3.1 According to the Master Plan for Guam, January 1966, intensive urbanization is expected to continue although significant changes in land use are not anticipated in the near future. The 1966 Master Plan is subject to periodic updating, but the basic document has not been revised in total or replaced to date. The projected economic growth

and development indicates that lands in urban and non-urban use today are expected to be more intensively utilized in the future. The 1965 and 1985 land use by major use categories is shown in the following table, indicating only small percentage changes. A map of the estimated 1985 land use, as shown in the 1966 Master Plan, is presented in plate 5.

1965 AND PROJECTED 1985
LAND USE FOR GUAM

<u>Category</u>	<u>1965</u>		<u>1985</u>	
	<u>Acres</u>	<u>Percent</u>	<u>Acres</u>	<u>Percent</u>
Non-Urban	81,115	59.8	74,579	55.0
Military	45,716	33.7	45,716	33.7
Conservation	3,594	2.6	6,057	4.5
Residential	2,002	1.5	3,927	2.9
Roadways	1,600	1.2	2,227	1.6
Public & Semi-Public	1,161	0.9	2,192	1.6
Commercial	309	0.2	538	0.4
Industrial	<u>182</u>	<u>0.1</u>	<u>443</u>	<u>0.3</u>
TOTAL	135,679	100.0	135,679	100.0

3.2 The following table presents the election district breakdowns of land use acreages for districts which are within or, in part, within the Agana drainage basin.

1965 LAND USE IN THE
AGANA DRAINAGE BASIN AND ADJACENT AREA

	<u>Agana</u>	<u>Barri-</u>	<u>Chalan</u>	<u>Mangi-</u>	<u>Mongmong-</u>	<u>Total</u>	<u>Percent</u>
	<u>Sinajana</u>	<u>gada</u>	<u>Pago-</u>	<u>lao</u>	<u>Toto-</u>	<u>Acreage</u>	<u>Distri-</u>
			<u>Ordot</u>		<u>Maite</u>		<u>bution</u>
Non-Urban	1,403	1,644	3,722	4,356	826	11,951	60.0
Military	229	3,837	--	1,513	194	5,773	29.0
Residential	168	285	85	164	164	866	4.4
Roadways	177	64	72	165	92	570	2.9
Public & Semi-Public	217	27	61	302	93	700	3.5
Commercial	22	4	1	1	--	28	0.1
Industrial	7	--	--	--	9	16	0.1

3.3 In addition to the currently applicable Guam Master Plan of 1966, other comprehensive land/water use plans include the Outdoor Recreation on Guam report and a separate water conservation master plan adopted by the Territorial Planning Commission in 1972. The Outdoor Recreation Plan has been revised in 1971 and 1973, and describes the phased Central Park development. The plans have been discussed in Section 2 of this statement.

3.4 Another report, Conservation Requirements for the Preservation of Guam Water Resources, PUAG, 1970, establishes conservation, low density and drainage basin watershed areas for the island. Portions of the project drainage area which are in the higher reaches above the swampland are designated water conservation and low density areas.

3.5 The Twelfth Guam Legislature, passed an act (P.L. 12-96) on 16 January 1974 to authorize the Territorial Planning Commission to prepare a feasibility study and general plan for the development of the Agana River Reclamation Project. To date, funds for the study have not been released and the Planning Commission has not initiated the study. The study would consider the feasibility of and prepare plans for a project that may include a variety of recreation and related uses within the Agana Basin.

4. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

A. Overall Impact.

4.1 The proposed plan of improvement would provide protection from floods up to the standard project flood. Under existing conditions, the peak flood discharge is 33,000 cfs and the volume of the runoff is 3,800 acre-feet. Under improved conditions, the standard project flood is routed through the swamp, and the resulting outflow is 7,500 cfs, with a maximum water surface elevation of 17.7 feet msl. The 7,500 cfs outflow would be accommodated by the channelization of the lower reaches of the river.

4.2 Land would be acquired for permanent structures such as channel and levee works and the pumping facilities, and for flowage easements up to about elevation 18.0 feet in the Agana Swamp and within the leveed area. Acquisition would include 2 acres for the channel, 12.5 acres for the levees and pump station, and about 360 acres for flowage easements. About 285 of the estimated 375 acres (at elevation 18 feet msl) required for the project are located upstream of the powerline access road and are considered part of the Agana Swamp.

4.3 Located on the fringes of the swamp, the levees would require about twelve acres of land, but would permanently delineate the developed lands from the remaining undeveloped swamp. The flowage easement designation of the area encompassed by the levees would require that they be kept in open space for flood storage purposes. The Government of Guam would be required to provide assurances that encroachment on the improved channel and on the required flowage easements would not be permitted. If flowage easements and capacities are impaired, the Government of Guam will be required to provide substitute storage capacity or equivalent pumping capacity. Impacts on the vegetation and wildlife habitat of the swamp would be limited to the fringe areas where levee construction is to take place. Except for the construction period, disturbances to the swamp proper (south of the powerline access road) should be minimal. No change to the existing swamp conditions are expected, and future encroachment should be restricted by local enforcement of the flowage easement requirement. The loss of twelve acres of swamp fringe land is considered an adverse effect on the habitat of endangered bird life. However, the loss is offset by long-term preservation of the remaining 360 acres of habitat within the flowage easement.

4.4 Channelization would replace 1,750 feet of existing unlined river with a lined waterway. The channelization would require some excavation, backfilling, and removal of bankside vegetation. Most of the section to be channelized, however, flows through an area where development by residential and commercial interests has extended very close to the existing banks. Therefore, loss of vegetation would not be as adverse as it would be through undeveloped portions of the swamp.

4.5 Under normal and low flow conditions, the removal of bankside vegetation and the concrete lining of the channel sides and bottom will result in higher water temperatures in the lower stream area. In addition, the lining

would result in loss of some watering sites for birds and other wildlife, and utilization by migratory species such as the eel Anguilla marmorata and the prawn Macrobrachium lar may be discouraged. Although the precise rise in temperature cannot be accurately predicted due to a number of variables, the total amount is not expected to be lethal or damaging to living organisms. Measures are being incorporated to minimize the effects of concrete channelization. Tidal waters already extend up the channel about 800 feet at high tide. Since the channel bottom near the Saylor Street bridge would be raised slightly, the extent of tidal water upstream may be reduced. There would be a portion of channel between Saylor Street and the upper limits of tidal water in the river that may be dry or practically dry during low flows. A low-flow channel would be provided within the channel invert to facilitate the passage of low flows for fish and wildlife purposes from above Saylor Street to the ocean (see plate 2). In addition, bankside landscaping will provide trees and shrubs to shade the low-flow areas and minimize temperature increases. Tidal effects should keep the lower 800 feet of the river bottom covered with water under most conditions. Provisions for low-flow augmentation, which might enhance fish habitat by increasing continuous flows from the swamp to Agana Bay, will be investigated during detailed design studies.

4.6 Outlet works at the river mouth would require some dredging of the bottom, and lining of the submerged outlet sections. There is some indication that gradual sedimentation and filling in of the mouth could occur, during normal to low-flow conditions. Excessive filling is not expected since current studies conducted in conjunction with the Agana Small Boat Harbor project indicate nearshore currents flow from the east toward the Paseo de Susana and along the Paseo out to sea.

4.7 The project is not expected to adversely affect the existing water quality of the river or bay/estuary. The tidal filling of the lower reaches of the stream should not be significantly changed, and the levees along the swamp fringes would not affect the river or swamp during non-flood conditions. Implementation of the plan will, however, change the nature of floodwater impacts upon the reef flat and water quality of Agana Bay.

4.8 Under existing conditions, flood flows would inundate the swamp as well as developed areas as shown on plate 4 and discharge into Agana Bay over a wide stretch of shoreline. The uncontrolled flows carry silt, debris, and waterborne objects into the bay waters. The estimated velocity for the standard project (design) flood at the mouth of the Agana River under existing conditions is about 9.4 feet per second (fps).

4

4.9. With the proposed plan, the detention effect of the leveed storage area within the flowage easements would reduce the standard project flood peak of 33,000 cfs to a peak channel flow of 7,500 cfs. With the reduced peak flow, the flow velocity entering the bay from the improved channel outlet would be about 9 fps, essentially unchanged from existing conditions. While channelization concentrates the principal point of discharge at the river outlet, it also prevents overbank flows so that overland runoff within the developed area would be minimal. The prevention of extensive overland

flow and discharge into Agana Bay over a long stretch of shoreline is considered an improvement to the bay water quality. In addition, the outlet works are designed to reduce the possibility of scour and to facilitate the transport of river flows out the channel along the Paseo and into deeper waters, minimizing adverse impacts on the reef flat.

4.10 Although precise quantification of changes is not possible, the proposed improvements are not expected to change existing groundwater characteristics of the basin or its ground water levels. Channelization is limited to the lower 1,750 feet of the stream. Under existing conditions within the lower reaches of the stream, flows are low (about 1 cfs) and interflow of water between the stream and the banks is negligible. When the lower stream is channelized and lined, provisions will be made for a subdrain system which includes perforated piping and weep holes. This system will permit interflow between the channel and banks to continue. Further, the ground water sources from which potable drinking water supplies are obtained are known to be at higher elevations than the swamp, and effects to the drinking water supply are not expected.

4.11 On the basis of known or inferred geologic and groundwater conditions, the limestone in the Agana Basin area has moderately high to high permeability, and recharge from rainfall moves rapidly downward to the water table and laterally to the saturated zone. The principal sea-level fluctuations affecting the groundwater are the ocean tides. The magnitude of fluctuation becomes progressively smaller with the distance from the shore. Major fluctuations in recharge follow the seasonal pattern of rainfall. In a study by the U.S. Geological Survey, subtraction of tide levels from the groundwater water levels produces rises and falls coinciding roughly with the rainfall in two abandoned wells in the Agana area.

4.12 In view of the above relationship, the proposed project would have very little effect on groundwater changes for higher frequency storms. Changes would be influenced primarily by the amount of rainfall. For low frequency storms, there would probably be a slightly greater recharge due to an increase in ponded water. With the estimated maximum ponding time at about 6 hours under design storm conditions, the increase is considered insignificant. In 1957, the 8 to 9 inches of rainfall during Typhoon LOLA caused an increase of about 8 inches in the groundwater levels in the coastal area of Agana. The high levels are attributed, however, to high seas and storm waves that piled water up on the shores so that the discharge transmissibility at or near the shore was reduced. As noted by the U.S. Geological Survey study, equal rainfall on other occasions had smaller and shorter effects in the same area.

B. Construction Impacts.

4.13 Effects on air, noise, and water quality within the project area would be limited to the construction period, estimated to be about 18 months. Control measures to reduce the adverse impact on the community will be detailed in the construction plans and specifications. Access for construction is not expected to be a problem since existing roads and open space are more than adequate for construction operations, including contractors' work and storage areas.

4.14 The proposed plan would not require relocation of any residences, businesses, or public buildings. None of the bridge crossings would need to be reconstructed, although modifications under the bridges would be required to increase their capacities. The sewer and water lines at the Marine Drive crossing would require relocation. In addition, the roadway grade of the sections where the proposed levee alignment intersects O'Brien Drive and the powerline access road would be raised. The pavement elevation at these points would be the same, or slightly higher than the top of the levee to be consistent with impoundment requirements. The total length of the roadway which would be affected is estimated at about 700 feet.

4.15 Excavation of the channel sections would yield about 21,000 cubic yards of earth. Stripping and excavation for levee construction would yield 33,000 cubic yards of material. The total 54,000 cubic yards would be used onsite to construct the overbuilt section of the levees so that disposal of channel spoil at another site would not be necessary. In addition, the overbuilt areas could be arranged to provide a more irregular and natural appearing structure, which when landscaped, would blend better with the surrounding environment.

4.16 The project will also require about 4,200 cubic yards of concrete for the channel improvements, 4,900 cubic yards of rock and granular material, and about 135,000 cubic yards of additional fill material suitable for levee construction. The concrete is commercially available, and the rock will be obtained by the contractor from one of several existing quarries on the northern half of Guam. Sources of fill material will be designated by the Government of Guam, probably from the Sinajana and Barrigada districts, within six miles of the project site. Impacts on the source sites will be reviewed when the sites are designated during the post-authorization design studies. Significant impacts will be reported in a supplemental environmental statement at that time.

C. Socio-Economic Impacts.

4.17 The proposed plan would protect all existing developments within the flood plain from floods up to the design (standard project) flood. Should a flood greater than the design flood occur, damages could still result, but they would not be as severe as with no improvements. Approximately 70 homes with an average fair market value of \$20,000 each and about 150 commercial establishments, ranging from small shops and offices to large department stores, banks, and warehouses are located within the flood plain and would be protected from floods. In addition, there are about 20 acres of commercial-zoned property and about 4 acres of residential property that are now vacant. If developed, the vacant lands could yield an additional 16 homes (7,000 square feet of land per home) and about 80 businesses (four commercial establishments per acre). Implementation of this project would also protect these future developments although the extent of future development is subject to local reviews, permits, and agency approvals. Development of vacant lands is already underway, and based on structures that were recently completed and those that are now under construction, no floodproofing measures are being effected at this time.

4.18 With flood protection, the Agana Central Park has the potential to become a major recreation-sports complex on Guam. It is expected that facilities such as a gymnasium, sports arena, cultural exhibition buildings, and other facilities for spectator-oriented activities will be planned within the protected area. The levee alignment proposed has been favored by the Government of Guam as it is the most compatible with their Outdoor Recreation Plan and allows sufficient flood-protected lands (20 acres) for development in accordance with the plan.

4.19 The proposed work should not have a significant impact upon employment levels or composition of the labor force except for the temporary increase accompanying the construction of the flood control improvements. Similarly, indirect benefits to employment would be evident with the flood protection provided to future developments; however, no significant changes are expected as the Agana area is already the center of commercial activity and should remain the center with or without the plan.

4.20 Implementation of the proposed improvements should result in an increase in property values. While the highly developed commercial areas may not be affected significantly, lower density developments along the stream alignment may experience higher rates of increase. Concurrently, the protection provided may encourage property owners to upgrade their properties, further increasing their values. As discussed in paragraph 4.17, the project would also provide protection for new residential and commercial developments.

4.21 Effects upon public facilities and services are evident in two main areas. First, flood protection will reduce damages to existing and future public facilities and structures such as schools, libraries, parks, and government buildings. Secondly, the reduction of flood damages will decrease local expenditures for flood emergency work and cleanup activities. Construction of the improvements will require services for maintenance, but the cost of these services would be small compared to emergency and cleanup operations.

4.22 The beneficial effects of the plan upon community growth and protection of existing developments also contribute to community cohesion within the Agana area. The elimination of serious disruption by flooding and the high level of protection provided would contribute to the orderly development of the community. The insular character of the island extends the cohesion and orderliness of development in Agana to outlying communities as well since the city serves as the business, cultural, and recreational center for the island.

4.23 The proposed plan will have both beneficial and adverse effects upon aesthetic or visual values within the flood plain. Concrete or rock channelization between Saylor Street and the mouth will replace the existing unlined stream with a man-made waterway. Architectural treatment such as modified formwork or darkening of the concrete will be incorporated to minimize adverse visual impact. The concrete portion is aligned through a highly developed area, and its visual impact would probably be most pronounced at the Marine Drive and Saylor Street bridges. The rock lining of

the channel below Marine Drive will also be highly visible, both from the roadway and from the Paseo de Susana peninsula park. The visual and landscaping aspects of the proposed works will be given special attention during post-authorization studies as the improvements are located in the civic center and a future recreation development area.

4.24 The levees will be new highly visible structures within the flood plain, but their earth construction with grass cover and landscaping should aid in blending them with the surrounding environment. They will have an average height of 10 feet and a maximum height of about 15 feet above the surrounding ground level. The levee system and floodway designation will preserve the stream above Saylor Street and the surrounding swamplands in their essentially natural condition. Revegetation of the banks, planting of trees and other landscaping will help to restore areas adversely affected by the improvements. The tile block pumphouse and related structures would be built on the edge of the levee slope near Saylor Street and would occupy about 500 square feet. Efforts will be made to integrate the design and landscaping of the small structure with the levee to minimize adverse visual effects.

D. Cultural Impacts.

4.25 The project will not adversely affect any cultural, historical or archeological sites identified to date. As mentioned earlier, the Agana Springs site is not subject to flooding, with or without the project. Both Plaza de Espana, and the Agana Spanish Bridge are within the flood plain, but will not be affected by the levees or channel alignment. Rather, they will be protected from floods up to the magnitude of the design flood. In his review of the draft environmental statement, the Guam Historic Preservation Officer has provided the following list of other known potential historic sites which are either unsurveyed or have not been considered by the Guam Historic Preservation Review Board to date. He qualified the list by stating that while the sites are all within the flood plain, they will be benefitted by the project rather than adversely affected by them.

<u>Unsurveyed Sites</u>	<u>Surveyed Sites to be Considered by Review Board</u>
Government of Guam Administration Bldg	Torres House
Statue of Liberty Copy	Calvo House
Skinner Plaza Monument	Shimizu House
Marine Drive Monument	U.S. Naval Cemetery
Guam Heroes Memorial	Japanese Caves
Japanese Fortifications, Paseo de Susana	
Guam Legislative Building	
Nieves Flores Library Building	
Dulce Nombre de Maria Cathedral	

4.26 In consultation with the Guam Historic Preservation Officer, it has been determined that the only Agana site on the National Register that might be affected by the project is the Spanish Dikes, shown on plate 3. The dikes are subject to flooding from the Agana River under existing conditions and will continue to be subject to flooding with the project.

4.27 The project's effects have been evaluated against the Criteria of Adverse Effect outlined in the Advisory Council on Historic Preservation's Procedures for the Protection of Historic and Cultural Properties, FEDERAL REGISTER, 25 January 1975, Vol. 39, No. 18, Part II. None of the proposed project's structural features will destroy the site, isolate the dikes from the surrounding environment, or alter the character or setting of the property. The only effect upon the dikes will occur during rare flood occurrences. As noted earlier, the dikes are subject to flooding under existing conditions. With the project, the swamp will be used as a low-level storage area for flood waters, and the dikes will continue to be subject to inundation. Under project conditions, the depth of inundation would be slightly increased and the period of inundation would also be lengthened, but neither change is considered to be a significant deviation from existing conditions. Inundation would constitute a slow rise in water level rather than rapidly moving flows. Under standard project flood conditions, the period of inundation with the project would not exceed about 6 hours.

4.28 The lack of significant difference between pre- and post-project effects on the dikes and the rarity of flood events that might affect the dikes indicate that no significant adverse effect upon the Spanish Dikes will result from implementation of the proposed project. None of the effects are expected to threaten the structure to a greater degree than under existing conditions. Since the dikes were first constructed for the purpose of impounding water for rice production, the temporary and infrequent occasions of flood water inundation would not appear to pose a new or significant threat to the dikes.

4.29 The Guam Historic Preservation Officer has reviewed both the draft project report and environmental statement. He is in agreement with the description of historical resources in the project area as well as with the assessment of effect upon the Spanish Dikes. In his 24 June 1975 letter (see Section 9), he concurs that no adverse impact upon historical, architectural, archaeological, or cultural resources will result from implementation of the proposed plan of improvement, alternative plan 3. The Advisory Council on Historic Preservation has noted this determination, adding that a change in the selected alternative may require re-coordination of this matter. The possibility that unknown historical resources may exist in the Agana Swamp is also acknowledged, and the discovery and evaluation of any resources found during project construction will be coordinated with the appropriate authorities.

5. ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED.

5.1 The primary adverse effects which cannot be avoided are related to the structural features of the plan. The channelization will adversely affect about 2 acres of existing riverbed and riverbank lands in the stream-estuary portion of the river near its mouth. The concrete lining and rectangular-shaped channel do not provide suitable habitat for aquatic organisms, can produce increases in water temperature, and are generally less visually acceptable than natural streambanks. These adverse effects will be mitigated to some extent by architectural treatment, construction of a low-flow channel, and bankside revegetation and landscaping, but they cannot be completely avoided.

5.2 Adverse effects to the Agana Swamp which cannot be avoided include the loss of about 12.5 acres of land at the northern edge of the swamp and along the swamp fringes for the construction of levees. The main levee alignment extends into the swamp between Saylor Street and the powerline access road. South of the powerline road, it swings toward Route 4 where it terminates at the edge of the swamp. As stated previously, the area north of the powerline access road has been subjected to a number of alterations, filling, and encroachment by man-made structures. In considering the current land situation on Guam, the location of government buildings, and the center of population, the Agana River flood plain area is prime land needed for the continued growth of the island's economy.

5.3 Although minimizing of swamp and wildlife habitat losses has been a major consideration in plan selection, the scarcity of wetland habitat on the island and the development pressures known to be threatening vacant lands makes any loss of wetlands an adverse one. The loss of 12.5 acres of swamp lands might be viewed as a comparatively small one in the long-term as it would require the preservation of the remaining swamp (360 acres at elevation 18 feet) by the Government of Guam through its enforcement of the designated flowage easement.

5.4 The levee alignment, while consistent with local land use designation for recreation uses, will allow the development of about 20 acres of undeveloped swampland north of the powerline access road as part of the Agana Central Park. Permanent structures can be constructed in the swamplands to be protected by the project. The benefit to recreation aspects will occur at the cost of 20 additional acres of swampland. Like the land requirements for the levees, the future recreational development will permanently remove lands from the swamp, and decrease this unique habitat. On the other hand, the designated recreation lands are situated in the swamp area most highly disturbed by man's activities and subject to intrusion by the adjacent developments and population.

5.5 Finally, the adverse effects associated with the construction period can be minimized through construction practices, but temporary degradation of air, noise, and water quality cannot be eliminated. In addition, some traffic inconvenience may be experienced during roadway alterations and utility relocations, but rerouting will be effected to minimize the interruption.

6. ALTERNATIVES TO THE PROPOSED ACTION.

6.1 a. No Action. During the development of planning objectives, the no action alternative was evaluated for the drainage basin. The analysis was done by considering the expected future in the project area, with no change in existing programs and resource management. Under these conditions, the economic growth, which started during the 1960's and has extended to the present time, is expected to continue for the next 10 to 20 years, despite the current lag which is considered a temporary condition. Agana is expected to remain the governmental, commercial, and financial center of Guam. Consequently, the Government of Guam would

consider the improvement and development of this city to be of vital importance to the economic well-being of the territory.

6.2 The principal result of continued economic growth is expected to be the increase in the density of the population in the Agana area. This increase will impact on public facilities, socio-economic values, and environmental resources. Based on no change in existing development policies and limited resource management practices, the continued growth of the Agana area would result in developed areas being redeveloped for higher use, and the spread of urban development to currently undeveloped lands zoned for urban use, as well as to lands currently zoned for other uses. Based on correlation of the 1965 and projected 1985 land use for Guam with the 1965 land use of the Agana basin and adjacent communities, it is estimated that about 560 acres in the basin and adjacent communities could be converted from non-urban to urban use by 1985. This anticipated future land use would occur with little or no controls and would result in encroachment on existing low-lying areas which are subject to flooding. This encroachment is expected to occur with or without comprehensive improvements for flood protection, and would aggravate the existing flood problem in the drainage basin unless measures are taken to alleviate this problem.

6.3 The anticipated future of the Agana area based on existing development and resource management policies and practices, is also expected to:

- a. Encroach on existing natural resources such as the unique Agana Swamp environment, including its flora and fauna.
- b. Tax existing public facilities such as the water supply and highway systems.
- c. Alter socio-economic conditions such as changing from village to urban life.
- d. Create new demands for amenities such as recreational facilities needed to support urban life.
- e. Create pressures for urban development on neighboring rural residential communities and possibly some conflict between agricultural and urban uses of these lands.

6.4 The anticipated growth and attendant problems described above may, however, be altered by the impending enforcement of the Flood Disaster Protection Act of 1973. This act stipulates that future Federal financial assistance to a community would be contingent on the community's implementation of an effective flood plain management program, participation in the National Flood Insurance Program or implementation of improvements to alleviate future flood losses. Failure to comply with this act would disqualify the community from all Federal and Federally related financial assistance which includes small business loans and grants, Veterans and Federal Housing Administration mortgage loans, and conventional construction and mortgage loans from Federally insured,

regulated or supervised lending institutions which comprises nearly all commercial and saving and loan banks. Therefore, no change in existing policies and resource management practices could severely restrict future growth in the Agana area following enforcement of the National Disaster Protection Act of 1973 in the Territory.

6.5 The no action alternative assumes economic growth and expansion with little or no change to the existing programs and resources management. However, the Government of Guam realizes that unless effective planning and controls are implemented, the quality of life on the island would deteriorate. Therefore, to achieve orderly economic growth without damaging the quality of life, effective controls on urban development and economic expansion, as well as effective management of the island's natural resources would be instituted. On this basis, it was considered to be highly unlikely that the no action alternative would be desired or implemented. Consequently, the planning objectives were formulated on the assumption that the probable alternative future for the Agana basin would be continued economic development and expansion, but with increasing controls, such as implementation of the Flood Insurance Program, which may be slowly and cautiously implemented at first, but which are expected to increase with experience.

b. Planning Objectives.

6.6 The objectives which follow were adopted as guidance for project planning and for the development of viable alternative solutions to the flood control and related problems of the Agana basin. The primary planning objective for the Agana River basin is the alleviation of existing problems and the development of policies and procedures to guide future development in an effort to attain the probable alternative future. Within the limits of the Harbors and Rivers in Guam authority, the planning objectives addressed by this study concern the alleviation of existing water and related resource problems in the basin, the most serious of which is the flood problem. Specific components of this objective are as follows:

a. Reduce the flood hazard and associated flood damages which constitute the most serious water resources problem in the basin.

b. Prevent further degradation of water quality in the basin; where possible, provide measures for improving it.

c. Where possible, include provisions for enhancing recreational opportunities in the basin.

d. Preserve and maintain existing environmental resources and alter these resources only where necessary for human safety and after careful consideration of the tradeoffs involved.

e. Provide for efficient and wise use of project lands consistent with the socioeconomic and cultural needs and desires of the study area residents as well as with long-range development plans for the area.

As noted in the planning objectives, flood control is the primary objective of this study, and the principal benefit values are in the city of Agana. The inventory of possible flood control solutions includes many non-structural and structural measures which are discussed in the following paragraphs.

c. Non-Structural Measures.

6.7 Non-structural measures do not attempt to reduce or eliminate flooding, but are intended to minimize loss of life and damages during floods. These measures include the regulation of development in the flood plain through zoning ordinances and building codes, flood proofing structures subject to inundation, and flood forecasting and evacuation of flood-prone areas. Because they usually minimize physical impact on the environment, these measures generally benefit fish and wildlife resources by aiding in the preservation and/or maintenance of the flood plain.

6.8 Flood Plain Zoning. Flood plain zoning is a legal device through which local governments can control development of flood-prone areas in such a manner as to minimize damage during floods. Zoning ordinances could designate limiting elevations below which development would not be permitted. In accordance with a planned program for development of the Agana area, zoning measures could effectively reduce the risk potential by keeping important structures, goods, and people outside the flood plain at the critical times. Effective flood plain zoning will provide for the best use of flood-prone lands in the interest of the needs, safety, and future growth of the community. Under this concept, flood-prone areas need not be left idle but can be developed into parks or other low-risk uses which would not be subject to severe damage during floods.

6.9 Building Codes. The Government of Guam could adopt building code regulations that would assist in reducing future flood damages. The building code would specify standards for the construction of buildings and structures, types of material which would withstand inundation and water pressure, and would regulate the storage of equipment and material in the flood plain that would be hazardous to life during flood flows.

6.10 Flood Proofing. This flood control measure consists of adjustments to structures and building contents which are designed or adapted primarily to reduce flood damages. Flood proofing includes, but is not limited to: (a) raising existing buildings, (b) providing flood walls to protect structures and contents, (c) providing flood shields for all openings, and (d) providing a waterproof coating to reduce seepage.

6.11 Flood Forecasting and Temporary Evacuation. Flood forecasting can be considered useful in two ways: (a) the preparation of temporary protection to minimize damage from an impending flood, and (b) the evacuation of flood plains anticipated to be inundated. Reliable, accurate, and timely forecasts of flooding and flood stages can be a valuable asset in providing adequate warnings to permit orderly and complete evacuation.

6.12 Other Non-Structural Measures. Other non-structural preventive measures include restrictive mortgage insurance to prospective developers; urban renewal to clear hazardous areas and convert them to safe uses; and a flood insurance program in which premiums accurately reflect the flood risk.

6.13 Applicable Non-Structural Measures. Because the existing use of the lower Agana basin is primarily commercial, preliminary analysis indicated that an essentially non-structural plan is possible and would partially meet the planning objectives. A non-structural plan consisting of flood proofing all existing and future structures together with a program for comprehensive flood plain management was evaluated through the planning process. This non-structural plan is discussed further in subsequent sections. It was concluded early in the study that the other non-structural measures would be appropriate only for specific localized situations. Application of these other measures on a basin-wide basis would not provide a practical, economical, or acceptable solution to the basin-wide problems and needs.

6.14 Although flood plain zoning and building codes would control future development and thereby eliminate or drastically reduce damages, this approach will not alleviate the existing flood problems in the developed urban areas. Flood prediction, warning, preparation of temporary flood protection measures, and temporary evacuation would help to decrease both the loss of human lives and flood damages. However, because of the uncertainty of predicting hydrologic variables over a relatively small drainage area, the flashy nature of stream flows, the costly measures associated with business interruption and evacuation, these methods of damage reduction for Agana are considered inadequate and undesirable by the affected people.

d. Structural Measures.

6.15 A wide variety of structural measures exists for managing resources, reducing flood damages, as well as minimizing or preventing the occurrence of floods. These measures were examined with respect to their effectiveness in achieving the planning objectives. Structural measures which attempt to confine, retain, and channel harmful floodwaters include reservoirs, levees, channel improvements, and combinations of these structures.

6.16 Reservoirs. The function of a reservoir is to store a portion of the flood flow in such a way as to reduce the flood peak to a safe capacity along the areas to be protected. Reservoirs offer the possibility of serving several purposes. Multiple use of reservoir projects may include water supply, irrigation, recreation, hydroelectric power, fish and wildlife conservation, and flood mitigation.

6.17 Levees. Levees are the oldest structural form of flood control. They are used to confine floodwaters to a designated floodway, or to divert these waters away from developed areas and into a designated channel or floodway.

6.18 Channel Improvements. The occurrences of floods and their damaging effects can be controlled by the construction of channel improvements which are designed to contain normal streamflows as well as floodflows. Channel improvements include realigning the channel to eliminate restrictive bends, enlarging the channel capacity, lining the channel to prevent bank erosion, and constructing structures to control the velocity of water flowing

through the channel. All channel improvements are related to three hydraulic factors: (1) Straightening, widening and deepening the channel to increase the flow area and hydraulic radius; (2) shortening the channel length to increase the slope; and (3) shaping the channel cross section to decrease the relative roughness.

6.19 Applicable Structural Measures. Because of the nature of existing and future land use and the small capacity of the existing channel, the preliminary analysis indicated that use of a single structural measure, although technically possible, would fall short of achieving the desired planning objectives. For example, a storage reservoir without downstream levee or channel improvements would necessitate excessive reservoir construction costs. In addition, the limited reservoir release necessitated by the small capacity of the downstream channel would decrease the degree of protection, since a second storm may occur before the drawdown is completed. Therefore, the reservoir storage potential for a series of storms would be substantially less than under ideal conditions.

6.20 Conversely, channel improvements without floodwater storage and retardation structures would necessitate a wide channel right-of-way through the urban area so that sufficient conveying capacity would be provided against large floodflows on rare occasions. The limited land area adjacent to the river, the size of the channel that would have to be provided, and the existing restrictive bridge openings would result in an impractical project which could not be economically or environmentally justified. As a result of preliminary engineering studies and estimates, and in view of the detrimental social and environmental effects, the implementation of a single structural measure to obtain the desired objectives was eliminated from further consideration.

e. Non-Structural And Structural Combinations.

6.21 Because of the type and extent of existing improvements and facilities in the flood plain and the estimated high flood flow peaks and volumes, structural flood control measures are considered essential components of an overall plan. Non-structural measures are considered important adjuncts to any basin plan, particularly for the undeveloped sections of the basin such as the Agana Swamp. In addition to its prime location, the flat and mildly rolling terrain of the swamp may attract future developments unless effective land management policies prevail. Evidence of encroachment is underway with the current construction of a shopping center at the northwestern edge of the swamp along Route 4. Without proper protective measures, future encroachment would increase the flood damage potential. Therefore, non-structural measures to complement structural improvements or to be applied to areas where structural solutions are not justified were seriously considered during the planning process.

f. Alternatives Considered Further.

6.22 As a result of the preliminary screening and analysis of applicable measures, five alternative plans that could fulfill study objectives were developed. These plans are described in the following paragraphs.

(1) FLOOD PROOFING (Plan 1)

6.23 As discussed earlier, flood proofing was found to be the only practical non-structural flood control measure. Within the Agana River flood plain, there are approximately 150 commercial and public buildings, and 70 residential homes. The homes are mostly single wall, wood siding structures posted on footings. Large lateral forces produced by flooding would structurally damage these frame homes by rupturing walls and floors. On this basis, the most practical flood proofing measure for residential homes would be raising the floors to flood-free levels. For commercial-public buildings, some of which are modern high rise structures, adequate structural unity is assumed; however, numerous measures such as flood shields for all openings, waterproof coating to reduce seepage, valving off sewer lines, and sump pump installation are considered appropriate techniques to reduce damages.

6.24 The total cost for flood proofing all existing and projected future structures for standard project flood protection is estimated at \$7.2 million. The beneficial effects that will result from this plan are limited to reduction of existing and future flood damages to the urban areas within the Agana flood plain. Flood proofing of structures would produce flood damage reduction benefits for approximately 280 acres of existing and potential urban lands downstream of the powerline access road. The primary adverse effect associated with various flood proofing measures is the "added on" visual impact on existing structures, particularly the large commercial buildings. Required functional measures and additions could detract from the existing structural and architectural appearance. Field inspections during the study also revealed that a number of residential homes and buildings are structurally inadequate for flood proofing unless substantial improvements are made prior to or during the flood proofing process. Furthermore, the large number of land owners in the basin, together with other non-structural steps such as temporary evacuation and reoccupation, would present many social as well as economic problems which must be addressed before flood proofing can be carried out in an orderly manner. Other adverse effects would be the necessary safeguarding of the evacuated town against vandalism and theft; and the personal hardship for the involved people. Other than the reduction of flood damages, this plan does not meet any of the component needs for recreation, fish and wildlife, low flow augmentation, and water quality.

6.25 This alternative of flood proofing existing and future developments was discussed with local interests. Because of the possible detrimental visual impact and the complex pattern of land and building ownership which would create problems in implementing this plan, local interests favored structural improvements over the non-structural flood proofing alternative. Based on this determination during the early planning, no further consideration was given to the flood proofing alternative.

(2) LEVEE AND CHANNEL IMPROVEMENTS (Plans 2 and 3)

6.26 Two levee and channel plans, designated as Plans 2 and 3, which would provide a high degree of protection for the urban Agana area were investigated. Under these plans (plates 6 and 7), channel improvements would be

constructed from the mouth of the Agana River to Saylor Street, following the existing unimproved river alignment. A levee system would be constructed upstream of Saylor Street, and along the lower edge of the Agana Swamp to provide low-level detention of floodflows in the Agana Swamp. Because of the storage provided by the swamp, the design flow through the channel would be reduced from the standard project flow peak of 33,000 cubic feet per second to 7,500 cubic feet per second. Depending on the levee alignment, flowage easements of about 360 to 380 acres of land within the leveed area would be required. These lands, most of which are considered part of the swamp, are essentially undeveloped and currently zoned for agriculture or conservation. Each plan would also include a pumping plant behind the left bank levee upstream of Saylor Street to pump local drainage over the levee during high flows.

6.27 Both of the plans provide the same degree of flood protection. The plans differ with respect to the alignment of the levees and their impact on factors such as construction costs, land use, and natural resources. Plan 2 provides for a shorter levee than that provided under Plan 3 and therefore maximizes retention of the existing swamp environment and is considered the best plan from the environmental standpoint. On the other hand, the longer levee provided by Plan 3 is considered more desirable by local interests because it would enable intensive recreation development, complementing the development plans for the Agana Central Park complex. The main difference in costs between the two plans, as shown below, is the higher construction cost for Plan 3, since the total length of the levees would be about 800 feet more than that for Plan 2. The higher annual benefit under Plan 3 reflects \$131,000 of average annual recreation enhancement benefits due to the higher degree of development and use of the Agana Central Park. Plan 3 has been designated as the one which maximizes benefits to the economy.

<u>Levee and Channel Plan</u>	<u>First Cost (\$1000)</u>	<u>Annual Cost (\$1000)</u>	<u>Annual Benefit (\$1000)</u>	<u>B/C Ratio</u>
Plan 2	4,800	319	506	1.6
Plan 3	4,930	327	552	1.7

(3) FLOOD CONTROL RESERVOIR AND DOWNSTREAM CHANNEL IMPROVEMENT (Plan 4)

6.28 Storage of floodwaters by an upstream reservoir was investigated in reconnaissance scope. On the basis that adequate foundation exists within the Agana Swamp for a low dam, a high degree of flood protection could be provided primarily because of the storage potential of the swamp. The site selected for study of this alternative is approximately 1,300 feet upstream (plate 8) of the powerline access road. Preliminary routing of the standard project flood (SPF) indicated that an embankment about 40 feet high and approximately 2,300 feet long could provide SPF protection when an average reservoir release of 800 cubic feet per second through an outlet is assumed. To safely convey reservoir releases, limited channel improvements at critical areas downstream would be required. With this plan, a design storage capacity of 3,200 acre-feet is estimated as compared to the total SPF

runoff of 3,800 acre-feet. This alternative would require approximately 400 acres of lands, easements, and rights-of-way, relocation of four homes which are located in the storage site, and about 600 feet of channel improvements. A summary of the economics of this alternative is as follows:

Total first cost	\$7,500,000
Total annual charges	562,000
Average annual benefits	742,000
Benefit to cost ratio	1.3

(4) MULTIPURPOSE RESERVOIR AND DOWNSTREAM CHANNEL IMPROVEMENT (Plan 5)

6.29 In addition to the flood control function, a multipurpose reservoir (Plate 9) which would include general recreation and fish and wildlife enhancement was evaluated. With additional lands, the Agana Swamp site, which was considered for the single purpose flood control project, could provide auxiliary recreation development to meet a portion of Guam's present and future recreation needs. The central location of the site makes it easily accessible by both local residents and visitors. Because of its open space qualities, development of recreational facilities at this site would be responsive to the following priorities of the Outdoor Recreation of Guam Plan:

- a. Facilities to meet multiple recreation demands.
- b. Development of sites endowed with scenic, historic, and wilderness qualities.
- c. No requirement for extensive access roads, and site development could be programmed by increments.
- d. Qualifies for Federal participation under Public Law 89-72, Water Project Recreation Act.
- e. Preservation and enhancement of fish and wildlife.

6.30 With its rolling hills, the site is suitable for the development of recreation functions such as picnicking, camping, and general outdoor recreation activities. In addition, the topography of the site is such that a 180-acre recreation pool could be established for water skiing, fishing, and boating. Based on preliminary estimates, a multipurpose project with recreation functions would attract an average of 180,000 visitors annually. Required project lands consist of about 400 acres for flood control, and an additional 160 acres specifically for recreation. On normal dry weather days, however, designated flood control zones such as the recreation pool and adjacent areas would be available for recreation use. Thus, the actual acreage available for recreation use would be in excess of 400 acres.

6.31 The single purpose flood control alternative and the multipurpose alternative differ only by the added recreation function. Both alternatives would require about 600 lineal feet of downstream channel

improvements. The estimated costs and benefits for flood control, land enhancement, and recreation purposes are shown below.

Total first cost	\$17,300,000
Total annual charges	1,278,000
Average annual benefits	1,042,000
Benefit to cost ratio	0.8

g. Assessment and Evaluation.

6.32 Impact assessment and evaluation studies were conducted to identify, measure, and compare the likely economic, social, and environmental effects of the alternative plans. These effects were analyzed and formed the basis for evaluating the beneficial and adverse contributions of the alternatives, and provided a basis for choosing the most desirable alternative. The economic factors (i.e., cost and benefits) of the four alternative plans (Plans 2-5) were presented in the previous paragraphs. Specific social, economic, and environmental effects of each of the four alternative plans are summarized in the following paragraphs. The alternative plans, considered appropriate in achieving various levels of contributions to the defined objectives, were analyzed individually for beneficial and adverse effects, and collectively so that the differences among alternatives show tradeoffs among the specific components of the objectives.

6.33 Plan 2 - Levee and Channel Improvements. Of the 280 acres of flood plain north of the powerline access road, about 210 acres would be flood-free due to this plan of improvement. The protected area would include most of the Agana downtown area. The remaining 70 acres below the powerline access road would be reserved for flowage easements and construction of levees and channel improvements. Under this plan, about 2 acres of riverbed and riverbank lands would be channelized from Saylor Street to Agana Bay, 10 acres would be required for levee construction, and flowage easements would be required for a total of about 380 acres. Most of the 380 acres of required flowage easements are currently zoned agriculture or conservation. Approximately 285 acres, or 75 percent of the total easements are within the Agana Swamp, upstream of the powerline access road.

6.34 In addition to providing standard project flood protection, the new channel and related improvements would enhance the urban environment along the riverbanks between Saylor Street and Marine Drive. Without channel improvements, the highest utilization of the 3-acre vacant land located along the right bank between Saylor Street and Marine Drive cannot be realized. Both the Official Zoning Map and the Projected Land Use Map of the Government of Guam indicate commercial usage for that parcel. Landscaping of the project area along the proposed channel would beautify the adjacent neighborhood. Provisions for a low flow channel and minor design adjustments at the upstream end could provide low flow augmentation in the interest of fish and wildlife resources. The proposed levees and flowage easements are compatible with the existing facilities at the Agana Central Park and consistent with the concept of maintaining an open space environment around the swamp. The imposition of the flowage easements above the

powerline access road would further preserve the current agriculture-conservation designation. Agricultural and pasture land uses along with non-damageable recreation facilities are considered appropriate for the area within the leveed flowage easements.

6.35 This alternative plan would not have any appreciable effect on sediment transport or ground water levels since normal low flows would not be affected; however, it would result in supplanting and changing about 1,750 lineal feet of natural stream bed and vegetation along the lower reach of the Agana River.

6.36 Plan 3 - Levee and Channel Improvements. Except for the location of the setback levee on the left bank of the Agana River, Plan 2 and Plan 3 are practically identical. The change in the levee alignment under this plan would decrease the flowage easement by 20 acres to a total of 360 acres. However, the 20 acres would increase the protected flood plain lands from 210 to 230 acres. Since this 20-acre parcel is situated within the Agana Central Park, the addition of 20 acres of protected land would provide the park with a higher level of planning flexibility in that needed or desired facilities and structures could be planned on a larger area. Compared with Plan 2, this plan is environmentally less desirable because of the greater encroachment of the levee on the wetland swamp. The total length of the levees proposed under Plan 3 is longer than the length of the levees for Plan 2. The longer length, in turn, increases the levee land requirement for Plan 3 from 10 to 12.5 acres. The net loss of flood storage between Plan 2 and Plan 3 is negligible.

6.37 Plan 4 - Flood Control Reservoir. A high-capacity storage reservoir would minimize channel construction and eliminate levee construction in the lower Agana River basin. Only about 600 lineal feet of channel improvements below Saylor Street would be necessary in conjunction with the storage operations. The scope of the channel work would be nominal since the channel improvements would primarily consist of bank protection and slight increase in capacity to handle reservoir releases only. This reservoir alternative would allow full utilization of the 380 acres of existing and future urban lands below the selected reservoir site. The lands, easements, and rights-of-way required for this alternative are estimated at 400 acres, of which 380 acres would be for flowage easements.

6.38. The flood protection provided by this alternative would permit a higher economic use of the lands below the reservoir site, thereby increasing the land resources and property values for the community and the local government. However, unless land use is controlled by zoning ordinances, this plan could encourage urban sprawling and irrational development. In addition to flood protection, this alternative would have beneficial effects on ground water recharge, silt deposition, and low flow augmentation. The most pronounced adverse effects associated with this plan would be the permanent inundation of the Spanish Dikes historic site, intrusion on the swamp proper, and the elimination of swamp-marsh habitats. At present, there are at least 10 known threatened or endangered species in the Agana Swamp. The swamp is considered one of the last large remaining

habitats for some of these species, and elimination of habitat would contribute to the further decline of these species. Other adverse impacts related to construction of this alternative would involve approximately 500,000 cubic yards of earthwork for the embankment. Although temporary, clearing operations for access roads and project construction would contribute to environmental problems such as noise, air, and water pollution.

6.39 Plan 5 - Multipurpose Reservoir. This alternative is similar to Plan 4 except for the inclusion of general recreation and fish and wildlife enhancement, the addition of specific lands and facilities to achieve the multiple purposes, and minor design adjustments to the flood control structures for compatibility with the different purposes. With an additional 160 acres of land and specific facilities, Plan 4 can be converted into a large multipurpose reservoir project. The provisions for recreation and fish and wildlife would permit development of critically needed recreation facilities on Guam as indicated by the inventory of existing and planned recreation sites by the Government of Guam which shows that there are and will be significant gaps for picnicking, camping and general outdoor recreation facilities.

6.40 The beneficial and adverse effects of a multipurpose dam and reservoir project compared to the single-purpose flood control reservoir described earlier are:

a. The multipurpose project would increase the requirement for lands, easements, and rights-of-way from 400 to 560 acres.

b. The development of facilities for land-based and water-based recreation activities such as picnicking, camping, boating, water skiing, fishing, and general outdoor opportunities under the multipurpose project would add substantially to the basin's recreation resources.

c. Provisions for the preservation and enhancement of fish and wildlife resources would receive equal consideration with other project purposes. Efforts would also be directed to protect species of native fish, wildlife, and migratory birds that are rare or threatened with extinction. However, the increased land requirements and human activity would result in more severe swamp habitat loss and threat to endangered species than Plan 4.

d. Public access and increased traffic would have an adverse impact on the neighboring residential areas. On the other hand, the close proximity of the recreation complex can be considered beneficial for the people in these areas.

h. Tradeoff Analysis and Plan Selection.

6.41 The tradeoff analysis was used to provide a basis for selecting a plan. This analysis consisted of comparing the alternative plans and ranking them according to: (1) the beneficial and adverse effects of each alternative (table 1); (2) the Federal interest in the different plans; and (3) other Federal criteria such as tests of acceptability, effectiveness, efficiency, and completeness.

Table 1 - Summary Comparison of Alternative Plans

	Levee and Channel EQ Plan		Levee and Channel NED Plan		Flood Control Reservoir Plan		Multi-Purpose Reservoir Plan	
	Plan 2	Plan 3	Plan 4	Plan 5	Plan 4	Plan 5	Plan 4	Plan 5
1. PLAN DATA								
Structures	1. Levees for low level flood control.	1. Levees for low level flood control.	1. Levees for low level flood control.	1. Levees for low level flood control.	1. Swamp site for reservoir for flood control.	1. Swamp site for reservoir for flood control.	1. Swamp site for reservoir for flood control, recreation and fish and wildlife.	1. Swamp site for reservoir for flood control, recreation and fish and wildlife.
Lands	2. Downstream channel improvements.	2. Downstream channel improvements.	2. Downstream channel improvements.	2. Downstream channel improvements.	2. Minimal downstream channel improvements.	2. Minimal downstream channel improvements.	2. Minimal downstream channel improvements.	2. Minimal downstream channel improvements.
	1. 12.0 Acres for channel and levees; and 380 acres of flowage easements.	1. 14.5 Acres for channel and levees; and 360 acres of flowage easements.	1. 14.5 Acres for channel and levees; and 360 acres of flowage easements.	1. 20 Acres for dam and related structures; and 380 acres of flowage easements.	1. 20 Acres for dam and related structures; and 380 acres of flowage easements; and 160 acres for recreation.	1. 20 Acres for dam and related structures; and 380 acres of flowage easements; and 160 acres for recreation.	1. 20 Acres for dam and related structures; and 380 acres of flowage easements; and 160 acres for recreation.	1. 20 Acres for dam and related structures; and 380 acres of flowage easements; and 160 acres for recreation.
Nonstructural	1. Regulatory zoning within flowage easements.	1. Regulatory zoning within flowage easements.	1. Regulatory zoning within flowage easements.	1. Regulatory zoning within flowage easements.	1. Regulatory zoning within flowage easements.	1. Regulatory zoning within flowage easements.	1. Regulatory zoning within flowage easements.	1. Regulatory zoning within flowage easements.
2. NATIONAL ECONOMIC DEVELOPMENT (NED)*								
Beneficial	80	100	116	158				
Adverse	46	47	81	183				
Net	33	53	36	(15)				
3. ENVIRONMENTAL QUALITY (EQ)								
Open Spaces	380 Acres flowage easement preserved in open space.	360 Acres flowage easement in swamp preserved in open space.	380 Acres flowage easement preserved in open space.	380 Acres flowage easement preserved in open space plus 160 acres recreation.	380 Acres flowage easement preserved in open space plus 160 acres recreation.	380 Acres flowage easement preserved in open space plus 160 acres recreation.	380 Acres flowage easement preserved in open space plus 160 acres recreation.	380 Acres flowage easement preserved in open space plus 160 acres recreation.
Historical/ Archaeological Resources	Same as NED Base Plan.	Temporary inundation of Spanish dikes during floods. All sites in town protected. Downtown Agana protected.	Temporary inundation of Spanish dikes during floods. All sites in town protected. Downtown Agana protected.	Permanent inundation of Spanish dikes by reservoir pool. All downstream sites protected.	Permanent inundation of Spanish dikes by reservoir pool. All downstream sites protected.	Permanent inundation of Spanish dikes by reservoir pool. All downstream sites protected.	Permanent inundation of Spanish dikes by reservoir pool. All downstream sites protected.	Permanent inundation of Spanish dikes by reservoir pool. All downstream sites protected.
Quality of Water, Air, and Land Resources	Same as NED Base Plan.	Temporary adverse effects during construction period. No change to ground water supply.	Temporary adverse effects during construction period. No change to ground water supply.	Greater construction impacts due to dam/reservoir. Contributions to ground water recharge.	Greater construction impacts due to dam/reservoir. Contributions to ground water recharge.	Greater construction impacts due to dam/reservoir. Contributions to ground water recharge.	Greater construction impacts due to dam/reservoir. Contributions to ground water recharge.	Greater construction impacts due to dam/reservoir. Contributions to ground water recharge.
Fish and Wildlife Resources	Slightly more swamp preservation than NED Plan. Least potential for encroachment on swamp.	Levees on swamp fringes. Flowage easements preserve most swamp habitat. Some potential for encroachment downstream and west of main levee.	Levees on swamp fringes. Flowage easements preserve most swamp habitat. Some potential for encroachment downstream and west of main levee.	Structural change from swamp habitat to lake. Endangered birds species may be threatened.	Structural change from swamp habitat to lake. Endangered birds species may be threatened.	Structural change from swamp habitat to lake. Endangered birds species may be threatened.	Structural change from swamp habitat to lake. Endangered birds species may be threatened.	Structural change from swamp habitat to lake. Endangered birds species may be threatened.
Recreation Resources	Least potential for intensified use.	Potential for intensified recreation use in lower swamp, downstream and west of main levee.	Potential for intensified recreation use in lower swamp, downstream and west of main levee.	Potential for local recreation development on all lands protected by dam.	Potential for local recreation development on all lands protected by dam.	Potential for local recreation development on all lands protected by dam.	Potential for local recreation development on all lands protected by dam.	Potential for local recreation development on all lands protected by dam.
4. REGIONAL DEVELOPMENT								
Project Area	No change	No change	No change	No change	No change	No change	No change	No change
5. SOCIAL WELL-BEING								
Real Income Distribution	Enhances base	Enhances base	Enhances base	Enhances base	Enhances base	Enhances base	Enhances base	Enhances base
Life, Health and Safety	Flood protection	Flood protection	Flood protection	Flood protection	Flood protection	Flood protection	Recreation and flood protection	Recreation and flood protection

* 100 = base index of relationship of alternative plans to base plan.

6.42 Beneficial and Adverse Effects. As summarized in table 1, the major monetary beneficial effect that will result from the alternative plans is the reduction of existing and future flood damages in the Agana River drainage basin. In addition to the inundation reduction benefits that would accrue to all of the alternative plans, recreation enhancement benefits and increased employment opportunities would be realized at the Agana Central Park under Plans 3, 4, and 5. Location benefits would be realized for Plans 4 and 5, and project-related recreation benefits would result from implementation of Plan 5. With respect to the adverse economic effects, the greatest difference between plans is the higher project costs for the reservoir alternatives as compared with the levee and channel alternatives.

6.43 Non-monetary resources were considered as tradeoffs for the removal of the flood threat and other beneficial effects in the Agana basin. The non-monetary resources are primarily intangible socio-economic and environmental values. The levee and channel alternatives would result in a loss of about 1,750 lineal feet of natural river and vegetation along the lower Agana River. Levee construction would require 10 to 12.5 acres of land along the downstream edge of the swamp. The removal of 1,750 feet of natural river would result in a small (about 1.5 acre) loss of river-estuary habitat. However, the habitat preservation achieved by the imposition of flowage easements in the swamp which would restrict future urban encroachment is considered to be many times more valuable than the net loss. The commitment of land for levee construction is viewed as a direct economic enhancement to local interests because it would protect and enhance development of the Agana Central Park.

6.44 The reservoir alternative plans would result in utilizing 400 to 560 acres of the swamp and adjacent properties. The flood protection provided by a reservoir would allow higher economic use of downstream lands. Approximately 100 acres downstream of the dam site, most of which are currently swamp and pasture lands, could be developed and urbanized under the reservoir alternative plans. Construction of any storage reservoir would constitute a major adverse effect on the existing open space and wildlife habitat in the Agana Swamp. Much concern has been expressed by local interests and citizens relative to the overall adverse effects of the reservoir plans on the Agana Swamp. Of prime concern is the elimination of the habitats of rare or endangered species.

6.45 Federal Interest. Federal interest was established for three of the four alternatives considered in the tradeoff analysis. These alternatives are the two levee and channel plans, and the single-purpose flood control project. The Federal interest in these alternatives was determined on the basis that beneficial impacts exceeded adverse impacts. The multipurpose reservoir plan did not meet the stated criteria primarily because of the high cost and the detrimental environmental effects to the Agana Swamp. (Although substantially qualitative, the environmental aspect of this analysis appears to be reasonable in view of expressed public opinion.)

6.46 Other Federal Criteria. In addition to determining the Federal interest in the alternative plans, various other Federal criteria were applied in the selection of a plan. These criteria were applied to the three alternative plans that met the Federal interest criterion. The following table shows the evaluation in simplified, tabular form.

Table 2
COMPARISON OF ALTERNATIVE PLANS

<u>Criteria</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 4</u>
1. Acceptability by affected public	Most acceptable environmentally	Most acceptable overall	Least acceptable
2. Certainty of objective attainment	Yes	Yes	Yes
3. Completeness of necessary investments and actions to insure plan attainment	N/A ^{1/}	N/A ^{1/}	N/A ^{1/}
4. Effectiveness of meeting the objectives	Effective	Very effective	Effective
5. Efficiency in achieving objectives in the least-cost way	Least cost	Slightly more than Plan 2	Highest cost
6. Equity to affected society	Fair to majority	Fair to majority	Possibly least fair to property owners at reservoir site
7. B/C ratio	1.6	1.7	1.3
8. Planning space or area encompassed by plan	Agana River basin only	Same as Plan 2	Same as Plan 2
9. Reversibility of plan	Possible	Possible	Possible
10. Stability to alternative futures	Moderate stability	Greatest stability	Lowest stability
^{1/} Subject to funding and local cooperation prior to implementation of the recommended plan of improvement.			

1. The Selected Plan.

6.47 The plan selected for implementation was essentially the plan which was shown to be superior to the others based on the trade-off analysis. This analysis involved (subjective) judgments and evaluation of public opinions and input. It showed Plan 4 to be the most costly of the three alternative plans and the least desirable from the environmental standpoint, primarily because it would permanently inundate the Spanish Dikes which are included in the National Register of Historic Places. This plan would also change 180 acres of the natural swamp environment to a man-made lake, thereby disrupting and destroying existing fish and wildlife habitats.

6.48 Comparison of Plans 2 and 3 showed them to be identical except for the alignment and length of the levee on the left bank. The impact of this difference essentially concerns a 20-acre parcel of swamp land on the left bank. Under Plan 2, the existing natural environment of this 20-acre area would be retained. This plan is therefore superior to Plan 3 from the standpoint of fish and wildlife resources. Under Plan 3, the 20-acre area would be protected from floods, thereby enabling conversion to higher use. In particular, the area could be developed for recreational use as part of the Agana Central Park. Based on the comments received during coordination of the alternative plans with Federal and Government of Guam agencies, community groups, and interested citizens, and during the public meetings on 17 July 1974 and 12 June 1975, Plan 3 appears to be the most desirable plan and the plan which would be most responsive to the planning objectives. This plan, shown on Plates 1 and 7, appears to provide for the best balancing of the physical, environmental, and socio-economic factors pertinent to the Agana drainage basin. It would provide a high degree of flood protection for the residential and commercial communities while retaining most of the existing swamp environment. It would also enhance recreational opportunities by enabling more extensive development of the Agana Central Park. Plan 3 was therefore considered the tentatively selected plan. Based on the comments received on the draft report, draft environmental statement, and during the public meetings, Plan 3 has been selected for recommendation and implementation.

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

7.1 The proposed plan would result in the long-term reduction of existing and future flood damages to the Agana River basin as well as increased potential for recreation development in the downtown Agana area. In addition, the non-structural feature of the plan, or the flowage easement requirements, would assure long-term productivity of most of the Agana swamp as a unique, wetland and wildlife habitat. These benefits are derived from direct losses of swampland amounting to about 12.5 acres for the levees and about 20 acres for the area to be developed in recreation. However, the habitat preserved by the imposition of flowage easements which will restrict future urban encroachments is considered many times more valuable than the initial net loss.

7.2 The scarcity of developable lands on Guam and the prime location of the Agana flood plain area make it highly likely that pressures to fill and

develop portions of the swamp will continue and increase in the future. The results of such pressures are already evident as lands at the outskirts of the swamp have been redesignated for commercial or residential uses and filled accordingly. The recreation designation of presently vacant swamp-lands is included in the current land use plans of the territory. With implementation of the flood control improvements, these lands can be fully developed. This project effect might be viewed as another example of encroachment on the swamp. However, in an effort to balance long-term needs for flood control, recreation, and development, this trade-off was supported by the Government of Guam.

8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED.

8.1 The proposed plan would require commitments of about 2 acres of river-bed and riverbank lands between Saylor Street and Agana Bay, 12.5 acres of land along the fringes of Agana Swamp for levee construction, and about 360 acres of flowage easement within the Agana Swamp. The commitments of land for channel and levee works are essentially irreversible and would necessitate the permanent commitment of these presently undeveloped areas for flood control structures. On the other hand, the commitment of most of the Agana Swamp for flowage easement assures that it will remain in undeveloped open space and that it will not be further altered. Unless other flood control measures are instituted, no alteration of the swamp by filling or other development would be allowed. Thus, the bulk of the swamp would be committed to open space.

8.2 The project would also require about 135,000 cubic yards of fill material, 4,900 cubic yards of stone and granular material, and 4,200 cubic yards of concrete, as well as the labor and time of construction crews. Over the life of the project, local government would be required to maintain the facilities and assure their effective operation, involving a commitment of local manpower resources over the 50-year life of the project.

8.3 Construction of the project will result in implementation of developments in accordance with local land use plans. About 20 acres of commercial-zoned lands, about 4 acres of residential-zoned land, and 20 acres of recreation designated lands which are now vacant and flood-prone, would become available for future development. All of these lands are either outside the swamp proper, or located at the periphery of the swamp where the encroachment and influence of man's activities are already in evidence.

9. COORDINATION WITH OTHERS.

A. Public Participation.

9.1 In the interest of navigation, flood control, and related water resources development, three informational meetings were held on Guam in February 1972. For flood control and allied purposes, a formulation stage meeting was held on 17 July 1974, to afford local interests the opportunity to express their views and comments on possible alternative plans that could be considered for the Agana River basin. The alternatives were presented on a conceptual level, in terms of structural and nonstructural choices. During the meeting, the desire for flood protection for the lower Agana basin was expressed by local interests. Although it was generally agreed that structural measures such as channel improvements and levees would be required to solve the flood problem in the Agana River basin, interest in a multipurpose reservoir was also expressed. In general, no specific preferences for alternative measures were stated by the residents, but the Government of Guam did support alternatives which would be compatible with plans for development of recreational facilities in the Agana area.

9.2 Alternative plans were discussed in more detail at a 12 June 1975 meeting. Plan 3 was presented as the recommended plan, and no objections to the selected plan were presented. Other than minor clarifications or requests for information, the primary concern expressed related to the acquisition of the flowage easements and the means for enforcement of these easements to prevent encroachment. Both of these actions will be the responsibility of the Government of Guam as part of their local cooperation requirements.

B. Government Agencies.

9.3 The draft environmental statement was circulated to various government agencies for their review and comments in May 1975. Copies of the draft survey report were also distributed to concerned agencies for formal project review and to enable them to make more substantive comment on the draft ES. Comments received on the draft ES have been summarized, and copies of agency letters are attached as appendix C.

FEDERAL AGENCIES

(1) U.S. DEPARTMENT OF TRANSPORTATION, U.S. COAST GUARD

Comment: The Coast Guard has no objections to implementing the flood control improvements at this time. The recreation and navigation aspects of the project are of interest. Although boating in the lower Agana River is not a part of this project, future plans of this nature should be reviewed by the Coast Guard.

Response: The proposed plans for the lower river are strictly for flood control purposes and do not include plans for enhancement of boating. Future plans of this nature may be undertaken by the Government of Guam, and the need for Coast Guard review will be brought to its attention.

(2) U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF MINES

Comment: Mineral development would not be adversely affected by construction of the proposed project.

(3) U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OUTDOOR RECREATION

Comment: The Bureau is in accord with the determination that alternative plan 3 provides the best balance of physical, environmental, and socio-economic factors under the proposed project.

(4) U.S. DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

Comment: The Service is in general accord with the plan to provide flood protection within the Agana River area. It is suggested that the statement acknowledge the contribution of past and current developments to the flood problem.

Response: Paragraph 2.52 has been revised as suggested.

Comment: The discussion of the effects of concrete-lined channels should be expanded to include increases in the velocity of water. In addition, a statement as to whether greenbelt landscaping with adequate shade plantings to reduce water temperatures will be included in the project should be made.

Response: Paragraphs 4.5-4.9, as well as the PROJECT DESCRIPTION, have been revised accordingly.

Comment: The Service considers the impact of the project upon fish and wildlife resources as well as on the habitat of threatened and endangered wildlife to be significant and recommends that the statement recognize this.

Response: The discussion of environmental impacts has been revised to include the views of the Service.

Comment: The discussion of nonstructural alternatives should also indicate that these measures aid in the preservation and/or maintenance of the flood plain and generally benefit fish and wildlife resources.

Response: The discussion has been modified as suggested.

Comment: The Service concurs that alternative plan 2 is more desirable from a habitat preservation and fish and wildlife standpoint; it is a "better EQ plan."

Response: Alternative plan 2, as described in the comment, was determined to be the Environmental Quality Plan, whereas plan 3 was designated the National Economic Development Plan. Table 1 has been revised to clarify this.

Comment: The discussion of multipurpose reservoirs should recognize that the facilities would eliminate wildlife habitat and contribute to the further decline of threatened and endangered species.

Response: The discussion has been reworded as recommended.

(5) U.S. DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE

Comment: The proposed action will not affect any existing or proposed units of the National Park System or any existing, proposed, or known potential sites or properties listed or to be listed as National Landmarks. The statement appears to deal adequately with archeological and historical resources.

Comment: Specific measures to be taken in conjunction with this project to avoid compounding poor water quality conditions, as well as local government efforts to improve and protect Agana River for fish, wildlife, esthetic enjoyment, and recreation should be described.

Response: Measures developed to date are related to modifications of the channel works and levee system to maintain continuous low flows and to avoid ponding and stagnation. Other specific measures such as future low flow augmentation will be evaluated during post-authorization studies in conjunction with local interests. The Guam Environmental Protection Agency has not indicated any specific program efforts being taken at the local level to improve the river water quality. The agency's input to this study to date has been limited to provision of limited water quality testing data. Joint consideration of specific water quality measures that are also acceptable from the habitat preservation standpoint will be pursued during preconstruction studies.

Comment: The discussion of impacts on fish and other aquatic organisms should be expanded.

Response: The discussion in paragraph 4.5 has been expanded.

(6) U.S. DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY

Comment: The amount of material to be excavated for the channel as described in the project report does not appear to correspond with the 21,000 cubic yards mentioned in paragraph 4.15 of the environmental statement.

Response: Paragraph 4.15 has been revised to include the levee excavation material as well as the channel excavation.

(7) U.S. DEPARTMENT OF COMMERCE, NATIONAL MARINE FISHERIES SERVICE

Comment: The final environmental statement should specifically detail measures to be used to mitigate increased stream temperatures caused by concrete channelization. The construction of low flow channels, unlined or boulder-imbedded concrete lining, and greenbelt bankside shading were discussed as possible measures during early project coordination.

Response: The discussion of mitigating measures to be incorporated has been revised, and the PROJECT DESCRIPTION has been supplemented. In addition, plate 2 has been added to show the plan profile and typical sections, including a low-flow channel.

(8) U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Comment: The material provided appears to describe adequately the impacts of the proposed action as well as the alternatives presented. The review does not identify problems related to the specific concerns of the Department.

(9) U.S. PACIFIC FLEET, COMMANDER, U.S. NAVAL FORCES MARIANAS

Comment: No objection or criticism is submitted on the proposed plan.

(10) U.S. ADVISORY COUNCIL ON HISTORIC PRESERVATION

Comment: The Advisory Council notes that the Guam Historic Preservation Officer has concurred with the determination of no adverse effect to the Spanish Dikes by implementation of the proposed plan of improvement. However, the Council further notes that when the final selection of an alternative plan is made, consultation and evaluation of the effect upon the Spanish Dikes and/or other properties be reinitiated.

Response: As stated in the draft environmental statement and draft survey report, plan 3 is the tentatively selected, or recommended plan. Based upon the comments received during the coordination of these documents, there has been general concurrence that plan 3 is the best solution from the overall consideration of project planning objectives, and it will be recommended for authorization by Congress. Should the recommended plan change significantly during post-authorization studies, coordination with all agencies, including the Historic Preservation Officer and the Advisory Council will be reinitiated.

(11) U.S. ENVIRONMENTAL PROTECTION AGENCY

Comment: EPA has no major objections to the proposed action, but expresses concerns relating to water quality, ground water, and changes in condition of the swamp.

In view of the availability of water quality data from the Guam EPA, the data should be included to provide background information so that post-project conditions may be better assessed.

Response: Although the data is available, there are several limitations to the adequacy of the sampling program that are described in the environmental statement. The discussion in the statement is limited to a summary and analysis of what data is available. It is intended that additional sampling and analysis will be conducted during post-authorization studies. A copy of the available data will be provided to EPA in the interim.

Comment: EPA requests clarification of whether there will be a reduction in peak flows (post-project conditions) for 50-year or less flood events. If there is a higher discharge for these more frequent events, would there be a corresponding increase in sediment and debris transport to Agana Bay?

Response: For the 50-year flood event under existing conditions, the peak flood discharge is 14,600 cfs. With implementation of the project, the resulting outflow would be reduced 4,300 cfs. For a 10-year flood event, the peak discharge would be 9,500 cfs without the project and 3,000 cfs with the project. Under all conditions, the peak flows would decrease with the project implementation, and therefore, a corresponding decrease in sediment and debris transport could be expected.

Comment: EPA is interested in the expected range of temperature increases and the mitigation measures that will be incorporated to maintain water quality standards.

Response: As discussed in paragraph 4.5, the precise range of temperature increase cannot be determined at this time. The increase would be dependent upon the variable streamflow, the extent of tidal influence (high or low tide levels), the effectiveness of bankside landscaping, and the adequacy of the low flow channel design in consolidating the low flows. Studies of Hawaiian streams have shown that increases in excess of 1.5°F do occur in cases of shallow sheets of water passing over a wide concrete channel bottom. The provisions for inclusion of a low flow channel, bankside vegetation, and lack of interruption of the river flow have been recommended by fish and wildlife agencies as appropriate mitigation actions. Further coordination and investigation on this matter will be continued during detailed design studies.

Comment: Additional information on the expected quality of water to be discharged into the Agana River from the pumping plant should be included.

Response: The pumping plant is designed to pump storm water runoff that accumulates behind the levee. The water would be comparable to the storm water runoff within the leveed areas. The volume of water that might be pumped into the river under project conditions is negligible compared to the total volume of the standard project flood. No significant contribution to adverse water quality or quantity can be attributed to the pumpage.

Comment: The ground water characteristics, potential ground water changes, and effects on Agana Springs should be discussed in more detail.

Response: Paragraphs 4.10-4.12 have been expanded to discuss these matters. Since significant changes in groundwater resources are not expected from the project, effects on the springs or its water quality are also not anticipated. The spring waters would be more significantly affected by excessive pumping of existing wells rather than by the proposed project.

Comment: The feasibility of shifting the proposed levee further to the west so that a greater amount of the swamp may be preserved while still providing the necessary protection to existing developments should be addressed.

Response: Plan 2, the environmental quality plan, is presented as the alternative which maximizes the preservation of swampland. Plan 3 attempts to conform to the local government's desires to expand and maximize the recreational development in the affected area, the Agana Central Park. During detailed investigations, the feasibility of varying the levee alignment to a position between the two plans will be considered.

Comment: The possibility of adverse effects on the swamp due to reduction of tidal interchange should be discussed. Should low flow augmentation be incorporated, what will be the source of the water and would temperature increases be minimized?

Response: Based upon salinity measurements of water in the river-estuary, tidal influence is estimated to extend about 800 feet upstream from the mouth at high tide. The extent of influence does not extend into the swamp habitat area and is confined to the river-estuary vicinity of the river channel near its outlet. Therefore, reduction of tidal interchange should not affect the swamp. Low flow augmentation is a possible action that will be considered during detailed design. Its intent would be to insure continuous low flows from the upper reaches of the stream to the ocean, possibly by detention of river flows and controlled release during dry periods. The situation would be similar to a dam/reservoir project, but on a smaller scale. The feasibility of such a system needs further investigation. It is likely that such augmentation would further mitigate low flow temperature increases caused by concrete channelization.

GOVERNMENT OF GUAM AGENCIES

The Department of Public Works, Government of Guam, was asked to serve as a clearinghouse for comments made by Government of Guam agencies. The department was asked to compile and transmit local agency comments and to discuss and resolve any problems that arise regarding areas of local responsibility or jurisdiction.

(1) DEPARTMENT OF PUBLIC WORKS (COVERING LETTER FOR GOVERNMENT OF GUAM COMMENTS)

Comment: The department is in accord with the selection of plan 3 as the recommended plan. There appeared to be no dispute regarding this selection at the public meeting on 12 June 1975. The acquisition of flowage easements required for implementation of the project may be a critical item. Consideration of an alternative to extend channel improvements upstream in conjunction with a small dam and system of levees would increase the acreage of land in Agana suitable for future development.

Response: The problems of land acquisition are recognized. Since acquisition of all lands, easements, and rights-of-way for the project will be a responsibility of the Government of Guam, timely resolution of local problems will be necessary. The dam/reservoir schemes were considered as plans 4 and 5 and are discussed in detail in the Alternatives section.

(2) UNIVERSITY OF GUAM MARINE LABORATORY

Comment: The laboratory feels the recommended plan is a good one and has no objections to it. The Government of Guam must, however, provide assurance that the floodwater storage area within the proposed levees will be maintained so that no further encroachment on the swamp occurs in the future.

Response: As explained in paragraph 4.3, the Government of Guam will be required to enforce flowage easement requirements to assure that encroachment on the improved channel and on the required flowage easements would not be permitted.

(3) DEPARTMENT OF LAND MANAGEMENT

Comment: The department has no comment to offer.

(4) DEPARTMENT OF COMMERCE

A number of corrections and additional information have been provided by the department. The appropriate sections of the text of the environmental statement have been revised to incorporate most of the suggestions and recommendations.

Comment: The reference made to a Water Conservation Master Plan in paragraph 3.3 should be checked.

Response: The reference was incorrectly made and should have referred to the Public Utility Agency of Guam's Conservation Requirements for the Preservation of Guam Water Resources, 31 August 1970.

Comment: The plate showing the extent of the flood plain should be extended to the west, including topographic lines around the proposed levee near Mongmong School. What will happen to the water trapped behind this levee?

Response: Aerial coverage of the entire flood plain to the west is not available at this time, but detailed and complete aerial coverage of the entire flood plain will be obtained during the detailed design studies. Water should not accumulate behind the levees since structures will be provided within the levee design to drain water behind the levees into the flowage easement area.

Comment: A similar plate should be added to depict the 100-year flood plain after the proposed project is completed.

Response: Since the project is being designed for a flood of standard project flood magnitude (greater than 100-year flood), plates 1 and 7 which show the recommended plan and the conditions with the project, could also serve to show the results of a 100-year flood. As shown, the flood plain would be reduced to the area within the leveed flowage easements. For the 100-year flood, the areal coverage of the flood would be approximately the same, but the depth would be less.

Comment: Land ownership problems and the requirements and controls for the flowage easements should be described.

Response: Land ownership problems are recognized and discussed in paragraph 2.71. The flowage easements required are shown on plates 1 and 7. The enforcement requirements are described in paragraph 4.3. Since both the land acquisition and enforcement of flowage easement requirements are the responsibility of the Government of Guam and will be part of their local cooperation requirements, these problems will need to be resolved locally before the project can be implemented.

Comment: A plate showing the 20-year flood plain should be included.

Response: A 20-year flood plain map is not available, but plate 4 includes the 10-year, 100-year, and standard project flood limits.

Comment: The labelling and discussion of the alternative plans should be revised to minimize confusion.

Response: Paragraphs 6.23 through 6.48, as well as the tables and plates, have been revised to clarify plan designations. The proposed plan shown on plate 1 is the same as alternative plan 3 shown on plate 7, except that the plates are drawn at different scales. Reference to the highway and streets should help the reader to understand the relationship.

Comment: What is the relationship of the river flood protection provided to the tidal flooding which also causes extensive damages in the Agana area?

Response: The proposed flood control improvements are designed to provide a high degree of protection from overland flooding. While flooding from typhoon waves also occurs and would continue to threaten the shoreline area, damages of this nature are limited to washing/erosive type of damage rather than the longer inundation-type caused by overland flood flows. Consequently, the proposed works would reduce the total damages incurred during severe storms.

(5) GUAM ENVIRONMENTAL PROTECTION AGENCY

Since the agency's comments were directed to the Department of Public Works which was designated coordinator of comments on the environmental statement, a number of the comments made related to local problems and issues which need to be resolved by interagency cooperation and coordination on the territorial level. Requests for additional information and clarification of points have been incorporated into the appropriate sections of the statement. A summary of other specific comments and responses follows:

Comment: The department is interested in the procedures for recording minutes of public meetings held for this project and the availability of these minutes.

Response: Official record of all meetings held on civil works projects is taken. A record copy is kept in the official project file and copies of the meeting record accompany the survey report for review in the Office of the Chief of Engineers. Transcripts of the meeting are not distributed to attendees, but are available on request in the Office of the District Engineer. A summary of the major points raised during the 17 July 1974 and 12 June 1974 meetings are included in the environmental statement as well as in the project report. Specific questions can always be directed to the District Engineer for individual reply. All meetings are widely announced at least one month in advance to allow interested parties to prepare testimony for inclusion in the official record or to be present at the meeting to have specific questions answered.

Comment: A number of comments refer to the consideration of nonstructural regulatory-type solutions and the apparent lack of local enforcement of land use, zoning, and grading regulations. The Guam EPA did not favor any specific alternative plan, and objected to the selected plan based on its environmental and fiscal impacts.

Response: A thorough review of the Alternatives section should show that the full range of project alternatives were considered and should explain why

certain measures were found infeasible or undesirable. While this flood control study is being conducted by the Honolulu Engineer District, it is being done at the request of the Government of Guam and much of its implementation, both in fiscal and regulatory terms, will be the responsibility of the Government of Guam.

Comment: Establishment of a gaging station on the Agana River would serve to provide accurate data rather than "rough calculations."

Response: Information on the Agana River gaging station is provided in paragraph 2.21. Detailed hydrologic studies have been conducted based on other streamflow data available for the island, and the project hydrology is considered to be adequate for the present level of design detail. The reference to rough calculations is vague and unsubstantiated.

Comment: The discussion of the project's impacts on water quality appears to be minimized.

Response: Adverse effects during construction and thermal heating of the streamflows during low flow conditions are recognized. However, the overall effects are not expected to be serious. A discussion of these items is found in paragraphs 4.7 to 4.9. The Guam EPA will be asked during detailed design to reevaluate and substantiate concerns that Agana Bay will become "a dumping ground for heated water carrying excessive silt loads and heavy metals" or that the project would "create large dead areas and violate local and national water quality standards." Evaluation to date indicates that implementation of the project with mitigative measures included would not significantly change existing low or normal flow conditions and water quality impacts, and should improve conditions under flood flows.

Comment: How will the impacts on the designated source site for fill material be evaluated? Maintenance costs and responsibilities for the project should also be defined.

Response: Since the source site will be designated by the Government of Guam, its designation should be approved by all appropriate local agencies. As stated in paragraph 4.16, additional evaluation will be done during detailed design studies. Maintenance costs and responsibilities are defined in the PROJECT DESCRIPTION and in appendix A.

(6) PUBLIC UTILITY AGENCY OF GUAM

Comment: The agency is in support of the selected proposed plan since it would not have any effects upon groundwater levels and would assure conservation of the Agana swamp.

The environmental statement should include the traffic inconvenience that would result during relocation of utilities.

Response: The recommendation has been incorporated into the discussion of temporary construction period impacts, paragraph 5.5.

(7) GUAM STATE HISTORIC PRESERVATION OFFICER

Comment: The officer is in agreement with the evaluation of impact upon historic resources as described in the draft ES. The two alternatives which include reservoir construction should be considered unacceptable as they would permanently inundate the Spanish Dikes. The islandwide survey completed in the spring of 1974 included only major known historical sites and structures. A list of other known possible historic sites which are unsurveyed or are yet to be considered by the Historic Preservation Review Board was provided with the qualification that all of these sites are benefitted by the project rather than adversely affected. The officer agrees that no adverse impact upon historical, architectural, archaeological, or cultural resources will occur if the proposed plan is implemented.

Response: The list of additional unsurveyed sites has been added to paragraph 4.25. Any resources identified during construction will be recorded and subsequent studies conducted as determined necessary in coordination with the Guam Historic Preservation Officer.

9.4 The following agencies and organizations were sent copies of the draft environmental statement for review, but no comments have been received from them as of 1 August 1975.

Government of Guam

Department of Agriculture, Fish and Wildlife Division
Department of Health and Social Services
Bureau of Planning, Budget, and Management
Central Planning Agency

Guam Chamber of Commerce
Guam Science Teachers Association
Commissioner of Agana

9.5 The Revised Draft Environmental Statement and Interim Report on Flood Control, Agana River, Guam were circulated in June 1976 by the Office of the Chief of Engineers for review and comments. Copies of the documents were sent to the Government of Guam and to Federal agencies at the Washington (Departmental) level. Upon completion of the Departmental review, all letters and comments received on the documents were reviewed, and responses to the comments are included in the following paragraphs. All letters received during the Departmental review are included in Appendix D.

(1) DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Comment: The statement appears to adequately address the impacts of the proposed action as well as the alternatives presented.

(2) US ENVIRONMENTAL PROTECTION AGENCY

Comment: EPA's comments have been classified LO-2, lack of objections, additional information requested. EPA suggests that a discussion of the project's relationship with ongoing land use and water quality planning activities by the Government of Guam be included.

Response: The Revised Draft Statement and the Final Environmental Statement were prepared to accompany the Interim Report on Flood Control, a survey or feasibility level study. The relationship of the project to land use and water quality planning available during this stage of study is discussed throughout the Final Statement in paragraphs 2.55-2.58, 2.69-2.71, 3.1-3.5, 4.17-4.18, and in response to EPA's earlier comments on the Draft Environmental Statement. Current information on land use and water quality planning would require updating and reevaluation during post-authorization studies.

Comment: The project's compliance with local water quality and erosion/sediment control regulations should be discussed.

Response: The provisions of local water quality and erosion/sediment control regulations will be included in the plans and specifications for the project which would be developed during post-authorization studies. Construction of the project would be subject to compliance with these regulations. Where specific regulations cannot be met during certain phases of construction, mitigative or protective measures will be included to minimize adverse effects.

Comment: The impacts of the project on groundwater quality in the swamp area and the impacts of siltation as a result of ponding should be given.

Response: The discussion in paragraphs 4.10 to 4.12 apply to both impacts on the groundwater quality and quantity. The groundwater sources from which potable drinking waters supplies are obtained are known to be at higher elevations than the swamp, and effects to the drinking water supply are not expected. Furthermore, due to the high permeability of the limestone in the Agana River basin, the project would have very little effect on groundwater resources. For low frequency storms, the increased ponding period in the swamp may result in a slightly greater recharge, but even under maximum ponding conditions, the ponding time would be only about six

hours, and therefore, no significant changes to the existing groundwater characteristics, quality or quantity, are expected to result from the project. Similarly, the amount of siltation during ponding should not vary from existing conditions. The swamp area currently serves as a natural ponding basin during high flows and would continue to do so under project conditions.

Comment: The effects of erosion in the borrow area on water quality and the impacts of the fill material on the wetland area should be addressed.

Response: As discussed in paragraph 4.16, the source of the fill material for levee construction will be designated during post-authorization studies. Since the sources will be designated by the Government of Guam, compliance with local water quality and erosion/sediment control regulations will be applicable in the determination of the source site. As suggested, the fill material will be evaluated for suitability and compatibility with placement within a wetland area.

(3) DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Comment: HUD concurs with the flood control plan which will mitigate overland flood damages and permit enhancement of the existing urban area.

(4) DEPARTMENT OF THE INTERIOR

Comment: A rendering or photo of the beautification/landscaping plans should be included.

Response: At this stage of planning, only a general discussion of aesthetic treatment of channel walls, bankside landscaping (grassing, shrubs, trees), and use of spoil material to create overbuilt areas along the levees was intended. A beautification plan with specific landscaping details will be developed during the post-authorization studies.

Comment: It is recommended that a statement noting that Agana Swamp is the last remaining major wetland habitat on Guam be added.

Response: The statement has been added to paragraph 2.2 of the Final Environmental Statement.

Comment: Information on the frequency and magnitude of storm-generated tides should also be provided and related effects on flooding of the project area should be assessed.

Response: Storm surges have been accounted for in the hydraulic design of the flood control measures. The channel in the tidal reach was designed to convey the discharge coincident with the highest tide observed at 2.0 feet MSL.

Comment: The text should recognize that a total of 35 acres of wetland would be affected by the proposed project.

Response: In a broad sense, 35 acres of land will be affected; however, throughout the statement, an attempt has been made to assign some value or significance to each of the categories of wetlands that would be affected. All alterations have been disclosed, and it is believed that it

is more realistic to specifically identify the types of wetlands being affected: About two acres of riverbed and riverbank land will be lost to channelization; 12.5 acres would be covered by the construction of levees; 20 acres of swampland which are now undeveloped would be protected from flooding and would be suitable for development as planned by the local government for recreation uses. The 20-acre future development area lies north of the Powerline Access Road on the fringes of the swamp where man's activities have most seriously disturbed the swamp. Therefore, while a total of about 35 acres of wetlands would be affected by the project, the specific descriptions provided in the statement help to evaluate the losses in perspective. As the statement points out, the project would also result in the permanent commitment and preservation of 360 acres of swampland.

Comment: On page 29, paragraph 5.4, it is suggested that the word "vacant" be changed to "undeveloped".

Response: The change has been made as suggested.

Comment: It is recommended that a field survey for species verification be made to more positively address the presence or absence of threatened and endangered bird species in the swamp.

Response: Although specific surveys were not performed for this project, the report has relied on information provided by Guam Fish and Wildlife and the US Fish and Wildlife Service. It has been assumed that endangered bird species may be present in the swamp area and, therefore, improvements were confined to the downstream portions of the swamp that have been most disturbed by man's activities. Specifically, all of the improvements lie north of the Powerline Access Road, and the great portion of the swamp (360 acres) which is to the south of the road would not be altered. Detailed surveys of endangered species will be conducted during post-authorization studies.

(5) DEPARTMENT OF TRANSPORTATION

Comment: DOT has no objection to the project, but suggests that a discussion of the secondary effect of increased traffic on the existing and planned highway and street system be included.

Response: At this stage of planning, the statement has recognized temporary construction-period traffic increases, but has not included a discussion of secondary project-induced traffic increases. While traffic increases are likely to accompany future recreation and commercial development, the status of the recreation plans in particular is conceptual, and detailed estimates of traffic increases cannot be made at this time. The development would be implemented by the Government of Guam at an undetermined time in the future, and as mentioned in paragraph 3.5 of the statement, the uses of Agana basin are being reevaluated by the local government and may change the types and extent of development. As the plans become available during post-authorization studies, the cumulative effect of various types of development will be better assessed.

(6) DEPARTMENT OF AGRICULTURE

Comment: The Department finds no conflicts with any of its ongoing or planned programs or projects. It would strengthen the statement if project-associated impacts on agricultural land were more clearly defined.

Response: The proposed project would only affect lands currently designated for urban and conservation uses. No lands in agricultural production or planned for agricultural production would be affected by the project, which is confined to the downstream reaches of Agana River and to the Agana Swamp. The future land uses of the Agana basin as a whole are shown on Plate 5, Estimated 1985 Land Use. Urban development proposed for the swamp area would not be displacing cultivated or agriculturally suitable lands. The amount of urban development that may take place upon agricultural lands elsewhere in the Agana basin would be subject to local government planning restrictions and pressures regardless of whether the Agana Swamp is committed to undeveloped open space or not. As can be seen from Plate 5, urban development was envisioned only for the northernmost portions of the swamp, and not for the entire swamp area.

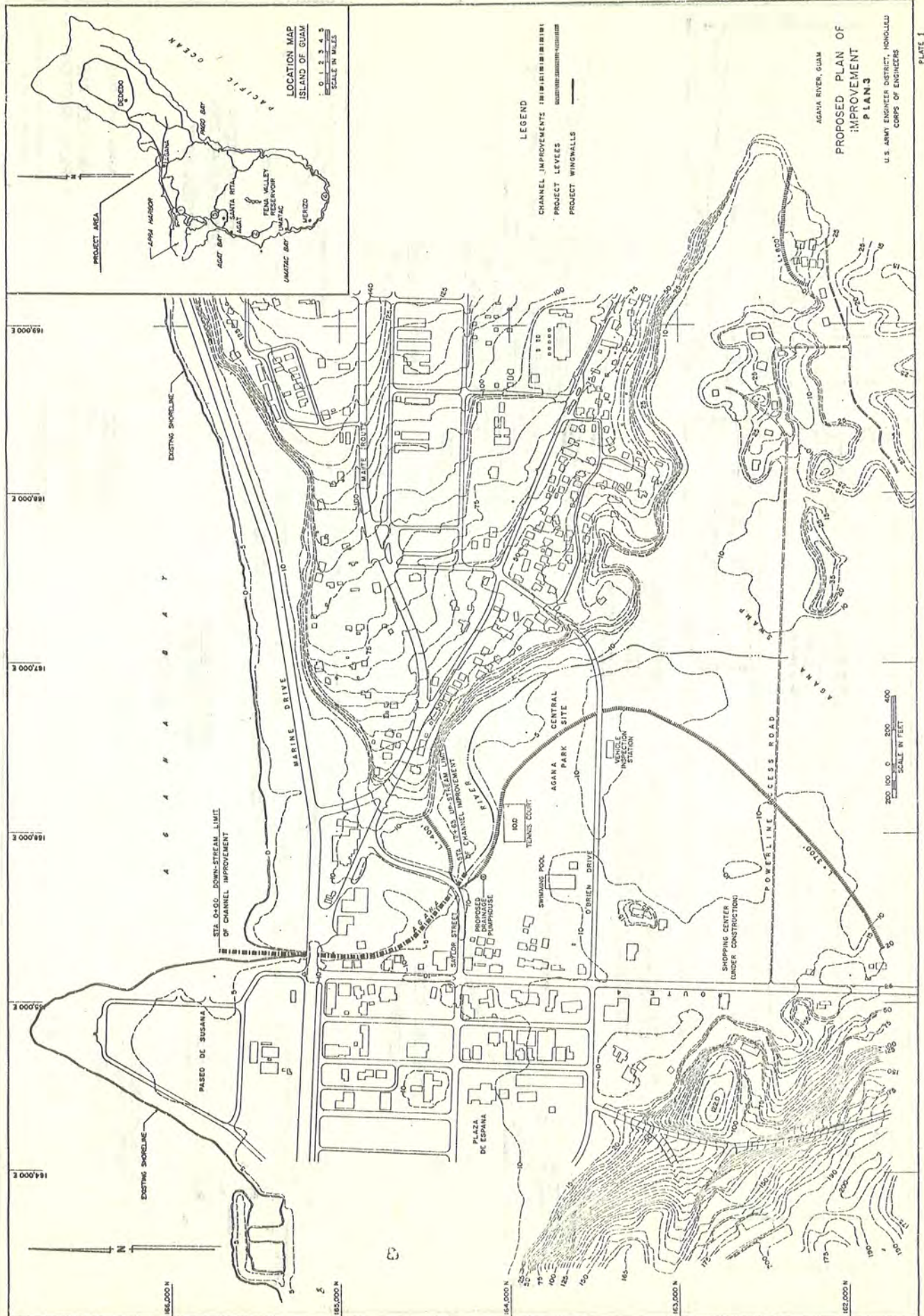
Comment: (Additional comments on the derivation of benefits which is covered in the Interim Project Report, but not in the environmental statement, were answered by direct response to the Department).

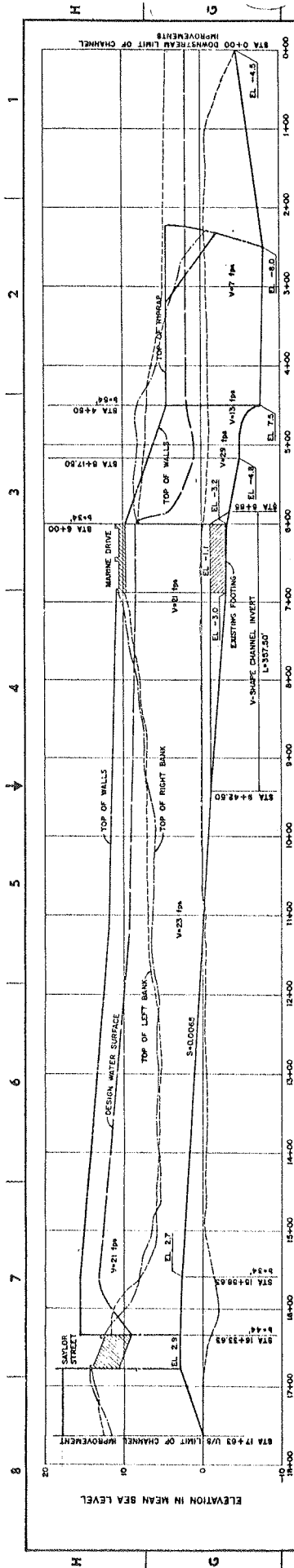
(7) DEPARTMENT OF COMMERCE

Comment: The Department has no new substantive comments to raise. Concerns of the National Marine Fisheries Service with regard to the mitigation measures were included in earlier reviews of the documents.

(8) GOVERNMENT OF GUAM, OFFICE OF THE GOVERNOR

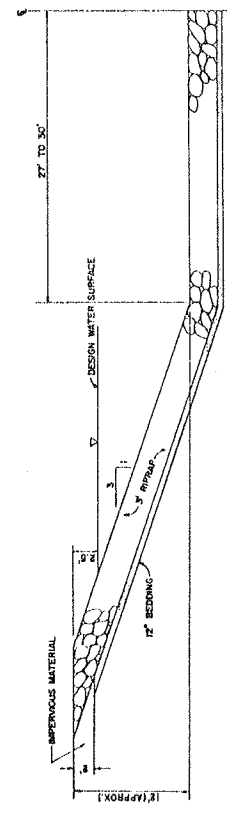
Comment: The alternatives of flood control through structural and non-structural measures are endorsed, and the project should be carried on to the next stage of study.





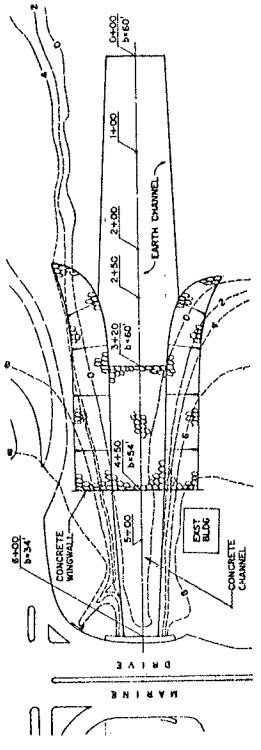
CHANNEL PROFILE

1. TRANSVERSE ASPECT ALONG OF ABOUT 45° WILL BE PROVIDED AND WALL ELEVATIONS WILL BE ADJUSTED DURING THE DETAILED DESIGN STAGE TO REFLECT SUPERELEVATION ALONG ALL CURVED CHANNEL REACHES
2. CHANNEL ABOVE MLLW (-1.4 MSL) WILL BE PROVIDED WITH A LOW FLOW CHANNEL FOR FISH MIGRATION. SEE TYPICAL SECTION BELOW



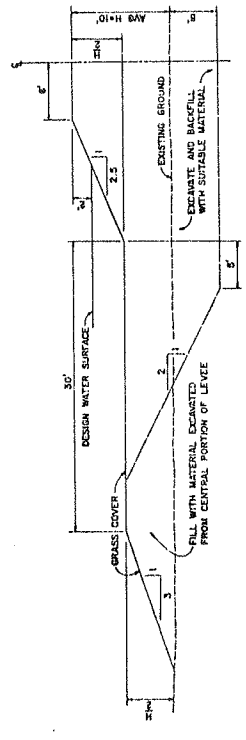
TYPICAL HALF-SECTION CONCRETE CHANNEL

SCALE IN FEET



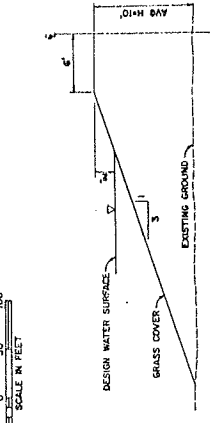
PLAN - OUTLET CHANNEL

SCALE IN FEET



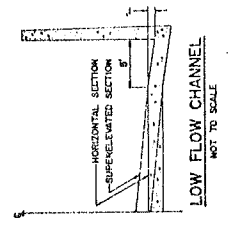
TYPICAL HALF-SECTION LEVEE (SWAMP AREA)

SCALE IN FEET



TYPICAL HALF-SECTION LEVEE (NON SWAMP AREA)

SCALE IN FEET



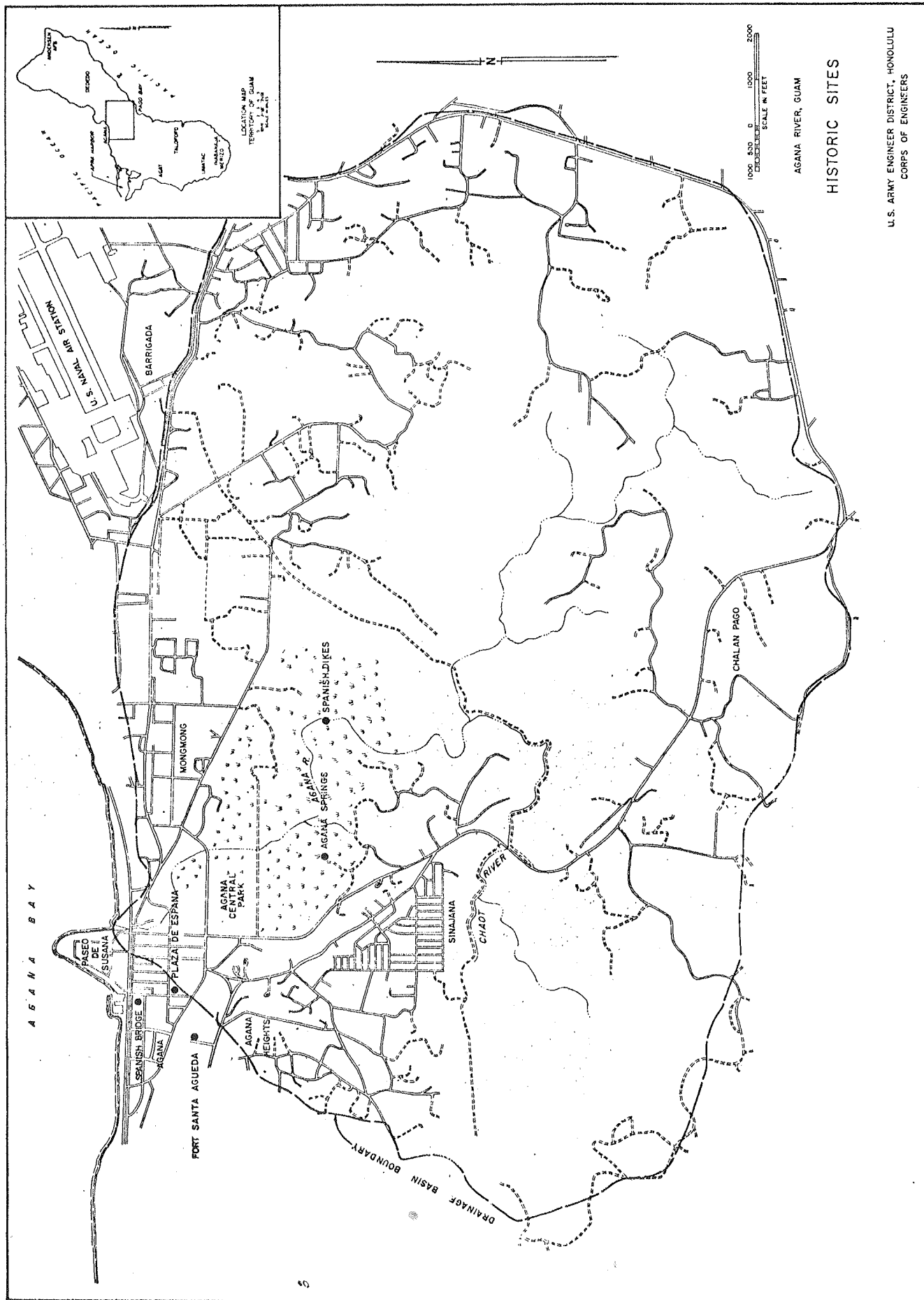
LOW FLOW CHANNEL

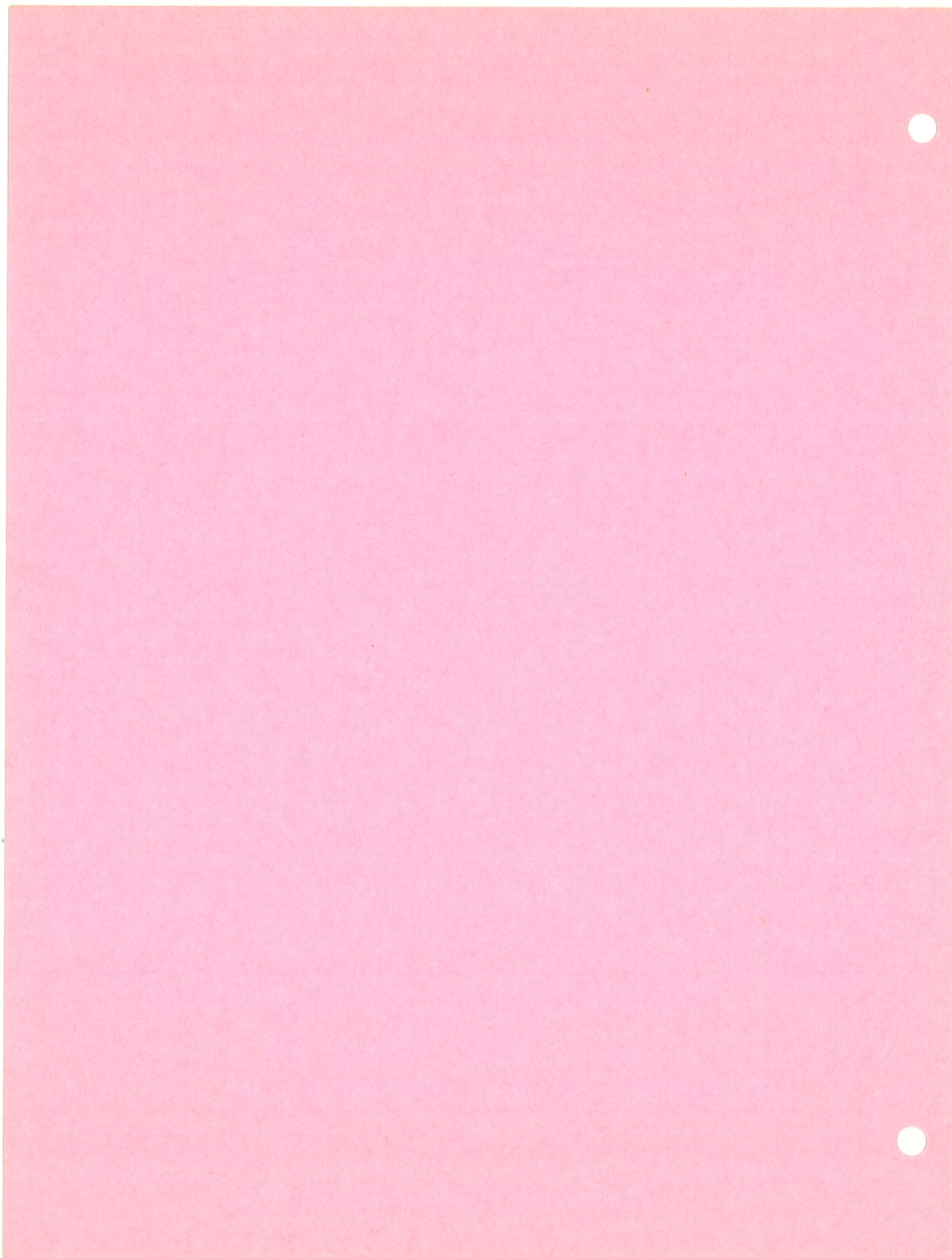
NOT TO SCALE

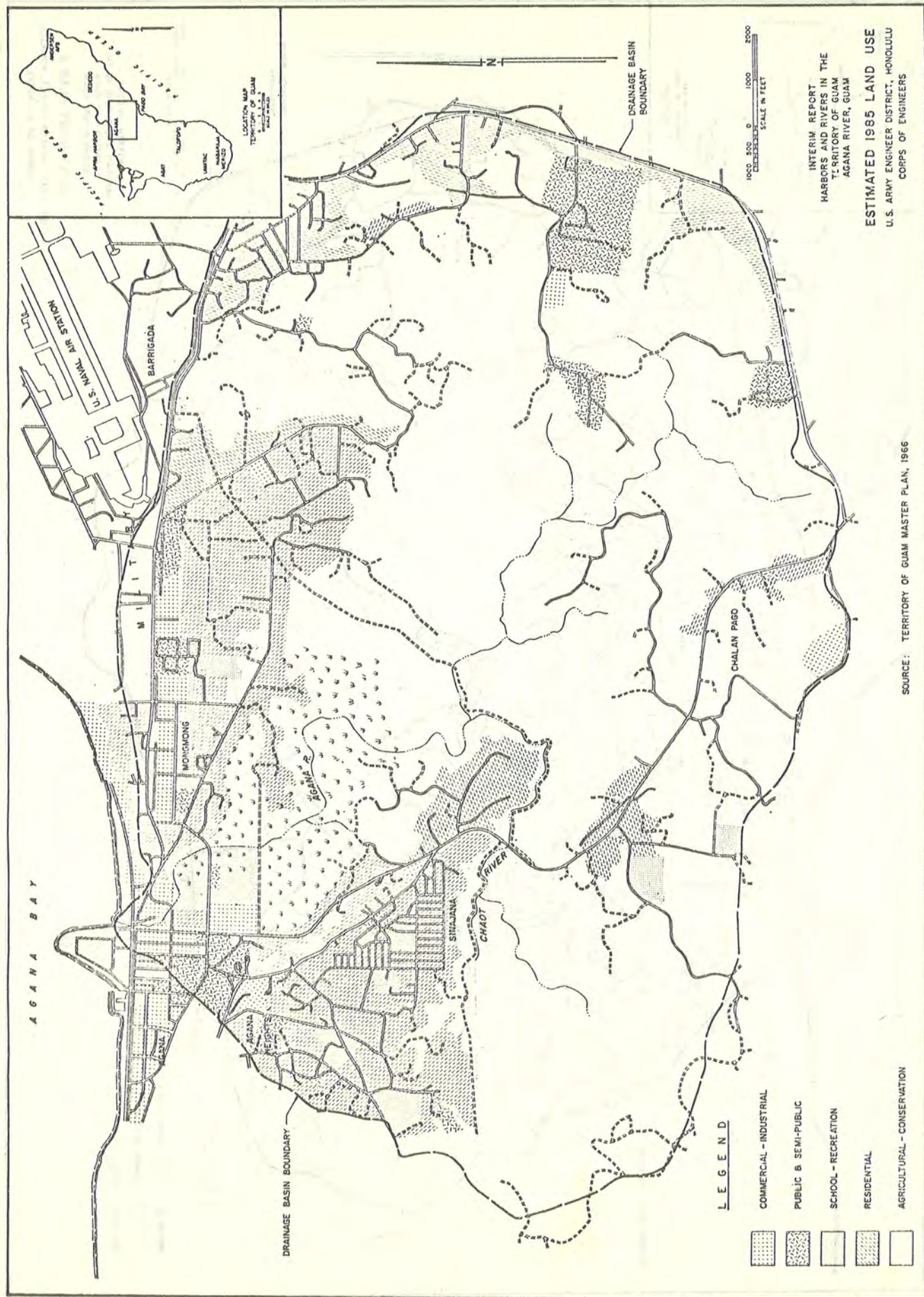
TYPICAL HALF-SECTION CONCRETE CHANNEL

SCALE IN FEET

ASANA RIVER, GUAM
 PROFILES AND
 TYPICAL SECTIONS
 U.S. ARMY ENGINEER DISTRICT, HONOLULU
 CORPS OF ENGINEERS



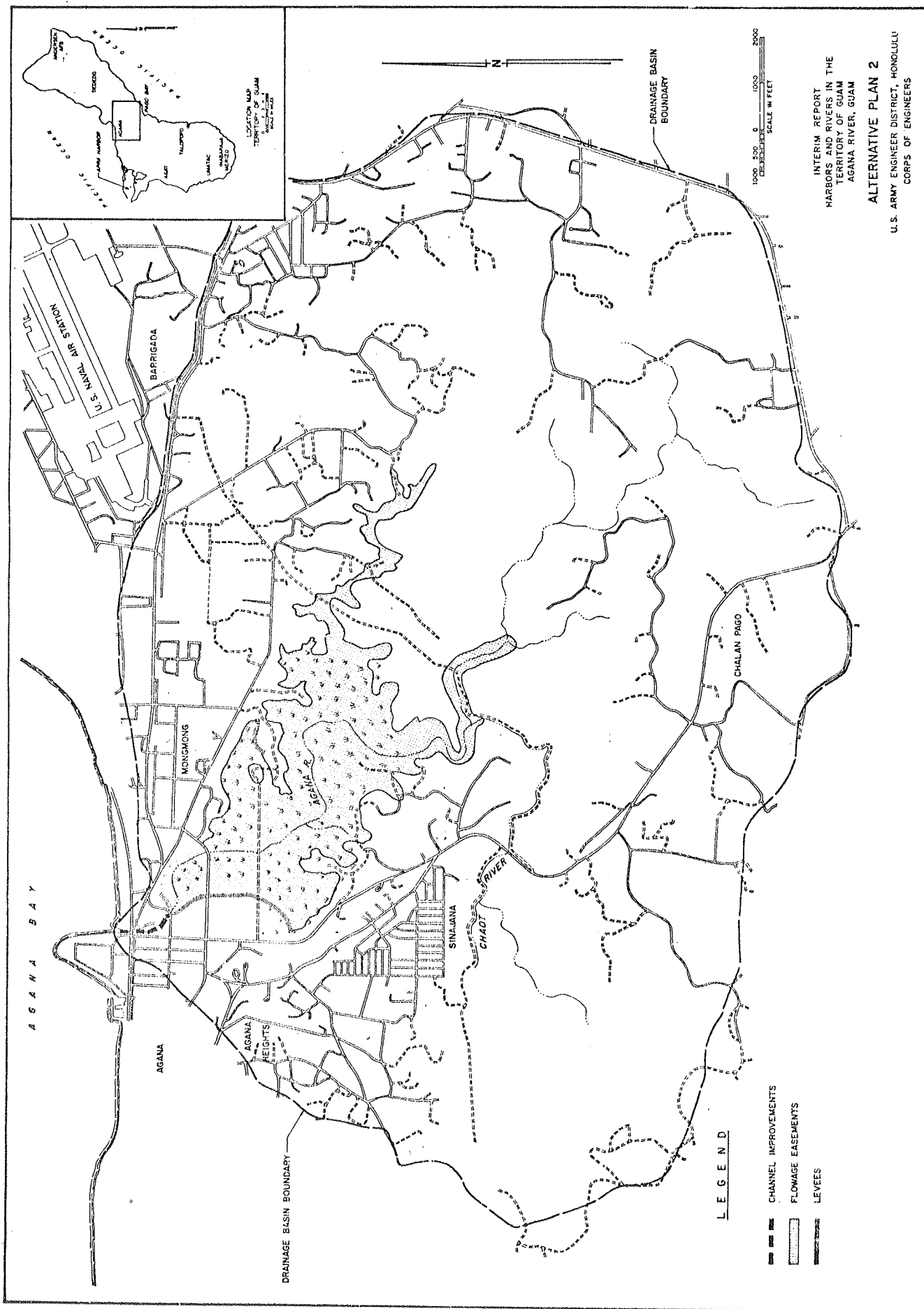


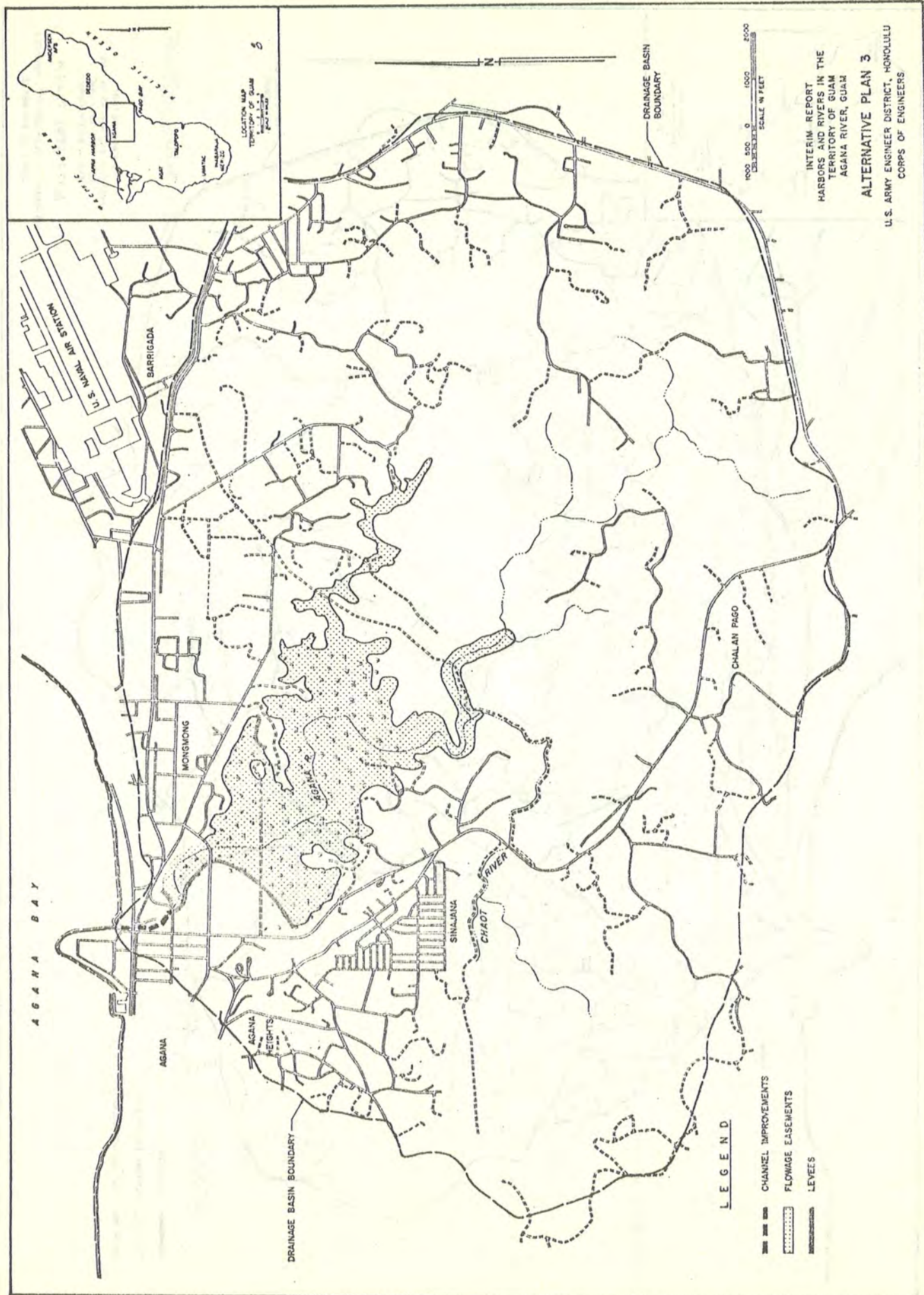


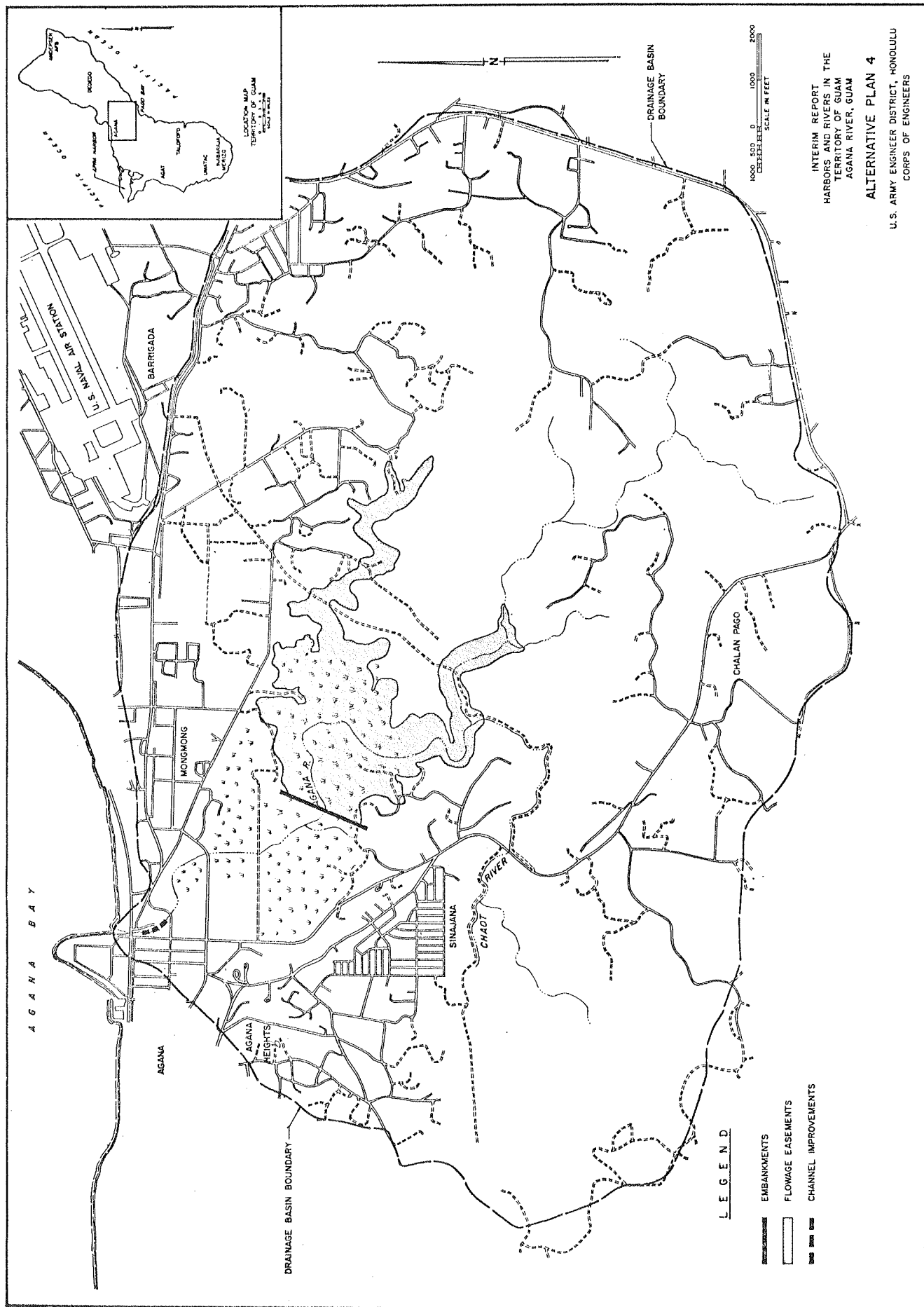
SOURCE: TERRITORY OF GUAM MASTER PLAN, 1966

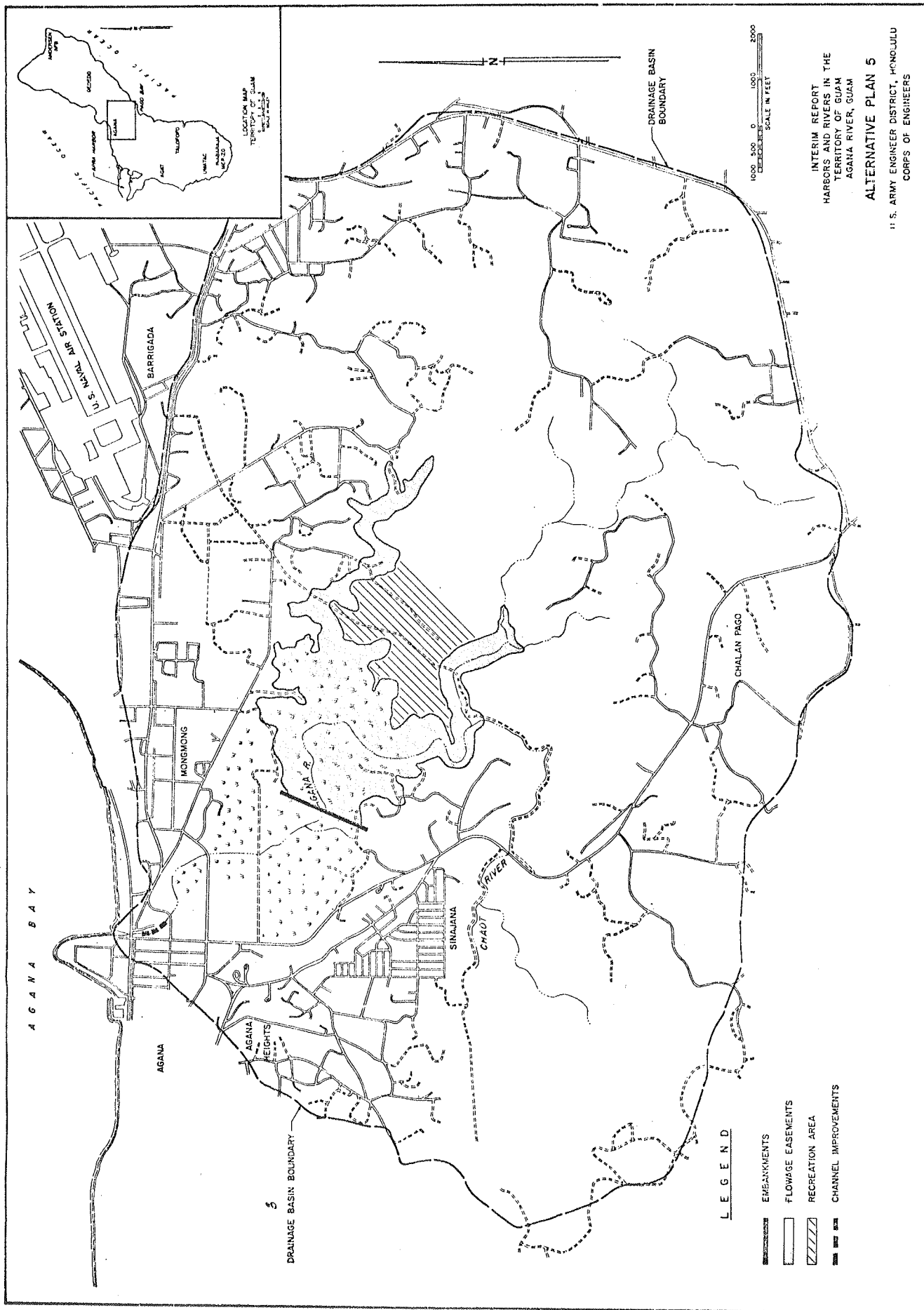
INTERIM REPORT
HARBORS AND RIVERS IN THE
TERRITORY OF GUAM
AGAÑA RIVER, GUAM

ESTIMATED 1985 LAND USE
U.S. ARMY ENGINEER DISTRICT, HONOLULU
CORPS OF ENGINEERS









APPENDIX A

SUMMARY OF BENEFITS AND COSTS

The total project first cost is estimated to be \$4,930,000, of which \$2,855,000 will be borne by the Federal Government. The remaining \$2,075,000 will be borne by the Government of Guam.

The analysis of benefits and costs is based upon a comparison of the equivalent average annual charges (i.e., interest, amortization, operation and maintenance cost) with the equivalent average annual benefits anticipated to accrue over the 50-year life of the project. The value given to benefits and costs at their time of accrual was made comparable by converting them to an equivalent time basis using an interest rate of 5-7/8 percent. The following summarizes the average annual benefits and costs from which the benefit-cost ratio of 1.7 was derived. The fiscal analysis does not include intangible environmental costs, either beneficial or adverse. These environmental impacts, such as fish and wildlife losses and visual impacts, are discussed in the text of this statement and are not quantified in terms of dollar costs.

The following is extracted from the Interim Report on Flood Control, Agana River, Guam. The complete document is available at the US Army Engineer District, Honolulu, Building 230, Ft. Shafter, APO San Francisco 96558.

Summary of Benefit-Cost Analysis

Federal First Cost	\$2,855,000
Non-Federal First Cost	<u>2,075,000</u>
Total Project First Cost	\$4,930,000

TOTAL AVERAGE ANNUAL COST ^{1/}	\$327,000
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*Average Annual Benefits

Flood control	
Inundation reduction	
Residential	\$92,000
Commercial	252,000
Public property	93,000
Emergency	4,000
Location	47,000
Affluence factor (existing only)	31,000
Area redevelopment	33,000
Future damage prevention	<u>-</u>
TOTAL AVERAGE ANNUAL BENEFITS	\$552,000
Benefit to Cost Ratio	1.7

^{1/}Includes \$20,000 for average annual maintenance.

* Revised 2 February 1976.

APPENDIX B

FLORA AND FAUNA OF THE AGANA-CHAOT RIVER BASIN

Randall and Tsuda, Field Ecological Survey of the
Agana-Chaot River Basin, July 1974

APPENDIX B

FLORA AND FAUNA OF THE AGAMA-CROCI RIVER BASIN

Radde and Fendler, Field Ecological Survey of the
Agama-Croci River Basin, July 1914

APPENDIX B

FLORA OF THE AGANA-CHAOT RIVER BASIN

Species	Life Form ¹	Status ²	BIOTOPES			DISSECTED HILLY LAND		RIVER
			WET LAND			A	B	ESTUARY
			A	B	C	A	B	
DIVISION CYANOPHYTA								
Nostocaceae								
<u>Anabaena</u> sp.		N			X			
Oscillatoriaceae								
<u>Schizothrix calcicola</u> (Ag.) Gomont		N			X			X
<u>Microcoleus lyngbyaceus</u> (Kutz) Crovan		N						X
DIVISION CHLOROPHYTA								
Boodleanaceae								
<u>Boodlea composita</u> (Harv.) Brand		N						X
Codiaceae								
<u>Avrainvillea obscura</u> J. Ag.		N						X
Dasycladaceae								
<u>Neomeris annulata</u> Dickie		N						X
Desmidiaceae					X			
Microsporaceae								
<u>Microspora</u> sp.		N			X			
Oedogoniaceae								
<u>Oedogonium</u> sp.		N			X			
Ulvaceae								
<u>Enteromorpha compressa</u> (L.) Grev.		N						X

Species	Life Form	Status	BIOTOPES			DISSECTED HILLY LAND		RIVER ESTUARY	
			WET LAND			A	B		
			A	B	C				
DIVISION PHAEOPHYTA									
Dictyotaceae									
<u>Padina tenuis</u> Dory		N						X	
Ectocarpaceae									
<u>Feldmannia indica</u> (Sonder) Womersley & Bailey		N						X	
DIVISION RHODOPHYTA									
Ceramiales									
<u>Centroceras clavulatum</u> (C. Ag.) Montagne		N						X	
DIVISION PTERIDOPHYTA									
Aspidiaceae									
<u>Heterogonium pinnatum</u> (Copel.) Holttum	H	N		X		X	X		
Devalliaceae									
<u>Davallia solida</u> (Forster fil.) Swartz	E	N				X	X		
<u>Nephrolepis hirsutula</u> (Forster)									
Hymenophyllaceae									
<u>Cephalomanes boryana</u> (Kunze) van den Bosch				X					
Parkeriaceae									
<u>Ceratopteris thalictroides</u> (L.) Brongniart					X				
Polypodiaceae									
<u>Pyrrosia adhaesens</u> (Swartz) Ching	E	N				X	X		
Pteridaceae									
<u>Acrostichum aureum</u> L.	H	N		X					

Species	Life Form	Status	BIOTOPES			DISSECTED HILLY LAND		RIVER ESTUARY
			WET A	LAND B	C	A	B	
DIVISION ANTHOPHYTA								
Dicotyledon								
Acanthaceae								
<u>Beloperone guttatus</u> Brandegee	S	I				X		
Annonaceae								
<u>Annona muricata</u> L.	T	I				X		
<u>"Jaguana"</u>								
<u>Annona reticulata</u> L.	T	I ^N				X	X	
<u>"annonas"</u>								
<u>Annona squamosa</u> L.	T	I ^N				X	X	
<u>"atis"</u>								
<u>Cananga odorata</u> (Lam.) Hook.	T	I ^N				X	X	
<u>"ilang-ilang"</u>								
Cariacaceae								
<u>Carica papaya</u> L.	T	I ^N				X	X	
<u>"papaya"</u>								
Compositae								
<u>Bidens pilosa</u> L.	H	I ^N				X	X	
<u>Mikania scandens</u> (L.) Willd.	V	I ^N	X	X				
Cucurbiaceae								
<u>Momordica charantia</u> L.	V	I ^N				X	X	
<u>"almogosa"</u>								
Euphorbiaceae								
<u>Melanolepis multiglandulosa</u> (Reinwardt)	T	N				X	X	
Reichb. <u>"alom"</u>								
Labiatae								
<u>Hyptis</u> sp.	H	I		X				
<u>Mentha arvensis</u> L.	H	I				X	X	
<u>"yerba buena"</u>								

Species	Life Form	Status	BIOTOPES			DISSECTED HILLY LAND		RIVER ESTUARY
			WET LAND	A	B	C	A	
Leguminosae								
<i>Abrus precatorius</i> L. "kolales halomtano"	V	IN					X	X
<i>Adenanthera pavonina</i> L.	T	I					X	
<i>Cassia alata</i> L. "ake-biha"	T	IN					X	
<i>Desmanthus virgatus</i> (L.) Willd.	S	IN					X	X
<i>Dolichos lablab</i> L. "cheribilla apaka"	V	I					X	X
<i>Intsia bijuga</i> (Colebr.) O. Kuntze "ifil"	T	IN					X	X
<i>Leucaena leucocephala</i> (Lam.) DeWit	T	IN					X	X
<i>Mogonia strobilifera</i> (L.) R. Br.	S	IN					X	X
<i>Mucuna gigantea</i> (Willd.) DC.	V	N					X	
<i>Peltophorum pterocarpum</i> (DC.) Backer	T	IN					X	X
<i>Pithecellobium dulce</i> (Roxb.) Benth	T	I					X	
"kamachile"								
<i>Samanea saman</i> (Jacquin) Merrill "monkeypod"	T	IN					X	X
Malpighiaceae								
<i>Malpighia coccigera</i> L.	S	I					X	
Malvaceae								
<i>Abelmoschus moschatus</i> (L.) Medicus	H	I			X			
<i>Hibiscus tiliaceus</i> L. "pago"	T	N			X		X	X
<i>Malvastrum coromandelianum</i> (L.) Garcke	S	IN					X	X
Moraceae								
<i>Artocarpus incisus</i> (Thunb.) L.f. "lemae"	T	I					X	X
Myrtaceae								
<i>Psidium guajava</i> L. "abus"	T	I					X	
Oxalidaceae								
<i>Averrhoa bilimbi</i> L. "bilimbi"	T	I					X	
Passifloraceae								
<i>Passiflora foetida</i> L.	V	IN					X	X
Piperaceae								
<i>Piper guahamense</i> DC. "pupulu-n-aniti"	S	N					X	X

Species	Life Form	Status	BIOTOPES			DISSECTED HILLY LAND		RIVER ESTUARY
			WET LAND	A	B	C	A	
Polygonaceae								
<u>Antigonon leptopus</u> Hooker & Arnott	V	I					X	
Rubiaceae								
<u>Morinda citrifolia</u> L. "lada"	T	N					X	X
Rutaceae								
<u>Triphasia trifolia</u> (Burm. f.) P. Wils. "lemon-china"	T	IN					X	X
Solanaceae								
<u>Cestrum diurnum</u> L. "tinta'n-china"	S	IN					X	X
Tiliaceae								
<u>Muntingia calabura</u> L. "manzanilla"	T	IN			X		X	
Verbenaceae								
<u>Lantana camara</u> L. "lantana"	S	I					X	X
<u>Stachytarpheta indica</u> (L.) Vahl	H	IN					X	X
<u>Vitex parviflora</u> Jussieu	T	IN					X	X
Monocotyledon								
Araceae								
<u>Alocasia macrorrhiza</u> (L.) Schott "papao-atolong"	H	I			X		X	X
<u>Colocasia esculentia</u> (L.) Schott "sun"	H	I			X		X	X
<u>Pistia stratiotes</u> L.	H	I				X		
Ceratophyllaceae								
<u>Ceratophyllum demersum</u> L.	H	N				X		
Cyperaceae								
<u>Cyperus</u> spp. (various species)	H				X		X	X
Gramineae								
<u>Bambusa blumeana</u> Schultes "piao lahe"	T	I					X	X

Species	Life Form	Status	BIOTOPES					
			WET A	LAND B	C	DISSECTED HILLY A	LAND B	RIVER ESTUARY
<u>Bambusa vulgaris</u> Schroder "piao paluan"	T	I				X	X	
<u>Cenchrus echinatus</u> L.	H	I ^N				X	X	
<u>Digitaria</u> sp.	H	I ^N				X	X	
<u>Eragrostis pilosa</u> (L.) Beauvois	H	I ^N		X				
<u>Panicum maximum</u> Jacquin	H	I ^N				X	X	
<u>Paspalum</u> sp.	H	I ^N				X	X	
<u>Phragmites karka</u> (Retz.) Trin.	H	N		X	X			
<u>Saccharum spontaneum</u> L.	H	I ^N			X			
<u>Setaria pallide-fusca</u> (Schumacher) Stapf & C. E. Hubbard	H	I ^N				X	X	
Hydrocharitaceae								
<u>Hydrilla verticillata</u> (L.f.) Royle	H	N			X			
Orchidaceae								
<u>Spathoglottis plicata</u> Blume	H	T				X		
<u>Taeniophyllum mariannense</u> Schlechter	E	N				X	X	
Palmae								
<u>Cocos nucifera</u> L.	T	I ^N		X		X	X	
<u>Heliconia elata</u> Scheffer	T	N				X	X	
Pandanaceae								
<u>Pandanus fragrans</u> Gaud. "kafu"	T	N				X	X	
Pontederiaceae								
<u>Eichhornia crassipes</u> (Mart. & Zucc.)	H	I	X		X			

1 Life Form - herb (H), vine (V), epiphyte (E), shrub (S), tree (T).

2 Status - endemic (E), native (N), introduced (I), introduced and naturalized (I^N).

APPENDIX-B

FAUNA OF THE AGANA-CHAOT RIVER BASIN

Species	BIOTOPES		
	I Wet Land	II Dissected Hilly Land	III River Estuary
PHYLUM PROTOZOA			
Vorticellidae			
<u>Vorticella</u> sp.	X		
PHYLUM ARTHROPODA			
Class Crustacea			
Atyidae			
<u>Caridinides wilkinsi</u> Calman			X
Grapsidae			
<u>Sesarma</u> sp.			X
<u>Varuna laterata</u> (Fabr.)			X
Paguridae			
<u>Clibanarius</u> sp. 1 "hermit crabs"			X
<u>Clibanarius</u> sp. 2 "hermit crabs"			X
Palaemonidae			
<u>Macrobrachium lar</u> (Fabricius)	X		
<u>Palaemon</u> sp.			X
Portunidae			
<u>Lupocyclus sexspinosus</u> Leene			X
PHYLUM MOLLUSCA			
Class Gastropoda			
Achatinidae			
<u>Achatina fulica</u> Bowdich		X	
Cerithiidae			
<u>Cerithium nodulosus</u> (Drugulere)			X

Species	BIOTOPES		
	I Wet Land	II Dissected Hilly Land	III River Estuary
Cypraeidae			
<u>Cypraea moneta</u> (Schluder)			X
Muricidae			
<u>Morula granulata</u> (Duclos)			X
Neritidae			
<u>Nerita plicata</u> L.			X
<u>Quoyia decollata</u> (Quoy & Gaimard)			X
<u>Septaria porcellana</u> (Linnaeus)	X		
Strombidae			
<u>Strombus mutabilis</u> (Swainson)			X
Class Pelecypoda			
Cardiidae			
<u>Fulvia</u> sp.			X
Veneridae			
PHYLUM ECHINODERMATA			
Class Echinoidea			
Toxopneustidae			
<u>Triopneustes gratilla</u> (Linnaeus)			X
Class Holothuroidea			
Holothuriidae			
<u>Bohadschia marmorata</u> (Jaeger)			X

Species	BIOTOPES		
	I Wet Land	II Dissected Hilly Land	III River Estuary
PHYLUM CHORDATA			
Class Osteichthyes			
Anguillidae			
<u>Anguilla bicolor</u> McClelland	X		
<u>Anguilla marmorata</u> Quoy & Gaimard	X		
Apogonidae			
<u>Apogon</u> sp. 1			X
<u>Apogon</u> sp. 2			X
Balistidae			
<u>Rhinecanthus aculeatus</u> Linnaeus			X
Chaetodontidae			
<u>Chaetodon lunula</u> (Lacepede)			
Cichlidae			
<u>Tilapia mosambica</u> (Peters)	X		X
<u>Tilapia zillii</u> (Gervais)	X		
Clariidae			
<u>Clarias batrachus</u> (Linnaeus)	X		
Cyprinidae			
<u>Cyprinus carpio</u> Linnaeus	X		
Eleotridae			
<u>Eleotris fuscus</u> (Schneider)	X		
Gobiidae			
<u>Chonophorus guamensis</u> (Valenciennes)	X		X
<u>Periophthalmus koelreuteri</u> (Pallas)			
<u>Stiphodon elegans</u> (Steindachner)	X		
Labridae			
Mugilidae			
<u>Mugil</u> sp.			X

Species	BIOTOPES		
	I Wet Land	II Dissected Hilly Land	III River Estuary
Mullidae			
<u>Mulloidichthys samoensis</u> (Gunther)			X
<u>Parupeneus barberinus</u> (Lacepede)			X
Muraenidae			
<u>Uropterygius micropterus</u> (Bleeker)			X
Poeciliidae			
<u>Gambusia affinis</u> (Baird & Girard)	X		
<u>Poecilia reticulatus</u> (Peters)	X		
Pomacentridae			
<u>Abudefduf</u> sp.			X
Scorpaenidae			X
Synodontidae			
<u>Saurida gracilis</u> (Quoy & Gaimard)			X
Tetradontidae			
<u>Arothron hispidus</u> (Lacepede)			X
<u>Arothron meleagris</u> Bloch & Schneider			X
Class Amphibia			
Bufonidae			
<u>Bufo marinus</u> (Linnaeus)	X	X	
Class Reptilia			
Colubridae			
<u>Boiga irregularis</u> Merrem		X	

Species	BIOTOPES		
	I Wet Land	II Dissected Hilly Land	III River Estuary
Iguanidae			
<u>Anolis carolinensis</u> Voigt		X	
Scincidae			
<u>Emoia callisticta wernerii</u> (Voigt)		X	
Typhlopidae			
<u>Typhlops braminus</u> (Daudin)		X	
Testudinidae			
<u>Pseudemys scripta</u> (Schoepff)	X		
Varanidae			
<u>Varanus indicus</u> (Daudin)		X	
Class Aves			
Ardeidae			
<u>Ixobrychus sinensis</u> (Gmelin)	X	X	
"Chinese least bittern"			
Alcedinidae			
<u>Halcyon cinnamomina cinnamomina</u> Swainson		X	
"Micronesian kingfisher"			
Columbidae			
<u>Gallicolumba xanthonura xanthonura</u> (Temminck)		X	
"white-throated ground dove"			
<u>Streptopelia bitorquata dussumieri</u> (Temminck)		X	
"Philippine turtle dove"			
Dicruridae			
<u>Dicrurus macrocercus harterti</u> S. Baker	X	X	
"black drongo"			
Laridae			
<u>Gygis alba candida</u> (Gmelin) "fairy tern"		X	

Species	BIOTOPES		
	I Wet Land	II Dissected Hilly Land	III River Estuary
Muscicapidae			
<u>Rhipidura rufifrons uraniae</u> Oustalet "rufous-fronted fantail"		X	
Ploceidae			
<u>Munia atriaeupilla</u> "rice bird"	X	X	
<u>Passer montanus</u> "European tree sparrow"	X	X	
Rallidae			
<u>Gallinula chloropus guami</u> Hartert "gallinule"	X	X	
* <u>Pollolimnas cinereus micronesiae</u> Hachisuka "white-browed rail"		X	
<u>Rallus owstoni</u> (Rothschild) "Guam rail"		X	
Scolopacidae			
<u>Erolia acuminata</u> (Horsfield) "sharp-tailed sandpiper"		X	
<u>Gallinago megala</u> Swinhoe "marsh snipe"	X	X	
Sturnidae			
<u>Aplonis opacus guami</u> Momiyama "Micronesian starling"		X	
Sylviidae			
* <u>Acrocephalus luscini</u> luscini (Quoy & Gaimard) "nightingale reed-warbler"	X		
Class Mammalia			
Muridae			
<u>Rattus exulans</u> Peale "Polynesian rat"		X	

*Endangered

APPENDIX C

LETTERS RECEIVED

BY THE

DISTRICT ENGINEER

ON THE

DRAFT ENVIRONMENTAL STATEMENT



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDER(mep)
Fourteenth Coast Guard District
677 Ala Moana
Honolulu, Hawaii 96813
5922

17 JUN 1975

From: Commander, Fourteenth Coast Guard District, Honolulu, HI
To: District Engineer, U.S. Army Engineer District, Honolulu, HI
Subj: Draft Environmental Statement on Flood Control Improvements
on Agana River, Territory of Guam

Ref: (a) Your ltr PODED-P dtd 14 MAY 75

1. Staff review of the subject draft environmental statement has been completed and the Coast Guard has no objections to implementing the flood control improvements at this time.
2. The project is seen as being in the interest of saving lives and property, which is certainly of Coast Guard concern. We are also interested in the aspects of recreation (especially water recreation) and navigation mentioned in the statement. It is understood that there are no plans for this project to enhance boating in the lower Agana River; however, we would like to review any such plans should they be developed later.
3. The opportunity to review the draft statement is appreciated. Please forward a copy of the final statement when it becomes available.

Sincerely,

/W. H. STEWART
Captain, U. S. Coast Guard
Chief of Staff
Fourteenth Coast Guard District



United States Department of the Interior

BUREAU OF MINES

EAST 315 MONTGOMERY AVENUE
SPOKANE, WASHINGTON 99207

Western Field Operation Center
June 24, 1975

Colonel F. N. Pender
District Engineer
Honolulu District
Corps of Engineers
Building 230, Fort Shafter
Honolulu, Hawaii 96812

Dear Colonel Pender:

The draft environmental statement and interim report "Harbors and Rivers in the Territory of Guam" were reviewed in this office for any mineral involvement. Mineral development would not be adversely affected by construction of the flood control project on the Agana River, Guam.

Sincerely yours,

R. N. Appleton, Jr.
R. N. Appleton, Jr., Chief
Western Field Operation Center



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION
PACIFIC SOUTHWEST REGIONAL OFFICE

IN REPLY REFER TO:

BOX 3602
450 GOLDEN GATE AVENUE
SAN FRANCISCO, CALIFORNIA 94102

June 18, 1975

District Engineer
U.S. Army Engineer
District, Honolulu
Building 230, Fort Shafter
APO San Francisco 96558

Dear Sir:

We have reviewed the draft environmental statement and interim report on Harbors and Rivers in the Territory of Guam, Flood Control, Agana River, Guam (ER-75/553).

We are in accord with the findings under 6.45, page 41, of the draft environmental statement which indicate that Plan 3 provides the best balance of physical, environmental and socio-economic factors under the proposed project.

Sincerely yours,

Frank E. Sylvester
Regional Director



United States Department of the Interior

FISH AND WILDLIFE SERVICE

1500 N.E. IRVING STREET

P.O. BOX 3737

PORTLAND, OREGON 97208

July 8, 1975

Colonel F. M. Pender, District Engineer
U.S. Army Engineer District, Honolulu
Building 230, Fort Shafter
APO San Francisco 96558

Dear Colonel Pender:

We are pleased to provide the following comments on your draft environmental statement and preliminary draft interim technical report (Appendix I) on Harbors and Rivers in the Territory of Guam, Flood Control, Agana River, Guam.

Our comments relate only to matters within the jurisdiction and expertise of the U.S. Fish and Wildlife Service and are not to be construed as those of the Department of the Interior. We understand that formal Departmental comment by Interior will be provided at a later date upon request of the Chief of Engineers.

We are in general accord with the plan to provide flood protection within the Agana River area. The project would assure that the flood flow easement area of Agana Swamp would be preserved or maintained for use by fish and wildlife species.

We have the following specific comments on the draft environmental statement.

We suggest that the discussion in paragraph 2.52, relating to primary causes of flooding in the area, be expanded to indicate that the flood problem is caused by past and current developments in Agana Swamp.

Paragraph 4.5, page 21, discusses the effects of concrete lined channels. The first sentence should be expanded to indicate that concrete channels will also increase the velocity of the water. We suggest that under C. Socio-Economic Impacts, paragraphs 4.19 and 4.20, the statements concerning landscaping indicate whether or not a greenway would be established along the levee areas and if the proposed tree planting would provide shade to the channelized sections. Plantings that would shade the channelized stream section would aid in reducing water temperatures during low flow periods and benefit fish and wildlife resources.

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Part 5, Any Probable Adverse Environmental Effects Which Cannot Be Avoided, page 27, paragraph 5.3. The first sentence indicates that the impact on swamp habitat and wildlife are not expected to be significantly adverse. We suggest that the word "significantly" be deleted. This section should stress the fact that the loss of 12.5 acres for levees and 20 acres of vacant swamplands located north of the power line for the Agana Central Park would result in further reduction of the environment necessary to maintain present populations of fish and wildlife and specifically that habitat necessary for the threatened and endangered wildlife species whose presence is acknowledged in paragraph 6.37, page 37. In addition, the section should point out that this habitat loss, or intrusion on the swamps, could contribute to the further decline of endangered and threatened species. Such action would be subject to the criteria contained in Section 7 of the Endangered Species Act of 1973.

Part 6, Alternatives to Proposed Action, paragraphs 6.6, 6.7 and 6.8, discusses non-structural measures, flood plain zoning, building codes, etc. The sections all indicate that these measures are intended to minimize the loss of life and damages during floods. We suggest an additional statement be included indicating that non-structural measures will aid in the preservation and/or maintenance of the flood plain and generally benefit fish and wildlife resources.

Also, paragraphs 6.25, 6.32 and 6.35 discuss levee and channel Plans 2 and 3. Plan 2 would result in construction of less levee and adversely affect less marsh area. We believe this plan would be the most desirable from a habitat preservation and fish and wildlife standpoint. It is a better EQ Plan, as indicated in Table 1 - Summary Comparison of Alternative Plans - compared to Plan 3.

Multipurpose reservoirs are also discussed in paragraphs 6.36 through 6.39. It should be noted that reservoirs constructed within Agana Swamp would eliminate threatened and endangered wildlife habitat and contribute to the further decline of these species. Paragraph 6.37 acknowledges the presence of at least 10 known threatened or endangered species in Agana Swamp.

Preliminary Draft Interim Report, Harbors and Rivers in the Territory of Guam, Agana River, Guam - Technical Report - Appendix I.

Noted on the cover of the draft was a statement indicating that a series of plates (Plates C-1, E-4 through E-18 and F-1) were not included in the report. Lack of these plates complicated draft review since numerous references within the text refer to these plates.

Section C, Problems, Needs, and Objectives, paragraph 4, page C-2, indicates that the flood problem is primarily attributed to the limited capacity of the Agana River. This statement should be expanded to point out that the alteration of the flood plain and developments within the plain are a contributing factor.

In the discussion on Plan Selection, page D-11, a number of plans are discussed. Of the number discussed, Table D-1, Plan 2, Environmental Quality Plan, is the most desirable proposal from the standpoint of fish and wildlife resources. This plan would preserve more marshland habitat for wildlife, especially endangered and threatened species. This point should be emphasized in the report. Also, in the Table D-1, Plan 2, item 2, Environmental Quality, Biological Reserves and Ecological Systems, it should be indicated below the column entitled Total that destruction of part of the native Agana Swamp habitat will occur and that the effects will be irreversible. This rationale would also apply to the tables concerning Plans 3, National Economic Development Plan, and 4, Flood Control Reservoir Plan.

In this same section, in Table D-2, Summary Comparison of Alternative Plans, under the column Flood Control Reservoir Plan, a statement indicates "Structural change from swamp habitat to lake. Endangered birds species may be threatened." This wording should be revised to read: "Structural changes from swamp habitat to lake. Endangered bird species will be threatened and/or destroyed."

Page D-14, paragraph 48, indicates that Plan 3 appears to be the most desirable plan and would be most responsive to planning objectives. As indicated previously, Plan 2 is the superior plan from the standpoint of fish and wildlife resources since it preserves a greater area of Agana Swamp in its natural state.

Effect of the Plan on the Environment (i.e., The Selected Plan) - Impact on Natural Resources, page E-4, paragraph 14, fourth sentence. Change the word "may" to "will". The sentence, in part, should then read "... the extent of tidal water upstream will be reduced."

Page E-4, in paragraph 16, first sentence should be changed to indicate that the project will adversely affect the stream. Concrete lining does not provide adequate habitat for fish and wildlife species in this area.

Page E-9, paragraph 38, indicates that impacts on swamp habitat and wildlife are not expected to be significantly adverse, yet acknowledges that any loss of wetlands is adverse. Thus, the sentence is an anomaly and needs revision. In this area the loss of marsh



United States Department of the Interior

NATIONAL PARK SERVICE

WESTERN REGION

450 GOLDEN GATE AVENUE, BOX 16063
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO:

L7619

(WR)PSE

July 2, 1975

land will have an impact on the remaining wildlife species, including endangered and threatened species by the mere reduction of the habitat. We consider the reduction would be significant.

In the Selected Plan, it appears that the water level in the marsh will raise during periods of heavy runoff. Due to the reduction in flood plain, the elevated water could drown out nesting birds during nesting season. We suggest the plan include some nesting islands to insure that any nesting waterbirds will not be displaced during flooding periods. We are specifically concerned with the Guam Gallinule Gallinula chloropus guami Hartert. Nesting islands would provide additional assurances that this endangered species is protected.

We appreciate the opportunity to comment.

Sincerely yours,

Douglas M. Hanks
Totting Regional Director

Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Engineer District, Honolulu
Building 230, Fort Shafter
APO San Francisco, California 96558

Dear Mr. Cheung:

We have reviewed the draft environmental statement and interim report for flood control improvements on Agana River, Territory of Guam. The following comments are for technical assistance only as they do not represent a formal response from the Department of the Interior.

COMMENTS ON THE PROPOSED ACTION

The proposed action will not affect any existing or proposed units of the National Park System or any existing, proposed, or known potential sites or properties listed or to be listed as National Landmarks.

COMMENTS ON THE ENVIRONMENTAL STATEMENT

Page 8 (Paragraph 2.27). The water quality of the Agana River is in great need of improvement. It is stated that "efforts will be made to avoid compounding the poor water quality conditions" of the river. The statement should include specifically what these efforts will be. It should also include what effort, if any, the local governments are making to improve and protect Agana River water for fish, wildlife, esthetic enjoyment and recreation.

Page 25-26. The statement appears to deal adequately with archeological and historical resources.

Page 27 (Paragraph 5.3). It is unclear how it was determined that impacts upon swamp habitat and wildlife would not be significant. Fish and other aquatic organisms were not even considered under "Environmental Impact





United States Department of the Interior

GEOLOGICAL SURVEY

RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR

ER-75/553

JUL 17 1975

of the Proposed Action." It is noted that water temperature will increase (page 21) yet nowhere do we find the effect of increased water temperature upon algal growth, fish and other aquatic organisms mentioned under possible impacts of the project.

Sincerely yours,

Bruce M. Kilgore

Bruce M. Kilgore
Associate Regional Director,
Professional Services

District Engineer
U. S. Army Engineer District
Honolulu, Hawaii
APO San Francisco 96558

Dear Sir:

We have reviewed your draft environmental statement on flood control for the Agana River in Guam and have the following comments.

It has been noted in the Technical Report, Appendix I, that channelization would require excavation of about 54,500 cubic yards from the river bed and banks (p. E-19, last par.). The volume of excavated material to be used for levee construction is given as 21,000 cubic yards in the draft environmental statement (p. 23, par. 3). If excavation will produce an additional 23,500 cubic yards, the proposed disposition of this material should be discussed.

Thank you for the opportunity to comment on the environmental statement.

Sincerely yours,

Henry W. Cordley
Acting Director



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

July 15, 1975

Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Engineer District, Honolulu
Department of the Army
Building 230, Fort Shafter
Apo San Francisco, California 96558

Dear Mr. Cheung:

The draft environmental impact statement "Harbors and Rivers in the Territory of Guam-Interim Report on Flood Control, Agana River, Guam", which accompanied your letter of May 14, 1975, has been received by the Department of Commerce for review and comment.

The statement has been reviewed and the following comments are offered for your consideration.

General Comments:

We are concerned with the probability of increased temperatures within Agana River due to concrete channelization. This problem was raised by National Marine Fisheries Service during initial discussions with the Corps of Engineers on the flood control project. We feel the final environmental impact statement should specifically detail mitigating measures to be employed in correcting increased temperatures in the stream flow. During our initial review of the project, we recommended the following:

1. The construction of low flow channels which would maintain a continuous flow from Agana Swamp to the ocean.
2. Leaving the bottom of the channels unlined to provide natural habitat for resident and migrating fauna. If flood flow velocities prohibit this, then measures such as boulder-imbudded concrete should be placed in the channel bottoms to provide pools, eddies, and other natural conditions.



2.

3. The use of a green belt on both sides of the channelized section of the river with planting of indigenous trees and other adequate bankside shade foliage should be incorporated into the project.

These measures are important in order to assure that the native diadromous fauna, particularly the edible eel, *Anguilla marmorata*, and prawn, *Macrobrachium* *lar*, will continue to inhabit Agana River and Swamp and be available for local consumption.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight copies of the final statement.

Sincerely,

Sidney R. Galler
Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

REGIONAL OFFICE

50 PULFORD STREET

SAN FRANCISCO, CALIFORNIA 94102

OFFICE OF
THE REGIONAL DIRECTOR

Office of Environmental Affairs

July 14, 1975

RE: Flood Control Improvements
Agana River, Territory of Guam

Kisuk Cheung
Chief, Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Bldg. 230, Ft. Shafter
APO San Francisco 96558

Dear Sir:

The above Draft Environmental Impact Statement has been reviewed in accordance with the interim procedures of the Department of Health, Education and Welfare as required by Section 102 (2) (c) of the National Environmental Policy Act, PL 91-190.

The material provided appears to describe adequately the impacts of the proposed action as well as the alternatives that were presented. The major concerns of this department are related to possible impacts upon the health of the population, services to that population and changes in the characteristics of the population which would require a different level or extent of services. Our review does not identify problems related to these specific concerns.

The opportunity to review this statement was appreciated.

Sincerely,

James D. Knochenhauer
James D. Knochenhauer
Regional Environmental Officer

cc: Ms. P. Hayes
Mr. W. Muir



U.S. PACIFIC FLEET
COMMANDER U.S. NAVAL FORCES MARIANAS
FPO SAN FRANCISCO 96630

IN REPLY REFER TO

W4

6010

Sec. 516

17 JUL 1975

From: Commander, U. S. Naval Forces Marianas
To: Chief, U. S. Army Engineer Division, Pacific Ocean,
APO San Francisco 96558

Subj: Flood Control Improvements on Agana River, Territory
of Guam

Ref: (a) USAED-POD ltr PODED-P of 18 Jun 1975

1. The Draft Environmental Statement and Draft Survey Report, submitted by reference (a), has been reviewed.

2. No objection or criticism is submitted on the proposed plan.

Wm C. Duffson
Wm C. Duffson
Chief of Staff

COPY TO:
PACNAVFACENCOM
OICC Marianas

Advisory Council

On Historic Preservation

1522 K Street N.W. Suite 430
Washington D.C. 20005

July 16, 1975

Mr. Kisuk Cheung
Chief, Engineering Division
Corps of Engineers, Honolulu District
U.S. Department of the Army
Building 230, Fort Shafter
APO San Francisco 96558

Dear Mr. Cheung:

This is in response to your letter of July 3, 1975 transmitting additional information concerning the potential effects the proposed Agana River Flood Control Improvements, Territory of Guam, will have upon the Spanish Dikes, a property included in the National Register of Historic Places. The Council notes from the comments of the Guam Historic Preservation Officer (HPO) enclosed with your letter that either the "proposed plan of improvement" or the "tentatively selected plan" number 3 would result in no adverse effect to the property pursuant to the "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800).

However, the Council notes further, that the HPO has determined several of the other proposed alternatives to the project would result in adverse effects to the National Register property. Therefore, the Council suggests that once the Corps has determined which of the various project alternatives is the most acceptable solution to the flooding problem, it again consult with the HPO concerning the effects of that proposal upon the Spanish Dikes and/or other properties in the vicinity included in or eligible for inclusion in the National Register, and submit its determination regarding that alternative for Council comment pursuant to the procedures at that time.

Should you have questions or require additional assistance in this matter, please contact Michael H. Bureman of the Council staff at (303) 234-4946.

Sincerely yours,

Louis S. Wall
Assistant Director
Office of Review and Compliance



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

Colonel Frank M. Pender
District Engineer
U. S. Army Engineer District
Honolulu, HI
Building 230, Fort Shafter
APO San Francisco 96558

JUL 31 1975

Dear Colonel Pender:

The Environmental Protection Agency has received and reviewed the draft environmental statement for the Agana River Flood Control, Agana, Guam. EPA's review of the draft environmental statement is in conjunction with a review of the preliminary draft technical Report.

EPA's comments on the draft environmental statement have been classified as lack of objections LO with additional information needed 2. The classification and the date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

EPA appreciates the opportunity to comment on this draft environmental statement and requests one copy of the final environmental statement when available.

Sincerely,

L. Russell Freeman, Jr.
Paul De Falco, Jr.
Regional Administrator
Acting

Enclosures

cc: Council on Environmental Quality
O. V. Natarajan, Administrator, Guam Environmental Protection Agency

COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT

AGANA RIVER FLOOD CONTROL

AGANA, GUAM

At this time, EPA has no major objections to the proposed action. However, it should be recognized that a "lack of objections" rating on the proposed project is contingent upon the adequacy and environmental importance of additional information presented in response to our concerns. EPA's concerns focus on three major issues: (a) water quality, (b) ground water, and (c) changes in condition of the swamp.

Water Quality Issues:

a. On page 7 of the draft EIS it is indicated that water quality sampling is conducted by the Guam Environmental Protection Agency. In view of the availability of water quality data, EPA requests that water quality data be included to provide background information (i.e. pre-project base water quality conditions) so that post-project conditions may be better assessed.

b. In the draft EIS (page 21) it is stated that, "Under existing conditions, the peak flood discharge is 33,000 cfs and the volume of the runoff is 3,800 acre feet." It is further indicated that with the post project condition, "...the resulting outflow is 7,500 cfs...." While EPA recognizes the reduction in peak flows for a standard project flood and 100 year flood, we are interested in if there will be a reduction in peak flows (post-project conditions) for higher frequency events i.e. 50 year and less events. EPA's concern is that if the peak flow discharge is increased for the higher frequency events, will there be a corresponding increase in sediment and debris transported to Agana Bay?

c. It is stated (page 21, draft EIS) that, "The concrete lining would eliminate the existing natural bottom conditions and raise the temperatures of the water due to thermal heating of the concrete." EPA is interested in the expected range of temperature increase. EPA notes that the standards of water quality for the waters of the Territory of Guam state, "Temperature shall not deviate from natural conditions by more than 1.50 F." (April, 1988 standards). In addition, should the expected range of temperature be greater than 1.50 F, EPA is interested in the mitigation measures that the Corps will incorporate to maintain water quality standards?

d. The proposed action indicates that a pumping plant will be necessary to prevent inundation due to local surface runoff and that the, "Required pumping capacity is estimated at 3,000 gallons per minute." The report indicates that the runoff will discharge into the Agana River. EPA suggests that additional information be included on the expected quality of water which will be discharged into the river.

Ground Water Issues

a. Although it appears that there will be an increase in ponded water for low frequency events and a decrease in ponded water for higher frequency events; as indicated earlier (see comment 1b), it is not clear if the proposed project will result in an annual increase or decrease in water being ponded in the swamp. EPA appreciates the complexity of the issue; however it is felt that the statement (page 22), "Although precise quantification of changes is not possible. The proposed improvements are not expected to change existing ground water levels significantly," does not adequately address the potential ground water changes which may occur as a result of the project. EPA suggests that additional information be included on: (1) the ground water characteristics of the area, and (2) an evaluation of the proposed project in relation to ground water changes.

b. In view of the importance of the Agana Springs area, EPA suggests that information be included on the relation of potential ground water changes and the resultant effects on the Agana Springs. In addition, while the draft EIS indicates that the Agana Springs is no longer suitable as a potable water source due to poor water quality, EPA is interested in whether water quality problems at the Spring will be compounded as a result of the proposed project?

Changes in Conditions of the Swamp

In review of projects affecting wetlands, EPA is guided by the Administrator's Decision Statement Number 4 which provides: "It shall be the Agency's policy to minimize alterations in the quantity or quality of the natural flow of water that nourishes wetlands and to protect wetlands from adverse...filling practices, siltation...and to prevent violation of applicable water quality standards from such environmental insults." EPA recognizes and commends the proposed project for including the permanent preservation of 360 acres (flowage easements) within the swamp. However, as indicated below, it is felt that a closer examination is necessary to determine if the proposed action will not only protect the swamp from encroaching land use changes, but also be accomplished in a manner which minimizes damage to the swamp.

a. In examining Plate 3 and projecting the structural measures on the photo, it appears that the structural measures bisect the lower swamp (north of the powerline access road) in order to protect the Department of Motor Vehicle building (which is planned to be relocated), tennis courts and a swimming pool. EPA is interested in the feasibility of an alternative of shifting the proposed levee further to the west so that a greater amount of the swamp may be preserved. This alternative would still provide the necessary protection to the existing development.

b. On page 21 of the draft EIS, it is stated, "Since the channel bottom near the Saylor Street bridge would be raised slightly, the extent of tidal water upstream may be reduced. There would be a portion of channel between Saylor Street and the upper limits of tidal water in the river that may be dry or practically dry during low flow." Although it is later indicated that the feasibility of low flow augmentation will be considered during the post-authorization studies, EPA is interested in the expected adverse impacts on the swamp resulting from the reduction of tidal interchange. In addition, what will be the source of water for the low flow augmentation? Finally, in view of the fact that the temperature of water may increase (see comment 1c), would the low-flow augmentation offset the temperature increases?

EIS CATEGORY CODES

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.



DEPARTMENT OF PUBLIC WORKS
GOVERNMENT OF GUAM
AGANA, GUAM

JUN 23 1975

Mr. Kisuk Cheung
U.S. Army Engineer District, Honolulu
Building 230, Ft. Shafter
APO San Francisco 96558

Dear Mr. Cheung:

Attached are the comments we received from the various Government agencies in regard to the Agana Flood Control Project-Draft Environmental Statement.

We feel that the alternative selected for this project was the best of those considered. There appeared to be no dispute regarding this selection at the public hearing on June 12, 1975.

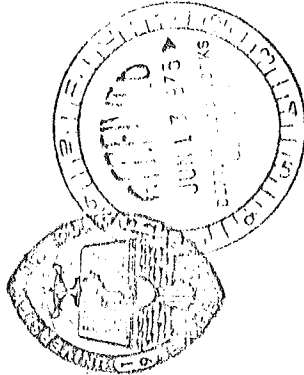
Obtaining the flowage easements may be a critical item in implementing any plan of improvement in this area. Perhaps an extension of the channel improvement upstream along with a small dam and system of levees could have been considered. More land in the area adjacent to Agana could then be utilized for further development instead of used as a flood plain.

Sincerely yours,

PETER C. TOVES, P.E.
Director of Public Works

By *David Scheffey*
DAVID SCHEFFEY
Acting Principal Engineer
Division of Hydraulics

Attachments



University of Guam

MARINE LABORATORY
P. O. BOX 22 AGANA, GUAM 96910

June 12, 1975

Memorandum

To: Director, Public Works
From: Director, University of Guam Marine Laboratory
Subject: Comments on Draft Environmental Statement
For Agana River Flood Control

Both Dr. Marsh and I have read the draft environmental statement for the Agana River Flood Control and have no strong objections to the proposed plan. In fact, we feel the plan is a good one which will not only alleviate the flooding situation but will provide more recreation area for Guam.

We do feel, however, that Government of Guam must provide some assurance that the flood water storage area within the proposed levees will be maintained so that no further encroachment occurs in the future. The continual presence of this flood water storage area will help protect the freshwater lens in this area from further saltwater intrusion and will preserve one of Guam's unique aquatic habitats for future generations.

Roy T. Tsuda
ROY T. TSUDA

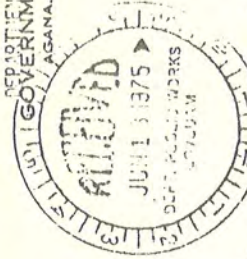


GOVERNMENT OF GUAM
AGANA



DEPARTMENT OF COMMERCE
GOVERNMENT OF GUAM
AGANA, GUAM 96910

JUN 17 1975



Memorandum

Memorandum

To: Director of Public Works
From: Director of Land Management
Subject: Review Comments, Draft Environmental Statement,
Agana River Flood Control Project

We have reviewed the Draft Environmental Statement and have no comment to submit. We commend the Corps of Engineer for a subjective and comprehensive report.

Esteban U. Torres
ESTEBAN U. TORRES

To: Director, Department of Public Works
From: Director, Department of Commerce
Subject: Flood Control Improvements on Agana River

The Corps of Engineers has requested our review comments on the draft environmental statement for the flood control improvements on the Agana River. They have designated your office as the clearing house to identify and resolve interagency conflicts regarding such comments. Our comments are as follows:

Page 8 Paragraph 2.23 discusses the islands economy and overstates our present agricultural exports. Crops, fish, and meat have not been export commodities for some time. Inclusion of eggs, bread, sportswear, bottled and canned drinks, and scrap metal would be more accurate.

Page 9 Paragraph 2.31 talks of Guam's geographic districts as election district. This is a misrepresentation.

Page 18 Paragraph 2.63 discusses the status of the Agana Harbor project. The paragraph overstates our present status, but should be updated just before publication.

Page 20 Paragraph 3.3 mentions a Water Conservation Master Plan adopted by TPC in 1970. My staff along with the Bureau of Planning and Department of Land Management assistance have been unable to locate such a plan. This document could be extremely valuable and we would appreciate a copy if it is found.

This paragraph 3.3 should also mention our 3rd annual Volume III Historic Preservation Plan which has been approved by the Governor and forwarded for National Park Service approval. This involves a \$30,000 repair project at the Plaza de Espana. Our Volume I and II Historic Preservation Plan, which is reaccomplished on 10-year increments, is presently before the Governor for his review before forwarding to the National Park Service.

Page 24 Paragraph 4.15 states that even without implementation of flood control measures the Agana area will continue to grow as the center

of commercial activity. The impact of the "no action" alternative must be re-evaluated throughout the document. The Department of Housing and Urban Development, Federal Insurance Administration will be implementing the National Flood Insurance Program on Guam in approximately three years. This Flood Insurance Program will exempt from Federal license or assistance any project within the 100 year flood plain unless prohibitively expensive non-subsidized insurance is purchased, or some measures are taken to lessen flood damage. With Guam's policy of maximizing Federal Assistance this will mean abandoning almost all of Agaña for any Government of Guam projects. This may or may not be beneficial, but should be discussed. This is also relative to page 27, paragraph 6.1.

Paragraph 6.28 mentions Public Law 39-72. The title of this law should be included to make this section logical. Research shows this to be "an act to provide uniform policies with respect to recreation and fisheries and wildlife benefits and costs of Federal multi-purpose water resource projects."

Plate 3 should be expanded to show the extent of the existing 100-year flood plain to the west. Also topographic lines should be shown around the Mongmong school area where a levee is proposed. What will happen to water trapped behind this levee? A similar plate should be added to depict the 100-year flood plain after the proposed project is completed.

The document does not address itself to land ownership problems in the area. Who owns the river channel where the lining is to be installed? A plate should be included to show flowage easement necessary to the "proposed plan," along with a discussion of how these areas will be controlled if they are not public land.

Plate 4 shows estimated 1985 land use within the Agaña River basin based on a 1966 source; Guam has changed considerably since then, relative to our tourist industry development. Some discussion had been included about controlling development within this basin so that runoff into the project area will not increase beyond what the project can handle. The Corps of Engineers should require constraining laws, as past of Government of Guam's cooperation, for all areas within the basin.

Table 1 and/or Table 2 should show a financial comparison summary.

It should be pointed out in paragraph 6.10 that evacuation of the area during major floods is not acceptable in this case. The existing flood situations, such as the government offices, Red Cross offices, RCA overseas telephone exchange, (only civilian

link by telephone or teletype to Hawaii and Mainland), Pacific Daily Newspaper (the only newspaper press on Guam is on the ground floor), and all Guam civilian police department offices. Loss of these services during such an emergency as a 100-year flood is unacceptable.

A plate should be included to show the 20-year flood plain, as this may be more realistic in assessing the impact of the "no action" alternative.

Plate 1 shows the "proposed plan" of improvement while page 41 paragraph 6.45 states that plan 3 is the tentatively selected plan. This is shown on plate 6 and is considerably different from plate 1. What is plate 1? Maps plate 1 should be labeled plan 1, and is the FED plan mentioned on table 1.

Paragraph 6.27 through paragraph 6.45 is extremely difficult to understand due to poor labeling. The following labels were assumed and are suggested for inclusion if they are correct:

Page 34, Paragraph 6.27, discusses plan 4.

Page 34, Paragraph 6.28, discusses plan 5.

Table 1 FED base plan is plan 1.

Table 1 EQ plan is plan 2.

Table 1 Flood Control Reservoir plan is plan 4.

Table 1 Multi-purpose Reservoir plan is plan 5.

The opening summary pages discuss "the proposed plan" which is not in agreement with plan 3 which was selected in paragraph 6.45. This problem is continued throughout the document as the "proposed plan" at the front of the document is not in fact the one selected after all the analysis is completed. This will require a general rewrite with the "proposed plan" called plan 1 and included in the analysis discussions.

Paragraph 4.16 discusses increased property tax as an advantage of flood control. This is a rainfall concept not relative to the Guam situation. Property taxes on Guam are very minimal and are not likely to become important. This is a result of legislators not wishing to cause the exertion of this type of pressure on land, since many landowners can trace family ownership of the land back to before U.S. occupation. This project is to protect the village of Agaña from extensive flooding of the Agaña River. However, it should be pointed out that heavy rains on Guam that would cause such flooding are usually associated with storm centers which also cause extensive tidal flooding. Will we be wasting our efforts to protect Agaña from the river when the

Memorandum
Flood Control Improvements on Agana River

ocean may flood the village from the opposite direction? This should be considered, possibly with the inclusion of a plate showing the 100-year tidal flood plain in Agana.

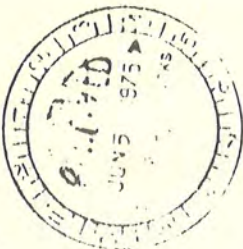
We are hopeful these comments will be helpful to the Corps of Engineers in reworking the draft statement, and we look forward to reviewing the redraft.

David Tencap
DAVID TENCAP



GUAM ENVIRONMENTAL PROTECTION AGENCY

POST OFFICE BOX 2839
AGANA, GUAM 96910
TELEPHONE: 749-9901, EXT. 372



JUN 05 1975

INTER-AGENCY MEMORANDUM

TO: Director, Department of Public Works
FROM: Administrator
SUBJECT: Comments on the Draft Environmental Statement and Draft Survey Report for the Agana River Flood Control Improvements

Our comments on the above subject are as follows:

- 1) Why weren't official minutes of the July 17, 1974 meeting, held to gather comments on possible alternatives, given to those who attended or interested agencies? Will the meeting to be held June 12, 1975, have minutes taken and subsequently given to participants?
- 2) The groundwater characteristics of the Agana River watershed as related to existing and potential public water supplies are not sufficiently explained. Since these supplies are significant and the project may impact on them, they should be discussed in detail and the extent of the impact described quantitatively. In addition, the impression should not be created that the quality of the springs cannot be improved; by law this improvement must take place to meet local and national standards.
- 3) The Spanish dikes and Agana Springs Nature Preserve are both indicated as being within the flood plain; however, the structural impact on these facilities of naturally occurring flood levels vs. the higher water levels that these improvements will create is not explained.
- 4) The statements concerning growth of commercial development within the flood plain brings out the question as to why controls, particularly through building permits, are not being exercised to prevent or minimize this build up. We are in fact creating the need for even more expansive and expensive flood control measures because of lack of land use controls at the agency level. Building in floodplains is used as a rational for flood control rather than using susceptibility to flooding

"ALL LIVING THINGS OF THE EARTH ARE ONE"

as a rationale for preventing further encroachment. For example, if grading is not controlled within the Agana watershed, what effect will this have on design capacities of the proposed improvements? Unless a strong regulatory program including zoning, building permits and grading is undertaken, expensive investment for flood control will continue and this project will constitute only the first "down payment."

- 5) Since this project has been ongoing since 1972 and an investment of several million dollars anticipated, why wasn't a gaging station established at Agana River? The expense is minimal and it would serve to provide accurate data rather than the very rough calculations provided. Comparisons could be made between present flows and those that could be accomplished by periodic clearing of the river channel in order to evaluate the effectiveness of channel maintenance.

- 6) One of the major areas of impact minimized by the report is water quality. The project will, of course, eliminate biological activity within the lower reaches of the Agana River by replacing the natural river with a concrete channel. The loss in aesthetic potential insofar as using and developing landscaping in conjunction with river preservation is not dealt with. An even more serious problem, and one which will have long term effects is the use of Agana Bay as a dumping ground for heated water carrying excessive silt loads and heavy metals. A storm drain of the magnitude contemplated may effectively destroy the southern portion of the Bay through excessive sedimentation and reduced oxygen levels. At a time when several sectors of the public here are stressing the need to enhance and protect the quality of the Bay as an attraction and complement to the Capitol, it seems ill-advised to develop structures that effectively create large dead areas and violate local and national water quality standards. There is no doubt that, if implemented as planned, this discharge would fall under the Federal National Pollution Discharge Elimination System requiring a permit, compliance monitoring by the discharger, and subsequent pollution control strategies. If a decision to protect the quality of water in Agana Bay is put off now, what subsequent action may be necessary to treat the polluted storm discharge that this project will generate?

- 7) The statement on p. 23, B.4.9 is untrue; major adverse impacts will occur during construction (and no specific recommendations are made to prevent this), but these will be overshadowed by long term effects on water quality within Agana Bay.

- 8) Page 23, B.4.12 - if impacts on designated source site for fill material are to be delayed until final designation, how will these impacts be incorporated into the Environmental Impact Statement and made available for public comment?
- 9) There is no mention as to the cost of maintaining the proposed system. Who will maintain it and at what yearly cost? Those responsibility is the maintenance of the existing river channel; when was it last performed and with what effect on subsequent storm levels?
- 10) The statement on page 24, B.4.16, should be substantiated by indication of current property taxes and specific increases that will occur because of the project. Real estate taxes on Guam are extremely low and using this as a rationale based on mainland tax structures may not be applicable.
- 11) It is not safe to assume that growth of the Agana area cannot be accomplished without the expensive controls proposed by this report. A more limited approach that uses a combination of relocation, attractive flood proofing by commercial enterprises, regular maintenance of the existing channel, and strict regulation of further building both in terms of location and design - would allow for orderly development of Agana without enormous expense to all taxpayers.
- 12) Page 30, B.6.13, again seems to reiterate the need not to control growth in flood-prone areas so that the Corps can rely on the need to construct even larger improvements in the future. It seems to be analogous to how the construction of larger highways encourages more auto use which in turn creates the need for even larger highways. The Corps and the "local interests" that are constantly referred to seem to want to shun any kind of a regulatory approach on land use.
- 13) Page 33, B.6.26, any plan that minimizes the impact on our environmental and fiscal resources should be considered the primary alternative. For health and maintenance (cost) reasons, we should minimize structures that require 24-hour human occupation in swamp areas to avoid mosquito problems and the accompanying costly control measures that go along with them. Simple structures, such as parks, that can be visited during the day during time of little rain, should be integrated with the Agana Swamp.



DEPARTMENT OF COMMERCE
GOVERNMENT OF GUAM
AGANA, GUAM 96910

In summary, we feel that alternative schemes maximizing lower cost lower impact controls were not sufficiently developed and studied. The use of regulatory controls over building and grading within the flood zone and within the Agana River Basin as a need to prevent future damage are avoided. Maintenance of the existing channel and its impacts on controlling flood levels were not assessed. At a minimum, considering the large expenditure of funds required, a gaging station should be installed to provide better information on flow levels. Long term maintenance costs and the longevity of the usefulness of improvements (considering the report's position on encouraging growth in the Basin) should be included within the report. Lastly, the impact on water quality within the southern portion of Agana Bay must be looked at in detail to determine if this project will destroy its beneficial uses. If so, a more limited approach incorporating controls to prevent degradation of water quality will be required.

C. V. Natarajan
O. V. NATARAJAN, Ph.D.

CC: Bureau of Planning
Army Corps of Engineers Honolulu
Army Corps of Engineers - Local Guam
Department of Commerce

June 24, 1975

Mr. Kisuk Cheung
Chief, Engineering Division
Corps of Engineers, Honolulu District
U.S. Department of the Army
Building 230
Fort Shafter
APO San Francisco 96558

Dear Mr. Cheung:

Our office has reviewed the draft environmental statement for Flood Control Improvements on the Agana River, Territory of Guam, dated May 1975, and is in agreement with paragraphs 2.39 through 2.43 and 4.21 through 4.24 which reference historic items. The two reservoir alternate plans involve permanent inundation of the Spanish dikes; this should be considered unacceptable and the economic figures should reflect costs for relocating these structures, if one of these plans were to be selected. In accordance with your letter of May 14, 1975, we have directed our other comments on the draft environmental statement to the Director, Department of Public Works, Government of Guam. Our comments were extensive and indicate a redraft of the statement is necessary.

Our office has not received a copy of the draft survey report for this project, and has previously requested your office supply this document.

The island-wide survey of historical-archaeological sites mentioned in paragraph 2.41 was completed in the spring of 1974. However, this was only a 10 week survey and included only major known historical sites and structures. Other known possible historical sites remain unsurveyed. Some such sites in the Agana River Flood plain area include:

Government of Guam Administration Building
Statue of Liberty Copy
Skinner Plaza Monument
Marine Drive Monument
Guam Heroes Memorial
Japanese Fortifications, Paseo de Susana
Guam Legislative Building
Nieves Flores Library Building
Dulce Nombre de Maria Cathedral

Page 2
Letter: Mr. Kisuk Cheung

Other sites have been surveyed but not considered by the Historic Preservation Review Board as yet. These include:

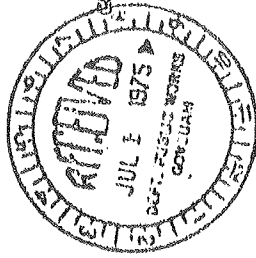
Torres House
Calvo House
Shimizu House
US Naval Cemetery
Japanese Caves

All of these sites are in the same category as those mentioned in the draft environmental statement paragraph 2-42, in that they are benefitted by the project rather than adversely impacted. There is always a chance that unknown historical resources may exist in the Agana swamp and be hidden by the growth, such as WWII aircraft. Such items could be moved from the site if located during construction.

The Advisory Council on Historic Preservation's letter of May 29, 1975 states that it is unclear whether or not our surveys have included project lands under the control and jurisdiction of the Corps. In this regard we would wish to know what lands on Guam or the surrounding waters are included within your jurisdiction. I have been briefed by your local representative that no lands on Guam are under the Corps' of Engineer's jurisdiction.

This letter can be used as agreement of no adverse impact upon historical, architectural, archaeological, or cultural resources, in fulfillment of the requirements of Section 106 of the National Historic Preservation Act of 1966, if the "proposed plan of improvement" or the "tentatively selected plan" number 3 is carried out as discussed in the draft environmental statement.


RALPH J. J. JONES
State Historic Preservation
Office



GOVERNMENT OF GUAM

AGANA

JUN 30 1975

Memorandum

To: Director, Department of Public Works
From: Chief Officer, Public Utility Agency of Guam


Subject: Comments on Draft Environmental Statement and Draft Survey Report on Agana River Flood Control.

The following are our comments:

1. PUAG is in support of the selected proposed plan for reasons that would not have any effects on ground water levels and would assure conservation of the Agana swamp which is one of the precious water source in the Agana area.
2. Under the technical report on pages E-5, F-1 and F-3. Additional study must be given to the relocation of the sewer lines particularly the 30" Agana-Dededo Interceptor. We doubt that the cost for the relocation of utilities shown on page F-3 would be adequate. Relocating the 30-inch interceptor to another longer route would require all the remaining downstream portion of the interceptor to be adjusted in grade.
3. Page E-19 of the technical report mentioned the Fadian Point quarry as an available source for rocks. This site has been considered unacceptable by the Guam EPA for extractive operations.
4. Page 27 of the draft environmental statement should include that traffic inconvenience will also be experienced during relocation of utilities.

Subject: Agana River Flood Control
Page 2

Should you have some questions regarding our comments, please
contact us.


R. W. R. PAULINO
Acting



APPENDIX D

LETTERS RECEIVED BY THE
CHIEF OF ENGINEERS AS A RESULT
OF COORDINATION OF THE REVISED
DRAFT ENVIRONMENTAL STATEMENT

APPENDIX D

LETTERS RECEIVED BY THE
CHIEF OF ENGINEERS AS A RESULT
OF COORDINATION OF THE REVISED
DRAFT ENVIRONMENTAL STATEMENT



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

REGIONAL OFFICE
50XXXXXXXXXXXXUnited Nations Plaza
SAN FRANCISCO, CALIFORNIA 94102
Office of Environmental Affairs
July 23, 1976
THE REGIONAL DIRECTOR

US Army Engineer District
Honolulu, Hawaii
APO San Francisco 96558



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

36010

Colonel F. M. Pender, District Engineer
U.S. Army Engineer District, Honolulu
Building 230, Fort Shafter
APO, San Francisco 96558

AUG 30 1976

Dear Colonel Pender:

The Environmental Protection Agency has received and reviewed the draft Environmental Impact Statement for the Agana River Flood Control Project, Agana River, Guam. EPA's comments on the draft statement have been classified as IO-2. Classification and data of EPA's comments will be published in the Federal Register, in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the consequences of the proposed action, and the adequacy of the environmental statement.

EPA suggests that the final environmental statement assess the following:

1. A discussion of the proposed project's relationship with ongoing land use and water quality planning activities by the government of Guam.
2. The proposed project's compliance with all appropriate local requirements, including water quality standards for the Territory of Guam (September 25, 1975) and the Guam Soil Erosion and Sediment Control Rules and Regulations (December 5, 1975).
3. The anticipated impacts of the project on groundwater quality in the Agana swamp area. The draft EIS does provide a qualitative discussion of the anticipated effects on groundwater quantity, but very little information is offered on groundwater quality. A discussion on the impacts of siltation in the swamp area as a result of ponding should be given.

Dear Sir:

The Revised Draft Environmental Impact Statement for Harbors and Rivers in the Territory of Guam has been reviewed in accordance with the interim procedures of the Department of Health, Education and Welfare as required by Section 102 (2) (c) of the National Environmental Policy Act, PL 91-190.

The material provided appears to describe adequately the impacts of the proposed action as well as the alternatives that were presented. The major concerns of this department are related to possible impacts upon the health of the population, services to that population and changes in the characteristics of the population which would require a different level or extent of services. Our review does not identify problems related to these specific concerns.

The opportunity to review this statement was appreciated.

Sincerely,

James P. Knochenhauer
James P. Knochenhauer
Regional Environmental Officer

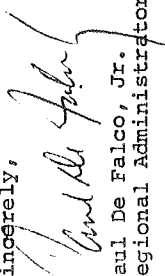
cc: OEA
CEQ

4. With respect to paragraph 4.16 concerning impacts on removal at 135,000 cubic yds. from an as yet unidentified borrow site:

- A. The final EIS should discuss possible effects of erosion in the borrow area on water quality, particularly in the Sinajana area which borders the Chrot River drainage area.
- B. The final EIS should provide an evaluation of the proposed fill material, to assure that the fill does not contain unacceptable quantities of constituents that may leach or erode into the wetland area, thereby causing an unacceptable adverse impact on this sensitive area.

EPA appreciates the opportunity to comment on this draft environmental statement, and requests two copies of the final statement when available. If you have any questions about our comments, please contact Patricia Sanderson Port, EIS Coordinator, at (415) 556-3232.

Sincerely,


Paul De Falco, Jr.
Regional Administrator

Enclosure

cc: Council on Environmental Quality

EIS CATEGORY CODES

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.



REGION IX
450 Golden Gate Avenue
San Francisco, California 94102

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
AREA OFFICE
1000 BISHOP STREET, P.O. BOX 3377
HONOLULU, HAWAII 96813

September 8, 1976

IN REPLY REFER TO:
9.7F (Sakamoto/
546-5554)

Department of the Army
Office of the Chief of Engineers
Attention: DAEN-CWP-A
Washington, D.C. 20314

Dear Sir:

In accordance with your letter to Mr. Robert H. Baida, Regional Administrator, Department of Housing & Urban Development, Region IX, San Francisco, we have reviewed the proposed report and the revised draft environmental impact statement on Agana River, Guam.

We concur with the proposed flood control plan which will mitigate overland flood damages to the city of Agana. The proposed improvement will permit enhancement of the existing urban area.

We appreciate the opportunity to take part in the review of the proposed report and draft EIS.

Sincerely,

Alvin K. H. Pang

Alvin K. H. Pang
Director

cc:
Council on Environmental Quality



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-74/614

SEP 21 1976

Dear General Morris:

Thank you for the letter of June 23, 1976, requesting our views and comments on the revised draft environmental statement and interim report on flood control, Agana River, Guam. We are pleased with the consideration the Corps of Engineers has given to our previous comments. Several additional comments and suggestions are offered below.

Interim Reports

Page B-4, paragraph 21, Fish and Wildlife. The text relates that a list of threatened and endangered bird species was provided by Guam Division of Fish and Wildlife. The list discussion states that the species were once inhabitants of the swamp, but numbers have been drastically reduced and their presence today is uncertain. In addition, reference to the Nightingale Reed Warbler, a species listed as endangered by the Department of the Interior, states that the bird "may inhabit the area, although it is considered extinct by some experts." We recommend that a survey of swamp avifauna be accomplished to positively verify presence or absence of this and other threatened or endangered species.

Page E-2, paragraph 5, Selected Plan. The text states that the levee system will confine flood waters and maximum water surface elevation of the impoundment would be 17.7 feet msl. In a July 8, 1975, letter to the Honolulu District Engineer, the Department's Fish and Wildlife Service indicated concern over proposed reduction of flood plain and elevated waters and consequent loss by inundation of nesting endangered waterbirds. The Service suggested that construction of nesting islands would be of value to endangered species. It is recommended that the text acknowledge adverse impact of high water on bird nesting. This could be added in the subpart entitled Effects of the Plan on the Environment, page E-3,



and that bird nesting mounds be included in the Design subsection on page E-9. Top elevation of these should exceed 17.5 feet msl.

Revised Draft Statement

The plan provides for the expenditures of \$84,000 for the beautification of the channel and landscaping of the levees. The draft statement should provide a rendering or photo - modification of the completed channel showing the extent of these amenities.

Environmental Setting Without Project, page 2. We suggest inclusion of an additional statement indicating that Agana Swamp is the last remaining major wetland habitat on Guam.

Page 13, paragraph 2.50. It is indicated in this section that floods are common in the Agana River basin and have been reported to occur following moderate as well as heavy rain. Information on the frequency and magnitude of storm-generated tides should also be provided and related effects on flooding of the project area should be assessed. These effects may have a bearing on the adequacy of the proposed flood control measures.

Page 29, paragraph 5.3. The text should acknowledge that approximately 35 acres of wetland will be altered, including about 2.5 acres of stream environment, 20 acres of marsh proposed for filling, and 12.5 acres of wetlands that would be diked and filled.

Environmental Impact of Proposed Action, page 23, paragraph 4.5.


The narrative should indicate that loss of 35 acres of wetland habitat with implementation of the selected plan would reduce Guam's threatened and endangered wildlife environment.

Page 29, paragraph 5.4. The text discusses 20 acres of vacant swamp land available for development. We suggest the word vacant be changed to undeveloped, since flood plain lands available to wildlife are not considered vacant from a fish and wildlife standpoint.

Page 6, paragraph 2.18 states that existence of threatened and endangered bird species in the swamp as listed, is uncertain. We recommend that species verification be made by a field survey so the document can more positively address the matter.

We hope these comments will be of assistance to you.

Sincerely yours,



Deputy Assistant Secretary of the Interior

J.W. Morris
Major General, USA
Director of Civil Works
Corps of Engineers
Department of the Army
Washington, D.C. 20314



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS: (G-WS/73)
U.S. COAST GUARD
WASHINGTON, D.C. 20399
PHONE: (202) 426-2262

21 September 1976

Lieutenant General J. W. Morris
Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Morris:

This is in response to Lieutenant General Gribble's letter of 24 June 1976 addressed to Secretary Coleman concerning a draft environmental impact statement on the Agana River, Guam.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. The Federal Highway Administration commented as follows:

"Implementation of the proposed project will require the reconstruction of a short section of O'Brien Drive and some modification under the bridges at Saylor Street and Marine Drive. These items have been adequately discussed in the Draft Statement.

"Not discussed in the Draft EIS is the secondary effect of increased traffic on the existing and planned highway and street system should the anticipated recreational and commercial development, made possible by the proposed project, actually occur."

The Department of Transportation has no other comments to make nor do we have any objection to this project. The final statement, however, should address the concern of the Federal Highway Administration.

The opportunity to review this draft statement is appreciated.

Sincerely,

D. J. Riley

D. J. RILEY
Captain, U.S. Coast Guard
Deputy Commanding Officer
United States Coast Guard
By direction of the Commandant



DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

22 September 1976

Lieutenant General J. W. Morris
Chief of Engineers
Office of the Chief of Engineers
Army Corps of Engineers
U.S. Department of the Army
Washington, D.C.

Dear General Morris:

This is in reply to General Gribble's letter of June 24, 1976, transmitting for our review and comment your proposed report and revised draft environmental impact statement on Agana River, Guam.

We have reviewed the above documents and find no conflicts with any of our ongoing or planned programs or projects. We offer the following comments for your consideration:

1. Pages 13 and C-5 - The report identifies the need to develop the agricultural potential of Guam. There are about 2,000 acres of potential farmland within the Agana basin, of which only about 100 acres are currently under cultivation. The report identifies areas adjacent to the Agana Swamp which, if developed for agriculture, would help to meet Guam's agricultural production goals as well as help to prevent urban development from infringing on the swamp. The report states that installation of the selected plan will assure that the Agana Swamp will remain as undeveloped open space. However, the report is silent as to how much of the projected urban development adjacent to the swamp might then take place upon adjacent agricultural land. It would strengthen the environmental impact statement if these project-associated impacts on agricultural land were clearly spelled out.

2. Page F-7 - It seems desirable to briefly describe the procedure whereby the \$31,000 of "affluence factor" benefits were derived rather than to just refer to ER 1105-2-351.

3. Table F-6 lists \$166,000 of benefits from future flood damage prevention. Even though the benefit-cost ratio cited in the main report excludes this item, some explanation of how future damage prevention benefits were derived seems appropriate.

We appreciate the opportunity to review this material.

Sincerely,

Paul A. Vander Myde
PAUL A. VANDER MYDE
Deputy Assistant Secretary



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Policy
Washington, D.C. 20230

27 September 1976

Lieutenant General John W. Morris, USA
Chief of Engineers
Office of the Chief of Engineers
Washington, D. C. 20314

Dear General Morris:

Secretary Richardson has asked me to reply to Lt. General Gribble's letter of June 24, 1976, concerning the Chief of Engineers' proposed interim report on flood control for Agana River, Territory of Guam.

In the Department of Commerce review of this interim report no new substantive comments were raised. However, some concern has been brought to my attention with regard to the mitigation measures in the project plan. I understand these concerns have been expressed in previous correspondence to the Corps of Engineers by the National Marine Fisheries Services upon its review of the draft environmental impact statement. Thus, I will not repeat these apprehensions.

Thank you for the opportunity to review the subject report.

Sincerely,

Robert S. Milligan
Robert S. Milligan
Deputy Assistant Secretary
for Policy Development
and Coordination



TERRITORY OF GUAM
OFFICE OF THE GOVERNOR
AGAÑA, GUAM 96910
U.S.A.

JAN. 21 1977

Lt. Gen. W.C. Gribble, Jr.
Chief of Engineers
Office of the Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Gribble:

I regret that there has been inordinate delay in replying to your letter dated June 24, 1976 with regard to our comments on the Agana Flood Control project report and the environmental impact statement report.

The Directors of the various Government of Guam agencies have had a second look at the project and have endorsed the alternatives of flood control through structural and non structural controls.

I, therefore, wish to inform you that the project should be carried on to the next stage with the declared intent of Government of Guam to participate in the project pursuant to Section 3 of the 1936 Flood Control Act. This letter is not binding in any way on the Government of Guam and the work will proceed only after Government of Guam commits itself to the financial burden of this project.

I take this opportunity to thank the Corps of Engineers Pacific Ocean Division for their effort and look forward to their continued cooperation.

Sincerely yours,

Rudolph G. Sablan
RUDOLPH G. SABLAN
Acting Governor

REFERENCES

The Guam Science Teachers Association, A Naturalist's Guide to Guam, August 1968.

Territorial Planning Commission, Outdoor Recreation on Guam, 1966.

--1971 Revision, dated 1 October 1971.

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Randall, Richard H., and Roy T. Tsuda, Field Ecological Survey of the Agana-Chaot River Basin, prepared for the US Army Engineer Division, Pacific Ocean, July 1974.

Territorial Planning Commission, Territory of Guam Master Plan, January 1966.

US Army Engineer Division, Pacific Ocean:

Economic Base Study, Territory of Guam Mariana Islands, May 1973.

Flood Hazard Study, Agana River, Guam, March 1975.

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Public Utility Agency of Guam, Conservation Requirements for the Preservation of Guam Water Resources, 31 August 1970.

Ward, Porter E., Stuart H. Hoffard, and Dan A. Davis, Hydrology of Guam, Geological Survey Professional Paper 403-H, 1965.

