



I Tano'-ta The Land Use Plan for Guam



PREPARED FOR
The Territorial Planning Council

GENERALIZED CAPITAL IMPROVEMENT PLAN

and

CONCURRENCY MANAGEMENT SYSTEM

W. B. FLORES & STRATEGIC PLANNING GROUP

A Joint Venture

I TANO'-TA

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**GENERALIZED CAPITAL
IMPROVEMENT PLAN AND
CONCURRENCY MANAGEMENT
SYSTEM**

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TABLE OF CONTENTS

TITLE	PAGE
INTRODUCTION	1
INVENTORY OF EXISTING CAPITAL FACILITIES	2
WASTEWATER TREATMENT AND SYSTEM CAPACITY	2
POTABLE WATER	4
TRAFFIC CIRCULATION	7
ENERGY	10
SOLID WASTE DISPOSAL	12
PUBLIC SAFETY	13
EDUCATION	15
PARKS AND RECREATION	17
CURRENT CAPITAL IMPROVEMENT PROJECTS	26
SANITARY SEWER AND POTABLE WATER	28
TRAFFIC CIRCULATION	30
PUBLIC SAFETY	36
SOLID WASTE DISPOSAL	36
PARKS AND RECREATION	37
PROJECTING CAPITAL IMPROVEMENT NEEDS	38
LEVELS OF SERVICE	38
EXISTING LEVELS OF SERVICE	41
FIVE YEAR ZONING PLAN	44
FIVE YEAR PUBLIC FACILITY DEMAND	45
WASTEWATER TREATMENT	46
POTABLE WATER	47
AUTOMOBILE TRAFFIC	47
ENERGY	49
SOLID WASTE DISPOSAL	49
POLICE OFFICERS	49
FIRE FIGHTERS	49
HEALTH CARE BEDS	49
EDUCATION	50
PARKS AND RECREATION	50
CONCURRENCY MANAGEMENT SYSTEM	51

TABLE OF CONTENTS...(Continued)

TITLE	PAGE
CONCURRENCY MANAGEMENT SYSTEM INVENTORY	53
TRAFFIC CIRCULATION	53
SANITARY SEWER	54
POTABLE WATER	54
ENERGY	55
SOLID WASTE DISPOSAL	56
EDUCATION	56
PARKS AND RECREATION	57
CONCURRENCY ASSESSMENT PROGRAM	58
SCENARIO FOR INDIVIDUAL	60
SCENARIO FOR DEVELOPER	61
SUMMARY	65

LIST OF TABLES

TABLE #	TITLE	PAGE
1	WASTEWATER PUMP STATIONS MAXIMUM CAPACITY (GALLONS PER MINUTE)	2
2	WASTEWATER TREATMENT PLANTS	4
3	SUMMARY OF PUAG WELLS	5
4	SURFACE AND SPRING SUPPLY FACILITIES	6
5	EXISTING PUAG WATER CAPACITY BY SERVICE AREA	6
6	ROAD CLASSIFICATIONS AND LANES PER ROAD	8-9
7	GPA POWER GENERATION-EXISTING AND PROPOSED UNITS	11
8	ELECTRICAL POWER CONSUMPTION	11
9	ELECTRICAL POWER DEMAND AND CAPACITY	12
10	ENROLLMENT AND NUMBER OF CLASSROOMS, 1991-1992 SCHOOL YEAR	16
11	PUBLIC SCHOOL ENROLLMENT	17
12	PUBLIC SCHOOL STUDENT/TEACHER RATIO	17
13	INVENTORY OF PARK AND RECREATIONAL FACILITIES BY VILLAGE	21-26
14	MAJOR PROPOSED CAPITAL IMPROVEMENT PROJECTS, 1992	27-28
15	WASTEWATER AND POTABLE WATER CAPITAL IMPROVEMENT PROJECTS.	31-32
16	PROPOSED SHORT-RANGE IMPROVEMENT PROJECTS	
	GUAM 2010 HIGHWAY MASTER PLAN	33-36
17	PROPOSED PARKS FROM CURRENT MILITARY LANDS	37
18	GUAM OUTDOOR RECREATION STANDARDS	43-44
21	PROJECTED DEFICIENT HIGHWAY LINKS, 1995	48
19	GUAM POPULATION MODEL RESIDENTIAL POPULATION, 1998	67
20	ZONING PLAN DEMAND FOR PUBLIC FACILITIES 1993-1998	68
22	RECREATIONAL FACILITY DEMAND	69-71
23	SYSTEM FOR THE MANAGEMENT OF CONCURRENCY (SYMCON)	72

THE LAND USE PLAN FOR GUAM
GENERALIZED
CAPITAL IMPROVEMENT PLAN
AND
CONCURRENCY MANAGEMENT SYSTEM

INTRODUCTION

The purpose of this document is to project gross capital improvement needs consistent with the Five Year Zoning Plan (1993-1998) based on projected population growth during this time period. This Capital Improvement Plan differs from GovGuam's traditional and current capital improvement planning process in that it is intended as a generalized model from which to project future capital infrastructure needs based on population growth.

The plan is setup in such a fashion to work in tandem with a Concurrency Management System (CMS) to maintain adequate levels of public services and facilities consistent with the additional demand for services and facilities required by new population growth over short-term (five year) planning periods. The scope is limited to only those improvements derived from level of service (LOS) analysis in I Tano'-ta, The Land Use Plan for Guam, and the proposed Concurrency Management System. It focuses on the generalized needs required to meet any existing deficiencies and to maintain adopted LOS standards planned for public facilities in the Land Use Plan.

The Plan will also summarize existing short-term plans underway by various GovGuam agencies for major improvements in certain public sector facilities that impact upon the Land Use Plan, such as highway and transportation improvements, potable water and wastewater treatment facilities and the expansion of park and recreational facilities. The determination of these needs is concerned with relatively large-scale projects of generally non-recurring high costs.

The overall intent of the generalized capital planning process is not to project cost estimates for needed projects, but to understand all of the capital facility planning which is undertaken by various GovGuam agencies and to bring those planning functions together in a more coordinated manner. Hopefully, by doing so, a more efficient means to planning, funding and implementation of capital facilities will be achieved.

INVENTORY OF EXISTING CAPITAL FACILITIES

Wastewater Treatment

Sewage treatment services are provided by the Public Utility Agency of Guam (PUAG). There are seven major wastewater treatment plants that serve the island: the Agat, Agana, Baza Gardens, Umatac, Commercial Port, the Northern District (Dededo), and the Inarajan treatment plants. Twenty pump stations support this treatment system, as shown in Table 1.

TABLE 1 WASTEWATER PUMP STATIONS MAXIMUM CAPACITY (GALLONS PER MINUTE)			
Location	No. of Pumps	Total Capacity	Current Treatment*
1. Asan	2	1400	19.8
2. Asmuyao	2	1100	-
3. Aspingab	2	1750	-
4. Bayside at Camp Watkins Tamuning	1	300	36.6
5. Chaot	2	1400	-
6. Harmon	2	1000	50.4
7. Ipao	2	1200	36.0
8. Latte Heights	2	1200	-
9. Mongmong Toto	2	1400	31.2
10. Mangilao	2	6300	55.8
11. Piti	2	700	30.0
12. Sinajana	2	700	18.0
13. Ypaopao	3	2100	-
14. Pago	2	1820	-
15. Fujita	2	3600	-
16. Mamajanao	2	3600	143.4
17. Liguan	2	8120	-
18. Agana	4	20,000	-
19. Northern District	3	12,000	55.2
20. Tumon**			

Note: * The current treatment flow represents an average per minute flow over the one week period, September 8 through September 14, 1991.

** The Tumon Facility is no longer in use. It has been replaced by the Fujita Facility.

Source: Public Utility Agency of Guam, 1991.

Wastewater Treatment and System Capacity

Public wastewater treatment service is provided to most of the more urbanized areas of the island.

All of the existing treatment plants provide the minimal primary treatment process to effluent required by the U.S. Environmental Protection Agency. All plants have direct ocean outfalls except: Inarajan,

which provides a land application process; Baza Garden, which discharges into a local stream which ultimately flows into the ocean; and Umatac, which also employs a land percolation process.

The rapid increase in population and hotel construction during the 1980s has, in some areas, overwhelmed the capacity of the wastewater collection and treatment system. Problems exist not only in the capacities of the treatment facilities to properly treat the effluent, but also in the capacities of the collection systems to process the flow of wastewater to the treatment plants. This is especially the case in the Tumon-Tamuning area where untreated or poorly treated sewage effluent has overloaded the collection system and periodically overflows onto streets and ultimately into the coastal waters of Tumon Bay. The problem is compounded during periods of heavy rainfall when infiltration and inflow of stormwater into the collection lines quickly exceeds the capacity of the pipes. This situation is planned to be alleviated through the Northern District Sewage Reversal Project. This process entails transferring the sewage flow from the Tumon-Tamuning area which was flowing to the heavily over-utilized Agana plant to the under-utilized Northern District wastewater treatment plant. This project has diverted more than three mgd of wastewater flow to the northern plant. Nevertheless, the Agana plant continues to operate at 75 percent of its capacity.

Another problem area is the Agat wastewater plant currently operating well beyond its design capacity. The situation is exacerbated by significant inflow from storm water on wet days and infiltration from groundwater caused by tree roots breaking the pipes. Localized flooding problems around the Umatac and Inarajan treatment plants frequently result in failure of the land application effluent disposal process which increases the discharge of poorly treated effluent to coastal waters. Degraded water quality has been documented in areas served by ocean outfall points, including Agana Bay, Tanguisson, Apra Harbor and Agat.

It is recommended that when average daily flows reach 90 percent of treatment plant design capacity, no further development be allowed to connect into the plant system. This guarantees at least a 10 percent reserve capacity to treat peak flow periods. Based on this standard, the Agat and Commercial Port facilities are already at capacity, while the Agana and Umatac treatment plants have limited remaining capacity to handle significant additional growth.

The recent explosion of development proposals in areas not currently serviced by PUAG (for example, Talofoto, Yona and portions of Mangilao) has resulted in many of these projects being allowed to develop individual wastewater treatment "package" plants to serve individual developments. However, this will make eventual connection of these developments into a centralized wastewater treatment system more difficult and costly.

The amount of wastewater treated in the last three years has grown from an average of almost 13 mgd in 1989 to almost 17 mgd in 1991, while total treatment plant capacity has remained unchanged at approximately 26 mgd, as shown in the following table. A faster than expected growth rate has outpaced the availability of new treatment facilities.

TABLE 2 WASTEWATER TREATMENT PLANT 1991			
TREATMENT PLANT	DESIGN CAPACITY	CURRENT TREATMENT (AVERAGE DAILY FLOW) (GPD)	TREATMENT/CAPACITY RATIO
Agat	750,000	1,200,000	160%
Agana	12,000,000	9,000,000	75%
Baza Gardens, Talofofo	600,000	200,000	33%
Umatac	500,000	400,000	80%
Commercial Port	20,000	20,000	100%
Northern District	12,000,000*	6,000,000	50%
Inarajan	91,300	40,000	44%
Total	25,961,300	16,860,000	N/A

Note: * Approximately 4 mgd of capacity at the northern plant is reserved for military needs.

Source: Public Utility Agency of Guam, 1992.

Potable Water

Potable water is provided to the island by the Public Utility Agency of Guam (PUAG). The agency meets Guam's water requirements in three major ways. Through:

- (1) Well production, primarily using the northern aquifer;
- (2) Surface and spring supplies and;
- (3) Water purchased from Navy and Air Force reservoirs.

There are currently 92 PUAG wells in operation, located primarily over the northern aquifer, and an additional ten wells not in operation. These wells provide approximately 81 percent of the overall island water supply. Surface supplies and springs, including Asan Springs, Santa Rita Springs, Geus River Dam, Siligin Spring, and Laelae (Piga) Spring, provide an estimated three percent of the overall island water supply. The military supplies approximately 16 percent (four mgd) of the total daily island water requirement. The Navy produces the majority of its water supply from the Fena Lake Reservoir system

and the Air Force acquires its water from the Tumon-Maui well and several other wells in the Marbo and Upper Marine Drive area. Presently, the U.S. Air Force, U.S. Navy, and private water systems withdraw over 16 million gallons per day from the northern aquifer.

**TABLE 3
SUMMARY OF PUAG WELLS**

SERIES	GENERAL LOCATION	WELLS IN OPERATION	WELLS UNDER CONSTRUCTION	TOTAL UNDER CONSTRUCTION	TOTAL WELLS
A	Agana	27	0	0	27
AG	Machananao	3	0	0	3
D	Dededo	21	0	0	21
EX	Mangilao	2	0	0	2
F	Finegayan	12	0	0	12
GH	Dededo	1	0	0	1
H	Harmon	1	0	0	1
M	Mangilao	15	0	0	15
MJ	Malojloj	2	0	0	2
Y	Yigo	8	0	0	8
Total		92	0	0	92

Sources: GEPA: Groundwater Management Report, FY 89.
PUAG: Total Production and Purchases of Water for FY 89.

Regional Water Service Areas

Public water service areas are divided into four water service regions, "A" through "D", which are described as follows:

Regional Water Service "A", located in the northern portion of the island and including the communities of Yigo, Machananao (Agafa Gumas), Dededo, and Harmon Village, meets its water requirements through well production and purchased water from the U.S. Air Force. It contains no spring or surface supply sources.

Regional Water Service "B", located in the north central portion of the island, includes the villages of Asan, Piti, Agana Heights, Sinajana, Chalan Pago-Ordot, Mongmong-Toto-Maite, Mangilao, Barrigada, and Tamuning, contains the Asan Springs facility. This facility, originally constructed in 1929, has a storage capacity of 30,000 gallons. The facility also includes two wells. Production pumps run continuously, supplying the Chaot Reservoir.

Regional Water Service "C", including the Agat-Santa Rita area, contains one major water facility, the Santa Rita Springs. This facility has a storage capacity of 105,000 gallons. Additional water requirements in this area are met by water purchased from the U.S. Navy.

Regional Water Service "D", serves the southern portion of Guam, including Yona, Talofofo, Inarajan, Merizo, and Umatac, and has historically been supplied by local streams and springs for their water supply. However, most of these production facilities do not provide adequate treatment of available water supplies. Oftentimes, water pressure is inadequate due to power supply limitations and a lack of backup power supplies. Imported northern groundwater augments water supplies for the southern villages.

TABLE 4 SURFACE AND SPRING SUPPLY FACILITIES		
REGIONAL WATER SERVICE AREA	NAME OF FACILITY	ESTIMATED CAPACITY (GPM)
A	None	-
B	Asan Springs	297
C	Santa Rita Springs	149
D	Geus River Dam	39
	Siligin Spring	10
	Laelae (Piga) Spring	34

Note: Estimated capacity indicates estimated average production only. Accurate records on historical production are not available.

Source: PUAG: Total Production and Purchases of Waters for FY 89.

TABLE 5 EXISTING PUAG WATER CAPACITY BY SERVICE AREA	
SERVICE AREA	WATER CAPACITY IN MILLION GALLONS
Regional Water Service Area "A":	5,500
Regional Water Service Area "B":	6,500
Regional Water Service Area "C":	1,000
Regional Water Service Area "D":	5,800
Total Capacity:	18,800

Source: Barrett Consulting Group.

The Military Water System

The Navy's major water source is Fena Reservoir, located in the Naval Magazine. The reservoir has a capacity of approximately 2.3 billion gallons. In addition, the Navy operates three wells in the Navy Communication Station - Finegayan area. In a 1956 agreement with the Government of Guam, the Navy committed itself to provide a portion of its water supply for Government of Guam use.

The northern groundwater lens is the Air Force's sole source of potable water. The Air Force's major facility is the Tumon-Maui well located in upper Tumon. Water is pumped to as reservoir in Dededo with a capacity of 250,000 gallons. Additional wells are located in the Air Force Marbo Annex area and along Marine Drive. The Air Force and PUAG have discussed a trade in which the Air Force would acquire PUAG water from wells close to Anderson Air Force Base in exchange for its southern area sources, but they have not yet reached an agreement.

Traffic Circulation

The mobility offered by automobiles has helped spread population growth out away from the traditional work places and shopping areas. Traffic flows have increased on the highways around the significant traffic generating land uses (i.e. hotels, shopping centers, offices, airport, etc.). Yet the spreading out of the population has made it difficult to achieve the critical density necessary for mass transit to significantly reduce the number of vehicles on the roadways.

The major residential, commercial, and industrial developments are located in the central portion of the island. Due to traffic generated by that development, most of the very high traffic volumes occur in and around the Agana, Tamuning, and Barrigada areas. Traffic is slowed down further by the poor condition of many roads, inadequate pedestrian access across them, and their frequent flooding during the rainy season. Traffic accident data from the Guam Police Department indicate that highway accidents almost doubled from a decade earlier (from 4,591 in 1980 to 9,181 in 1990), highway deaths increased by more than 50 percent over the same time period, and property damage almost doubled.

Functional Classifications of Streets and Highways

Guam's street and highway network is divided up into four types of roadway: trunk highway, major highway, minor highway and collector road. A trunk highway, such as Route 1 (Marine Drive), connect major population centers and traffic generators and carries large volumes of traffic for long distances. Major highways, such as Routes 7A and 10, connect major population centers and traffic generators to small population centers and carry moderately high volumes of traffic over long distances.

A minor highway, such as Route 4 from Umatac to Yona, connects smaller communities and traffic generators to trunk and major highways and carries moderate volumes of traffic. A collector road, such as Routes 14 and 14A, link traffic from residential, industrial, hotel and institutional areas to trunk, major or minor highways and generally carries moderate to light volumes of traffic. The table below describes the island's existing street and highway network by road classification and number of lanes.

TABLE 6
ROAD CLASSIFICATIONS AND LANES PER ROAD

ROAD	NUMBER OF LANES
<u>Trunk Highways</u>	
Route 1 (Santa Rita to Agana)	4
(Agana to Dededo)	6
<u>Major Highways</u>	
Route 1 (Dededo to Yigo)	4
Route 2A	2
Route 2 (through Agat)	2
Route 4 (through Yona)	4
(Yona to Route 10 (Chalan Pago))	2*
(Route 10 to Route 7A (Agana))	4
(Route 7A to Route 1 (Agana))	6
Route 5	2
Route 10 (Chalan Pago to Barrigada)	4
Route 11	3**
Route 16	4
Route 7	2
Route 8 (Route 1 (Agana) to Route 7A (Maite))	4
(Route 7A (Maite) to Bunny Hardware (Maite))	6
(Bunny Hardware (Maite) to Route 10 (Barrigada))	4
Route 7A (Route 7 (Agana Heights) to Latte Stone Park)	2
(Latte Stone Park to Route 4 (Agana))	4
(Route 4 to Route 8 (Maite))	3**
<u>Minor Highways</u>	
Route 2	2*
Route 4 (Umatac to Yona)	2
Route 3	2
Route 9	2
Route 12	2
Route 4A	2
Route 17	2
Route 6 (Route 1 (Piti) to Nimitz Hill (Asan))	4
(Nimitz Hill to Route 1 (Agana))	2
Route 15	2
Route 27	2
<u>Collector Roads-</u>	
Route 10A	2*
Route 14 (Route 1 (Tamuning) to Flores Circle)	6
(Flores Circle to Route 1 (Upper Tumon))	4
Route 14A	2
Route 14B	2
Route 30	2
Route 30A	2
Route 29	2
Route 32	2

TABLE 6 (CONTINUED)
ROAD CLASSIFICATIONS AND LANES PER ROAD

ROAD	NUMBER OF LANES
Route 33	2
Route 34	2
Route 28	2
Route 26	2

Note: Does not include center turn lanes.
 * Climbing lanes provided on uphill sections.
 ** Two eastbound lanes; one westbound lane.

Source: Department of Public Works and Wilbur Smith & Associates, October, 1991.

The most heavily traveled routes are found in the most heavily urbanized areas of the island which include:

- Marine Drive (Route 1) between Agana and Tamuning where approximately 60,000 vehicles - or about 60 percent of the total number of vehicles registered on Guam in 1990 - travel along this route daily.
- Marine Drive (Route 1) between Asan and Piti where almost 30,000 vehicles pass through every day.
- San Vitores Road (Route 14) in Tumon which handles more than 25,000 vehicles per day.
- Route 8 in Mongmong-Toto which experiences almost 25,000 vehicles per day.
- Route 16 from Barrigada to Mangilao which funnels more than 21,000 commuting vehicles every day to and from work places in Agana and Tumon-Tamuning.

The northern section of the island is also experiencing a significant traffic increase, most notably in Yigo on Marine Drive (Route 1) where over 18,000 vehicles pass through daily, and in Dededo on Route 28 (Y-Sengsong Road) where approximately 12,000 daily vehicle trips have been recorded.

Proposed development in Mangilao and Yona will place additional demand on expanding Route 4, which currently serves more than 11,000 vehicles per day but is projected to increase significantly over the next ten years.

The least travelled routes are in the southern part of the island, including the Agat/Umatac Road (Route 2), which recorded less than 3,000 daily vehicle trips, and Route 4 in Merizo, which recorded only 2,000 daily trips.

Energy

Existing Facilities

Power is provided to the island by the Guam Power Authority (GPA). In 1989, GPA served 30,644 customers. Generation, transmission, and distribution facilities are operated by GPA and the Navy.

The power pool agreement between the Guam Power Authority and the Navy has expired and a new "Customer Supplier Agreement" has been signed by the Navy and is currently waiting approval by the Public Utilities Commission and the Legislature. The new agreement calls for the Guam Power Authority to be the sole energy provider for the entire island with the Navy being a "transmission" customer.

There are three existing civilian generation plants: Cabras, Tanguisson, and Dededo; one Navy-operated generation plant in Piti; and nine substations located in Dededo, Agana, Macheche, Tamuning, Tumon, Harmon, Barrigada, Apra Heights, and Talofofo providing power to the island. Three new generation plants are in the planning stages and will be located in Marbo, Dededo, and Manengon. The Manengon plant will be built by the developers of the Manengon Hills Resort Community and will be turned over to the Guam Power Authority. Existing and proposed power generating facilities and their capacities are described in Table 7.

Power Consumption and System Capacity

Total energy consumption increased by over 68 percent from 1980 to 1990, as shown in Table 8. Increased demand for power from residential and commercial growth generated a peak demand for 205.8 megawatts (MW's) in 1990, compared to a total peak system capacity of 262 MW's, as indicated in Table 9.

TABLE 7
GPA POWER GENERATION - EXISTING AND PROPOSED UNITS

Unit Name	Unit Capacity (MW's)	Type	Existing/Proposed
<u>Base Load Units, MWs</u>			
Cabras Gen 1	66	Steam	Exists
Cabras Gen 2	66	Steam	Exists
Cabras Slow Dsl #1	35	Slow Diesel	Proposed 1996
Cabras Slow Dsl #2	35	Slow Diesel	Proposed 1999
Piti Gen 3*	11.5	Steam	Exists
Piti Gen 4	22.5	Steam	Exists
Piti Gen 5	22.5	Steam	Exists
Tanguisson Gen 1	24	Steam	Exists
Tanguisson Gen 2	26.5	Steam	Exists
Rizal	26.5	N/A	Proposed 2005
<u>Emergency/Peaking Units, MWs</u>			
Cabras G1/G2	2	Diesel	Exists
Dededo G1/G2	4	Diesel	Exists
Dededo G3/G4	4	Diesel	Exists
Dededo CT #1	23	Combustion Turbine	Proposed 1992
Dededo CT #2	23	Combustion Turbine	Proposed 1994
Agana (Navy)	4	Diesel	Exists
Orote (Navy)	4	Diesel	Exists
NCS (Navy)	4.5	Diesel	Exists
AAFB (Navy)	7	Diesel	Exists
Radio Barrigada (Navy)	5	Diesel	Exists
NRMC (Navy)	1.25	Diesel	Exists
Marbo	16	Combustion Turbine	Proposed 1993
Manengon	23	Combustion Turbine	Proposed 1994
Piti CT #1	23	Combustion Turbine	Proposed 1995
Piti CT #2	23	Combustion Turbine	Proposed 2004

Note: * Will be retired with the addition of Piti CT #2.

Source: Guam Power Authority, August, 1991.

TABLE 8
ELECTRICAL POWER CONSUMPTION

FISCAL YEAR	TOTAL CONSUMPTION (MILLION KILOWATT HOURS)
1981	452.8
1982	436.0
1983	439.7
1984	463.5
1985	473.1
1986	508.0
1987	566.3
1988	628.7
1989	701.7
1990	761.3

Note: From 1981-1983, the fiscal year included the 12 months prior to June 30. From 1984-1990, the fiscal year included the 12 months prior to September 30.

Source: 1991 Guam Annual Economic Review.

TABLE 9 ELECTRICAL POWER DEMAND AND CAPACITY		
YEAR	PEAK DEMAND (MWs)	GENERATING CAPACITY (MWs)
1984	146.7	284.00
1985	149.0	284.00
1986	157.5	284.00
1987	169.0	284.00
1988	181.0	284.00
1989	194.5	284.00
1990	205.8	262.75

Source: Guam Power Authority, 1991.

Fast-paced growth and the resulting demand for energy has strained GPA's ability to maintain a consistent power supply. Power outages have been common due to maintenance problems with some power-generating units and the need for "load shedding" because of transferring generating requirements among several different units during peak demand periods. Limited back-up power systems on-island pose problems when major generating units are unable to meet the demand, consequently interrupting water and wastewater service.

Solid Waste Disposal

There are three landfills on Guam - one public landfill, the Ordot Landfill, operated by the Department of Public Works, and two military landfills: the Naval Landfill, located on Naval Station, south of Apra Harbor, and the Air Force Landfill, located on Anderson Air Force Base. There are also three transfer stations operated by DPW, including the Agat and Malojloj stations in southern Guam and the Dededo station in northern Guam. All Air Force generated waste is sent to the Air Force Landfill and all Navy generated waste is sent to the Naval Landfill. All remaining waste is sent to Ordot or to one of the three temporary transfer stations. Waste such as junked cars and large appliances is not sent to Ordot but to one of the transfer stations, where the waste is scrapped and shipped off island.

In 1990, the three landfills received the following amount of solid waste:

- Ordot: Approximately 900,000 cubic yards. Assuming 200 pounds per cubic yard, the Ordot Landfill received approximately 245 tons per day in 1990. Previous studies by the Guam Environmental Protection Agency estimated 150 tons per day for 1980 and 375 tons per day forecasted for the year 2000;

-
- Naval: 476,265 cubic yards; and
 - Air Force: 124,360 cubic yards (with a projected increase of 61 percent to 2000, 360 cubic yards due to temporary increases in construction waste).

Public Safety

Police

Three police precincts serve the island, including the Southern precinct located in Agat, the Central (main) precinct located in Agana, and the Northern precinct located in Dededo. There are two substations, styled after the Japanese "Koban", located in Tumon on Hotel Row and on Farenholt Avenue, Tamuning.

According to the Guam Police Department, Guam's 1990 crime statistics are well below those of comparable sized cities on the United States mainland. The 1990 crime rate generally kept pace with the island's population increase. The population grew 2.7 percent from 1989, while the Uniform Crime Report (UCR) rate grew 2.4 percent per 1,000 population increase. Total crimes have risen slightly from 1985 to 1990 while violent crimes generally held steady. Crimes such as rape and assault increased where as murder decreased.

Adult Correction

The Department of Correction's Adult Correction Facility is located on Dairy Road in Mangilao. The facility has a design capacity of 78 inmates. In 1992, the facility was far beyond capacity with 223 individuals imprisoned.

Youth Correction

Youth Correction is administered by the Department of Youth Affairs at their facility in Mangilao. The Youth Correction Facility is badly outdated and overcrowded, according to the Department. The existing facility has a design capacity of 24 male beds and 18 female beds. During peak periods, the facility houses double the design capacity (approximately 50 males and 40 females). Other youth correction facilities include two small cottage homes in Talofofo (one housing eight males, the other accommodating eight females) and three sanctuary shelters (two in Mangilao and one in Dededo) serving 31 clients.

Fire and Emergency Services

The Guam Fire Department serves the island with eleven fire stations. There are two civilian Search and Rescue facilities on Guam, one at the Agana Boat Basin and the second at the Agat Marina. Ambulance service is provided through the fire stations. There are eight active ambulances and two standby ambulances. The new Talofofo station includes ambulance service for a total of nine active ambulances.

In addition to the services and facilities described above, federal fire and emergency services are available and have been extensively used to meet civilian needs. These services include the United States Coast Guard, Marianas Section, which coordinates overall Search and Rescue for all civil emergencies on Guam, the Navy's HC-5 (H-46 helicopters) and VQ-1 (P-3 airplanes) squadrons which conduct most of the airborne overland and maritime Search and Rescue and MEDEVAC missions, and federal firefighters and Naval Hospital ambulances which, together with the Guam Fire Department, respond to Mass Casualty/Extra Alarm Fires.

All firefighting on the island's military property is performed by either federally employed civilian firefighters or military firefighters. Guam's Fire Department personnel do not cover the military bases.

Health Care

Guam Memorial Hospital, located in Tamuning, is the only public hospital on-island. As of 1992, 135 acute care beds and 23 skilled nursing beds were available. There are 846 staff members including over 100 physicians at Guam Memorial Hospital (GMH).

Also providing mental and physical health services are the Department of Public Health and Social Services (DPHSS) and the Department of Mental Health and Substance Abuse (DMHSA). DPHSS houses a main facility in Mangilao with field offices in Dededo and Inarajan. DMHSA is currently utilizing the old hospital facility in Tamuning, however, a new building is currently under construction. The remainder of (non-military) health care on Guam is provided by private facilities, the majority of which are through group insurance programs. The military is provided health care services by the U.S. Naval Hospital in Agana Heights.

Education

Public Schools

The delivery of educational services is one of the most important roles the Territorial Government plays in regards to its citizens. Providing an adequate education has become one of the foundations for sound economic development policy. Producing a work force with the educational background to compete locally (Guam), regionally (Micronesia), nationally (United States) and internationally (Asia), will be one of the great challenges facing Guam during the next decade. Attending the University of Guam and U.S. mainland universities after completing compulsory elementary and secondary education is one of the most advantageous opportunities available to many young residents. Job skills, vocational training, and higher education opportunities all rely on a fundamental quality public education system at the elementary and secondary level.

The demand on educational facilities by immigration has produced overcrowded classrooms on the island giving rise to a significant problem facing the island today. Responding to this problem, a new elementary school, Central Elementary, is planned and two new high schools have been approved for construction, one for the northern districts and one for the southern municipalities. In the interim, numerous temporary classrooms have been constructed to meet the required student/classroom ratio, as shown in Table 10. However, according to island residents, parents, students and teachers, the problem is that the temporary structures tend to become "permanent" and that these structures do not adequately meet the needs of the students and teachers and, furthermore, do not ease the strain on other school facilities, such as recreational facilities, cafeterias, etc.

While the data suggest room for improvement in the quality of education, and examination of the physical capabilities of the public school system may indicate some of the symptomatic conditions affecting the quality of education.

Public school enrollment has maintained a relatively stable population over the last five years as exhibited in Table 11. Total elementary and secondary enrollment topped 26,000 students in 1990. Projections from the Guam Department of Education indicate an increase to approximately 36,000 public school students are expected by the year 2010.

TABLE 10
ENROLLMENT AND NUMBER OF CLASSROOMS, 1991-1992 SCHOOL YEAR

CAMPUS	ENROLLMENT	NUMBER OF CLASSROOMS		
		PERMANENT	TEMPORARY	TOTAL
<u>HIGH SCHOOLS</u>				
Inarajan High	482	41	-	41
Sanchez High	1704	51	51	66
Oceanview High	1000	N/A	-	N/A
George Washington High	2033	88	1	89*
John F. Kennedy High	2199	79	5	84
<i>Total High School</i>	<i>7418</i>			<i>280</i>
<u>MIDDLE SCHOOLS</u>				
Untalan Middle	1004	32	12	44
Johnston Middle	1069	60	-	60
Dededo Middle	1764	63	2	65
Piti Middle	760	34	-	34
Inarajan Middle	411	5	20	25
Leon Guerrero Middle	1317	46	5	51
<i>Total Middle School</i>	<i>6325</i>			<i>279</i>
<u>ELEMENTARY SCHOOLS</u>				
Agana Heights	443	18	3	21
Agat	844	45	-	45
Upi	845	45	7	52
Carbullido	495	23	2	25
Ordot-Chalan Pago	396	19	-	19
San Miguel	546	99	-	99
Finegayan	364	39	13	52
Lujan	839	46	-	46
Ulloa	1253	-	-	50
Sanchez	119	18	-	18
Inarajan	323	-	-	23
Merizo	279	-	-	20
P. Lujan	694	34	-	34
Price	767	30*	5*	35*
Torres	333	12	3	15
Taitano	595	34	-	34
Talofofo	278	-	-	19
Tamuning	537	-	-	30
Wettengel	791	-	-	35
Truman	589	16	7	23
Yigo	916	-	-	39
Johnson	296	18	3	21
Harmon Loop	735	-	-	35
<i>Total Elementary School</i>	<i>13,277</i>			<i>790</i>

Notes: * 1979-1980 figure

Data for all schools is unavailable at this time. As of Fall 1991, the Department of Education is gathering information on each school's capacity (number of permanent and temporary classrooms).

Source: Department of Education.

**TABLE 11
PUBLIC SCHOOL ENROLLMENT**

ACADEMIC YEAR	ELEMENTARY K-5	MIDDLE 6-8	SENIOR HIGH 9-12	UNGRADED SCHOOL *	TOTAL
1986-1987	12,812	5528	6804	150	25,294
1987-1988	12,696	5632	7078	145	25,551
1988-1989	12,711	5582	7258	124	25,675
1989-1990	13,306	5622	7121	81	26,130
1990-1991	13,332	5564	7046	69	26,011

Note: Enrollment figures do not include Guam Community College High School.
* Brodie Memorial School.

The student-teacher ratio for the 1990-1991 school year was 17.3 students per teacher. The student/classroom ratio was 27 students per room. These ratios were set by the Department of Education and the Guam Federation of Teachers. The actual 1990-1991 student/teacher ratio was 26,011 students to 1,501 teachers or 17.3 students per teacher (see the following table).

**TABLE 12
PUBLIC SCHOOL STUDENT/TEACHER RATIO**

ACADEMIC YEAR	ELEMENTARY			SECONDARY			TOTAL		
	STUDENT	TEACHER	RATIO	STUDENT	TEACHER	RATIO	STUDENT	TEACHER	RATIO
1986-1987	12,812	734	17.5	12,332	677	18.2	25,144	1411	17.8
1987-1988	12,841	714	18.0	12,710	675	18.8	25,551	1389	18.4
1988-1989	12,835	701	18.3	12,840	678	18.9	25,675	1379	18.6
1989-1990	13,387	172	17.1	12,743	821	15.5	26,130	1603	16.3
1990-1991	13,401	784	17.1	12,610	717	17.6	26,011	1501	17.3

Note: Figures do not include Guam Community College High School.

Source: Department of Education, October, 1991.

Parks and Recreation

There are several different types of park lands on the island: national parks, territorial parks, natural preserves (which are to remain unimproved), conservation reserves (which can be improved to provide access to park users while still preserving natural features), historic sites, community parks, territorial recreation facilities and community recreation facilities. The national parks - the six parks designated as units of the "War in the Pacific National Historic Park" - are administered by the United States National Park System. These include the Asan Beach Unit, the Asan Inland Unit, the Mt. Tenjo/Mt. Chaochao Unit, the Mt. Alifan Unit, the Agat Unit and the Piti Guns Unit. At the present time, the parks are not

fully developed and not all have facilities available to the public. The territorial parks, natural preserves, conservation reserves and historic sites come under the jurisdiction of the Department of Parks and Recreation.

There are a total of eleven major beach parks and numerous other scenic vista points and places of interest, including Ypao and Tanguisson Beaches in the north and Talofofo, Saluglula, Merizo and Nimitz Beach Parks in the south.

In 1978, 8,885 acres of land and 6,276 acres of submerged land were reserved as the Guam Territorial Seashore Park. The area contains three significant features. These are the southern mountains, Fouha Bay to Facpi Point Coastline, and Cocos Lagoon. The park was created to conserve these important natural features along with the historic features found in the area. Historic features include Chamorro village sites, Spanish ruins such as bridges and forts, an early American school house, and features from World War II such as a Japanese Zero airplane. The Seashore Park will allow expansion of the present villages and does not include private land. Thus, this area of Guam will provide opportunities for outdoor recreation, managing renewable resources, and provide an economic incentive for southwest Guam.

Additionally, several parcels of federal land are still being considered for transfer from the Department of Defense to the Government of Guam under the General Services Administration. This transfer of surplus real property for public park, recreation, and wildlife conservation purposes is long overdue. Applications were originally prepared in 1985 for Hilaan Beach, Tanguisson Beach, and the Masso Reservoir. A portion of Cocos Island was transferred to the Department in 1982.

Community parks and their associated recreational facilities comprise the village level community center system. These parks and facilities are managed by the appropriate village mayors.

As a part of the 1989 Guam Comprehensive Outdoor Recreation Plan, the DPR assessed the relative demand for recreational facilities in Guam. Demand for activities are listed in terms of their relative priority assessed by DPR.

Playground facilities cater to a large segment of Guam's children and young adults. Schools, public parks, neighborhood parks, private nurseries, church grounds and beaches provide the facilities for these active youngsters. Guam is no exception to mainland communities in its growing support for physical fitness programs. Joggers are seen in neighborhood streets and sidewalks, in parks and open fields, beaches, and even highways. Some paths have been designed specifically for jogging.

In the baseball, basketball, and volleyball activity categories, there appears to be adequate facilities.

However, many of the fields and courts are school-owned and are not generally available beyond school use. Many facilities need renovation. Demand is increasing for more neighborhood sports facilities.

Water skiing, jet skiing, scuba diving, wind surfing, and fishing areas are difficult to measure. The open sea surrounding Guam is limitless. The problems of conflicting usage continues to grow due to tourism and development. Rental companies for this equipment desire beach front properties, while the fishermen want them for fishing grounds. Large areas of beach land under military ownership are not open to the public. There are also thousands of acres of undeveloped public owned beach land which could be developed to accommodate the growing demand for these recreation activities.

Guam is becoming a golf course mecca. The island already has the equivalent of nine existing golf courses and significantly more have been proposed for development.

Tennis is popular on the island, and demand generally exceeds the supply of courts available for use. More football, soccer, and hockey fields are needed. Multi-purpose sport developments can provide a variety of facilities within the limited spaces available for such developments. Schools provide a majority of the currently usable fields.

Boating and sailing are increasingly popular recreation activities on Guam. Many persons may desire to sail or to go boating, but do not own boats due to a lack of facilities. There were more than 550 registered boats on the island in 1990.

Bicycling is becoming increasingly popular in Guam. The desire to bicycle seems to be much greater than the actual number of persons who bicycle, due to limited designated bicycle paths. Some paths are currently designated for this purpose; however sidewalks and secondary roads are often used by those who enjoy this activity.

Hunting on Guam is a seasonal activity. Thousands of acres of undeveloped land at Andersen Air Force Base and public and private lands islandwide support wild deer, pigs, goats, and fowl. Hunters' permits are issued by the Department of Agriculture. Limited hunting on Andersen Air Force Base is available to the public. The need at this time is more than adequately met.

A system of hiking trails on Guam has been identified. Numerous public areas, especially mountain trails and historic site trails, are being identified and developed which will meet the growing demand.

Surfing is a popular sport but is hindered due to an accessibility problem. Existing surfing areas are being used and new areas are difficult to create.

Camping is increasing in popularity as a recreation activity on Guam. Camping is desired especially on beaches and in the mountain areas. Additional acreage of camp sites could possibly be developed in the southern mountains of Guam.

Horseback riding is another activity with high interest. A horse ranch and undeveloped riding areas have satisfied the present demand of riders.

Canoeing or river boating occurs on certain rivers and streams, since there are no interior water bodies large enough to allow for canoeing. Since there has been an interest shown for this activity, an area such as the Piti Channel could possibly be developed and promoted for this sport.

Outdoor cultural activities are quite extensive and include historic sites, cultural projects, the amphitheater, and private developments. These activities are encouraged. The Department of Parks and Recreation assists other government agencies and private groups in the organization and planning of cultural activities and in the development of sites. An important part of Guam's lifestyle today is the interest and support given to the island's recreational programs. However, the full outdoor recreation potential has yet to be realized. The military services maintain developed facilities for their personnel which are not available to most island residents or to tourists. The limited facilities of the Government of Guam and private groups are primarily devoted to beaches, sports, and games. Many beaches, dramatic waterfalls and the most beautiful scenic areas are seen and used by only the most adventuresome individuals.

The anticipated growth of Guam's population will create increasing demands for added parks and recreation services. Many of the island's existing and potential outdoor recreation sites can be improved without damaging the scenic and natural values of the areas. These values can be enhanced by the proper development of the areas through continued maintenance, landscaping, and control of pollution, vehicles, and public access.

With an increasing trend towards subdivision development, provision of space for neighborhood recreational facilities is needed and should be required of the developer by the government to meet the recreation needs generated by their development.

**TABLE 13
INVENTORY OF PARK AND RECREATIONAL FACILITIES BY VILLAGE**

PARK NAME	ACREAGE	ACTIVITIES AND FACILITIES
<u>AGANA</u>		
Agana Central	45.0 Acres	Swimming Pool, 4 tennis courts, 2 handball courts, playground equipment, parking, pool building with restrooms, classroom building, and drinking water.
Agana Naval Cemetery	0.7403 Acre	Park/Cemetery.
Agana Springs	24.91 Acres	Freshwater wildlife pool.
East Agana Beach	10.0 Acres	6 picnic units, fishing, parking, snorkeling and swimming.
Fort Santa Agueda, Government House, and Latte Stone Park	41.15 Acres	Relocated Latte Stones, 1 shelter, 3 benches, 3 litter containers, parking, 2 restrooms, viewing area, Japanese Caves, governor's residence, and Spanish Fort.
Japanese Caves	1.0 Acre	Caves.
Marine Drive Strip	4.0 Acres	Marine Drive Historical Marker.
Padre Palomo Memorial	0.8 Acre	Padre Palomo Monument, snorkeling, swimming, one picnic table, 2 benches, water and power.
Paseo de Susana	26.0 Acres	Lighted multi-purpose court with bleachers, pavilion with lights and power, 4 outside picnic tables, 2 shelters with tables, 1 bench, lighted baseball field with bleachers, drinking water, fishing, 3 sets of restrooms, parking, viewing area, ping pong/pool tables, Farmers' Market, Sagan Dinana, Japanese Pillbox, and Chief Quipuha Monument.
Plaza de Espana	6.0 Acres	Drinking fountain, 1 outside picnic table, 7 benches, 10 litter containers, historic site, museum, play apparatus, Azotea, with power and lights, Kiosko, and Chocolate House.
San Antonio Bridge	0.8 Acre	Historic site, 1 picnic table, 2 benches, 4 litter containers, and Sirena Statue.
San Ramon Hill Triangle	2.5 Acres	None.
Skinner Plaza	2.8 Acres	28 benches, 8 litter containers, memorial markers, sculpture.
West Agana Beach	8.0 Acres	14 outside picnic tables, 20 litter containers, 1 dumpster, fishing, parking, snorkeling, and swimming.

TABLE 13 (CONTINUED) INVENTORY OF PARK AND RECREATIONAL FACILITIES BY VILLAGE		
PARK NAME	ACREAGE	ACTIVITIES AND FACILITIES
<u>AGANA HEIGHTS</u>		
Headquarters Building, Department of Parks and Recreation	1.19 Acres	Administration Office Building.
Incinerator	1.265 Acres	Incinerator Building, and asphalt pavement existing.
<u>AGAT</u>		
Nimitz Beach	10.0 Acres	Undeveloped boat launching area, parking lot, water, 2 restrooms, and fiesta pavilion with lights and power, swimming, camping, fishing, and scuba diving.
Old Agat Family Beach	2.0 Acres	Swimming, snorkeling, 1 shelter, outside picnic table, picnic table with shelter, 1 litter container, 5 barbecue pits.
Talayag Bridge	0.2 Acre	Historic Site.
Taleyac Bridge	0.2 Acre	Historic Site, 1 litter container.
<u>ASAN</u>		
Adelup	6.7 Acres	Steps to WWII Japanese defense structure remains and marble plaque, 13 picnic shelters 2 pavilions, 22 outside picnic tables, 2 picnic tables with shelters, 3 benches, 20 litter containers, 2 dumpsters, 20 litter containers, 22 barbecue pits, and 9 parking lots.
Asan Memorial Beach	4.0 Acres	Fishing, historic site, parking, 3 litter containers, and scuba diving.
Libungon Vista	0.6 Acre	Scenic overlook and litter container.
<u>CHALAN PAGO-ORDOT</u>		
Francisco F. (Gonga) Perez Picnic Facility	2.0 Acres	1 pavilion with 2 picnic tables and benches, 2 restrooms, 2 litter containers, and a parking lot.
<u>DEDEDO</u>		
Astumbo Gardens Park	3.0 Acres	1 sand area, 1 baseball field, and fencing.
Buffer Strip	20.0 Acres	2 picnic shelters with table and benches, power and water, and 2 barbecue pits.
Fern Terrace	3.2 Acres	1 sand area, 1 lighted multi-purpose court, walkways, and fencing.

TABLE 13 (CONTINUED)
INVENTORY OF PARK AND RECREATIONAL FACILITIES BY VILLAGE

PARK NAME	ACREAGE	ACTIVITIES AND FACILITIES
GHURA 501	2.8 Acres	Sand area, playground equipment.
GHURA 505	3.7 Acres	1 sand area, multi-purpose court, 1 baseball field, playground equipment.
GHURA 506	5.5 Acres	Multi-purpose court, tennis court, play apparatus, 2 restrooms, 2 drinking fountains, and 1 barbecue pit, 1 picnic table with shelter.
Kaiser #7	1.0 Acre	Handball court.
Kaiser #8	4.0 Acres	Multi-purpose court, tennis court, play apparatus, 2 restrooms, 2 drinking fountains, and 1 barbecue pit, 1 picnic table with shelter.
Liguan Terrace Recreation Area 1, Tract 100	5.1 Acres	2 multi-purpose courts, play apparatus area, 1 shelter, 1 barbecue pit, and a parking lot.
Liguan Terrace Recreation Area 2 Tract 100	2.6 Acres	2 multi-purpose courts, play apparatus area, 1 shelter, 1 barbecue pit, and parking lot.
Liguan Terrace Recreation Area 3, Tract 100	5.3 Acres	1 multi-purpose court, parking lot, 1 shelter, 1 volleyball court, play apparatus area, and 1 barbecue pit.
Parcel 2	270.0 Acres	None.
Wettengel	4.0 Acres	1 baseball field, football/soccer field, 1 shelter, 2 restrooms, 14 benches, 6 litter containers, and parking lot.
Ypaopao	0.5 Acre	Multi-purpose court and playground apparatus area.
Ypaopao	2.5 Acres	Baseball field.
<u>INARAJAN</u>		
Asiga	90.0 Acres	Historic site, trails and camp sites.
Bebesbes Beach	10.0 Acres	None.
Inarajan Bay	7.0 Acres	Historic site and shelter.
Inarajan Falls	UNKNOWN	Historic site.
Saluglula Pool	7.9 Acres	1 pavilion, 2 restroom facilities, 7 outside picnic tables, 7 picnic tables with shelters, 3 benches, 6 litter containers, 3 drinking fountains, 2 showers, 6 barbecue pits, and parking.

TABLE 13 (CONTINUED)
INVENTORY OF PARK AND RECREATIONAL FACILITIES BY VILLAGE

PARK NAME	ACREAGE	ACTIVITIES AND FACILITIES
Talofofo Beach	7.0 Acres	1 shelters with picnic tables, 2 restroom facilities, 3 outside picnic tables, 5 benches, 3 litter containers, 3 barbecue pits and 2 parking lots.
<u>MANGILAO</u>		
Pagat	4.0 Acres	1 baseball field and 1 basketball court.
<u>MERIZO</u>		
Merizo Public Cemetery	5.0 Acres	Cemetery/Park.
<u>MONGMONG-TOTO-MAITE</u>		
Maintenance Shop	0.8 Acre	Maintenance shop.
<u>PITI</u>		
Atantano Shrine	0.2 Acre	Historic site, shrine with shelter.
Guam Veterans Cemetery	N/A	Cemetery/Park.
Masso Reservoir	28.0 + Acres	Camping, fishing, picnicking, and hiking.
Nimitz Hill	2.0 Acres	1 picnic table with shelter, 1 barbecue pit, 3 benches, playground, 1 volleyball court.
Tepugan Beach	1.0 Acre	Fishing, snorkeling, swimming, and scuba diving (day and night).
Vicente A. Limtiaco Memorial Cemetery	30.0 Acres	Park/Cemetery, 6 litter containers.
<u>SANTA RITA</u>		
Afleje Memorial Park	10.0 Acres	2 restroom facilities, a barbecue pit, swimming, snorkeling, and scuba diving.
<u>TALOFOFO</u>		
Aratama Maru	N/A	Historic site.
Asquiroga Cave	20.0 Acres	Historic site and trail.
Ipan Beach	4.0 Acres	2 shelters with picnic tables, 2 restroom facilities, 10 outside picnic tables, 4 litter containers, 1 dumpster, 4 drinking fountains, and 7 barbecue pits.

TABLE 13 (CONTINUED)
INVENTORY OF PARK RECREATIONAL FACILITIES BY VILLAGE

PARK NAME	ACREAGE	ACTIVITIES AND FACILITIES
<u>TAMUNING</u>		
Chinese Park	2.6 Acres	1 shelter, 2 restrooms, 12 benches, 6 litter containers, and a parking lot.
Devil's Punch Bowl	2.6 Acres	Topographical feature of a sink hole.
Matapang Beach	5.2 Acres	5 litter containers, parking lot, swimming, snorkeling, and fishing.
Puntan dos Amantes	28.8 Acres	2 restrooms, 2 outside picnic tables, 7 benches, 9 litter containers, 2 barbecue pits, parking lot, and viewing area.
Tamuning Cliff	55.0 Acres	Natural preserve.
Tanguisson Beach	20.6 Acres	2 pavilions, 2 outside picnic tables, 4 litter containers, 5 barbecue pits, parking lot, sand area, swimming, and snorkeling.
Governor Joseph Flores	30.0 Acres	2 volleyball courts, 22 shelters with picnic tables, 1 pavilion, 1 amphitheater, 9 restroom facilities, 5 outside picnic tables, 40 litter containers, 4 dumpsters, 2 drinking fountains, 4 showers, 24 barbecue pits, 3 parking lots, 2 playgrounds.
<u>UMATAC</u>		
San Dionisio Church Ruins	0.6 Acre	Historic site.
Umatac Bay	7.2 Acres	4 outside picnic tables, 4 benches, 2 litter containers, 2 drinking fountains, 3 barbecue pits.
<u>YIGO</u>		
Anao	650.0 Acres	Natural preserves.
Lujuna Site	45.9 Acres	Historic site.
Pagat Site	100.0 Acres	Historic site.
Ponderosa Park	0.6 Acre	Playground apparatus.
Y-Piga	16.0 Acres	Natural preserve.

TABLE 13 (CONTINUED)
INVENTORY OF PARK AND RECREATIONAL FACILITIES BY VILLAGE

PARK NAME	ACREAGE	ACTIVITIES AND FACILITIES
<u>YONA</u>		
Col. Stanley Bohnic	5.0 Acres	1 baseball field, 2 litter containers.
Man Apu	1.0 Acre	1 basketball court and playground equipment.
Ralph Balajadia	1.0 Acre	13 benches and play apparatus area.
Tagachang Beach	114.0 Acres	3 shelters with picnic tables, 1 pavilion, 2 restroom facilities, 5 litter containers, 1 shower, 5 barbecue pits, and parking lot.
<u>GUAM TERRITORIAL SEASHORE PARK</u>		
Dano, Merizo	21.0 Acres	2 shelters, 2 restroom facilities, 3 outside picnic tables, 3 barbecue pits, camping, picnicking, and hiking.
Merizo Pier	6.0 Acres	1 basketball court, 3 shelters with picnic tables, 2 restroom facilities, 3 outside picnic tables, 6 benches, 2 litter containers, 5 barbecue pits, playground equipment, fishing, swimming, and snorkeling.
Cetti Bay Overlook	1.0 Acre	1 shelter with picnic table, 7 benches, 2 litter containers, and parking lot.
Fort San Jose	2.6 Acres	Historic site.
Fort Soledad	8.0 Acres	1 shelter with picnic table, 2 restroom facilities, 6 benches, 2 litter containers, and 1 drinking fountain.
Memorias Para i Lalahita	1.0 Acre	1 shelter, 2 benches, 2 litter containers, 1 drinking fountain.
Sella Bay Overlook	1.0 Acre	N/A.
Sella Bay Trailhead	1.0 Acre	N/A.

Source: Guam Department of Parks and Recreation.

CURRENT CAPITAL IMPROVEMENT PROJECTS

Existing revenue sources and available funding mechanisms for capital improvements include the General Fund, which includes Section 30 funds (an income tax revenue generated from all federal employees on Guam and returned to Guam by the federal government), the Special Revenue Fund (this includes the Tourist Attraction Fund—a revenue generated by taxing hotels and other tourist uses) and federal funds

(grants). The following table represents a list of existing ongoing public and private Capital Improvement Projects in 1992 that could significantly affect the island's land use pattern. In addition to these projects, operation and maintenance improvement projects are planned for island-wide public facility and service improvements, including roadway, water, sewer, telephone, power, drainage, solid waste, school, park, and library improvements.

TABLE 14 MAJOR PROPOSED CAPITAL IMPROVEMENT PROJECTS, 1992			
PROJECT	VILLAGE	AGENCY	COMPLETION DATE
A/E Two Public Golf Courses	-	Parks	-
GPA Slow Burn Diesel Generator	Piti	GPA	'95-'96
New Legislature Building	Agana	Legislature	-
New Rec. Bldgs, Pasco Rec. Area	Agana	Parks	-
New Public Market	Agana	Commerce	5/94
Agana Spring/Afame Sewer Collect.	Agana	PUAG	4/92
Agana Heights Gym	Agana Heights	DPW	-
Chaligan/Talefac Sewer System	Agat	PUAG	-
Access Road-OHS	Agat	DPW	-
RR Cruz Subdivision Rds/Sidewalk	Agat	DPW	-
Agat Swimming Pool	Agat	DPW	-
Agat/Santa Rita Sewer Phase 1	Agat/Santa Rita	PUAG	12/92
Central Elementary School	Asan	DOE	-
82 Subsidized Housing Units	Asan/Ded/Mer/Tal	GHURA	-
"Koban"-type Police Box	Chalan Pago/Ordot	GPD	-
Macheche-Mogfog Sewer System	Dededo	PUAG	-
Astumbo Subdivision Infrastructure	Dededo	DPW	-
Sidewalk Y-Sengsong, Sta. Monica	Dededo	DPW	-
Liguan Terrace Baseball Field	Dededo	DPW	-
Olympic Swimming Pool	Dededo	DPW	-
Harmon Loop Sports Complex	Dededo	DPW	-
Livestock Service Facility	Dededo	DPW	-
Police Substations	Ded/Agat/Tam	GPD	-
Inaraj./Maloj. Water Source (Ugum)	Inarajan	PUAG	'92-'93
Access Road	Inarajan	DPW	-
Malojloj Baseball Field	Inarajan	DPW	-
Inarajan Boat Ramp	Inarajan	Parks, DPW	1/1/92
113 School Classrooms	Island-wide	DOE	-
Mangilao Baseball Field	Mangilao	DPW	-
Latte Heights Park	Mangilao	DPW	-
"Koban"-type Police Box	Mangilao	GPD	-
Merizo Flood Control Project	Merizo	DPW	-
Merizo Public Cemetery	Merizo	DPW	-
Sewer Lines	Mongmong	PUAG	-
D/C New Community Center	Mongmong	DPW	5/1/91
Two New High Schools	North/South	DOE	-

TABLE 14 (CONTINUED) MAJOR PROPOSED CAPITAL IMPROVEMENT PROJECTS, 1992			
PROJECT	VILLAGE	AGENCY	COMPLETION DATE
Garbage/landfills/recycling	Ordot	GEPA	-
Sidewalks-Ordot and A. J. Elementary	Ordot/Chalan Pago	DPW	-
A/E Multi-purpose Building	Piti	DPW	-
Recreational Facility	Tamuning	DPW	1/1/91
New Mental Health Building	Tamuning	DMHSA	1/23/92
New Guam Visitors Bureau	Tumon	GVB	-
San Vitores Rd. Completion	Tumon	DPW	-
Yigo Firestation	Yigo	GFD	-
Water Facilities Anao Subdivision	Yigo	PUAG	-
Yigo/Dededo Water Source Improvement	Yigo/Dededo	PUAG	-
Slaughterhouse	Yigo	Agriculture	-
Speedway Park	Yigo	Parks	-
Yigo Community Center	Yigo	DPW	-
Yona Library	Yona	Library	-
"Koban"-type Police Box	Yona	GPD	-
Miyama Hills Generator	Yona	GPA	3/93

Source: Bureau of Planning, Government of Guam.

The current capital improvement projects consist of those planned improvements already "in the pipeline" insofar as GovGuam agencies are concerned. The inventory attempts to identify only those projects which will improve the capacity of existing public facilities and which are largely driven by population growth. These facilities are listed by relative infrastructure type (e.g., sanitary sewer) or service provider (e.g. PUAG) by village. Classifying improvements by village allows easier comparison to future population growth demands. Facility needs which recur on a periodic basis (e.g., operation and maintenance costs) and those that are not necessarily population-driven (e.g., flood control projects) are not generally included in this assessment.

Sanitary Sewer and Potable Water

Public potable water and wastewater treatment services are provided by PUAG. Based on current trends PUAG is moving forward on a proposal for a new 9-12 mgd wastewater treatment plant in Agat to replace the existing facility and upgrade effluent treatment to the secondary level. It is also likely that a new plant will be necessary in the Fadian Point area to serve proposed development in Mangilao and Pago Bay.

As the island continues to grow, the upgrading of the overall wastewater treatment system will increase in importance. PUAG's highest priority future projects include the Baza Gardens Sewer Treatment Plant Modifications, Agat/Santa Rita Sewer System Phase One, Agat/Santa Rita Sewer System Phase Two, and development of the Talofoto Village Sewer System.

The major problem with the water system and its reliance on the military supply for water supplements is the unaccounted loss of large amounts of water. The primary cause for this loss (which accounts for as much as 30-40 percent of total water production) is the age of the water lines and the need for new and updated distribution systems. Improvements to water lines along the island's roadways have been made as the roadway system has been upgraded. According to the 1990 Preliminary Water Master Plan Update, prepared by Barrett Consulting Group, the loss rate could be reduced to 15 percent by the year 2010 if comprehensive leak detection, meter maintenance, and water conservation programs are implemented.

The availability of water is one of the major constraints to the island's continued growth.

Due to rapid growth over the last decade, annual water production (consumption plus water loss) has more than doubled - from four billion gallons in 1979 to almost nine billion gallons in 1989. The island-wide existing capacity of the PUAG system is more than 18 billion gallons. Current shortages are caused by the inefficiencies in the existing delivery system and are not due to a lack of available supply on the island. However, additional capacity will be required to supply the demand from pending and proposed major development projects.

According to the Guam Environmental Protection Agency, the northern water lens has a production capacity of approximately 58-60 million gallons per day (mgd), while 1991 production is about 30 million gallons per day. Additional wells in this area will need to be developed in the future. However, past studies have suggested that the lens may be susceptible to significant saltwater intrusion if sustained yields reach 50 mgd. Approximately 18 mgd of this lens is located under Anderson Air Force Base. PUAG does not have wells operating in this district of the island. Thus, the available supply to PUAG may only be in the 40-42 mgd range.

However, with significant additional yields, the potential for salt water to be drawn in and contaminate the groundwater (which supplies more than 80 percent of the overall island water needs) is increased. Improper land uses in high recharge areas can further accelerate contamination through the discharge of chemical or toxic substances.

Two of PUAG's larger proposed projects to develop new water sources for the island are, in the north, improvements to Yigo/Dededo water sources and, in the south, the utilization of the Ugum River as a primary surface water source for the Inarajan/Malojloj areas.

However, surface water supplies have expanded over the last decade to a point where they have assumed a greater share of the overall water supply for the island. For example, in 1977 groundwater supplied over 90 percent of the total island-wide water consumption, compared to slightly over 80 percent in 1990.

However, surface water supplies have expanded over the last decade to a point where they have assumed a greater share of the overall water supply for the island. For example, in 1977 groundwater supplied over 90 percent of the total island-wide water consumption, compared to slightly over 80 percent in 1990. This trend is expected to continue as PUAG searches for other means to curtail the consumption rate from the northern aquifer and augment the total island-wide water supply with surface water sources.

Nevertheless, the bulk of future sources are most likely to originate in the northern lens. Southern surface water sources are particularly susceptible to droughts and are not seen as reliable as groundwater sources.

The current PUAG water and wastewater project summary is contained in the following table 15.

Traffic Circulation

Highway improvements are undertaken by DPW through a variety of funding sources, including federal aid projects, highway revenue maintenance funds, and infrastructure improvement bond projects. These projects include the construction of new access roads in the areas of Agat, Yigo, and Inarajan, the reconstruction of several roads, including San Vitores Road in Tumon, new sidewalks in the areas of Agat, Dededo, and Chalan Pago-Ordot, new signalization and streetlights on various streets, and maintenance of roadways island-wide.

An island-wide 20-year Highway Master Plan has recently been completed by Wilbur Smith and Associates and Duenas and Associates for DPW. This plan recommends specific improvements necessary to maintain an efficient level of service for island roadways to the year 2010. The proposed short-range (five year) improvement plan is outlines in Table 16.

TABLE 15
WASTEWATER AND POTABLE WATER CAPITAL IMPROVEMENT PROJECTS

VILLAGE	PROJECT TYPE	PROJECT DESCRIPTION
Agana	Sewer	Chaot/Marine Drive relief sewer along Route 4 to Route 1.
Agana	Sewer	Sewerlines around Agana Spring and Afame, Sinajana.
Agana	Sewer	Sewerlines on thirteen streets in Agana Heights.
Agat	Sewer	Agat/Santa Rita Sewer, Phase I design and construction of new forcemain, pump stations and transmission lines.
Agat	Sewer/Water	Design and construction of R. R. Cruz Subdivision Water/Sewer System.
Agat	Sewer	Agat/Santa Rita Sewer, Phase II design and construction of new wastewater treatment plant.
Agat	Sewer	Design/Construct sewerlines on Route 2 and on ten village streets in Chaligan/Taleyfac.
Agat	Sewer	Installation of sewer laterals along Babauta and Naoua Roads.
Asan	Sewer	Design forcemain and pump stations for Nimitz Hill turner Road and Dean Brothers Subdivision.
Barrigada	Sewer	Design/construct sewer collector lines along West Brook Road.
Barrigada	Sewer	Liguan Terrace/Barrigada Heights pump station and forcemain.
Barrigada	Sewer	Sewer collector lines along Bello Road.
Dededo	Sewer	Expand southern link pump station to increase capacity from 8,000 GPM to 22,000 GPM.

TABLE 15 (CONTINUED)
WASTEWATER AND POTABLE WATER CAPITAL IMPROVEMENT PROJECTS

VILLAGE	PROJECT TYPE	PROJECT DESCRIPTION
Dededo	Sewer	Design/construct sewer collector system for Macheche-Mogfog.
Dededo	Sewer	Design/construct main sewer trunk line from GTA Building in Dededo to Southern link Pump station in Liguán Terrace.
Dededo	Sewer	Design/construct forcemain from southern link pump station to northern District Treatment Plant.
Dededo	Sewer	Design/construct new sewer collector lines behind Hotel Plumeria.
Mangilao	Sewer	Design/construct sewer collector lines in Lalo District.
Mangilao	Sewer	Design/construct sewer lines in BMP.
Mangilao	Sewer	Construction of sewer lines along Tenorio Street.
Mangilao	Sewer	Design/construct sewer collector line along Chalan Kareta/Talayo Street.
Mangilao	Sewer	Design/construct sewer collector lines along Mamis Villa Subdivision.
Mongmong/ Toto/Maite	Sewer	Design collector gravity and forcemain collector lines.
Ordot/Chalan Pago	Sewer	Design/construct sewer collector lines.
Ordot/Chalan Pago	Sewer	Design/construct sewer collector line for Ordot-Chalan Pago Elementary School.
Piti	Sewer	Design/Construct sewer collector lines along J. R/ Roberto and Bela Street.
Santa Rita	Sewer	Design/construct sewer collector lines in lower Santa Rita area/San Vicente area.
Talofofo	Sewer	A study of the feasibility to install sewerlines in the southern Guam area from Talofofo Bay to Agat.
Talofofo	Sewer	Design/construct sewer collector lines in Camp Watkins area.
Tamuning	Sewer	Design/construct sewerlines to reverse flow of Mamajanao Pump Station.
Tamuning	Sewer	Design/construct sewerlines from Ypao Beach P. S. to Mamajanao P.S. and a new pump station near Brodie School.
Tamuning	Sewer	Design/construct sewer collector lines in Harmon Industrial Park.
Tamuning	Sewer	Design/construct sewerline in South Luisa Street and Palm Court areas adjacent to Carlos Heights, Upper Tumon Harmon.

**TABLE 16
PROPOSED SHORT-RANGE (1998) IMPROVEMENT PROJECTS
GUAM 2010 HIGHWAY MASTER PLAN**

PROJECT NO.	LOCATION	MUNICIPALITY	TYPE OF IMPROVEMENT
1	Intersection of Marine Dr./Ch. San Antonio	Tamuning	Add lane to allow 3-lane through movements (NB direction) on Marine Dr.
2	Marine Dr., Airport Access Rd. to Y-Sengsong Rd.	Tamuning/ Dededo	Reconstruct outer lanes; widen median turning lane; construct sidewalks from JFK Rd. to Rte. 16; add lane for right turns on Marine Dr. at Airport Access Rd. (NB direction), at JFK Rd. (SB direction), at Harmon Access Rd. (NB direction), at Upper San Vitores (SB direction) and at Route 16 (NB direction); add signal at Tumon La. (see Proj. No. 8); add lane for dual left turns on Marine Dr. at Rte 3 (NB direction) and at Harmon Loop Rd. (SB direction); place power lines underground, Airport Access Rd. to Rte. 16; reset power poles, Rte 16 to Y-Sengsong Rd.
3	Intersection of Marine Dr./Wusstig Rd.	Dededo	Relocate Marbo Rd. to a point opposite Marine Dr./Wusstig Rd. intersection; install signal.
4	San Vitores Rd., Ypao Rd. to JFK Rd.	Tamuning	Add lane for right turns (EB direction) at JFK Rd.; shift roadway northward and construct sidewalk on the south side.
5	Intersection of San Vitores Rd./Gogna Rd./Upper San Vitores	Tamuning	Add lane for right turns on San Vitores Rd.
6	JFK Rd.	Tamuning	Widen road to 5-lane configuration; construct sidewalks on both sides.
7	Cold Storage Rd. Extension	Tamuning	Construct extension of Cold Storage Rd. to connect with Rte. 16 at Rte. 16/Harmon Loop Rd. intersection; use 3-lane configuration with sidewalks on both sides
8	Harmon Connector; Harmon Strip; Harmon Access Rd.	Tamuning	Construct connector between Cold Storage Rd. and Harmon Strip; widen Harmon Strip and Harmon Access Rd; use 3-lane configuration with sidewalks on both sides; install signal at Harmon Strip/Harmon Access Rd. intersection.
9	Tumon La., Taitano Rd.	Tamuning	Reconstruct Tumon La. and Taitano Rd. between Marine Dr. and Rte. 16; use 2-lane configuration; construct connector between Tumon La. and Taitano Rd.; install signal at Marine Dr./Tumon La. intersection; relocate existing signal at Iglesia Ni Christo Church (ped. X-ing) to Rte. 16/Taitano Rd. intersection.

TABLE 16 (CONTINUED)
PROPOSED SHORT-RANGE (1998) IMPROVEMENT PROJECTS
GUAM 2010 HIGHWAY MASTER PLAN

PROJECT No.	LOCATION	MUNICIPALITY	TYPE OF IMPROVEMENT
10	Gov. Camacho (Camp Watkins) Rd.; Farenholt	Tamuning	Widen Gov. Camacho Rd., Marine Dr. to Memorial Hospital; widen Farenholt Ave. Gov. Camacho Rd. to Ch. San Antonio; use 3-lane configuration with sidewalks on both sides.
11	Macheche Ave.	Dededo	Widen road to 3-lane configuration between Alageta St. and Marine Dr.
12	Jalaguac Connector	Tamuning/ Mongmong- Toto-Maite	Construct connector between Jalaguac St. and Biang St. with new R-O-W along with new R-O-W along western boundary of NAS; use 5-lane (or 4-lane, dual configuration on the connector; widen Jalaguac St. to 5-lane configuration with sidewalks; install signal at Route 8/Biang St. intersection.
13	Harmon Loop Rd.	Dededo	Widen road to 5-lane configuration; install signal at Harmon Loop Elementary School Access.
14	Route 3, Marine Dr. to Potts Jct.	Dededo	Reconstruct road to modern design standards; use 5-lane configuration, Marine Dr. to NAVCAMS; use 3-lane configuration, NAVCAMS to Potts Jct.
15	Alageta St.	Dededo	Construct connector between Airport Rd. and Alageta St. with new R-O-W along southern side of Harmon Coral Pit; use 2-lane configuration with climbing lane; construct new access to Macheche Ave., via Ahua La. and Corenoso St. intersection.
16	Route 15, Route 10 to Carnation Ave.	Mangilao	Reconstruct road to modern design standards; use 3-lane configuration in developed areas and 2-lane configuration elsewhere.
17	Route 15, Carnation Ave. to Andersen AFB	Mangilao; Yigo	Reconstruct road to modern design standards; use 3-lane configuration in developed areas and 2-lane configuration elsewhere.
18	West O'Brien Dr., Ch. Obispo	Agana	Install signals at Aspinall Ave. and Ch. Obispo intersection.
19	Peter Nelson Dr.; Ch. Obispo to Route 4	Agana; Agana Heights	Reconstruct Ch. Obispo intersection and remove irregular alignment on Peter Nelson Dr.; install signals at St. Ch.Obispo and Rte. 4 intersections; add lane for right turns (EB direction) on Peter Nelson Dr. at Rte. 4 intersection.
20	Route 16, Route 10 to Marine Drive	Barrigada; Dededo; Tamuning	Reconstruct road to modern design standards; use 5-lane configuration; add lane for right turns at Harmon Loop Rd. (NB direction); relocate existing signal from Iglesia Ni Christo Church to Taitano Rd. intersection (see proj. No. 8)

TABLE 16 (CONTINUED)
PROPOSED SHORT-RANGE (1998) IMPROVEMENT PROJECTS
GUAM 2010 HIGHWAY MASTER PLAN

PROJECT NO.	LOCATION	MUNICIPALITY	TYPE OF IMPROVEMENT
21	Route 4, Route 10 to Yona Village	Chalan Pago-Ordot; Yona	Reconstruct road to modern design standards; widen road to 5-lane (or 4-lane dual) configuration.
22	Route 4, Route 10 to Yona Village to Cross Island Rd.	Yona	Reconstruct road to modern design standards; widen road to 5-lane (or 4-lane dual) configuration; construct sidewalks on both sides, Yona village to top of cliff line above Ylig Bay.
23	Route 4, Cross Island Rd. to Talofofo River	Yona, Talofofo	Reconstruct road to modern design standards; use 2-lane configuration in undeveloped areas, 3-lane configuration in developed areas (e.g. Ipan village) and at major intersections.
24	Marine Dr., Polaris Pt. Access to Rte. 2A	Piti; Santa Rita	Construct road to modern design standards; use 5-lane configuration.
25	Route 2A, Marine Dr. to Namo River	Santa Rita	Reconstruct road to modern design standards; use 3-lane configuration; relocate Camp Covington Access to a point opposite Rte. 2A/Rte. 5 intersection; install signal at Rte. 2A/Rte. 5 intersection.
26	Route 2, Namo River to Agat Cemetery	Agat	Reconstruct road to modern design standards; use 5-lane configuration with sidewalks on both sides; install signal at Erskin Dr.
27	Rte. 2, Agat Cemetery to Santa Ana Chapel	Agat	Reconstruct road to modern design standards; use 3-lane configuration.
28	Route 2, Umatac Village	Umatac	Construct bypass at Umatac Village, passing east of village and school; connect to existing road at Veteran's Memorial Park (north end of bypass) and at Umatac Bridge (south end of bypass); use 2-lane configuration with climbing lane in NB direction.
29	Route 4, Talofofo River to Inarajan Village	Talofofo; Inarajan	Reconstruct road to modern design standards; use 3-lane configuration in developed areas and 2-lane configuration elsewhere.
30	Route 4, at Inarajan Village	Inarajan	Construct bypass at Inarajan Village, passing west of village and school; connect to existing road at Inarajan River (north end of bypass) and at Agfayan Bay (south end of bypass); use 2-lane configuration with climbing lanes where needed.
31	Route 4, Inarajan Village to Merizo Village	Inarajan; Merizo	Reconstruct road to modern design standards; use 3-lane configuration in developed areas and 2-lane configuration elsewhere.

TABLE 16 (CONTINUED)
PROPOSED SHORT-RANGE (1998) IMPROVEMENT PROJECTS
GUAM 2010 HIGHWAY MASTER PLAN

PROJECT No.	LOCATION	MUNICIPALITY	TYPE OF IMPROVEMENT
32	Route 4 at Merizo Village	Merizo	Construct bypass at Merizo Village, passing between village and Pigua development; connect to existing road at Bile Bay (north end of bypass) and at Piga Beach (south end of bypass); use 2-lane configuration with climbing lanes where needed.
33	Route 4, Merizo Village to Umatac Village	Merizo; Umatac	Reconstruct road to modern design standards; use 3-lane configuration in developed areas and 2-lane configuration elsewhere.
34	Ch. Chanton Tutujan Extension	Agana Heights	Extend Ch. Chanton Tutujan westward from Tutujan Dr. to Joseph Cruz Ave; use 2-lane configuration.

Source: Guam 2010 Highway Master Plan, Ducuss and Associates and Wilbur Smith & Associates.

Public Safety

Future police plans for expansion include new "Koban"-type Police Boxes in Chalan Pago-Ordot, Mangilao, Yona, and Inarajan and new substations in Dededo, Agat and Tamuning. The Department has also initiated the introduction of a bill into the Guam Legislature to study the feasibility of a new adult correctional facility. A master planning effort is currently underway for a new youth correctional facility as well, and a major new facility is being proposed. Construction is tentatively scheduled to begin in 1992. The new facility will house 100 males and 60 females. The new facility is proposed to be built at the same location as the existing, although other sites are being sought for possible consideration. The Fire Department's future plans for expansion include a fire station in Yigo, near Andersen Air Force Base on Route 3. This station would serve the proposed 1,000 unit Astumbo community housing project.

A \$5.3 million expansion project at the Guam Memorial Hospital is almost complete and will increase the number of available beds to 161 acute care and 35 skilled nursing. This is the first of several planned expansion activities to improve the hospital's overall delivery system.

Solid Waste Disposal

The Ordot Landfill has been operating beyond its design capacity since the mid-1980s. In 1991, a limited expansion program was approved, increasing the landfill's acreage by 53 percent and its life-span by another six years. The landfill has also been plagued in recent years by frequent, deliberately set fires, creating hazardous conditions for landfill workers, firefighters, and nearby residents. At this time,

alternative landfill sites are being studied and construction of a waste-to-energy incinerator is under consideration with possible completion in 1995. The Guam Environmental Protection Agency and Guam Economic Development Authority is currently studying garbage/recycling alternatives to help to ease the strain on solid waste facilities.

The Air Force and Naval Landfills are also nearing capacity. Combined use of the proposed incinerator is being studied although no agreements have yet been made. Both the Air Force and the Navy have initiated recycling programs (at this time limited to aluminum cans).

Parks and Recreation

Major projects planned by the Department of Parks and Recreation include the Dededo Sports Complex, two additional public golf courses, expansion to the Paseo recreation area in Agana, the Inarajan boat ramp, a Speedway Park in Yigo, and improvements to sports facilities in Mangilao and Yona.

In addition, there is also significant opportunity to expand the territorial park system through the transfer of surplus military lands. The DPR has specifically proposed the formation of three new parks from portions of the excess military lands inventory identified by the Department of Defense. These include Hilaan Park, Tarague Park and the Fena Valley Parks.

TABLE 17 PROPOSED PARKS FROM CURRENT MILITARY LANDS			
NAME	LOCATION	LEGAL DESCRIPTION	SIZE
Hilaan Park	Dededo	Anderson, Harmon, Annex, South Finegayan and NAVCAMS Beach	958 Acres
Tarague Park	Yigo	Anderson Air Force Base	Est. 1,000 Acres
Fena Valley Parks	Agat, Santa Rita, Talofofo	Naval Magazine	885 Acres

Source: Department of Parks and Recreation

The proposed Hilaan Park extends from Puntan dos Amantes north to the Federal Aviation Administration housing and offers an outstanding opportunity for such a unique public park.

The area contains a series of white sand beaches with offshore coral reefs, while inland are coconut groves and the tropical limestone forest rising over 300 feet offering dramatic scenic vistas. Secluded within this area are remnants of Chamorro culture including the village of Hilaan with numerous latte

stones near the unique fresh water pool of Hagoi or Lost Pond.

At the southern end is the developed Tanguisson Beach with its two pavilions and new restroom located in a grove of coconut trees behind the broad sandy beach. In addition to Tanguisson Beach, the public increasingly uses the area for a wide variety of activities including swimming, snorkeling, hiking, fishing, picnicking, photography, nature study, camping, and Chamorro cultural activities such as plant gathering for suruhanos (native healers).

Therefore, it can be seen that the Hilaan coastline offers an opportunity for all of Guam in a natural setting for a Chamorro resource, the islands proposed first campground for both groups and families, and a unique destination area.

Other opportunities include the proposed Tarague Point Park, which is likely to be included in the proposed Guam National Wildlife Refuge now being considered by the U.S. Fish and Wildlife Service to cover much of Andersen Air Force Base.

Another proposed park lies in the Fena Valley around Fena Reservoir lands in the Naval Magazine.

PROJECTING CAPITAL IMPROVEMENT NEEDS

Levels of Service

What are Levels of Service?

"Levels of Service" is a term that describes the process used to measure how many people within a defined area have available to them a particular government facility or service. This is usually expressed in measurable terms. If a community of 100,000 residents has 10 neighborhood parks within its boundaries, then the level of service is expressed as one neighborhood park for every 10,000 residents. This analysis is normally performed for a number of public facilities, including municipal water and sewer systems, recreation, solid waste facilities, and transportation facilities. Other elements that are often measured include, police and fire protection, education, and health care (when provided by a governmental entity).

The existing levels of service within the community may be compared with those of other communities or with national standards to determine how well government is doing in its provision of facilities and services. In particular, other governmental entities that have received favorable notice in their ability to bring to their residents various services are frequently used as the goal to be attained.

The process may be characterized as definable and rational. If a community's current level of service in terms of its provision of neighborhood parks is one facility for every 10,000 residents, and its goal is to improve this figure to one park for every 5,000 within a 10 year period, its officials can establish a program that identifies what they must do to meet this level.

How do we measure the need for public services?

The objective of planning in any form is to link knowledge with action. The aim of community planning more specifically focuses on providing community residents with the highest quality of life consistent with their level of expectation. In other words, growth management attempts to balance the needs (i.e., expectations) of community residents regarding public services (e.g., recreation facilities, police and fire protection, utilities) with the local government's ability to provide those services.

One way to establish the need for public services is, of course, to survey residents about their desires. The series of village meetings held during the development of the Land Use Plan, for example, helped to ascertain the relative desires of neighborhood or community residents about given issues. The next step is to meld the desires of individual neighborhoods or villages with a governmental service provider that functions at the Territorial level. There is a rational step-by-step process that planners use to assist communities in making these determinations. By quantifying the need for public services based on a current per capita unit of demand, the government can more efficiently plan for the delivery of those services in the future based on new population growth. This is the purpose of establishing levels of service.

As discussed throughout the planning process, the Land Use Plan is aimed at providing a wide range of economic opportunities in the Territory while implementing appropriate performance standards to address the potentially negative impacts of growth. The use of performance standards can mitigate a number of negative side-effects of incremental land development, including increased stormwater run-off, pollution from inadequate septic tank systems, and increased traffic congestion caused, in part, by the lack of adequate off-street parking. At the same time, however, the cumulative impacts of incremental growth create a demand for a regional approach to address larger-scale impacts such as the increasing number of automobiles Territory-wide, increase in the demand for wastewater treatment, potable water, and so forth. This includes the provision of regional potable water and sanitary sewer systems, public safety, highways and major roads, watershed drainage control, and recreational facilities. This is typically the area of governmental responsibility.

During the past 20 years, rapid growth has taken place in the absence of strong planning controls. This situation inevitably results in an infrastructural deficit if there is no linkage between development and

the provision of necessary public services and facilities. Growth has been encouraged to create job opportunities and generate public revenues with little consideration given to where and how growth creates additional demand for public services. Without a mechanism to link development with the related cost to provide adequate public services, the Territorial government has been relegated to playing "catch-up" in both determining the need and providing for adequate public services. This, in turn, has led to a number of social and environmental problems which contribute to a loss in the quality of life. This is exemplified by events such as traffic jams, periodic power outages, coastal water pollution caused by inadequate sewage treatment facilities, water rationing, overcrowded schools, increasing crime, and the demand for improved public safety. Unless alternatives to deficit financing of growth are employed, these conditions can only be expected to worsen.

But Guam is not alone in facing these problems. Many fast growing islands and communities in the U.S. and around the world have experienced the same dilemma. While performance standards have been successfully used to assess and negate some of the impacts of new incremental development, government spending and capital planning (to address regional issues) remain enshrined in a larger and more intricate political process.

There are basically two major determinants in any capital planning process: estimating the need for public services and funding the provision of those services in an effective and timely manner. One of the most successful approaches in determining the need or demand for public services has been through the implementation of the aforementioned levels of service.

It should be noted that the establishment of levels of service provides only a statistical basis for determining what facility provisions are likely to be required in the future. For certain elements, such as how many policemen or fire fighters will be needed in future years, this may be all that will be required. However, other public facilities such as neighborhood parks, may also require that geographic considerations be taken into account.

The tool used to analyze and determine which "competing" projects should be built and according to what priority schedule is known as the Capital Improvements Program (CIP). This device is being employed in the government today, although it does not yet include all of the government divisions and agencies that have capital needs. A CIP is normally set up for a five or six-year period and includes all of the capital projects (not including operations or maintenance programs) that have been identified as essential by the various agencies. These projects must all have cost estimates and the sources of funding must be identified. Another integral role that the CIP plays is in prioritizing the projects. Not every project can be built this year! Decisions must be made as to what is most important and what can be built in any year, given the financial constraints of the budget. The staging of projects

can also be done through the CIP. Using the neighborhood parks example again, it is possible to earmark funds for the acquisition of land for these facilities in fiscal year 1991 - 1992, and to program their development in following years.

Another important point to remember about a CIP is that it is not a "one-time" exercise. Every year the program must be reviewed, priorities reassessed and a new year added to it. When this total system is in place, the Territory will have a responsible, pro-active financial/growth management program.

The levels of service provision offers a number of advantages in a capital improvement planning process. It provides an objective measure of demand based on a critical determinant: population. The determination of service level provision itself, however, is not apolitical and requires community consensus-making and legislative adoption. The level of service analysis is intended to be flexible and can be directly linked to funding constraints based on the quality of life desired and the Government's (or private sector's) ability to finance necessary improvements. It can accommodate geographical mobility, in that differing levels of service may be established at the island, or even (with additional refinement) at the village level. Further flexibility is provided by a two-tiered approach which establishes an existing level of service, cognizant of funding or other constraints, and proposes establishment of higher levels of service at some identifiable point in the future to recognize a rising level of expectation and aim for the improvement in the delivery of public services and facilities.

As an example, it may be determined that the present level of service provision with respect to neighborhood parks is one acre for each 10,000 people. The "ideal" provision level may be one acre for each 2,500 persons. Although GovGuam may sincerely desire to attain this ideal level, they know that, given competing demand for limited dollars, they will not be able to achieve it in the next five or six years. To begin to move toward the ideal, GovGuam may establish an interim standard to be reached in the next five years that represents an incremental improvement over the current level of service. In this way, GovGuam services can be improved and while the ideal standard may not be attained in five years, a system is being established whereby it may be achieved within a decade. In addition, this process is more understandable to the public and can help to de-mystify the capital improvement planning process.

Existing Levels of Service

Wastewater Treatment

The amount of treated effluent is based on daily flow levels through the plants. However, actual measurements of flows through the system are difficult to ascertain. However, general engineering

standards predict that between 80 and 90 percent of water consumption is returned through the wastewater collection system as effluent. Both PUAG and GEPA estimate that approximately 85 percent of metered water consumption returns through the wastewater collection system. Applying this standard to the range of per capita metered water consumption rates identified by the PUAG Water Master Plan Update (99-138 gpcd) yields an estimated wastewater treatment level-of-service range of 84-117 gallons per capita per day (gpcd) for planning purposes. The PUAG uses an average of 85 gpcd as an existing level of service for planning purposes.

Potable Water

Residential users account for the largest share of consumption. They consume 68 percent of PUAG's overall water demand. Commercial users account for the second largest group of consumers. They comprise approximately 21 percent of total demand. Government and agriculture utilize the remaining 11 percent of total demand.

The per capita level of service use, according to the Preliminary Water Master Plan Update, varies from 99 gallons per capita per day (gpcd) to 138 gpcd (excluding unaccounted-for water). The PUAG uses a standard figure of 100 gpcd as an existing level of service for planning purposes. Hotel water consumption is estimated at a typical rate of 450 gallons per room per day (gprd). In addition, golf courses are estimated to require approximately 1,000 gallons of water per hole each day, according to the PUAG Water Master Plan Update.

Solid Waste Generation

Based on existing 1990 demand at the Ordot Landfill (245 tons per day), an average generation rate can be ascertained based on the existing population. For planning purposes it is estimated that per capita solid waste generation from the resident population on-island is approximately four pounds per day.

Automobile Traffic

In 1991, there were more than 100,000 registered vehicles in Guam. This amounts to approximately one vehicle for every 1.3 residents, a very high vehicle-to-population ratio, given an island setting with limited land area.

Parks and Recreation

In order to accurately gauge demand for outdoor recreation areas and facilities, the Department of

Parks and Recreation (DPR) established local facility/population standards for recreational activities on Guam. These standards are shown in the following table.

TABLE 18 GUAM OUTDOOR RECREATION STANDARDS	
ACTIVITY	SUPPLY (UNIT/POPULATION)
Bicycling	1 mile/500
Boating	1 slip/500
Camping	1/5,000
Canoeing	N/A
Jogging	1/1,000
Hiking	1 mile/1,000
Horseback Riding	1 mile/1,000
Hunting/Skeet Shooting	N/A
Sailing	N/A
Surfing	N/A
Tennis	1/3,000
Trail Bikes	1 mile/5,000
Water Skiing	N/A
Skating/Skateboarding	1/2,500
Playground Activities	1/2,000

TABLE 18 (CONTINUED) GUAM OUTDOOR RECREATION STANDARDS	
ACTIVITY	SUPPLY (UNIT/POPULATION)
Picnicking	1/2,500
Swimming (Beach/Pool)	1 acre/1,000
Diving (Snorkeling/Scuba)	N/A
Fishing	N/A
Outdoor Games	
1. Football Field	1/15,000
2. Baseball Field	1/1,300
3. Basketball Court	1/2,500
4. Volleyball Court	1/2,500
5. Soccer Field	1/20,000
6. Hockey Pitch	1/10,000
Outdoor Cultural Activities	1/Community (village)
Pleasure Driving	1 mile/1,000

Source: Department of Parks and Recreation.

In addition, the inventory of GovGuam park acreage indicates a level of service of 102 acres of park land for every 1,000 persons on Guam. The Department of Parks and Recreation have established park standards that apply to new subdivisions of twenty or more units. There are four major park types: play lots (2,500 sq. ft. to one acre in size), vest pocket parks (also 2,500 sq. ft. to one acre), neighborhood parks (five acre minimum size), and district parks (20 to 100 acres in size). According

to DPR standards, parks should be provided at one acre per fifty dwelling units, or one acre per 43,560 square feet of building.

Police Personnel

At present, there are 330 police officers in the Guam Police Department serving a total resident population of 133,152. This reflects a level of service of 2.48 police officers for every 1,000 permanent residents.

Firefighters/Emergency Medical Service Personnel

There are 273 certified firefighters in the Fire Department with 17 additional firefighters to be added in the near future. With a 1990 total resident population of 133,152 this translates into an existing level of service of 2.18 firefighters for every 1,000 residents.

Health Care Beds

The existing supply and recent expansions to the Guam Memorial Hospital amount to a total of 196 immediate healthcare beds. This translates in turn, into an existing level of service delivery of 1.76 healthcare beds for every 1,000 residents of Guam.

FIVE YEAR ZONING PLAN

The Five Year Zoning Plan is based on a continuation of the resident population trends at the village level experienced from 1980-1990 out to 1998. This amounts to an average annual growth rate of 2.3 percent over the next five years. The Plan also incorporates proposed GovGuam capital improvement projects aimed at improving the island's existing infrastructure deficit, such as major wastewater, potable water, highway and recreation improvements. Hotel room projections, however, are based on an assessment of only hotel developments and expansions expected to be completed by 1998. The Plan allocates enough land to accommodate more than the projected population will require. This has been done to reduce the need for rezonings and to ensure some flexibility in the land development market on the island. By matching the proposed capital improvement projects which most directly affect the ability of the land to accommodate various land uses, additional areas can be designated for higher intensities of land use. The criteria used were based on new or expanded wastewater collection/treatment and potable water delivery systems by PUAG; highway improvement or widening projects by DPW; and expanded recreational opportunities planned by DPR that provide a

higher level of service for a greater population area. Land in the service areas of the major infrastructure projects have been designated for the appropriate intensities in accordance with the level of service allowed by the improved public facilities.

Resident population gain would amount to a net island-wide growth of approximately 3,200 persons per year over the next five years. The largest share of new growth is still expected to occur in Dededo, Mangilao, Yigo, and Tamuning, as well as Santa Rita. Distribution of growth in this scenario is initially predicted by the "Small Area Population Model" shown on the accompanying spreadsheet. In Table 19, the model uses a series of projection techniques which are then averaged to arrive at a recommended "Net Growth" figure for the five-year time period. Again, in certain cases, the population trends associated with particular villages between 1980-1990 causes a skewing of the model predictions. In these cases, adjustments have been made to arrive at most probable growth projections based on approved projects that may alter the historic pattern of growth in some villages. These adjustments are shown on Table 20 which outlines the relative demand on public facilities from the Five Year Zoning Plan, including the gross demand for housing units, land area, wastewater treatment capacity, potable water delivery, solid waste generation, public safety, and park needs. Overall housing demand generated by this level of development amounts to approximately 4,200 dwelling units, based on an average household size of 3.8 persons. This, in turn, would require about 1,350 gross acres of land (at a density of about three units per acre) to house the additional population growth expected over the next five years.

Areas which have been considered likely for development include the Macheche-Mogfog area of Dededo, portions of Chalan Pago-Ordot, the Lalo and Tai districts of Mangilao, areas of Harmon Industrial Park, portions of Talofofo and Maina, as well as Umatac and Merizo. In most cases, this is due to planned GovGuam wastewater, potable water, and highway improvement projects that are planned to occur in these areas over the next five years. This would allow for more development to occur in surrounding areas. The Five Year Plan also designates recommended zoning designations for the federal releasable lands on the island. Of prime importance is the Harmon Annex property that is planned to accommodate both the proposed Hilaan Territorial Park and an area of Intensity District 3 (Moderate Intensity). It is envisioned that the area designated for Intensity District 3 could serve as a suitable site for single or limited multi-family affordable housing development.

FIVE YEAR PUBLIC FACILITY DEMAND

The Five Year Zoning Plan projects an additional 16,000 residents on-island during the next five years. This new population will place additional demands on various public services and facilities provided

by GovGuam. Based on level of service analysis, the projected gross demand for public facilities over the next five years are presented in Table 20.

Wastewater Treatment

Island-wide, the additional demand for residential wastewater treatment is expected to exceed 1.3 million gallons per day (mgd) over existing levels by 1998. In addition, new hotel development may generate another 1.8 mgd of new demand during peak periods. More than one-half of the new treatment demand from hotels will originate in Tumon. This new demand is expected to be met through the on-going improvements to the existing Tumon transmission system and the reversal project to pump effluent to the Northern District sewage treatment plant (STP) in Dededo. The remaining hotel growth areas will likely be in Barrigada, Chalan Pago-Ordot and Yona, with smaller hotels already approved in Asan, Inarajan and Dededo. The largest hotel room increase outside of Tumon will occur in Barrigada, where more than 1,200 hotel rooms have already been approved and may be built by 1998. Hotels approved in the more rural portions of the island, such as Yona and Inarajan, are likely to include either self-contained package treatment plants or provide larger treatment facilities (such as Leo Palace) to serve later phases of development.

Residential demand for sewage treatment will be greatest in Dededo, Yigo, Mangilao, Tamuning and Santa Rita. Over 600,000 gpd may be generated by new residents in Dededo and Yigo alone. While a portion of these new residents will rely on more rural-based septic systems, most of the effluent produced by this new population will be connected to existing collection and transmission lines that transmit to the Northern District STP. New development in Tamuning will also connect into this system, as well as the Agana STP collection system, which has excess capacity at the present time. New population growth in Santa Rita will be dependent upon completion of the Agat/Santa Rita Sewer Phases I and II to create adequate capacity in a new STP. Mangilao is somewhat limited in terms of available capacity for higher density development and would require connection to a central collection system. The village is experiencing pressure for increased density and growth due to the continued development of UOG and the new Guam Community College. PUAG is already examining the possibility of a new STP being required in the Fadian Point area to serve projected development in the Mangilao and Pago Bay area. Other areas of the island may be able to accommodate the additional growth projected during the next five years without major improvement or expansion of existing facilities, provided current upgrading of facilities and improvement projects are completed.

The Northern District STP will face the greatest increase in use during the next five years. Projected growth figures indicate that the facility should be able to accommodate the increased load, provided no significant increase in military needs are experienced during the same time period. In fact, some

of the available plant capacity currently reserved for the military may have to be utilized by PUAG by 1998 if current growth trends continue.

Potable Water

The availability and access to a safe and plentiful groundwater supply remains a fundamental concern to continued growth on the island. Demand for water resources will come from three main sources during the next five years—new tourists, new residents and new golf courses. New hotel water use is expected to create an additional demand for more than 2.1 mgd of potable water by 1998. New residential demand will thirst for another 1.6 mgd. Additionally, another eight golf courses currently approved and expected to be complete and operational by 1998 will require more than 0.15 mgd of water resources during the next five years. The greatest demand for water will come from the northern and central villages and will be supplied through increased pumping of the northern groundwater lens. Sufficient capacity exists to more than adequately provide the additional 3.85 mgd likely to be needed during this time period. This does not include commercial, industrial or military uses. Further study of groundwater supply and demand factors should be undertaken to better understand this most important resource.

However, as discussed in the Land Use Plan and based on available data, continued population growth (and consumption rates) at historic levels will likely exhaust existing known supplies of groundwater reserves by the year 2015. Unless population growth slows, water conservation measures are taken, or additional groundwater supplies are accessed beneath Andersen Air Force Base, new development in the northern and central portions of the island will be severely limited in the 21st century.

The recent completion of the Ugum River project will increase the supply of potable water available for consumption in the southern part of the island. PUAG is increasing its water resource emphasis in exploiting surface water supplies in the southern part of the island.

Automobile Traffic

The present level of demand for automobiles on island is extremely high and reflects the dispersed nature of the population distribution and development patterns. If the present ratio of approximately 0.75 automobiles per person continues into the future, Guam can expect another 12,000 automobiles on its highways by 1998.

The existing highway network is already overloaded in many parts of the island as was discussed earlier in this Report. The Highway Master Plan has identified the roadway segments projected to be

deficient by 1995. These are listed in Table 21.

The Highway Master Plan has also identified the short-term improvement projects necessary to relieve critical congestion points and intersections in the next five years. However, these recommended projects are aimed at only addressing existing deficiencies in the highway network and not toward providing significant improvement in the transportation infrastructure required by future development. These types of needs are addressed in the long term highway improvement plan which focuses on improvements that will be required by 2010. The primary focus of the Highway Master Plan is on highway improvement and new highway construction to relieve automobile congestion problems. However, little attention has been given to the role of mass transit in future development or its role in reducing the demand for new automobiles and subsequent energy and new highway cost savings.

The Guam Mass Transit Authority is developing a plan for improving its mass transit services. The most likely area for substantial transit success in reducing the average daily traffic flow lies in the congested Marine Drive corridor from Dededo to Adelup. The high residential density and employment centers in the corridor offer the best opportunity for a demonstrated improvement in service and ridership on the mass transit network.

TABLE 21 PROJECTED DEFICIENT HIGHWAY LINKS IN 1995	
ROAD	LOCATION
<u>Moderately congested:</u> Marine Drive Route 10 Route 4	Portions in Piti, Agana, and Dededo Barrigada Between Chalan Pago and Yona
<u>Severely Congested:</u> Marine Drive Route 2 Gov. Camacho Road and Farenholt Avenue Route 3 Route 16 O'Brien Drive Route 8 Harmon Loop Road West Santa Monica	Portions in Agana and Dededo and nearly all Tamuning Agat Tamuning Dededo Most from Airport Access Road northward Most in Agana Marine Drive to East O'Brien Drive in Maite Portion in Dededo Dededo

Source: Guam 2010 Highway Master Plan, Duenas and Associates, 1993.

The long range (2010) Highway Master Plan includes recommendations for both improvements in the existing highway network and the construction of new roadways to serve the long range population

growth of the island.

Energy

The anticipated growth of the island by 16,000 residents in 1998 will create a demand for an additional 23.52 megawatts of electrical power at peak demand periods. This is based on a current average per capita peak demand consumption rate of 0.00147 megawatts. This per capita figure factors in all non-residential uses, including business, industry, and hotels; therefore, the 1998 projected demand figure assume that the same relationship of the range of land uses will be in existence at that time as is found on Guam today.

Solid Waste Disposal

New population growth over the next five years will contribute an additional 32 tons per day (tpd) of solid waste disposal by the Ordot landfill. The need for new waste disposal facilities is paramount in light of the new demand as well as the existing situation. Municipal solid waste recycling, incineration or reuse alternatives must be considered given the limited land area and dangers from landfill contamination of groundwater aquifers. The short-term solution may be to establish a second sanitary landfill; however, for the long-term solution, reliance must be placed on efforts to reduce the solid waste stream flow through recycling or other alternatives.

Police Officers

New population growth will also require additional police personnel and stations to be located in the highest growth areas of the island during the next five years. As many as 40 new police officers will be needed by 1998 to maintain the existing level of service provided by the Guam Police Department.

Firefighters

In order to maintain the existing level of fire protection service to residents of Guam, the Fire Department will have to hire an additional 35 firefighters between 1993 and 1998.

Health Care Beds

New population growth over the next five years will demand an additional 24 acute health care beds just to maintain the present level of service of health care providers. The greatest regional need will be to serve residents in the Dededo and Yigo area.

Education

At the present time, approximately 9.5 percent of the total population of Guam is enrolled in the public elementary schools, 4.5 percent are in middle schools, and 5.3 percent are matriculation through the high schools. Assuming that the island's population grows by about 16,000 people over the next five years, and anticipating that the above-stated relationships remain approximately the same, there will be 1,520 additional elementary school-aged children, 720 children in middle schools and about 850 youngsters in the high schools. Using the standard established by the Department of Education and the Guam Federation of Teachers of 27 students per classroom means that there will be a need for 56 new elementary school classrooms, 27 middle school classrooms, and 32 high school classrooms, not including any additional special educational facilities such as gymnasiums, laboratories, etc.

Parks and Recreation

The gross demand for recreation areas can be calculated based on the existing islandwide relationship of total park acres per 1,000 population. This exercise indicates a gross demand of 1,643 acres of new park land by 1998. This number can be met or exceeded during the next five years through acquisition and development of the excess military lands that have been recommended as future parks by the DPR. These include the proposed Hilaan, Tarague and Fena Valley parks. However, the demand for individual park types and specific recreational facilities can be further refined based on adopted DPR standards. For example, the need for neighborhood parks, based on new residential subdivisions and the standard of one acre of park for every 50 dwelling units indicates a gross demand of 85 acres of new neighborhood parks. In addition, the demand for the most popular recreational facility types is shown in Table 22 based on adopted standards for Guam by DPR.

CONCURRENCY MANAGEMENT SYSTEM

A determination of the current level of service for the various government services that provides officials with a statistical base for determining where existing deficiencies may exist. However, in a fast growing island environment new growth creates additional burdens on government services and spawns more challenges to development management.

How will government officials know when there are future deficiencies?

How can government keep track of service levels and measure the impacts of new development on public facilities and still maintain acceptable levels of service ?

One tool available to help answer these questions is called "concurrency management". This term is applied to the concept that governments maintain an adequate delivery of public services by linking "growth" with the demand for new public facilities. The effect is to limit growth concomitant with the availability of public services to serve new growth (i.e., to ensure that public facilities are available "concurrent" with the impacts of growth). In this way, the quality of life factors represented by applicable government facilities and services are the overriding determinants to maintaining an orderly, safe, and efficient land use pattern in Guam. The process, once adopted, establishes an objective approach to assess the impacts of growth and the government's (and private sector's) ability to fund the improvements necessary to maintain desired levels of service.

Concurrency management is the product of rising frustration in many parts of the United States with the fact that the public's quality of life is being slowly degraded by failing to put infrastructure in place concurrent with the impacts of development. The rationale for such an implementation mechanism is simple. To continue to fail to "pay as we grow" dooms a community inevitably leads to a long run decline in the quality of life, the character and quality of environmental systems, and ultimately undermines economic health.

A Concurrency Management System (CMS) would require GovGuam agencies to establish and adopt level of service standards for public facilities, and enforce those standards by requiring public facilities to maintain the standards concurrent with or "at the same time as" the impacts of new development. The system would consist of three primary components:

- 1) An inventory of existing public facilities for which concurrency is to be determined;
- 2) A concurrency assessment program to evaluate the impact on affected public facilities from each application for development; and
- 3) A schedule of capital improvements needed to correct any existing public facility deficiencies.

The statutes and enabling legislation of the CMS are specifically interested in the determination of timing by which the capacity of such facilities must accommodate the impacts of development. The objective of the CMS is to ensure that developments have adequate infrastructure and permits without delay. However, under a concurrency concept, GovGuam could not issue a final development order or permit that would result in levels of service for the affected facilities below the standards adopted by the Government. In this case, a "final development order" should be construed to mean a permit or approval that would allow for the construction of a project or physical activity to begin, such as building permit. Therefore, GovGuam staff must have the foresight to prepare for urban growth based on the guidance of the Land Use Plan and an associated Capital Improvement Program (CIP).

Remedies to current or anticipated deficient public facilities may include agreements, phasing, planning, and petition. Agreements with the Government could allow developers to correct deficiencies by building facilities themselves or contributing to the funding of capital improvements. Phasing a project would allow construction in stages that follow the progressive improvement or expansion of facilities over time. Careful planning of a project with knowledge of public construction schedules would assist the development community. Petitions to amend the CIP may request enlargements of public facilities to accommodate the impacts of proposed development, lower level of service standards, or increased funding

sources (e.g., impact fees or assessments). Therefore, developers will still have opportunities to build their projects if they encounter or anticipate deficient facilities.

CONCURRENCY MANAGEMENT SYSTEM INVENTORY

Gross levels of service have already been determined for many of the existing public services and facilities. These standards are discussed in the Land Use Plan and have been utilized to determine the preliminary impacts of growth projected to occur over the next 25 years. However, for the purposes of establishing a CMS, a more detailed inventory and analysis, including geographic sub-areas and their critical components (i.e., pump stations for water/wastewater and road segments for transportation) must be established.

Therefore, the following inventories should be maintained by GovGuam to be used for the concurrency assessment of new development:

Traffic Circulation

1. Design capacity of various roadway types.
2. The existing level of service measured by the average annual number of trips\ per day on a roadway link and the peak hour trips as provided in counts taken by the Department of Public Works.
3. The adopted level of service standards for all roadway types.
4. The existing capacities or deficiencies of system components.
5. The volumes estimated to be generated by approved but unbuilt development.
6. The projected capacities or deficiencies due to approved but unbuilt development.
7. The improvements to be made to all roadways in the current fiscal year by approved developments pursuant to previous development orders and the impact of such improvements on the existing capacities or deficiencies.

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8. The improvements to be made to each roadway in the current fiscal year by the Government and the impact of such improvements on the existing capacities or deficiencies.

Sanitary Sewer

1. The design capacity of wastewater treatment facilities.
2. The existing level of service, measured by the average annual number of gallons per capita per day, based on the average flows experienced at the treatment plant in the twelve months of the previous fiscal year and the population of the service area.
3. The existing peak level of service, measured by the peak 24-hour number of gallons per capita per day, based on the peak 24-hour flows experienced at the treatment plant in the twelve months of the previous fiscal year and the population of the service area.
4. The adopted level of service standards for average annual and peak 24-hour flows.
5. The existing capacities or deficiencies of the system.
6. The volumes anticipated to be generated by approved but unbuilt development.
7. The projected capacities or deficiencies due to approved but unbuilt development.
8. The improvements to be made to the facility in the current fiscal year and by any approved developments pursuant to previous development orders and the impact of such improvements on the existing capacities or deficiencies.
9. The improvements programmed to be made to the facility in the current fiscal year by the Public Utility Agency of Guam and the impact of such improvements on the existing capacities or deficiencies.

Potable Water

1. The design capacity of existing potable water treatment facilities.
2. The existing level of service measured by the average annual number of gallons per capita per

day based on the average flows for billed water in the twelve months of the previous fiscal year and the population of the service area.

3. The existing potable water storage capabilities of the water system.
4. The existing minimum water pressure.
5. The adopted level of service standards for all of the above.
6. The existing capacities or deficiencies of the system.
7. The volumes anticipated to be generated by approved but unbuilt development.
8. The improvements programmed to be made to the facility in the current fiscal year by any approved developments, pursuant to previous development orders and the impact of such improvements on the existing capacities or deficiencies.
9. The improvements programmed to be made to the facility in the current fiscal year by the Public Utility Agency of Guam and the impact of such improvements on the existing capacities or deficiencies.

Energy

1. The design capacity of existing electric power generating facilities.
2. The existing level of service, measured by the average daily peak demand.
3. The adopted level of service standard for energy consumption.
4. The existing capacities or deficiencies within the electric power generating system.
5. The amount of average daily peak demand for electric power that can be anticipated to serve the approved but unbuilt development.
6. The energy system's capacities or deficiencies due to approved but unbuilt development.
7. The improvements made to the electrical generating system in the current fiscal year by any

approved developments pursuant to previous development orders and the impact of such improvements on the existing capacities or deficiencies.

8. The improvements programmed to be made to the electrical generating system in the current fiscal year, by the Guam Power Authority and the impact of such improvements on the existing capacities or deficiencies.

Solid Waste Disposal

1. The design capacity of existing solid waste disposal facilities.
2. The existing level of service, measured by the average annual number of pounds of solid waste generated per capita per day, based on the billed tonnage of solid waste delivered to the Ordot Landfill and based on the civilian population of the island.
3. The adopted level of service standard for solid waste.
4. The existing capacities or deficiencies of the landfill.
5. The volumes of solid waste anticipated to be generated by approved but unbuilt development.
6. The project capacities or deficiencies due to approved but unbuilt development.
7. The improvements to be made to the facility in the current fiscal year by any approved developments pursuant to previous development orders and the impact of such improvements on the existing capacities or deficiencies.
8. The improvements programmed to be made to the facility in the current fiscal year by the Department of Public Works and the impact of such improvements on the existing capacities or deficiencies.

Education

1. The existing schools, by type (elementary, etc.) and location, and including the number of classrooms, age, condition, and land areas at each facility as defined by the Department of Education.

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2. The existing level of service measured by the number of children enrolled at each school divided by the number of classrooms in each school.
 3. The adopted levels of service for educational facilities.
 4. The existing capacities or deficiencies within the public education system.
 5. The additional requirements that will be generated by approved but unbuilt development projects.
 6. The projected capacities or deficiencies due to approved but unbuilt development projects.
 7. The improvements to be made to educational facilities in the current fiscal year by any approved developments pursuant to previous development orders and the impact of such improvements on the existing capacities or deficiencies.
 8. The improvements programmed to be made to educational facilities in the current fiscal year and the impact of such improvements on the existing capacities or deficiencies.

Parks and Recreation

1. The existing combined acreage of neighborhood and community parks as defined by the Department of Parks and Recreation.
2. The existing level of service measured by the combined number of acres of neighborhood and community parks available per 1,000 residents based on an inventory of park lands and the population of the island.
3. The adopted level of service standard for combined neighborhood and community park acreage.
4. The existing capacities or deficiencies of the park system.
5. The additional acreage requirements that will be generated by approved but unbuilt development.
6. The projected capacities or deficiencies due to approved but unbuilt development.

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7. The improvements to be made to park facilities in the current fiscal year by any approved developments pursuant to previous development orders and the impact of such improvements on the existing capacities or deficiencies.
 8. The improvements programmed to be made to park facilities in the current fiscal year and the impact of such improvements on the existing capacities or deficiencies.

CONCURRENCY ASSESSMENT PROGRAM

To fully implement the concurrency management system, the ability to simulate system models for each facility type subject to concurrency is essential. The model will serve to analyze the effects of additional service demands on that facility and compare the demand against available capacity. This type of computer system is termed the "System for the Management of Concurrency" or SYMCON.

The data and analysis documentation for the simulation should include the following information for each facility impacted by the proposed development review. The data base should be presented in a manner which reflects the following logic flow that is exhibited on the accompanying sample spreadsheet model Table 22:

- A. Existing "design" capacity (at adopted level of service, if appropriate) available for consumption;
- B. Additional "design" capacity programmed for construction (as allowed consistent with additional criteria);
- C. Total amount of "design" capacity which is reserved for intergovernmental use (i.e., military needs) if any;
- D. Total "design" capacity (at adopted level of service) available for consumption $((A + B) - C)$;
- E. Existing demand on available capacity generated by actual development;
- F. Impending demand on available capacity generated by approved development;
- G. Total existing demand (i.e., total capacity consumed) generated by actual and approved development $(E + F)$;

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- H. Capacity reserve available for consumption by new proposed development (D-G);
 - I. Estimate of capacity demand generated by new proposed development under review.
 - J. Estimate of surplus/deficit capacity available for new proposed and future uncommitted development (H-I).

There should be two types of determination of whether capacity is expected to be available for development. First, prior to a change in land use or rezoning of an existing land use, a determination should be made as to whether the future growth plans of Guam can accommodate the proposed usage. This determination should be made on the basis of expectations for capital improvements that may go beyond the guidelines of the Land Use Plan and other applicable elements of the Comprehensive Master Plan for Guam and that will not assume a "vesting right" for future development. Vesting refers to a development project which may be declared exempt from the requirements of new regulations (concurrency, in this case) based on the effective date of application, "grandfathering", or other form of previous government action. The purpose of this "concurrency" determination will simply be to address the long range potential for development.

The second tier of concurrency determination will be for the purpose of issuing final development orders (e.g., building permits) and must be an integral part of that process. The intent of GovGuam is to make this determination to ensure that there is concurrency between the effects (impacts) of development and the availability of the services necessary to support that development. However, in accomplishing this goal a reasonable balance must be struck between the benefits to be achieved and the cost of the concurrency management system to the people of Guam.

The minimum requirements of a "determination of concurrency" criterion should include the following five standards, any one of which may satisfy the concurrency requirement:

- 1. The necessary facilities are in place at the time a development permit is issued;
- 2. The development permit is issued subject to the condition that the necessary facilities be in place when the development's impacts occur;
- 3. When the permit is issued, the facilities are under construction;
- 4. The necessary facilities are guaranteed in an enforceable development agreement which requires commencement of construction of the facilities or provision of services within one year of the issuance of the development permit; or

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5. The Government of Guam has committed to provide the necessary facilities and services in accordance with a 5-year schedule of capital improvements.

As a part of any CMS, the Government must determine the "best fit" organizational and administrative structure for implementing the concept. This will include processing, monitoring, and determining concurrency requirements for government operation of the affected public facilities and review of proposed development, and the appropriate legal and statutory requirements (i.e., appeals process, consistency, etc.). However, at this point several scenarios can be developed to describe how the process could work in a "real world" setting. Two different scenarios are presented here to 1) assess the process for an individual, and 2) for a developer. Both scenarios are presented based on the existing GovGuam development review process. It is recommended that the Bureau of Planning (BOP) assume the functional role of "overview agency" with regard to implementing and monitoring the CMS.

Scenario For Individual

An individual desiring to build a single family home on a piece of property already owned by the individual should have the least impact on levels of service for the five facilities required to be concurrent and hence, should have only a minimum review conducted to ensure that the project does not cause a violation of the concurrency provisions. The individual will not normally be attempting to reserve anticipated capacity to assure availability of a given public facility when the development is expected to begin construction.

The following steps would normally be involved:

- The individual would normally go to the Department of Public Works (DPW) to seek a building permit.
 - a. If the individual wishes to reserve facility capacity or simply have a determination of capacity made rather than obtain a building permit at this time, the individual may be directed to the GovGuam agency or department section responsible for determining and reserving capacity.
- The Department of Public Works will obtain information as to the individuals current address; the address/location of the proposed home (by property description, if available, or street address if property description is not known); the size/type of home the individual is planning to build; and a copy of plans for the home.

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- DPW will enter the location of the proposed home into a computer program linked to the Bureau of Planning GIS system. The GIS will examine a locational overlay to determine the zoning of the property and whether any level of service standards are below the standard set by the proposed home. The computer should be able to display the zoning of the property and the types of facilities that are already below the established level of service for that location, if any.
 - a. If the zoning is improper for a single family home, the individual will be advised of this and directed to the Department of Land Management (DLM) section dealing with the area in which the individual's property is located. If one or more facilities are already below the established level of service for the property location the individual will be advised that public services at that location are inadequate and that a building permit can not be issued unless arrangements can be made to provide that service. The individual will then be directed to a customer service representative in the DLM section dealing with the specific facilities that are inadequate. The customer service representative will provide the applicant with information on alternate methods of providing service, generally for water or wastewater problems, and/or information on when adequate service is anticipated.
 - If the zoning is correct and none of the five facilities required to be concurrent are displayed as inadequate, the individual may be issued a building permit upon payment of a fee. The fee for the building permit should include cost associated with the determination of capacity along with other administrative costs.
 - The DPW will enter information on the square footage of the proposed home (living space for possible use by appraisers office and covered space for use in determining impervious surface area) and the number of bedrooms planned in the home (used to continually calibrate facility usage levels). This information will be transferred to an update file within the SYMCON computer. The update file will be used to update information on available capacity on a daily basis.

Scenario For Developer

A developer (anyone other than individual requesting one single family home) may have widely varying impacts on the level of service for the five facilities required to be concurrent, based on type and scope of the project anticipated by the developer and the degree to which the developer plans to provide the

services needed by the development. Even within a type of development, such as commercial, a wide level of needs may exist depending on the specific type of commercial activity that will take place. Hence, the developer at all levels must expect to provide more information to the Government and be subject to a much closer examination of the development's effects on the levels of service than the individual proposing a home on his own property.

It is not expected that a developer will contact the Public Works Department for a building permit before having gone to the Department of Land Management. The following steps would normally be followed before a building permit is issued to a developer under a concurrency requirement:

- The developer desiring to develop a piece of property already owned by the developer or a client should normally go to the DLM to seek a determination of available capacity for facilities bound by concurrency.
- The DLM will obtain information as to the address/location of the proposed development (by property description); the size/type of project the developer is planning to build; and a copy of any preliminary plans for the site the developer may already have. This information will be used for a preliminary determination of potential problems only. More information will be required for actual determination of available capacity and possible reservation of that capacity.
- The DLM will enter the location of the proposed project into a computer program linked to the Bureau of Planning GIS system. The GIS will examine a locational overlay to determine the zoning of the property and if any level of service standards are below those set by GovGuam for the service areas encompassing the proposed project. The DLM computer will then display the zoning(s) of the property and which of the five facility types required to be concurrent with development are already below the established level of service for that location, if any.
- If the zoning is improper for the proposed project, the developer will be advised of this and directed to the DLM section dealing with the area in which the developer's project will be located.
- If one or more of the five facility types required to be concurrent with development are already below the established level of service for the property location, the developer will be advised that public services at that location are inadequate and that a building permit can not be issued unless arrangements can be made to provide those services. The

developer may then elect to discuss the situation with a representative or continue with the capacity determination.

- a. If the developer does not desire further analysis of capacity, they will be directed to see a representative in the DLM section dealing with the specific facilities that are inadequate. The DLM representative will provide the developer with information on alternate methods of providing service and/or information on when adequate service is anticipated. The DLM representative will not review proposals by the developer that may alleviate the existing inadequacy and provide sufficient capacity for the development until the developer pays for and has a complete capacity determination.
- b. If the developer desires to proceed with the capacity determination, the developer will be required to pay a fee for and obtain a capacity analysis based on the specific needs of the proposed project. The analysis will proceed as if all facilities had initially been found adequate.

If the zoning is correct and none of the five facility types required to be concurrent with development are displayed as inadequate, the developer will be advised of the fee required for a capacity determination and asked to provide additional project information in sufficient detail to adequately determine capacity needs of the project. If specific information can not be provided, the maximum capacity usage within the land use category for the site will be used by the DLM to determine the needs of the proposed project.

The DLM will enter the specific information on the proposed development into the computer after payment of the capacity determination fee. This information may be linked to the individual facility models and the models run, as appropriate, to determine capacity needs and availability for the proposed project. The DLM computer will then display a list of the facility types that are required to be concurrent with development but that are inadequate to accommodate the capacity needs of the proposed project, if any. The computer will also display the extent to which the proposed development will exceed the existing available capacity, if the available facility capacity is inadequate for the proposed project.

- o If one or more of the five facility types required to be concurrent with development will fall below the established level of service for the property location and proposed project, the developer will be advised that public services at that location are inadequate for the project as proposed and that a building permit cannot be issued unless arrangements can be made to provide that service. The developer will then be directed to a representative

in the DLM section dealing with the specific facilities that are inadequate. The DLM representative will advise the developer as to if and when a capital facility will be constructed that would provide capacity for the proposed project or with information on alternate methods of providing service to accommodate the proposed project. The representative will also review proposals by the developer that may alleviate the potential inadequacy and provide sufficient capacity for the development. The representative will make recommendation to the Department Director on possible development agreements, where appropriate.

- a. If no resolution of the capacity problem can be reached and a potential for correction of the problem by the Government appears to exist in current 5-year Capital Improvements Program, the developer may elect to reserve capacity on specific types of facilities that are available and necessary to the developer's project. Reservation of capacity will occur as if all facility types were available, including a deposit based on capacity actually reserved, a two year limitation on reservation, and forfeiture of that portion of reservation deposit representing unused reserved capacity at the end of the reservation time limit.
- b. Should the facility type capacity needed by the proposed project, that was unavailable at the time of reservation of other facility type capacity, become available before the reservation time limit for already reserved facility type capacities expires, the developer's having already reserved capacity on some facility types needed for a proposed project will have first option, after existing development agreements, on the new capacity available. Priority for developers in this situation will be based on the earliest facility type reserved for the proposed project.

If none of the five facility types required to be concurrent with development are displayed as inadequate for the proposed project, the developer will be given the option of reserving the capacity needed for the project upon payment of a reservation deposit. The reservation deposit amount will be based on the impact and capacity fees that would result from use of the capacity reserved in the area of the proposed project and the potential for lost revenue to enterprise funds resulting from the reservation. The developer may elect to reserve only a portion of the projected capacity needed for a project or not to reserve capacity at all.

- o If capacity is not reserved at this time, no further action need be taken. The capacity information provided to a developer may only be accurate for the day on which the

information was provided. The developer will be required to pay a new capacity determination fee and have a new capacity determination made if the developer elects not to reserve capacity for a proposed project and then returns with that project at a future date.

If the developer elects to reserve all or a portion of the facility capacity projected as needed for the proposed project, the reservation deposit required will be determined by the appropriate agency and must be made prior to the reservation being effective. Capacity may be reserved for two years from the date of the reservation deposit.

The DLM will enter information on reservation of capacity at the time of deposit is made and provide the developer with a certification indicating capacity of facilities reserved. This information will be transferred to an update file within the computer. The update file will immediately update the used capacity (reserved) files in the SYMCON data base.

SUMMARY

Too often in the past twenty years, under intense growth pressure, various government agencies responsible for capital facility planning have had to scramble to catchup with development. For example, it was not uncommon to see new roads paved, only shortly after to be tornup to accommodate new water or sewer lines. Without a land use plan to predict with any accuracy where development would be taking place, facility providers were hard pressed to predict where they should be planning future extensions of service. At the same time, the sheer number of new residents and visitors quickly overloaded existing capital facility systems. Without an accurate predictor of new population growth, providers were equally at odds with the increasing demand for services by type as well as by location.

This led to other problems in the land development process. Decision-makers were often without accurate and dependable information upon which to base important land use decisions. The lack of coordination and accurate data for public facilities only slowed the process further and reduced the level of service provided by the government.

The use of level of service analysis in planning capital facilities does not (and is not intended to) replace traditional specific capital facility planning, design and implementation. It does, however, address the very problems by which GovGuam has gotten so far behind in capital improvement planning. The process alerts the capital planner to early trends and indications in population growth (demand) characteristics, as well as to the existing supply of capital facilities and the relation of these factors to

each other. The CMS is an excellent tool by which government planners can better predict where and what types of capital facilities will be needed in the near future and by which growth can be managed to best protect the quality of life.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	GUAM POPULATION MODEL													
2	RESIDENT POPULATION - YEAR 1998													
3	Strategic Planning Group, Inc.													
4														
5	ENTER THE FOLLOWING DATA													
6														
7	1980 GUAM POPULATION			105,989										
8	1990 GUAM POPULATION			133,152										
9	PROJECTED POPULATION			149,258										
10	PROJECTION YEAR			1,998										
11						1998								
12	PLANNING AREA	PLANNING	AREA			PLANNING AREA								
13	(ENUMER. DIST.)	POPULATION				PROJECTION								
14										ADJUSTED	NET	LAND AREA	NEW HOUSING	GROSS ACRES
15	NORTH	1980	1990	SHARE	LINEAR	SHIFT		EXPONENTIAL	AVERAGE	AVERAGE	GROWTH	(ACRES)	DEMAND* (DU's)	ABSORBED
16	Dededo	23,644	31,728	38.521	38.195	37.381	0.24	40.144	38.060	38.974	5.248	19,200	1,381	439
17	Yigo	10,359	14,213	18.498	17.296	17.008	0.25	18.305	17.277	18.784	2.571	22,400	875	215
18	subtotal	34,003	45,941	53.019	55.491	54.389	0	58.449	55.337	53.758	7.817	41,600	2,056	654
19	CENTRAL WEST													
20	Tamuning	13,560	16,673	18.507	19.147	18.342	0.16	19.647	18.911	18.371	1.698	3,840	447	142
21	Agana	898	1,139	1.283	1.333	1.289	0.19	1.380	1.321	1.284	145	640	38	12
22	subtotal	14,478	17,812	19.790	20.480	19.631	0	21.027	20.232	19.655	1,843	4,480	485	154
23	CENTRAL EAST													
24	Agana Heights	3,284	3,648	3.881	3.938	3.857	0.08	3.964	3.854	3.744	98	640	28	8
25	Barrigada	7,786	8,648	9.488	9.710	9.100	0.10	9.817	9.528	9.258	410	5,780	108	34
26	Chalan Pago/Ordoi	3,120	4,451	5.240	5.516	5.468	0.28	5.914	5.534	5.378	925	3,840	243	77
27	Mangilao	8,840	10,483	12.643	13.397	13.448	0.34	14.751	13.559	13.172	2,689	8,400	708	225
28	Mong-Tolo-Malla	5,245	5,845	6.201	6.325	5.885	0.09	6.374	6.198	6.019	174	1,280	48	15
29	Sinajana	2,485	2,858	2.781	2.798	2.584	0.05	2.805	2.731	2.653	-5	640	-1	0
30	subtotal	28,540	35,929	40.192	41.680	40.118	1	43.625	41.402	40.220	4,291	18,560	1,130	359
31	SOUTH WEST													
32	Asan	2,034	2,070	2.091	2.099	1.885	0.01	2.099	2.044	1.985	-85	3,840	-22	-7
33	Piti	2,868	2,480	2.251	2.171	1.775	0.12	2.209	2.102	2.042	-438	4,480	-115	-37
34	subtotal	4,900	4,550	4.342	4.270	3.660	0	4.308	4.146	4.027	-523	8,320	-137	-44
35	SOUTH EAST													
36	Talofoto	2,008	2,310	2.490	2.553	2,401	0.11	2,588	2,508	2,438	128	10,880	33	11
37	Yona	4,228	5,338	5.996	6.228	6,007	0.19	6,432	6,185	5,989	651	12,800	171	54
38	subtotal	6,234	7,648	8.486	8.779	8,408	0	9,018	8,673	8,425	777	23,680	204	65
39	SOUTH													
40	Agat	3,999	4,980	5.530	5.729	5,503	0.17	5,893	5,883	5,502	542	7,040	143	45
41	Inarajan	2,059	2,459	2.712	2.797	2,682	0.15	2,855	2,757	2,678	209	12,160	55	17
42	Merizo	1,683	1,742	1.789	1.805	1,641	0.04	1,808	1,781	1,711	-31	3,840	-8	-3
43	Santa Rita	9,183	11,204	12.402	12.821	12,281	0.18	13,137	12,855	12,294	1,090	10,240	287	91
44	Umatac	732	897	995	1,029	985	0.16	1,055	1,018	987	90	3,840	24	8
45	subtotal	17,836	21,282	23.428	24.181	23,052	1	24,748	23,852	23,172	1,900	37,120	501	159
46														
47	GUAM	105,789	133,162	149,257	154,681	149,258	2	181,175	153,642	149,257	18,105	133,760	4,239	1,346
48														
49	NOTES:													
50	* New Housing Demand = net population growth / ave. persons per unit (3.8 PPH)													
51	** The projected total population for 1998 for Guam was computed using the annual average compound growth rate from 1980 to 1990 of 2.31%													
52	Source: U.S. Dept. of Commerce, Bureau of the Census, Census of Population, 1980, 1970, 1960, 1950													

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
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13	(ENUMER. DIST.)	POPULATION				PROJECTION								
14										ADJUSTED	NET	LAND AREA	NEW HOUSING	GROSS ACRES
15	NORTH	1980	1990	SHARE	LINEAR	SHIFT		EXPONENTIAL	AVERAGE	AVERAGE	GROWTH	(ACRES)	DEMAND* (DU's)	ABSORBED
16	Dededo	23,644	31,728	38.521	38.195	37.381	0.24	40.144	38.060	38.974	5.248	19,200	1,381	439
17	Yigo	10,359	14,213	16.498	17.298	17,008	0.25	18,305	17,277	16,784	2.571	22,400	875	215
18	subtotal	34,003	45,941	53.019	55.491	54,389	0	58,449	55.337	53.758	7.817	41,600	2,056	654
19	CENTRAL WEST													
20	Tamuning	13,580	18,673	18.507	19.147	18,342	0.18	19,647	18,911	18,371	1.698	3,840	447	142
21	Agana	896	1,139	1.283	1.333	1,289	0.19	1,380	1,321	1,284	145	640	38	12
22	subtotal	14,476	17,812	19.790	20.480	19,631	0	21,027	20,232	19,655	1,843	4,480	485	154
23	CENTRAL EAST													
24	Agana Heights	3,284	3,648	3.861	3.938	3,657	0.08	3,964	3,854	3,744	98	640	26	8
25	Barrigada	7,766	8,648	9.488	9.710	9,100	0.10	9,817	9,528	9,258	410	5,760	106	34
26	Chalan Pago/Ordot	3,120	4,451	5.240	5.518	5,468	0.28	5,914	5,534	5,378	925	3,840	243	77
27	Mangilao	8,640	10,483	12.643	13.397	13,448	0.34	14,751	13,559	13,172	2,689	8,400	708	225
28	Mong-Tolo-Maite	5,245	5,845	6.201	6.325	5,885	0.09	6,374	6,198	6,019	174	1,280	48	15
29	Sinejana	2,486	2,858	2.781	2.798	2,564	0.05	2,805	2,731	2,653	-5	640	-1	0
30	subtotal	28,540	35,929	40.192	41.680	40,118	1	43,625	41,402	40,220	4,291	18,560	1,130	359
31	SOUTH WEST													
32	Asan	2,034	2,070	2.091	2.099	1,885	0.01	2,099	2,044	1,985	-85	3,840	-22	-7
33	Piti	2,868	2,480	2.251	2.171	1,775	0.12	2,209	2,102	2,042	-438	4,480	-115	-37
34	subtotal	4,900	4,550	4.342	4.270	3,660	0	4,308	4,146	4,027	-523	8,320	-137	-44
35	SOUTH EAST													
36	Tatofolo	2,008	2,310	2.490	2.553	2,401	0.11	2,588	2,508	2,436	128	10,880	33	11
37	Yona	4,228	5,338	5.998	6.228	6,007	0.19	6,432	6,185	5,989	651	12,800	171	54
38	subtotal	6,234	7,648	8.488	8.779	8,408	0	9,018	8,673	8,425	777	23,680	204	65
39	SOUTH													
40	Agat	3,999	4,980	5.530	5.729	5,503	0.17	5,893	5,863	5,502	542	7,040	143	45
41	Inarajan	2,059	2,459	2.712	2.797	2,682	0.15	2,855	2,757	2,678	209	12,160	55	17
42	Merizo	1,683	1,742	1.789	1.805	1,641	0.04	1,808	1,781	1,711	-31	3,840	-8	-3
43	Sanja Rita	9,183	11,204	12.402	12.821	12,281	0.18	13,137	12,855	12,294	1,090	10,240	287	91
44	Umatac	732	897	995	1,029	985	0.16	1,055	1,018	987	90	3,840	24	8
45	subtotal	17,638	21,282	23.428	24.181	23,052	1	24,748	23,852	23,172	1,900	37,120	501	158
46														
47	GUAM	105,789	133,182	149,257	154,881	149,258	2	161,175	153,642	149,257	18,105	133,760	4,239	1,346
48														
49	NOTES:													
50	* New Housing Demand = net population growth / ave. persons per unit (3.8 PPH)													
51	** The projected total population for 1998 for Guam was computed using the annual average compound growth rate from 1960 to 1990 of 2.31%													
52	Source: U.S. Dept. of Commerce, Bureau of the Census, Census of Population, 1960, 1970, 1980, 1990													

1993-1998 ZONING PLAN DEMAND FOR PUBLIC FACILITIES														
Region	Number of Hotel Rooms Existing/1992	Peak Daily Tourists 1992	Total Number of Hotel Rooms Project 1998	Peak Daily Tourists 1998	New Hotel Rooms 1992-1995	Additional Hotel Water Demand (450 gpd)	Additional Hotel Waste Water Generation (382 gpd)	Peak Daily Tourist Growth 1992-1998	Resident Population 1990	Resident Population 1998	Resident Population Growth 1990-1998	Percent of 1990-1998 Growth	Additional Dwelling Unit Demand (3.8 PPH)	Additional Residential Acres 1990-1998
Election District	Existing/1992	1992	Project 1998	1998	1992-1995	(450 gpd)	(382 gpd)	1992-1998	1990	1998	1990-1998			
North														
Dededo	0	0	62	106	62	27,900	23,684	106	31,728	38,551	4,823	29.95%	1269	403
Yigo	0	0	0	0	0	0	0	0	14,213	18,525	2,312	14.36%	608	193
Subtotal	0	0	62	106	62	27,900	23,684	106	45,941	53,076	7,135	44.31%	1877	596
Central/West														
Tamuning	5,430	9,285	7,987	13,658	2,557	1,150,650	976,774	4,372	18,673	18,476	1,803	11.20%	474	151
Agana	205	351	265	453	60	27,000	22,920	103	1,139	1,282	143	0.89%	38	12
Subtotal	5,635	9,636	8,252	14,111	2,617	1,177,650	999,694	4,475	17,812	19,758	1,946	12.09%	512	163
Central/East														
Agana Heights	0	0	0	0	0	0	0	0	3,646	3,649	203	1.26%	53	17
Barrigada	66	113	1,344	2,298	1,278	575,100	488,196	2,185	8,846	9,460	614	3.81%	162	51
Chalan Pago/Ordot	0	0	300	513	300	135,000	114,600	513	4,451	5,257	806	5.00%	212	67
Mangilao	0	0	0	0	0	0	0	0	10,463	12,724	2,241	13.91%	590	187
Mong-Toto-Matta	104	178	104	178	0	0	0	0	5,845	6,182	337	2.09%	89	28
Sinajana	0	0	0	0	0	0	0	0	2,658	2,752	94	0.58%	25	8
Subtotal	170	291	1,748	2,989	1,578	710,100	602,796	2,698	35,929	40,224	4,295	26.65%	1131	358
South/West														
Asan	0	0	200	342	200	90,000	76,400	342	2,070	2,066	16	0.10%	4	1
Piti	0	0	0	0	0	0	0	0	2,480	2,256	-224	-1.39%	-59	-19
Subtotal	0	0	200	342	200	90,000	76,400	342	4,550	4,342	-208	-1.29%	-55	-18
South/East														
Talofafo	0	0	0	0	0	0	0	0	2,310	2,483	173	1.07%	46	14
Yona	0	0	200	342	200	90,000	76,400	342	5,338	5,990	652	4.05%	172	55
Subtotal	0	0	200	342	200	90,000	76,400	342	7,648	8,473	825	5.12%	218	69
South														
Agai	70	120	70	120	0	0	0	0	4,960	5,522	562	3.49%	148	47
Inarajan	0	0	200	342	200	90,000	76,400	342	2,469	2,706	237	1.47%	62	20
Merizo	0	0	0	0	0	0	0	0	1,742	1,783	41	0.25%	11	3
Santa Rita	0	0	0	0	0	0	0	0	11,204	12,380	1,176	7.30%	309	98
Umatac	0	0	0	0	0	0	0	0	897	993	96	0.60%	25	8
Subtotal	70	120	270	462	200	90,000	76,400	342	21,272	23,384	2,112	13.11%	555	176
Total	5,875	10,047	10,732	18,352	4,857	2,185,650	1,855,374	8,305	133,152	149,257	16,105	99.99%	4238	1344

RECREATIONAL FACILITY DEMAND									
Region	Resident Population Growth 1990-1998	Additional Dwelling Unit Demand (3.8 PPH)	Total Gross Demand for Park Acreage (102 Acres per 1000 Persons)	Additional Demand for Neighborhood Parks (One Acre Per 50 Dwelling Units)	Additional Demand for Playground Parks (One Acre Per 2,000 Population)	Additional Demand for Baseball Field (One Acre Per 1,300 Population)	Additional Demand for Basketball Courts (One Field Per 2,500 Population)	Additional Demand for Volleyball Courts (One court Per 2,500 Population)	Additional Demand for Tennis Courts (One court Per 3,000 Population)
North									
Dededo	4,823	1,269	492	25.38	2.41	3.71	1.93	1.93	1.61
Yigo	2,312	608	236	12.17	1.16	1.78	0.92	0.92	0.77
Subtotal	7,135	1,877	728	37.55	3.57	5.49	2.85	2.85	2.38
Central/West									
Tamuning	1,803	474	184	9.49	0.90	1.39	0.72	0.72	0.60
Agana	143	38	15	0.75	0.07	0.11	0.06	0.06	0.05
Subtotal	1,946	512	199	10.24	0.97	1.50	0.78	0.78	0.65
Central/East									
Agana Heights	203	53	21	1.07	0.10	0.16	0.08	0.08	0.07
Barrigada	614	162	63	3.23	0.31	0.47	0.25	0.25	0.2
Chalan Pago/Ordol	806	212	82	4.24	0.40	0.62	0.32	0.32	0.27
Mangilao	2,241	590	229	11.79	1.12	1.72	0.90	0.90	0.75
Mong-Toto-Maite	337	89	34	1.77	0.17	0.26	0.13	0.13	0.11
Sinajana	94	25	10	0.49	0.05	0.07	0.04	0.04	0.03
Subtotal	4,295	1,131	439	22.59	2.15	3.30	1.72	1.72	1.43
South/West									
Asan	16	4	2	0.08	0.01	0.01	0.01	0.01	0.01
Pili	-224	-59	-23	-1.18	-0.11	-0.17	-0.09	-0.09	-0.07
Subtotal	-208	-55	-21	-1.10	-0.10	-0.16	-0.08	-0.08	-0.06
South/East									
Talofofo	173	46	18	0.91	0.09	0.13	0.07	0.07	0.06
Yona	652	172	67	3.43	0.33	0.50	0.26	0.26	0.22
Subtotal	825	218	85	4.34	0.42	0.63	0.33	0.33	0.28
South									
Agat	562	148	57	2.96	0.28	0.43	0.22	0.22	0.19
Inarajan	237	62	24	1.25	0.12	0.18	0.09	0.09	0.08
Merizo	41	11	4	0.22	0.02	0.03	0.02	0.02	0.01
Santa Rita	1,176	309	120	6.19	0.59	0.90	0.47	0.47	0.39
Umatac	96	25	10	0.51	0.05	0.07	0.04	0.04	0.03
Subtotal	2,112	555	215	11.13	1.06	1.61	0.84	0.84	0.7
Total	16,105	4,238	1,645	84.75	8.07	12.37	6.44	6.44	5.38

	Additional	Additional	Additional	Additional	Additional	Additional	Additional	Additional
	Potable Water	Wastewater	Solid Waste	Automobile	demand	demand	demand	demand for
Region	Demand	generated	generated	demand	for	for	for	Parks
Election District	(100 g/p/day) 8	(85 g/p/day) 9	(4 lbs./p/day) 10	(0.75/person) 11	Police Officers (2.48/1000 persons) 12	Firefighters (2.18/1000 persons) 13	Health Care Beds (1.76/1000 persons) 14	(102 Acres per 1000 Persons) 15
North								
Dededo	482,300	409,955	19,292	3,617	12	11	7	492
Yigo	231,200	196,520	9,248	1,734	6	5	3	236
Subtotal	713,500	606,475	28,540	5,351	18	16	10	728
Central/West								
Tamuning	180,300	153,255	7,212	1,352	5	4	3	184
Agana	14,300	12,155	572	107	0	0	0	15
Subtotal	194,600	165,410	7,784	1,459	5	4	3	199
Central/East								
Agana Heights	20,300	17,255	812	152	1	0	0	21
Barrigada	61,400	52,190	2,456	461	2	1	1	63
Chalan Pago/Ordot	80,600	68,510	3,224	605	2	2	1	82
Mangilao	224,100	190,485	8,964	1,681	6	5	3	229
Mong-Toto-Maite	33,700	28,645	1,348	253	1	1	1	34
Sinajana	9,400	7,990	376	71	0	0	0	10
Subtotal	429,500	365,075	17,180	3,223	12	9	6	439
South/West								
Asan	1,600	1,360	64	12	0	0	0	2
Piti	-22,400	-19,040	-896	-168	-1	0	0	-23
Subtotal	-20,800	-17,680	-832	-156	-1	0	0	-21
South/East								
Talofofo	17,300	14,705	692	130	0	0	0	18
Yona	65,200	55,420	2,608	489	2	1	1	67
Subtotal	82,500	70,125	3,300	619	2	1	1	85
South								
Agat	56,200	47,770	2,248	422	1	1	1	57
Inarajan	23,700	20,145	948	178	1	1	0	24
Merizo	4,100	3,485	164	31	0	0	0	4
Santa Rita	117,600	99,960	4,704	882	3	3	2	120
Umatac	9,600	8,160	384	72	0	0	0	10
Subtotal	211,200	179,520	8,448	1,585	5	5	3	215
Total	1,610,500	1,368,925	64,420	12,081	41	35	23	1,645

1993-1998 PUBLIC FACILITY DEMAND NOTES

1. Bureau of Planning, March 1992
2. Peak daily tourists determined by multiplying number of hotel rooms by average room occupancy (1.8 persons) and by peak hotel occupancy rates (0.95)
3. Bureau of Planning, Guam Hotel and Restaurant Association, Department of Commerce. Compilation of hotel developments and expansions expected to be completed by 1997; collated by village as of March 1992.
4. PUAG Water Facilities Master Plan Update prepared by Barrett Consulting Group, indicates average hotel room potable water and wastewater demand rates on Guam.
5. 1980-1990 island population growth rate applied to 1990-1998 time period, adjusted for villages showing negative population growth by WBF/SPG.
6. Demand for new dwelling units calculated by dividing the net population growth per village by the average household size (3.8), WBF/SPG.
7. Multiply dwelling unit demand by projected single-family detached and multi-family units, (0.74) and (0.26) respectively. Sum is divided by the average residential density; (2.5) and (12) units per acre.
8. Potable water demand projected based on average daily level-of-service demand of 100 gallons per person used by PUAG.
9. Wastewater demand projected based on average daily level-of-service demand of 85 gallons per person used by PUAG.
10. Solid waste generation based on average daily rate 4 lbs. per person: WBF/SPG and Department of Public Works.
11. Automobile demand based on 1991 ration of automobiles to resident population: WBF/SPG and Department of Motor Vehicles.
12. Additional demand for police officers based on 1991 level-of-service rate of 2.48 officers per every 1,000 resident population: WBF/SPG and the Guam Police Department.
13. Additional demand for firefighters based on 1991 level-of-service rate of 2.18 firefighters per every 1,000 resident population: WBF/SPG and the Guam Fire Department.
14. Additional demand for health care beds based on 1991 level-of-service rate of 1.76 beds per every 1,000 resident population: WBF/SPG and the Guam Health Department.
15. Additional demand for park facilities based on 1991 level-of-service rate of 102 acres of parks per every 1,000 resident population: WBF/SPG and the Department of Parks and Recreation.

	SYSTEM FOR THE MANAGEMENT OF CONCURRENCY (SYMCON)									
Region/Facility	Existing Facility Design Capacity	Additional Programmed "Design" Capacity	Intergovernmental Capacity Reservation (i.e., military)	Total Design Capacity Available For Non-Reserved Consumption	Existing Demand Generated by Actual Development	Impending Demand Generated by Approved Development	Total Existing Demand Actual + Approved Development	Capacity Available For Consumption by New Proposed Development	Estimate of Demand Generated by New Proposed Development	Surplus/Deficit Capacity Available For New Proposed and Future Uncommitted Development
Northern Facilities										
Dededo				0			0	0		0
Yigo				0			0	0		0
Subtotal	0	0	0	0	0	0	0	0	0	0
Central/West Facilities										
Tamuning				0			0	0		0
Agana				0			0	0		0
Subtotal	0	0	0	0	0	0	0	0	0	0
Central/East Facilities										
Agana Heights				0			0	0		0
Barrigada				0			0	0		0
Chalan Pago/Ordot				0			0	0		0
Mangilao				0			0	0		0
Mong-Toto-Maite				0			0	0		0
Sinajana				0			0	0		0
Subtotal	0	0	0	0	0	0	0	0	0	0
South/West Facilities										
Asan				0			0	0		0
Piti				0			0	0		0
Subtotal	0	0	0	0	0	0	0	0	0	0
South/East Facilities										
Talofofo				0			0	0		0
Yona				0			0	0		0
Subtotal	0	0	0	0	0	0	0	0	0	0
Southern Facilities										
Agat				0			0	0		0
Inarajan				0			0	0		0
Merizo				0			0	0		0
Santa Rita				0			0	0		0
Umatac				0			0	0		0
Subtotal	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0

The Land Use Plan for Guam

Generalized Capital Improvement Plan

ADDENDUM

February 1994

This addendum addresses the comments received from TPC staff regarding the Generalized Capital Improvement Plan.

Specifically, the Addendum includes: 1) the discussion of comparable level of service standards for the U.S. and other island communities when applicable and available; and 2) recommendations for several alternative means of financing CIPs which GovGuam may consider.

TPC staff comments on this work product also included a request for "a prioritization of CIPs." As a component of the Five-Year Zoning Plan "product," GovGuam capital improvement projects were reviewed, confirmed, updated, and analyzed by WBF/SPG insofar as defining the phasing (timing) of the projects relative to the design of the Five-Year Zoning Plan for the 19 villages. Prioritizing the individual projects was not a "product" unto itself, but was part of the planning process in developing the Five-Year Plan. Assigning priority to CIPs is currently the responsibility of individual agencies' respective planning operations.

Comparable LOS Standards Guam Land Use Plan

Existing Levels of Service

Wastewater Treatment

The amount of treated effluent is based on daily flow levels through the plants. However, actual measurements of flows through the system are difficult to ascertain. However, general engineering standards predict that between 80 and 90 percent of water consumption is returned through the wastewater collection system as effluent. Both PUAG and GEPA estimate that approximately 85 percent of metered water consumption returns through the wastewater collection system. Applying this standard to the range of per capita metered water consumption rates identified by the PUAG Water Master Plan Up-date (99-138 gpcd) yields an estimated wastewater treatment level-of-service range of 84-117 gallons per capita per day (gpcd) for planning purposes. The PUAG uses an average of 85 gpcd as an existing level of service for planning purposes.

Comparable U.S. standards, are difficult to ascertain owing to the general lack of measuring (metering) for wastewater effluent. However, Monroe County, Florida, which includes the Florida Keys, was examined as a comparable island environment.

This area has used desalination plants to provide potable water, has a cistern system requirement for new residences, and now pipes in water from the mainland. Water is even more of a precious commodity in the Florida Keys than in Guam. It should also be noted that this area is considered to have the worst soil conditions in the State of Florida, so that on-site septic systems are not considered to be a viable development option.

With these factors and conditions in mind, the following LOS's for sanitary sewers have been developed in Monroe County. In general, these figures indicate a slightly higher rate of daily wastewater effluent than Guam based on a per capita rate.

Household Size	Sanitary Sewage Generation Rate
2 Bedroom Dwelling Unit or between 601 and 1,000 sq.ft. of enclosed living area	270 gpd*
3 Bedroom Dwelling Unit or between 1,001 and 2,000 sq.ft. of enclosed living area	405 gpd*
4 Bedroom Dwelling Unit or more than 2,000 sq. ft. of enclosed living area.	540 gpd*
*gpd = gallons per day	

Source: Monroe County, Florida Planning Department, 1991

Potable Water

Residential users account for the largest share of consumption by type. They consume 68 percent of PUAG's overall water demand. Commercial users account for the second largest group of consumers. They comprise approximately 21 percent of total demand. Government and agriculture use comprise the remaining 11 percent of total demand.

The per capita level of service use, according to the Preliminary Water Master Plan Update, varies from 99 gallons per capita per day (gpcd) to 138 gpcd (excluding unaccounted-for water). The PUAG uses a standard figure of 100 gpcd as an existing level of service for planning purposes. Hotel water consumption is estimated at a typical rate of 450 gallons per room per day (gprd). In addition, golf courses are estimated to require approximately 1,000 gallons of water per hole each day, according to the PUAG Water Master Plan Update.

For comparison purposes, other island communities both in the Pacific as well as the Caribbean were consulted to ascertain selective LOS demand figures for potable water. The standard LOS used for most U.S. community-based systems is 100 gpcd. Research from the U.S. Virgin Islands indicated that cistern users not on the public water supply system used an average of 38-40 gpcd. Another study indicated that metered residences (public supply users) in the Virgin Islands averaged 50 gpcd.

The difference between the U.S. community based systems average LOS and that associated with a dry island environment (U.S. Virgin Islands), indicates a wide disparity in water availability and consumption. This also indicates higher use of water conservation strategies relevant to water availability.

Data from Bermuda and Maui, Hawaii indicate that these islands have more severe potable water availability issues facing them than exist in Guam--at the present time.

In Bermuda, there is an effective level of service provision of 25 gallons of potable water per person, while in Maui, Hawaii, the current rate of provision is 23 gallons per person per day. These levels of demand are significantly lower than the LOS used by PUAG to calculate demand in Guam for potable water.

Solid Waste Generation

Based on existing 1990 demand at the Ordot Landfill (245 tons per day), an average generation rate can be ascertained based on the existing population. For planning purposes it is estimated that per capita solid waste generation from the resident population on-island is approximately four pounds per day.

Applicable standards for communities in the U.S. usually range from 5-12 pounds per day per person.

Automobile Traffic

In 1991, there were more than 100,000 registered vehicles in Guam. This amounts to approximately one vehicle for every 1.3 residents, a very high vehicle-to-population ratio, given an island setting with limited land area.

The U.S. standard is approximately one vehicle for every 2.3 residents.

Parks and Recreation

In order to accurately gauge demand for outdoor recreation areas and facilities, the Department of Parks and Recreation (DPR) established local facility/population standards for recreational activities on Guam. Their standards are shown in the following table.

Guam Outdoor Recreation Standards

Activity	Supply
Bicycling	1 mile/500
Boating	1 slip/500
Camping	1/5,000
Canoeing	N/A
Jogging	1/1,000
Hiking	1 mile/1,000
Horseback Riding	1 mile/1,000
Hunting/Skeet	N/A
Shooting	
Sailing	N/A
Surfing	N/A
Tennis	1/3,000
Trail Bikes	1 mile/5,000
Water Skiing	N/A
Skating/Skateboarding	1/2,500
Playground Activities	1/2,000
Picnicking	11/2,500
Swimming (Beach/Pool)	1 acre/1,000

Diving (Snorkeling/Scuba)	N/A
Fishing	N/A
Outdoor Games	
1. Football	1/15,000
2. Baseball	1/1,300
3. Basketball	1/2,500
4. Volleyball	1/2,500
5. Soccer	1/20,000
6. Hockey	1/10,000
Outdoor Cultural Activities	1/Community (Village)
Pleasure Driving	1 mile/1,000

Source: Department of Parks and Recreation

In addition, the inventory of GovGuam park acreage indicates a relative level of service of 102 acres of park land for every 1,000 persons on Guam. The Department of Parks and Recreation have established park standards that apply to new subdivisions of twenty or more units. There are four major park types: play lots (2,500 sq. ft. to one acre in size), vest pocket parks (also 2,500 sq. ft. to one acre), neighborhood parks (five acre minimum size), and district parks (20 to 100 acres in size). According to DPR standards, parks should be provided at one acre per fifty dwelling units or one acre per 43,560 square feet of building.

Recreation Standards

The most generally accepted method of assessing the need for future recreational facilities is to use "standards." Recreational standards are short-hand mechanisms for predicting the number of particular facilities, such as ballfields or basketball courts, a group of people would typically utilize. Statistically, the average number of times and number of individuals that will use different types of facilities form the collective "demands;" however, a particular facility can only be used a finite number of times. the resulting standards, such as one soccer field per 10,000 persons, set the baseline for evaluating recreational needs. These baseline standards would then be adjusted to suit local conditions, if required.

The following tables are presented to review generally accepted recreational standards against which the Territory's facilities can be compared. These tables represent a starting point for setting LOS for recreational and park facilities. The following table presents the Department of Natural Resources' recommended population standards for park facilities in Florida. This table presents a minimum, median, and maximum population served for each facility.

Population Guidelines for Facility-Based Recreation Activities

Resource/Facility	Population Served		
	Minimum	Maximum	Median
Baseball/Softball Field	2,000	10,000	5,000
Football/Soccer Field	4,000	25,000	6,000
Basketball Court	500	10,000	5,000
Tennis Court	1,067	10,000	2,000
Volleyball Court	4,000	12,000	6,000
Exercise Trail	10,000	50,000	15,000
Handball/Racquetball Court	2,500	20,000	10,000
Play Area/Tot Lot	500	15,000	10,000
Multipurpose Field	500	10,000	3,750

Sources: *Outdoor Recreation in Florida - 1989*, Florida Department of Natural Resources, Division of Recreation and Parks, 1990.
Strategic Planning Group, Inc., 1991.

The following table presents site guidelines for recreational facilities in Florida. For each park classification, guidelines have been established for minimum acreage, the area served, and suggested facilities.

Site Guidelines for Recreation Facilities State of Florida

Park/Facility	Minimum Acreage	Service Area	Suggested Facilities
Play Area/Tot-Lot	1/4 acre	2-3 block area	Play apparatus areas, benches and open space landscaping, picnic tables optional.
Neighborhood Park	2 acres	1/4-1/2 mile	Play apparatus areas, recreation buildings, sports fields, paved multipurpose courts, senior citizens area, picnic and play areas.
Community Park	5 acres	1/3-3 miles	All the facilities found in a neighborhood park plus facilities to service the entire family. Pools, softball and baseball fields, tennis courts, play areas and picnic areas.

Sources: *Outdoor Recreation in Florida* - 1989, Department of Natural Resources, 1990.
Strategic Planning Group, Inc., 1991.

Police Personnel

At present, there are 330 police officers in the Guam Police Department serving a total resident population of 133,152. This reflects a level of service of 2.48 police officers for every 1,000 permanent residents.

Currently, the police force on St. Croix (USVI) is comprised of 175 police officers serving a total estimated resident and seasonal population of 53,343. This reflects a level of service of 3.3 police officers for every 1,000 residents.

For evaluation purposes, a comparison can be made of other communities' police service provision. Data indicates that the island of Bermuda provides for an extremely high 8.2 policemen per 1,000 residents, while Maui, Hawaii is providing 2.5 officers per 1,000 residents. A recent state-wide survey of Florida communities indicated an average level of service of 2.2 police officers per 1,000 residents.

Firefighters/Emergency Medical Service Personnel

There are 273 certified firefighters in the Fire Department with 17 additional firefighters to be added in the near future. With a 1990 total resident population of 133,152 this translates into an existing level of service of 2.18 firefighters for every 1,000 residents.

For comparative purposes, an examination can be made of other communities' fire protection levels of service relative to that of Guam. Data indicates that the island of Bermuda provides approximately 2.3 firefighters per 1,000 population. A study conducted of South Florida communities in 1986 to determine an "ideal" rate of provision for firefighters indicated a Florida community average of 1.8 firefighters per 1,000 population. It should be noted that virtually all of the communities surveyed require that their firefighters be cross-trained as Emergency Medical Technicians (EMT).

Health Care Beds

The existing supply and recent expansions to the Guam Memorial Hospital amount to a total of 196 immediate healthcare beds. This translates in turn, into an existing level of service delivery of 1.76 healthcare beds for every 1,000 residents of Guam.

No applicable U.S. based level of service standard is available.

Capital Improvement Financing Mechanisms Guam Land Use Plan

Existing revenue sources and available funding mechanisms for capital improvements include the General Fund, which includes Section 30 funds (an income tax revenue generated from all federal employees on Guam and returned to Guam by the federal government), the Special Revenue Fund (this includes the Tourist Attraction Fund--a revenue generated by taxing hotels and other tourist uses) and Federal Funds (grants).

Traditionally, localities have had three major choices in securing funds for capital improvements financing:

1. federal grants
2. long-term borrowing, and,
3. other self-financed sources

The role of these funding mechanisms has changed substantially between the 1950s and the 1990s.

In the 1950s, long-term borrowing accounted for about half the funds used for capital improvements needs. Federal grants played only a minimal role. By the 1970s, federal aid had grown significantly in importance, and by 1980 had become the primary source of capital funds. Changes in federal spending priorities, however, reversed this trend. Long-term borrowing has now reemerged as the major source of funding for capital improvements. In addition, localities are increasingly beginning to look to other self-financed sources to provide needed capital improvements. These include:

1. Property taxes (ad valorem). Property taxes are based on millage rate, taxable value of all real property. Depending upon policies established by GovGuam, revenue from ad valorem taxes can be used to fund operating costs or capital projects.

Although property taxes are a major source of revenue for the Island, it is unrealistic to anticipate the use of this source as a funding mechanism for major capital investments. The revenue generated by property taxes is consumed largely by day-to-day GovGuam operations. Other appropriate funding sources for capital expenditure must be identified and utilized.

2. Public Utility or User Charges. These charges are typically derived from the operation of publicly owned utilities. Some utilities for which user charges are common are water, sewer, solid waste removal, and electricity. GovGuam operates several public utilities and, therefore, receives significant revenue from this source. The utilities include water and sewer (PUAG), electrical power (GPA) and solid waste removal (DPW).

3. Other Taxes, Fees, and Charges. The local revenue sources previously discussed are not always sufficient to fund Island needs. The following sources of revenue represent options available to GovGuam to finance required capital improvements.

- a. Impact fees. Impact fees are fees charged in advance of development. The fees are designed to pay for infrastructure needs but not for operating costs. The fees can only be applied to the specific group benefiting from the capital improvement and the monies collected can only be used for the cited improvement. Impact fees have been used in funding transportation improvements, recreation facilities, schools, sewer, water and emergency services.
- b. Special Assessments. Special assessments are similar to impact fees in that they are levied only against those who benefit directly for the new service or facility. For example, a new sewer system for an existing neighborhood can be financed through a special assessment instead of through GovGuam's general fund or operating agency budgets.
- c. Tourist Attraction Fund. This tax is designed to raise revenue for tourist-related facilities and projects. The tax is levied against short-term (tourist) rentals of hotels/motels and other tourist uses.
- d. Borrowing. The high cost of many capital improvements can require that local governments borrow. Short-term financing, from one to five years, is generally available through local banks. Long-term bond issues are, however, the more typical approach. There are several types of bond issues available for the territory to use:
 - (1) General obligation bonds. These bonds are backed by the full faith and credit of the local government and must be approved by voter referendum. General obligation bonds receive a lower interest rate than most other bonds because they are, in effect, secured by the taxing power of the local government. Revenues received by the government are used to repay the debt. Capital improvements financed through general obligation bonds should benefit the island as a whole rather than a particular area or group.
 - (2) Revenue bonds. Revenue bonds are financed by those benefiting from the capital improvement. Revenue obtained from this type of bond is used to finance publicly-owned facilities such as electric power plants. The charges collected from the users of the facility are used to repay the bond issue. Interest rates tend to be higher than for general obligation bonds. Revenue bonds can be approved without a voter referendum.

- (3) Industrial revenue bonds. This type of bond is issued by a local government, but is actually assumed by companies or industries who then use the revenue for construction of plants or facilities. These bonds can hold a tax-exempt status and carry relatively low interest rates.

A wide variety of other techniques are available to GovGuam to finance infrastructure development by direct and indirect means, as well as techniques to reduce the cost (or demand) for new improvements. Several options are discussed in the following section.

Development Exactions and Impact Fees

"Development exaction" is a generic term that describes a variety of mechanisms by which communities require dedication of land or facilities or payment of a fee in lieu of the provision of land or facilities. Exactions are referred to by many names, including "dedications," "linkage requirements," and "mitigation requirements." Exactions are either explicitly mandated in development regulations or imposed informally on a case-by-case basis in rezoning or special permit negotiations. Impact fees require a developer to pay an amount of money determined by a uniform formula.

Traditionally, exactions have required a developer to provide on-site infrastructure, such as roads, parks, sewer or water lines, and drainage facilities. Realizing that to require certain on-site improvements such as parks might be inefficient or inequitable, many communities have begun to require developers to pay fees instead of providing the actual improvements. These fees are then earmarked for providing those facilities to serve the development.

Recently, communities have begun to impose impact fees to finance an expanding variety of public facilities and services. Martin County, Florida, for example, has enacted a Beach Impact Fee Ordinance, which requires developers to contribute to a fund, based upon the projected demand resulting from the proposed project, to purchase and maintain beach-front property for public use.

While there may be considerable interest in imposing an impact fee system in Guam, it is probably premature to initiate such a process at this time. It must be understood that the courts have found that this mechanism may be used to pay only for the impacts created by new development, not to correct past deficiencies. For the Territory to rationally determine what new impacts will be created by a proposed development, they must be able to establish what the current level of service is for any given facility and what the desired service level is. The difference between the existing and the desired level is the measure of the current deficiency for the facility (e.g., roads, recreational facilities, sanitary sewers, etc.) being analyzed.

Because it is difficult to determine precise current service levels for most facilities, it would be impossible to know with any degree of accuracy the impact that new development would

have. For example, once GovGuam can establish with accuracy the volume of traffic that is traveling on any public roads, they will then be able to determine what impact any new development will have on any given highway.

Adequate Public Facilities Ordinances

This type of ordinance or code conditions development approval upon a finding that adequate public facilities are available to serve proposed development. The code sets quantitative standards for required public service levels and links development approval to the ability of public services that serve the proposed developed to comply with these standards.

Much of the discussion above with regard to impact fees is also appropriate here. It would be difficult for GovGuam to legally stop development from occurring until such time as it can be determined what the current service levels are and how adequate (or inadequate) they are when measured against a standard toward which the Government is striving to achieve.

This type of ordinance (as well as impact fee legislation) has a relationship to capital improvements programming that, to work properly, must be tied to a comprehensive level of service analysis. Until this relationship is established, it will be extremely difficult to defend a policy of not issuing a development permit on the basis of inadequate public facilities without appearing to be arbitrary and capricious.

The public services that have the greatest impact on development decisions are water, sewer, and roads. Other public services sometimes linked to development approval are stormwater management facilities, park and recreational facilities, and emergency response time. Some states require all local governments to adopt adequate public facilities ordinances or codes.

Transfer of Development Rights

Transfer of Development Rights (TDR) is a technique based on the concept that ownership of land gives the owner many rights, each of which may be separated from the rest and transferred to someone else. One of these rights is to develop land. With a TDR system, landowners are able to retain their land, but sell the rights to develop the land for use on other property. Under a typical TDR program a governmental entity awards development rights to each parcel of developable land in the community or in selected districts, based on the land's value or acreage. Individuals may then sell their development rights on the open market if they don't want to develop the property, or are prohibited by regulation from building at a desired (the property owner's) density. Land from which development rights have been sold cannot be developed.

TDR can reduce substantially the value shifts and economic inequities of restrictive zoning. For example, it can allow the market to compensate owners whose land cannot be developed because of its environmental or historic significance. By selling his or her development rights, a landowner can receive profit from property appreciation without developing the

parcel. At the same time, government can achieve potentially great cost-savings toward acquisition or preservation of unique historic, recreation, cultural and environmental resources.

At the heart of TDR programs is the premise that good public policy should require developers to pay for the preservation of scarce natural or historic resources threatened by new development. But public preservation activities reduce the financial resources available for other programs. In Guam, where significant dollars will be necessary to fund a myriad of infrastructure projects at least to the end of the century, money must be a key consideration. The fact that TDR would draw its resources from a group of private property owners undertaking new development would not reduce the responsibility of Government officials to ensure that the money would be spent as effectively as possible to meet island-wide needs.

The other techniques that are available for the preservation of island resources, such as performance standards, should be considered when making the decision as to whether or not to utilize TDRs. If other methodologies can be employed that achieve the desired end of preserving natural and historic resources without adversely impacting the financial capabilities of the Government, then the more prudent course to take may be one that does not include TDR as part of the package.

Public Spending and Taxing Policies

Although not traditionally viewed as methods of managing development, public expenditure and property taxation policies may have significant impacts on land use. Public facilities such as roads, water, sewer, and public transportation can especially influence the level and characteristics of development in a community.

Capital Improvements Programming

The provision of public services is an important tool for managing development. A public decision whether to extend or expand utilities or facilities strongly influences the economic viability of most large private development projects. The extension of public services is generally governed by a capital improvements program (CIP), a device by which the community indicates the timing and level of public services it intends to provide over a specified duration. Generally, the CIP covers a five- or six-year period.

Capital programming, by itself, influences land development decisions. By committing itself to a timetable for expansion of services, a community influences development decisions to a certain extent, especially in areas where on-site sewage disposal or water supply is unfeasible or expensive. A capital program may also be used effectively as part of a more comprehensive planning process (such as the Land Use Plan) to manage development. By properly coordinating its utility extension policy with its planning and growth management program, the Territory can control the pace and direction of development. Using the Land

Use Plan to delineate the location and intensity of development desired and the CIP to schedule the provision of services, the Territory can inform developers when construction on a particular parcel will be encouraged and the intensity of development that will be allowed. Additionally, the Government can regulate the pace of development to coincide with the availability of adequate public services.

The ability of Government officials to establish agreed upon levels of service for public facilities and services (e.g., transportation, water, sewer, fire and police protection, solid waste, recreation, etc.) will enable GovGuam to develop a rational, defensible CIP.

Preferential Assessment

Most states have enacted preferential or use-value property tax assessment programs for farmland and open space lands. With use-value assessment, property taxes for a parcel are based upon the value of the parcel considering only its present use, rather than its development potential. Use-value assessment can reduce the property taxes for land whose value for development purposes exceeds its worth as agricultural use. Reduced property tax assessments can lessen the need to sell or develop that is sometimes caused by high real estate taxes and therefore, reduce the need for increased infrastructure improvements.

A form of preferential assessment that could be considered for Guam would be similar to one that is used in Massachusetts for agricultural land. If an individual has a vacant parcel of land of a defined minimum size (ten acres, for example), he may apply for an agricultural assessment for his property. If he receives this assessment (which is much lower than any other assessment rate), he must agree to maintain his property in an agricultural or a vacant classification for a minimum period of time. In Massachusetts, this time period is 25 years. If someone comes to the landowner with an offer to buy his property for the purpose of developing it within the stated minimum time period, the property owner will have to pay back taxes on the property to the year that he received his agricultural assessment rate, based on the use for which the developer intends for the land.

If GovGuam intends to develop an agricultural component as part of a diversified economic program, then some form of preferential assessment should be contemplated. This could make farming activities a more financially attractive land use activity option.

Special Assessments

The special assessment is the taxation technique that has the greatest potential impact on growth management policy. A special assessment, while not technically a tax, is a method of raising revenue in which all or part of the cost of a facility is charged to a landowner who derives a special benefit from the facility. Special assessments are often used for road improvements, street lighting, sewers, and water systems. The fee is normally proportional to the distance the facility abuts the parcel, the area of the land served by the improvement, or the value added to the land served.

As Guam embarks on a program to improve and/or expand infrastructure, this may be a viable means of generating revenues to help to pay for these improvements. These special assessments amount to being "user fees." If they are to be employed, there must be established a fair means of establishing the proportional share that everyone will have to bear. A simple computation of the linear front footage might appear to be the simplest, fairest way of dealing with this matter, but it does not take into account the individual with his single- or two-family home next door to the multi-family highrise or 100-unit hotel, and both having approximately the same amount of street frontage. Therefore, it might be more appropriate to establish the rate on a units-served basis. In the case of non-residential development, such as commercial or office space, it should probably be done on a square footage basis. For vacant land, the matter becomes more complex. Although there is no existing development on the site, it should not be assessed at the lowest possible rate because the installation of the facility, be it sewer, water, or improved roadway, is making the parcel much more attractive for development. Therefore, it should be assessed based upon its development potential.

A note of caution should be interjected at this point. It can reasonably be assumed that most infrastructure improvements that would be the subject of any type of special assessment would be either in existing built up areas or along the major roadways. These locations would also be prime sites for affordable housing developments. A policy would have to be developed prior to establishing any sort of special assessment on infrastructure so that these fees do not contravene the intent of providing low cost housing to Guam residents. This policy could take the form of a partial or total exemption from the special assessment.

Improvement Districts

Special improvement districts have been created in many forms to raise revenues for roadway improvements or other public improvements within a defined geographic area. Landowners within this specified district are levied a special tax which is used to make public improvements that will benefit that district.

A mechanism that is being used increasingly by American communities is known as tax increment financing (TIF). The basic tenet of TIF is that redeveloped property will increase in value and generate higher property tax revenues than if nothing were done to rehabilitate property and/or structures. It is most commonly used in downtown areas so that if it were to be used in Guam, it would probably be employed in Agaña or Tumon. The increase, or increment, in the tax revenues over the assessed value prior to the improvements would be "captured" and pledged to pay off the bonds that were issued to finance the redevelopment. Once the project has been paid off, the increment may be channeled back to a redevelopment fund or assimilated into the general revenue fund. This technique has proven to be an effective means for encouraging and facilitating needed downtown redevelopment.

How the process might work in Guam is explained in the following example. If it were determined that a parking garage is necessary to improve the functioning of downtown

Agana, a redevelopment district would be established for the area that would be primarily affected by such an improvement. The redevelopment district with its precisely drawn boundaries must first have a detailed plan prepared for the area. There must then be a declaration of substandard conditions in the area that will lead to the establishment of the TIF District. Once this is done, the tax rate is frozen within the TIF until the improvements that have been identified in the redevelopment plan have been accomplished, including the building of the parking garage. At this point, the tax freeze is lifted and the increase in tax revenues are used to pay off the bond that was issued to pay for the improvements within the TIF District.

Land Acquisition

Government enjoys broad authority to acquire real property interest, either through voluntary sale or condemnation, for any legitimate public purpose. Land acquisition is an important supplement to land use regulations as a means of managing growth and protecting critical resources. Although communities generally use land acquisition to directly control the use of the specific parcel acquired, several places have used this technique to influence growth management policies. Boulder, Colorado, for example, has used the proceeds of local bond issues and local sales tax to acquire a large amount of land in the foothills of the Rocky Mountains and farming districts surrounding the City to prevent environmentally destructive and fiscally unsound development (from the City's standpoint) of these areas.

Land acquisition programs are normally funded by property, sales, or real estate transfer taxes. Bond issues backed by one of these taxes are commonly used. Nantucket Island, Massachusetts, and Block Island, Rhode Island, for example, impose a two percent conveyance tax on most real estate transfers to fund open-space acquisition programs.

Fee Simple Acquisition

Government generally acquires fee simple ownership for parks and other property needed for public uses, such as schools and other public buildings. Fee simple acquisition provides the greatest level of control over a parcel; however, it is also usually the most expensive method of land acquisition. In addition to the substantial acquisition costs, fee simple acquisition removes property entirely from the tax rolls, and can result in significant maintenance costs. For these reasons, governments and land trusts often prefer alternative land protection techniques to fee simple ownership.