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FRESHWATER USE CUSTOMS ON GUAM:

AN EXPLORATORY STUDY

Technical Report No. 8

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FRESHWATER USE CUSTOMS ON GUAM

AN EXPLORATORY STUDY

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UNIVERSITY OF GUAM

Water Resources Research Center

Technical Report No. 8

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Partial Project Completion Report

for

SOCIOCULTURAL DETERMINANTS OF FRESHWATER USES IN GUAM

OWRT Project No. A-009-Guam, Grant Agreement Nos. 14-34-0001-8012,9012

Principal Investigator: Rebecca A. Stephenson

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ABSTRACT

Traditional Chamorro freshwater use customs on Guam still exist, at least in the recollections of Chamorros above the age of 40, if not in actual practice in the present day. Such customs were analyzed in both their past and present contexts, and are documented to provide possible insights into more effective systems of acquiring and maintaining a sufficient supply of freshwater on Guam. Archaeological evidence suggests a close correspondence between prehistoric settlement patterns and freshwater sources. It is speculated that pre- and post-contact Chamorro living in the northern plateau of Guam may have been involved in reciprocal trading arrangements with sites that had fresh water readily available during dry periods. The perception of freshwater in the Chamorro language context is shown to be changing. Ethnohistorical studies indicate that availability of freshwater to meet the needs of Guam's people has always been a problem. Sociocultural studies, as gleaned from the questionnaire, on the other hand, suggest that Chamorros over the age of 40 do not recall problems for the most part in their water supply systems of the past. Chamorro informants tend to identify their villages of residence and traditional water sources by locally derived names, names that are not often found on present-day maps of Guam. Further studies on the theme of freshwater use customs on Guam are recommended.

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PROBLEM AND METHODOLOGY

77 The research projects sponsored on Guam to date by the Water Resources Research Center have been concerned with technical aspects of freshwater: water quality, water properties, analysis of groundwater, and the like (Zolan et al. 1978, Mink and Lau 1977, Mink 1976, and others). This study is a step in a new direction, having as its theme cultural determinants of freshwater uses.

77 Problems in acquiring and maintaining a sufficient supply of freshwater to meet the needs of Guam's people are not new, as this report is able to document. In contemporary times, however, there is renewed interest in finding long-term solutions to long-standing problems of freshwater availability. Exploratory queries indicated that traditional Chamorro freshwater use customs still exist, which influenced the utilization of fresh water in the past as well as making provisions for potential conflicts of interest where freshwater was concerned. However, 80 knowledge of such customs seemed to be fragmentary, and no written records were found to exist that would shed light on this body of 82 information.

82 The purpose of this project is to document the data provided by Chamorro informants to the research team concerning traditional Chamorro freshwater use customs. This is an exploratory study, designed to 87 identify the salient questions that should be asked and to provide some preliminary answers to such questions.

91 The project was formally initiated on October 1, 1977. Anthropology and geography students at University of Guam, under the direction of Dr. Rebecca Stephenson, began the project with the initial premise that freshwater has always been a valuable but potentially limited resource in Chamorro culture. In the first trimester of the project, student research aides divided themselves into archaeological, linguistic, and cultural components. Each component explored the theme of sociocultural determinants of fresh water uses through class lecture-discussions, field trips, consultation with local experts as appropriate to each component, and the students wrote individual preliminary papers on the theme.

In the second trimester of the project, beginning on January 1, 1978, the students undertook the writing of a questionnaire regarding freshwater use customs on Guam to be administered to a sample of Chamorro informants. After conducting a test survey, the questionnaire was further refined. The final printed version of the questionnaire was ready for distribution to an availability sample of Chamorros over the age of 40 years beginning on April 1, 1978.

Completed questionnaires were returned to the research headquarters at House Number 11, Dean's Circle, University of Guam, through the late spring and summer of 1978. Beginning in September 1978, student research

aides assisted with the coding and analyzing of the data. The final sample includes 265 questionnaires.

Standard anthropological techniques were employed for gathering, analyzing, and interpreting the data: library reference research and map work, archaeological fieldwork and laboratory analysis, formal and informal interviews, and participant-observation. The research team interviewed a portion of the informants directly; other questionnaires were self-administered by informants. It seemed as though Chamorro informants over the age of forty would have the most to tell in regard to social and cultural water use customs and practices, for such informants would have been living on Guam prior to World War II. They would have experienced the pre-War lifeway, as well as the disruptions and cultural changes which occurred during and after the war. Prior to World War II, piped water was not readily available in the homes of the people of Guam (although we found a surprisingly large percentage of the population of Agaña to have had piped water in their homes prior to the war).

The questionnaire that accompanies this project is unique for several reasons: 1) its length 2) its comprehensiveness and 3) its use of the Chamorro language as well as English. Much of the questionnaire is written in bilingual form. We thought the use of key Chamorro words and concepts would facilitate lengthy and accurate responses from Chamorro informants. We chose to utilize the new orthography proposed by the Chamorro Language Commission (1978) for the Chamorro language section of the questionnaire. A major difficulty in working with the written Chamorro language to date is that the spelling system is not standardized. Anticipating that any spelling form we utilized might be irregular, we decided to be consistent throughout the questionnaire and employ the new orthography. Informants were advised of this approach on the first page of instructions that accompanied the questionnaire. The final page asks informants if there is anything else they wish to say concerning freshwater uses on Guam. A number of informants utilized this space to make comments about the questionnaire, but only two wrote criticisms of the orthography we had utilized.

We repeat that this is an exploratory study. We did not consult Government of Guam agencies in regard to more technical aspects of water use. We designed this project to be informant-centered, personal and as subjective as our informants cared to make it. To be sure, when working with human subjects, especially when the research project is qualitative and expansive in nature, it may be hard to learn "the truth". Human subjects can tell only part of a story if they so desire, or even contrive a story. The data gathered, then, are basically data that the human subjects are willing to share. It must be taken in good faith that the data presented in this report are reliable and valid.

ARCHAEOLOGY AND WATER RESOURCES
(PREHISTORIC CHAMORROS)

On Guam as well as in any niche where people have established themselves, water is a necessity to maintain life. It sustains us, nourishing, cleansing, refreshing, and separates us from the rest of humankind. The island ecosystem on the islands of the world is affected by both seawater and freshwater. In this discussion, however, we seek insights toward the Chamorros' usage and perception of freshwater, as it can be determined by an examination of the archaeological record (Illustration 1).

Geography and Distribution of Pre-Contact Settlements

Guam is the southernmost island of the Marianas Archipelago. It has a land area of 212 square miles with two geographical zones dividing the island into a northeastern plateau and the southwestern mountain range. These two zones are a result of the repetition of elevations on the large volcanic base, and coral formations with these repetitions.

There were one hundred sites surveyed in Guam's inventory of pre-historic sites as recorded in the Guam Prehistoric Preservation Plan (1976). Of these sites, 40% are situated on the rocky coastal shelf of the northern plateau. On this side of the island there are numerous rock shelters and caves on the base of the steep limestone cliffs. These caves sometimes hold water in them and frequently show evidence of use by the pre-contact Chamorros particularly during the dry season, which extends from January to May (Illustration 2). This type of water source is a natural outlet from the lens system of the northern plateau. The water lens systems is evident in the northern plateau as a result of the action of the water which infiltrates the plateau. Percolating down through the permeable limestone, it continually recharges a large basal groundwater body underlying most of the area. Basal groundwater floats on the underlying seawater in the containing rocks because of its lower specific gravity. Under natural conditions the freshwater lens system is in continuous motion -- inflow is from the rains and discharge is through coastal springs and seeps. Thus the lens system in the north tends to assure the availability of water as it is replenished by rain (Illustration 3). Without proper rainfall the quality and quantity of water can change. Guam occasionally experiences droughts and intermittent rainfall. The mean annual rainfall for Guam ranges from less than 90 inches on the western side of the island to nearly 120 inches in the higher plateau areas. "Most of the rain falls during the passage of tropical lows and typhoons which track east to west in the inter-tropical convergence zone of the Pacific Ocean" (Tracey, 1964).

The remaining 60% of the sites are recorded in the southern portion of Guam. In this area, which is mostly mountainous, the prehistoric habitation sites are found scattered at the base of the mountains close to the ocean, as well as in the interior river valleys. Unlike the

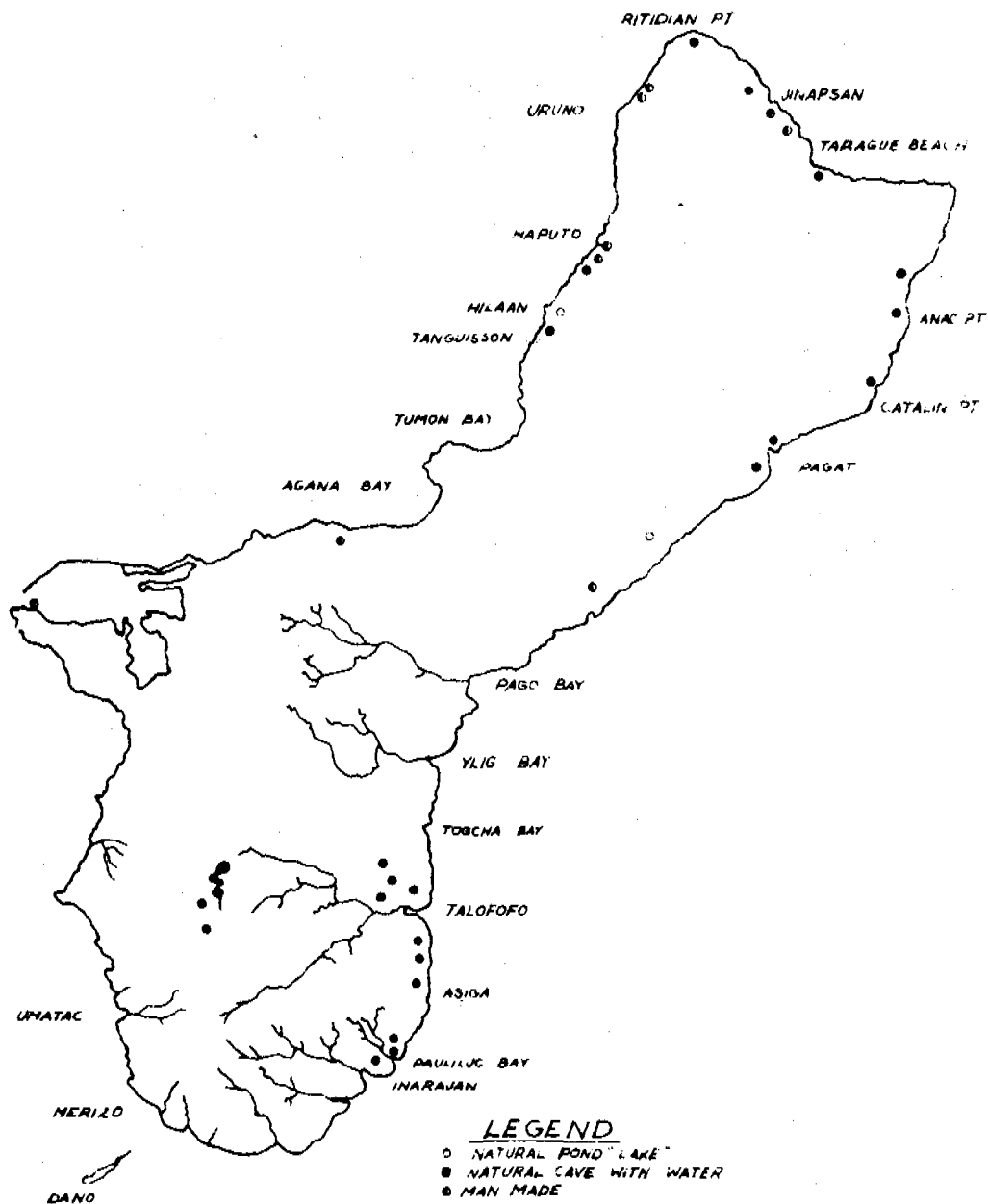


Illustration 1. Major Natural Water Sources on Guam

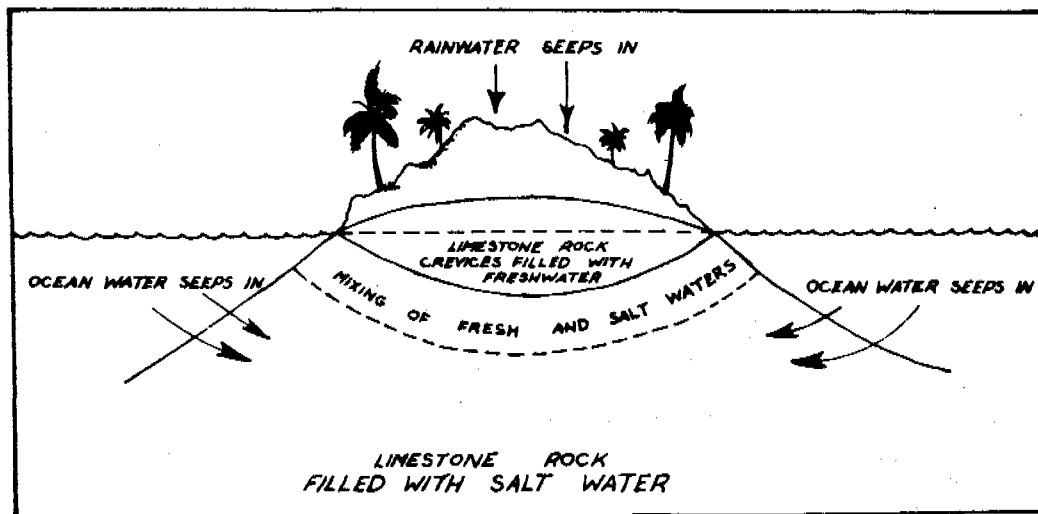


Illustration 2. Water Cave (Topuk)



Illustration 3. A Cross-section of the Northern Water Lens, after the Guam Comprehensive Development Plan 1978:151.



Illustration 4. River (Hunum Saduk).



Illustration 5. Waterfalls (Manutu).



Illustration 6. Tree Catchment with Ceramic Container (Tinajan Hanum).



Illustration 7. Coconut Tree Catchment (Tok-no).



Illustration 8. Man-made Well (Topo).

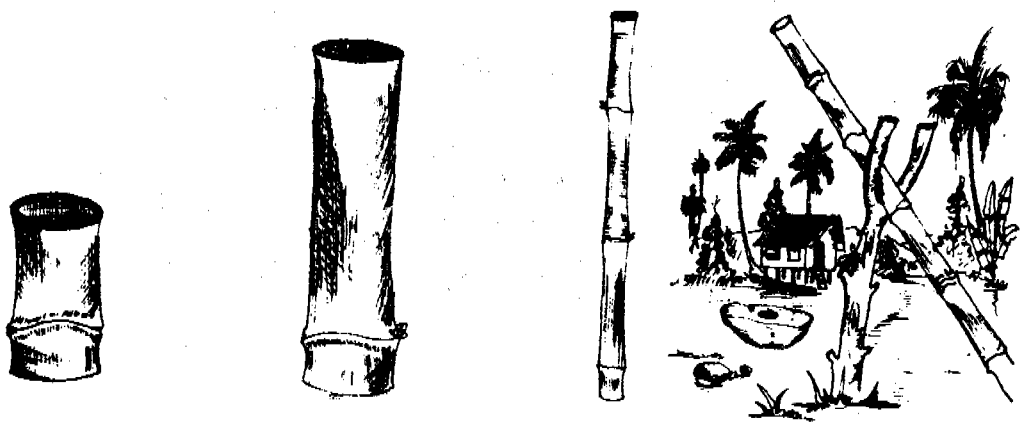


Illustration 9. Bamboo Vessels (Bongbung).



Illustration 10. Freshwater Sink (Papau)

northern half of the island, the southwestern mountain range does not have a freshwater lens system. The southern portion of Guam does, however, have an extensive river system, most of which extends from the Fena River valley to the coast (Illustrations 4 and 5).

So, an apparent primary complex of factors differentiating the sites of northern Guam and those of southern sites is the availability of water, and the means which the pre-contact inhabitants of Guam developed in order to acquire it. In northern Guam the resource outlets vary from wells to other adaptations for storing water such as:

- 1) Tree catchment by use of the Tinajan Hanum (ceramic ware container for water), a method of catching water off the trunk of a tree by grooves which direct the water into the receptacle for storage (Illustration 6). This method is still being utilized although the container types have changed.
- 2) The coconut tree catchment was a storage methods by which the base of the tree trunk was gouged out to form a container, Tok-no, in the absence of a portable container (Illustration 7).
- 3) Man-made wells, Topo, were lined with smooth rocks to keep water for close access (Illustration 8).
- 4) Containers used were also bamboo with centers hollowed, and various other ceramic vessels (Illustration 9).

Southern sites, where streams were abundant, made it convenient for water to be obtained at any point along a stream. So, in the south the freshwater was distributed over a much wider area and apparently was much easier to obtain. Its distribution to the prehistoric habitation site was dynamic as compared to the north where natural sinks or caves are the only types of continuous flow of freshwater (Illustration 10).

It is speculated that this variance in distribution systems may have had an effect on the regional perception of freshwater. Populations in some areas undoubtedly had to spend more time gathering and storing water, as compared to sites near streams or natural sinks.

Ecological Associations

It is common to see thousands of coconut (*Cocos nucifera*) trees lined along the beaches of the northwestern coast of Guam. Coconut trees are the most prominent of the plant communities in Guam. The coastal zones are also lined with small shrubs and low vines. In the low lying ridges below the cliffs of the northwest coast are many hardwood trees, as well as occasional bamboo patches. These are types of wood that may have been used for water storage in aboriginal times. Post-contact use continued until recent years when metal and plastic containers became

not readily available. Elderly informants still remember exploiting these sources.

The prominent hardwoods of Northern Guam are Fadang (Cycas circinalis), Pandanus (The Chamorro language differentiates three types: Akgag, Kafu, and Pahung), tangan-tangan, and breadfruit (Artocarpus). The higher elevation of the upland areas of the cliffs commonly have ifil (Intsia) in the thick secondary jungle growth. Pandanus are also found here, along with puting (Barringtonia speciosa) and chopak (Ochrocarpus), along with Banyan (Ficus) and other typical trees of the limestone forests. (Reed 1957).

The tree inventory of the Southern Mountain Range in contrast, consists mostly of grasslands of swordgrass (Miscanthus) with scattered pandanus. Some of the other plant communities on the southern coast are mangrove swamps along the mouths of rivers where estuaries are formed.

It is apparent from the remaining vestigial material culture that these plant communities all played a vital role in the lives of the pre-contact Chamorros, and many were directly utilized for water acquisition.

Population and Site Location Associations

The estimated population of pre-contact Guam was 50,000 to 100,000; so, pressure must have been felt in the sites away from natural resources. Sites in the north are much larger when compared to sites in the south. The Tarague Beach site was one of the most populated in pre-contact times (Reinman 1965-1966). Because of the population density and the types of water resources, the northern sites may yield valuable information regarding the aboriginal people's perception of the role freshwater played in their lives. The availability of water in the north was concentrated in caves; this may be a reason why populations may have seemed greater in apparent density in the north determined by the proximity to water sources. In contrast, the southern areas with an abundance of rivers and streams apparently favored smaller sites.

Reinman (1965-66) notes that it is apparent that sites in the north had heavy density as depicted by the size of these sites as well as the large amount of cultural material such as pottery, bone and shell tools, and other cultural remains. Cultural material was not absent in southern sites, but the concentration level is much higher in the north. A reason for this may be the geologic makeup of the island. Rainwater runs off in the south, taking with it artifacts, and eroding midden deposits, while rainwater in the north percolates through the limestone, leaving the topsoils undisturbed.

Consideration of the aboriginal habitation sites in their environmental as well as geological context makes it clear that "storing" was a necessity. Strategies for storage must have had greater development in the north because of these facts:

- 1) Large amounts of pottery and midden (cultural remains).
- 2) Northern sites are more extensive than southern sites.
- 3) There are no wells recorded in the south. "Wells (depressions) on the low sandy beaches of the northwest coast and their apparent absence on either the east coast or in the south reflects the limestone character of the eastern side of the island and the presence of larger rivers in the south as a source of water." (Reinman p. 26)
- 4) There are latte associated with both northern and southern sites but much more midden remains in northern sites.
- 5) Northern Guam is made up mostly of limestone, and streams are virtually absent. Southern Guam is a volcanic area with streams and rivers. Each offer unique aspects in water usage. Villages usually developed along near-sea freshwater streams, around springs at the base of cliffs, and near freshwater sinks. Streams flowed over numerous parcels of land and the water from these streams was associated with usufructory rights that were aspects of complex family and clan organization. Water was used by permission through long established modes of courtesy and reciprocity (Thompson 1945)
- 6) Thompson, reflecting on varying availability of water concludes that (1947), "In spite of the relatively high precipitation, scarcity of water, especially on the northern plateau, was long an important factor in island life. Hundreds of farmers who formerly lived in this area had to haul water long distances to their farms during dry season. But after the war, a number of reservoirs were constructed and wells were drilled by the government so that this condition was alleviated." So, "storing" water during the dry season played a vital role in the society's daily lives, especially in the north.

Theories regarding the political division of the island in pre-contact times are still being validated. Reports of the early missionaries reflect observations indicating that the island was divided into districts each forming a single distribution network with local adaptations to water acquisition.

Examples of these sites are Pagat, Tarague, Nomna, Jinapsan, Uruno, Haputo and Hilaan, which indicate the effect of the varying water sources on village layout. This is not generally consistent throughout the island, but appears to be closely oriented to the local topography. This is reported by Reinman (1965-66) who observes "generally compact clustering of the structures in small bays, while along the narrow beaches of the west coast or in the river valleys, the structures are strung out end to end."

Thompson (1947) makes reference to the "highest development of rank and etiquette in Guam (was) in Agana. There are fifty-three principal houses and about one hundred and fifty other houses. The latter are a lower class of people and are separate from the others who give them no part in the affairs of the town or court." (Garcia, p. 36).

However, even with fifty-three major households all the people had rights to land. Lundsgaard (1974) states that "despite varied geographical and cultural settings there is a direct connection between land tenure principles and general social structure." Coote (1950) stressed the importance of land utilization and the particular importance it had in the island sociocultural setting. The fragmentary reports of travellers and missionaries will yield clearer data for analysis when the archaeological record has been sufficiently expanded by more extensive excavation.

The two major phases of Guam's pre-history are:

The Pre-Latte Phase: 2000(?) BC - 500 to 800 AD and

The Latte Phase: 800 AD - 17th century (European Contact)

The early phase of adaptation to Guam's environment began after travel over vast areas of ocean from regions yet to be precisely identified, to the south and west. The term used for classifying these early settlers is a linguistic one: Malayo-Polynesian. Possibly they were descended from peoples who began a sea migration from the south China coast six thousand years before their ancestors were to go ashore on Micronesian high islands and atolls. Population pressures from the interior, it is speculated, forced these coastal folk to sea. They possibly brought with them certain plants of southeast Asia such as the coco palm which have become characteristic of the entire Pacific basin. It has been theorized that their Asian mainland Bronze Age technology was replaced by one based on stone, shell, vegetable and fiber products which are most easily accessible in the island biosphere.

Recent excavation of Pre-Latte material from Ypao Beach site on the NW coastline of Guam, bordering the Philippine Sea, indicates a more advanced technological adaptation than previously recognized from the heretofore sparsely available material recovered from this early prehistoric period.

The pottery reconstructed from the Pre-Latte period:

...was smaller in size and thin walled, as differentiated from more massive ware of the Latte period. This can be seen by comparing the examples from the Ypao site. Of the two major types of Pre-Latte period ceramic ware thus far excavated, one is a thin walled undecorated type provided with a curved rim, which was characterized by Alexander Spoehr (1957) as Marianas Redware.

Contemporaneous with this type is another style of pottery, simple in design, delicate in execution, and precisely decorated with geometric designs. This was given the designation Lime-Filled, Impressed Trade Ware, based on Spoehr's analysis of twelve potsherds excavated at the Laulau rock shelter on Saipan. The decorative elements include circles, semi-circles, chevrons, diagonal lines, parallel lines, and diamond form shapes. These were first incised into the clay, which was then apparently fired and rubbed with lime. The lime has remained in the decorative grooves of a number of the examples displayed. More than one hundred pottery fragments of this type have been excavated at Ypao thus far.

Notable in excavations of the Pre-Latte phase is the absence of the sling stones and spear points associated with the Latte period. Fish hooks and net sinkers are found in both periods. Latte period artifacts include adze blades of basalt, an igneous, or fire made rock. Pounders of this mineral form are the hardest of local materials, and are prevalent in Latte phase excavations. In addition to the archaeological record, our knowledge of the Latte period comes to us from missionary records and the observations of those visiting seafarers and explorers who left written accounts of their travels. They describe a form of social organization which has been called tribal, with a three class model which has lately become familiar to us through the efforts of local social studies educators: that of nobles, their supporters and the working class. Prior to the Ypao excavation, the predominant amount of unearthened cultural material related to the later Latte phase. It is hoped the recent excavation at Ypao, as yet largely unanalyzed, will tell us more about the behavior of the Pre-Latte community. So far a pre-tribal people, organized into a band-extended family type of social organization, subsisting by fishing and gathering strategies, is partially reconstructed. It remains for a thorough analysis of the Ypao material to be completed. Laboratory work is in progress (Montvel-Cohen and Lizama 1978).

There are other types of references to land tenure but it is summed by W. H. Alkire (1972), "In Oceania, land is a way of life. Throughout Micronesia the basic social institutions have been molded by adaptation to the concept and reality of limited land. Limited land means limited resources. This not only shapes the subsistence economic systems, but other social, political, and religious institutions as well."

Questions persist regarding sites with a less than abundant annual water supply. It is possible to speculate that sites with minimal water had to arrange some sort of reciprocal ties with sites that did have water. Other strategies would be to build wells, inhabit sites seasonally,

distill water systematically,¹ or make large pots for storing. The often massive appearance of Latte period ware encourages the notion of storage in pots (Photo 1). When the dry season commenced, freshwater sinks associated with the lens system always had water and some rivers associated with springs do not dry up except on rare occasions. The rainfall is sparse at times; wells, pots, and tree catchments function only when water is deposited in them.

Because of the importance of storing, pots may not have been widely transported since they were heavy and could easily be broken. The pottery, as described in the above inventory of the Pre-Latte period, was small, thin-walled or sometimes filled with lime impressed decorative patterns. Pottery of the Latte period was much more massive, thicker, heavier, and decorated in a much less complex manner. So transferring of pots from a water source would have been inconvenient. It can be inferred that the storage vessels were stationary and that water was transported to them through other containers such as bamboo.

Bamboo and coconut were also important products of water storage. In dry seasons, the milk of the coconut can quench the thirst, and the stump can be a means of water catchment as well. Traditionally two types of bamboo have been used on Guam as a means of carrying water: 1) thorny bamboo (Bambusa spiniosa) introduced from the Philippines, was used as water vessels for transferring water from one place to another, and 2) smooth bamboo (Bambusa arundinacea) was used in the pre-WWI period (Beaty 1967).

A look at the geology of the island reveals that in the north there is only one major area for the acquisition of clay. This is located at Mt. Santa Rosa. Water transfer from caves in the north associated with the water lens would make it more reasonable for a more abundant population closer to a water site, thus the greater amount of cultural remains in a large area. Southern sites could have been smaller and more widely distributed because of the many water sources available through streams, and therefore storage would have not been as necessary, or as difficult.

¹The Guam Comprehensive Development Plan (1978:62) features a drawing of a Chamorro cultural scene with the following caption: "Sketch showing distillation technique by Chamorros from Dumont d'Urville's 1835 book, A Voyage Around the World." But were they distilling water? This report features a similar drawing in the Age of Discovery section, but Emilie Johnston of MARC suggested the latter sketch was probably the work of Arago, the illustrator with the Freycinet expedition, 1817-1820, and shows the distillation technique for making tube (aguagenti).

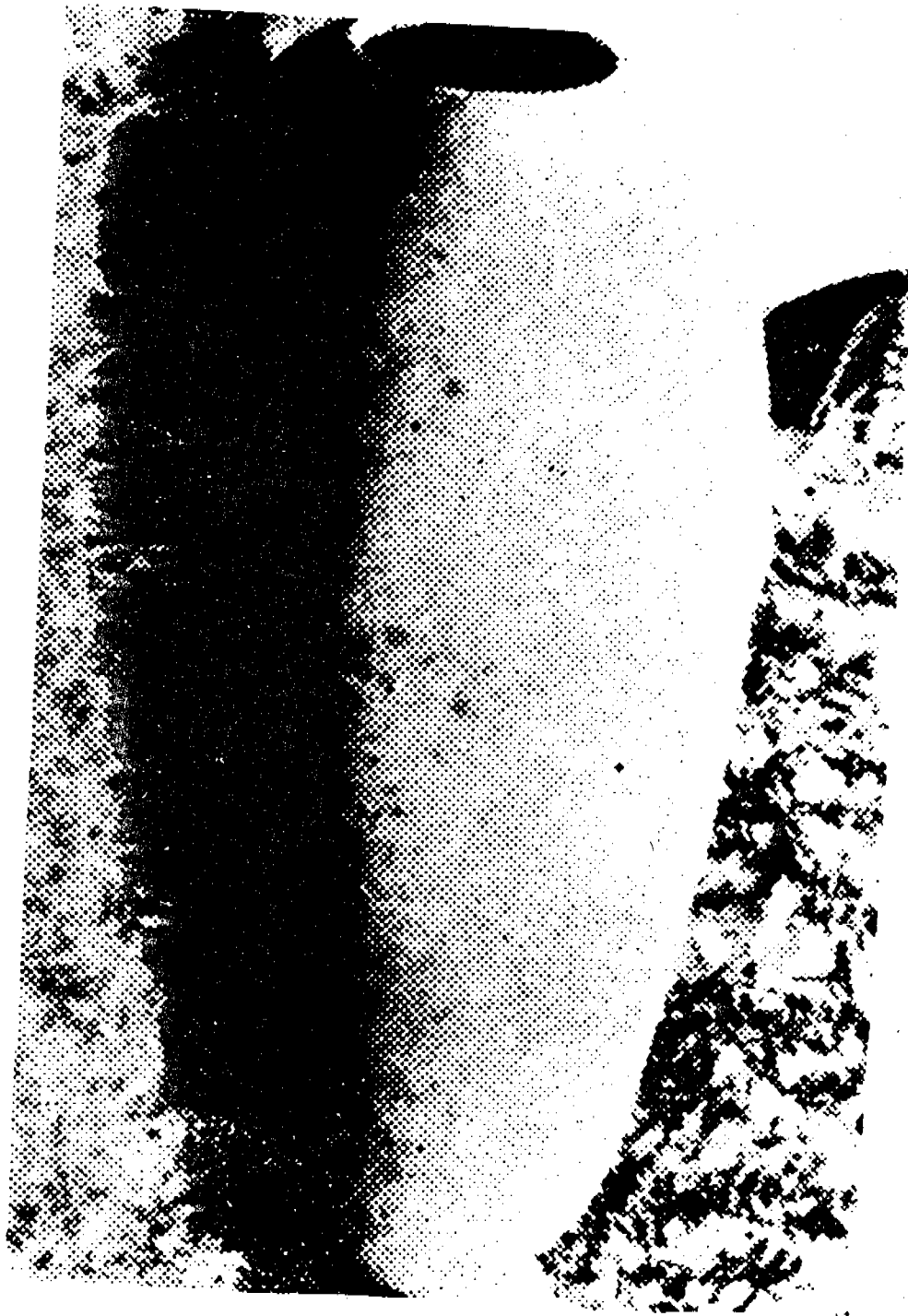


Photo 1. Large jar used for storage water.

An Archaeological Overview of Pre-Contact Guam

We have noted that there are two periods of habitation in Pre-Contact Guam, the Pre-Latte and the Latte Periods. These periods were categorized by the absence or presence of Latte stones, which were foundations for men's houses and for families of the noble class. Trapezoidal stone columns topped with a capstone are usually of coral; they follow a megalithic style which can be traced through Yap and Palau to the Celebes. The upright (Haligi) ranges from 30 cm. - 150 cm. in height, and the capstone (Tasa) were usually made from brain coral and were hemispherical in shape. That there were distinctive differences in the types of pottery associated with each period is clear. As classified by Alexander Spoehr (1957) the Marianas Plain ware is the pottery associated with the Latte Period; Marianas Red is associated with that of Pre-Latte ceramic ware. Temper is one of the primary factors for making the distinction between Latte and Pre-Latte ceramic ware. Temper in Guam is, ... "entirely phenocystic mineral grains and ground mass fragments of andesite." Marianas Red Ware is usually thinner and smaller as opposed to its more massive counterpart Marianas Plain.

	<u>Marianas Red</u>	<u>Marianas Plain</u>
Temper	Calcareous sand	Volcanic sand
Surface Treatment	Plain, slipped, lime-filled	Plain, trailed, combed, incised, impressed
Thickness	3-20 mm range 8.23 mm mean	15-35 mm range @20 mm mean
Rim Forms	Usually simple	Simple and inverted

The chronological placement of these two major phases of Guam's prehistory was based on the stratigraphic and distributional differences of the pottery types in the various sites studied by Spoehr (1957) and reinforced by two radiocarbon dates. The earlier, 1527 BC + 200 years, established that settlement was begun in the Marianas by that time. A later date, 845 AD + 145 years, relates to the beginning of Latte construction on Saipan.

Recent excavation at Ypao Beach site, although as yet undated, indicates an earlier threshold for the Pre-Latte phase as previously noted in this chapter. Pre-Latte phase investigations reflect intermittent use of some areas as habitation sites perhaps on a seasonal basis. A small self sufficient population subsisted by fishing and gathering. The Pre-Latte population was relatively small and well able to subsist on the abundant wild plants, fish and other seafood. That subsistence was done with reasonable ease is indicated by the variety of complex decorative ornaments recently excavated at Ypao. Their diet

is reflected in abundant shells and fishbones found in the midden.

The vast increase in population during the Latte phase called for more complex strategies in water resource exploitation. As the megalithic tradition became firmly established, villages increased in size to house as many as a thousand or more people. The autochthonous population of Guam is estimated to be as high as one hundred thousand. The more complex social structure reflected that of other major high islands in Micronesia. Northern villages were located for the most part in biotic niches that were provided with adequate access to the water table. Those in the south of the island were located along rivers and streams or at the mouths of rivers flowing into the reef.

Only some of the interior sites seemed to be insufficiently provided with water. These sites seem to have been established late and are provided with shallow midden, perhaps indicating avoidance of close contact with the colonizers from Europe.

Karolle's (1978) recent observations of persistent agricultural patterns continue to support the conclusions of research undertaken by previous investigators regarding water use in agriculture. Both Spoehr (1957) and Thompson (1932) reconstruct the ancient Chamorro garden inventory to include yams, taro, bananas, breadfruit, sugar cane, coconut palms and rice.

Thompson (1947) notes continuous rice cultivation in the Geus river valley north of Merizo as well as rice growing districts in Agat, Piti and Asan. Although virtually all rice is imported today, taro patches continue to be tended close to rivers and streams in the southern districts of the island, particularly in foothill regions which are located just inland from coastal areas. These gardens and farms are frequently located on lands which include archaeological features. In fact, taro can be often found growing in close proximity to ancient house sites.

Karolle (1978) reports farmers finding lusongs, which are stone mortars, a characteristic feature of habitation sites. In addition, he reports the awareness of concentrations of potsherds and occasional lithic material among the farmers he interviewed. Field observations support these findings.

The Chamorro language, too, contains "archaeological" clues in the form of words and phrases which are concerned with water use in subsistence as well as social patterns. It is in many ways a rich source of support for the archaeological investigation of water use.

Although the post-contact period had an immense impact on Chamorro social patterns, there are further insights to be gained toward an understanding of autochthonous subsistence behavior through linguistic studies which may be related to archaeological investigation.

LINGUISTICS AND WATER:
THE PERCEPTION OF FRESH WATER IN CHAMORRO CULTURE

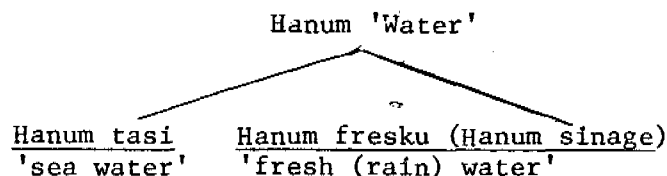
The basic thesis in Benjamin Lee Whorf's writings (e.g., 1965) is that our perception of the world and our way of thinking about it are deeply influenced by the structure of the language we speak. Our perception of the world is also deeply influenced by the culture we have or live in. In turn, both our language and culture deeply influence our perception of the world. Both are patterned behavior and thinking phenomena which are organized, systematic, regular and constant. Language and culture support each other. The two must be seen as corresponding parts of a whole, and also as wholes in themselves.

The exploratory remarks presented herein are based on research papers written by two students in an anthropological research methods course at University of Guam in Fall Semester 1977. The first paper, by Carmen Pearson, is entitled, "A Survey of the Water Use Patterns of Guam's Elderly." The second paper is by Francisco C. Pangelinan, entitled, "Analysis of Water and Water-Related Terms of the Chamorro Language."

Three patterns of water perception emerged from a survey conducted by Pearson. These patterns are compared and contrasted in three views. Two of these views compare and contrast parts of a whole. The third view considers the whole in its entirety. The first view concerns the differences between salt water and fresh water. The second view portrays the differences between tap water and fresh water. Finally, the third view considers fresh water in and of itself. All three are unique sets which can be illustrated by the following diagrams:

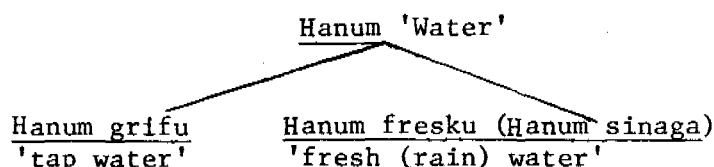
View 1.

Water -----> sea water + fresh (rain) water



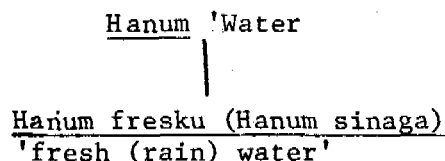
View 2

Water ----> tap water + fresh (rain) water



View 3

Water ----> fresh water



In general, fresh water is perceived as being similar to rain water in Pearson's sample of 10 elderly Chamorro informants. The attributes of fresh water are basically the same as those of rain water. Both are natural and uncontaminated substances. View 1 shows that the two major components of water are sea water and fresh (rain) water. In contrast, View 2 shows that water can be conceptualized in another way, as being composed of tap water (hanum grifu) and fresh (rain) water (hanum fresku/hanum sinaga). Finally, View 3 shows the noncontrastive relationship of fresh water to itself.

All three views can be illuminated further. The following key words and phrases were offered by Chamorro informants to elucidate their conceptualizations of the diverse expressions of water. We present the responses verbatim.

View 1

Water ----> sea water + fresh (rain) water

Sea water ----> salty (ma'asin or fa'it); has to be distilled to make salt; hurt eyes and make them red; more clear if left in a container in comparison with rain water which seem darker.

fresh (rain) water ----> clear; taste good and sweet; clean; come from God or air; tastes fresh and cools the body system; settle in my body better; feels like medicine in my body; cleans my inside; does not hurt one's eyes or make them red; sweeter than tap water and is preferred to tap water; it is not chlorox (use fresh (rain) water for plants because chlorox will kill them).

View 2

Water ----> tap water + fresh (rain) water

tap water ----> tastes like chlorox; not sweet like rain water; contaminated with chlorox; tasteless; come from ground and mixed with chlorox; taste cold.

fresh (rain) water ----> clear; taste good and sweet; clean; come from God or air; taste fresh and cools the body system; settle in my body better; feels like medicine in my body; cleans my inside; does not hurt one's eyes or make them red; sweeter than tap water and is preferred to tap water; it is not chlorox (use fresh (rain) water for plants because chlorox will kill them).

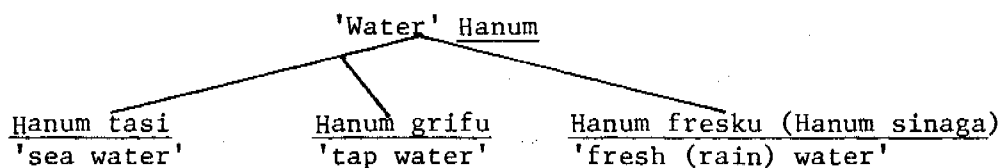
View 3

Water ----> fresh (rain) water

fresh (rain) water ----> clear; taste good and sweet; clean; come from God or air; taste fresh and cools the body system; settle in my body better; feels like medicine in my body; cleans my inside; does not hurt one's eyes or make them red; sweeter than tap water and is preferred to tap water; it is not chlorox (use fresh (rain) water for plants because chlorox will kill them).

Both Views 1 and 2 present a partial view, in that there is a conceptual difference between salt water and fresh water, and between tap water and fresh water. If there were no salt water at all in existence, tap water would be considered in its place, or coming from the same main branch as salt water. Tap water perceived by Chamorro elderly people consulted in this sample is closer to, or one and the same concept as salt water, rather than the modern or present day view of tap water as being closer to or one and the same thing as fresh water. The following diagram shows the perceptual view of our older Chamorro informants on water:

Water ----> (salt water + tap water) and fresh (rain) water



(the above in Chamorro):

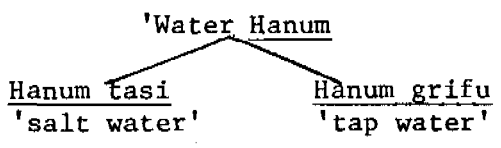
Hanum ----> [Hanum tasi + Hanum grifu] + Hanum fresku (Hanum sinaga)

Today, owing to technological advancements and modernization, tap water seems to be gradually replacing fresh (rain) water in the conceptual framework of Chamorros. One of the Chamorro informants interviewed (the youngest of the ten informants, age 52) defines fresh water as coming from the tap because it is cold. (However, she prefers rain water for drinking and watering her plants because it does not have chlorox and it will not kill her plants.)

The perception of the difference between salt water and fresh water is still constant in the Chamorro speaker's mind, even though tap water is seemingly taking the place of the fresh water concept. Although perceived as being unnatural and contaminated due to the chlorine, tap water still has some of the properties of fresh (rain) water. Tap water is cold; does not hurt the eyes or make them swollen; cleans the body; and can be consumed. Tap water is more natural than salt water, although it comes from the ground and is chlorinated. It could eventually be conceptualized in the following framework:

Hanum ----> Hanum tasi + Hanum grifu
 'Water' -----> 'salt water' + 'tap water'

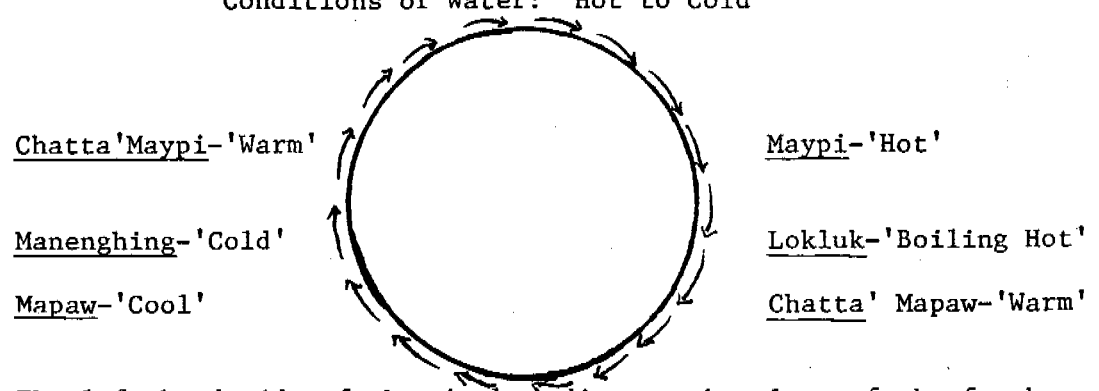
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Although in a different form, tap water may be in the process of becoming the concept of fresh water. The concept is still there although in a different form. The above diagram is still View 1, which is essentially how our sample of elderly Chamorro people perceive water. The structure has not changed; it is still systematic and regular.

To support this analysis further, consider the following sketch from Pangelinan's (1977) paper. Conditions of water - hot or cold - can be shown to relate to sea water and fresh water.

Conditions of Water: Hot to Cold



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The left hand side of the circle indicates the place of the fresh water concept. Cold and cool are attributes of fresh water. The other half or right hand side of the circle is the unnatural state of fresh water, such as when it is heated or becomes warm or hot. This latter is also one of the sensations of sea water, as experienced when entering the sea. The sketch substantiates the contrastive views between sea water and fresh water.

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We suggest that the data in the above mentioned papers complement each other in terms of findings and viewpoints which are described as perceptions of water in Chamorro culture. The patterns that we see emerging are not contrived; they are inherent manifestations of the culture.

ETHNOHISTORY: FRESH WATER ON GUAM

The Age of Discovery

The people of Guam view Ferdinand Magellan's discovery of their island on March 6, 1521 as an important part of their history. To say that Magellan "discovered" Guam when he anchored in the Bay of Umatac is a bit of a misnomer. The island was fully populated with Chamorros at the time of his arrival. Although historians do not completely agree that he was the first European to arrive on Guam's shores, however, his so-called discovery of Guam is of central importance to this particular study. For in connection with this event is the first mention of water sharing on Guam between Chamorros and Europeans. Pigafetta, Magellan's historian, described the desperate state of conditions on shipboard in regard to availability of water: "We drank yellow water that had been putrid for many days" (Carano and Sanchez 1964:41). It must have been a great relief for Magellan's crew to acquire fresh water. Carano and Sanchez recreate the scene: "Amid scences of laughter and rejoicing they replenished their water supply, stocked their ships with fresh fruits and other foods, and generally refreshed themselves." Pigafetta reported that Magellan's crew drew fresh water from the springs of Umatac (Van Peenen 1945:24).

On September 4, 1526, another expedition, commended by Fray Garcia Jofre de Loaisa, arrived at Guam. Other ships followed, including the one commanded by Alvaro de Saavedra in 1527 and the one commanded by Villalobos in 1542. All of them replenished their stores of fresh water and food on Guam. Searles (1940:9) described the importance of fresh water on shipboard:

Water was carried in several thousand jars, some of which were stowed below, and others hung in the rigging. On a few galleons water was carried in bamboo tubes, and occasionally in cisterns. There never was enough water, and the insufficient amount was supplemented, when possible, by rain water. It was not uncommon for the water ration to be reduced to about a quart a day for all purposes, and on some trips men and women died of thirst. "

Miguel Lopez de Legaspi and his crew found it much more difficult to deal with the Chamorros. Having taken possession of Guam for Spain in 1565, it is reported that landing parties looking for water were frequently ambushed and stoned (Cushner 1971:47-8). The crew was able, however, to fill barrels from the ship with water from an unidentified river. Legaspi mentioned the existence of large houses serving as arsenals in each barrio and tells us they went to one for "water supply" (Pacific Profile 1965:34-6). Further information to elucidate this statement is lacking. It cannot be established whether someone (a

chief?) at the arsenal was the person giving permission for Legaspi's crew to collect water elsewhere, or whether a supply of fresh water was kept at the arsenal itself, the arsenal serving as a water storage place.¹

In 1600 A.D., Olivier Van Noort, in command of a Dutch fleet, stopped for two days on the Island of Guahan, ". . . from which above 200 canoes came to the ships, bringing fish, fruits, rice, fowls, and water in gourds, to exchange for iron" (Carano and Sanchez 1964:49). The Nassau fleet, under the command of Admiral Jacob L'Heremite, arrived at Guam on January 25, 1625. Carano and Sanchez (1965:51) report that ". . . the fleet took on fresh water and, in exchange for iron, procured rice, fowls, coconuts, yams, potatoes, and bananas from the natives." Burney's account (1806:34, cited in Carano and Sanchez) adds additional information about the provisions taken on board:

. . . cocoa-nuts were here in inexhaustible quantities; rice was cultivated in many places and the natives sold it by weight, in bales of between 70 to 80 lbs. each; but not one bale was found which had not been increased in weight by the addition of sand and stones.

Apparently the availability of fresh water was not a major problem on Guam during the Age of Discovery, and apparently the continued requests for stores of water did not seriously deplete the local supply. Galleons on voyages between Acapulco and Manila were required to make regular stops on Guam for provisions, including water, beginning in June 1668. The royal order decreed that, during the month of June, beacon fires were to be kept burning on the highest points of Guam and Rota (Searles 1940:10). For recompensation, the Spanish crown directed that 34,000 pesos be sent annually from Mexico to Guam as "situado and socorro" 'subsidy and relief'. All Spanish galleons stopped on Guam until such runs were abolished in 1815.

¹Burney (1806), writing of the voyage of Legaspi, taking his notes from F. Juan de Grijalva and Fray Gaspar, quotes Gaspar: "That which most caused admiration was that they (i.e., the Chamorros) would drink salt water, and were such expert swimmers, and passed so much of their time in the water, that, as among other animals, some are amphibious, in like manner it seemed as if these people were in their nature amphibians." We wonder if Gaspar misunderstood what he was seeing. The drinking of sea water by Chamorros seems rather unlikely. Perhaps they were actually drinking sea water that had been distilled (Photo 2, Distillation technique).



Photo 2. Tuba (aguamenti) distillation technique.

The Missionary Period

The first permanent Spanish mission on Guam was established by Father Diego Luis de Sanvitores. He arrived on Guam in 1668 with a handful of assistants and they were accompanied by a small band of militia. At this time, the population was estimated to number from 50,000 to 100,000 Chamorros living in approximately 180 villages (Harvey 1920:19). It is the theme of water, again, that is noteworthy for the purposes of this report. Carano and Sanchez (1964:62) say that the galleon San Damian on which San vitores was traveling, bound for the Philippines, stopped at Guam in 1662 for water. Sanvitores was inspired to return to Guam as soon as possible and convert the Chamorros to Christianity after seeing them in their small canoes as they came out to meet his ship.

Sanvitores and his assistants divided Guam into four districts with a church in each, forty villages coming under the jurisdiction of each church (Carano and Sanchez 1964:71). One of the major efforts undertaken at this time was that of baptizing both adults and infants. Higgins shows the zeal of the missionaries for baptism in a translation from a history compiled by Padre Garcia in 1683 (1937:14-15):

The Padre Bustillos [took] a small gourd full of water which he carried on his belt, as did all the missionaries on the advice of Padre Sanvitories, in order to baptize children on the road or who might be found where there was no water..."¹

Unfortunately and coincidentally, a few infants died after being baptized. It was relatively easy for a shipwrecked Chinese man named Chaco to persuade the Chamorros that the water being used for baptism was poisoned.² Chaco's influence stimulated the growing resistance among Chamorros against conversion to the new religion; proselytizing efforts of the missionaries frequently met with rebellion, and battles ensued. A chamorri 'chief' named Matapang, whose infant daughter was baptized without his permission, and a handful of other Chamorros killed Sanvitores on April 2, 1672.

A Chamorro legend, "The Treachery of the Rain" gives an insight into the Chamorro world view during the Spanish-Chamorro Wars that followed, an intermittent period of warfare that lasted for a period of some twenty-five years. The legend says that the Spanish soldiers seized two famous Chamorro chiefs and held them as hostages, in an

¹In explaining the value of baptism, San Vitores taught that the water of God does not take life from the body, but gives life to the soul (Carcia 1937:15).

²No apprehension towards baptismal water seems apparent today.

attempt to encourage the end to this period of warfare. Undaunted, Chamorros kept fighting and succeeded in setting fire to a Spanish fortress. A heavy rain fell and put out the fire. The Chamorros were frightened by this bad omen, confused by the rain and wind, and they retreated. The Spaniards rushed out and killed many of them. The Chamorros reasoned that they could not fight the Spaniards and nature at the same time, and, being vanquished, were sad. They felt they had spent too much of their time fighting the Spaniards and in the process had lost the skills of the Before Time Ancestors, who knew how to interpret as well as control both good and bad omens (Van Peenen 1945:29-30).

In contemporary times, Catholicism is the main religious faith held by Chamorros. It is important to remember that Chamorro women intermarried with Spanish soldiers after a large proportion of Chamorro men met their deaths during the Spanish-Chamorro wars. Carano and Sanchez point out (1964:86) that from a population base of 50 to 100 thousand before the conquest, the Chamorro population during the course of the wars was reduced to less than 5,000.¹

Another early account explains that the Chamorros had ceremonies to ask anitis 'spirits' for water. Risco (1970:136) translates that . . . "among the skulls they kept, some had special virtue of attracting rain. They called these skulls maran anuchan 'miraculous talisman for the rains' and they were kept in special houses watched over by the macanas 'priests.'" If it was necessary to have traditional ceremonies to ask for rain, it occurred to the research team to wonder if obtaining an adequate water supply was at times a problem for the native population.

Spanish Rule

As well as the records of the missionaries, the accounts from the days of the Spanish governors give additional information in regard to the early development and utilization of fresh water resources on Guam (Photo 3, Tilling tobacco). During the time of the Crozet expedition, there were about fifteen hundred Chamorros living on Guam. As well as in Agana, they lived in twenty-one small settlements, all on the seacoast (Carano and Sanchez 1964:111). Such settlements were composed of five to six families. There is a reference to Crozet's crew amusing themselves by fishing for. . .

¹Nelson (1940:84) indicates that there were some 50 thousand Chamorros, but that during the course of 250 years of Spanish rule, the population was reduced to less than 9,000, mostly owing to wars of political and religious natures and diseases brought in by the Spaniards.

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Photo 3. "Tilling Tobacco", utilizing bongbung 'bamboo tubes' to water the plants.

"eels, mullet, goby, carp, and others...most of these were freshwater fish and proved to be excellent eating" (cited in Carano and Sanchez 1964:112). The sailors noticed, however, that the natives would not eat them. . ."They preferred salt-water fish, which in general seemed to be of inferior quality to the fresh-water ones."

Kotzebue, a lieutenant in the Russian navy, stopped on Guam in November 1817. Along with a general description of the town of Agana, he wrote (cited in Carano and Sanchez 1964:131), "An inconsiderable stream, which flows through the town, supplies the inhabitants with water." On the way back to their ship which was anchored in Apra Harbor, Kotzebue and Dr. Eschscholtz, a naturalist in the Russian party, stopped in the villages of Tepungan and Asan, where the people brought them fresh water and fruits.

Beginning about the year 1823, whalers, mostly from Great Britain but later from America, stopped on Guam for a month's rest at Apra Harbor and Umatac. While in port they took on water as well as food stores and other goods, as did the earlier expeditions.

Around 1830, when Francisco Ramon de Villalobos became governor of Guam, the first recorded attempts were made to control the rivers of Guam. A water system of sorts was established when several bridges were built. The Agana river was diverted from its natural outlet at the boat basin and made to flow through the village of Agana parallel to the shore. It flowed out to sea near to the present day Mark's department store in Anigua. Attempts were made to drain Agana swamp in order to utilize the area for agricultural purposes, particularly the cultivation of rice (Carano and Sanchez 1964:149, Johnston 1974: 11-12). The diversion of the Agana river was accomplished by the installation of dikes hued out of rough stone, which are still in evidence today, even though the river was returned to its former channel after the bombing in World War II (Photos 4 and 5). Governor Villalobos also opened the Atantano Valley for the cultivating of rice during this period. Don Felipe de la Corte, who served eleven years as the Governor of Guam from 1855 to 1866, made the following statement in his memoirs regarding the diversion of the Agana River (Guam Recorder 1926:138):

This waterway is used for laundry work and for all other ordinary purposes by the people of the city, except that they do not drink from it, either because it is thick and brackish, or because they may have some scruple about doing so. Moreover, they have better drinking water in wells conveniently near their houses.

It is apparent that the waters of the Agana river served numerous purposes. But it is difficult to reconstruct which of the purposes may be regarded as the traditional or customary. Washing clothes in

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Photo 4. Remains of the Spanish dikes, Agana Swamp.



Photo 5. Sluice gate, Spanish dikes, Agana Swamp.

the river could be identified as a practice introduced by the Spanish, for no clothes were worn by the Chamorros prior to contact. But, "other ordinary purposes" seems to include bathing, for several other historians comment on the people of Guam bathing in the rivers. Perhaps bathing in the rivers can be regarded as a traditional or customary practice. Arago, a member of the Freycinet Expedition engaged in scientific studies in the South Seas, wrote in 1823 of his stay on Guam that he... "bathed in the Agana river where the women bathed" (Arago 1823:202). Perhaps his statement indicated that there were certain places in the river for women to utilize while bathing and other places for men. Or, perhaps men of Guam at that time bathed by some other means.

The wells mentioned by de la Corte in his memoirs could have been a part of the pre-contact lifestyle or a Spanish-introduced item. Archaeological evidence substantiates the former. Reinman (1965:66:13) identified "depressions" in several of the pre-contact archaeological village sites in the northern coastal areas of Guam which he suggested could have been wells. These stone lined depressions were fifteen feet in diameter and five to six feet deep. To date we have no further information regarding the purpose(s) these depressions served.

Several historians who stopped on Guam in the late 1800's recorded details of cultural practices. Some of these documents included additional references to wells. Apparently the large houses in the villages were enclosed by a fence. Within the fenced area stood the cook house, described as a separate building located behind the main house, and a "well", frequently placed under a tree. The "well" was funnel shaped, and filled with brackish water. The women apparently washed clothes in the "well" and spread them on the grass to dry (Fritz 1904:30-36). The "better drinking water in wells conveniently near their houses" mentioned by de la Corte must have been vessels or containers separate from those used for washing clothes.

The historical records indicate the existence of some wells thought to be public wells, in addition to those private wells previously described. These public wells were placed in strategic locations in the villages and have best been described by Haddock (1974:20-22) (Photo 6). Approximately four and three-fourths feet deep, three sides of the well were generally walls constructed of snugly fitted stone blocks. The fourth side consisted of stone steps leading down to the water. In utilizing a well of this type, a person had to carry the water in a bucket or other device from the bottom of the well up the steps. It is important to mention that the water level in Agana lies only a few feet below the surface of the ground. Wells such as the one described by Haddock could become contaminated by sewage and human waste rather easily.

Other historians indicated that river water or rainwater was utilized for drinking purposes on Guam by local people in the mid-1800's. One method of catching rainwater follows (Fritz 1904:34,40):

A Japanese clay container called a matabana, which was about one meter tall, was placed under a coconut tree. One leaf was tied in such a way that the water ran down the trunk and into the container.

The same method of catching rainwater was reported for the nearby island of Rota, except that a bamboo stalk was used to catch the rain instead of a clay container. Possibly the bamboo stalk was the original device utilized to collect rainwater. It was noted that other containers mentioned included tin pails, glass vessels, and pumpkin shells with bindings of coconut fibre. Caldera 'large iron pots' were used for the purpose of boiling water. At least one description of an early bathtub exists (Stafford 1910:7): "It was a huge earthenware jar from China, filled by a bamboo trough which collected water from the eaves of the tiled roof."

The practice of washing clothes in the Agana river is described in greater detail by Safford (1910:7) (Photo 7). According to his accounts, the women, while standing thigh deep in the water, used shallow rectangular wooden trays called bateha which were rested on the rocks.¹ Wild citrus fruit was used for soap and the clothes were scrubbed with corn cobs. Apparently the women washed their hair in the river as well, using a local fruit, perhaps the same one as utilized to wash clothes. The fruit produced a lather and made the hair soft and fragrant, according to Safford. Safford also commented that local people were observed transporting water in carabao carts or in sections of bamboo slung over the backs of oxen or water buffalo.

The American Naval Administration

The United States formally acquired control of Guam 1899. The majority of information available regarding the development of water systems, improved sanitation practices, and other such advancements in fresh water utilization practices date from this time, when the U.S. Department of the Navy took over administration of the island from the Spanish government.

According to historical accounts and military records, Agana was the major residential area on Guam, with approximately seventy percent of the population living there in 1900. Apparently the practice of living in Agana had been established much earlier, as the memoirs of

¹The Pacific Daily News on October 6, 1978, featured a picture of a young woman of Chalan Pago scrubbing a shirt on a bateha or old-style washboard in her mother-in-law's outdoor laundry room. "The bateha and human muscle power, even with cold water, can out-clean any modern washing machine," she said.



Photo 6. View from the back of the well showing natural water level covering the lowest step.



Photo 7. Women washing clothes in the Agana River.

de la Corte (Guam Recorder 1926) indicated that 5,251 people of a total population of 6,276 lived in Agana and the immediately surrounding area during the period of the mid-1800's.

When the U.S. Navy took over the administration of Guam at the turn of the century, records indicate that public and private wells, the Agana river, and local water catchments were the only sources of fresh water for the residents of Agana.

The Naval Administration considered the only part of the island where there were problems with availability of fresh water to be Agana. Water supplies in other areas came from fresh water streams, and was considered to be both adequate in supply and of good quality (Governor's Annual Report, 1901:8).

The Administration recognized several problems with water conditions shortly after takeover.¹ In 1899 Lieutenant Kaiser took steps to improve the sanitation practices in Agana (Carano and Sanchez 1964:182). A general problem was to provide an adequate supply of fresh water to Naval Officers and staff. To solve the problem, Governor Leary had a water distilling plant built in 1901. According to Haddock (1974:21), it was designed using the boilers of eight old steam-powered motor launches. The distilled water was pumped into a small iron tank on top of a wooden tower. The water was distributed by gravity to Government House and other Federal Buildings and to those houses belonging to Naval Officers (Guam Recorder, June 1926:66-67).

Carano and Sanchez (1964:202) point out that Agana is situated on a low plain, with an elevation of from five feet near the beach to about eleven feet at the foot of the cliffs behind the town. At that time the Agana River, flowing through the town, was used for bathing, as a laundry, and as an all purpose open sewer. The plain of Agana and the river bed as well were occasionally flooded during high seas, leaving the river water brackish. Taking all these factors into account, apparently Agana residents did not normally drink the water of the Agana River (as noticed by de la Corte and cited above).

¹Bradley, Jr., (1933:856) further illuminates the problem:

Because of the unsanitary conditions found in Agana, it was decided to allow the American sailors and Marines ashore to drink only water distilled on the Yosemite and sent to them daily in barrels. Because of the shallowness of the boat channel from Apra Harbor to Piti, the seaport of the capital, and dependence upon the tides, no regular boat schedule could be followed, and often it would take a good part of a day to deliver the water to Agana where thirsty men, not acclimated to the tropical heat, waited for a drink. Consequently, the building of a distilling plant was one of the projects first undertaken as soon as materials could be landed and delivered in Agana by bull cart.

Carano and Sanchez (1964:202) describe the village wells that were dug to provide drinking water. They say fresh water was found three to six feet below the surface of the ground when wells were dug, being rain water which had sunk to the water table rather than natural spring water. As the rain water soaked through the soil, however, it absorbed a good deal of lime. The water than was "hard" as it was drawn out of the wells and not very suitable for washing clothes. In taste, on the other hand, such water was more palatable than river water; thus, well water was used for drinking and cooking.

With almost no surface drainage possible, human and animal wastes eventually seeped to the water table during decomposition. The wells provided surface exposure for this polluted water. Public health problems were rampant, especially lumbricoid worms. According to Carano and Sanchez (1964:203), nearly every inhabitant of Agana from three months to eighty years of age had such parasites in very large numbers. Thus, the general condition of health of the people was described as poor.

Governor Dyer had many innovative ideas to improve Agana's water supply. Collecting rain water from house roofs to be stored in an underground reservoir was not feasible because most of the houses had thatched roofs. His next plan was to sink artesian wells, in the belief that ... "the millions of gallons of water falling from the clouds during the year are certainly not carried off by the few small rivers, and there are large areas where the water disappears into the earth with no evident outlet whatever" (Governor of Guam, Annual Report, 1905:9, cited in Carano and Sanchez, 1964:203). This plan failed for lack of financial resources to back it up. Finally Governor Dyer instituted a plan to build an extended reservoir system in the upper valley of the Pago River. Civil Engineer L. M. Cox, USN, drew up the plan in 1902 for an estimated cost of \$50,000. This project was rejected by the United States Congress, which vetoed the appropriation of funds for the building of the reservoir.

Apparently the lack of ice locally was also considered a problem that needed a high priority solution by the Naval Government, for the first Ice Plant on Guam was placed in operation in 1900 (Photo 8). Its opening was a major cause for celebration, and the first cake of ice was broken up and distributed among the Chamorro workers, very few of whom had ever seen ice before. Historical accounts say the workmen were not sure if this new substance was hot or cold. The Guam Recorder (October 1928:148) tells of the events that followed:

The native workmen about the Plant were given pieces of this ice, which they left in the afternoon sun to be taken home with them when they quit work, and which they intended to show to their families; but, needless to say, there was nothing but a damp spot left when this time arrived, and they accused one another of stealing their ice.

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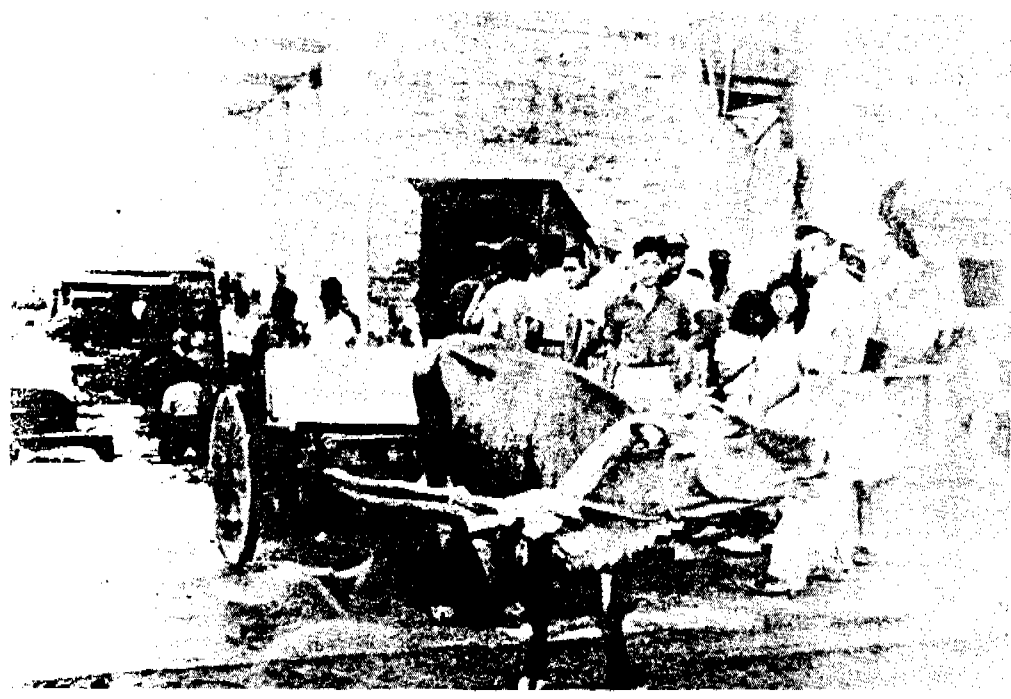


Photo 8. Agana Ice Plant, 1945.

supplied from the distilling plant. Arrangements will be made by which any person desiring to pipe this water to his house can connect with the nearest branch pipe line.

Assistant Civil Engineer R.M. Warfield is in charge of the construction of this water supply system: he states that it will be delivering good fresh water to Agana within a year.

A Water tax of \$1.20 per year was levied on each house in Agana ("Guam News Letter" 1910:1). Arrangements could be made by any person desiring to pipe this water into his or her house, to connect with the nearest pipeline. J. Schnabel and Company placed an advertisement in the "Guam News Letter" on July 25, 1910 which included the following reassurance: "Contracts will be made with householders to install water into their houses. All plumbing, work and fittings at very reasonable rates." Public hydrants were placed at principal street crossings for fire protection. The people were warned ("Guam News Letter" 1910:2)

...to only partly open the valves on account of the great force with which the water comes through them and also to close tightly after using. Children must not be allowed to play with the hydrants and waste water.

People in various villages contributed to the work of providing for the water supply. In 1910, the "Guam News Letter" (July 25) described the efforts of the people of Piti:

The water service at Piti was also thrown open to the public during the first week of July, and has proved a great convenience to those living on the pipe line. Public hydrants having been placed at intervals of 500 feet.

The labor on the reservoir and dam, as well as for the laying of the pipe line was furnished, free, by the people of Piti, who enjoy free water in return.

Finally, in anticipation of a dependable water supply from the reservoir and for sanitary reasons, the Governor ordered old wells in Agana to be closed, both public and private (Governor's Annual Report 1911:3).¹ The Guam News Letter carried the story (Sept.

¹Two hand-blown American-made bottles were found in the well described by Haddock (1974:22). The find of them helps to clarify the time frame in which they would have been left in the well, and when the well was subsequently closed off from further use. The Americans first arrived on Guam in 1898. Machine-made bottles became commonplace in America and thus on Guam between 1915-1920. Therefore, these hand blown bottles must have found their way into the well sometime between 1898 and 1915.

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In 1906 Governor Potts issued an Executive Order which, in the interests of improved sanitation practices, required outhouses to be built, and household premises to be kept clean. This order further provided for inspections which were to be made by the Department of Public Works employees. The inspectors would perform cleanup tasks, if required, and the violators would be charged a fee (Governor's Annual Report 1906:2).

In an attempt to find an adequate supply of water for Naval and civilian residents of Agana, a drill was acquired in 1907. The Administrators hoped to drill an artesian well as a reliable water source for Agana. Funds were limited, however, and the project postponed. Later, when funds were made available, no artesian well was located. The residents of Agana continued to suffer with an inadequate supply of water.

A water system was finally developed utilizing the Fonte River. The "Guam News Letter" in 1909 (Vol. 1, Nov. 20) printed a story of the new water supply system for Agana in both English and Spanish. The English version reads as follows:

New Water Supply System for Agana

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An appropriation of fifty thousand dollars has been made to construct a new water supply system for the Naval Station and incidently for the town of Agana.

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The main dam and reservoir to collect and hold the water from an area of about two thirds of a square mile will be situated in the Fonte Valley near the wireless telegraph station. The excavation for this dam and reservoir is practically completed, and much of the material for their construction is at the site. From this reservoir the water will be carried in a six inch pipe to the distributing reservoir to be located on the hill just south of Agana. This reservoir will contain 33,000 gallons, and from it will be led the pipes supplying the town. The main pipe line from the distribution reservoir runs along San Ramon Street to the corner of San Antonio and San Nicolas, and from it are led branch lines running along the following streets as far as the town boundary:--San Juan de Letran, General Solano, San Ignacio, Soledad, and San Antonio. Another branch line runs along the street in front of the Palace. Hydrants will be placed at the principal street crossings for protection against fire.

well

The water which will be supplied from this system has been analyzed and found exceptionally pure. The area from which the water will be collected will be fenced in, as will be the reservoirs; in this manner it is expected that water will be supplied as free from contamination as that now

25, 1910:3: "The Federal Government having, at great expense, furnished an ample supply of wholesome water to the town of Agana, Executive General Order No. 161 has been issued requiring that all wells be closed within a certain stated time. By this means it is believed that many of the diseases prevalent among the residents will be prevented in the future." The same order fixes severe penalties for polluting the water supply, and also repeals the increase tax on houses having water piped into them.

In an article entitled "History From Our Files", the Guam Recorder in 1937 set forth the improvements and changes in public conveniences that came about on Guam in 1912 (reprinted from the "Guam News Letter" of March, 1912).

Public Conveniences

The Agana Waterworks system has been finally completed, and a line runs into Sinajana. The Asan system has been extended to the Presidio. A water supply for Merizo has been completed, and is now being constructed for Umatac. The Tepungan and Agana channels have been dug out, making possible a water-haul of heavy freight from Piti at greatly reduced cost. The Fonte watershed, embracing about 800 acres, has been purchased and fenced. The Agana sewer system is 60 per cent completed. Repairs and renovation of the iceplant have made possible a reduction of thirty cents per hundred in the cost of ice.

When Governor Robert E. Coontz arrived on Guam to take up his duties in 1912, the island was suffering from one of the driest seasons in its history. Carano and Sanchez point out (1964:213): "Indeed, water was so scarce that the people of Agana lined up at the ice plant and were given a pint of water at a time". Rain began falling a short time later which alleviated the crisis, but the governor set about to insure a permanent water supply for Agana residents. According to Carano and Sanchez, although his request to the federal government was in the amount of \$11,000, he had stated the problems of Agana's water supply so convincingly that \$25,000 was awarded for the project. The "Guam News Letter", June 1913, printed the optimistic news:

Water Relief in Sight

Congress has appropriated \$25,000.00 for the extension of the Guam water system and the money becomes available after July 1st. This means the pumping of the Agana spring water to the reservoir for distribution and the combining of the water, fire and flushing systems in one general system. It also means no more water famines for Agana, the extension of the water line to Anigua and probably water for Agat next year.

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With sufficient funds now available, a reservoir was built on the cliff above Agana. Water from a nearby spring was piped into the reservoir over a distance of several miles. When this project was completed, residents of Agana received not only an increase in the amount of freshwater available, but also water that was consistently pure. Health conditions of the people began to show dramatic improvements.

In 1914 pumps were installed at Agana Springs, but the people were cautioned in regard to economy of water use, especially in Agana:

U. S. Naval Station, Guam, March 7, 1914--

Owing to the fact that the Fonte Water is getting low in the reservoir, the greatest economy must be exercised by everyone in the use of water.

Leaky faucets, hydrants, valves and flushing tanks will be reported to the Public Works Officer or Foreman Plumber, immediately, in order that repairs may be made. The use of garden hose for watering grass or shrubbery is forbidden, until the water shortage is over.

In cases where water is hauled to ranches for use of live stock, it will be taken from the Agana River. Hydrant water will not be used for washing clothes. Children or other persons must not waste water at the street hydrants.

Violation of the provisions of this notice will be punishable by the offender's house being cut off from the water supply.

The Foreman Plumber, Mr. Walker, has been appointed a Special Policeman, to see that the provisions of water notices are complied with.

"Guam News Letter", April 1914

In 1915, pumps were installed at Asan Springs; however, similar cautions were set forth:

Notice

The greatest economy must be exercised by everyone in the use of Fonte water in order to insure a supply during the coming dry season. Leaky faucets, valves and flushing tanks should be reported to the Public Works Officer or to Foreman Plumber immediately in order that repairs may be made.

The following uses of Fonte water are FORBIDDEN:

- 1) Hauling water to ranches for use of live stock or in any quantity greater than five (5) gallons.
- 2) Washing clothes.

Particular attention is invited to the wasting of water in baths and at the street hydrants.

Evidence of the waste of water in houses will cause the water to be shut off that house.

The water will be shut off the entire Fonte system during the following hours:

9:00 a.m.	to	11:00 a.m.
2:00 p.m.	to	5:00 p.m.
8:00 p.m.	to	6:00 a.m.

The Foreman Plumber, Mr. Walter, as a Special Policeman will see that provisions of this notice are complied with.

This Notice will be in effect from and after February 5, 1915.

"Guam News Letter," February 1915

In July 1915 the Naval Station Notes Section of the "Guam News Letter" called on people to examine their attitudes in regard to water uses:

The very serious shortage of water that a couple of months ago necessitated the laying of the temporary line to Asan still continues. About the first of this month the water again got dangerously low in the Fonte dam. No other explanation of the drop can be possible except that people are not careful with the water. The residents of Agana should realize that they are fortunate, in that the Government looks out for their water, and spends thousands of dollars a year that they may have water. A small amount of co-operation of everyone would save money to the Government, anxiety to the officials of the station, and insure water for everyone. It would also be an evidence of appreciation that the people at large should show for the efforts being made in their behalf. The people should realize that the fact they can get a supply of good water is a privilege and not a right.

By the end of 1915, the quantity and quality of water seemed to be finally dependable. About this time, a large latrine was constructed

latrine in San Nicolas at the end of Dr. Hesler Street near the river. It measured nine feet in width by 35 feet in length and contained toilets and showers with separate compartment for men and women, as well as space for washing clothes ("Guam News Letter 1915:4) (Photo 9, Illustrations 11 and 12). The land on which it was built was ceded to the Naval Government of Guam by Carmen Camacho Pangelinan. The June 1915 issue of the "Guam News Letter" reported the cost of building the latrine to have been less than \$500.00.

While much emphasis had been placed on providing the residents of Guam with an adequate water supply during this period, other areas of the island were also struggling to obtain water. Cisterns had been built at most of the school houses to catch and store rain water from the roofs. A water system for Inarajan was completed which included a public bathhouse containing four showers and four "water closets" which were connected to the sewer system (Governor's Annual Report, 1919:18). Cisterns of wood or concrete were built in various villages such as Dededo, Sumay, Barrigada, Talofoto and Yona which provided residents in those areas with rain water. In 1927 two small concrete dams were constructed at Mt. Santa Rosa in the northern part of Guam and water was piped to Yigo School. The fact that there are no rivers in the northern part of the island meant that the farmers had to spend many hours hauling water to their ranches or depend upon rain water collected from roofs and stored in barrels or gasoline drums (Governor's Annual Report 1937:18).

In 1915 the Naval Station encountered several problems when a new tower for the water distillation system was built. When the water was turned into the old mains, they burst; then a seam in an old tank started to leak when it was moved to the new tower and all of the water drained out during the night ("Guam News Letter," October 1915:3).

With mechanical problems such as the above, in addition to environmental difficulties--either the rainy season dumping too much water too fast in the systems or the dry season when not enough rain occurred, or the typhoons which destroyed everything--a dependable water supply was not easily attained. For example, when the Inarajan water system was damaged by heavy rains, it was necessary for local residents to draw drinking water from "Mapa", which was located approximately one mile from town, in bamboo tubes ("Guam News Letter" May 1916:6).

All water systems were running low in 1917. In response, Executive Notice No. 95 as reproduced below appeared in the January 6, 1917 issue of the "Guam News Letter:"

I. All persons are enjoined to exercise the strictest economy in the use of water from all water systems. This is necessary on account of the prospect of a very serious shortage. The following uses of water from the Asan, Fonte or distilled



Photo 9. Inarajan public wash house, 1945.

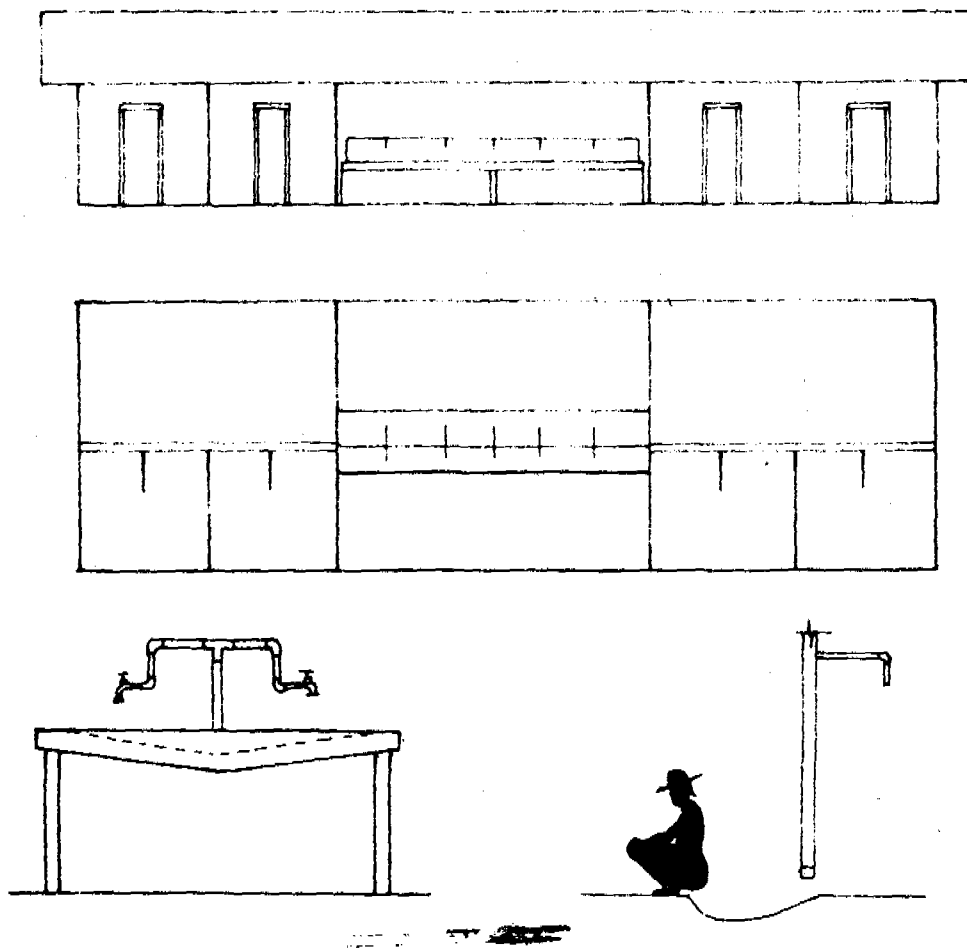
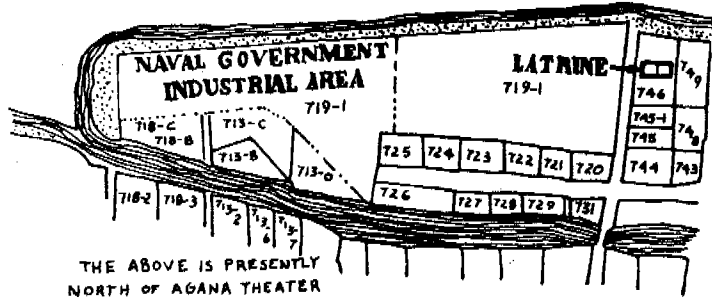


Illustration 11. Diagram of a latrine.

AGANA BAY



THE ABOVE IS PRESENTLY NORTH OF AGANA THEATER

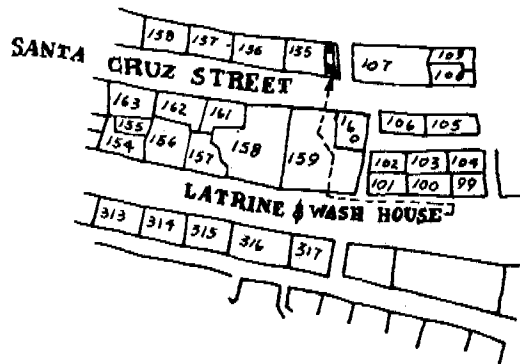
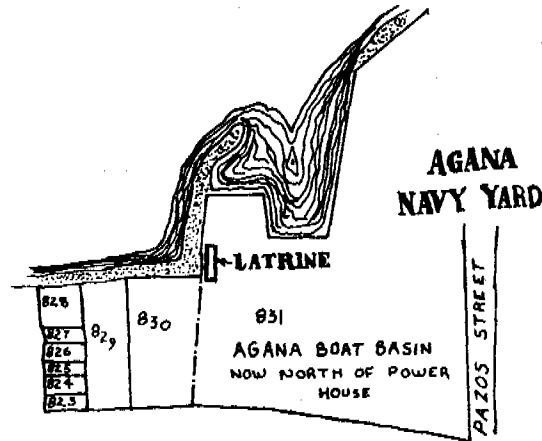


Illustration 12. Sketch Maps: Location of Agana Latrines.

water systems are forbidden until further notice:

- a) The hauling of water to ranches in greater quantity than five (5) gallons. Water so hauled must be used for cooking and drinking only.
- b) Watering of livestock, washing of livestock, carriages, automobiles, etc.
- c) Washing clothes.
- d) Watering lawns or gardens.

II. All leaks in plumbing must be immediately repaired.

III. All faucets must be kept closed when water is not being actually drawn for use, whether pressure is on the pipe or not.

IV. Faucets only will be used for drawing water from the water system. Fire hydrants shall not be used at any time except in cases of fire.

V. Any person who violates any of the foregoing provisions or a parent or guardian of any minor who violates any of the foregoing provisions shall be subject to fine of not less than One Dollar (\$1.00) and not more than Ten Dollars (\$10.00) for each offense.

VI. Three places will be prepared on the Agana River to facilitate taking water for livestock, washing vehicles, etc.

Executive Notice #95, Jan. 6, 1917
"Guam News Letter"

The Interim Period: Between Two World Wars

In the period between the two World Wars, 1914-1940, the people of Guam experienced substantial improvements in their lifeway. The concern of this report, again, is with fresh water uses and practices (Photo 10). In spite of all of the work on the water system to date,¹ water shortages continued. The following article was printed in the Guam Recorder, May

¹described in detail by Johnston 1926:66-67.

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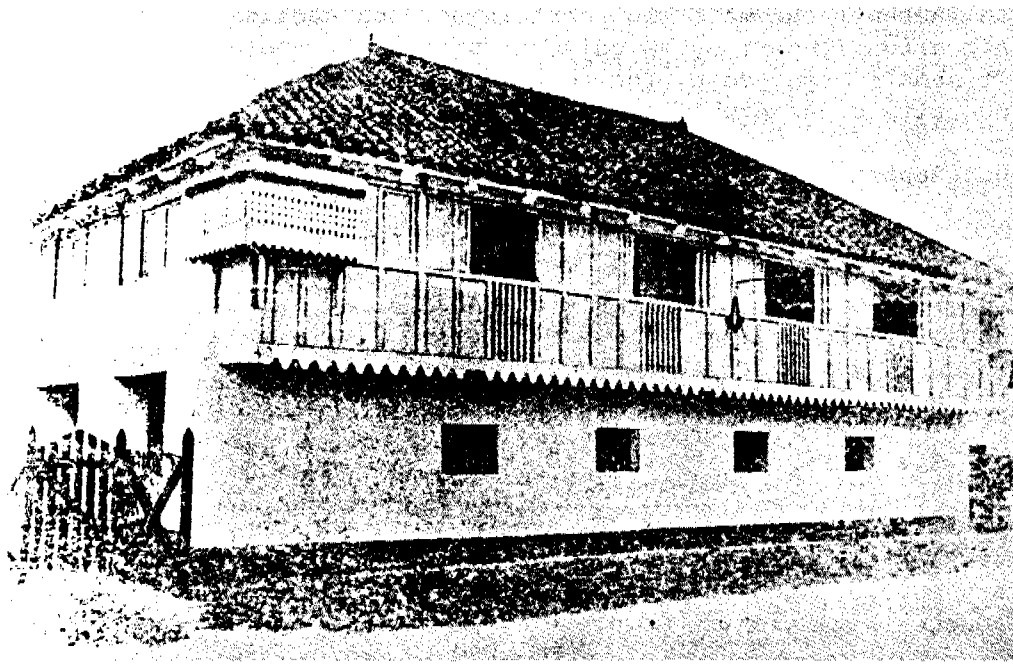


Photo 10. Masonic Lodge, Agana, with two banquera 'water storage facility attached to the outside of a building.'

1925:2:

THE WATER SHORTAGE which began in January still exists. Practically no water has been secured from the Fonte River for two months, and if last year's experience be repeated, it may be two or three months before the river is flowing. From 8 to 12 hours pumping daily from Agana Springs is necessary, and this means money - about \$1,000.00 a month.

We again warn everyone that the utmost economy must be observed in the use of water. Waste cannot be tolerated, and unless the daily consumption decreases, it may be necessary to shut off the water for certain periods each day. The situation is serious as only one pump is in operation, and if it should break down, the town would only receive a small quantity of Asan water.

Report all leaks, whether in your own house or elsewhere.

Do not let water run when you are not using it.

Be economical in the use of water at public hydrants, wash houses, latrines, and showers.

Wash clothes in the Agana or Pigo Rivers.

SAVE WATER.

To attempt to stabilize the Agana water supply, a spring near Asan was developed as a water reservoir, as well as a spring near the western edge of Agana swamp. Water was available for Agana from these two sources beginning in about 1919.

In April 1924, a change in The Water Tax was making local news:

The Guam Recorder, April 1924

The attention of all property owners is called to Executive General Order No. 383 dated 17 July, 1923, which causes a change in the Water Tax of the island, effective 1 July, 1924.

This law provides that owners of private residences shall pay a Water Tax of \$2.00 per year for each residence within the limits of Agana and Sumay. And \$3.00 per year for each residence within the limits of the towns of Sinajana, Anigua, Asan, Piti, Agat, Umatac, Merizo and Inarajan.

For each and every separate residence having private outlets from the water system, property owners shall pay an additional

annual tax as follows:

For One	(1)	one-half inch outlet	\$0.50
For Two	(2)	one-half inch outlets	1.25
For Three	(3)	one-half inch outlets	2.25

and for additional one-half inch outlets at the rate of \$1.00 each.

House connections to the water system will in general be limited to a half inch pipe, and in case where larger pipes are installed, the charge will be proportional to the increased area.

Industrial and commercial establishments shall pay in accordance with water used, and shall at their own expense provide and install water meters of a type approved by the Public Works Officer.

Property owners having meter connections will pay as follows, in lieu of the above rates:

For two thousand (2,000) cubic feet or less per year, \$2.50; for quantities over 2,000 cubic feet, the rate of twenty (20) cents per 100 cubic feet.

The Naval government created positions of Insular Patrolmen, who among other duties (Carano and Sanchez 1964:216) were assigned to carefully monitor the sources of the water supply and check for sanitation in each district. In addition, they were responsible for seeing that water was equally distributed to all village residents.¹ The offenders were fined (Governor's Annual Report 1922:19-20). In 1937, with this practice continuing to be enforced, 247 infractions of Sanitary Regulations were recorded. The Patrolmen must have taken their duties seriously. The Administration indicated that, as a result of the monitoring system, as well as an extensive educational program carried on in the schools in regard to cause of disease and the corresponding necessity of keeping the premises clean, the general level of sanitation

¹Carano and Sanchez (1954:258-59) indicate that sanitary regulations were enforced: "During 1941 an average of 87 cases per month were investigated by the chief of police. The most common offenses were traffic violations, infractions of the sanitary regulations, simple battery, and disturbing the peace."

and health had greatly increased over the years. (Governor's Annual Report 1937:21).¹

Toward the end of the year in 1924, Guam experienced a typhoon. Heavy rainfall accompanied it, which caused the Agana River to overflow its banks. The result was severe flooding in Agana, particularly in the San Antonio barrio, causing considerable damage. According to the Guam Recorder, the rain gauge at the Marine Barracks registered a rainfall of 9.83 inches and Padre Palomo and San Victores streets were covered with two to three feet of water. Serious flooding also occurred in the southern part of Guam, especially in Merizo.

An editorial in the Guam Recorder brought up again the subject of proper drainage for the city of Agana. Given that the streets of Agana were then mostly higher than the adjoining private properties, rain water commonly collected under houses and stores, standing there until it was gradually absorbed into the ground.

The damp floors and flooded yards were suggested to generate much sickness among the local populace, particularly in the wet season. The editorial pointed out that Guam had experienced an average of 282 rainy days in the last four years, the annual rainfall averaging around 100 inches.

In the same issue of the Guam Recorder, farmers were advised to build cisterns for optimum usage:

Should a farmer desire to build a cistern to be supplied by rain-water from a roof, he can, if he knows the actual rainfall of his locality, so construct his cistern as to make the best possible use of the rainfall. For instance, a rainfall of one inch on a roof of 3,000 square feet capacity would mean a total volume of 432,000 cubic inches, or 250 cubic feet available for the cistern (loss from splashing, etc., not considered). This is equal to 1,870 United States gallons, or about 41.5 barrels of 45 gallons each, enough to fill a cistern 8 feet in diameter to a depth of 4.97 feet.

On September 25, 1925, the Guam Recorder reported that work would be starting soon on a 100,000 gallon concrete water reservoir

¹However, the diligence of these Patrolmen and the school programs on sanitation in those years may have served as a hindrance to our research. Some of the older informants seemed to think we were suggesting by our questionnaire that they were not as clean as they ought to be, or, at least that we were checking upon their sanitation practices.

in Barrigada near the Canada road. This water supply would be particularly for the use of nearby ranchers, to save them the need of hauling water from Agana.

A later issue of the Guam Recorder in the same year reported a new 225,000 gallon water reservoir being constructed in Barrigada near the Lalo junction. Likewise, readers were advised the San Antonio flood channel was near to completion, and that residents of that barrio in Agana should be relieved of further property damages and corresponding health problems due to flooding.

Finally, an article in the Guam Recorder described details of the flooding of the Agana River during the typhoon, that it followed the course of the old Agana River channel, which was closed by the Spanish when the new channel was dug about the year 1900, the same year the Spanish Bridge in Agana was built. The old course of the river, readers were reminded, "was through the west part of San Antonio, and used to flow between where the houses of the Cascado family now stand and that of Mariano Castro, following back of the house of Luis Baza, and through the place in front of the chapel, by way of Calle San Victores (sic) to the sea."

Public health matters were of central concern to the Naval Government of Guam in the mid - 1920's. Executive Order No. 61 and Executive Notice No. 186 directly pertain to the health of the local populace.

The Guam Recorder: March 5, 1924

Naval Government of Guam, Executive Special Order No. 61:

- 1) The shortage of the Agana fresh water supply necessitates its serious consideration and the co-operation of all people to avoid waste of fresh water. The town now is using an average of about 72 gallons for every man, woman and child in town. That is excessive and needless. The Fonte reservoir is empty, and most of the water used is pumped from the Agana Spring. That pumping is expensive.
- 2) Because of this condition, the water will be shut off from the public wash houses at noon on Sundays, Wednesdays, Thursdays, and Fridays; at 4 p.m. on other days, and will be turned on at 7 o'clock each morning.
- 3) Everybody's attention is called to the duty of avoiding and preventing waste of fresh water. At present there is enough water for all necessary purposes, but there must be no waste. The Police Force is hereby ordered to watch especially for persons wasting fresh water and to report them for further investigation and action by the Chief of Police. Parents are responsible for their children in this matter.

- 4) The Agana River water above San Juan de Letran Bridge is all right for washing clothes, and clothes may be washed there. Washing clothes in Agana River below San Juan de Letran Bridge continues to be forbidden because of the danger to the health of the community.
- 5) It may be necessary to close all the public wash houses unless less fresh water is used and wasted.
H.B. PRICE, Governor of Guam.

The Guam Recorder: September 2, 1924

Naval Government of Guam, Executive Notice, No. 186:

- 1) The present epidemic of dysentery now prevailing requires that stringent and active measures be taken to combat all known sources of infection.
- 2) The week beginning September 4 is designated as "CLEAN UP" week for Agana and Sinajana.
- 3) The occupant of every house, dwelling, store or premises is directed to immediately place their premises in condition satisfactory to sanitary inspector.
- 4) The owner of a vacant lot is responsible for its sanitary condition.
- 5) Present sanitary regulations are sufficient and will be strictly enforced.
- 6) Cooperation of everybody is required in enforcing the following measures necessary to check epidemic:
 - a) Use public latrines as far as practicable.
 - b) Keep privies clean and free from flies.
 - c) Use lime in privy cans.
 - d) Empty privy cans daily in the ocean.
 - f) Keep food covered so flies cannot get at it.
 - g) Boiling all drinking water is recommended.
 - h) Below San Juan de Letran Bridge, Agana River water is dangerous, do not use for any purpose.
 - i) EVERYBODY KILL FLIES.

7. The Chief of Police in cooperation with Health Department is placed in immediate charge of all work to accomplish desired results.

A.W. BROWN, Acting Governor of Guam.

Governor Price, in a notice in the Guam Recorder dated March 24, 1926, stressed the importance of keeping the Agana River clean:

Because of the scarcity of fresh water, the Agana River water may be used for washing clothers, and clothes may be washed there until further orders. Agana River water must not be used for any other purpose than washing clothes. It is now emphasized again that it is strictly forbidden because of the danger to the health of the community, to put any trash, refuse, fecal matter, dead animal or bird, in the Agana River. The Chief of Police shall cause particular attention to be given this matter, he and the Commissioner of Agana shall see to it that everybody, and especially those living near the river, fully understand it. There must be vigilance to detect and report anyone violating this order. The people must be made to understand that it is a matter seriously affecting their health and that it is a duty to themselves and the community to report promptly any person they detect polluting the river water.

In July 1926, the people of Guam were advised to use the Navy procedure when taking a shower: "Wet down, soap down, scrub down, rinse down, shutting the water off between times", in the interests of conserving water. Later that year, the issue of flooding in Agana was still a problem. Some history of the difficulties was elucidated in the Guam Recorder (1926:245) in December:

---At one time the streets were provided with gutters and drain pipes which permitted storm water to drain into the river, but these have long ago been buried under much resurfacing material. Until now many of the streets are two or more feet higher than they were originally and with no attempt to provide proper drainage (Photo 11).

In 1927, interest was again shown in utilizing Agana Swamp. Don Felipe de la Corte, in his memoirs of 1856, had pointed out the disease breeding character of Agana Swamp. He had recommended that the area be drained and that particular trees such as coconut and bamboo be planted there, to purify the area and make productive the soil (reported in the Guam Recorder, December 1926:246). A follow-up article in the Guam Recorder in January (1927:280) elaborated on the idea:

Approximately 270 acres of this low land is not only useless

and a breeding place for mosquitos, fevers, and vile smells, but it is a real menace in times of heavy rainfalls, for then, due to the choked condition of the outlet, the water backs up over this large section, and when released by its great pressure, the banks of the Agana river overflow and cause sections of the town to be under water for days...It does not require a great amount of imagination to picture this large, valuable and neglected area, transformed into a wonderful park and recreation grounds, that would be second to few of the pleasure places of any of our island possessions...a lake dredged out which could serve as an additional water supply, the low land filled in, drainage canals constructed, the whole area systematically planted with palms, shrubs and flowers. A place where the inhabitants and sojourners, alike would enjoy fresh water swimming, boating, model yacht sailing, and various other water sports. Athletic grounds with a running tracks, tennis courts, baseball field, a dancing pavilion and concert hall, bungalows surrounded by lawns and tropical plants, and with well kept roads winding through this beauty spot.

As follow-up to the earlier (1927) interest shown in making improvements in Agana Swamp, Seabury (1934:85-86) reported that modernization of the swamp was becoming an actuality. Although a dam at the eastern end of the swamp had remained in a good state of preservation since it was built in about 1850, it could no longer be used. Rather, a clear channel approximately 20 feet wide and 3 feet deep was cut through the marshland to the Agana Springs Reservoir. This new channel was over 5,700 feet long. Another channel some 1,500 feet long was cut from the main stream into the heartland of the swamp. The result was that over two-thirds of the entire area was drained free of all surface water. The ground water level was noticeably lowered in all adjacent areas. An important by-product of the dredging work was an increased flow of the Agana River during dry periods. Experts pointed out that local flood conditions would be less serious in the future: runoff from a dry region occurs in a comparatively slow manner. Nonetheless, all problems were not solved. Regular cleaning of the channels to remove under-growth would be required in order to maintain the unrestricted flow.

Given that rice was the principal food item in the diet of the people of Guam, in 1934 Governor George Alexander encouraged the people to plant more of this food staple. Some 260 acres of rice lands were already being cultivated (Carano and Sanchez 1964:240) but an additional 151 acres were committed to rice growing by the end of 1936 (Photo 12). To assist with rice cultivation, a reinforced concrete dam was constructed near Inarajan. After it was completed, 390 additional acres of land were set aside for rice growing. Eckberg (Guam Recorder, February, 1935:297) discussed the likely success for a rice growing effort in the Atantano River Valley between Piti and Sumay. With a successful undertaking of such a venture, the Piti-Sumay road would be protected from further flood damage.



Photo 11. "Bamboo water pipes in old Agana.

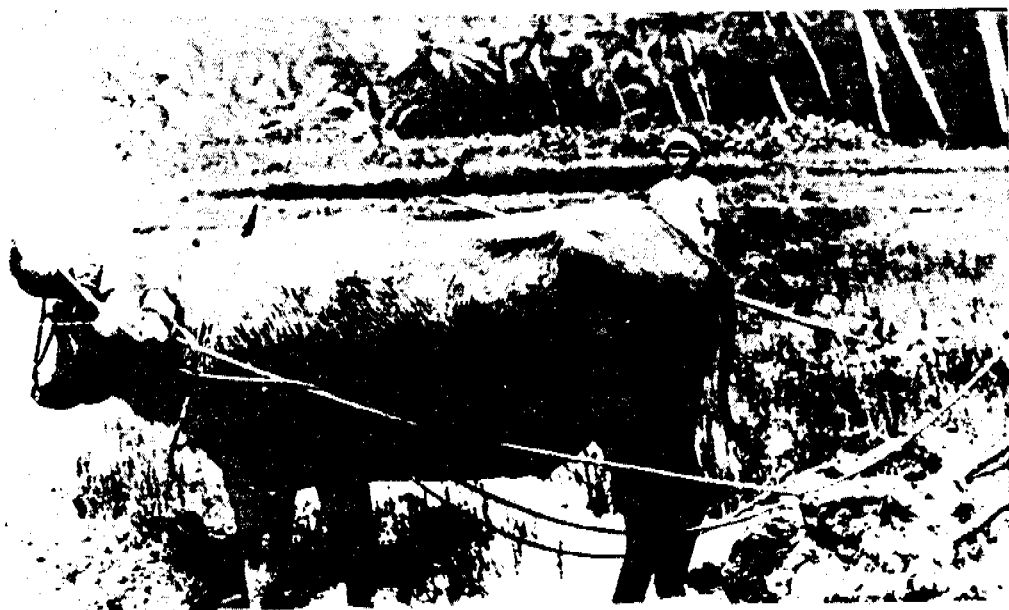


Photo 12. Carabao pulling plow in irrigated rice field.

Important news in June, 1937 (reported in the Guam Recorder 1937:25) was headlined, "Water found at Barrigada". According to the accompanying story, a well drilling machine had recently been purchased by the Naval Government and brought to Guam. It was first set up adjacent to the Wettengel reservoir in the vicinity of the Wettengel School, with aid to the ranchers in northern Guam in mind. After twenty-three days of drilling, water was found at a depth of 289 feet 6 inches. It was definitely potable, with a salinity content of 1.3 grains or less per gallon. The story pointed out, significantly, that as the demand for more water would be made, larger pumps could be installed without increasing the size of the well casing. The plan was to move the drilling machine to another location as soon as the safest depth for the well was determined. Other tentative locations where drilling likely would be undertaken included Dededo, Yona and Talofoto.

As well as the acquisition of the drill rig, the services of a qualified expert to evaluate Guam's water resources were made available for the first time in 1937. H.T. Stearns of the U.S. Geological Survey made an investigation into the relationship between the geology and the water resources of Guam at the request of the Navy (Mink 1976:4). In regard to cultural customs, Stearns observed that fresh water on Guam was used chiefly for domestic and municipal supplies. He further noted that the farmers on the northern plateau continued to go to Agana each weekend to do their laundry, take baths, and haul water back to their ranches. The Agana river, still flowing through its walled course, continued to serve as a place for washing clothes (Stearns 1937:31).

Carano and Sanchez (1964:245) point out that the Guam Recorder in 1937...."was greatly improved, both in content and in form. A number of articles on scientific matters were contributed by qualified persons." In regard to the theme of fresh water, the following articles are among those referred to by Carano and Sanchez: a feature article entitled "Agana Water Supply" by Lieutenant Commander George Brooks, (May 1937); a followup article by Brooks entitled "Water for the People of Guam" (July 1937); and finally "Water is Precious", author not cited, in August 1937.

Brooks, in the first article, pointed out that upon the United States' acquisition of Guam in 1898, almost all of the citizens of the island were drawing their fresh water from springs or shallow private wells, which were of questionable quality. Cisterns were also utilized to some degree. Brooks then makes the point that civilization demands not only an adequate amount of water that is pure in quality, but also that the water is accessible or convenient for use. Accordingly, the Civil Engineer Corps of the Navy was called upon at once to devise a better water supply system if the island of Guam was to enjoy progress in the modern sense. Brooks reviewed the earlier work at Fonte Dam and Agana Springs, and the Asan water system, which was developed in 1915. Of the Asan system, Brooks reminded readers that (1937:7):

25) The man-made works of this system consist of an 80,000 gallon
ng twin concrete reservoir from which a 4-inch cast iron bell and
o spigot pipe line conveys water by gravity to the city of Agana
- distributing system which is a separate and distinct system from
n. the Fonte distributing system. The pipe line which leads to Asan,
1. Tepungan and Piti is a 3-inch galvanized threaded pipe line.

Brooks indicated those efforts relieved the water situation in Agana. But the population of Agana almost doubled between 1915 and 1937, putting heavy demands on that supply system. At the time Brooks wrote his article, the water supply in Agana could not meet the demands of the people, especially during severe dry spells, and had to be shut off at night for conservation purposes. Asan, Tepungan and Piti, accordingly, were left without fire protection during the time the water was turned off.

Brooks outlined four major efforts in 1937 directed toward maintaining and improving the current water supply. The first two efforts--bringing in additional water from other sources and keeping the water in use safe for public consumption--were standard. The second two efforts he outlined were new enterprises for Guam: extending sanitary protection by purchasing and controlling water gathering areas, and chlorination of water supplies to assure positive protection at all time.

For the first effort, Brooks noted that two new pumps of larger capacity were in the process of being purchased for installation at Agana Springs. The second effort essentially involved maintenance in general, cleaning of the reservoirs to prevent vegetable growth, patrolling the lines to watch for leaks, and such. In the third area of effort, Brooks pointed out that the catchment area above Asan reservoir was recently purchased by the Naval Government. Other such areas would be purchased or at least policed, keeping persons and animals away. Finally, in regard to chlorination of the water, Brooks reported that funds for the chlorination of the water system had been requested (presumably from the Federal government), and that if and when such funds were granted, then the Fonte, Asan and Agat systems would be chlorinated.

Finally, Brooks cautioned his readers that the answer to the extravagant use and wastage of water in other areas has been a metered service, with the consumer paying for the amount of water actually utilized. He concluded, "let us hope Guam will not have to resort to the use of meters to accomplish the same results". People were once again enjoined to take pride in the water system of Guam and the men who maintained it,..."those maintenance plumbers, who occasionally, night or day, stand waist deep in the water of swollen streams, risking colds or pneumonia, to repair leaks so that the water service can be maintained for you".

In July 1937, concentrated efforts were put forth to repair and/or build latrines, bath houses, laundries, and septic tanks in all the villages. In the Department of Industries Notes, Guam Recorder, it was

reported that repairs and modifications had been completed on 25 separate public latrines located throughout the island.

The February 1938 section of Department of Industries Notes, Guam Recorder reported further public health projects, including the work of making school and public latrines fly-proof; chlorination of wells and reservoirs; screening water containers with Monel metal screen to keep out insects; the construction of a double shower bath at the north end of the main toilets at Padre Palomo School; and the building of a drinking fountain of 50-gallons capacity for the Jalaguag School.

In an effort to control insects, the Bufo Marinus was introduced on Guam in 1937. The following notice appeared in the Guam Recorder (August 1937:24):

Beware of the Giant Toad

The Giant Toad which has been recently released in the vicinity of Agana Springs is the friend of man in the sense that he destroys the bugs and insects that destroy our vegetative and food plants. In another sense he is not a friend. He is not an edible toad. The Bufo Marinus or Giant Toad is poisonous for eating purposes. His mission on the Island is to eat insects. He is not here to be eaten. Do not eat the Giant Toad.

Brooks (1937:25) pointed out that exploratory studies to locate water sources brought about the discovery of Almagosa Springs. Water from this source could be piped to the Agat reservoir, keeping in mind the utility of gravity flow. It was determined that Almagosa Springs could produce a minimum flow of 600,000 gallons per day.

In a article entitled, "Water is Precious," (Guam Recorder, August 1937:31,39) the people of Guam were reminded once again to conserve water:

It takes four minutes to fill two wash tubs with water that should do any family wash.

Under the faucet with water running, one piece of clothing may take as much as twenty minutes to wash.

Think of the waste!

In the same article, with a margin of profit of only \$788.16 at hand from the previous year, Guam's people were advised that it was necessary to increase the water rate, as follows:

Private connections--
from \$4.00 to \$4.50 per year

Public outlets--
from \$2.00 to \$2.25 per year.

Lieutenant Commander Armknecht (Guam Recorder, August 1940:183-184) wrote of Guam's new water project, generally describing improvements that have already been cited elsewhere in the published literature. Armknecht's contribution is unique, however, in that he takes the theoretical point of view that the island of Guam has never suffered a water shortage. Rather, he points out, Guam always has water, considering Guam's ninety-inch average annual rainfall. The water, however, is stored away underground and it takes the proper equipment and the right amount of capital to bring that water to the surface.

The Japanese Period

During the Japanese occupation from December 1941 to July 1944, little was done to change the existing water system (Mink 1976:6). The Americans did not destroy any utilities prior to the Japanese invasion. Once fully entrenched on Guam, on the other hand, the Japanese disrupted the water supply, presumably to obtain metal. Availability of fresh water then became a major problem for local people (Rowcliff 1945:790).

Carano and Sanchez (1964:269) point out the dramatic shift of the residence of Guam's people during wartime. Approximately 11,000 Guamanians moved away from Agana to take up residency elsewhere, beginning in December, 1941. Accordingly, there would have been less strain on the Agana water supply for local utilization. However, many Japanese troops were quartered on Guam during the occupation. For purposes of administration, according to Carano and Sanchez (1964:281), the Japanese authorities divided rural Guam into several districts. Such districts were approximately the same as those set apart before the war, based on the traditional barrio boundaries. When the American forces landed on Guam, beginning on July 21, 1944, they were met by Japanese resistance forces numbering nearly 18,500 men. Thus, the Japanese troops would have utilized the Agana water supply in significant numbers, taking the place of Guamanians who were no longer using it after their shift of residence.

Post World War II

A critical need for water existed when the U.S. military were in the process of retaking Guam in the closing phases of World War II. Carano and Sanchez reported (1964:307) that....

As the advance moved farther north, troops began to run low on food and water. The route of march led through such rugged terrain that vehicles were unable to bring up supplies. The lack of water, especially, made it necessary to capture Barrigada quickly in order to gain possession of its deep well that could provide 30,000 gallons of pure water daily.

Enough water had been brought in to give each man a two-gallon ration per day for his first five days on the island. This water had come from Guadelcanal in five-gallon Jerry cans and, according to Lt. W.A. Lawrence (1946: 56)... "had acquired the odor and taste of an old paint locker."

As soon as Guam had been secured by the Americans, there was a great need to ensure sufficient water supply for the military and the local populace alike. Reservoirs and water lines had suffered severe damage in the struggle for Guam. A municipal water supply was needed, especially for the purposes of supplying two to four million gallons of treated fresh water daily for shore-based activities, as well as the fleet. Materials and supplies for re-building the water system were practically nonexistent. But the need was urgent.

Spring water dosed with chlorine and distillation units capable of changing salt water into fresh water provided the first relief from the crisis. The Almagosa Springs installation was broken, and the million gallon Maanot Reservoir was in even a worse condition. Not only were the bodies of dead Japanese military men found in and around the reservoir, but also human wastes left over from their camps in the area provided serious contamination. Ground-lying pipes near Orote Peninsula had either been crushed, ripped or broken in the days of fighting; for those pipes that looked secure, weary and thirsty Marines had shot holes in them, hopeful of a short spurt of fresh, clear water.

Restoration of the water supply was undertaken as soon as conditions were safe. The troops at Agat beach needed water as soon as they gained a foothold. The Agat Reservoir and pipelines were repaired in makeshift fashion to render them usable as soon as possible. It was feared that Japanese hiding out from the Americans would try to poison nearby natural waterways.

After a painstaking gathering process, as much cast-iron pipe as possible was salvaged for a seven mile connection through the jungle from Almagosa Springs through Maanot Reservoir down Almagosa Mountain across to Orote Peninsula and Sumay. Even sections of the cast-iron pipes with bullet holes in them were repaired sufficiently well with bronze plugs to be usable. Virtually no equipment was available to assist with the repairwork. Eight and ten inch pipes were moved by hand and will power.

All of this was happening during the rainy season. It was a relief to see the rain fall but, in order to catch it, the repaired water pipes were vital. Water buffalos (carabao) were utilized to move heavy lengths of pipe in and out of the mud-soaked trenches.

The hard-working Seabees rebuilt some seven miles of eight and ten inch pipeline in approximately 40 days. In the course of their efforts, they recovered more than three miles of damaged pipes and

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repaired them. At the same time other Seabees were putting repairs on Almagosa catch basin and at Maanot Reservoir. Lack of materials, again, was a problem but left-over fine cement from the Japanese stores was readily utilized. Likewise, at Agana pumping station, the patchwork technique was put into practice (Photo 13). Agana pumping station could only be operated in the daylight, for, being situated near the dense undergrowth of Agana Swamp, Japanese snipers favored it for target practice. The Marines posted a six-man detail in the area to curtail such activity.

Repairing the water mains of the city of Agana was an additional challenge. It was, again, a temporary, patchwork effort. But by September 18 or so, 59 days after the first U.S. assault on the beaches of Guam and 39 days since the end of organized resistance a rather large utility type water system was in working order. Lt. Lawrence (1946:560-567) gave full credit to the 25th, 53rd and 59th construction Battalions for a job well done.

By the end of 1946, the reconstruction of Guam was well underway. Prewar Agana was a shreds and patches arrangement of homes, public buildings and the like. Postwar planners laid out the city in evenly divided blocks along straight roadways. Former lot boundaries and former property lines were disregarded. Streams were filled in and their channels were diverted. The Agana River's course was changed at this time to the present course.

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In 1948, nearly \$1,000,000 more in funds had been set aside for further reconstruction of Guam, especially in the villages. Among other village repairs were repairs to the village water systems. The Navy constructed a major dam and reservoir in the Fena basin at the headwaters of the Talofofu River, to regulate the water supply in that area. The area is fed by two springs as well, Almagosa Springs and Bona Springs. Fena Reservoir was built on Navy property, and continues to supply water to the Naval facilities in the present day.

In 1950, the Organic act was passed, enabling Guam to become self-governing. The new government faced the same old problems in regard to the island's water supply. Since Fena Reservoir was supplying water very successfully to the military community, at this time most of the problems were in regard to the civilian community's water supply. The Navy made arrangements to sell water to the Government of Guam. This solution was reliable for some ten years. However, after typhoon Karen damaged public works in 1963, Federal funds were made available so that the local government could contract a plan for water development. The principal plan submitted by Austin, Smith and Associates, Inc., proved to be too costly to initiate and was abandoned. The government decided to take a chance on drilling additional wells. By 1974 some 57 wells were providing water to the civilian community in Guam's northern plateau (Mink 1976:10).



Photo 13. Agana Springs Pumping Station, 1945.

The Present

Providing an adequate supply of fresh water in quantity and quality to the civilian population on Guam continues to be a problem in contemporary times. This is particularly the case during the dry season, when the flow of water in the southern rivers tends to be reduced.

However, it is felt that certain recent measures are steps in the right direction. One such step is the Water Resources Conservation Act adopted in 1967, which states that. . . "comprehensive planning and regulation (must) be undertaken for the protection, conservation and development of the water resources of Guam" and that . . . "restrictions are necessary to prevent over-pumping of wells, the depletion of surface and underground water, the intrusion of salt water, sewage and other contaminants and the resultant permanent destruction of underground water reservoirs and sources of potable water supply."

Karolle (1978:23-24) cautions that for 1975, water consumption amounted to more than four billion gallons by the community for the year, nearly a four-fold increase over the 1963 yearly consumption level of 1.4 billion gallons (as reported by Karolle).

Guam present water supply is produced from varied sources. The largest proportion, 56%, comes from wells. Likewise, 36% is drawn from rivers and Fena Lake, and 8% from springs. According to Charles J. Huxel, hydrologist with the U.S. Geological Survey on Guam, local sources of produced water include the following: Government of Guam, 43%; U.S. Navy, 41%; U.S. Air force, 12%; and a mere 4% is produced from private sources. The Navy takes 10 to 11 million gallons per day from Fena Lake Reservoir, selling three million gallons per day to the Government of Guam (also cited in Karolle). Karolle concludes (1978:24): "With proper water conservation and careful development, Huxel believes the island has sufficient water resources."

The newly produced Guam Comprehensive Development Plan (1979) is not quite as optimistic. It points out the need for the people of Guam to . . . "recognize the limitations of Guam's water supply to meet the future demand of the island's population." The Plan states succinctly (1978:17):

The availability of water is one of the major constraints to the island's continued growth. The estimated dependable yield of water on Guam is 50 million gallons per day (mgd) from groundwater sources and 17 mgd from surface water sources.

Recent studies estimate that if more than 50 mgd is drawn from the northern water lens (which supplies almost 90% of current island needs), salt water may be drawn in and contaminate the underground lens. Improper land uses can accelerate contamination.

Currently, the water consumption on Guam is between 26 and 29 mgd. Of this, 43-48% is consumed by the military. From 1966 to 1976, water consumption increased 3.5 times. This rate continues to increase. Since water consumption is determined by population growth, the island's supply capacity will be reached within the next 25 years.

Sociocultural Studies of Fresh Water: The Questionnaire

An availability sample of 265 Chamorros responded to the project's questionnaire in regard to water use customs on Guam. The data gathered from the questionnaires are presented in descriptive fashion in this portion of the report. A sample questionnaire appears in Appendix A with the informants' responses tabulated in numerical form.

Section One

The survey begins with a few general questions for informants on their personal and social backgrounds. Question 1 asks for the age of the respondent. A breakdown of the ages represented in the sample is shown as follows:

<u>Age</u>	<u>Number of Informants</u>
40-45 years	43
46-50	34
51-55	44
56-60	25
61-65	35
66-70	29
71-75	23
76-80	14
81 and over	13
No response	5

It is impossible to say how closely our sample corresponds to the current age base of the Chamorro population of Guam. Neither the Government of Guam's Statistical Abstract of 1977 nor the Bureau of Planning's Five Year Economic Development Strategy of 1978 presents such population statistics. For our sample population, 55.08 percent of our informants are between the ages of 60 and 75; and 10.18 percent of the population sampled are over the age of 75.

Question 2 asks for the sex of the respondents. 61.88 percent of the respondents were females; 33.73% were males. Perhaps these figures reflect male deaths during World War II, easier accessibility to female informants by the researchers, and/or the actual population pyramid of Guam, which likely would show more elderly females among the population than elderly males.

The third question asks the respondents to name their country of origin, according to birth. As the questionnaire was directed to a Chamorro population, we anticipated that a majority of the informants were born on Guam. In fact, 95.84 percent of the respondents confirmed that they were born here. Other answers included the following:

<u>Location</u>	<u>No. of Informants</u>
USA	2
Japan	1
Philippines	3
Trust Territories	2
Other	12
No response	1

Of the people that answered "other", no one wrote in the name of their country of origin.

Question 4 asks informants, "In what village on Guam were you born?" A breakdown of the responses and percentages is shown below:

<u>Village</u>	<u>No. of Informants</u>	<u>Percentage</u>
Agafa Gumas	7	2.64
Agana	115	43.39
Agana Heights	2	.75
Agat	14	5.28
Asan	4	1.50
Barrigada	7	2.64
Chalan Pago	3	1.13
Dededo	6	2.26
Inarajan	27	10.18
Maina	4	1.50
Maite	0	0
Malojloj	1	.37
Mangilao	0	0
Merizo	14	5.28
Mongmong	1	.37
Piti	13	4.90
Santa Rita	0	0
Sinajana	7	2.64
Sumay	3	1.13
Talofof	9	3.39
Tamuning	5	1.88
Toto	2	.75
Tumon	1	.37
Umatac	7	2.64
Yigo	3	1.13
Yona	4	1.50
No response	6	2.26

These figures indicate well-known information regarding the people of Guam born prior to World War II. The largest single percentage of informants, 43.49 percent, were born in Agana. Prior to World War II, Agana was the largest village on Guam.

Question 7 asks informants of their marital status, and Question 8 asks how many other people are living in their household. A breakdown of these responses is shown as follows:

Marital Status

<u>Status</u>	<u>No. of Informants</u>
1) Married	184
2) Single	13
3) Separated	4
4) Divorced	5
5) Widowed	50
6) Other	0
7) No Response	9

Number of People in the Household

<u>No. of Persons</u>	<u>No. of Informants</u>
1) 1-3	82
2) 4-10	131
3) 11-15	28
4) 16-20	11
5) Over 20	7
6) No Response	6

Questions 9, 10, and 11, "Where do you now reside," gave the researchers a chance to compare pre-World War II population sizes by village on Guam with those of the post-War era.

<u>Village</u>	<u>No. of Informants</u>	<u>Percentages</u>
Agafa Gumas	10	3.70
Agana	9	3.33
Agana Heights	21	7.77
Agat	15	5.55
Asan	4	1.48
Barrigada	24	8.88
Chalan Pago	12	4.44
Dededo	21	7.77
Inarajan	23	8.51
Maina	3	1.11
Maite	2	.74
Malojloj	4	1.48
Mangilao	12	4.44

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Inarajan	23	8.51
Maina	3	1.11
Maite	2	.74
Malojloj	4	1.48
Mangilao	12	4.44

<u>Village</u>	<u>No. of Informants</u>	<u>Percentage</u>
Merizo	13	4.81
Mongmong	7	2.59
Piti	7	2.59
Santa Rita	4	1.48
Sinajana	21	7.77
Sumay	1	.37
Talofof	9	3.33
Tamuning	18	6.66
Toto	3	1.11
Tumon	1	.37
Umatac	4	1.48
Yigo	8	2.96
Yona	14	5.18

In comparison with the question on village of birth, when Agana was named by 43.39 percent of the people, only 9 people now named Agana as their village of residence, or 3.33 of the total responses. We thought this was significant. The villages of residence most frequently named were Tamuning, Dededo, Sinajana, Agana Heights, Inarajan, and Barrigada, which accurately reflect the migration of Guam's people away from Agana to the new villages built up after World War II. More people are living in the northern part of Guam now. This may be, among other things, a response to the wells tapped by the Government of Guam in northern Guam, allowing people in the north to reside permanently on their farms since water was consistently available.

After asking people where they now reside, a corresponding question asked informants how long they had lived there. These responses also show the movement of the population base of Guam. The table below shows a breakdown of the responses.

<u>No. of Years</u>	<u>No. of Respondents</u>
1) 0-3	17
2) 4-6	14
3) 7-10	21
4) 11-15	10
5) 16-20	15
6) 21-25	38
7) 26-30	22
8) Over 30	125
8) No Response	3

As can be seen, an overwhelming 47.16% of the population have lived in their present village over 30 years. Considering the movement of many people from Agana, and the movement of people to the northern villages, it may be inferred that the people who have lived in the same village for over 30 years may be found in such villages as Barrigada, Inarajan, Merizo and Umatac.

<u>Village</u>	<u>No. of Informants</u>	<u>Percentage</u>
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Piti	7	2.59
Santa Rita	4	1.48
Sinajana	21	7.77
Sumay	1	.37
Talofof	9	3.33
Tamuning	18	6.66
Toto	3	1.11
Tumon	1	.37
Umatac	4	1.48
Yigo	8	2.96
Yona	14	5.18

In comparison with the question on village of birth, when Agana was named by 43.39 percent of the people, only 9 people now named Agana as their village of residence, or 3.33 of the total responses. We thought this was significant. The villages of residence most frequently named were Tamuning, Dededo, Sinajana, Agana Heights, Inarajan, and Barrigada, which accurately reflect the migration of Guam's people away from Agana to the new villages built up after World War II. More people are living in the northern part of Guam now. This may be, among other things, a response to the wells tapped by the Government of Guam in northern Guam, allowing people in the north to reside permanently on their farms since water was consistently available.

After asking people where they now reside, a corresponding question asked informants how long they had lived there. These responses also show the movement of the population base of Guam. The table below shows a breakdown of the responses.

<u>No. of Years</u>	<u>No. of Respondents</u>
1) 0-3	17
2) 4-6	14
3) 7-10	21
4) 11-15	10
5) 16-20	15
6) 21-25	38
7) 26-30	22
8) Over 30	125
8) No Response	3

As can be seen, an overwhelming 47.16% of the population have lived in their present village over 30 years. Considering the movement of many people from Agana, and the movement of people to the northern villages, it may be inferred that the people who have lived in the same village for over 30 years may be found in such villages as Barrigada, Inarajan, Merizo and Umatac.

The survey goes on to ask the informants if fresh water was located on their property. Of the sample population, 32.83% of the informants said there was fresh water located on their property while 62.28% said there was not. 1.88% gave no response to this question. It is unknown whether the informants who answered yes were including piped water in their responses.

After finding out how many people had fresh water on their land, we asked those who did have fresh water, "In what village was the fresh water located?" The responses were as follows:

<u>Village</u>	<u>No. of Informants</u>	<u>Percentages</u>
Agafa Gumas	3	2.27
Agana	24	18.18
Agana Heights	3	2.27
Agat	8	6.06
Asan	9	6.81
Barrigada	4	3.03
Chalan Pago	3	2.27
Dededo	1	.75
Inarajan	15	11.36
Maina	3	2.27
Maite	1	.75
Malojloj	2	1.51
Mangilao	0	0
Merizo	10	7.57
Mongmong	2	1.51
Piti	2	1.51
Santa Rita	0	0
Sinajana	2	1.51
Sumay	6	4.54
Talofofo	8	6.06
Tamuning	1	.75
Toto	1	.75
Tumon	0	0
Umatac	7	5.30
Yigo	8	6.06
Yona	3	2.27
Other	6	4.54

Other: Fena-1; Manaigon-1; Dedigi-1; no response-3

Twenty-four respondents, or 18.18%, indicated they utilized fresh water in Agana. Agana, of course, was the major community on Guam prior to World War II.

This personal and social background section of the questionnaire gives the research team details of the informant population essential to the survey. Most importantly, it shows migrations of the people of Guam from Agana to the outlying villages, and from the central

areas to the north in the post-war era when water was made permanently available to residents there.

Section Two

This section of the survey focuses on Chamorro informants' view of their place in their island ecosystem prior to World War II, their use of freshwater in their daily lives, and their perception of water ownership. Of the 265 informants taking part in the survey, 87 responded positively to the question: "Was there a river or spring or well on your property?" The following questions pursued the theme in greater detail.

Question: "What type of water was located on your property?"

There were 153 responses to the question. The informants identified the various types of water on their properties as follows: 61 indicated river water; 35 indicated spring water; and 35 indicated well water. From these totals we see nearly an equal distribution in numbers of spring and well water found on various properties; about 30 percent in each case. Forty percent of the people mentioned that river water was located on their property (Illustrations 13, 14, & 15).

Question: "How did you or your family get the land where the water was located?"

There were 112 responses to this question. 49 persons answered "inheritance"; 13 indicated "purchase"; 11 indicated "land rental"; and 25 had "permission of owner" to stay on the land. Forty-three (43) percent of the 112 respondents revealed that their acquisition of the land was based on inheritance. Twenty-two (22) percent stated that they used the land with the permission of the owner. These two significantly large categories of responses suggest that land ownership was kinship-based and/or that the customs of sharing and reciprocity between relatives and friends persisted among the Chamorros. Such customs seem to have been central to the traditional society (Thompson 1964:21).

Question: "Who owned the water that you used?"

Seven (7) responses were possible for this question, but informants were asked to choose a single answer. The possible responses were:

1. I did
2. My family did
3. Rent or lease from relatives
4. A company
5. The Government
6. No one owned it
7. Other (please list)

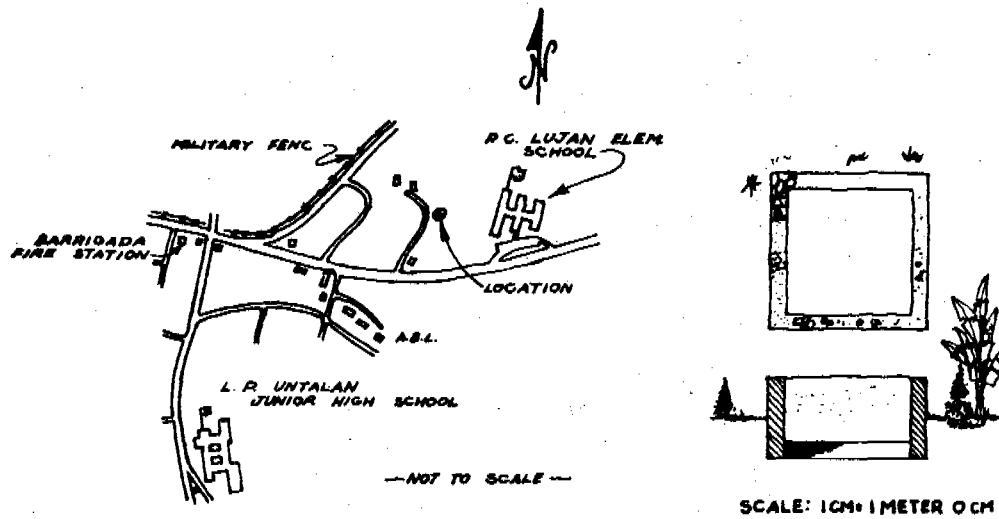


Illustration 13. Example of Concrete Water Catchment on Guam.

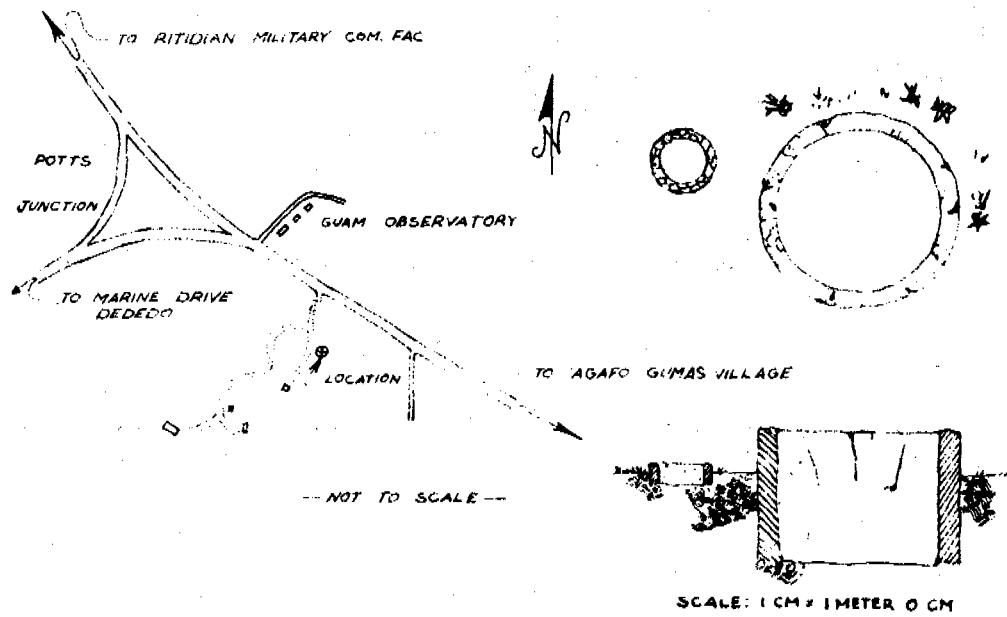


Illustration 14. Example of Concrete Water Catchment on Guam.

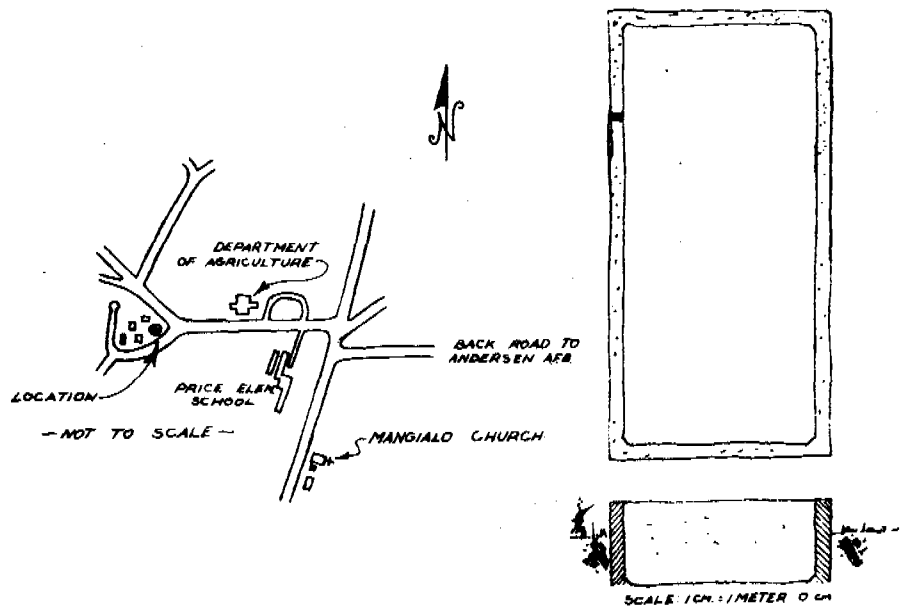


Illustration 15. Example of Concrete Water Catchment on Guam.

Of 231 responses to this question, 20 informants reported that they owned their water; 31 indicated their water was owned by their family; 9 answered that their water was rented or leased; 139 people reported that their water was owned by the Government; and 18 indicated that no one owned the water that they used.

The majority of respondents (60% of 231 responses) indicated that the Government owned their water. As the ages of our informants ranged from 40 years to 50 years of age and older, "the Government" for them may well be the U.S. Naval Government, which was first established on Guam in 1899. When the United States took possession of Guam in 1899, 14,581 hectares of land was acquired from Spain as Government land (or about one-fourth of Guam's total land area); however, these lands were mostly of poor quality, and some of them were timberlands. Private lands, remaining in the hands of local residents, were of the best quality. Immediately after the abolition of the Spanish real estate tax, the Naval Government imposed a land tax with rates varying in relation to distance of the lands from Agana. Many peasants as well as large landowners could not pay their taxes, and had to relinquish control of their lands to the Naval Government (Thompson 1947:115). By 1937, land holdings in the hands of the Navy included about 2,924 hectares which had been alienated, 16,507 hectares from the Spanish crown, and 1,926 hectares gained through outright purchase, or about one-third of the land area of Guam. The combined land holdings of the Federal and Naval government by 1939 amounted to almost two-thirds of the island (Thompson 1947:118).

The "Guam News Letter" in October, 1914, printed Articles 407-427 of Title IV, Chapter First, Sections First through Fourth of the Civil Code of Guam in regard to ownership of waters, uses of public waters, and the like (See Appendix Item 2). Section First, Article 407 of that document indicates that rivers and their natural beds are owned by the public. However, it appears that many of our informants perceived the Government as the actual owner. According to the same document, springs are also publicly owned. Wells, however, are privately owned.

Of the 18 people that indicated no one owned the water that they used, informants wrote in comments such as: "God owns the water"; "How can anybody own the water because it does not stand still; it flows"; and "Everybody, we own the water altogether." While researching in the literature, we noticed that although numerous sources (e.g., Thompson 1947; Carano and Sanchez 1964; etc.) discuss land tenure, these authors do not discuss water tenure, that is, if land and water ownership can be treated as one and the same entity, or if the two are conceptualized as different and thus laws apply to them differently. Traditionally the concept of individual ownership of land or property was not a preferred pattern on Guam. Reciprocity seems to have been the basis of most transactions; natural resources were available to all who needed them (although Section Third, Article 414 of the Civil Code of Guam, as reproduced in the "Guam News Letter", October 1914, clearly states: "No one may enter private property in search of waters or make use of

them without permission from their owners"). Water tenure on Guam is a complex issue, taking into account colonization and changes from Spanish, American, and Japanese occupations.

In an attempt to focus on the various uses of freshwater the next question asked, "What did you use freshwater for?" Twelve possible choices including "other" were suggested as possible answers with more than one selection possible. With 243 responses for each of these answers, cooking and drinking were the activities indicated most frequently by the informants, bathing was third, washing clothes and cleaning (housework) were fourth and fifth in order of importance according to informants. The use of freshwater to water plants and animals was indicated as next choice.

There was a significant drop between the number of informants selecting the first three activities and the following eight as can be seen in the table. For instance, of 243 people answering this question, only 67 informants indicated fresh water was used for swimming, 62 indicated it was used for the toilet and 61 indicated it was used for medical practices. Only 32 informants indicated that they used a freshwater source for fishing. An example of "other" uses for freshwater suggested by the informants was: to temper machetes. The chart below shows the numerical breakdown of responses for each listed activity:

<u>Activity</u>	<u>Number of Responses</u>
Cooking	243
Drinking	243
Bathing	230
Washing Clothes	199
Cleaning (housework)	188
Watering plants	135
Watering animals	130
Swimming	67
Toilet	62
Medical Practices	61
Fishing	32
Other	13

Apparently then, according to the informants answering this question, it was felt that the most frequent uses of freshwater were for cleaning, drinking, and bathing purposes. The next set of questions examines more closely the type of water that was used for cooking, drinking, bathing, and the like.

Question: "What type of water did you use for cooking?"

Out of 399 responses, the chart below sets forth the type of water preferred by informants for cooking purposes:

<u>Type of Water</u>	<u>Total Responses</u>
River	70
Spring	66
Well	64
Rain	158
Lake	1
Pool	0
Other (Please List)	31

The data indicate that rain water is the preferred type of water for cooking. Perhaps the close availability of stored rainwater to most household units is a contributing factor. Section four of this questionnaire elaborates upon the theme of water storage in greater detail.

Question: "What type of water did you use for drinking?"

<u>Type of Water</u>	<u>Number of Responses</u>
River	64
Spring	62
Well	63
Rain	182
Lake	3
Pool	0
Other	31

Rainwater, again, is the most frequent response. Again, the proximity of stored rainwater to most household units is likely a significant factor. The cleanliness of fresh rainwater might make it viewed as more palatable than the other types of water. Several informants suggested that rainwater has a sweeter taste when compared with other types of water.

Question: "What type of water did you use for bathing?"

Of 459 responses, the type of water preferred for bathing is indicated as follows:

<u>Type of Water</u>	<u>Number of Responses</u>
River	121
Spring	58
Well	66
Rain	138
Lake	8
Pool	8
Waterfalls	14
Community Bath House	17
Other (Please List)	29

Rainwater and river water are shown to be the most preferred types of water for cleansing the body. The proximity of stored rainwater and the proximity of a river might be reasons for both preferences.

Question: "What type of water did you use for swimming?"

Out of 257 responses, the chart below denotes the type of water preferred for swimming:

<u>Type of Water</u>	<u>Number of Responses</u>
River	167
Spring	19
Lake	19
Pool	13
Other (Please List)	38

Clearly, the rivers are the main choice for a place to swim. We questioned informants as to whether swimming is different from bathing. They concurred that swimming is recreational in nature; body cleanliness is only a byproduct.

Question: "What type of water did you use of cleaning (housework and laundry)?"

Of 430 responses to this question, the chart below sets forth the type of water preferred for cleaning.

<u>Type of Water</u>	<u>Number of Responses</u>
River	131
Spring	63
Well	67
Rain	125
Lake	8
Pool	1
Other (Please List)	37

Once again, river and rainwater are the preferred types of water for laundry and housework. Rainwater is normally stored close to the house; the convenience of having rainwater close at hand may figure in its ready use (Photo 14). Availability of river water seems to be the obvious reason for washing clothes in the river. Likewise, the river seemed to be a site where neighbors gathered to exchange the news of the day as they washed their clothes. The location was normally cool and shady; small children could play nearby safely.

Question: "What type of water did you fish in?"

Of 208 responses by informants, the chart below denotes the type of water preferred for fishing:

<u>Type of Water</u>	<u>Number of Responses</u>
River	113
Spring	5
Lake	13
Pool	4
Other (Please List)	73

The river is the preferred place for fishing. The 73 responses in the "other, please list" category indicated they fished in the ocean. However, ocean fishing is excluded from consideration by this questionnaire as our topic is fresh water. One informant commented that the freshwater eel which is caught in the rivers is only eaten if there are no fish in the lagoon. He was of the opinion that only in times of great need was fishing in the rivers necessary. But a photo from the "Pacific Daily News" in 1962 (Photo 15) suggests that fresh water fishing in the old Spanish dikes was of public interest. In line with this discussion of freshwater fishing, under Spanish Rule in the Ethnohistory section of this report, we recall that the Crozet expedition noticed that Chamorros preferred to eat salt-water fish, which expedition members deemed inferior in quality to the fresh-water ones. Likewise, we recall an historical tenet that decreed only high status people were allowed to fish in the lagoon; low status people were restricted to fishing in the rivers (cf. Thompson 1947).

Two questions dealing with the watering of plants and animals were combined, as follows:

Question: "What type of water did you use for watering animals and plants?"

<u>Type of Water</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
	<u>Animals</u>	<u>Plants</u>
River	88	110
Spring	37	34
Well	54	62
Rain	165	155
Lake	6	5
Pool	4	4
Other (Please List)	28	25

Again, we can infer that rainwater may have been plentiful; therefore, it was readily used for plants and animals. River water is also strongly indicated as a preference for both plants and animals. From this chart, it seems that rainwater and also river water are utilized especially for animals, plants, and humans without distinction.

Question: "What type of water did you use for medical practices?"

Of the 290 responses to this question, the chart below indicates

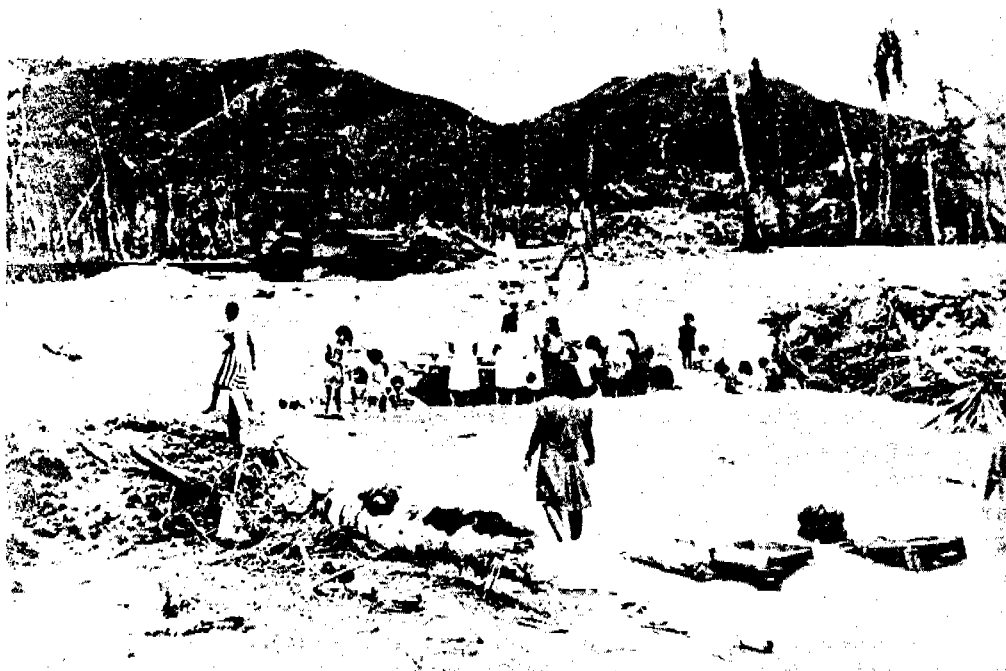


Photo 14. "Marine military policemen and native policemen water over a group of women as they wash clothes in the Fonte River near their camp after the liberation of Guam. Water in the civilian camp was at a premium as it had to be hauled in by water trailer and Marines at the front line had to be cared for first, hence groups were taken to the rivers."



Photo 15. "Members of the El Centro 4-H Club in Didigue, Sinajana, clearing an old Spanish rice dike to preserve the fresh water for fishing."

the types of water preferred for medical practices by our informants:

<u>Type of Water</u>	<u>Number of Responses</u>
River	54
Spring	47
Well	58
Rain	108
Lake	1
Pool	1
Other (Please List)	21

Rainwater again is the most preferred type of water. The cleanliness and availability of stored rainwater allows the suruhanos (traditional medical practitioners) access to pure water at anytime. River water with 54 responses, well water with 58 responses and spring water with 47 responses add to the variety of liquids that could be utilized by our informants in preparing medicinal herbs.

In each of the previous questions, some informants indicated the use of "other" kinds of water. This was frequently elaborated as tap water, piped water, or water from the faucet, which would indicate that many people did not have to depend upon other freshwater sources outside the central water supply.

Question: "How did you clean your body?"

There were 314 responses to this question by our 265 informants. More than one answer could be given by each informant. 91 people responded that they entered the water, probably the river (see chart above on "bathing", Photo 16). 20 people said they stood at the edge of the water; 112 people reported that they took water home to bathe (this could mean that water was normally available at home for bathing purposes). 32 people indicated they went to community bathhouses.¹ Body cleansing may be viewed as a private affair, taking into account that 113 people indicated they went home to bathe.

In summary, the river and rain water seem to have been the main source for water usage in Guam prior to World War II. The focus of the daily activities of Chamorros was centered at the river. In Section Five of this questionnaire, the distribution of labor is

¹One of our informants offered up another use for the community bathhouse. She confided, "After the war, I was a teenager living in Merizo. The Community Bathhouse was still standing, but nobody went there to bathe anymore. But it was a clean place, quiet, nobody around; girls used to go in there with their boyfriends to neck!"

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shown to be mostly equal among males, females, and children in the collecting of freshwater, including river water. It seems as though in pre-war Guam, the river scene was filled with the people of all ages, making the most practical use of this resources of their natural environment.

Section Three

Throughout the world, systems which have been utilized for collecting and transporting water have ranged from the very simple to the very intricate and complex. Each system seems to be restricted to the level of technology and the resources available in that society. The people of Guam, especially prior to World War II, had their own modes of collecting and transporting water.

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The questions which were surveyed in this section concerned collection and transportation of fresh water. Informants were first asked, in individual questions, how they collected river, spring, well, and rain water. They then were asked, again in individual questions, how they carried river, spring, well, and rain water. For each separate question, the final choice of a response was always "other (please list)". It should be pointed out that for each question, the informant was advised that "more than one answer possible" in each category.

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Listed below is a tabulation of the responses to the two major questions, shown in percentages, for 265 respondents. A discussion section follows.

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Question: "How did you collect river, spring, well and rain water?"

Water Source

<u>Type of Container</u>	<u>River</u>	<u>Spring</u>	<u>Well</u>	<u>Rain</u>
Metal container	53	47	48	72
Bamboo tubes	38	32	25	24
Wooden containers	9	9	13	18
Clay pots	12	11	9	15
Other	6	6	8	9
Tree Catchments*				23

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*This choice was given when asked "How did you collect rain water?"



Photo 16. "Native girl bathing some of the small children
in an old shell hole.

Question: "How did you carry river, spring, well and rain water?"

Water Source

<u>Type of Container</u>	<u>River</u>	<u>Spring</u>	<u>Well</u>	<u>Rain</u>
Metal container	44	40	41	56
Bamboo tubes	28	27	26	25
Wooden containers	10	8	11	13
Carabao carts	26	23	20	13
Hand carried	41	36	31	42
Motor vehicles	5	5	4	3
Other	7	7	6	8

River water

Fifty-three percent of our sample population collected and 44% carried river water in metal containers. Of all possible responses, metal containers appear to have been the most commonly utilized vessels for collecting and carrying river water by Chamorros. Metal containers were not made on Guam prior to World War II. But they seem to have been readily available, especially during the American period.

The next choice given was bamboo tubes, and the response to this was that 38% of the sample population collected and 28% carried river water in bamboo tubes. Although bamboo is a local resource, the difference in the amount of water bamboo is capable of carrying compared, for example, to a five gallon can is a factor which should be considered. Bamboo tubes were prepared in various sizes and were named in Chamorro accordingly. It is safe to infer that an adult man could carry a larger bamboo tube than a child (Photo 17). But, several smaller bamboo tubes could have been tied together to facilitate the collection of a large volume of water (Photo 18). We were not able to conduct any experiments in regard to the number of gallons of water bamboo tubes of various sizes could hold. But informants stressed in the "other (please list)" column that each family used whatever collecting devices they had. So factors of personal preference, biggest container, and the like, may not have been the most important consideration.

A further consideration may have been the all-over utility of the water vessel. After watering the garden or animals, a metal container could be used to collect coconuts, vegetables or fruits, whereas a bamboo tube would be inadequate for such uses.

'Wooden containers' were listed as possible vessels in which in collect and/or carry river water. Nine percent of the sample population collected river water and 10% of the sample carried river water in wooden containers. One of the reasons why wooden containers received such a low response may be that they were supposedly brought into Guam during the Spanish era. Most of the respondents of the survey were of the

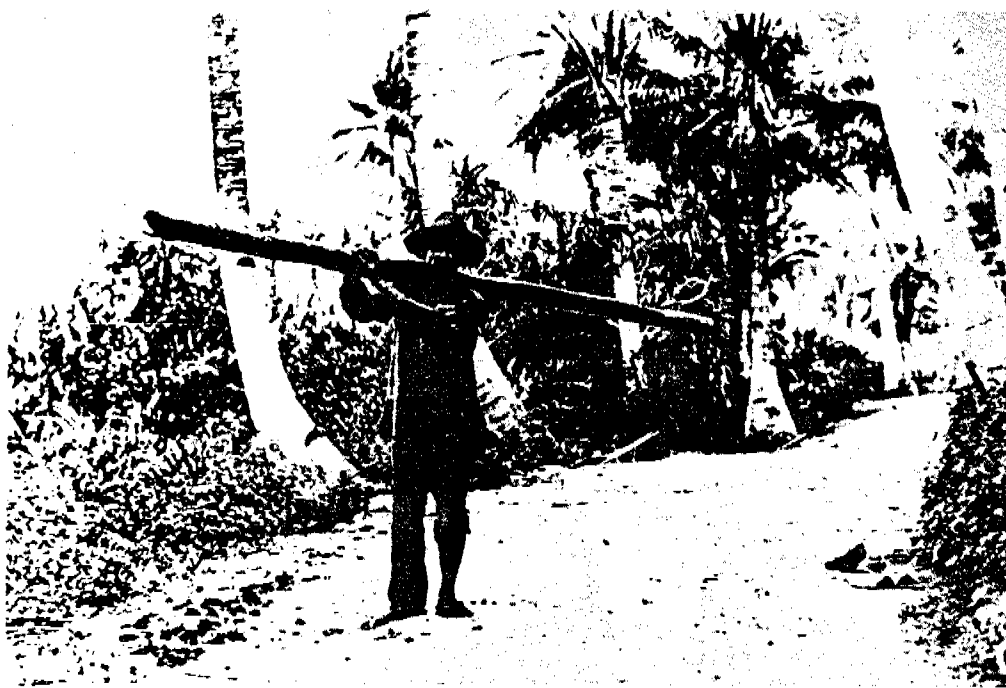


Photo 17. Rancher carrying water in bamboo tube.



Photo 18. Young buffalo carrying water in bamboo vessels.

chronological age in which most of the wooden barrels would have disintegrated, taking into account Guam's tropical climate. Likewise, we should consider that wooden barrels are heavy, especially when filled with water. They would seem more suitable for storing water than for carrying it.

Of the sample population, 12% indicated that they used clay pots for collecting river water. As with wooden barrels, clay pots were allegedly brought into Guam during the Spanish era. Except for the small clay pots used in kitchens, the majority of clay pots seem more suited for storing water than for carrying water, owing to their bulky and/or fragile nature. Of the 6% of the sample population which indicated 'other' for collecting water, some of the vessels listed were 'big jars' or 'bottles' or 'gourds made of a dried squash'. It appears as though it did not matter what type of vessel was used, so long as the end result was achieved.

Three additional choices given for carrying river water were carabao carts, hand carried, and motor vehicles, with responses of 26%, 41% and 5%, respectively. It appears that of these three options, most people hand carried their water. It may be that large numbers of Chamorros did not own or have access to carabaos. Fewer of them appear to have owned or had access to motor vehicles, based on the percentage of responses. Perhaps many Chamorros lived near a river or other source of fresh water, and thus did not need to carry water long distances, except when carrying water to their ranches.¹ Of the 7% who indicated 'other' for carrying river water, one of the listed carriers was "cow cart," which appears to have been basically the same as a bull cart or a carabao cart, the only difference being the type of animal utilized to pull the cart and the adjustment on the cart according to the specifications of the animal. Another carrier listed was batanga or wooden sled. Such a carrier, however, may have been inadequate for the rough terrain on Guam; some of the water would have probably spilled out. One informant in the interviews remarked that in many places on the island it would have been difficult to bring either a bullcart or a batanga down close to the river's edge, owing to the uneven terrain found in many areas on Guam.

Spring water

It appears that the usage of spring water was not as great as river water, noted in the preceding section, or rain water, noted below. Metal containers seem to have been the most commonly utilized vessels for

¹Thompson writes (1947:22): "In spite of the relatively high precipitation, scarcity of water, especially on the northern plateau, was long an important factor in island life. Hundreds of farmers who formerly lived in this area had to haul water long distances to their farms for domestic and stock purposes during the dry season."

collecting and carrying spring water, with responses of 47% of the sample and 40% respectively. Ranking second was bamboo tubes, with a response of 32% of the sample collecting and 27% carrying spring water in this manner. Clay pots ranked third, with 11% of our sample using them to collect spring water. The response for using clay pots was nearly the same as the response for wooden containers, which ranked fourth with a response of 9% of the sample collecting and 8% carrying spring water in clay pots. The response for 'other' in collecting spring water was 6%.

Again, it appears that hand carrying was the most common means of transporting spring water, with a response of 36%, followed by carabao carts (23%) and motor vehicles (5%). The percentage of response for 'other' was 7%; basically the responses given were the same as those under 'other' for the collecting and carrying of river water.

Well water

In regard to the collecting and carrying of well water, metal containers again rank first in common usage, with a response of 48% of the sample collecting and 41% carrying well water in such devices. Ranking second was bamboo tubes, with a response of 25% of the sample utilizing them for collecting and 26% for carrying well water. Wooden containers ranked third with a response of 13% for collecting and 11% for carrying well water. Clay pots ranked fourth, with 9% indicating the use of clay pots for collecting water. The response for 'other' in collecting well water was 8%.

Of the most common modes for transporting well water, hand carrying ranked first with a response of 31% of the sample, followed by carabao carts, 20%, and motor vehicles, 4%. The response for 'other' in carrying well water was 7%.

Rain water

Of the four sources of water being collected and carried, (river water, spring water, well water, and rain water) rain water ranked the highest of the four for utilization of metal containers with a response of 72% of the sample collecting and 56% carrying rain water in metal containers. It appears in general that rain water was the most commonly collected variety of water resource. It may be due to Guam's high average annual rainfall¹ and the fact that collecting rain water requires less energy once a collection system was established. Ranking second

¹Statistics concerning Guam's average annual rainfall are discussed at length in Ward, Hoffards, and Davis, 1965. See also the 'Freshwater Resources' section of the Vail study, 1975, p. V-37ff.

among informants was bamboo tubes with a response of 24% of the sample collecting and 25% carrying rain water in this manner. Tree catchments ranked third, with 23% of the sample collecting rain water by this method. In the interviews conducted, informants indicated that coconut trees were the most common type of tree used for collecting rain water. The following description was given: a container was placed on the side of the tree where rain water ran off. It was usually easy to spot the side on a coconut tree where the runoff flowed because of the presence of dark or green colored moss on the trunk or the ground.

Wooden containers ranked fourth in popularity with a response of 18% of the sample collecting and 13% carrying rain water in wooden vessels. The response for collecting rain water in clay pots was 15%, and the response for 'other', 9%.

For the section dealing with transportation of water, hand carrying was the most common means of transporting water. Forty-two percent of the informants indicated hand carrying, followed by 13% indicating carabao carts, and 3% indicated motor vehicle. The response to 'other' was 8%.

Section Four

The first question in Section 4 of the survey concerns water storage. Again we were interested in four types of freshwater: river, spring, well and rain water. We were interested in trying to determine if Chamorros commonly stored fresh water.

According to the responses of our informants, the four 'main varieties' of freshwater were stored to a large extent. Out of a sample size of 265 respondents, there were 1,003 positive responses in regard to storage of fresh water, keeping in mind that each informant could respond with more than one answer.

We attempted to determine if differences existed in the types of containers used for storing various kinds of freshwater. Metal containers, bamboo tubes, wooden containers and clay pots were suggested as possible containers. More than one choice was possible. A space called "other, please list" was also included on the questionnaire.

Our sample indicated that metal containers were used as the most common means of water storage. Metal containers included, among other items, tin buckets, five gallon cans and 55 gallon drums. The second most frequent answer regarding type of container used to store water was bamboo tubes, third was clay pots and fourth was wooden containers. A few people wrote that glass jars or bottles were also used for storage. The chart below indicates the number of respondents who stored the different types of water in the various containers.

<u>Type of Container</u>	<u>River</u>	<u>Spring</u>	<u>Well</u>	<u>Rain</u>
Metal vessel	103	111	102	149
Bamboo tube	73	58	50	61
Clay pot	28	36	33	46
Wooden vessel	23	27	23	37

As the above chart shows, the largest number of people indicating a preference for the use of a metal container for storage were the 149 respondents who indicated metal containers were used to store rain water. This number is significantly larger than the number of people selecting the use of metal containers to store other types of water. This trend was further supported by comments from a number of people which seemed to indicate that rain water was frequently stored in 55 gallon drums. One respondent described a drum into which a faucet had been inserted, making it easier to draw the water. Others mentioned that screen or cloth, such as a clean rice sack, was used to cover the storage drum and served to keep the water clean. Many informants during the open-ended interviews told us it was important for the storage drum to be cleaned thoroughly before it was used to store rain water. Other informants reminded us that such storage drums rust after considerable use, so now and again a family might have to acquire a new 55 gallon drum to replace the old one.

It is also interesting to note that the chart shows more people were likely to store river water in bamboo tubes. It seems, then, that people generally stored water, frequently stored rain water in metal containers and often stored river water in bamboo containers.

The survey inquired if rain water was kept where it was collected. Thirty percent of those answering this question indicated that it was, suggesting that they were storing rain water in large containers that could not easily be moved from place to place, especially when full of rain water. In addition, several respondents mentioned that they collected and stored rain water in cement tanks (Photo 19).

In the section of the questionnaire on water storage, a possible alternative answer for each category was "did not store". Thirty-nine respondents indicated that river water was not stored and at least one informant indicated that river water "was never kept". Thirty-seven respondents were of the opinion that well water was not stored. Twenty-eight informants replied that spring water was never kept. Seventeen respondents indicated that rain water was not kept, with a total of 122 people suggesting that freshwater was not stored or kept. The conclusion from a careful analysis of the data is clearly that many people did store freshwater. The largest number of negative responses was in the category of river water storage, and that figure was around 17%. Apparently, it was a less common practice to store river, well, or spring water and more common to store rain water. But, to a large extent, many varieties of freshwater were stored.

In connection with water storage practices, we were interested in noting whether informants told us that water was stored in anticipation of periods of drought. Our sample reveals that fifty percent of the respondents did not keep water in anticipation of shortages while forty percent did. The remaining ten percent did not answer the question. (One person indicated that it was saved for fire fighting purposes, "in case the house catches fire".) This is interesting, in light of

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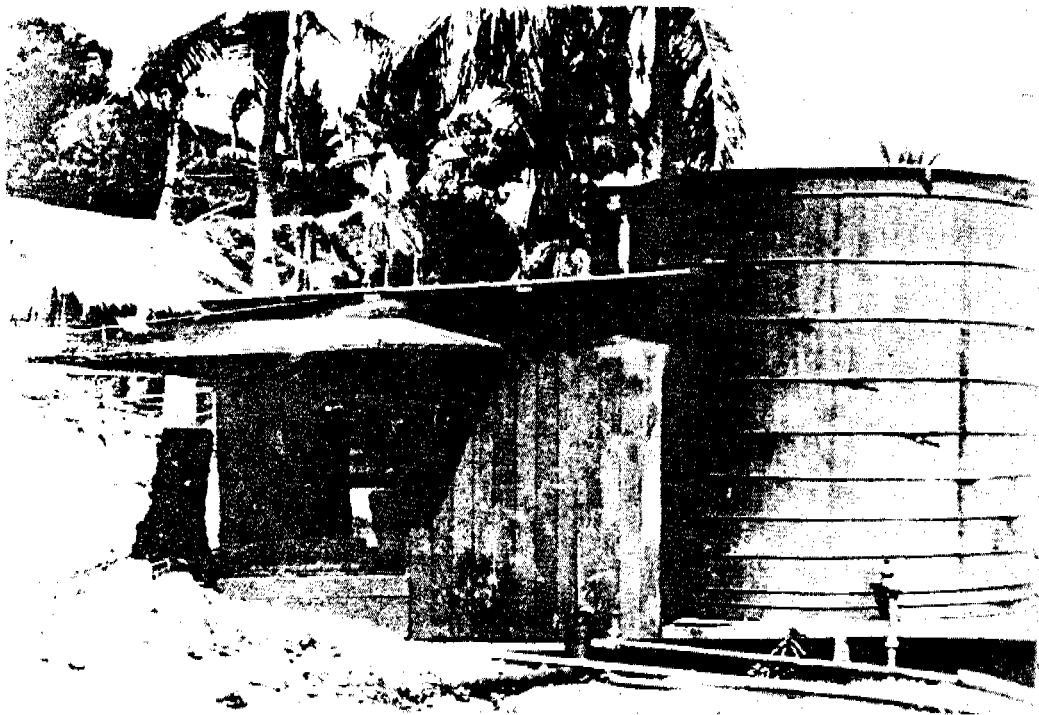


Photo 19. Village water tank, Asan, 1945.

the data from the Ethnohistory section of this report which suggests that having a sufficient supply of water for Guam's people has always been a problem on this island. Have our informants forgotten the pre-World War II conditions on Guam? Did they not read all of those articles in the Guam Recorder in the 1920's that advised them of water shortage problems?¹ Or, were Chamorros accustomed to "making do", and, by means of reciprocity practices with relatives, friends, and neighbors, they actually managed to have enough water to meet their needs? Did they then never perceive that they experienced water shortages, and thus never felt the need to keep water in anticipation of a shortage?

In response to the question "Was water ever rationed?", an overwhelming number, 179 of the total sample of 265, indicated "no". Only sixty-two people responded affirmatively. A few people indicated that it was rationed if there was a shortage. These responses tend to suggest that we may be accurate in regard to non-perception of water shortages by our informants, especially prior to World War II.

Another area of water usage that was considered in the questionnaire was that of attitude towards fresh water. Was it considered a valuable and/or limited resource? Two questions relating to this topic was included in the questionnaire.

First, the respondents were asked if fresh water was reused, and if so how? The majority, 65 percent, revealed that water was not reused. Those who indicated that it was, suggested that water used to wash rice or vegetables was frequently used to water plants or animals. "If it had soap in it, and was not fit for the animals to drink, it could be used for the pig wallow".

In response to the second question, a majority of persons in the sample, 63 percent, indicated that fresh water was not considered to

¹The following information from Carano (1964:245-246) describes newspaper distribution on Guam:

The Guam Recorder was founded in March 1924. From the very beginning, it . . ."constituted the island's and the Naval Station's most complete and interesting record and has been closely associated with the official life of both the Naval Station and the Naval Government." On Oct. 2, 1933, the Naval Government purchased the Guam Recorder from its owner and editor, Mr. W.W. Rowley. At that time it was decided to devote the magazine more and more to matters of interest to the islanders, who as a rule read only very little. (underlining ours). . . Monthly circulation in 1938 was about 800 copies. The subscription price was one dollar a year. Besides subscriptions, the magazine was supported by income from advertising and commercial job printing. . . . The Guam Eagle was the island's only daily newspaper, published in mimeographed form primarily for the American colony . . . Daily circulation in 1941 was about 610 copies.

be a limited resource. Those who replied positively to this question indicated that fresh water was considered to be a limited resource during the dry season or if they had to travel far to get the water. Whether or not fresh water was considered a limited resource, then, seems to have depended upon the circumstances of the individual involved, and the availability of the water; again, a perceptual assessment.

The next question concerned access to water sites or responses.

Question: "Were the people who had control over access to water regarded differently?"

Sixty-eight percent of the sample indicated "no". Eleven percent reported "yes". Twenty-one percent of the informants did not answer the question. The fact that nearly one fourth of the people did not respond may be significant. Perhaps the question seemed offensive to these people, or perhaps the issue is a sensitive one. Many people made additional comments which may provide some insight to the complexities of the question. Some of the individual responses were:

"People who controlled access to water were regarded as more fortunate."

"If they had a faucet, they didn't have to go for water as frequently."

"If they had water, they lived in a decent house, they had everything."

"People who had control over access to water were treated nicely, with respect, perhaps given gifts."

"People who lived close to a water source had healthier plants and animals."

"People who had water gave it to others generously. Back then, people never had to make points in order to get water."

"In the past people were very cooperative and helped each other."

"Rivers and springs were owned by communities. No one owned a water source except the government."

To further support the above statement regarding the trend of sharing and generosity which seemed to exist in the past among Chamorros, our sample reveals that it was commonplace to ask for and be given permission to use water that was located on property belonging to someone else. The sample also revealed that trade or rental agreements for access to water with the landowners were not considered a major part of water usage practices in the past.

The following questions is taken from the questionnaire in regard to this issue. The numerical figures show a break-down of responses.

Question: "If you owned the land where the fresh water was located, how did other people acquire the use of the water?"

Permission from you	76
No permission needed	54
Just told you they needed water	57
Family ties	30
Trade or exchange	11
Rent	5

Question: "If you used water on someone else's land, how did you acquire the use of it?"

Asked for permission	103
Just told Landowner	53
No permission needed	43
Family ties	30
Just used it	27
Trade or exchange	9
Rent	4

These numbers show that almost twice as many respondents indicated they would ask for permission to use water on someone else's land as compared to the number of those who indicated any of the other procedures. But a focused question in the interviews in regard to this theme brought forth the frequent response, "You only had to ask for permission one time. After that, just go and take the water you need, if it's not too much". Another informant pointed out succinctly, "You don't have to talk about the obvious. If you are headed toward a water source with a 55 gallon drum on the carabao cart, it's pretty obvious what you are going to do when you get there."

Section Five

Section 5 of the questionnaire presents field data provided by Chamorro informants over 40 years of age in response to questions on collection, use, and special practices concerning fresh water on Guam (Photo 20).

Question: "Who collected fresh water?"

Of six possible answers with more than one answer allowed per informant, 158 persons stated that males did the collecting; 133 said that females collected fresh water; and 117 said children performed the task. Youths collected fresh water in the opinion of 126 people. Adults in general was the answer given by 133 persons and 84 said that elderly people did it. Among the remarks and observations made, research aides



Photo 20. The Agana River, 1902.

found that children were understood to be those over six years of age through adolescence. Some informants who answered adults in the interviews indicated they thought that small children were not strong enough to lift loads of water. Others mentioned that children would play in the water and perhaps get it dirty so they would not be trusted to collect water. From such responses, we supposed that informants had in mind heavy containers and the carrying of large quantities of water. Many people (158 of 265, or about 60%) replied that it was a job for males, also suggesting that it was a physically strenuous task. Fewer informants (84) said the elderly collected fresh water. Traditionally, older people on Guam are respected and not made to do hard labor. We may suppose that when elderly people assisted with water collection, they utilized smaller containers and transported smaller quantities of fresh water.

Question: "When was fresh water collected?"

A majority of persons (173 or about 65%) replied that this was done in the morning. Afternoon was the answer given by 88 persons; 133 stated that water was collected in the evening, and only 68 gave night for their answer. Afternoon and evening answers may be interchangeable, as people's understanding of hours in the "P.M." may differ slightly. Hours when the sun is not high (the cooler time of day) may be taken into account as "P.M." replies. A few people responded in the interviews: "When it rains", or "When needed."

One informant pointed out that preparations for night were made while it was still daylight, because generally people did not wander about at night after dark, owing to beliefs in taotaomona 'spirits of the old people' and the like. She suggested the need to collect water at night would be a good excuse to meet up with a sweetheart.

Question: "Who drank fresh water?"

As in all questions in this section more than one reply was possible, and we find the breakdown of responses is similar.

Males	--	192	Females	--	191	Adults	--	185
Children	--	175	Youths	--	186			
Elderly	--	201	Babies	--	163			

The lesser number of babies is explained in remarks by some of the people interviewed that nursing infants depended on mother's milk and thus would not be drinking much water.

Question: "Who used fresh water?"

Survey replies show that 189 people stated males; 188 said females; 163 answered babies; and 176 children. Likewise, 180 people gave youths as answers; 159 named adults, and 200 persons answered that elderly people used fresh water. This question and the one before it (Who drank

fresh water?) show a slight rise in elderly people's use of fresh water. Evidence presented elsewhere in this report, in the linguistics portion, indicated that fresh water is viewed as being good for senior citizens.

Question: "Why did you use fresh water?"

The following are replies to the first five possible answers asked under the above: Cleaner than other liquids - 110; Fresher than other liquids - 108; For sickness - 107; For thirst - 170; When you are hot - 98. In a sixth possible response, "Other - please list," 58 persons gave 30 separate replies, which we quote in their entirety: Agriculture; shower and food purposes; essential uses; washing, cleaning, cooking; cooking; washing, bathing, cooking; more convenient; you cannot eat without water; the best; water is essential for life; washing clothes and dishes; fresh water readily available; watering plants and livestock; only water; only water source; only thing available; no other source of water; to wash, cook; to cook, bathe; to cook, bathe, water plants and animals. Others answered: Are you crazy?; thirst; to cure thirst; used for Guamanian medicine; for thirst; en-plus-to(?); better than pipe water - chlorine no good; for high fever; for fainting spells; for high fever--water is cool.

Question: "Did you have any customs or special practices concerning fresh water use?"

From a sample size of 265, replies were as follows:

Yes -- 44 No -- 164 Left Blank -- 55

Question: "If yes, please list them."

Over 20 different practices were given by those answering the survey. "To cure boils" was the answer given by 8 informants. Other practices listed were these: Dew on banana trees in the morning heals sore eyes sooner; baptizing the babies; cover containers to protect water from insects and dust; use good sense; putting in coconut shell makes water taste better and cooler; wet hair causes lockjaw; medication; if you kill Marine life in fresh water the water will become stagnant; ask permission from taotaomona; make you feel good after bathing (implied: after bathing in the sea?); it was always thought to be cleaner than other kind of water; Chamorro Language (?); boil for infants - put water on forehead; water needed purification--it was boiled and then used by the family; cooking and drinking; washing dishes and shower; not to drink when you come in from the sun, might have sunstroke; little boy and girl - girl not to drink; drinking, making coffee and rinsing my hair; not superstitious; not sleep on wet hair--get a crooked mouth in

morning (lockjaw implied).¹

In addition to these customs or practices, two local villages celebrate Catholic religious fiestas annually which are essentially "water fiestas" with villagers praying for rain. These are the Fiesta of Nuestra Senora delas Aguas (Our Lady of the Rains) celebrated by the village of Mongmong and the San Isidro Fiesta in Malojloj.

One informant told us that the area of Mongmong was formerly an important agricultural center supplying produce to the church and the schools. According to an article which appeared in the January 25, 1959, weekly edition of Umatuna Si Yuus published by the Vicariate Apostolic of Guam, "Where so much depends upon rain, it is important that there be no long season of drought. And while Guam is usually blessed with sufficient rainfall to guarantee sufficient moisture for the crops to grow, it has not been unknown in this area to have long periods without rain at this time of the year."

The Fiesta of Nuestra Senora de las Aguas is celebrated shortly after the full moon in January. The month of January marks the beginning of the dry season on Guam. Farmers on Guam plant both dry season and wet season crops. A belief exists that certain crops should be planted during the full moon. The rains would then come advantageously after the seeds had been planted to insure a good crop.

Perhaps the contemporary "rain fiesta" celebration is a modern approach to the ancient ceremony associated with the 'miraculous talisman for the rains' mentioned in the Ethnohistory Section of this report.

Question: "Were menstruating women allowed to enter a fresh water source such as a river or spring?"

Yes -- 22 No -- 104 No reply -- 73

On the last two questions, there seem to be some contradictions. The next question may clear up any misunderstanding. Research aides generally think that those replying "no" (104) to the above, may have replied "no" in the sense that people would not enter the water, and thus indicated that the water was not contaminated.

Now, the next question which is related to the last two:

¹Note: The above listed replies have been copied as they were given. Some do not sound logical, i.e., "Chamorro Language," and this may be due to the surveyed persons' problems with written Chamorro translation of questions or perhaps misunderstandings of the intent of the survey questions.

Question: "If no one could enter the water, why not?"

One reply received stated that the water was stored in a tank. Clearly, if the tank provided some people with their main source of fresh water, the whole problem of humans entering that water at all is thrown out.

In addition, we have 51 replies stating in various ways that people could not or would not enter the water because such an action would have contaminated the source.

One person answered that women could not enter the water because, when they got out, one might see through their clothing. This reply may have been humorous or light-hearted, or the informant may have been perfectly serious. Concerning the above three questions, one person commented on menstruating women entering fresh water by stating: "Taking a shower first and then going into the water would cause the menstrual flow to stop." This reply shows some misunderstanding of the questions aimed at contamination or pollution and more properly belongs with "practices/customs."

In addition to the 51 replies about contamination by people entering the water, some 12 other responses were given: (Quoting) People or animals could not enter an area designated as drinking water; This is ridiculous; If someone bathed in fresh water you could not use it over; Could not enter if sick; If you yelled or hit the water, your action could cause a wave to form and drown someone; Because it was used for drinking and cooking; So you can't bleed more heavier (menses?); Get sick; Fresh water turns red (from red clay?) with rain floods and when dead animals in it; For drinking only; Used for drinking only; Used for drink and food. Note: Seven (7) of the above replies seem to imply fear of contaminating the water; 3 answers seem to show beliefs or taboos; the rest seem to be humorous or do not answer the question at all. One answer is clearly a popular culture response. The respondent answered the question, "If no one could enter the water, why not?" by drawing a shark and writing "JAWS" next to the drawing, bringing to mind the well-known movie by the same name shown in summer 1978 on Guam!

Question: "If fresh water was used by itself as a remedy, what was it supposed to cure?"

Of those persons answering the questionnaire, 333 responses were indicated in this section. A breakdown of the responses reads as follows:

colds	--	70	childhood diseases	--	41	<u>bodig</u>	--	13
headaches	--	82	body aches	--	83	<u>litico</u>	--	15
						other	--	19

McMakin (1978) points out that fresh water is an essential ingredient of virtually all medicines prepared by suruhanos 'traditional curers' on Guam. Informants substantiated McMakin's thesis as well as indicating by their individual comments that fresh water was useful alone, as the following: "Fresh water can heal a headache"; "Use fresh water to massage the skin of a baby"; "Fresh water is used to prepare herb medicine to cool the body"; "It's a good remedy if one is confronted with a fainting spell"; "Good to bring down a high fever"; "Sugar added with water is fresh and clears the 'sadness and sorrow' from the heart". The response, "Are you crazy?" may have come from an informant who thought there was no way that water alone could be viewed as a remedy.

McMakin explains how the suruhano can work with patients diagnosed to have the condition known as bodig or litico: (1978:21)

Many of his (i.e., the suruhano's) patients suffer from litico or amyotrophic lateral sclerosis (A.L.S.), a disease of the central nervous system that causes progressive paralysis. Other patients have bodig or parkinsonism dementia which results in progressive degeneration of speech ability and body tremors. Patients with these diseases cannot be helped to a great extent by western physicians and often resort to the suruhano, who with his positive reassurance and sincere concern help to relieve much of the depression and fear which accompany such illnesses. Patients with bodig or litico receive the full course of treatment and the extremely high incidence of these afflictions on Guam has probably contributed to the perpetuation of the demand for suruhano service through time. The frequency of A.L.S. on Guam is 100 times greater than in the rest of the world.

Medical conferences on Guam bring in experts to report on these perplexing conditions (Pacific Daily News, various issues). The Vail study (1975: V.48) reports that the National Institute of Neurological Diseases and Stroke, a branch of the U.S. Public Health Service, has taken note of the high content of manganese in Guam's southern rivers. They have analysed water and fish samples to attempt to determine if manganese may become concentrated in fish tissue and whether there may be a link between consumption of fish and contraction of bodig or litico.

A number of our informants seemed to indicate a lack of a cause-and-effect understanding of these two diseases. Particularly during the interviews some of them laughed as they made comments such as the following, "If you eat and drink too much and get lazy, you will go bodig. It's your own fault"; "Those people are the lazy ones"; "Just do your work and you will be alright". A man of the 46-50 age bracket wrote on the questionnaire in regard to bodig: "It seems like it's a helpless case and they live for a long time and are incapacitated. Coconut oil - just warm it - mix with some kind of herb - it gives them comfort and a little mobility." Of litico, he wrote, "Drink herbs. There's nothing much to do. (The person is) completely immobile, including the voice."

Summary Remarks

On the last page of the questionnaire, people were asked, "If you have anything else you would like to say concerning fresh water uses on Guam, please feel free to write it in the space below." People surveyed made the following concluding remarks concerning fresh water and the survey format itself:

"People are world's worst polluters".

"Mt. Santa Rosa Creek is called "Y Memii Aguila", translated as the Eagle's Urine."

"Areas having no river or spring had government-owned cisterns made out of concrete with metal top and (they) caught rain water."

"People thought rain water made their hair soft and pliable."

"Water runoff from roofs was put in drum; a faucet was connected to have running water."

"Streams on high ground could be connected to house with bamboo (water pipes)."

"Made the sign of the cross before entered water to purify themselves."

"People that did not have faucet in their house use water from a faucet along the street."

"You can enter river but not enter fresh (standing?) water."

"Before electricity people never worry about having water."

"Fresh water was used for irrigating rice fields."

Note: A handful of informants from the Agana area felt that the questions included on the survey dealt with "ancient times." They claimed to have had faucets, pipes, and the like in their homes even while growing up as children. The Ethnohistory Section of this report confirms that they probably did.

PERCEPTION OF ENVIRONMENT AND WATER

Yi-Fu Tuan (1974) coined the word "topophilia," which he says is the . . . "affective bond between people and place or setting." His application of the term "topophilia" is eclectic, as he acknowledges serious research efforts in many disciplines that are trying to determine the nature of the bond between the environment and the human occupants of it.¹ In the diverse fields of human geography and environmental psychology, in architecture, landscape architecture and urban planning, social scientists are trying to elucidate the concept of environmental perception, following Tuan's lead.

The subtitle of Tuan's book Topophilia is A Study of Environmental Perception, Attitudes, and Values. He points out that much of the so-called reality in environment is based on personal experiences, the subjective and introspective aspects, the impressionistic and attitudinal elements, rather than on a firm definition of reality as the here-and-now. He adds that humans are ecologically dominant, and that human behavior in regard to environment needs to be understood in its entirety, not merely mapped.

We asked two open ended questions on the Questionnaire that encompassed the environmental perception theme. Question 13 on page 2 asks:

"In what village did you live before World War II? Manu na sumasaga haw antis di World War II? (Please write the actual Chamorro name of the village)."

Since many of our informants were elderly people, we wanted to know if they might offer village names on Guam that are different from the ones we consider standard at the present time. Question 25 on page 3 asks:

"If you used a river for a source of water, what was its name?"
Janggin un usa i hanum saduk para hanommu hafa na' anna"
(Please write the name in this space)."

Earlier on page 3 we asked informants to indicate what type of water was located on their property. We offered then the options of river water (hanum saduk), spring water (matan hanum), well water (Hanum tupu), and other ("please list"). We did not feel we could identify on maps of Guam all springs and wells that informants might have utilized. But we did feel that we could identify rivers informants named by cross-tabulating such river names with their villages of residence. Would informants give different names for rivers, based perhaps on ownership or usufruct of the land that the river traversed? Could we get some hints toward their perception of villages as physical or social places; of rivers as local phenomena?

¹In Tuan's most recent book, Space and Place: The Perspective of Experience, 1977, he further considers the relationship between humans and the environment.

Village Names

In an assessment of the responses of informants to the question, "In what village did you live before World War II?", it will be instructive to address the issue of boundary maintenance on Guam. It is very difficult to get an accurate assessment of the number of Chamorro settlements on Guam prior to contact.¹ The Guam Historic Preservation Plan (1976) lists 144 separate sites on Guam that were evaluated by the field research team. But these cannot all be viewed as separate named settlements.

Carano and Sanchez (1964:22) explain that, in pre-contact times, Guam was divided into districts composed of one or more neighboring villages. There was much jealousy and suspicion between districts and warfare between the districts was not uncommon. According to Laura Thompson (1947:33), Sanvitores made the following observation in regard to population distribution on Guam:

The Chamorros lived in villages of from 50 to 150 huts near their garden lands along the coast and in hamlets of from 6 to 20 huts in the fertile valleys of the interior. Altogether there were 180 such local groups on Guam.

The total population of Guam was estimated to be some 50,000 persons. In regard to that estimate, she notes:

. . .examination of the potential land resources of Guam has led the writer to the conclusions that even with the old methods of land utilization the island could have supported at least 40,000 inhabitants, which is twice the population of Guam today (i.e., 1947).²

Thompson points out that the concentration of Chamorros into town areas began around 1680, when the people were forced to abandon their traditional villages and hamlets on the coastal plains and in the interior, in order that they be fully subjugated to Spanish authorities and to the influences of the Catholic Church. Many of these people moved to Agana. Don Jose Quiroga, Spanish governor of the Marianas, influenced the establishment of parishes in six other areas where churches were built. These six parishes were Inapsan, Pago, Inarajan, Merizo, Umatac and Agat (Thompson 1947:40). Each parish was composed of a number of hamlets.

¹Underwood (1973:15 and 1976:203-204) summarizes population estimates by various authors for Guam in the 'early period' (1521-1668).

²Within thirty years of contact, owing to warfare and epidemic diseases, the population of Guam was reduced to about 5,000 (by 1699). At contact, the population was variously estimated from 30,000 to 60,000 (Underwood 1973:11-13 and 1976:203).

By 1710, Thompson continues, all settlements in northern Guam around Inapsan had been abandoned. In 1856, the settlement at Pago was permanently abandoned after a severe epidemic of smallpox in the area.

During Spanish times there was a gradual and continual movement of Chamorros from the rural areas to Agana. Thompson states (1947:41): "In 1710 only about twenty percent of the population lived in and around the city, whereas, by 1870, 84 percent had concentrated there.¹ The Guam Recorder in April, 1926 named the "prominent places" on Guam as Agana, Asan, Piti, Sumay, Agat, Umatac, Merizo, Inarajan, Talofoyo, Yona, Sinajana, Barrigada, Dededo and Yigo.

Thompson lists 13 named municipalities for Guam in 1946, pointing out that there were two additional municipalities in 1940. Sumay² and Machanao were no longer inhabited after World War II; residents of these municipalities were relocated to other areas. Thompson names the 13 municipalities in 1946, and shows population changes between 1940 and 1946 in the following table (1947:43):

<u>Municipalities</u>	<u>Population 1946</u>	<u>Population 1940</u>
Agana	760	10,004
Asan	908	656
Barrigada	3,231	875
Dededo (and Tamuning)	1,818	1,196
Machanao		275
Piti	1,307	1,175
Sinajana	7,547	1,236
Yigo	416	324
Yona	1,156	656
Agat (and Santa Rita)	2,620	1,068
Inarajan	1,270	1,076
Merizo	964	866
Talofoyo	726	456
Umatac	508	430
Sumay		<u>1,997</u>
Total	<u>23,245</u>	<u>22,290</u>

The city of Agana was traditionally divided into barrios ('under the bells') each being a group of households which surrounded a church or chapel (Carano and Sanchez 1964:57). Thompson (1947:54) names the barrios of Agana as follows: Anigua, Juliae (sic), Santa Cruz, Dr. Sargent, San Ignacio, Togae, San Nicholas, San Ramon, San Antonio, and

¹During the prewar American Naval Administration of Guam, ranchers were encouraged to move back to their lands in the rural areas. By 1938 only about 50 percent of the population lived in Agana.

²The Pacific Daily News on December 2, 1979 featured an article entitled, "Sumay Revisited." It described Sumay as . . . "once a bustling village along Apra Bay, now a small, silent graveyard on Naval Station."

Padre Palomo. Sablan (personal communication) indicates the following were the traditional barrios of Agana: San Antonio, Bilibic, Aniquac, Julale, Santa Cruz, San Ignacio, San Nicholas, Togoe, and San Ramon. Sablan suggests that Padre Palomo became established as a barrio much later in time than the others, being named after a prominent Catholic priest. Sablan agrees with Thompson that San Igancio, the oldest and most centrally located, was the highest ranking barrio.

Thompson (1947:160) points out that as the Americans were re-capturing Guam during World War II, many of the towns were completely destroyed, including Agana, Piti, Sumay, Asan, Anigua, and Agat. These towns together housed over two-thirds of the people of Guam. All of the towns were rebuilt after the war as general residential areas except for Sumay. (Illustration 16).

Karolle (1978:96) maps nineteen regional districts on Guam. They are named as follows:

Yigo	Mongmong-Toto-Maite	Piti
Dededo	Sinajana	Yona
Tamuning	Agana Heights	Santa Rita
Barrigada	Inarajan	Agat
Mangilao	Asan	Talofofa
Agana	Chalan Pago-Ordot	Umatac
		Merizo

Sablan (personal communication) points out that there are just four political districts on Guam, according to the new Guam Constitution. Although the Constitution has not yet been ratified by the people of Guam, the new four district arrangement was utilized on Guam for the primary and general elections in Fall 1978. The four political districts of Guam encompass the following regional areas:

1) District One

Dededo and Yigo

2) District Two

Tamuning
 Mongmong-Toto-Maite
 Barrigada
 Sinajana
 Agana
 Agana Heights

VILLAGES OF GUAM

SHADED NUMBERS INDICATE PRE-WAR VILLAGES

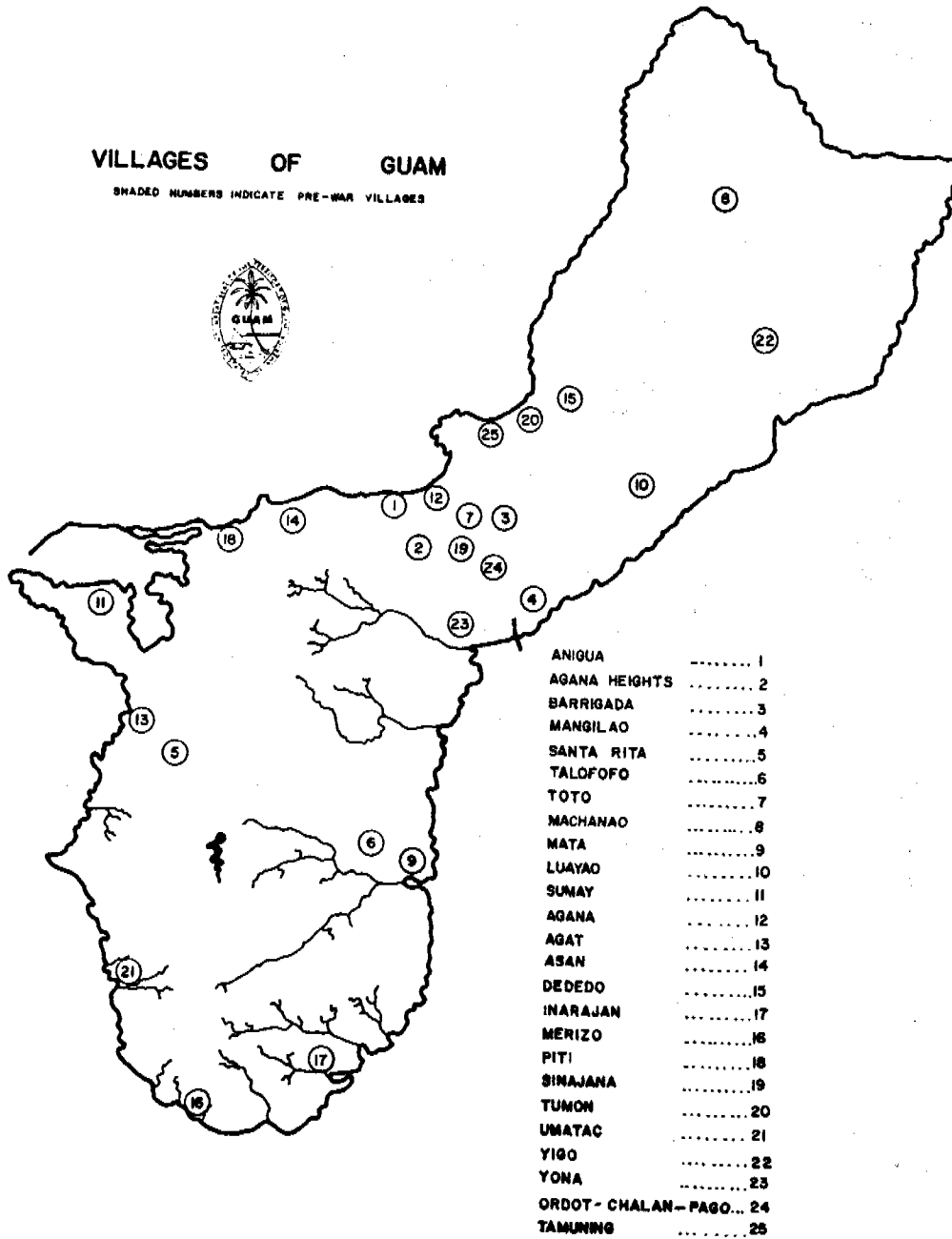


Illustration 16. Villages of Guam.

3) District Three

Yona
Mangilao
Piti
Asan
Chalan Pago-Ordot

4) District Four

Santa Rita
Agat
Umatac
Merizo
Inarajan
Talofofo

Sablan suggests that the only meaningful districts in contemporary times are the political districts. But Karolle points out (personal communication) that commissioners are still elected in each of the nineteen regional districts, and they are responsible for the representation of all the people within their region.

On the questionnaire, respondents were asked: "In what village did you live before World War II?", and they were asked to list the Chamorro name of the village as they knew it. Of 265 questionnaires returned to us, 220 people wrote in the name of their village. Our analysis revealed that a total of 75 people had lived in Agana prior to World War II. But, as suggested by the preceding discussion, they did not simply name Agana, but named the particular barrio in which they had lived. The breakdown in responses is as follows:

Hernan Cortez, Agana	1
Julale, Santa Cruz	1
Santa Cruz	3
Padre Palomo	1
San Antonio	4
San Ignacio	4
San Nicolas	5
Bilibic, Hatgna	1
Tague, Agana	1

Some informants also simply indicated Agana without a barrio distinction, but spelled the name of the city in a different form. Some others wrote "Agana" in the contemporary manner.

Agana	45
Agatna	2
Hagatna	15
Hagna	1

The following chart lists the other named villages in alphabetical order and the number of respondents who said they lived in each. Village names are spelled exactly as informants recorded them on the questionnaire. The Comments section below adds further interpretation of the data, especially for named villages that are not listed in one of the four municipal districts.

<u>Village Name</u>	<u>No. of responses</u>
Afame	1
Agafu Gumas	4
Agana Heights	1
Agat	4
also Hagat	2
Anigua	5
Asan	4
Barrigada	7
Chalan Kanoa, Saipan	1
Dededo	5
Garapan, Saipan	3
Inalado	1
Inarajan	12
also Inalajan	3
Manengon	1
Matan Hanum	1
Mataguac	1
Merizo	4
also Meleso	3
also Malesso	1
Miana	1
Mogfog	1
Mongmong	3
Piti	11
Ritidian Point	1
Santa Rita	1
Sinajana	7
also Didigue, Sinajana	1
Sumay	8
Talayfag	1
Talofofu	4
Tamuning	2
Tepugan	1
Toto	1
Tumon	2
Tutujan	1
Umatac	8
also Humatac	1
Yap	1
Yigo	5
Yona	10

Comments

Afame is a small residential location in the central part of Guam.

Agafu Gumas was created after World War II. It was formerly an Army housing area and is known as such, even in the present day. It is located in the northern section of the island.

Anigua is an area bordering Agana in the central section of the island.

Didigue, Sinajana borders between Agana and Sinajana in the central section of Guam.

Inalado has not been identified to date by the research team. We have not been able to determine where this place was or is located.

Menengon is an area in the central to southern portion of Guam. Most Chamorros of Guam who are 45 years of age or older have vivid memories of this place.

Chamorros were incarcerated at Manengon by the Japanese just prior to the invasion of Guam by the American forces in July 1944. Carano and Sanchez (1964:290) describe this place as a concentration camp.¹

Matan Hanum is the Chamorro equivalent of spring water in English. The research team has not been able to determine where this place is. Perhaps we can infer the informant was referring to the place where his or her family regularly lived or stayed, a place where spring water was located.

Mataguac is ranchland located in the northern section of the island.

Miana has not been located either. Perhaps it is a variation on the spelling of Maina. Maina is located on the south central boundary of Agana.

Mogfog is situated in the northern part of Guam. Ranchland prior to World War II, it became a large U.S. Army depot and housing area after 1944.

¹The Guam Historic Preservation Plan (1976:93) describes Manengon in the Ylig River Valley as follows:

Manengon Camp was the temporary home of approximately 10,000 Guamanians prior to and after the July 21, 1944 invasion. In this camp, inmates were sequestered from the fierce and bitter fighting on the west side of the island. During the fighting the Japanese gradually abandoned the camp and the Americans liberated it on July 31, 1944. This camp is a symbol of the end of Japanese rule on the island and the beginning of the American administration.

Ritidan Point in the northern part of Guam has always been ranch land. This area has been incorporated for the most part into Andersen Air Force Base.

Sumay in the south central section of Guam is an old settlement area. U.S. Marines were quartered here during the first American occupation. This area is now federal land, and houses only military personnel. Many naval activities take place in this area.

Taleyfac is in Agat between Lengca and Anaguan, on the way to Umatac, the general area in which Sella Bay is located. An old Chamorro village by the same name was located here. A bridge still standing here was built in the 1700s as part of the old Spanish coastal road to Umatac.

Tepugan is a small area just outside of the village of Asan. Properly speaking, the area has been absorbed by Asan. The name itself is recognized mostly by older Chamorros. It is mentioned by Carano and Sanchez (1964:192) as Tepungan.

Tutuajan is another name for the area now called Agana Heights. Government House and the Naval Regional Medical Center are located here.

The responses of Chalan Kanoa, Saipan; Garapan, Saipan; and Yap cannot be considered further, for they do not apply to the question at hand, which is, asking for village names on Guam.

River Names

In assessing the responses of informants to the question, "If you used a river for a source of water, what was its name?", we took into account that there are thirty-three named rivers on Guam which empty into the Pacific Ocean or the Philippine Sea (Wilder 1976:159). Of the 265 informants responding to the questionnaire, 55 wrote in the name of a particular river that they utilized (Illustration 17).

In the preceding discussion, we pointed out that 75 of the 265 people indicated they lived in Agana before the war. Correspondingly, 24 of them indicated they utilized a water source in that area. One person simply listed Agana as his or her source of water supply. We infer that the respondent was referring to the Agana River. Three informants named the Agana River as their water source, and six named Agana Spring.

Two respondents listed Menendo as their source of water supply. Menendo is a swampland from which water eventually enters the Agana River.

One informant named Saduk Hagatna as the water source. This is also clearly the Agana River. Nine people named the Santa Cruz River, one person wrote Saduc Bilibic, and one person indicated Saduk Zoilo as a water

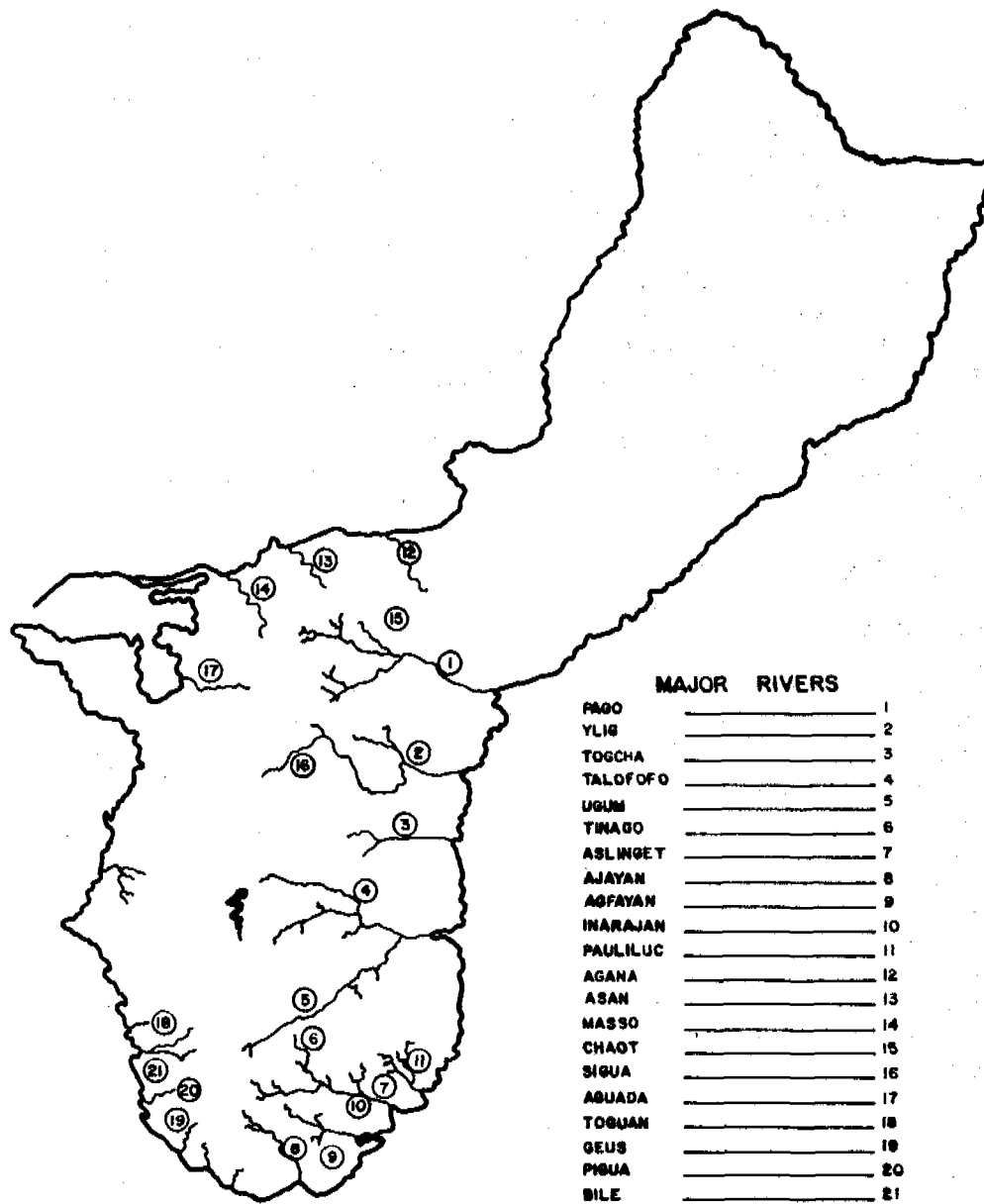


Illustration 17. Major Rivers.

source. After a careful analysis of the data, it is clear that all of these names, too, refer to the Agana River. Hagatna, as indicated above, is an alternate spelling of Agana. Santa Cruz is one of the barrios of Agana. There is no river except for the Agana River that flows at the boundary of or through Santa Cruz. We infer that the Agana River in Santa Cruz barrio was perceived as central to the barrior and thus was called by the same name as the barrio named by local residents. Bilibic (sic), as indicated above, is another of the barrios of Agana. The Agana River is the only river flowing at the edge of or through Bilibic. We suggest that the Agana River was conceptualized as the Saduc Bilibic as it passed through Bilibic. Finally, Zoilo is not a barrio of Agana. But a family named Zoilo held title to a rather large section of land along the Agana River, either in San Antonio or San Nicolas barrio, or perhaps in both. Likely at the place where the Agana River flowed across their land, they simply identified the river as Saduc Zoilo.

The following chart lists the other major named rivers in alphabetical order and the number of respondents who indicated they utilized that river as a water source.

<u>River Name</u>	<u>No. of Responses</u>
Asan River	1
Balonas	1
Chaliguan	1
Dam	1
also Damp Geus	1
Didigue, Sinajana	1
Fina River	3
Fonte Reservoir	1
Fonted River (Sic)	1
Lonfit River	1
Manengon River	3
Maina River	1
Sasa	1
also Sasa River	1
Tagua	1
Tinaga	6
Ugum Talofoyo	1
Ylig River	4

The Comments section above adds further interpretation of the data, especially for rivers that are not commonly known.

Comments

Asan River begins at the base of Libugan and flows in a zigzag northerly direction, emptying into Asan Bay. At the base and surrounding area of the river are sword grass, tangantangan, small land crabs, and the like.

Balonas: the informant gave the name of Balonas. No such river name can be found on Guam. However, there is a Bolonos in Umatac. This river starts in the mountains at Umatac near Pigua Springs and flows westerly, meeting the Pajun River and emptying near Umatac Bay. It is a rugged area with sword grass and other large vegetation present. Shrimps and other small animal life are found in the river.

Chaliguan is a river located between Bejao and Ladai. The river flows from the mountains out to the Philippine Sea. Tangatangan, pandanus and other vegetation are present in this area. Crabs, snakes, and mosquitos are also noticeable.

Dam or Damp Geus are inferred to be one and the same place in Inarajan. This river begins in Inarajan, flows south into Merizo, and empties near Merizo Bay.

Didigue, Sinajana is the location of Agana Springs. Some informants name the Springs according to their locational name. Agana Springs is on a higher ground not far from Menando and since this is a swamp area, part of the water from this spring flows into or feeds the Menando. The nearby area is used principally for recreational purposes.

Fina River starts in Talofofu, meets with the Talofofu River, and empties into Talofofu Bay. Sword grass and other such vegetation are present in this area. The soil is composed of red clay. Mosquitos, toads, shrimp, eel, and other small water life are present in this river. Fina River is one of the major sources of fresh water supply on the island.

Fonte Reservoir provides piped water for large numbers of the islands homes. The Fonte River starts at Fonte, flows northeast then northwest, and empties near Adelupe Point. This river sometimes dries up during the dry season.

Lonfit River (Ordot/Sinajana). This river starts at Lonfit in Sinajana and flows southeasterly into Pago Bay. Tangatangan and other such vegetation is found in the area, also bamboo groves along the river and nipa groves. The leaves of nipa are used for shelter in the construction of thatch roofed houses in old and even present-day Guam. Mosquitos, toads, shrimps, mud fish and eels are present at or near the river.

Manengon River in Yona flows southeast and meets with the Ylig River where it empties into Ylig Bay.

Maina River, located in the Maina area, is not properly a river any longer, but now best described as a spring.

Sasa and Sasa River are one and the same place. Sasa River originates in the mountains and flows in a westerly direction, crossing Marine Drive and emptying into a swampy area near Apra Harbor. Tangantangan, sword grass, bamboo, and other such vegetation are present along this river, also shrimp and other small water life. At the mouth of the river can be found small land crabs, fiddler crabs, and monitor lizards, along with toads and mosquitos. Monitor lizards are unusually large in size here owing to the abundance of food for them in this area. There is a strong possibility that snakes are also present.

Tagua was the name given by the informant. Perhaps he or she meant Taigua, a river located in or near Piti, and then flowing into Tepugan Channel. There is little or no waterlife present in the river, since it has a tendency to dry up during the dry season. The Vail study (1975:V-40) names the Taguag river flowing into or near Piti.

Tinaga is a river that originates in Inarajan and then flows in a northeasterly direction, meeting the Paulilic river and emptying into Pauliluc Bay. Sword grass, tangantangan and other such vegetation grow here. Shrimp, land crabs, snakes and mosquitos can be found in or near this river. The soil alongside the river is considered rich.

Ugam Talofoyo. The original word given by the informant was Ugam. After careful assessment of that particular questionnaire, we suggest the name is Ugum. Ugum Talofoyo is a river that originates at Mount Balanos, flows northeasterly into Talofoyo Falls, meets with Talofoyo River and empties into Talofoyo Bay.

Ylig River. This river originates near Mount Tenjo and flows southeasterly, meeting with the Manengon river and emptying at Ylig Bay. Sword grass, tangantangan, coconut, pago (wild orchid), and other such vegetation are present. Toads, shrimp, eel, land crabs, snakes, iguanas and other fresh water life, as well as mosquitos, are found in or near the river. This river apparently has never been known to dry up, not even in the dry season.

The above discussion accounts for responses of river names that we could identify as given by informants. However, other informants provided 29 additional named fresh water sources that are not as easy to locate. The following list sets forth these fresh water source names in alphabetical order.

Agana Boat Basin (1 respondent).

This respondent may have misunderstood the question, as to our knowledge there is no fresh water in this area. Agana Boat Basin is a marina, used for launching and docking of small boats.

Agana Heights Sadok (1 respondent).

At one time this river flowed in Agana Heights. It apparently has now dried up. Perhaps its source has been cut or diverted owing to the many construction projects in the area.

Alaguan at Umatac, Asatonina at Piti, As Ka Ballo at Umatac, and Atut River at Merizo (1 respondent each).

Considerable amount of time and effort were spent in working with maps and documents to no avail. These rivers could not be identified as to exact location in the areas named. We have no further information on Alaguan. Asatonina can best be translated as "Antonina's place". Likely it was a fresh water source known and used locally, and named accordingly. As Ka Ballo can best be translated as "the horses place". We might infer it was a fresh water source utilized by animals as well as by people. Although we could not find the Atut River in Merizo, there is a place called Atot there. Likely there was a fresh water source at that place--perhaps a small river or stream--but too small a source to be shown on a map.

Bobu (1 respondent).

Bobu is best translated as "spring" or water coming from underground. There are many springs on Guam, in various areas.

Hanum Sadok (3 respondents).

"River water" is the reoccurring theme in this discussion. We feel certain these respondents utilized river water, but we do not know the names by which they identified the rivers they used.

Lasan, Acho, Inarajan (1 respondent).

This fresh water source in Inarajan has not been located on any map. Likely it is a small, locally named and utilized source. Possibly it is at or near Acho Point in Inarajan.

The respondent who named Magua as a fresh water source indicated he or she lived in Merizo. But map work did not further identify Magua in that area. Mamahao or Mamakat was named by another respondent, but the answer could not be coordinated with a village or district name. Again, we suggest that both are small, locally utilized and accordingly, locally named, sources.

Mapa (2 respondents) and Mappa (2 respondents) probably refer to one and the same fresh water source. The name was given by a respondent who lived in Inarajan. But the source cannot be identified further at present.

Matan Hanum (1 respondent).

The name refers to water bubbling out from underground, giving a ripple effect. There are numerous springs of this sort on Guam. We do not know which particular matan hanum this respondent utilized.

Mount Santa Rosa (10 respondents).

Ten respondents indicated "Mt. Santa Rosa" as the source of their fresh water, but there are no named rivers or streams in the area that we have been able to identify.¹ However, the following statement from de la Corte (1926:128) illuminates the situation:

From the skirts of Mount Santa Rosa, a little stream runs through a glen until lost in the ground before reaching the coast; south of it, near a hill called Mataguac, bubbles forth another brook which runs for a short distance before it also disappears into a sink hole; both little streams although of scanty volume, never have been known to go dry.

¹The following public works report from the Guam Recorder, March 1927:324 substantiates that water can be drawn from the Mount Santa Rosa area:

"The project of piping water from Santa Rosa Mountain to the Yigo school has been completed and is in satisfactory operation. Two concrete dams were built, one on Meme Aguila Spring at an elevation of about 625 feet above sea level and one on Canoa Spring at an elevation of about 640 feet. Outlets were provided at convenient intervals to serve the needs of the district traversed.

The following paragraph from a booklet entitled "Tidbits About Yigo", 1965, further describes the water situation in that village:

Two water dams were constructed in 1925, both at the Santa Rosa area. One was known as "Y Chingi" and the other as "Y Memii Aguila". Two-inch water pipes were linked from the dams to the Yigo patrol quarters, which was then located opposite the present Yigo water pump near the Takano Store. From the dams to the patrol quarters was a distance of about three miles. Another fresh water supply was located at Mataguac. The source was sometimes known as "Y Milalag." Water from this source had to be hauled by bulcart or by bamboo containers. Residents of As-Ardas, Mataguac, Chaguian, part of Machananao, Yigo proper, Gallinero, Santa Rosa and Lupog obtained their water supply from these sources. The pipes were laid by village volunteers headed by the late Manual F. Torres in 1926. The pipes were provided by the Naval Government. And because of the work contributed by the volunteers, the residents of Yigo were exempted from the \$2 per annum water tax. As far as is known, the tax exemption continued up to World War II.

Power Plant Agana (1 respondent).

Since the electric power plant in Agana before World War II was located close to the Agana River, we suggest this respondent was drawing water from the Agana River itself near to the power plant. Thus, he or she named Power Plant as a source of fresh water.

Sadug Matague (1 respondent).

Saduk means "river". We have not been able to identify any rivers at Matague, which is located in Sumay. However, there were springs and wells at Matague. Perhaps, the informant actually obtained water from a spring or well instead of from a saduk 'river'.

Saturnina (1 respondent).

The name of this fresh water source can also be a woman's first name. Saturnina is apparently located in Umatac, as indicated by the respondent's answer to 'place of residence before World War II.' This place has not been further identified. The name can be translated as "Queen of the Saints." We wondered if Saturnina was viewed as a place to get holy water.

Tanke hanum (1 respondent).

The words translate to 'water tank'. There were numerous water tanks on Guam prior to World War II. We do not know which particular water tank the respondent utilized.

Tinaga Lingit (2 respondents).

Tinaga, as identified above, is a river that originates in Inarajan. Perhaps Tinaga Lingit is a section of Tinaga. We cannot identify the source further at present. The name may be translated as "Lingit's cut" (i.e., impression of the blade?), From the name above we may infer that it was a locally identifiable place, perhaps where a particular incident had occurred.

Tuku and Tupu (2 respondents).

Tuku is located at Inarajan, but we have not been able to identify Tupu as a single named source. Likely both are small springs or wells. Tupu in Chamorro means 'sugarcane'. Keeping in mind that sugarcane grows most readily in lowland areas, we suggest Tuku and Tupu are located somewhere in the southern lowland section of Guam.

Uman Naso (1 respondent).

The location is unknown. There is a place called Umang; Asau Spring is nearby. Uman Naso could be in or close to Umang and Asau Spring,

being a local fresh water source.

U-tang Saduk (1 respondent).

We do not know where this freshwater source is located.

In summary, the environmental perception theme is applicable to this study of freshwater use customs on Guam. The data gathered from the questionnaire can be seen as subjective in many cases, informant oriented rather than subject oriented. Personal perceptions by informants of both their village of residence and the river(s) they utilized take precedence over public (i.e., documented or mapped) nomenclature.

SUMMARY AND CONCLUSIONS

This project attempts to delineate cultural aspects of freshwater uses on Guam. Although the report is compartmentalized into various sections - archaeology, linguistics, ethnohistory, and sociocultural studies (with data gleaned through the questionnaire), as well as perception of environment - a central theme emerges, that of the importance of freshwater as a natural resource for the people of Guam. The archaeology section looks to the past; the linguistics and ethnohistory sections provide the continuum between past and present; and the sociocultural and perception of environment sections substantiate that the link from past to present is real and vital, especially as perceived by the informants who assisted with this study.

It has been well documented that availability of freshwater has long been a problem on Guam. From the pre-latte and Latte periods, especially for Chamorros who lived on the northern plateau - through the Spanish, American and Japanese occupations - up to the present - freshwater shortages have plagued Guam's people. But our work with informants, the apex of the anthropological effort, suggests a great deal of resourcefulness and flexibility on the part of our informants in regard to utilizing freshwater. Our informants for the most part did not view freshwater as a limited resource.

Twice the number of people did not have a river or spring or well on their property as those who did. In fact, 139 of 265 people, or 53%, simply related that "the government" owned the water that they used. In spite of this, however, one half of our total sample population responded negatively to the questions, "Was water ever kept in anticipation of shortages?" More than half, some 68%, answered "no" to the question, "Was water ever rationed?" It could be argued that the underlying point of view was that "the government" would take care of the local people, i.e., supply them with water if they needed it. Our study, however, suggests Chamorros viewed that the natural system of life would insure that everyone's needs would be met. We suggest Chamorros did not read all the newspaper accounts of water shortages. Common sense dictates were likely applied instead, people having a moderate if not respectful view toward natural resources such as water, and, although not wasting water, nonetheless viewing freshwater as a constant in their lives that replenishes itself. We make this comment because of the frequent indication that rain water was the preferred type of freshwater for widely varied uses. On the one side, perhaps rain water was the easiest to obtain - "just put a water container outside of your door" - but on the other side, people described qualities of rainwater (tastes sweet"; "cleans my insides"; and the like) in such detail to suggest they had earnestly compared rainwater with other types of freshwater and had found the other types of fresh water seriously wanting. Informants indicated to us in the present day in many cases that they preferred to drink rainwater, wash their hair with it, and such - when piped water water coming into the home is much easier to utilize.

We suggest that if we can describe "traditional" Chamorro values, customs, practices and such in the 1970s, a central concept is certainly that of reciprocity and sharing. For example, in this exploratory study, 182 of our sample of 265 persons, or 69% answered "no" to the question, "Were the people who had control over access to water regarded differently?" On the basis of responses to this question, it appears that status was not associated with ownership of a water source. But the relationship between ownership and usufruct in regard to water resources is not clear at this time. We tried to glean insights by asking, "If you owned the land where the fresh water was located, how did other people acquire the use of the water?" The combined answers of "No permission needed from landowner" and "Just told you they needed some water" (54 responses and 57 responses respectively) were cited more frequently than was the perhaps expectable answer from a Western perspective, "Permission from you" (76 responses in all). The responses to the question, "If you used water on someone else's land, how did you acquire the use of it?", we suggest, reflect a Chamorro worldview. Of the respondents, 38% (103 of 269 responses¹) indicated you should ask permission from the landowner, likely to show your respect. But nearly the same number of informants (96 of 269, or 36%) gave the answers, "No permission needed" and "Just told the landowner you need some water", seeming to indicate that those who needed water were not put in a position of having to seek a favor from the landowner. These figures do not include the 27 additional informants who chose the response to this question that reads, "Just used it."

The present project did not bring to light any animosities between key persons in the villages (such as village commissioners) and village families. People acknowledge that "now" there are water shortages in the villages, but no persons or agencies were blamed for the same. That is to say, the present project did not uncover any points of view against sharing of water resources. Broad, expansive views in general were set forth by informants in regard to freshwater use customs. Flexibility seems to be a central theme, as well as "making do". This study suggests that Chamorros who responded to the questionnaire were not overly concerned with conservation of water resources, but neither were they careless with the water resources at hand.

We stress that the present project did not really attempt to ask informants their views on contemporary water shortages. Our work with informants was centered on the pre-war time period, with informants asked to recall cultural aspects of water use "then".

¹For this question, an informant could cite more than one answer; hence the total number of answers is more than 265.

RECOMMENDATIONS

- 1) a follow-up study to determine how knowledge of pre-War freshwater use customs can be applied in the present day to assist in solving present and future freshwater related problems.
- 2) determination of water tenure principles, both legal and customary, in the present day
- 3) an analysis of contemporary perceived status differences among people of Chamorro heritage, and the relationship between status and water tenure (and by implication, land tenure)
- 4) examination of standard land and water use practices of inhabitants in the northern plateau of Guam, to determine whether such practices in the long run may overburden the water lens

ACKNOWLEDGMENTS

Many people have been involved in the "Water Project" from its inception in October 1977 up to the present time. I am pleased to acknowledge the assistance received from so many sources.

Dr. Stephen Winter, director of the Water Resources Research Center on Guam, first suggested that the project be undertaken. Numerous students at University of Guam - in anthropology and geography, in Chamorro language classes, and interested others - encouraged their families and friends to take part in the survey. Lolita Leon Guerrero Huxel acted as Chamorro language consultant to the project. Marvin Montvel-Cohen, Territorial Archaeologist, and the students of the Territorial Lab, Historical Preservation Section of the Department of Parks and Recreation, Government of Guam, were responsible for the archaeology section of the report. Charles Huxel of the U.S. Geological Survey spoke to the students on technical matters of water resources on Guam. Monsignor Oscar Calvo contributed a discussion of traditional Chamorro cultural concepts and practices.

Carmen Pearson arranged for me to speak with the village commissioners in May 1978, advising them that the survey was being distributed in their villages. We asked permission to have their offices be used as drop-off and pick-up places for the questionnaires, and they gave their approval. Mr. Thomas B. Santos, Director of the Servicio Para i Manamko (Services for the Elderly) graciously gave his consent for the students to talk with Chamorro senior citizens, particularly at the Merizo community center. I would also like to acknowledge the senior citizens at Lanchon Antigo at Inarajan who patiently answered the many questions on the survey in personal interviews, especially in Summer 1978. The staff of the Micronesian Area Research Center at the University of Guam, especially Emilie Johnston and Al Williams, were tireless in their efforts to assist project personnel.

Finally, I wish to thank all of the students who have served as research aides on the "Water Project" for the time and energy they have expended to learn about freshwater use customs on Guam. Salome Susuico Blas, Anita Rosario, and Victoria Cruz painstakingly typed and retyped various drafts of this manuscript; Evelyn Paulino typed the final draft. Last and most of all, I would like to thank the 265 persons who responded to the questionnaire, providing us with so much data that all of it cannot be included in this exploratory report.

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APPENDIX A

THE QUESTIONNAIRE WITH NUMERICAL FREQUENCIES SHOWN

University of Guam

WATER RESOURCES RESEARCH CENTER
P. O. BOX EK AGANA, GUAM 96910

April 1, 1978

Dear Chamorro Friends,

The Water Resources Research Center at University of Guam, located at the Marine Lab, has received federal funding to conduct a study entitled "Sociocultural Determinants of Fresh Water Uses in Guam." At the present time on Guam, fresh water resources such as rivers, springs, pools, wells and waterfalls are being developed. Since traditional Chamorro fresh water use customs still exist, we would like to record these customs before they are forgotten. Of special interest are personal recollections of the ways in which fresh water was used prior to World War II by Chamorro people. We would like you to share with us the way you lived before piped water was brought into the homes on Guam.

Chamorro friends over 40 years of age are being asked to assist with the project. Please read this questionnaire and answer the questions to the best of your ability. When the phrase "fresh water" is used in this survey, it refers to any type of water that is not salty. Therefore, information regarding the use of hanum tasi 'sea water' is not a part of this study.

Although we need to have the questionnaire returned to us as soon as possible, please take your time to answer the questions carefully. If you get tired, put the questions aside and come back to them on the next day. Time is important to us in terms of getting the questionnaires returned, but you are more important.

When you finish with the questionnaire, please give it back to whomever gave it to you: your village commissioner, your church, a University student, or a friend or neighbor. The Department of Anthropology and Geography at University of Guam is sponsoring this study.

Anthropology and geography students are administering this questionnaire, along with students in the Chamorro language classes. The Director of the Field Project is Dr. Rebecca Stephenson, an anthropologist. Mrs. Lolita Leon Guerrero Huxel serves as the Chamorro language consultant, and Mr. Marvin Montvel-Cohen, Guam's Territorial Archaeologist, is the archaeological consultant.

If you wish to contact us further in regard to this project, please telephone 734-2421 at the Marine Lab or send a message to the Department of Anthropology/Geography with a University student that you know. We are grateful for your assistance in this project. The sharing of your recollections will help to preserve Chamorro culture for the years to come. Si Yuus Maase.

NOTE: the orthography or spelling of the Chamorro words in this questionnaire follows the new spelling system being considered for introduction into Guam's schools by the Chamorro Language Commission.

Section I

PERSONAL AND SOCIAL BACKGROUND N= 265

Place the NUMBER of your answer on the line in the left margin, please.

1 What is your age? Kwantu anus haw? (single answer)

1. 40-45	<u>43</u>	4. 56-60	<u>25</u>	7. 71-75	<u>23</u>
2. 46-50	<u>34</u>	5. 61-65	<u>35</u>	8. 76-80	<u>14</u>
3. 51-55	<u>44</u>	6. 66-70	<u>29</u>	9. 81 and over	<u>13</u>

No response 5

2 What is your sex? Lahi pat pala'an? (single answer)

1. male	<u>100</u>	2. female	<u>164</u>
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No response 1

3 In what country were you born? (single answer)

1. Guam	<u>254</u>	3. Japan	<u>1</u>	5. T.T.P.I.	<u>2</u>
2. U.S.A.	<u>2</u>	4. Philippines	<u>3</u>	6. other (list place)	<u>2</u>

No response 1

4 In what village on Guam were you born? Mafanagu? (single answer)

1. Agafa gumas	<u>7</u>	4. Agat	<u>14</u>	7. Chalan Pago	<u>3</u>
2. Agana	<u>115</u>	5. Asan	<u>4</u>	8. Dededo	<u>6</u>
3. Agana Hts.	<u>2</u>	6. Barrigada	<u>7</u>	9. Inarajan	<u>27</u>

5

1. Maina	<u>4</u>	4. Mangilao	<u>0</u>	7. Piti	<u>13</u>
2. Maite	<u>0</u>	5. Merizo	<u>14</u>	8. Santa Rita	<u>0</u>
3. Malojloj	<u>1</u>	6. Mongmong	<u>1</u>	9. Sinajana	<u>7</u>

6

1. Sumay	<u>3</u>	4. Toto	<u>2</u>	7. Yigo	<u>3</u>
2. Talofofu	<u>9</u>	5. Tumon	<u>1</u>	8. Yona	<u>4</u>
3. Tamuning	<u>5</u>	6. Umatac	<u>7</u>		

No response 6

7 What is your marital status? Ko umasagwa haw? (single answer)

1. Married	<u>184</u>	3. Separated	<u>4</u>	5. Widowed	<u>50</u>
2. Single	<u>13</u>	4. Divorced	<u>5</u>	6. other	<u>0</u>

No response 9

8 How many people in your household? Kwantu gi familyamu? (single answer)

1. 1-3	<u>82</u>	3. 11-15	<u>28</u>	5. over 20	<u>7</u>
2. 4-10	<u>131</u>	4. 16-20	<u>11</u>		

No response 6

Where do you now reside? Manu na sumasaga haw? (single answer)

- | | | |
|--------------------------|------------------------|--------------------------|
| 1. Agafa gumas <u>10</u> | 4. Agat <u>15</u> | 7. Chalan Pago <u>12</u> |
| 2. Agana <u>9</u> | 5. Asan <u>4</u> | 8. Dededo <u>21</u> |
| 3. Agana Hts. <u>21</u> | 6. Barrigada <u>24</u> | 9. Inarajan <u>23</u> |

- | | | |
|----------------------|-----------------------|------------------------|
| 1. Maina <u>3</u> | 4. Mangilao <u>12</u> | 7. Piti <u>7</u> |
| 2. Maite <u>2</u> | 5. Merizo <u>13</u> | 8. Santa Rita <u>4</u> |
| 3. Malojloj <u>4</u> | 6. Mongmong <u>7</u> | 9. Sinajana <u>21</u> |

- | | | |
|------------------------|--------------------|-------------------|
| 1. Sumay <u>1</u> | 4. Toto <u>3</u> | 7. Yigo <u>8</u> |
| 2. Talofoyofo <u>9</u> | 5. Tumon <u>1</u> | 8. Yona <u>14</u> |
| 3. Tamuning <u>18</u> | 6. Umatac <u>4</u> | |

How long have you lived there? Kwantus anus sinagamu gwihi? (single answer)

- | | | |
|-----------------------|--------------------|----------------------------|
| 1. 0-3 yrs. <u>17</u> | 4. 11-15 <u>10</u> | 7. 26-30 <u>22</u> |
| 2. 4-6 <u>14</u> | 5. 16-20 <u>15</u> | 8. over 30 yrs. <u>125</u> |
| 3. 7-10 <u>21</u> | 6. 21-25 <u>38</u> | |
| No response <u>3</u> | | |

In what village did you live before World War II? Manu na sumasaga haw antis di World War II? (Please write the actual Chamorro name of the village.)

Was there a river or spring or well on your property? Saduk pat matan hanum pat tupu gi tano'mu? (single answer)

- | | | |
|------------------|------------------|----------------------|
| 1. yes <u>87</u> | 2. no <u>173</u> | No response <u>5</u> |
|------------------|------------------|----------------------|

If you answered yes to number 15, please complete 16-23. If you answered no to number 15, go on to 24. Janggin un oppi hunggan na funajan 16-23. Janggin un oppi ahi', hanaw para 24.

In what village was the fresh water located? Manu na banda ni sumasagahaw ni gaygi magigimin na hanum? (single answer)

- | | | |
|-------------------------|-----------------------|-------------------------|
| 1. Agafa gumas <u>3</u> | 4. Agat <u>8</u> | 7. Chalan Pago <u>3</u> |
| 2. Agana <u>24</u> | 5. Asan <u>9</u> | 8. Dededo <u>1</u> |
| 3. Agana Hts. <u>3</u> | 6. Barrigada <u>4</u> | 9. Inarajan <u>15</u> |

<u>17</u>	1. Maina <u>3</u> 2. Maite' <u>1</u> 3. Malojloj <u>2</u>	4. Mangilao <u>0</u> 5. Merizo <u>10</u> 6. Mongmong <u>2</u>	7. Piti <u>2</u> 8. Santa Rita <u>0</u> 9. Sinajana <u>2</u>
<u>18</u>	1. Sumay <u>6</u> 2. Talofofu <u>8</u> 3. Tamuning <u>1</u>	4. Toto <u>1</u> 5. Tumon <u>0</u> 6. Umatac <u>7</u>	7. Yigo <u>8</u> 8. Yona <u>3</u> 9. other (please list) <u>1</u>

Section II

What type of water was located on your property? Hafa na klasin hanum gaygi lugatmu? (indicate more than one answer if necessary)

19 River water (hanum saduk) 61

20 Spring water (matan hanum) 35

21 Well water (hanum tupu) 35

22 Other (please list) 23

How did you or your family get the land where the water was located? Taymanu gwahamu ni tano'umu ni gaygi i hanum? (single answer)

23

1. Inheritance <u>50</u>	3. Rent <u>11</u>	5. Other (please list) <u>11</u>
2. Buy <u>13</u>	4. Permission of owner <u>25</u>	

Who owned the water that you used? Haji gay iju i hanum ni un u'usa? (single answer)

24

1. I did <u>20</u>	4. A company or corporation <u>0</u>	6. No one owned it <u>18</u>
2. My family did <u>31</u>	5. The government <u>139</u>	7. Other (please list) <u>11</u>
3. Rent or lease from relatives or friends <u>9</u>		

If you used a river for a source of water, what was its name? Janggin un usa i hanum saduk para hanommu hafa na'anña? (Please write the name in this space.)

OK
25

What did you use fresh water for? Hafa na un u'usa i hanum fresku? (more than one answer possible)

1. Cooking	<u>243</u>	<u>32</u>	7. Watering plants	<u>135</u>
2. Drinking	<u>243</u>	<u>33</u>	8. Watering animals	<u>130</u>
3. Bathing	<u>230</u>	<u>34</u>	9. Medical practices	<u>61</u>
4. Swimming	<u>67</u>	<u>35</u>	10. Wash clothes	<u>199</u>
5. Cleaning (housework)	<u>188</u>	<u>36</u>	20. Toilet	<u>62</u>
6. Fishing	<u>32</u>	<u>37</u>	30. Other (please list)	<u>13</u>

What type of water did you use for cooking? Hafa na klasin hanum un u'usa para muna'lagu?

1. river (hanum saduk)	<u>70</u>	<u>42</u>	5. lake	<u>1</u>
2. spring water (matan hanum)	<u>66</u>	<u>43</u>	6. pool	<u>0</u>
3. well (hanum tupu')	<u>64</u>	<u>44</u>	7. Other (please list)	<u>40</u>
4. rain (hanum sinaga)	<u>158</u>			

What type of water did you use for drinking? Hafa na klasin hanum un gigimin?

1. river	<u>64</u>	<u>49</u>	5. lake	<u>3</u>
2. spring water	<u>62</u>	<u>50</u>	6. pool	<u>0</u>
3. well	<u>63</u>	<u>51</u>	7. Other (please list)	<u>31</u>
4. rain	<u>182</u>			

What type of water did you use for bathing? Hafa na klasin hanum un u'usa para omakmu?

1. river	<u>121</u>	<u>57</u>	6. pool	<u>8</u>
2. spring water	<u>58</u>	<u>58</u>	7. waterfalls (manutu)	<u>14</u>
3. well	<u>66</u>	<u>59</u>	8. community bath house	<u>17</u>
4. rain	<u>138</u>	<u>60</u>	9. Other (please list)	<u>31</u>
5. lake	<u>8</u>			

What type of water did you use for swimming? Hafa na klasin hanum un u'usa para omakmu (nangumu)?

<u>61</u>	1. river <u>167</u>	<u>64</u>	4. pool <u>13</u>
<u>62</u>	2. spring water <u>19</u>	<u>65</u>	5. Other (please list) <u>39</u>
<u>63</u>	3. lake <u>19</u>		

What type of water did you use for cleaning (housework and laundry)? Hafa na klasin hanum un u'usa para munagasgas gi halum guma'?

<u>66</u>	1. river <u>131</u>	<u>70</u>	5. lake <u>8</u>
<u>67</u>	2. spring water <u>63</u>	<u>71</u>	6. pool <u>1</u>
<u>68</u>	3. well <u>67</u>	<u>72</u>	7. Other (please list) <u>37</u>
<u>69</u>	4. rain <u>125</u>		

What type of water did you fish in? Janggin pumepeska haw, manu na pumepiska haw?

<u>73</u>	1. river <u>113</u>	<u>76</u>	4. pool <u>4</u>
<u>74</u>	2. spring water <u>5</u>	<u>77</u>	5. Other (please list) <u>73</u>
<u>75</u>	3. lake <u>13</u>		

What type of water did you use for watering plants? Hafa na klasin hanum un u'usa para un rega i tinanummu?

<u>78</u>	1. river <u>87</u>	<u>2</u>	5. lake <u>6</u>
<u>79</u>	2. spring water <u>37</u>	<u>3</u>	6. pool <u>4</u>
<u>80</u>	3. well <u>54</u>	<u>4</u>	7. Other (please list) <u>28</u>
<u>1</u>	4. rain <u>165</u>		

u'usa
 What type of water did you use for watering animals? Hafa na klasin hanum un u'usa para un nagimin i gaga' siha?

<u>5</u>	1. river	<u>110</u>	<u>9</u>	5. lake	<u>5</u>
<u>6</u>	2. spring water	<u>34</u>	<u>10</u>	6. pool	<u>4</u>
<u>7</u>	3. well	<u>62</u>	<u>11</u>	7. Other (please list)	<u>25</u>
<u>8</u>	4. rain	<u>155</u>			

Hafa
 What type of water did you use for medical practices? Hafa na klasin hanum un u'usa para (un nalagu amut siha) manamti?

<u>12</u>	1. river	<u>54</u>	<u>16</u>	5. lake	<u>1</u>
<u>13</u>	2. spring water	<u>47</u>	<u>17</u>	6. pool	<u>1</u>
<u>14</u>	3. well	<u>58</u>	<u>18</u>	7. Other (please list)	<u>21</u>
<u>15</u>	4. rain	<u>108</u>			

How did you clean your body? Taymanu haw umomak?

<u>19</u>	1. entered the water	<u>91</u>	
<u>20</u>	2. stood on the edge of the water	<u>20</u>	
<u>21</u>	3. took water home to bathe	<u>113</u>	
<u>22</u>	4. community bath houses	<u>32</u>	
<u>23</u>	5. other (please list)	<u>59</u>	

Section III
COLLECTION

How did you collect river water? Taymanu chule'mu ni hanum saduk? (more than one answer possible)

<u>24</u>	1. Metal containers	<u>141</u>	
<u>25</u>	2. Bamboo tubes (bongbung hanum)	<u>102</u>	
<u>26</u>	3. Wooden containers	<u>25</u>	
<u>27</u>	4. Clay pots	<u>31</u>	
<u>28</u>	5. other (please list)	<u>17</u>	

How did you collect spring water? Taymanu chule'mu ni matan hanum? (more than one answer possible)

<u>29</u>	1. Metal containers	<u>124</u>
<u>30</u>	2. Bamboo tubes	<u>84</u>
<u>31</u>	3. Wooden containers	<u>25</u>
<u>32</u>	4. Clay pots	<u>30</u>
<u>33</u>	5. other (please list)	<u>16</u>

How did you collect well water? Taymanu chule'mu ni hanum tupu'? (more than one answer possible)

<u>34</u>	1. Metal containers	<u>126</u>
<u>35</u>	2. Bamboo tubes	<u>66</u>
<u>36</u>	3. Wooden containers	<u>35</u>
<u>37</u>	4. Clay pots	<u>25</u>
<u>38</u>	5. other (please list)	<u>21</u>

How did you collect rain water? Taymanu chule'mu ni hanum uchan (hanum fresku)? (more than one answer possible)

<u>39</u>	1. Metal containers	<u>192</u>
<u>40</u>	2. Bamboo tubes	<u>63</u>
<u>41</u>	3. Wooden containers	<u>48</u>
<u>42</u>	4. Clay pots	<u>39</u>
<u>43</u>	5. Tree catchments	<u>61</u>
<u>44</u>	6. other (please list)	<u>25</u>

TRANSPORTATION

How did you carry river water? Taymanu kililimu ni hanum saduk? (more than one answer possible)

<u>45</u>	1. Metal containers	<u>116</u>
<u>46</u>	2. Bamboo tubes	<u>74</u>
<u>47</u>	3. Wooden containers	<u>26</u>
<u>48</u>	4. Carabao carts	<u>70</u>
<u>49</u>	5. Hand carried	<u>108</u>
<u>50</u>	6. Motor vehicles	<u>13</u>
<u>51</u>	7. other (please list)	<u>18</u>

How did you carry spring water? Taymanu kililimu ni matan hanum? (more than one answer possible)

<u>52</u>	1. Metal containers	<u>105</u>
<u>53</u>	2. Bamboo tubes	<u>71</u>
<u>54</u>	3. Wooden containers	<u>20</u>
<u>55</u>	4. Carabao carts	<u>61</u>
<u>56</u>	5. Hand carried	<u>95</u>
<u>57</u>	6. Motor vehicles	<u>13</u>
<u>58</u>	7. other (please list)	<u>19</u>

How did you carry well water? Taymanu kililimu ni hanum tupu? (more than one answer possible)

<u>59</u>	1. Metal containers	<u>108</u>
<u>60</u>	2. Bamboo tubes	<u>68</u>
<u>61</u>	3. Wooden containers	<u>30</u>
<u>62</u>	4. Carabao carts	<u>52</u>
<u>63</u>	5. Hand carried	<u>83</u>
<u>64</u>	6. Motor vehicles	<u>11</u>
<u>65</u>	7. other (please list)	<u>15</u>

How did you carry rain water? Taymanu kililimu ni hanum uchan? (more than one answer possible)

<u>66</u>	1. Metal containers	<u>149</u>
<u>67</u>	2. Bamboo tubes	<u>65</u>
<u>68</u>	3. Wooden containers	<u>34</u>
<u>69</u>	4. Carabao carts	<u>34</u>
<u>70</u>	5. Hand carried	<u>112</u>
<u>71</u>	6. Motor vehicles	<u>7</u>
<u>72</u>	7. other (please list)	<u>20</u>

Section IV

STORAGE

How did you keep river water? Taymanu na un sagwan i hanum saduk? (more than one answer possible)

<u>73</u>	1. Metal containers	<u>103</u>
<u>74</u>	2. Bamboo tubes	<u>73</u>
<u>75</u>	3. Wooden containers	<u>23</u>
<u>76</u>	4. Clay pots	<u>28</u>
<u>77</u>	5. Did not store	<u>39</u>
<u>78</u>	6. other (please list)	<u>11</u>

How did you keep spring water? Manu na un sagwan i matan hanum? (more than one answer possible)

<u>79</u>	1. Metal containers	<u>111</u>
<u>80</u>	2. Bamboo tubes	<u>58</u>
<u>1</u>	3. Wooden containers	<u>27</u>
<u>2</u>	4. Clay pots	<u>36</u>
<u>3</u>	5. Did not store	<u>28</u>
<u>4</u>	6. other (please list)	<u>14</u>

How did you keep well water? Manu na un sagwan i hanum tupu'? (more than one answer possible)

- 5
6
7
8
9
10
1. Metal containers 102
 2. Bamboo tubes 50
 3. Wooden containers 23
 4. Clay pots 33
 5. Did not store 37
 6. other (please list) 10

How did you keep rain water? Manu na un sagwan i hanum uchan (hanum fresku)? (more than one answer possible)

- 11
12
13
14
15
16
17
1. Metal containers 149
 2. Bamboo tubes 61
 3. Wooden containers 37
 4. Clay pots 46
 5. Where it was collected 45
 6. Did not store 17
 7. other (please list) 15

18
Was water ever kept in anticipation of shortages? Ko gwaha na ma'istima i hanum put u'oku'?

1. yes 106 2. no 133 No Response 26

19
Was water ever rationed? Ko gwaha na mapattida i hanum?

1. yes 62 2. no 179 No Response 24

20
Were the people who had control over access to water regarded differently? I tawtaw ni gaygi i hanum gi tano'ña, ko mangwaha esti na tawtaw?

1. yes 30 2. no 182 No Response 53

XX

21

If so, how? Janggin hunggan, pwes sangan taymanu.

22

Was fresh water ever reused? Ko gwaha na ma'usa talu (dinewbu) i hanum fresku?

1. yes 49 2. no 162 No Response 54

23

If yes, please state how. Janggin hunggan, pwes sangan taymanu ma'usana dinewbu.

25

Was fresh water considered to be a limited resource? Ko gwaha na makunsidera para u taja i hanum?

1. yes 55 2. no 168 No Response 42

26

If so, why?

27

1. Permission from you 76

28

2. Trade or exchange with you 11

29

3. Rent from you 5

30

4. Family ties 30

31

5. No permission needed from landowner 54

32

6. Just told you they needed some water 57

If you used water on someone else's land, how did you acquire the use of it? Janggin un usa i hanum otru tawtaw gi tano'na taymanu namana'i haw lisensia?

<u>33</u>	1. Permission from landowner	<u>103</u>
<u>34</u>	2. Trade or exchange with landowner	<u>9</u>
<u>35</u>	3. Rent from landowner	<u>4</u>
<u>36</u>	4. Family ties	<u>30</u>
<u>37</u>	5. No permission needed from landowner	<u>43</u>
<u>38</u>	6. Just told the landowner you need some water	<u>53</u>
<u>39</u>	7. Just used it	<u>27</u>

Section V

Who collected fresh water? Hagi lumulupuk i hanum fresku. (more than one answer possible)

<u>40</u>	1. Males	<u>158</u>
<u>41</u>	2. Females	<u>133</u>
<u>42</u>	3. Children	<u>117</u>
<u>43</u>	4. Youths	<u>126</u>
<u>44</u>	5. Adults	<u>133</u>
<u>45</u>	6. Elderly people	<u>84</u>

When was fresh water collected? Ngayan na malupuk i hanum fresku? (more than one answer possible)

<u>46</u>	1. Morning	<u>173</u>
<u>47</u>	2. Afternoon	<u>88</u>
<u>48</u>	3. Evening	<u>133</u>
<u>49</u>	4. Night	<u>68</u>

Who drank fresh water? Hayi gumigimin ' hanum fresku? (more than one answer possible)

<u>50</u>	1. Males	<u>192</u>
<u>51</u>	2. Females	<u>191</u>
<u>52</u>	3. Babies	<u>163</u>
<u>53</u>	4. Children	<u>175</u>
<u>54</u>	5. Youths	<u>186</u>
<u>55</u>	6. Adults	<u>185</u>
<u>56</u>	7. Elderly people	<u>201</u>

Who used fresh water? Hayi umu'usa i hanum fresku? (more than one answer possible)

<u>57</u>	1. Males	<u>189</u>
<u>58</u>	2. Females	<u>188</u>
<u>59</u>	3. Babies	<u>163</u>
<u>60</u>	4. Children	<u>176</u>
<u>61</u>	5. Youths	<u>180</u>
<u>62</u>	6. Adults	<u>159</u>
<u>63</u>	7. Elderly people	<u>200</u>

Why did you use fresh water? Para hafa na un usa i hanum fresku?

<u>64</u>	1. Cleaner than other liquids	<u>110</u>
<u>65</u>	2. Fresher than other liquids	<u>108</u>
<u>66</u>	3. For sickness	<u>107</u>
<u>67</u>	4. For thirst	<u>170</u>
<u>68</u>	5. When you are hot	<u>98</u>
<u>69</u>	6. other (please list)	<u>58</u>

Did you have any customs or special practices concerning fresh water use?
Ko gwaha kustumbremu un u'usa yanggin un nasetbi i hanum fresku?

70

1. yes 44 2. no 166 No Response 55

If yes, please list them.

71

Were menstruating women allowed to enter a fresh water source such as a river or spring? Ko sifa i rumerikla na pala'an humalum gi i sagan i hanum (sasuk pat bobu') fresku?

73

1. yes 22 2. no 202 No Response 41

If anyone entered the water, was the water contaminated? Janggin humalum i tawtaw gi sagan hanum, ko hatatmi i hanum?

74

1. yes 87 2. no 104 No Response 73

If no one could enter the water, why not? Janggin ti sina i tawtaw humalum gi sagan hanum, sa hafa?

75

If fresh water was used by itself as a remedy, what was it supposed to cure? Janggin ma'usa i hanum fresku para munamawlik (munahomlu'), put hafa ha nahohumlu' pat ha namawmawlik?

76

1. colds 70

77

2. headaches 82

78

3. body aches 83

79

4. childhood diseases 41

80

5. bodig 13

1

6. litico 15

2

7. other (please list) 19

If you have anything else you would like to say concerning fresh water uses on Guam, please feel free to write it in the space below. If you wish, you may write your name, address, and telephone number so we can contact you to talk with you further about this research project. Thank you for your assistance in the project--your effort is greatly appreciated.

Janggin hafa malago'-mu mas para un sangan put i hanum fresku ma'usana giya Guam, put fabot tugi' papa' gwini. Janggin malagu' haw tumugi' i na'an-mu, manu nasumasaga haw, jan numirun i tilifonmu kosa ki siña mangngwentus hit talu put esti i chicho-ta. Si Ju'us ma'asi' ni ayuda-mu ni hami.

APPENDIX B

TITLE IV, CHAPTER FIRST, CIVIL CODE OF GUAM

AS REPRINTED IN GUAM NEWS LETTER, OCTOBER, 1914.

Waters:

Section First. - Ownership of water.

Art. 407. The following are of public ownership:

1. Rivers and their natural beds.
2. Continuous or intermittent waters from springs or brooks running in their natural beds and the said beds.
3. Waters rising continuously or intermittently in lands of said public ownership.
4. Lakes and ponds formed by nature on public lands and their beds.
5. Rain waters running through ravines or sandy beaches, the beds of which shall also be public property.
6. Subterranean waters on public lands.
7. Waters found within the zone of operation of public works, even when they are made by a concessionnaire.
8. Waters flowing continuously or intermittently on estates belonging to private parties, to the State, to provinces, or to towns from the moment they leave paid estates.
9. The overflow of fountains, sewers, and public institutions.

Art. 408. The following are of private ownership.

1. Waters, either continuous or intermittent, rising on private estates as far as they run through them.
2. Lakes and ponds and their beds when formed by nature on said estates.
3. Subterranean waters found on the same.
4. Rain waters falling thereon as long as they remain within their boundaries.
5. The beds of flowing waters, continuous or intermittent, formed by rain water, and those of brooks crossing estates which are not public property.

In every drain or aqueduct the water, the bed, the sloping bank, and the side ways are considered as an integral part of the estate or building to which the waters are destined. The owners of estates through or along the aqueduct passes can allege no ownership over it, nor any right to make use of its bed or side ways, unless they base their claim on title deeds specifying the right or the ownership claimed.

Section second. - Use of Public waters.

Art. 409. The use of public waters is acquired.

1. By administrative concession.

2. By prescription of twenty years.

The limits of the rights and obligations of these uses shall be those appearing, in the first case, from the terms of the concession; and, in the second, from the manner and form in which the waters have been used.

Art. 410. Every concession of use of waters is understood without prejudice to third parties.

Art. 411. The right to make use of public waters is extinguished by the forfeiture of the concession, and by non user for twenty years.

Section Third. - Use of waters of private ownership.

Art. 412. The owner of an estate containing a spring or the source of a brook, continuous or intermittent, may use its waters as far as they run through the estate.

Art. 413. Private ownership of the beds of rain waters does not give a right to make works and constructions which may divert their course to the prejudice of a third party, nor those the destruction of which by the force of floods, may cause such deviation.

Art. 414. No one may enter private property in search of waters or make use of them without permission from their owners.

Art. 415. The ownership which the proprietor of an estate has in the waters rising on the same can not prejudice the rights which the owners of lower estates may have legally acquired to their use.

Art. 416. Every owner of an estate has a right to construct on his property receptacles for rain water, provided he does not prejudice the public or a third party thereby.

Section Fourth. Subterranean waters.

Art. 417. Only the owner of an estate or another person with his permission, may search for subterranean waters thereon.

The search for subterranean water on lands of public ownership can only be made with the permission of an administrative authority.

Art. 419. When the owner of artesian waters abandons the same to their natural course, they shall be public property.

Section Fourth. General provisions.

Art. 420. The owner of an estate on which there are defensive works to check waters, or on which by reason of the variation of their course, it should be necessary to reconstruct them, is bound at his option, to make the necessary repairs or constructions or to permit that, without injury to him, they be made by the owners of the estates who suffer or are clearly exposed to suffer damage.

Art. 421. The provisions contained in the preceding article are applicable to the cases in which it may be necessary to clear an estate from the material, the accumulation, or fall of which may obstruct the course of waters with injury or danger to a third party.

Arts. 422. All the owners who participate in the benefits arising from the works, referred to in the two foregoing articles, are obliged to contribute to the cost of their construction in proportion to their interest. Those who by their own fault may have caused the damage shall be liable for the expenses.

Art. 423. The ownership and use of waters belonging to corporations or private parties are subject to the law of eminent domain.

Art. 424. The provisions of this title shall not prejudice the rights previously acquired nor the private ownership which the owners of water drains, fountains, or springs have to use, sell, or exchange them as private property.

APPENDIX C

"WATER LEAKS ADD UP", PACIFIC DAILY NEWS, JANUARY 19, 1979, PAGE 1

Water leaks add up

By JEAN SNODGRASS
Daily News Staff

About one-fifth of Guam's water supply - more than 1,700 million gallons - was lost last year because of pipe breakages, leakages and illegal connections, according to the Public Utility Agency of Guam.

However, a senior PUAG official said, the water loss was drastically reduced from 1977, when 44 percent of the water found its way out of the system.

The reduction in the water loss to 18 percent last year was attributed by PUAG to the agency's constant maintenance program. Salas said a 15 percent water loss is normal.

According to Tony Salas, 44, acting PUAG director, civilians and military on Guam used 6,379,000 gallons of water in fiscal 1978. The figure does not include useage by military residents.

Salas said Guam is not expected this year to suffer water shortages during the dry season. Last year, southern villages were plagued by shortages and

PUAG requested customers to use less water.

Water loss, Salas said, can occur in a number of ways.

"In one case we found an open valve feeding into the military (system)" Salas said.

He said other losses occur at houses where meters have been cut off but where water still is being used. This can be corrected by plugging the lines and removing the meter, Salas said.

"We have a program of constant maintenance and on-going investigation of loss, breaks and leakage area by area on the island" he said.

Water is also lost through illegal connection, he said, which adds to the problem of not knowing where the water is going.

Most of Guam's water comes from wells in the north where the soil is best for holding the water, Salas explained. In the south, though the water is clean, the soil adds a funny smell and it doesn't absorb into the ground as well, he said.

The military uses surface water while Guam's civilians use well water, Salas said, adding that the military softens its water while civilian water is not treated.

Improvements to the system include an almost completed 12-inch water line from Malojloj to Merizo.

Four new water wells in the north and two in central Guam also are scheduled to be completed by April.

Salas said he feels the public learned from last year's scare and are now better educated to how and where we get our water.

"If people are aware of the problem, shortages can be eliminated completely," he said. "The answer is not for the customer to say he or she will absorb the cost of water usage in a shortage but to understand that water is a limited resource that we depend on nature for."

Salas also added that if tourism continues to grow at the same rate the water system should be able to support the industry.