

AMERICAN SAMOA WATERSHED PROTECTION PLAN

Volume 3: Watersheds 36-41

Volume 1: Watersheds 1-23

Volume 2: Watersheds 24-35

Volume 4: Stormwater Management Evaluations

Prepared for:

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and
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INTRODUCTION

PURPOSE

The primary purpose of the Watershed Protection Plan is to help focus future resource management efforts of the American Samoa Government. Resource management programs are already being carried out by various agencies of the American Samoa Government and other agencies of the United States Government. The primary agencies of the American Samoa Government (ASG) and federal agencies of the U.S. Government that are involved in resource management programs include the following:

American Samoa Government

American Samoa Environmental Protection Agency
American Samoa Department of Commerce, Coastal Zone Management Program
American Samoa Power Authority
American Samoa Department of Marine and Wildlife Resources
American Samoa Department of Public Works
American Samoa Community College, Land Grant Program
American Samoa Department of Agriculture

U.S. Government

U.S. Environmental Protection Agency
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of Interior, National Park Service
U.S. Department of Interior, Geological Survey

It is important that future resource management programs in the Territory are closely coordinated to avoid potential overlaps and conflicts in program objectives, and encourage a more cooperative, inter-agency approach to resource management. The Watershed Protection Plan is intended to provide a starting point for future cooperative efforts among these agencies.

SCOPE OF THE PLAN

A wealth of environmental data has been compiled by the American Samoa Government for, at least, the past 30 years. The Watershed Protection Plan brings together a significant amount of selected resource information for 41 watershed planning areas on the Islands of Tutuila, Aunuu, Ofu, Olosega and Tau. The inventory of historical and recent watershed characteristics and related environmental indicators provide the basis for conclusions regarding various resource management issues in each watershed, as well as recommended strategies for future resource management. Specific responsibilities are assigned to various ASG agencies for the implementation of specific resource management projects, as well as longer-term monitoring of selected resources and land uses.

Resource management issues that are addressed in the Plan for each watershed include:

- soil characteristics
- soil suitability for agricultural production, as well as soil-based wastewater treatment and disposal
- stream locations, drainage characteristics, and rates of stream flow
- surface water quality of streams and the nearshore waters
- wetlands
- coral communities and giant clam production
- wildlife habitat for birds and bats
- shoreline protection

- groundwater and surface water supplies
- resident population and land uses, as well as use of the nearshore waters for fishing and general water recreation
- anticipated land uses to the year 2015
- the impact of future population growth upon water consumption and wastewater generation
- flood potential
- stormwater runoff, sedimentation, and the relationship to surface water quality
- nearshore water quality and the marine environment

The level of evaluation associated with each of these issues varies considerably. This variation is dependent upon the availability and reliability of relevant information, as well as the perceived importance of each issue to overall resource management priorities in each watershed.

ORGANIZATION OF THE PLAN REPORT

The Watershed Protection Plan is a three-volume report. Each volume contains this introductory section, a glossary of Samoan words and agency acronyms, and a portion of the individual watershed evaluations. The watersheds included in each volume are as follows:

Volume 1 (watersheds 1-23): North and southeast coasts of Tutuila from Poloa through Laulii

Volume 2 (watersheds 24-35): Southcentral and southwest coasts of Tutuila from Pago Pago Harbor through Amanave, as well as the Island of Anuu

Volume 3 (watersheds 36-41): Islands of Ofu, Olosega, and Tau

The names and location of each watershed are illustrated at the beginning of the Watershed Evaluations in each volume. The references associated with publications and personal communications, which were used in the preparation of the Watershed Protection Plan, are provided at the end of Volume 3.

PLAN METHODOLOGY

Compilation and Review of Available Information

Available information was gathered from a variety of sources concerning natural resources, land uses, resident population, and other relevant data. Relevant information was summarized for subsequent incorporation into the Plan.

The American Samoa Power Authority, for example, provided recent population, land use, as well as water and wastewater system evaluations that were developed for its draft Utility Master Plan. Soils information was gained from the Soil Survey of American Samoa that was published in 1984 by the U.S. Soil Conservation Service (now the Natural Resources Conservation Service). The ASG Department of Marine and Wildlife Resources and the ASG Department of Agriculture provided results from field surveys concerning wildlife resources and village agricultural activities.

Pedersen Planning Consultants was also assisted by AECOS, Inc. in Kaneohe, Hawaii. Aecos, Inc. provided a review of available water quality information. This information generally represented historical information from the U.S. Geological Survey, U.S. Environmental Protection Agency, as well as the American Samoa Environmental Protection Agency.

Field Survey of Watershed Planning Areas

Available information was also supplemented by a field survey of each watershed planning area by Pedersen Planning Consultants (PPC) during April-May, 1996. Informal discussions with one or more residents of each watershed were made in conjunction with the field surveys. Residents that were typically contacted by PPC included village *matasi*, or other knowledgeable long-term residents of

communities in the watershed. In some cases, residents toured PPC representatives in selected watershed areas to identify or clarify specific watershed issues. Photographs and field notes were taken by PPC representatives for each watershed. Significant issues were also documented on available topographic maps of the Territory that are based upon 1989 aerial photography.

Geographical Information System for American Samoa

A geographical information system (GIS) was developed by Pedersen Planning Consultants to facilitate future reference to selected types of information. This planning tool resource should facilitate future resource planning and management activities. The GIS for American Samoa was developed through the use of ArcView software, version 3.0, which is manufactured and distributed by Environmental Systems Research Institute, Inc. in Redlands, California.

In the development of the GIS for American Samoa, some available digital information was provided by the American Samoa Department of Commerce, the American Samoa Power Authority, and the U.S. Geological Survey. A considerable amount of hardcopy information was also scanned via a high-quality scanner that was available at the University of Wyoming in Laramie, Wyoming. Some other information, e.g., point data, was manually digitized by PPC. Digital files were subsequently organized by Pedersen Planning Consultants to develop the actual geographical information system.

It is important for users of the Watershed Protection Plan to recognize that the illustrations provided in this report reveal only a portion of information that is readily available through the GIS. Users of the Plan are strongly encouraged to use the GIS for American Samoa when reviewing data, conclusions and recommendations in the Plan. The level of detail available in the GIS and the opportunity to correlate various combinations of information, e.g., soils and anticipated growth, enables GIS users to gain a greater understanding of watershed issues and/or share the information with other personnel.

RECOMMENDED STRATEGY FOR PLAN IMPLEMENTATION

Establishment of a Territorial Watershed Resource Management Board

Many of the federal programs of the U.S. Government that are related to resource management now encourage local resource management in the context of *watersheds*. This policy is a move away from past programs that focused primarily upon the preservation of endangered species or unique natural resources. It is widely recognized throughout most of the world that the conservation of natural resources is largely dependent upon the balance of ecological relationships within the watershed where natural resources are located. This is particularly true in the tropical environment of American Samoa.

The implementation of the various resource management programs that are associated with watershed conservation requires a cooperative partnership between several agencies in American Samoa, as well as several federal U.S. Government agencies.

Several federal agencies of the U.S. Government already provide technical assistance and/or grant funds that represent an important contribution to the implementation of various resource management programs in American Samoa. At the same time, several resource management agencies in American Samoa establish and carry out local programs to pursue various resource conservation strategies and, in some cases, related regulatory programs.

In order to formalize a more cooperative resource management effort, it is recommended that a Territorial Watershed Resource Management Board be established. This Board would consist of one representative from each of the following agencies of the American Samoa Government:

- American Samoa Environmental Protection Agency
- American Samoa Department of Commerce, Coastal Zone Management Program
- American Samoa Power Authority

- American Samoa Department of Marine and Wildlife Resources
- American Samoa Department of Public Works
- American Samoa Community College, Land Grant Program
- American Samoa Department of Agriculture
- Office of Samoan Affairs

Ex-officio members of the Watershed Resource Management Board would also include representatives of the following federal agencies:

- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Interior, National Park Service

The Watershed Resource Management Board should meet monthly or quarterly, or as frequently as desired. During regular meetings, the Board would discuss work progress and schedules related to the implementation of specific watershed improvement projects and ongoing monitoring tasks that are identified in the Watershed Protection Plan, as well as other cooperative resource management opportunities not reflected in the Plan. It is envisioned that representatives of participating agencies would also share findings from agency surveys, consultant reports, and other evaluations that would help increase the understanding of information gained from ongoing resource management programs of individual agencies.

Establishment of a Lead Agency

The Watershed Protection Board needs a lead agency that will assume responsibility for the overall management and daily implementation of the inter-agency, resource management program. Since many of the resource management issues relate to water quality, it is logical that the program should initially be managed by ASEPA.

The designation of ASEPA as the lead agency for watershed protection would not supercede the authorities already given to various ASG agencies. Rather, it would act as the catalyst for cooperative, watershed improvement programs that are made on an inter-agency basis. In addition, ASEPA would also help ensure that the progress and information gained from both independent and cooperative resource management programs are shared by all participating agencies which are represented on the Watershed Protection Board.

The lead agency will be responsible for assigning a full-time program manager who will be assigned to coordinate the implementation of the Watershed Protection Plan and the activities of the Territorial Watershed Resource Management Board. The program manager will need to be a strong individual who is willing to listen and constructively respond to the concerns of participating ASG and federal agencies and traditional village leaders, as well as take constructive, aggressive steps to support their decisions.

It is also important that the selected program manager is highly motivated and committed to making the program a successful effort. Knowledge of the Samoan language and culture, as well as the environment of American Samoa, is essential.

The use of a designated consultant firm should also be considered to provide occasional technical assistance to the lead agency, program manager, and the overall Watershed Resource Management Board. The selected firm would provide technical assistance related to specific watershed improvement projects, and possibly help make periodic evaluations of program success. Any firm selected for this work should have considerable experience associated with the environment of American Samoa, as well as some knowledge of *faaSamoa*. The firm should also be willing to supplement its resources with the capabilities of other consultants, if necessary.

Participation of Traditional Leaders and Residents in Resource Management Solutions

The implementation of the Watershed Protection Plan can only be accomplished via a cooperative inter-agency effort that is linked to traditional village leaders and residents. Despite significant changes in land tenure, a significant proportion of lands in the Territory remain as “communally-owned” lands. Many village councils also remain active in the management of village affairs, lifestyle, and village improvement projects. Traditional leaders and village residents in American Samoa are keenly aware of many resource management issues, as well as the specific environmental conditions in their respective watersheds.

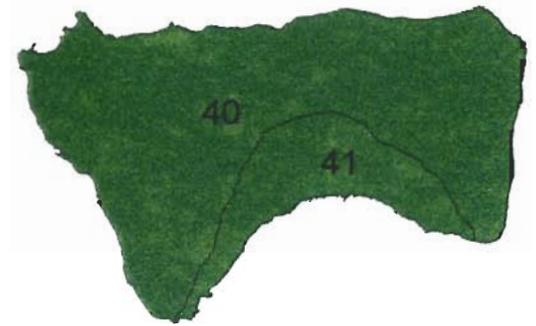
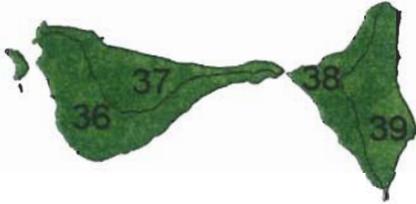
Desired modifications in the way people live and use natural resources typically require community motivation. More motivation for desirable changes can be expected when people affected can become involved in resource management decisions and gain some greater understanding and appreciation for the purpose and benefits of recommended changes in lifestyle, land use, and the use of other natural resources. It is their commitment that is essential to long-term change.

Despite many ongoing cultural changes, the village remains the heart of *faaSamoa*. It is this social unit that binds the families who live in Territory. It is interesting to note that some of the more recent immigrants to American Samoa, e.g., Tongans, are already building small communities within villages such as Nuuuli and Tafuna in order to organize themselves into their own “village units” away from their native islands.

Through the establishment of a constructive working relationship, the American Samoa Government is confirming to its traditional leaders that their wisdom and experience has relevance to addressing long-term management issues. Further, ASEPA and participating resource management agencies on the Watershed Resource Management Board will be sending the message that they stand ready to assist the villages rather than only telling them what to do, or not to do.

Through the sharing of information between villages and participating agencies, this process will help participating agencies better determine program and project priorities. Village leaders, in turn, will gradually begin to recognize that increased village participation and commitment to resource management will yield benefits that will help improve village sanitation, the quality of drinking water, flood control, surface water quality and coral communities, fishing opportunities, recreation, and general lifestyle.

Village leaders will be requested by the core management group to identify one representative that can be the primary point-of-contact for a given village. It is important that this person is respected and trusted by the village council. Ideally, the point-of-contact will also be a member of the village council.



Watersheds 36 - 41

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American Samoa Watershed Protection Plan

VOLUME 3 - LIST OF WATERSHEDS

Watersheds in this Volume Listed by Watershed Number

- 36. Ofu Saute
- 37. Ofu Matu
- 38. Olosega Sisifo
- 39. Olosega Sasae
- 40. Tau Matu
- 41. Tau Saute

Watersheds Listed Alphabetically (Watershed/Volume-Number)

- Aasu 1-7
- Afao-Asili 2-31
- Afono 1-11
- Alao 1-18
- Alega 1-22
- Amanave 2-33
- Amouli 1-20
- Aoa 1-15
- Aploau Sasae 1-5
- Aoloau Sisifo 1-6
- Auasi 1-19
- Aunuu Sasae 2-35
- Aunuu Sisifo 2-34
- Fagaalu 2-25
- Fagaitua 1-21
- Fagalii 1-2
- Fagamalo 1-4
- Fagasa 1-8
- Fagatele-Larsen Bay 2-29
- Fagatuitui-Vaaogeoge 1-9
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- Tau Matu 3-40
- Tau Saute 3-41
- Tula 1-17
- Vatia 1-10

OFU SAUTE Watershed 36

GEOGRAPHY

The Ofu Saute watershed generally represents the south and west sides of Ofu Island. The watershed comprises about 1.78 square miles of land area (Figure 36-1).

The inland boundaries of the watershed include Tumu Mountain and the mountain ridges known as Tia Ridge, Mako Ridge, and Leolo Ridge. Sunuitao Peak, which is located on the east end of Ofu, defines the east boundary of the watershed.

Along the south and west coasts of Ofu, the watershed extends between Feia Point, the northwest tip of Ofu, and Asagatai Point. Asaga Strait separates the Islands of Ofu and Olosega on the east side of Ofu. There are no embayments along the south and west coasts of Ofu.

RESOURCES OF THE WATERSHED

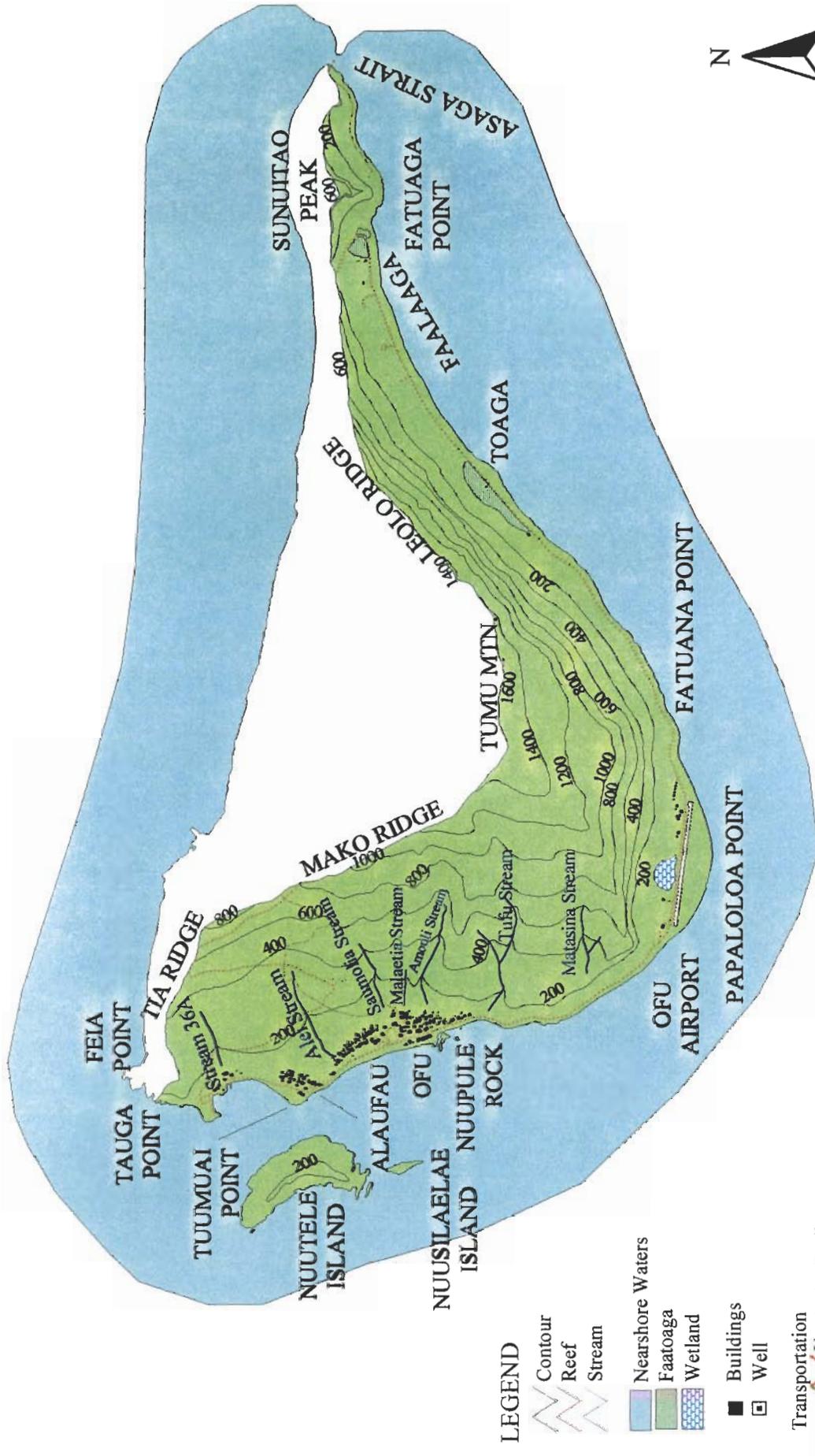
Soils

The U.S. Soil Conservation Service (National Resource Conservation Service) published a Soil Survey of American Samoa in 1984. Selected information derived from this survey provides some useful information for future watershed planning and management (Figure 36-2). Eight soil classifications were identified by the U.S. Soil Conservation Service for lands within the Ofu Saute watershed (Table 36-1).

**TABLE 36-1
SELECTED SOIL CHARACTERISTICS
OFU SAUTE WATERSHED**

SCS Soil Unit	Name	Typical Slope (Percent)	Flood	Runoff	Erosion	Soil Depth To:		Land Use Suitability	
						High Water (Feet)	Bed Rock (Inches)	Soil Based WW Treatment	Subsistence Ag Potential
2	Aua very stony silty clay loam	30-60	None	Rapid	Severe	<6	<60	Severe Slope	Poor
4	Fagasa family-Lithic Hapludolls-Rock outcrop assoc	70-130	None	Very Rapid	Very Severe	>6	20-40	Severe Slope Depth	Poor
6	Insak mucky sandy loam	0-2	Freq	Ponded to Slow	Slight	0.5-2.0	20-40	Severe Flooding depth to Rock Ponding	Poor for dry land crops
11	Ngedebus mucky sand	0-2	Occ	Very slow	Slight	>3.5	>60	Severe flood Wetness Poor Filter	Moderate
14	Ofu silty clay	15-40	None	Med	Mod	>6.0	>60	Severe Slope	Good
15	Ofu silty clay	40-70	None	Med	Mod	>6.0	>60	Severe Slope	Poor
27	Rock outcrop-Hydrandepts-Dystrandeps assoc	70-130	N/A	N/A	N/A	N/A	N/A	N/A	Poor
35	Urban Land-Ngedebus complex	0-5	Occ.	Slow	Slight	>3.5	>60	Severe Flood Wet Pool Filter	Poor

Source: U.S. Soil Conservation Service, 1984



Ofu Sautu Watershed
Existing Conditions

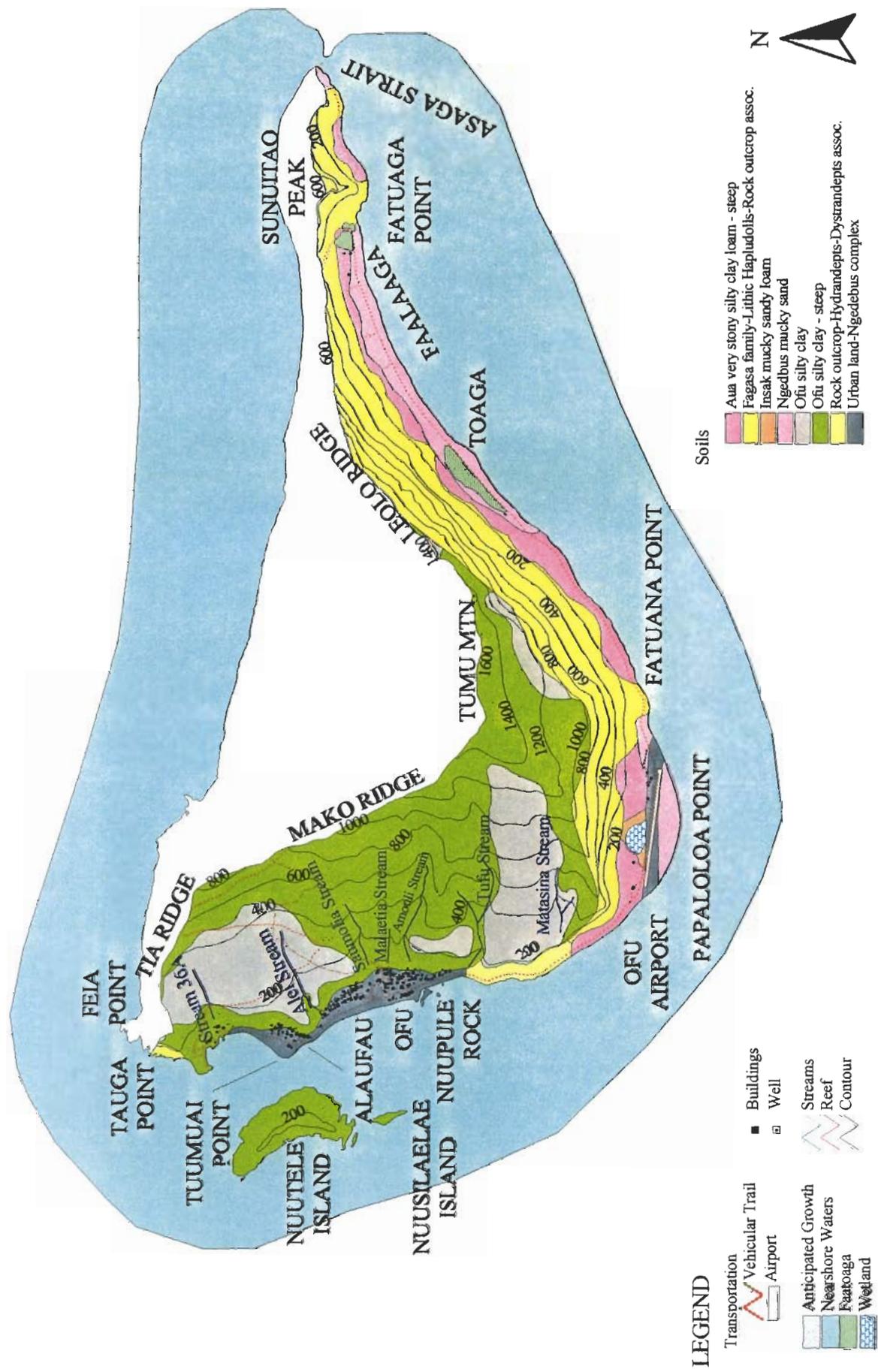
Figure 36-1

American Samoa Geographical Information System



Scale: 1:30,000

Prepared by: Pedersen Planning Consultants Tel: 307-327-5434



LEGEND

- Transportation
 - Vehicular Trail
 - Airport
- Anticipated Growth
- Nearshore Waters
- Faatoaga
- Wetland
- Buildings
- Well
- Streams
- Reef
- Contour

Soils

- Aua very stony silty clay loam - steep
- Fagasa family-Lithic Flapiudolls-Rock outcrop assoc.
- Insak mucky sandy loam
- Ngedbus mucky sand
- Ofu silty clay
- Ofu silty clay - steep
- Rock outcrop-Hydrandeptis-Dysirandeptis assoc.
- Urban land-Ngedebus complex



American Samoa Geographical Information System

Ofu Sautu Watershed Management Issues

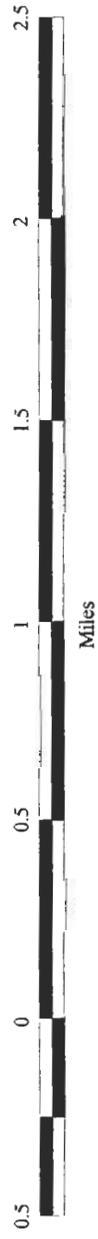


Figure 36-2

Urban Land-Ngedebus Complex

Urban land-Ngedebus complex soils (SCS mapping unit #35) is found in two areas of Ofu:

- north of Papaloloa Point in the vicinity of Ofu Airport; and,
- the inhabited village areas of Ofu and Alaufau villages.

These soils generally comprise coral fragments, sand, cinders and other material that have been graded or filled to support residential, commercial and public facilities in the village area.

The Ngedebus soil extends to a depth of 60 inches or more. The surface layer, which extends about 4 inches below ground elevation, typically contains light, brownish-gray and brown sand. The underlying material is characterized by pale brown and light yellow, brown sand.

The permeability of Ngedebus soil ranges between six and 20 inches per hour. Surface drainage on this soil is generally slow, and the hazard of potential soil erosion is slight. In some places, the soil is subject to occasional, brief periods of flooding during prolonged, heavy rainfall or during high tide (U.S. Soil Conservation Service, 1984).

These soils are generally suitable to support residential and commercial development in areas that are protected from flooding. However, this soil is poorly suited in unprotected areas (U.S. Soil Conservation Service, 1984).

Where moderate to higher housing densities occur, the U. S. Natural Resources Conservation Service recommends the use of community sewage systems prevent the potential contamination of groundwater and surface water supplies. Housing densities in Alaufau and Ofu range between five to seven units per acre.

Rock Outcrop-Hydrandepts-Dystrandepts Association, Very Steep

Along the west shoreline of Ofu, soils known as rock outcrop-hydrandepts-dystrandepts association (SCS mapping unit 27) are situated between Tufu Stream and Matasina Stream. These soils generally extend between the shoreline and the 200-foot contour (Figure 36-2). As the name implies, rock outcrop-hydrandepts-dystrandepts association represents a combination of rock outcrop, Hydrandepts, and Dystrandepts.

Exposed areas of bedrock represent Rock outcrop. The rock outcrop is on very steep and nearly vertical side slopes. This soil type contains little or no soil material. Where present, the soil is usually gravelly and ranges from sandy loam to silty clay loam.

Hydrandepts are located at higher elevations on very steep side slopes. Hydrandepts formed in volcanic ash under heavy rainfall. This soil is well drained and frequently represents a silty clay loam. Hydrandepts is typically shallow, or sometimes moderately deep to bedrock.

Dystrandepts are found at lower elevations on very steep side slopes. Dystrandepts, which is formed in volcanic ash, is well drained and are usually shallow or moderately deep to bedrock. The soil contains a stony surface layer and typically represents a clay loam or silty clay loam.

These soils are unsuitable for both subsistence agriculture and septic tank applications because of steep slopes and the lack of an adequate soil layer for soil-based wastewater treatment.

Ngedebus Mucky Sand

Four areas of the Island of Ofu contain Ngedebus mucky sand (SCS mapping unit #11):

- along the shore at Papaloloa Point;
- west of Fatuana Point and northeast of Ofu Airport;
- the Toaga area along the southeast coast of Ofu; and,

- in the vicinity of Asagatai Point on the east tip of Ofu.

Ngedebus mucky sand is a deep, somewhat excessively drained soil. This soil is derived from coral and sea shells.

The surface layer is typically black mucky sand that is approximately 12 inches thick. In some areas, the surface layer comprises loamy sand. The substratum is gray to very pale brown sand that extends to a depth of 60 inches or more.

The permeability of Ngedebus mucky sand is rapid. The potential hazard of water erosion is slight; potential runoff is very slow. Very brief periods of flooding can occur on these soils.

Ngedebus mucky sand is moderately suited to the production of subsistence crops such as taro, bananas, breadfruit and coconuts. However, agricultural uses are constrained by the retention of adequate moisture and low soil fertility.

Its suitability for septic tank installations and effluent drainfields is poor. Rapid permeability and the limited depth to the water table do not enable effective soil-based treatment.

Aua Very Stony Silty Clay Loam (30 to 60 percent slopes)

From northwest of Papaloloa Point to the west side of Sunuitao Peak, the steeper slopes of the lower watershed contain Aua very stony silty clay loam soils (SCS mapping unit #2). These steeper slopes are generally located downslope of the 200-foot contour (Figure 36-2).

The Aua soils range between seven to 60 inches in depth. The permeability of these soils (between 2 and 6 inches per hour) is moderately rapid. For watershed management purposes, it is important to note that these Aua soils have a high potential for runoff and erosion.

This Aua soil is not recommended for agricultural production because of the stoniness of the soil, the high erosion potential, and hazards associated with subsistence crop cultivation on steeper slopes. However, when cultivation in these soils is necessary, the use of a mulch or ground cover is recommended to reduce soil erosion in cultivated areas.

The U.S. Soil Conservation Service estimates that this soil can annually sustain up to 5 tons per acre of erosion without impacting crop productivity (U.S. Soil Conservation Service, 1984). While the erosive characteristics of this soil generally may not significantly impact subsistence crop productivity, the erosive quality of the soil can be a significant contributor to sedimentation in downslope streams and the nearshore waters.

The general characteristics of these Aua soils are also undesirable for individual wastewater disposal systems (U.S. Soil Conservation Service, 1984). The soils contain a significant amount of larger stones that hamper installation and provide inadequate soil treatment.

Insak Mucky Sandy Loam

Vaoto Marsh is situated on the north side of Ofu Airport. The Marsh and adjoining land areas to the east and west contain Insak mucky sandy loam (SCS mapping unit 6).

Insak mucky sandy loam is a moderately deep and very poorly drained soil that is typically found in coastal depressions. The soil is formed in coral sand and organic matter.

The surface layer, which is typically a black mucky sandy loam, is approximately 11 inches thick. In some areas, however, the surface layer contains a mucky loamy sand. Very dark, gray-mucky loam comprises a second layer of about six inches. White and light gray sand, approximately 9 inches thick, lies over coral that is found about 26 inches below ground elevation. The depth to bedrock ranges from 20 to 40 inches.

Soil permeability ranges between six and 20 inches per hour. The hazard of potential water erosion is considered slight; potential runoff is ponded to slow.

The depth of the water table is 10 to 20 inches below ground elevation. Areas that are unprotected are frequently flooded.

The soil is suitable for the production of wetland taro, and other water tolerant plants.

Insak mucky sandy loam is unsuitable for septic tank and effluent drainfield applications. Potential flooding and the limited depth to the water table do not promote effective soil-based treatment.

Fagasa Family-Lithic Hapludolls-Rock Outcrop Association

Steeper upland slopes along the south slopes of Tumu Mountain and Leolo Ridge, as well as the upland slopes of Sunuitao Peak, contain well-drained soils known as the Fagasa Family-Lithic Hapludolls-Rock outcrop association (SCS mapping unit 4).

The Fagasa Family soils contain a surface layer of dark, brown silty clay that is about 12 inches thick. A dark brown subsoil is approximately five inches thick. The substratum, which is characterized by a dark-brown, sandy clay loam, extends to a depth of 31 inches. The depth to bedrock ranges between 20 to 60 inches or more.

The Lithic Hapludolls soils are shallow, well-drained soils that are derived from igneous rock. The surface layer is highly variable, but U.S. Soil Conservation Service soil scientists have observed the surface layer to contain about five inches of dark brown, cobbly silty clay. The subsurface layer, which is about four inches thick, is a dark brown, very cobbly, silty clay. The substratum represents a clay loam, approximately six inches thick, over weathered bedrock.

The soil permeability of the Fagasa Family and Lithic Hapludolls soils are both between two and six inches per hour. Since the Fagasa Family-Lithic Hapludolls soils typically occur on very steep slopes, potential runoff can be very rapid. The potential for water erosion is very severe (U.S. Soil Conservation Service, 1984).

The cultivation of subsistence crops on these soils is not considered desirable. However, when cultivation in these soils is necessary, care should be exercised to minimize the amount of exposed soil in cultivated areas.

When heavier rainfall events occur, significant erosion of these soils can be expected from undeveloped upslope areas of the watershed. Natural runoff from steeper slopes in the watershed carries water, sediments, and organic debris to downslope drainage courses and streams. Such erosion can readily influence downstream water quality.

Fagasa Family and Lithic Hapludolls soils are unsuitable for septic tank and effluent drainfield applications. Steeper slopes and the limited depth to bedrock do not afford effective soil-based treatment of wastewater.

Ofu Silty Clay (40 to 70 percent slopes)

A portion of the steeper, upland slopes of Tumu Mountain and Mako Ridge are characterized by Ofu silty clay (SCS mapping unit 15). This soil is a deep, well drained soil formed in volcanic ash and residuum that is derived from basic igneous rock.

The surface layer, which is about 10 inches thick, is typically dark reddish-brown, silty clay. In some locations, the surface layer represents a stony silty clay. The subsoil contains about nine inches of dark reddish brown silty clay loam; reddish brown silty clay loam extends another 18 inches. The

substratum of reddish-brown, silty clay loam extends to a depth of 60 inches or more. The depth to weathered bedrock ranges from 40 to 60 inches or more.

Ofu silty clay soils have a soil permeability that ranges between two and six inches per hour. The potential hazard of water erosion is severe; the potential occurrence of runoff is medium to rapid.

These soils generally support woodlands, but not commercial timber harvests. Steeper slopes, as well as potential water erosion and runoff hazards, make these soils unsuitable for subsistence agricultural production.

The use of these soils for septic tank and effluent drainfield applications is also unsuitable. Steeper slopes where these soil occur do not promote effective soil-based treatment of wastewater effluent.

Ofu Silty Clay (15 to 40 percent slopes)

Ofu silty clay on 15 to 40 percent slopes (SCS mapping unit 14) is found on a portion of the slopes of Leolo Ridge, the steeper southwest slopes of Tumu Mountain, and the northwest slopes of Mako Ridge. This Ofu silty clay soil is a deep, well drained soil that is formed in volcanic ash and residuum derived from basic igneous rock.

The surface layer is typically a reddish-brown silty clay that is approximately 16 inches thick. A dark brown, silty clay loam characterizes the upper 29 inches of the subsoil; the lower 15 inches of the subsoil contains a dark brown silty clay. A substratum of dark brown silty clay, or silty clay loam, is found in some areas at depths of 30 to 60 inches or more.

The permeability of Ofu silty clay ranges between two and six inches per hour. The potential hazard of water erosion is moderate; potential runoff is considered to be medium (U.S. Soil Conservation Service, 1984).

Ofu silty clay is well-suited for subsistence crop production. Typical crops produced from these soils include coconuts, breadfruit, bananas and taro.

These soils are poorly suited for septic tanks and related effluent drainfields. Steeper slopes do not enable effective soil-based treatment of wastewater.

Streams

Stream Locations

There are seven streams in the Ofu Saute watershed. These drainages are all located along the west slopes of Tumu Mountain and Mako Ridge.

North of Alaufau, an unnamed stream (Stream 36A) originates at about the 315-foot elevation on the south side of Tia Ridge. This stream discharges north of the ASPA office, which is located generally east of the Ofu Harbor boat launching ramp. This stream drains the south slopes of Tia Ridge and the northwest slopes of Mako Ridge.

Alei Stream begins at approximately 325-feet above mean sea level along the southwest slopes of Mako Ridge. The stream passes through the north side of Ofu Village before discharging along the shoreline into the nearshore waters.

The headwaters of Saumolia Stream are located at about the 450-foot contour along the southwest slopes of Mako Ridge. The stream drains a portion of these slopes and discharges upland of Ofu Village near the 37-foot elevation.

Malaetia Stream also drains the southwest slopes of Mako Ridge. The stream originates near the 255-foot elevation. Malaetia Stream also discharges upslope of Ofu Village near the 45-foot contour. However, a small, man-made channel on the north side of Vaeao Store carries stormwater runoff from the center of the village to the shoreline. This channel primarily transports flows that are carried by Malaetia Stream.

Amouli Stream generally parallels Malaetia stream. This stream course begins considerably higher at about 545 feet above mean sea level. However, it also discharges upslope of Ofu Village at about the 70-foot elevation.

South of Ofu Village, Tufu Stream and one tributary carry surface runoff from the west slopes of Tumu Mountain. The main stem of the stream begins at about the 680-foot contour. Its point of discharge is upslope of the primary shoreline roadway at approximately 60 feet above mean sea level.

Along the southwest slopes of Tumu Mountain, Matasina Stream originates near the 600-foot elevation. This stream also discharges upslope of the primary shoreline roadway at approximately 270 feet above mean sea level.

Stream Flows Within the Watershed

In May, 1996, Chief Tafao reported that the four streams in Ofu Village (Alei, Saumolia, Malaetia, and Amouli) provided only intermittent flows. Otherwise, no other streamflow data was discovered for the seven streams in the watershed.

Surface Water Quality

Streams

The four streams that flow in the vicinity of Ofu Village also generate significant turbidity in the nearshore waters during and following heavier rainfall periods (Tafao, 1996).

Nearshore Waters

Observations by marine ecologists in October, 1979 reported good underwater visibility in the strait between Ofu and Nuupele Rock. However, refuse and silt accumulated in the nearshore boat channel (Aecos and Aquatic Farms, 1980).

During the same period, marine biologists also documented excellent underwater visibility in a nearshore depression that extended northwest from Papaloloa Point. Reduced water quality was evident closer to Papaloloa Point. It was also observed that longshore currents in this area flowed to the northwest.

Wetlands

On the north side of Ofu Airport, there is small coastal marsh known as Vaoto Marsh. The marsh contains approximately four acres of land that is backed by steep coastal cliffs. Available topographic maps of this area suggest that this marsh was somewhat larger prior to the construction of Ofu Airport.

Whistler reported in 1976 that vegetation in Vaoto Marsh primary consisted of mangrove, water chestnut, and willow primrose. He also noted that the marsh was reverting back to a natural condition because of an apparent neglect of cultivation.

During a May, 1996 survey of the watershed, it was learned that stormwater flows, which drain into the marsh, are normally detained within the margin of the marsh (Vaovasa, 1996).

Marine Resources

Coral Communities

The Island of Ofu is encircled by a fringing reef. Available topographic maps indicate that this reef ranges between 300 and 1,00 feet seaward of the shoreline.

Various private consultants have made field investigations of the fringing reef that adjoins the watershed since the late 1970's. In a cumulative sense, available survey information suggests that:

- Corals in this watershed have not been significantly reduced by recent storms or crown-of-thorns starfish infestations as coral communities around Tutuila Island.
- A number of rare corals inhabit the fringing reef along the south coast of Ofu.

1978-1979

On the reef flat seaward of Alaufau, marine life was almost non-existent to Nuutele Islet. Coral cover was less than 5 percent on rubble located north of Tuumuai Point.

The construction of Ofu Harbor was completed around 1975. After only four years, corals rapidly colonized harbor structures. The revetment within the inner harbor was characterized by a coral coverage near 50 percent between depths of 5 and 15 feet.

Seaward of Ofu Village, live coral was absent from a narrow boat channel that paralleled Ofu Beach. There was about five percent live coral cover on the reef flat near Nuutele Islet.

South of Nuupule Rock, coral coverage was only five percent on the inner reef flat. Limited coral coverage was noted on the outer reef flat.

Small amounts of coral were observed on the relatively flat outer reef platform that was seaward of Papaloloa Point.

In the vicinity of Asaga Strait, live coral was sparse near the shoreline. Offshore, coral coverage increased to about 15 percent. Near the middle of Agasa Strait, coral coverage ranged from 40 to almost 100 percent at a depth of 6 feet.

1992

Field investigations were made by Maragos, Hunter, and Meier in 1992 along the reef front that is seaward of Ofu Village.

These marine ecologists noted that the reefs seaward of Ofu Village are partially protected by offshore islands, Nuutele and Nuusilaelae. The nearshore waters in this area “.....support among the best developed reef slope coral communities in American Samoa. Furthermore, the reef flats along Ofu’s south coast to the east of Vaoto Lodge and the airfield are among the best developed in the territory. The rare blue coral Heliopora coerulea and several other corals form spectacular microatolls on the reef flats and reef moats. The National Park Service has designated a national park for this reef region, and the Territory of American Samoa designated the reef segments between the airfield and the National Park area as a territorial park. This latter reef area was intensively surveyed in September 1992” (Maragos, Hunter, and Meier, 1992).

1995

A recent 1996 study of various coral reefs throughout the Samoan Archipelago included the performance of five transects along the reef front that is located on the seaward side of Nuupule Rock. The study focused primarily upon the quantification of coral communities, the abundance and diversity of reef fish, and selected habitat characteristics.

Coral cover of less than 20 percent was observed. Fish species richness ranged between 100 to 149 species. present. Fish density was observed to be between 5,000 and 9,999 individuals per ha. Fish biomass was documented between 500 to 999 kilograms per ha.

Green also noted that the coral reefs of the Manua Islands were severely damaged by Hurricane Tusi in 1987, but escaped significant damage from Hurricane Ofa in February, 1990 and Hurricane Val in December, 1991. In addition, the reefs in Manua were also influenced by infestations by the crown-of-thorns starfish and a recent coral bleaching event. From her review of past studies, Green concluded that the reef fronts of the Manua Islands tended to be in better condition than those on Tutuila.

Wildlife Resources

In the 1980 Coral Reef Inventory, Nuutele Islet was identified as a major breeding place for five of the six species of seabirds that are known to nest on the Island of Ofu. These birds included:

- brown boobies;
- blue-grey noddies;
- brown noddies;
- white terns; and,
- red-footed boobies.

Three larger caves underneath Nuutele Islet, as well as trees on the Islet may also provide roosting sites for fruit and sheath tailed bats (Aecos and Aquatic Farms, 1980).

Aecos and Aquatic Farms also noted that flying fox roosts are found on the sea cliffs along the south coast of Ofu. It was also reported that the common brown noddy nests on the southern cliffs above Toaga.

More recently, a 1986 Survey of the Forest Birds of American Samoa also documented a considerable number of forest birds in various areas of the Island of Ofu (Engbring and Ramsey, 1989). These habitats generally included rain forest, secondary vegetation, mixed vegetation, and plantation lands. Specific locations of these habitats were not identified. However, several brown noddies were observed landing on the rocky west cliffs of Nuutele Islet. White-rumped swiftlets were also observed in this area.

In August, 1997, Brook counted 211 fruit bats that were exiting from a ridge behind the Vaota Lodge near Ofu Airport (Utzurum, 1998).

Shoreline Protection

The fringing reef of the Ofu Saute watershed affords some natural protection to the shoreline of the watershed. In addition, some man-made shore protection facilities have been developed at various shoreline locations:

- Ofu Harbor;
- South of Tuumuai Point;
- South of Nuupule Rock;
- the east and west ends of the Ofu Airport runway.

North of Alaufau, shoreline protection facilities include revetments associated with Ofu Harbor. Construction of the original harbor was completed in 1975. However, severe harbor damages that were sustained by Hurricanes Val and Ofa required significant repairs to protective revetments, a breakwater, and adjoining shoreline revetments in the mid-1990's.

Other shoreline protection facilities include marginal shore protection. These facilities generally include coral and basalt walls, as well as the placement of larger, basalt boulders.

In March, 1994, Sea Engineering, Inc. and Belt Collins Hawaii published a shoreline inventory report that outlined, in part, ongoing shoreline erosion conditions and related shore protection needs for American Samoa. Sea Engineering, Inc. and Belt Collins Hawaii noted the following conditions in the Ofu Saute watershed that were determined to be “critical”, or “potentially critical” conditions.

Tuumuai Point

In the vicinity of Tuumuai Point, there is a public dispensary that is operated by the American Samoa Government. The hospital immediately inland of Tuumuai Point is the only structure that is located seaward of the primary shoreline roadway. Critical erosion was documented to be occurring along the southern 100 feet of the beach at Tuumuai Point where waves reach a 3-foot rock wall that supports the foundation of the dispensary.

North of Nuupule Rock

Several homes are built seaward of the primary shoreline roadway and threatened with erosion. Some shore protection measures have been constructed or placed on the shoreline such as filled 50 gallon drums, a loose coral wall, and large 6-foot coral boulders at the mean lower water line. A sand beach is present, but the homes were observed to be less than 50 feet from the top of the wave swash, and only 3 to 4 feet above mean high water.

South of Ofu Village

South of Ofu Village there is a shoreline reach, between Tufu Stream and Matasina Stream that extends about 2,500 feet. The shoreline dirt trail closely parallels the shoreline and ranges between the 11 and 33-foot elevation. At two locations, a scarp is cut into the backshore and has damaged the shoreline trail. “*At the north end, a concrete retaining structure has been built and filled in. In the middle of the reach, the damage has been repaired with coral and basalt gravel and rocks*” (Sea Engineering, Inc. and Belt Collins Hawaii, 1994).

Papaloa Point

Along a 150-foot length west of the Ofu Airport runway, large basalt boulders have been placed alongside the shoreline trail to provide some shoreline protection. The airport runway is located on the flat backshore approximately 8 feet above MSL (mean sea level). The runway is set back over 400 feet in the middle, and 50 to 100 feet at each end. A scarp is cut into the backshore of the shoreline reach that is adjacent to the west end of the runway. The scarp, which is located within 5 feet of the west end of the runway, indicates past storm erosion.

Groundwater and Surface Water Supplies

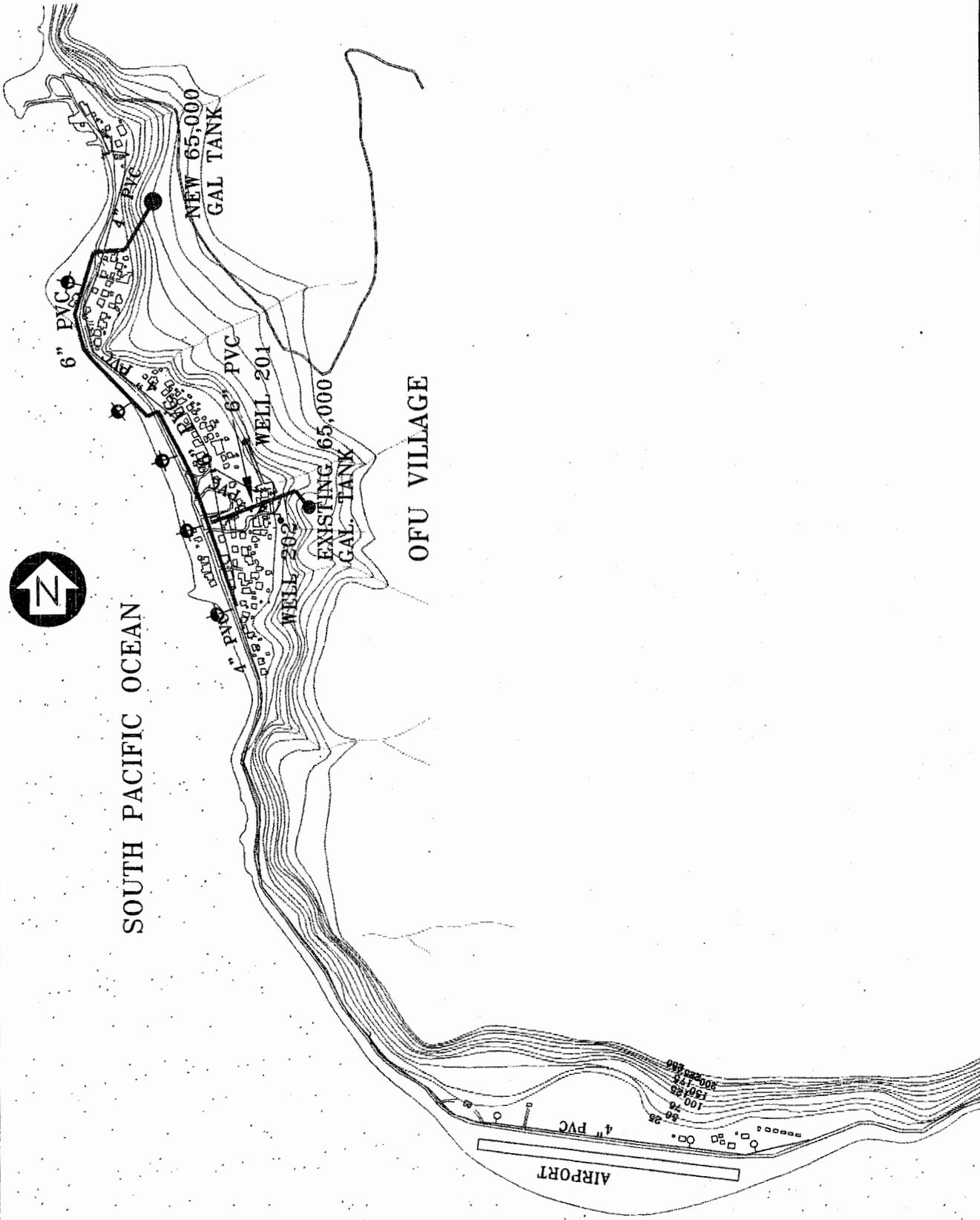
Groundwater Supply and Quality

Ofu Village has a satellite water system that is operated and maintained by the American Samoa Power Authority (ASPA). This system includes, in part, two groundwater wells (ASPA wells 201 and 202). This water system serves Ofu Village and the Ofu Airport area (Figure 36-3).

Good groundwater quality is provided by these groundwater sources. The groundwater supply is regularly chlorinated at well 202 via the regular application of a batched solution of liquid bleach and water. Existing chloride levels are low (ASPA, 1995).

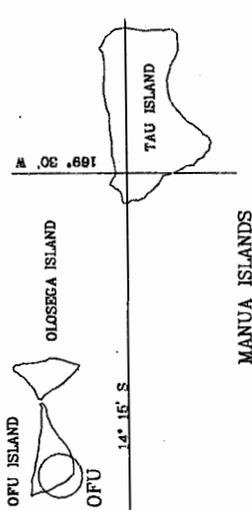
Surface Water Supply and Quality

There is no village water system in the Ofu Saute watershed (ASPA, 1995).



SOUTH PACIFIC OCEAN

OFU VILLAGE



MANUA ISLANDS

SCALE = 1 INCH = 800 FT.



LEGEND

- EXISTING**
- 4" PVC WATER MAIN, SIZE & TYPE
 - ROADS
 - CONTOURS
 - STREAMS
- PLANNED**
- 6" PVC WATER MAIN, SIZE & TYPE
 - 6" FIRE HYDRANT

FIGURE 36-3
OFU VILLAGE
PLANNED WATER SYSTEM IMPROVEMENTS

PLANNING CRITERIA

1995 POPULATION (ESTIMATED):	483	2015 POPULATION (FORECASTED):	549
1995 AVERAGE DAY DEMAND:	43,275 GAL.	2015 AVERAGE DAY DEMAND:	63,499 GAL.
		CONSTRUCTION COST (1995 USD):	\$230,000



**AMERICAN SAMOA
POWER AUTHORITY**

P.O. BOX PFB, PAGO PAGO, AMERICAN SAMOA

USE OF THE WATERSHED

Resident Population

Between 1980 and 1990, the resident population of Ofu Village increased from 345 to 353 residents. Such growth represented an average annual growth rate of about 2.3 percent. Development activity between 1990 and 1995 increased resident population to about 433 persons.

Population trends reflected in the 1990 Census statistics suggest that considerable in-migration has occurred in this community between 1980 and 1990. The proportion of residents who were born outside of American Samoa during the 1980-1984 period was about 15 percent. Between 1985 and 1990, the proportion increased to 53 percent. In 1990, the proportion declined sharply to 13 percent. The more recent downward swing of migration within Ofu suggests that a significant return of American Samoans, who were born outside of American Samoa, occurred during the 1985-1989 period.

Land Uses

Residential

The 1990 Census documented 59 units in the Ofu village Census area. Roughly 81 percent of the homes were owner-occupied; approximately two percent were rental units. Seventeen percent were vacant or used as vacation homes by their owners.

ASG Building Division records indicate that building permits were issued for three new single family structures from 1990 through 1994. Consequently, the 1995 housing stock included about 62 homes.

Agriculture

Piggeries

There were five piggeries in Ofu Village in May, 1996. Each piggery contained between six and 20 pigs (Tafao, 1996).

Subsistence Agricultural Crops

Faatoaga were scattered throughout various parts of the watershed.

Smaller plantations were observed on the east side of Ofu in the Toaga and Faalaaga areas. These areas were generally located on the north side of the primary shoreline roadway.

Along the upper slopes of the Matasina Stream drainage, an upslope plantation was observed on the south side of Matasina Stream. Plantations were also documented behind Ofu Village.

Commercial

There are about 17 commercial enterprises that operate on the Island of Ofu. These include the Amerika Samoa Bank, eight village grocery and retail stores, one bakery, two gasoline distributors, a construction contractor, two commercial agricultural product distributors, and two restaurants.

Vaoto Lodge, which is located on the northeast side of Ofu Airport, includes five guest cottages. The cottages can provide overnight accommodations for up to 20 persons.

Industrial

There are no industrial operations on the Island of Ofu.

Public Facilities

Public facilities in Ofu Village include a Post Office, a local public health dispensary, and Ofu Harbor.

The ASG Department of Education offers one early childhood education program in Ofu. In September, 1994, this program had a student enrollment of 17. Elementary school-aged children attend Olosega Elementary in the nearby village of Olosega. High school students attend Manua High School on Tau Island.

Use of the Nearshore Waters

Nearshore Fishing

One local resident indicated that 10 to 15 persons per day use the nearshore waters near the Ofu Airport for fishing (Vaovasa, 1996).

In Ofu Village, Chief Tafao reported that five to six persons per day typically use the nearshore waters for fishing purposes. Another 20 persons use the nearshore waters for swimming and general water recreation.

RESOURCE MANAGEMENT ISSUES

Future Land Uses to the Year 2015

Residential

Potential expansion area for future residential housing is located in four areas of Ofu:

- At least 112 single family homes could be built on moderate slopes that are *mauga* of Alaufau and northwest of Alei Stream.
- Between Samouli and Malaetia Streams, there is about one acre of shoreline property that remains undeveloped. About six single family units could be constructed there.
- Between Matasia and Tufu Streams, about 15 single family homes could be constructed *mauga* of the shoreline roadway between 200 and 275 feet above mean sea level.
- Along Ofu Island's southern coastline, between Papaloloa Point and Fatuaga Point, an existing faatoaga area could provide space area for about 66 new homes at a density between three and four units per acre.

While significant potential expansion area exists, only a gradual in-migration of more middle-aged American Samoans will generate some demand for new residential construction. However, this in-migration will continue to be offset with the out-migration of Manua's youth who attend high school and/or college off-island, but choose to not return.

The anticipated establishment of a U.S. National Park area along Ofu Island's southern coast will begin to bring a small wave of *palagi* visitors beginning in the year 2000. These visitors will undoubtedly be impressed with the beauty and resources Ofu and Olosega and will convey their conclusions to local chiefs and other Samoans in Tutuila and the continental United States.

These reactions will prompt greater interest among American Samoans, particularly those living on Tutuila. More American Samoans residing on Tutuila will begin to take more frequent weekend visits to Ofu and Olosega. Increased interest can be expected for the gradual development of a sizable number of vacation homes on the moderate slopes *mauga* of Alaufau. An unimproved dirt trail already provides vehicular access to this area.

Similarly, the inland *faatoaga* behind the proposed National Park shoreline area also provides a likely destination for future new residents of Ofu. The existing shoreline roadway provides good access to the Ofu Airport, other parts of Ofu Village, and the Island of Olosega.

Excellent views, the proximity to air transportation, and convenient access to Ofu Village will provide all the “ingredients” necessary to attract more new residential construction by American Samoans who are returning to seek an early retirement, help aging extended family members, or desire a more relaxed lifestyle. During the 1996-2015 period, about 30 new housing units are expected to be constructed by these future residents. These homes will be scattered throughout each of the four potential residential expansion areas; roughly 80 percent of the housing will be developed *mauga* of Alaufau or behind the proposed National Park shoreline area.

A second source of new residential construction will be derived from some “second-home” development by a smaller number of more affluent American Samoan families between 2006 and 2015. Such development will result from increased crowding on Tutuila that will prompt a greater number of off-island recreational visits by local residents. More affluent families will be those who will be able to invest in a second home and are able to spend a greater amount of time away from Tutuila. Prime candidates are those persons who are already involved in professional services such as lawyers, consultants, accountants, and sales representatives who are not dependent upon the maintenance of an office space in the Pago Pago Harbor area. Cellular telephones, personal computers, modems, and other telecommunication opportunities will only enhance potential investment opportunities to other professionals in the community.

During the next 20 years, ASPA believes that these potential development opportunities and constraints will generate the following sequence and volume of residential construction.

- | | |
|-----------|--|
| 1996-2000 | Two new single family homes between Samouli and Malaetia Streams between shoreline and 25-foot elevation.
One new single family home between Matasia and Tufu Streams between 200 and 275 feet above mean sea level. |
| 2001-2005 | One new single family home between Samouli and Malaetia Streams between shoreline and 25-foot elevation.
Two new single family homes between Matasia and Tufu Streams between 200 and 275 feet above mean sea level. |
| 2006-2010 | Six single family homes <i>mauga</i> of Alaufau and northwest of Alei Stream between 175 and 450-foot elevation.
Six single family homes along the southern coastline of Ofu between Papaloloa and Fatuaga Point (between shoreline and 25-foot elevation). |
| 2011-2015 | Six single family homes <i>mauga</i> of Alaufau and northwest of Alei Stream between 175 and 450-foot elevation.
Six single family homes along the southern coastline of Ofu between Papaloloa and Fatuaga Point (between shoreline and 25-foot elevation). |

The cumulative effect of this prospective residential growth is that the housing stock would increase to roughly 92 housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 5.97 persons per household. Consequently, the anticipated 2015 population will include about 549 persons.

Commercial

Informal discussions with the Honorable Tufele Lia, former Lt. Governor of American Samoa and present Manua District Governor, suggest that the American Samoa Government may eventually encourage the establishment of an increased number of commercial agricultural producers. District Governor Lia believes that expanded harbor facilities, an improved shoreline roadway, and the availability of vacant, developable lands that are suitable for agriculture, and the need for cash employment opportunities will drive ASG's future commitment to increased commercial agricultural production.

Increased commercial agricultural production may result in the development of some limited warehousing near existing harbor facilities. It is expected that a privately-owned warehouse will be built between 2001 and 2006 and will employ four persons.

The gradual influx of returning American Samoans and some additional part-time residents on the Island of Ofu will generate a limited increase in commercial retail establishments within Ofu Village. Future commercial expansion will include a new video store and an amusement center between the year 2001 and 2005. Two additional retail stores will begin operation during the 2006-2010 period. All commercial facilities will most likely be constructed on the one acre of vacant shoreline property in Ofu Village that is situated between Samouli and Malaetia Streams.

Hotel and Visitor Accommodations

The establishment of a National Park along the southern coast of Ofu Island will encourage a greater number of visitors to the Island, as well as an increased demand for overnight accommodations. It is believed that the demand for overnight accommodations will be limited, but sizable enough to support the gradual development and operation of two bed and breakfast facilities between 2001 and 2005. One additional bed and breakfast facility will begin operation between 2006 and 2010; one additional bed and breakfast will be established between 2011 and 2015.

Industrial

Despite modest increases in future resident population, no additional light industrial operations or facilities are anticipated during the next 20 years. The lack of developable land that would be suitable for industrial activities, as well as the lack of a nearby consumer market, represent the primary constraints to future industrial development in this community.

Public Facilities

Despite modest increases in the future population of Ofu, no facility expansions are anticipated for these facilities.

Population characteristics for Ofu in 1990 suggest that approximately seven percent of the village population is three and four years of age, 26 percent is elementary school age (ages 5 through 13), and about eight percent is high school age (14-18).

Application of these assumptions to anticipated future population suggests that Ofu will contribute the following estimated student enrollments to facilities within and outside the community in the year 2015:

- early childhood education 38 students
- elementary school 143 students
- high school 44 students

Impact of Future Population Growth Upon Water Consumption and Waste Generation

Future population growth and changes in land use in the Ofu Saute watershed will increase the volume of future wastewater and solid wastes that are generated by local residents. Wastewater generation in Ofu Village, for example, is expected to rise from about 30,293 gallons per day (gpd) to 44,449 gpd in the year 2015.

The consumption of potable water will also increase with a growing population. The American Samoa Power Authority (ASPA) estimates that the average day demand for water in Ofu was about 43,275 gallons in 1995. By the year 2015, ASPA anticipates that the average demand will increase to roughly 63,499 gpd.

Flood Potential

A flood insurance study of American Samoa and related flood insurance rate maps were published by the U.S. Federal Emergency Management Agency (FEMA) in 1991. The study evaluated selected geographical locations throughout the Territory. Hydrologic and hydraulic analyses that were presented in the study were made by the U.S. Army Corps of Engineers, Pacific Ocean Division. No detailed study was made of the Island of Ofu.

Inland Flood Potential

Potential flooding can be expected in Vaoto Marsh via a 100-year storm event. However, no potential flood elevations were calculated by Federal Emergency Management Agency (FEMA) for these areas.

The remaining areas of the Ofu Saute watershed have been designated by FEMA as “zone x”. This designation indicates that the areas are outside of the 100-year floodplain (Federal Emergency Management Agency, 1991). In essence, FEMA is suggesting that the flood hazard potential in these areas is limited.

Coastal Flood Hazard

The flood insurance rate map for the shoreline of the Ofu Saute watershed indicates that there is a coastal flood hazard through much of the nearshore waters and adjoining shoreline. However, no potential coastal flood elevations were determined by FEMA for the shoreline of the watershed.

Stormwater Runoff/Sedimentation and the Relationship to Surface Water Quality

Intermittent stream discharges on the west side of Ofu occasionally generate turbid fresh-water into the nearshore waters. The primary source of these turbid waters is derived from more erosive soils on steeper, undeveloped slopes of Tumu Mountain and Mako Ridge. Fortunately, only one stream in Ofu Village discharges into the nearshore waters at the shoreline.

Ofu Village residents use a considerable amount of coral fill around homes and village stores. This practice is very desirable as it helps filter urban runoff that could otherwise flow into man-made channels within the village.

The detention of turbid stormwater runoff on the west side of Ofu is desirable, but not practical. There are few, if any, areas that are sizeable enough and in close proximity to existing drainages.

However, anticipated residential development is expected to occur on moderate slopes upslope of Alaufau. Should this development be realized, the installation of individual drywells for each residence or the development of a community stormwater detention facility should be required to reduce potential stormwater discharges into the nearshore waters.

Nearshore Water Quality and the Marine Environment

Turbidity and Sedimentation

The concern for continued turbidity and sedimentation in the nearshore waters of the watershed is important. Coral communities are significantly dependent upon the availability of light and related photosynthesis, and occasional periods of significant turbidity and sedimentation do not promote long-term coral nutrition, growth, reproduction, and depth distribution (Richmond, 1993).

When corals fertilize, they are free-swimming. Consequently, they need a good location to settle and make a good attachment. With significant soil deposition, sediments can physically interfere with the recruitment of coral larvae (Richmond, 1993; Dashbach, 1996).

Coral communities are an important component of the overall ecology of the nearshore waters that adjoin the Ofu Saute watershed. They provide shelter to fish, invertebrates, and other marine organisms. Some of these resources represent a supplemental food source for residents of the watershed and other areas of Ofu Island.

Nutrient Inputs

Some nutrient contribution is also occurring through the continued use of septic tanks, cesspools, or other soil-based, wastewater treatment systems in the watershed. In addition, some of the piggeries in Ofu may also discharge nutrient-enriched wastewater into local streams and man-made channels. These sources of nutrients are also accompanied by some bacterial contamination.

While the total volume of wastewater generation from the watershed is limited, the discharges are concentrated in the inhabited village area where housing densities are between five and seven housing units per acre. Local soils are generally inadequate to provide effective treatment.

The long-term input of turbid and nutrient-enriched waters into the nearshore waters represents an important concern. These inputs are potentially detrimental to the quality because they can adversely change the composition of the nearshore marine environment. However, the degree of impact upon water quality is also highly dependent upon currents and water exchange within the nearshore environment.

As the population of the watershed grows, nutrient and bacterial inputs will only increase. Aside from these resource management considerations, the future use of the nearshore waters for fishing, swimming and general recreation will eventually represent a more significant public health concern unless practical steps are made to reduce potential nearshore water contamination.

The limited population of Ofu will likely continue to make this system expansion unfeasible. In the absence of this reality, village areas in the Ofu Saute watershed that are unsuitable for soil-based, wastewater treatment should be more specifically identified. As recommended in the ASPA Utilities Master Plan, this identification process should be based upon a more detailed sanitation survey of more densely inhabited areas such as Ofu and Alaufau. This survey would evaluate existing wastewater treatment practices, soil characteristics, the location and density of land uses, the distance to surface water supplies and the nearshore waters, topography, and other related factors. Using the conclusions and recommendations associated with this evaluation, ASPA and other participating Project Notification and Review System (PNRS) agencies will be better able to:

- require the use of septic tanks and leachfields that provide a sufficient amount of additional soil-based treatment;
- provide greater technical assistance to building permit applicants; and, if necessary,
- deny building applications in land areas that are unsuitable for soil-based treatment systems.

Long-Term Monitoring

The future monitoring of the nearshore waters is necessary and should be combined with water quality monitoring of the nearshore waters that adjoin Ofu Village. Turbidity and sedimentation are the primary stresses to the coral communities in the nearshore waters. However, future levels bacterial contamination and nutrient inputs should also be documented to help ensure future public safety and evaluate potential stresses to the fringing coral reef communities.

In addition, the ASG Department of Marine and Wildlife Resources should monitor the coral communities along the reef front that is seaward side of Nuupule Rock at least once every three years. Long-term monitoring of this site should also include an evaluation of the impact of sedimentation and turbidity that already influence the nearshore marine environment.

Groundwater and Surface Water Supplies

As stated earlier, Ofu Village is already connected to the ASPA water system. To facilitate the long-term conservation of these resources, it is also recommended that a 100-foot buffer or setback should be established around each surface supply, i.e., stream or spring catchment, in the watershed. In essence, the establishment of piggeries, new structural development, or other land uses would not be permitted within the 100-foot radius to prevent potential contamination of the surface supplies.

MANAGEMENT NEEDS AND RECOMMENDATIONS

The primary focus of future resource management in the Ofu Saute watershed will be to:

- detain urban runoff through the use of drywells in conjunction with the development of any new residential structures upslope of Alaufau;
- perform detailed sanitation survey of the inhabited Ofu Village area; and,
- conserve coral communities.

Representatives of participating public agencies should make periodic visits to the watershed to observe, document, and monitor selected resource conditions, determine potential methods of correcting a potential hazard or undesirable conditions, share potential solutions with designated residents of Ofu Village, and encourage the participation of traditional leaders and village residents in the implementation of resource management solutions.

The scope of issues that should be addressed by each agency in the field is summarized in Table 36-2. The general focus of recommended technical assistance is also identified. The experience and insights of agency representatives will determine the specific methodology to be used in the field.

**TABLE 36-2
RECOMMENDED FOCUS OF FUTURE TECHNICAL ASSISTANCE
OFU SAUTE WATERSHED**

Participating Public Agency	Resource Management Issue	Focus of Technical Assistance
ASEPA	Facilitate a coordinated resource management effort within the watershed.	<ol style="list-style-type: none"> 1. Coordinate overall watershed management activities. 2. Hold periodic meetings with participating ASG and federal agencies to discuss, prioritize, and schedule resource management activities. 3. Coordinate program efforts with local traditional leaders and/or designated residents of the watershed. 4. Make annual assessment of resource management program.
ASPA/ASEPA	Perform a detailed evaluation of community sanitation problems associated with the use of soil-based treatment systems.	<ol style="list-style-type: none"> 1. Survey inhabited village areas in Ofu Village. 2. Evaluate existing treatment practices, soil characteristics, location and density of land uses, the distance to water supplies and nearshore waters, topography, and other factors. 3. Require use of septic tanks and leachfields that provide sufficient amounts of additional soil-based treatment; or, deny building applications in areas unsuitable for soil-based treatment.
ASEPA	Conserve surface water supplies	<ol style="list-style-type: none"> 1. Revise American Samoa GIS to delineate 100-foot buffers around each surface supply. 2. Restrict land uses within designated buffers.
ASCZM/DOC	Detain stormwater runoff in future residential and commercial areas.	In the event that residential development takes place upslope of Alaufau, require the use of onsite drywells for all new residential structures, or the development of a community stormwater detention facility.
ASDOC	Monitor changes in population and land use	Annually map type and location of land uses in village and estimate resident population.
ASCC Land Grant Program	Reduce sedimentation from agricultural activities	<ol style="list-style-type: none"> 1. Determine locations where upslope agricultural activities may be generating some sedimentation. 2. Encourage soil conservation methods with resident growers of subsistence crops.
ASG Dept. of Marine and Wildlife Resources	Sustain healthy marine communities in nearshore waters	Monitor changes in coral coverage, fish habitat, diversity and other characteristics (used by Green) approximately every three years. Monitor reef front site seaward of Nuupule Rock.

Source: Pedersen Planning Consultants, 1998

OFU MATU

Watershed 37

GEOGRAPHY

The Ofu Matu watershed comprises the northeast side of the Island of Ofu. The watershed comprises about 1.06 square miles of land area (Figure 37-1).

The inland boundaries of the watershed include Tumu Mountain and the mountain ridges known as Tia Ridge, Mako Ridge, and Leolo Ridge. Sunuitao Peak, which is located on the east end of Ofu, defines the east boundary of the watershed.

Along the north coast of Ofu, the watershed extends between Feia Point, the northwest tip of Ofu, and Asagatai Point. Asaga Strait separates the Islands of Ofu and Olosega on the east side of Ofu. There are no embayments along the north coast of Ofu.

Agaputupu, Tafe, Ulafala, and Vaimuulua Streams comprise the four streams in the watershed.

Only a few homes are located on the east side of the watershed in the vicinity of Asagatai Point. Otherwise, the watershed is uninhabited.

RESOURCES OF THE WATERSHED

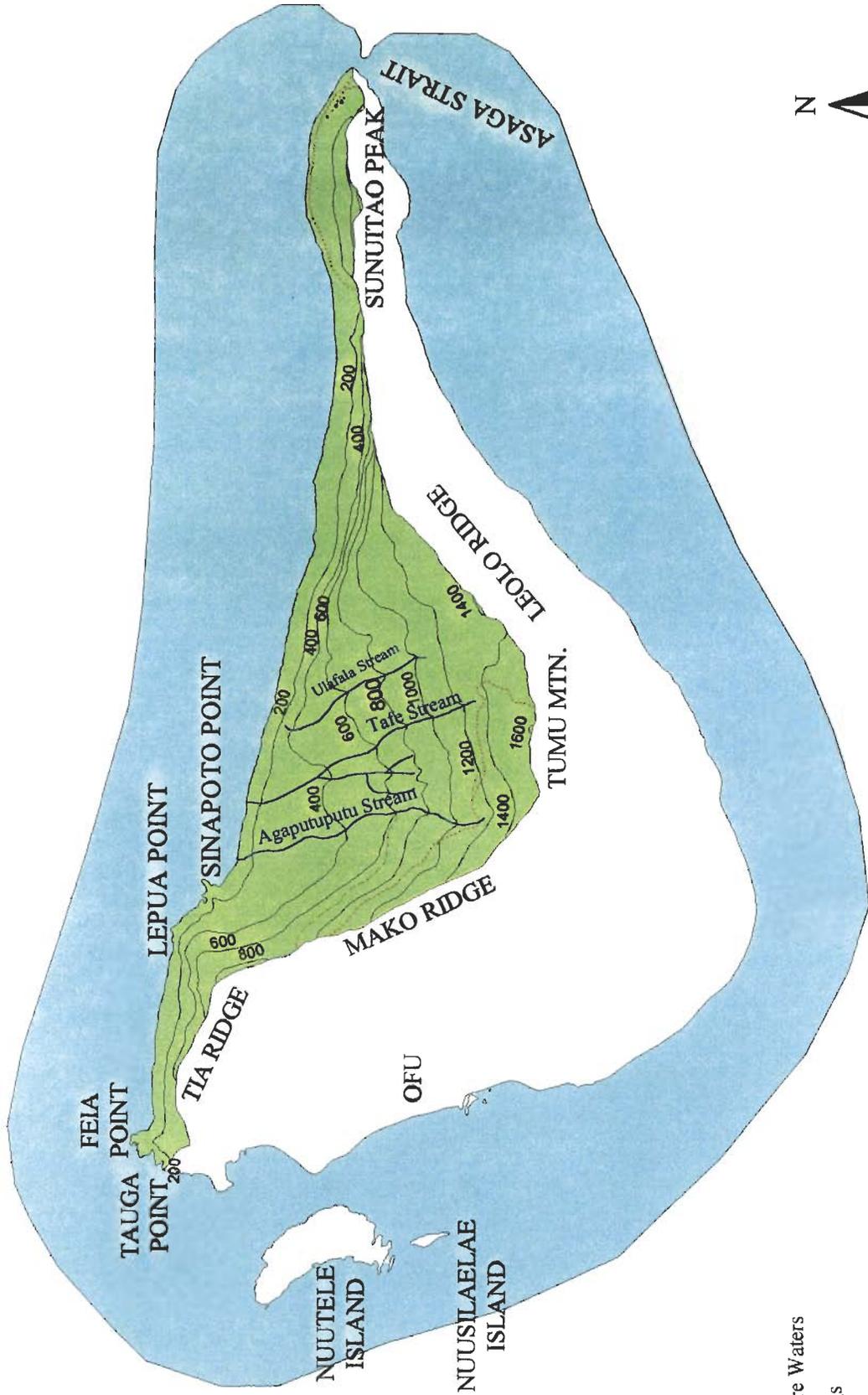
Soils

The U.S. Soil Conservation Service (National Resource Conservation Service) published a Soil Survey of American Samoa in 1984. Selected information derived from this survey provides some useful information for future watershed planning and management (Figure 37-2). Five soil classifications were identified by the U.S. Soil Conservation Service for lands within the Ofu Matu watershed (Table 37-1)

TABLE 37-1
SELECTED SOIL CHARACTERISTICS⁰
OFU MATU WATERSHED

SCS Soil Unit	Name	Typical Slope (Percent)	Flood	Runoff	Erosion	Soil Depth To:		Land Use Suitability	
						High Water (Feet)	Bed Rock (Inches)	Soil Based WW Treatment	Subsistence Ag Potential
2	Aua very stony silty clay loam	30-60	None	Rapid	Severe	<6	<60	Severe Slope	Poor
4	Fagasa family-Lithic Hapludolls-Rock Outcrop Assoc	70-130	None	Very Rapid	Very Severe	>6	20-40	Severe Slope Depth	Poor
11	Ngedebus mucky sand	0-2	Occasional	Very slow	Slight	>3.5	>60	Severe flood Wetness Poor Filter	Moderate
14	Ofu silty clay	15-40	None	Med	Mod	>6.0	>60	Severe Slope	Good
15	Ofu silty clay	40-70	None	Med	Mod	>6.0	>60	Severe Slope	Poor

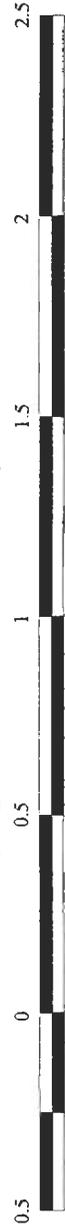
Source: U.S. Soil Conservation Service, 1984



LEGEND

- Contour
- Reef
- Stream
- Nearshore Waters
- Buildings
- Transportation
- Vehicular Trail

American Samoa Geographical Information System

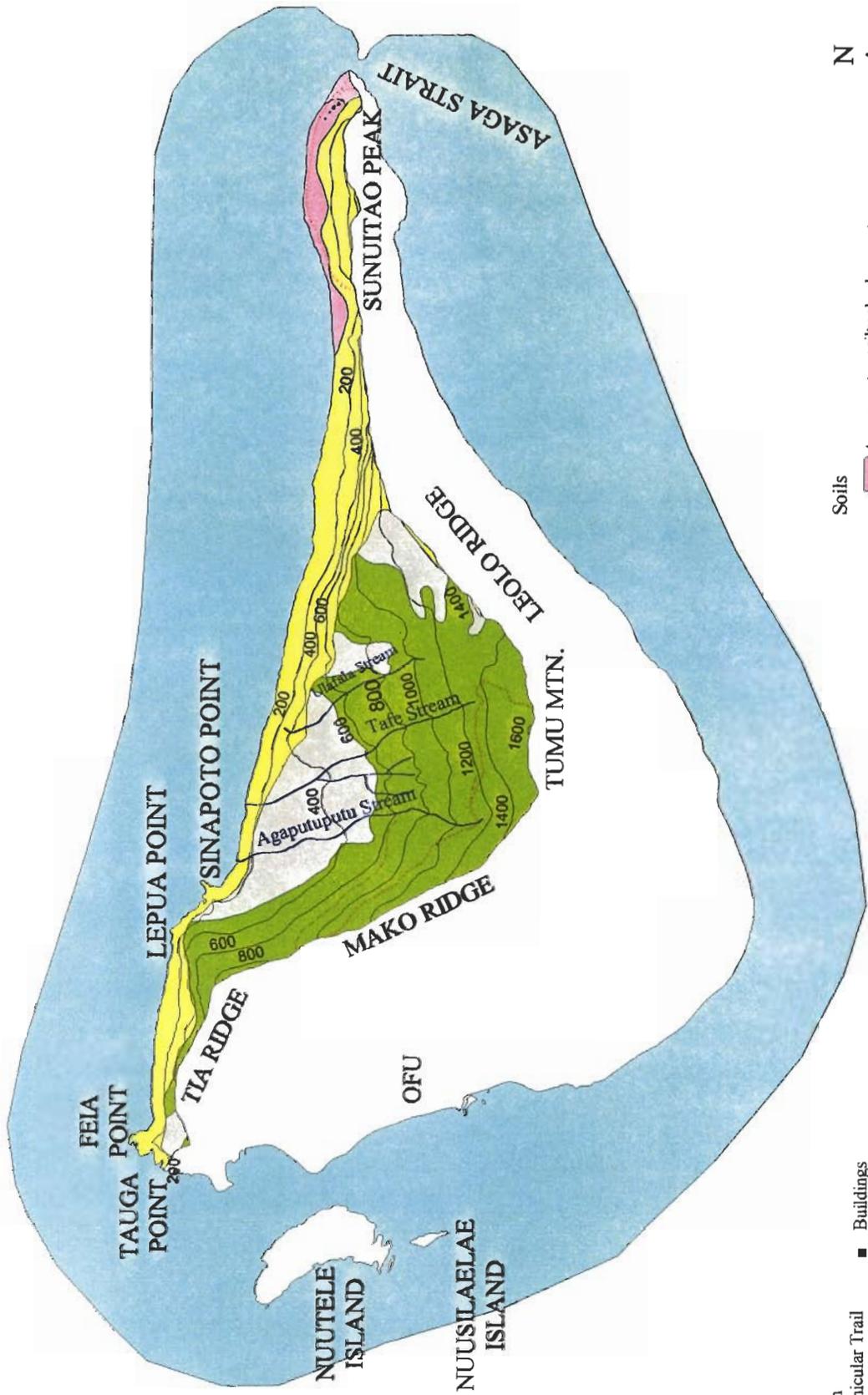


Scale: 1:30,000

Tel: 307-327-5434

Prepared by: Pedersen Planning Consultants

Figure 37-1



LEGEND

- Transportation
 - Vehicular Trail
- Nearshore Waters
- Faatoaga
- Buildings
- Streams
- Reef
- Contour

Soils

- Aua very stony silty clay loam - steep
- Fagasa family-Lithic Hapludolls-Rock outcrop assoc.
- Ngedibus mucky sand
- Ofu silty clay
- Ofu silty clay - steep



American Samoa Geographical Information System



Scale: 1:30,000

Prepared by: Pedersen Planning Consultants

Tel: 307-327-5434

Figure 37-2

On the north side of Sunuitao Peak, steeper slopes of the lower watershed contain Aua very stony silty clay loam soils (SCS mapping unit 2). Two or three dwelling units are located in this area.

The Aua soils range between seven to 60 inches in depth. The permeability of these soils (between 2 and 6 inches per hour) is moderately rapid. For watershed management purposes, it is important to note that these Aua soils have a high potential for runoff and erosion.

This Aua soil is not recommended for agricultural production because of the stoniness of the soil, the high erosion potential, and hazards associated with subsistence crop cultivation on steeper slopes. However, when cultivation in these soils is necessary, the use of a mulch or ground cover is recommended to reduce soil erosion in cultivated areas.

The U.S. Soil Conservation Service estimates that this soil can annually sustain up to 5 tons per acre of erosion without impacting crop productivity (U.S. Soil Conservation Service, 1984). While the erosive characteristics of this soil generally may not significantly impact subsistence crop productivity, the erosive quality of the soil can be a significant contributor to sedimentation in downslope streams and the nearshore waters.

The general characteristics of these Aua soils are also undesirable for individual wastewater disposal systems (U.S. Soil Conservation Service, 1984). These soils contain a significant amount of larger stones that hamper installation and provide inadequate soil treatment.

Fagasa Family-Lithic Hapludolls-Rock Outcrop Association

Steeper, lower slopes along the north side of Tia Ridge, Tumu Mountain and Leolo Ridge, as well as the upland slopes of Sunuitao Peak, contain well-drained soils known as the Fagasa Family-Lithic Hapludolls-Rock outcrop association (SCS mapping unit 4).

The Fagasa Family soils contain a surface layer of dark, brown silty clay that is about 12 inches thick. A dark brown subsoil is approximately five inches thick. The substratum, which is characterized by a dark-brown, sandy clay loam, extends to a depth of 31 inches. The depth to bedrock ranges between 20 to 60 inches or more.

The Lithic Hapludolls are shallow, well-drained soils that are derived from igneous rock. The surface layer is highly variable, but U.S. Soil Conservation Service soil scientists have observed the surface layer to contain about five inches of dark brown, cobbly silty clay. The subsurface layer, which is about four inches thick, is a dark brown, very cobbly, silty clay. The substratum represents a clay loam, approximately six inches thick, over weathered bedrock.

The soil permeability of the Fagasa Family and Lithic Hapludolls soils is both between two and six inches per hour. Since the Fagasa Family-Lithic Hapludolls soil typically occurs on very steep slopes, potential runoff can be very rapid. The potential for water erosion is very severe (U.S. Soil Conservation Service, 1984).

The cultivation of subsistence crops on these soils is not considered desirable. However, when cultivation in these soils is necessary, care should be exercised to minimize the amount of exposed soil in cultivated areas.

When heavier rainfall events occur, significant erosion of these soils can be expected from undeveloped upslope areas of the watershed. Natural runoff from steeper slopes in the watershed carries water, sediments, and organic debris to downslope drainage courses and streams. Such erosion can readily influence downstream water quality.

Fagasa Family and Lithic Hapludolls soils are unsuitable for septic tank and effluent drainfield applications. Steeper slopes and the limited depth to bedrock do not afford effective soil-based treatment of wastewater.

Ngedebus Mucky Sand

A small area of Ngedebus mucky sand (SCS mapping unit 11) is located on the east tip of Ofu in the vicinity of Asagatai Point (Figure 37-2).

Ngedebus mucky sand is a deep, somewhat excessively drained soil. This soil is derived from coral and seashells.

The surface layer is typically black mucky sand that is approximately 12 inches thick. In some areas, the surface layer comprises loamy sand. The substratum is gray to very pale brown sand that extends to a depth of 60 inches or more.

The permeability of Ngedebus mucky sand is rapid. The potential hazard of water erosion is slight; potential runoff is very slow. Very brief periods of flooding can occur on these soils.

Ngedebus mucky sand is moderately suited to the production of subsistence crops such as taro, bananas, breadfruit and coconuts. However, agricultural uses are constrained by the retention of adequate moisture and low soil fertility.

Its suitability for septic tank installations and effluent drainfields is poor. Rapid permeability and the limited depth to the water table do not enable effective soil-based treatment.

Ofu Silty Clay (15 to 40 percent slopes)

Ofu silty clay on 15 to 40 percent slopes (SCS mapping unit 14) is found on a portion of the upland slopes of Leolo Ridge, the steeper north slopes of Tumu Mountain, and the northeast slopes of Mako Ridge. This Ofu silty clay soil is a deep, well-drained soil that is formed in volcanic ash and residuum derived from basic igneous rock.

The surface layer is typically a reddish-brown silty clay that is approximately 16 inches thick. A dark brown, silty clay loam characterizes the upper 29 inches of the subsoil; the lower 15 inches of the subsoil contains a dark brown silty clay. A substratum of dark brown silty clay, or silty clay loam, is found in some areas at depths of 30 to 60 inches or more.

The permeability of Ofu silty clay ranges between two and six inches per hour. The potential hazard of water erosion is moderate; potential runoff is considered to be medium (U.S. Soil Conservation Service, 1984).

Ofu silty clay is well suited for subsistence crop production. Typical crops produced from these soils include coconuts, breadfruit, bananas and taro.

These soils are poorly suited for septic tanks and related effluent drainfields. Steeper slopes do not enable effective soil-based treatment of wastewater.

Ofu Silty Clay (40 to 70 percent slopes)

A portion of the steeper, upland slopes of Tumu Mountain and Mako Ridge are characterized by Ofu silty clay (SCS mapping unit 15). This soil is a deep, well-drained soil formed in volcanic ash and residuum that is derived from basic igneous rock.

The surface layer, which is about 10 inches thick, is typically dark reddish-brown, silty clay. In some locations, the surface layer represents a stony silty clay. The subsoil contains about nine inches of

dark reddish brown silty clay loam; reddish brown silty clay loam extends another 18 inches. The substratum of reddish-brown, silty clay loam extends to a depth of 60 inches or more. The depth to weathered bedrock ranges from 40 to 60 inches or more.

Ofu silty clay soils have a soil permeability that ranges between two and six inches per hour. The potential hazard of water erosion is severe; the potential occurrence of runoff is medium to rapid.

These soils generally support woodlands, but not commercial timber harvests. Steeper slopes, as well as potential water erosion and runoff hazards, make these soils unsuitable for subsistence agricultural production.

The use of these soils for septic tank and effluent drainfield applications is also unsuitable. Steeper slopes where these soil occur do not promote effective soil-based treatment of wastewater effluent.

Streams

Stream Locations

There are four streams that drain the north slopes of Tumu Mountain and the east slopes of Mako Ridge.

Agaputuputu Stream originates on the north slopes of Tumu Mountain at about the 1,130-foot contour. A steep, well-defined drainage course transports surface flows to a shoreline discharge east of Sinapoto Point. The defined stream course ends at about the 200-foot contour and discharges into the nearshore waters via a direct fall during higher stream flows. During lower stream flow periods, surface runoff continues to drain down the steep, lower slopes of the drainage before discharging into the nearshore waters.

Tafe Stream begins near the 1,300-foot elevation on the north slopes of Tumu Mountain. The main stem of the Stream and two upland tributaries carry surface runoff to the nearshore waters. Available topographic maps indicate a point of discharge near the 235-foot elevation. Similar to Agaputuputu Stream, higher stream flows may discharge to the nearshore waters as a fall while lower flows probably drain down the steep, lower slopes of the drainage.

The headwaters of Ulafala Stream are located at approximately 1,075 feet above mean sea level. This stream drains a portion of the north slopes of Tumu Mountain. The single stream stem discharges surface runoff to a point near the 400-foot contour where higher stream flows discharge as a fall; lower flows likely drain down the steeper, lower slopes of the drainage prior to its shoreline discharge.

Vaimuulua is a fourth stream on the north side of the Tumu Mountain. This stream is depicted on available USGS topographic maps, but not reflected on 1:200 scale topographic maps for the Territory. This stream likely originates near the 900-foot contour. At the 550-foot elevation, Vaimuulua Stream, higher stream flows discharge as a fall. Lower stream flows drain down the steep, lower slopes of the drainage before discharging into the nearshore waters.

Stream Flows Within the Watershed

There are no stream flow records that are available for the four streams in the Ofu Matu watershed. During the May, 1996 survey of the watershed, no stream discharges to the nearshore waters were evident. The streams of the watershed probably flow intermittently throughout the year.

Surface Water Quality

Streams

There is no water quality data for the streams in the watershed. However, significant erosion was documented along Mako Ridge and the vehicular trail in May, 1996. Visual observations from this area indicated that the west and central parts of the watershed contained several areas of exposed soils on steeper, upland slopes. Consequently, even though the watershed is heavily vegetated, local streams in the watershed likely transport a considerable amount of sediment and turbid water to the nearshore waters.

Nearshore Waters

No surface water quality data is available for the nearshore waters that adjoin the Ofu Matu watershed. Limited access to most of the watershed in May, 1996 did not enable an inspection of the points of discharge for the four streams that discharge into the nearshore waters.

Wetlands

No significant wetlands are located in the Ofu Matu watershed.

Marine Resources

Coral Communities

A fringing reef is located along most of the north coast of Ofu.

Various private consultants have made field investigations of the fringing reef since the late 1970's. In a cumulative sense, the available survey information suggests:

- Corals in this watershed have not been significantly reduced by recent storms or crown-of-thorns starfish infestations as coral communities around Tutuila Island.
- A number of rare corals inhabit the fringing reef along the south coast of Ofu.
- Corals in this watershed have not been impacted as dramatically by recent storms or crown-of-thorns starfish infestations as coral communities around Tutuila Island.
- A number of rare corals inhabit the fringing reef, although coverage is variable.

1978-1979

In the vicinity of Asaga Strait, live coral was sparse near the shoreline. Offshore, coral coverage increased to about 15 percent. Near the middle of Agasa Strait, coral coverage ranged from 40 to almost 100 percent at a depth of 6 feet.

1995

A recent 1996 study of various coral reefs throughout the Samoan Archipelago included the performance of five transects along the reef front on the northwest side of Asaga Strait. The study focused primarily upon the quantification of coral communities, the abundance and diversity of reef fish, and selected habitat characteristics.

Coral cover along the reef front ranged between 20 and 39 percent. Fish species richness included more than 150 species. Fish density was also considered to be "high," or greater than 10,000 individuals per ha. Fish biomass represented between 500 to 999 kilograms per ha.

Green also noted that the coral reefs of the Manua Islands were severely damaged by Hurricane Tusi in 1987, but escaped significant damage from Hurricane Ofa in February, 1990 and Hurricane Val in December, 1991. In addition, the reefs in Manua were also influenced by infestations by the crown-of-thorns starfish and a recent coral bleaching event. From her review of past studies, Green concluded that the reef fronts of the Manua Islands tended to be in better condition than those on Tutuila. The reef front at Asaga Strait represented one of the best coral reefs in the Samoa archipelago.

In this context, Green also expressed concern for proposed road construction along the east end of the Ofu Matu watershed. In May, 1996, this project was under construction by McConnell-Dowell. The road project was completed in late 1996.

Wildlife Resources

Historical data suggests that the common brown noddy may nest along the north coast of Ofu between Tauga Point and Sinapoto Point. In addition, a potential nesting area for the white-rumped swiftlets is located between Lepua Point and Sinapoto Point. The sheath-tailed roosts in caves in the vicinity of Sinapoto Point (Aecos and Aquatic Farms, 1980).

A 1986 Survey of the Forest Birds of American Samoa also documented a considerable number of forest birds in various areas of the Island of Ofu (Engbring and Ramsey, 1989). These habitats generally included rain forest, secondary vegetation, mixed vegetation, and plantation lands. The specific locations of these habitats on each island were not identified.

Shoreline Protection

Man-made shoreline protection facilities are located only along the shoreline northwest of Asaga Strait. Roughly 3,000 feet of shoreline revetment are located between the west side of Asaga Strait and the northwest slopes of Sunuitao Peak. The revetment affords some storm wave protection to the bridge that connects the Island of Ofu and Olosega, as well as two nearby residences.

Significant repairs to this rock revetment were completed in late 1996. These repairs were prompted by damage generated by Hurricane Val in December, 1991 which washed out the access road on both sides of the bridge.

The fringing reef and rugged basaltic shoreline provides natural protection to the remaining portions of the north coast of Ofu.

Groundwater and Surface Water Supplies

No groundwater wells or surface water systems are known to be developed in the Ofu Matu watershed. The two households on the east side of the watershed obtain drinking water via individual roof catchment and/or connection to ASPA's satellite village water system in Olosega.

USE OF THE WATERSHED

Resident Population

Two homes are located on the east side of the Ofu Matu watershed. The homes may house up to 10 residents. Otherwise, the remainder of the watershed is uninhabited.

Land Uses

In addition to limited residential use on the east side of the watershed, some *faatoaga* were located on the upper slopes of Tumu Mountain in May, 1996. No other land uses were documented.

Use of the Nearshore Waters

Shoreline access to the north coast of Ofu is limited to the northeast part of the watershed between Mafafa and Asaga Strait. No fishing and general water recreation is known to take place along the nearshore waters of the watershed. The repaired revetment northwest of Asaga Strait may, however, may encourage some future limited shoreline fishing from the revetment.

RESOURCE MANAGEMENT ISSUES

Future Land Uses to the Year 2015

With limited vehicular access, no new land uses are expected to occur in this watershed during the 1996-2015 period.

Impact of Future Population Growth Upon Water Consumption and Wastewater Generation

Since no increase in resident population is expected, there will be no impact upon future water consumption and wastewater generation.

Flood Potential

A flood insurance study of American Samoa and related flood insurance rate maps were published by the U.S. Federal Emergency Management Agency (FEMA) in 1991. The study evaluated selected geographical locations throughout the Territory. Hydrologic and hydraulic analyses that were presented in the study were made by the U.S. Army Corps of Engineers, Pacific Ocean Division. No detailed study was made of the Island of Ofu.

Inland Flood Potential

The entire Ofu Matu watershed has been designated by the Federal Emergency Management Agency (FEMA) as “zone x”. This designation indicates that the areas are outside of the 100-year floodplain (Federal Emergency Management Agency, 1991). In essence, FEMA is suggesting that the flood hazard potential in these areas is limited.

Coastal Flood Hazard

The flood insurance rate map for the shoreline of the Ofu Matu watershed indicates that there is a coastal flood hazard through much of the nearshore waters and adjoining shoreline. However, no potential coastal flood elevations were determined by FEMA for the shoreline of the watershed.

Stormwater Runoff/Sedimentation and the Relationship to Surface Water Quality

The four streams in the Ofu Matu watershed likely transport a considerable amount of turbid water and sediments to the nearshore waters that adjoin the watershed. These discharges are derived almost exclusively from the natural erosion of more erosive soils on steeper slopes of the watershed. However, some erosion from upland *faatoaga* and vehicular trails in the watershed also takes place.

The detention of a portion of future stormwater flows would be desirable. However, this is not feasible because of the remote nature of the central watershed.

No extensive use is made of the upland vehicular trails except by those persons who maintain and harvest crops from upland *faatoaga*. Consequently, there is no need to restrict vehicular travel along these trails.

In a broader context, it is recommended that future land uses in the watershed be limited to agricultural production and watershed conservation. Future agricultural production should be limited to upland areas where Ofu silty clay on 15 to 40 percent slopes (SCS mapping unit 14) is present. These soils have good potential for subsistence crop production. At the same time, the soils pose a moderate potential for water erosion and soil runoff. Consequently, the ASG Land Grant representatives should provide technical assistance to plantation operators to ensure that appropriate land conservation practices are applied to future agricultural production.

Nearshore Water Quality and the Marine Environment

Turbidity and Sedimentation

The concern for continued turbidity and sedimentation in the nearshore waters of the watershed is important. Coral communities are significantly dependent upon the availability of light and related photosynthesis, and occasional periods of significant turbidity and sedimentation do not promote long-term coral nutrition, growth, reproduction, and depth distribution (Richmond, 1993).

When corals fertilize, they are free-swimming. Consequently, they need a good location to settle and make a good attachment. With significant soil deposition, sediments can physically interfere with the recruitment of coral larvae (Richmond, 1993; Dashbach, 1996).

Coral communities are an important component of the overall ecology of the nearshore waters that adjoin the Ofu Matu watershed. They provide shelter to fish, invertebrates, and other marine organisms.

Long-Term Monitoring

The long-term monitoring of the reef front northwest of Asaga Strait is recommended. However, these investigations should be supplemented with a reef front seaward of the central watershed. The monitoring of the central watershed site will enable the ASG to better understand the ecological impacts associated with turbid water and sediment discharges from a relatively, undisturbed watershed.

Groundwater and Surface Water Supplies

The several residents who live on the east side of the watershed rely upon groundwater supplies in Olosega and/or surface water supplies derived individual roof catchment systems. Consequently, there are no significant management issues associated with these resources.

MANAGEMENT NEEDS AND RECOMMENDATIONS

The primary focus of future resource management in the watershed will be to:

- encourage appropriate agricultural practices in upland *faatoaga* areas;

- limit agricultural production to selected areas with soils more conducive to agricultural production and less prone to erosion;
- restrict land uses other than agriculture that would significantly increase the discharge of turbid waters and sediments into local streams;
- monitor future changes in land use; and,
- monitor the condition of coral reefs seaward of the central watershed.

Representatives of participating public agencies should make periodic visits to the watershed to observe, document, and monitor selected resource conditions, determine potential methods of correcting a potential hazard or undesirable conditions, share potential solutions with a designated resident of Ofu, and encourage the village’s implementation of resource management solutions.

The scope of issues that should be addressed by each agency in the field is summarized in Table 37-2. The general focus of recommended technical assistance is also identified. The experience and insights of agency representatives will determine the specific methodology to be used in the field.

**TABLE 37-2
RECOMMENDED FOCUS OF FUTURE TECHNICAL ASSISTANCE
OFU MATU WATERSHED**

Participating Public Agency	Resource Management Issue	Focus of Technical Assistance
ASEPA	Facilitate a coordinated resource management effort within the watershed.	<ol style="list-style-type: none"> 1. Coordinate overall watershed management activities. 2. Hold periodic meetings with participating ASG and federal agencies to discuss, prioritize, and schedule resource management activities. 3. Coordinate program efforts with local traditional leaders and/or designated resident of the watershed. 4. Make annual assessment of resource management program.
ASDOC	Restrict land uses other than agriculture that would generate significant discharges of turbid water and sediment into local streams.	<ol style="list-style-type: none"> 1. Require a PNRS review for any structural development in the watershed. 2. Limit future structural development to those supporting agricultural production. 3. Provide specific design and construction criteria in conjunction with the approval of any future structures.
ASDOC	Monitor changes in population and land use	Annually map type and location of land uses in village and estimate resident population.
ASCC Land Grant Program	Reduce erosion and sedimentation from upslope agricultural production	<ol style="list-style-type: none"> 1. Encourage soil conservation methods with resident growers of subsistence crops. 2. Encourage upslope agricultural production only on Ofu silty clay soils on 15 to 40 percent slopes (SCS unit 14).
ASG Dept. of Marine/Wildlife Resources	Sustain healthy marine communities in nearshore waters	Monitor changes in coral coverage, fish habitat, diversity and other characteristics (used by Green) approximately every three years. Monitor reef front seaward of central watershed, as well as northwest of Asaga Strait.

Source: Pedersen Planning Consultants, 1998

OLOSEGA SISIFO Watershed 38

GEOGRAPHY

The Olosega Sisifo watershed is located on the west side of the Island of Olosega. The watershed comprises about 0.8 square miles of land area (Figure 38-1).

The east and west sides of Olosega are divided by Piumafua Mountain, near the center of the Island, which rises approximately 2,095 feet above mean sea level. Alei Ridge extends north of the Piumafua Mountain peak to Leumasili Point. Mataala Ridge extends southeast to Maga Point, which represents the southern tip of Olosega.

Along the west shoreline of Olosega, the Olosega Sisifo watershed is located between Leumasili Point and Maga Point. No embayments are situated along the west shoreline of the watershed.

RESOURCES OF THE WATERSHED

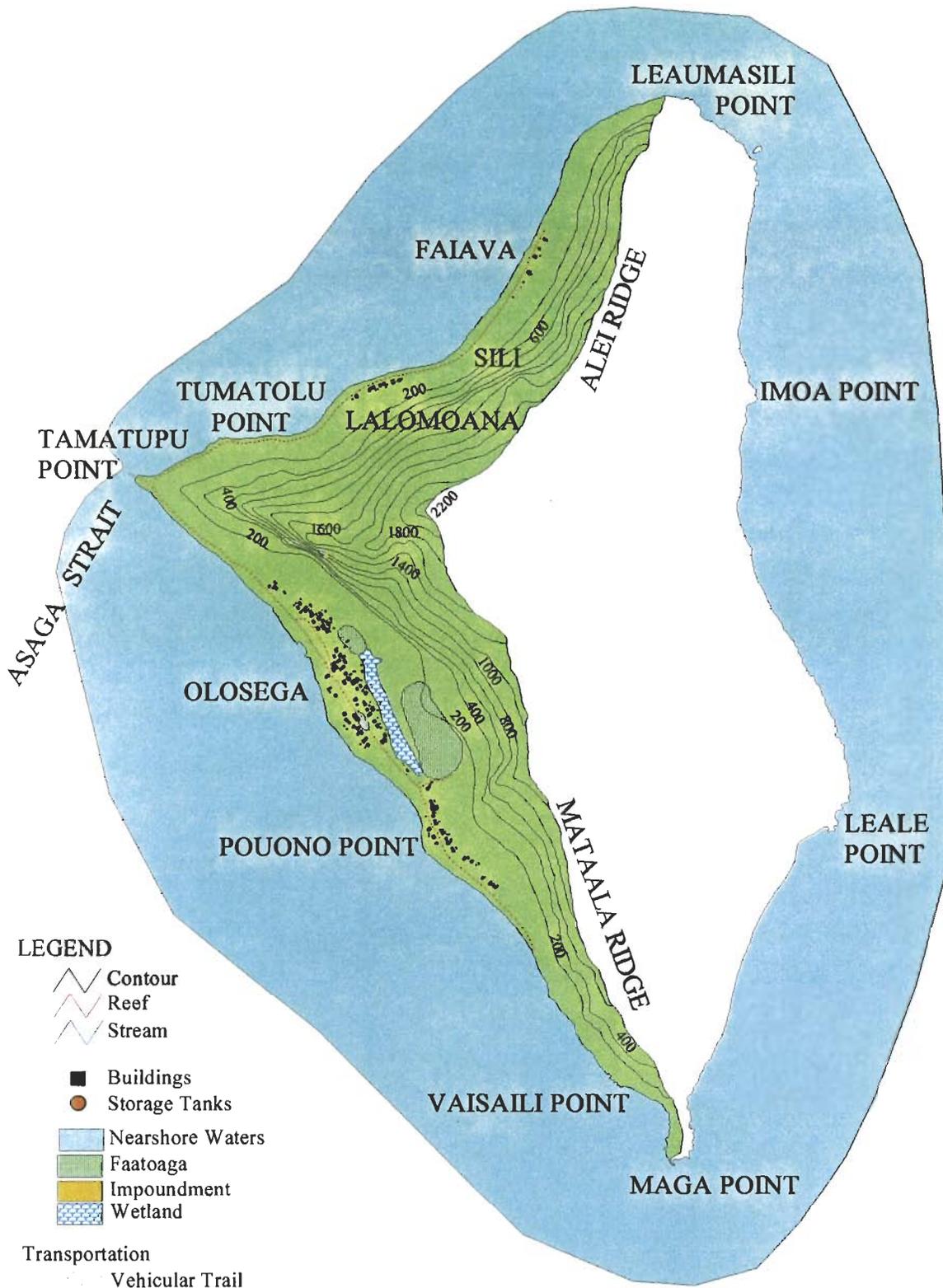
Soils

The U.S. Soil Conservation Service (National Resource Conservation Service) published a Soil Survey of American Samoa in 1984. Selected information derived from this survey provides some useful information for future watershed planning and management (Figure 38-2). Seven soil classifications were identified by the U.S. Soil Conservation Service for lands within the Olosega Sisifo watershed (Table 38-1).

**TABLE 38-1
SELECTED SOIL CHARACTERISTICS
OLOSEGA SISIFO WATERSHED**

SCS Soil Unit	Name	Typical Slope (Percent)	Flood	Runoff	Erosion	Soil Depth To:		Land Use Suitability	
						High Water (Feet)	Bed Rock (Inches)	Soil Based WW Treatment	Subsistence Ag Potential
2	Aua very stony silty clay loam	30-60	None	Rapid	Severe	<6	<60	Severe Slope	Poor
4	Fagasa family-Lithic Hapludolls-Rock outcrop assoc	70-130	None	Very Rapid	Very Severe	>6	20-40	Severe Slope Depth	Poor
6	Insak mucky sandy loam	0-2	Frequent	Ponded to Slow	Slight	0.5-2.0	20-40	Severe Flooding Depth to Rock Ponding	N/A
12	Ngedebus Variant extremely cobbly sand	0-5	Occ	Very Slow	Slight	>6.0	>60	Severe Flood Poor Filter Large Stones	Poor
14	Ofu silty clay	15-40	None	Med	Mod	>6.0	>60	Severe Slope	Good
15	Ofu silty clay	40-70	None	Med	Mod	>6.0	>60	Severe Slope	Poor
35	Urban land-Ngedebus complex	0-5	Occ	Slow	Slight	>3.5	.60	Severe Flood Wet Poor Filter	Poor

Source: U.S. Soil Conservation Service, 1984



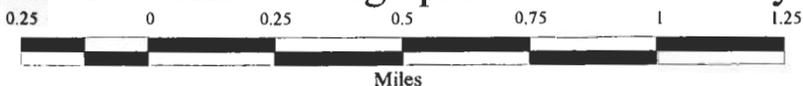
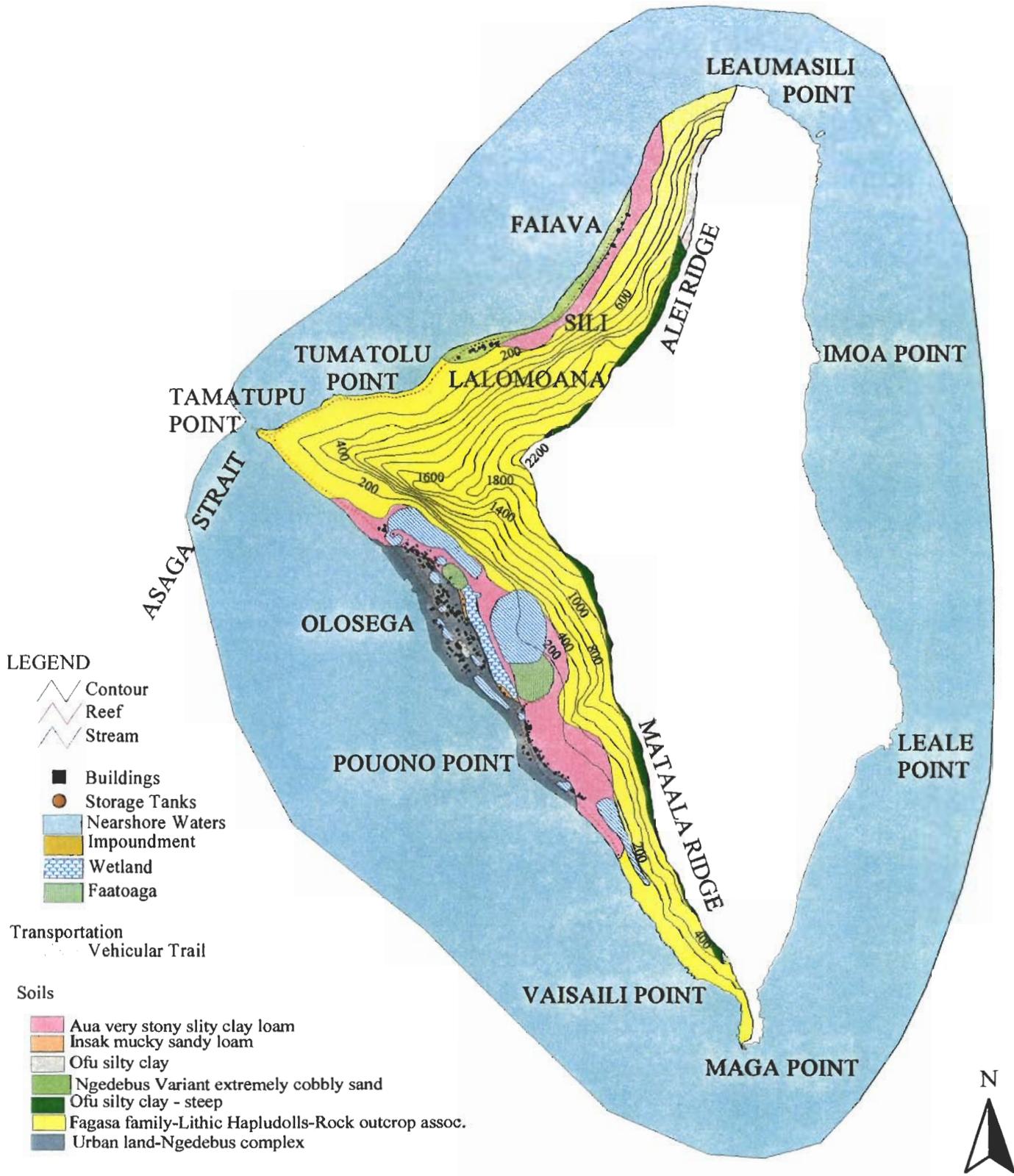
LEGEND

- Contour
- Reef
- Stream
- Buildings
- Storage Tanks
- Nearshore Waters
- Faatoaga
- Impoundment
- Wetland
- Transportation**
- Vehicular Trail



Miles
Scale: 1:24,000

Figure 38-1



Scale: 1:24,000

Figure 38-2

Urban Land-Ngedebus Complex

Most of the inhabited village area in Olosega contains Urban land-Ngedebus complex soils (SCS mapping unit 35).

These soils generally comprise coral fragments, sand, cinders and other material that have been graded or filled to support residential, commercial and public facilities in the village area.

The Ngedebus soil extends to a depth of 60 inches or more. The surface layer, which extends about 4 inches below ground elevation, typically contains light, brownish-gray and brown sand. The underlying material is characterized by pale brown and light yellow, brown sand.

The permeability of Ngedebus soil ranges between six and 20 inches per hour. Surface drainage on this soil is generally slow, and the hazard of potential soil erosion is slight. In some places, the soil is subject to occasional, brief periods of flooding during prolonged, heavy rainfall or during high tide (U.S. Soil Conservation Service, 1984).

These soils are generally suitable to support residential and commercial development in areas that are protected from flooding. However, this soil is poorly suited in unprotected areas (U.S. Soil Conservation Service, 1984).

Where moderate to higher housing densities occur, the U. S. Natural Resources Conservation Service recommends the use of community sewage systems prevent the potential contamination of groundwater and surface water supplies. Housing densities in Olosega range between two to six units per acre.

Ngedebus Variant Extremely Cobbly Sand

Ngedebus variant extremely cobbly sand soils (SCS mapping unit 12) extends along the northwest coast of the Olosega Sisifo watershed between Lalomoana and Faiava areas. This soil is found in most of the existing and former residential areas along the shoreline.

Ngedebus variant extremely cobbly sand soils is a deep, excessively drained soil that is derived from coral and seashells. These soils commonly comprise narrow sandy beaches less than 50-feet wide.

A representative surface layer is usually black extremely cobbly sand that is about 15 inches thick. The surface layer has a high content of organic matter; however, in some areas, the surface layer comprises extremely stony sand. Pale brown extremely cobbly sand defines the substratum to a depth of 60 inches or more (U.S. Soil Conservation Service, 1984).

The permeability of this soil ranges between six and 20 inches per hour. The potential hazard of water erosion is slight; potential soil runoff is very slow. This soil is occasionally subjected to brief periods of flooding.

Ngedebus Variant extremely cobbly sand soils has a poor potential for subsistence agricultural production. Coconut production can only be supported in scattered areas. Subsistence production is hampered by a higher content of coral fragments throughout the soil.

Rapid permeability characteristics of this soil make this soil unsuitable for septic tank and effluent drainfield applications. Rapid permeability of the soil does not afford effective soil-based treatment of wastewater.

Insak Mucky Sandy Loam

The coastal marsh that lies inland of the central village area of Olosega contains Insak mucky sandy loam (SCS mapping unit 6). This soil, which is formed in coral sand and organic matter, a moderately deep and very poorly drained soil that is typically found in coastal depressions.

The surface layer, which is typically a black mucky sandy loam, is approximately 11 inches thick. In some areas, however, the surface layer contains a mucky loamy sand. Very dark, gray-mucky loam comprises a second layer of about six inches. White and light gray sand, approximately 9 inches thick, lies over coral that is found about 26 inches below ground elevation. The depth to bedrock ranges from 20 to 40 inches.

Soil permeability ranges between six and 20 inches per hour. The hazard of potential water erosion is considered slight; potential runoff is ponded to slow.

The depth of the water table is 10 to 20 inches below ground elevation. Areas that are unprotected are frequently flooded.

The soil is suitable for the production of wetland taro and other water tolerant plants.

Insak mucky sandy loam is unsuitable for septic tank and effluent drainfield applications. Potential flooding and the limited depth to the water table do not promote effective soil-based treatment.

Aua Very Stony Silty Clay Loam (30 to 60 percent slopes)

Steeper slopes of the lower watershed include Aua very stony silty clay loam soils (SCS mapping unit 2). These soils are generally located immediately upslope of the inhabited village area of Olosega and below the 400-foot contour. Upland portions of the inhabited village area on the northwest and southeast ends of Olosega Village also include these Aua soils. Along the northwest coast of the watershed, these soils are found immediately upslope of Lalomoana, Sili, and Faiava.

The Aua soils range between seven to 60 inches in depth. The permeability of these soils (between 2 and 6 inches per hour) is moderately rapid. For watershed management purposes, it is important to note that these Aua soils have a high potential for runoff and erosion.

This Aua soil is not recommended for agricultural production because of the stoniness of the soil, the high erosion potential, and hazards associated with subsistence crop cultivation on steeper slopes. However, when cultivation in these soils is necessary, the use of a mulch or ground cover is recommended to reduce soil erosion in cultivated areas.

The U.S. Soil Conservation Service estimates that this soil can annually sustain up to 5 tons per acre of erosion without impacting crop productivity (U.S. Soil Conservation Service, 1984). While the erosive characteristics of this soil generally may not significantly impact subsistence crop productivity, the erosive quality of the soil can be a significant contributor to sedimentation in downslope streams and the nearshore waters.

The general characteristics of these Aua soils are also undesirable for individual wastewater disposal systems (U.S. Soil Conservation Service, 1984). These soils contain a significant amount of larger stones that hamper installation and provide inadequate soil treatment.

Fagasa Family-Lithic Hapludolls-Rock Outcrop Association

Most of the steeper upland slopes along the west slopes of Puimafua Mountain, Mataala Ridge, and Alei Ridge, as well as the upland slopes of Sunuitao Peak, contain well-drained soils known as the Fagasa family-Lithic Hapludolls-Rock outcrop association (SCS mapping unit 4).

The Fagasa Family soils contain a surface layer of dark, brown silty clay that is about 12 inches thick. A dark brown subsoil is approximately five inches thick. The substratum, which is characterized by a dark-brown, sandy clay loam, extends to a depth of 31 inches. The depth to bedrock ranges between 20 to 60 inches or more.

The Lithic Hapludolls are shallow, well-drained soils that are derived from igneous rock. The surface layer is highly variable, but U.S. Soil Conservation Service soil scientists have observed the surface layer to contain about five inches of dark brown, cobbly silty clay. The subsurface layer, which is about four inches thick, is a dark brown, very cobbly, silty clay. The substratum represents a clay loam, approximately six inches thick, over weathered bedrock.

The soil permeability of the Fagasa Family and Lithic Hapludolls soils are both between two and six inches per hour. Since the Fagasa Family-Lithic Hapludolls soil typically occurs on very steep slopes, potential runoff can be very rapid. The potential for water erosion is very severe (U.S. Soil Conservation Service, 1984).

The cultivation of subsistence crops on these soils is not considered desirable because of the stoniness of the soil and high erosion potential. When cultivation in these soils is necessary, care should be exercised to minimize the amount of exposed soil in cultivated areas. The U.S. Soil Conservation Service estimates that this soil can annually sustain up to 5 tons per acre of erosion without impacting crop productivity (U.S. Soil Conservation Service, 1984). While the erosive characteristics of this soil generally may not significantly impact subsistence crop productivity, the erosive quality of the soil can be a significant contributor to sedimentation in downslope streams and the nearshore waters.

When heavier rainfall events occur, significant erosion of these soils can be expected from undeveloped upslope areas of the watershed. Natural runoff from steeper slopes in the watershed carries water, sediments, and organic debris to downslope drainage courses and streams. Such erosion can readily influence downstream water quality.

Fagasa Family and Lithic Hapludolls soils are unsuitable for septic tank and effluent drainfield applications. Steeper slopes and the limited depth to bedrock do not afford effective soil-based treatment of wastewater.

Ofu Silty Clay (40 to 70 percent slopes)

Smaller areas of Ofu silty clay (SCS mapping unit 15) along the ridge of Puimafua Mountain, Mataala Ridge, and Alei Ridge. This soil is a deep, well-drained soil formed in volcanic ash and residuum that is derived from basic igneous rock.

The surface layer, which is about 10 inches thick, is typically dark reddish-brown, silty clay. In some locations, the surface layer represents a stony silty clay. The subsoil contains about nine inches of dark reddish brown silty clay loam; reddish brown silty clay loam extends another 18 inches. The substratum of reddish-brown, silty clay loam extends to a depth of 60 inches or more. The depth to weathered bedrock ranges from 40 to 60 inches or more.

Ofu silty clay soils have a soil permeability that ranges between two and six inches per hour. The potential hazard of water erosion is severe; the potential occurrence of runoff is medium to rapid.

These soils generally support woodlands, but not commercial timber harvests. Steeper slopes, as well as potential water erosion and runoff hazards, make these soils unsuitable for subsistence agricultural production.

The use of these soils for septic tank and effluent drainfield applications is also unsuitable. Steeper slopes where these soil occur do not promote effective soil-based treatment of wastewater effluent.

Ofu Silty Clay (15 to 40 percent slopes)

The upper north part of Alei Ridge is characterized by Ofu silty clay on 15 to 40 percent slopes (SCS mapping unit 14). This Ofu silty clay soil is a deep, well-drained soil that is formed in volcanic ash and residuum derived from basic igneous rock.

The surface layer is typically a reddish-brown silty clay that is approximately 16 inches thick. A dark brown, silty clay loam characterizes the upper 29 inches of the subsoil; the lower 15 inches of the subsoil contains a dark brown silty clay. A substratum of dark brown silty clay, or silty clay loam, is found in some areas at depths of 30 to 60 inches or more.

The permeability of Ofu silty clay ranges between two and six inches per hour. The potential hazard of water erosion is moderate; potential runoff is considered to be medium (U.S. Soil Conservation Service, 1984).

Ofu silty clay is well suited for subsistence crop production. Typical crops produced from these soils include coconuts, breadfruit, bananas and taro.

These soils are poorly suited for septic tanks and related effluent drainfields. Steeper slopes do not enable effective soil-based treatment of wastewater.

Streams

There are no defined streams in the Olosega Sisifo watershed. Surface runoff occurs along the steeper slopes of Piumafua Mountain, Mataala Ridge, and Alei Ridge. This runoff, which occurs via sheet flow, drains into the coastal marsh near the center of Olosega, as well as a small coastal depression on the north side of the village church.

Along the northwest coast, surface runoff drains directly into the nearshore waters. Lower flows may, in some areas, percolate along sandy beach areas or smaller, basaltic rock depressions. One full-time resident in the Lalomoana area reported that a cut in the steep, basaltic wall behind the residential area sometimes discharges surface runoff from upland slopes during heavier rainfall periods (Tau, 1996).

Surface Water Quality

Streams

Since there are no streams, there is no surface water quality data for these water bodies.

Nearshore Waters

There is no surface water quality available for the nearshore waters that adjoin the Olosega Sisifo watershed.

Wetlands

Near the center of Olosega Village, approximately six acres of wetland are located in narrow depression that is situated immediately inland of the inhabited village area. This area was, at one time, a coastal marsh (Whistler, 1976).

In 1976, Whistler observed that this area was covered with taro cultivation and weeds associated with taro. Secondly, this wetland contained some typical marsh plants such as the willow primrose, red mangrove, and water chestnut.

In May, 1996, it was evident that the wetland was used extensively for agriculture. *Faatoaga* were located on the northwest and southeast ends of this wetland area. The central portion of the wetland was characterized primarily by grass. No taro production was documented.

A buried culvert along the shoreline of Olosega Village was also observed in May, 1996. This culvert was seaward of the southeast end of the wetland. Despite this blockage, this culvert may still permit some discharge of overflows within the wetland. It is recommended that traditional leaders and the village *aumaga* of Olosega Village be encouraged to clear this culvert to enhance its intended function.

Marine Resources

Coral Communities

A continuous fringing reef characterizes the nearshore waters that adjoin the Olosega Sisifo watershed. Man-made *ava* have been cut the reefs seaward of Olosega and Sili to provide boat access to deeper coastal waters.

Indenting the margin of the irregular reef front off Olosega Village are small channels. At depths of 65 to 85 feet offshore the bottom is rocky and large limestone blocks form valleys and ridges.

Various private consultants have made field investigations of the fringing reef since the late 1970's. In a cumulative sense, the available survey information suggests:

- Coral communities seaward of Olosega were in considerably better condition compared to coral reefs that front the Island of Tutuila.
- The fringing reefs that front Sili and Olosega are considered to be some of the better coral reefs in the Samoa archipelago.

1978-1979

Seaward of Faiava, the middle reef flat contained approximately 20 percent live coral coverage.

The inner reef platform seaward of Sili was characterized with less than five percent coral cover. However, along the steep reef front, coral coverage ranges between 50 and 70 percent.

In the vicinity of Asaga Strait, coral cover was generally low on the reef flat north of the bridge that connects the Islands of Olosega and Ofu. South of the Strait, coral cover was up to 15 percent in shallow parts of the reef flat.

Southeast of Tamatupu Point, coral was almost absent on the inner reef flat. However, coral coverage increased to up to 10 percent on the middle reef that was located about 300 feet from shore.

North of Pouono Point, about five percent coral coverage was documented in the *ava* seaward of Olosega Village. On the middle reef flat, which began about 150 feet from the shoreline, live coral coverage was approximately 20 percent. "*An additional 15 percent of the bottom was covered by dead, standing coral heads*" (Aecos and Aquatic Farms, 1980). The outer reef was characterized by only five percent coral cover.

1988

A survey of Olosega was made by Itano and Buckley in 1988. Survey notes from this survey were briefly summarized in the 1992 American Samoa Coastal Resources Inventory Report.

Seaward Lalomoana, Itano and Buckley noted coral coverage along the reef front ranged between 50 and 100 percent.

The coral reef front between South Agasa Strait and Pouono Point varied between low and 50 percent cover.

South of Pouono Point to Vaisaili Point, a 100 meter stretch along the reef front was characterized by 50 percent coral cover. Between Vaisaili Point and Maga Point, maximum coral coverage was between 40 and 50 percent.

1991

Field investigations were also made by Maragos, Hunter, and Meier in 1991 in the nearshore waters of the watershed. The 1991-1992 American Samoa Coastal Resources Inventory

Report that the coral reefs between Lalomoana Village and Faiava Village, as well as Tamatupu Point to Vaisaili Point, contain “*high natural productivity and pristine value*” and are “*coastal marine areas recommended for special protection*” (Maragos, Hunter, and Meier, 1992).

Two sites are also considered to be “*sites of high natural productivity and pristine value*” and are “*coastal marine areas recommended for special protection.*” The Sili fringing reef, from, is the first site. The second site is the Olosega fringing reef and beach, from Tamatupu Point to Vaisaili Point.

1995

A recent 1996 study of various coral reefs throughout the Samoan Archipelago included marine surveys along reef front between Lalomoana and Sili, as well as the reef front at Olosega. The study focused primarily upon the quantification of coral communities, the abundance and diversity of reef fish, and selected habitat characteristics.

Marine surveys at both locations yielded similar results. Coral cover was greater than 40 percent. Fish species richness was greater than 150 species at each site. Fish density was greater than 10,000 individuals per ha at Lalomoana-Sili and Olosega. Fish biomass ranged between 500 and 999 kilograms per ha.

Green also noted that the coral reefs of the Manua Islands were severely damaged by Hurricane Tusi in 1987, but escaped significant damage from Hurricane Ofa in February 1990 and Hurricane Val in December 1991. In addition, the reefs in Manua were also influenced by infestations by the crown-of-thorns starfish and a recent coral bleaching event. From her review of past studies, Green concluded that the reef fronts of the Manua Islands tended to be in better condition than those on Tutuila.

Green also mentioned that the reef fronts at Lalomoana-Sili and Olosega were among the best surveyed in the Samoan archipelago.

Wildlife Resources

Forest Birds

A 1986 Survey of the Forest Birds of American Samoa also documented about 12 forest birds in various areas of Olosega (Engbring and Ramsey, 1989). This survey, which was made on the Islands of Tutuila, Ofu, Olosega, and Tau, recorded the number of birds observed during 8-minute counts in July 1986 (Table 38-2).

Bats

Steep rock and almost vertical rock faces characterize the rocky cliffs above Olosega and Sili. These areas represent roosting sites for the fruit bat in both Olosega and Sili. Small numbers of sheath-tailed bats may also roost in a cave located on the cliff above Sili Village (Aecos and Aquatic Farms, 1980). A limited survey of the fruit bat population of Olosega was made by Brooke, Solek and Utzurum in August 1997. Data obtained from this survey indicated that the fruit bat was very uncommon (Utzurum, 1998).

Other Birds

The common brown noddy has also been reported to nests in trees along the northwest coast of Olosega, as well as along the sea cliff upslope of Olosega Village (Aecos and Aquatic Farms, 1980).

Historically, the Australian gray duck has also been observed in the wetland area that is inland of the inhabited village area of Olosega (Aecos and Aquatic Farms, 1980). Little potential habitat for this duck was documented on the Island of Olosega during a 1986 survey (Engbring and Ramsey, 1989).

**TABLE 38-2
FOREST BIRD SURVEY RESULTS
NATIVE FOREST AND NON-FOREST BIRDS
JULY, 1986**

Species	Tutuila	Ofu	Olosega	Tau	Total
Tahiti Petrel	0	-	-	1	1
White-tailed Tropicbird	154	11	27	234	426
Red-footed Booby	22	-	-	-	22
Great Frigatebird	1	-	-	-	1
Reef Heron	1	0	0	0	1
Red Junglefowl	527	17	0	26	570
Banded Rail	163	22	16	75	276
Spotless Crake	-	-	-	1	1
Purple Swamphen	10	4	0	15	29
Blue-gray Noddy	1	0	0	0	1
Brown Noddy	65	1	0	359	425
Black Noddy	0	11	0	5	16
White Tern	331	88	17	60	496
Many-colored Fruit Dove	10	0	0	2	12
Purple-capped Fruit Dove	3,107	104	33	1,176	4,420
Pacific Pigeon	207	15	8	282	512
Blue-crowned Lory	-	65	79	533	677
Common Barn Owl	2	0	0	0	2
White-rumped Swiftlet	441	348	13	284	1,086
Collared Kingfisher	136	43	14	95	288
Red-vented Bulbul	95	-	-	-	95
Fiji Shrikebill	-	1	9	93	103
Wattled Honeyeater	3,748	875	457	2,779	7,859
Cardinal Honeyeater	621	-	-	-	621
Polynesian Starling	296	41	3	146	486
Samoan Starling	1,647	253	91	929	2,920
Total Birds Recorded	11,585	1,899	767	7,095	21,346

Notes: A dash (-) indicates the species is not resident on the island surveyed.

Source: Engbring and Ramsey, 1989

Seabirds

Nesting and roosting seabirds, including the brown booby, the brown noddy, and the blue-gray noddy, use the rocky peninsula at Maga Point and the adjacent coastal cliffs. Red-footed boobies and masked boobies have also been observed in this area (Engbring and Ramsey, 1989).

“Maga Point is steep and inaccessible, and seabirds have found a refuge here because of its isolation. The area should be designated as a seabird sanctuary” (Engbring and Ramsey, 1989). It is believed that this recommendation remains appropriate. There is no demand for land uses on the east side of Olosega or access to the nearshore waters. Consequently, the establishment of a seabird sanctuary could probably be made without significantly impacting recreational activities or other land uses in the vicinity of Maga Point.

It is recommended that the ASG Department of Marine and Wildlife Resources should discuss the proposed wildlife sanctuary with selected traditional leaders from all villages on the Island of Olosega. If traditional leaders believe that the designation of a wildlife sanctuary would not conflict with other land uses and recreational activities along the south tip of Olosega, the ASG Department of Marine and Wildlife Resources should prepare legislation for review and adoption by the *Fono*.

The ASG Department of Marine and Wildlife Resources should prepare legislation for review and adoption by the *Fono*.

Shoreline Protection

The shoreline of the Olosega Sisifo watershed varies considerably. Basalt boulders, basalt cobbles, and coral rubble characterize much of the shoreline along the northwest coast. However, a coral and basalt cobble beach is located along the shoreline that fronts Lalomoana. Narrow basalt boulders and coarse sand are found on the shoreline immediately southeast of Agasa Strait and Tamatupu Point. In contrast, the shoreline of Olosega Village contains a considerable amount of sandy beach that is interspersed with areas of basalt outcrops and boulders.

The fringing reef of that surrounds much of Olosega affords some natural protection from storm waves by its dissipation of nearshore wave energy. Otherwise, there are few shoreline protection structures that have been constructed in the watershed. One rock wall provides some marginal protection to one home in Lalomoana. In addition, some basalt rocks have been placed southeast of Tamatupu Point to stabilize a backshore scarp.

In March 1994, Sea Engineering, Inc. and Belt Collins Hawaii published a shoreline inventory report that outlined, in part, ongoing shoreline erosion conditions and related shore protection needs for American Samoa. Sea Engineering, Inc. and Belt Collins Hawaii noted the following conditions in the Olosega Sisifo watershed that were determined to be “critical” or “potentially critical” conditions.

Tumatolu Point

The shoreline fronting Tumatolu Point included a utility pole that defined the location of the former road shoulder along the northwest coast. Despite the extensive damage to the shoreline road along the northwest coast, FEMA recommended that the residential areas along the coast should not be rebuilt.

Southeast of Tamatupu Point

The shoreline northwest of Olosega Village is potentially vulnerable to a backshore erosion scarp. The scarp was within five feet of the primary shoreline access road.

During the May, 1996 survey, a considerable amount of shoreline erosion in front of Olosega Village. Such erosion was evident between the north end of the Village and the *malae* that fronts the house of the village *faiifeau*. Local residents recall the presence of many coconut trees along this portion of the shoreline and indicate that a growing volume of sand is being lost from the sandy beach (Malae, 1996; Tausaga, 1996).

Groundwater and Surface Water Supplies

Groundwater Supply and Quality

A satellite water system of the American Samoa Power Authority is located in Olosega Village. This system serves the Island of Olosega, Lalomoana and Sili (Figure 38-3).

The ASPA water system includes two groundwater wells (ASPA wells 203 and 204). Well 203 was out of service in 1995 because of pump and motor damage.

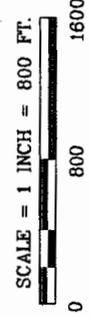
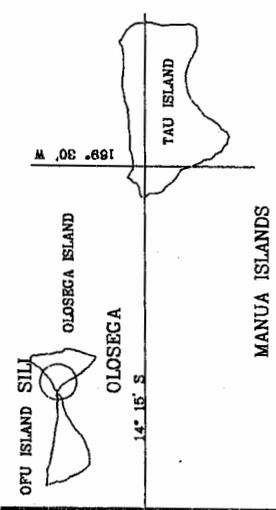


OFU ISLAND

SOUTH PACIFIC OCEAN

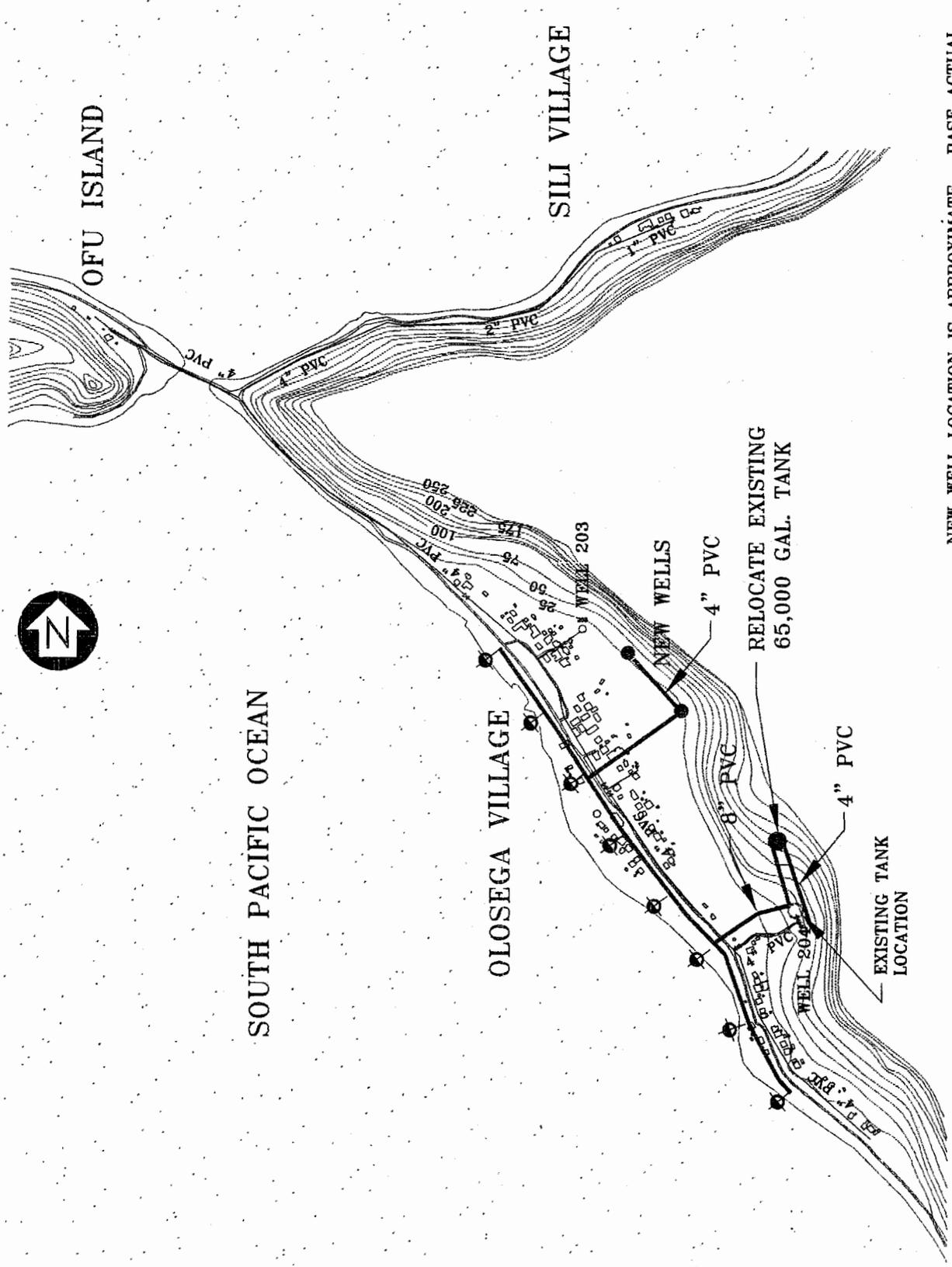
OLOSEGA VILLAGE

SILI VILLAGE



LEGEND

- EXISTING**
- 4" PVC WATER MAIN, SIZE & TYPE
 - ROADS
 - CONTOURS
 - STREAMS
- PLANNED**
- 6" PVC WATER MAIN, SIZE & TYPE
 - 6" FIRE HYDRANT



NEW WELL LOCATION IS APPROXIMATE. BASE ACTUAL
LOCATION OF DRILLING ON SITE AND GEOLOGICAL DATA

PLANNING CRITERIA

1995 POPULATION (ESTIMATED):	271	2015 POPULATION (FORECASTED):	334
1995 AVERAGE DAY DEMAND:	19,145 GAL.	2015 AVERAGE DAY DEMAND:	37,050 GAL.
CONSTRUCTION COST (1995 USD):		\$395,000	

AMERICAN SAMOA
POWER AUTHORITY



P.O. BOX PFB, PAGO PAGO, AMERICAN SAMOA

FIGURE 38-3

OLOSEGA AND SILI VILLAGES
PLANNED WATER SYSTEM IMPROVEMENTS

Both groundwater wells are characterized by elevated chloride levels. This water quality characteristic may reflect that the wells were drilled to deep (ASPA, 1995).

Residents of Olosega do not use water from the ASPA system for drinking purposes.

Surface Water Supply and Quality

A *vaipuna*, or spring, south of Olosega provides a surface water supply for Olosega residents. Local spring apparently provides a good source of potable water to the village (Hart, 1996). There is a spring box and a storage tank on the slopes of Mataala Ridge.

Available water quality from FY 1994 suggests that the village water system is chlorinated. Water quality indicated no coliform contamination, as well as some nominal levels of chlorine.

Proposed Water System Improvements

The draft ASPA Utilities Master Plan proposes the following improvements to its satellite water system in Olosega:

- completion of a leak detection survey of Olosega and Sili, and the related repair of all system leaks.
- renovation of well 203 and the restoration of its operation with chlorination.
- development of one or two groundwater wells north of Olosega Village at the base of Piumafua Mountain.
- development of a village spring as a water source for the ASPA system if the development of groundwater wells is not successful.
- development of new water storage tank northwest of the existing tank site at the 150-foot elevation.
- installation of a 4-inch PVC pipe extension to well 204 transmission main to new tank location.
- construction of an 8-inch discharge line to system distribution and the installation of PVC fire protection main along the primary shoreline road.
- installation of tank level telemetry for all groundwater wells.
- installation of 10 fire hydrants in Olosega Village.

USE OF THE WATERSHED

Resident Population

Between 1980 and 1990, the resident population of Olosega Village declined from 211 to 201 residents. This represents an average annual decline in population of about 4.7 percent. Development activity between 1990 and 1995 increased resident population to about 259 persons.

There were 13 persons living in the Lalomoana area in May, 1996. This population resided in two households.

Land Uses

Residential

Olosega

The 1990 Census documented 47 housing units in Olosega. Eighty-three percent of the housing stock was owner-occupied; two percent were rental units. Approximately 15 percent were vacant or used by owners as a vacation home.

ASG Building Division records indicate that six building permits were issued for new residential structures from 1990 through 1994. Consequently, the 1995 housing stock includes approximately 53 homes.

Sili

The 1990 Census documented 10 housing units in the Sili village Census area. Forty percent of the units were owner-occupied; none were rental units. Sixty percent were believed to be vacant or used by owners for vacation homes.

The existing housing stock has now reduced to about two housing units which are uninhabited. The Sili village Census area sustained serious damage from Hurricane Val which destroyed or seriously damaged several homes in the village. The ASG Building Division records indicate that no building permits have been issued for any new residential structures in the Village since the occurrence of Hurricane Val.

Agriculture

Piggeries

Historically, Olosega Village contained one large piggery that was located between the steep rock cliffs and the wetland that lie inland of the inhabited village area. This piggery extended all along the back side of Olosega Village to the present solid waste dump on the south end of the Village.

In 1996, about 35 families lived in Olosega. Almost every household had one piggery that housed three to four pigs (Malae, 1996).

Faatoaga

Various plantations are located in the watershed. Within Olosega Village, the primary agricultural production area is the wetland area inland of the inhabited village area.

Commercial

In 1995, five grocery stores and one retail store were operated in the Village.

Don and Ilaisa's Guest Fale is situated near the northwest end of Olosega Village. This facility includes four guest rooms that can accommodate between eight and 16 persons.

Industrial

There are no industrial operations on the Island of Olosega.

Public Facilities

The ASG Department of Education offers an early childhood education programs in Olosega. In September, 1994, this program had a student enrollment of five children.

Elementary school-aged children attend Olosega Elementary in Olosega Village. High school students attend Manua High School on Tau Island.

Use of the Nearshore Waters

Nearshore Fishing and General Water Recreation

The nearshore waters are primarily used on Saturdays. Thirty to forty persons use the nearshore waters that front Olosega Village or fishing on Saturdays. An additional 10 or more persons use the nearshore waters for swimming and general water recreation (Malae, 1996).

RESOURCE MANAGEMENT ISSUES

Future Land Uses to the Year 2015

Residential

Olosega Village

While available lands could accommodate a sizable residential expansion, the location of the Elementary School within the village is perhaps the most significant attraction to incoming families with younger children. In this regard, it is interesting to note that school enrollment at the public elementary school has increased over 40 percent since 1993 (Tuata, 1994). This may be a factor in future residential growth if proposed plans are made by ASG to encourage greater commercial agricultural opportunities in Ofu and Olosega. Potential cash employment opportunities might encourage a few more younger families to remain in the community rather than relocating to Tutuila.

Future residential growth in Olosega Village is expected to be driven primarily by a small, but growing number of returning American Samoans from the continental United States who are seeking an earlier retirement and have no school-aged children living with them. For these newcomers, lifestyle and the attractiveness of a potential housesite probably represents the more important concerns. From this perspective, the *taufusi* behind the main village area may somewhat discourage future residential expansion because the *taufusi* may generate some vector problems under various weather conditions.

The prospects and constraints to future population growth suggest that residential expansion in Olosega Village will not exceed 20 units between 1996 and 2015. Future residential expansion will probably occur on moderate slopes at the northwest and southeast ends of the village.

During the next 20 years, ASPA believes that these potential development opportunities and constraints will generate the following sequence and volume of residential construction.

- | | |
|-----------|--|
| 1996-2000 | Five new single family homes within the northwest end of the village between the shoreline and 25-foot elevation. |
| 2001-2005 | Two new single family homes between 25 and 100-foot elevation.
Three new single family homes within the northwest end of the village between the shoreline and the 25-foot elevation. |
| 2006-2010 | Five new single family homes between 25 and 100-foot elevation. |
| 2011-2015 | Five new single family homes between 25 and 100-foot elevation. |

The cumulative effect of this prospective residential growth is that the housing stock will increase to roughly 73 housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 4.17 persons per household. The anticipated 2015 village population will include about 304 persons.

Sili

The moderate slopes immediately *mauga* of Faiava and Sili could provide ample space for, at least, 15 housing units. However, this community is subject to potential storm wave damage, has no schools, or commercial facilities.

Nevertheless, it is expected that some extended families will return to either rebuild former houses or new homes. Such expansion will include two additional single family homes between 2001 and 2005 and two additional single family units between 2006 and 2010. This

growth will primarily be prompted by the construction of a paved roadway to Sili. Appropriations have already been approved by ASG for this project.

The cumulative effect of this prospective residential growth is that the housing stock will increase to roughly six housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 4.97 persons per household. It is expected that the 2015 village population will include about 30 persons.

Commercial

Informal discussions with the Honorable Tufele Lia, former Lt. Governor of American Samoa and present Manua District Governor, suggest that the American Samoa Government may eventually encourage the establishment of an increased number of commercial agricultural producers. District Governor Lia believes that expanded harbor facilities, an improved shoreline roadway, the availability of vacant, developable lands that are suitable for agriculture, and the need for cash employment opportunities will drive ASG's future commitment to increased commercial agricultural production.

Significant agricultural lands are located on the north side of Olosega. However, there is presently no convenient vehicular access to these lands. The proposed road to Sili will clearly enhance this commercial agricultural opportunity. The proximity of potential agricultural lands will encourage the formation of three new commercial agricultural enterprises in Olosega Village.

Otherwise, it is expected that two additional retail stores will be developed in the community between the year 2001 to 2005. These stores will be established to respond to new demands for more household amenities, e.g., video store.

The establishment of a National Park along the southern coast of nearby Ofu Island will encourage a greater number of visitors to the Island, as well as an increased demand for overnight accommodations. It is believed that the demand for overnight accommodations will be limited, but sizable enough to support the gradual development and operation of one new bed and breakfast facility between 2001 and 2005 and a second bed and breakfast operation during the 2006-2010 period.

The construction of no new commercial facilities in Sili is anticipated during the 1996-2015 period. The size of the residential community is not sufficient to economically support a feasible operation. Local residents will make use of commercial facilities in Olosega Village.

Industrial

Despite modest increases in future resident population, no additional light industrial operations or facilities are anticipated during the next 20 years. The lack of developable land that would be suitable for industrial activities, as well as the lack of nearby consumer market, represent the primary constraints to future industrial development in this community.

Public Facilities

Population characteristics for Olosega in 1990 suggest that approximately eight percent of the village population is three and four years of age, 20 percent is of elementary school age (ages 5 through 13), and about seven percent is high school age (14-18).

Application of population characteristics to anticipated future population suggests that Olosega will contribute the following estimated student enrollments to facilities within and outside the community in the year 2015:

- early childhood education 24 students
- elementary school 61 students
- high school 21 students

Population characteristics for Sili in 1990 suggest that approximately 13 percent of the village population is three and four years of age, eight percent are elementary school age (ages 5 through 13), and no students are of high school age (14-18).

Application of these assumptions to anticipated future population suggests that Sili will contribute the following estimated student enrollments to facilities within and outside the community in the year 2015:

- early childhood education 4 students
- elementary school 2 students
- high school 0 students

Impact of Future Population Growth Upon Water Consumption and Waste Generation

Future population growth and changes in land use in the Olosega Sisifo watershed will increase the volume of future wastewater and solid wastes that are generated by local residents. Wastewater generation in Olosega Village, for example, is expected to rise from about 11,833 gallons per day (gpd) to 24,145 gpd in the year 2015.

The consumption of potable water will also increase with a growing population. The American Samoa Power Authority (ASPA) estimates that the average day demand for water in Olosega was about 16,904 gallons in 1995. By the year 2015, ASPA anticipates that the average demand will increase to roughly 34,493 gpd.

Wastewater generation in Sili Village (including Lalomoana) is expected to rise from about 1,569 gallons per day (gpd) in 1995 to 1,790 gpd in the year 2015.

The American Samoa Power Authority (ASPA) estimates that the average day demand for water in Sili (including Lalomoana) was about 2,241 gallons in 1995. By the year 2015, ASPA anticipates that the average demand will increase to roughly 2,557 gpd.

Flood Potential

A flood insurance study of American Samoa and related flood insurance rate maps were published by the U.S. Federal Emergency Management Agency (FEMA) in 1991. The study evaluated selected geographical locations throughout the Territory. Hydrologic and hydraulic analyses that were presented in the study were made by the U.S. Army Corps of Engineers, Pacific Ocean Division. No detailed study was made of the Island of Olosega.

Inland Flood Potential

The entire Ofu Sisifo watershed has been designated by FEMA as “zone x”. This designation indicates that the areas are outside of the 100-year floodplain (Federal Emergency Management Agency, 1991). In essence, FEMA is suggesting that the flood hazard potential in these areas is limited.

Coastal Flood Hazard

The flood insurance rate map for the shoreline of the Ofu Saute watershed indicates that there is a coastal flood hazard through much of the nearshore waters and adjoining shoreline. However, no potential coastal flood elevations were determined by FEMA for the shoreline of the watershed.

Stormwater Runoff/Sedimentation and the Relationship to Surface Water Quality

Stormwater runoff and sedimentation is not an important issue on the Island of Aunuu unless steeper slopes upslope of Olosega Village are developed for residential purposes, or expanded considerably for agricultural use.

As stated earlier, no streams discharge turbid stormwater runoff into the nearshore waters. Sheet flow generated during occasional heavier rainfall periods drain into the wetland that is inland of the inhabited village area in Olosega. High Chief Malae reported that flooding does not occur in Olosega. Detention of the stormwater runoff in the wetland permits the filtering of sediments and turbid waters before their recharge into Olosega's basal aquifer. The future conservation of the wetland is important to ensure that this important wetland function continues. In its absence, Olosega Village can become flooded and groundwater supplies can become contaminated. Further, potential opportunities for groundwater recharge opportunities are considerably diminished.

It is recommended that be taken to ensure the conservation of Olosega's wetland area. No land uses other than subsistence and commercial crop production should be permitted in the Marsh. However, the land area within the wetland should not be filled to accommodate agricultural activities. In addition, no structural uses other than small buildings, e.g., sheds, that support the maintenance of *faatoaga*, should be authorized in the wetland. A community education program should accompany any land use restrictions associated with the future use of the wetland.

Olosega Village residents use a considerable amount of coral fill around homes and village stores. This long-time village practice is very desirable. Unlike paved concrete or other impermeable surfaces, the use of coral fill helps filter urban runoff.

Anticipated residential development is expected to eventually occur on moderate slopes upslope of Olosega Village. Should this development be realized, the installation of individual drywells for each residence should be required. A second option would be to require the development of a community stormwater detention facility to reduce potential stormwater discharges, potential downslope flooding, and potential discharges into the nearshore waters.

Nearshore Water Quality and the Marine Environment

Turbidity and Sedimentation

The concern for continued turbidity and sedimentation in the nearshore waters of the watershed is important. Coral communities are significantly dependent upon the availability of light and related photosynthesis, and occasional periods of significant turbidity and sedimentation do not promote long-term coral nutrition, growth, reproduction, and depth distribution (Richmond, 1993).

When corals fertilize, they are free-swimming. Consequently, they need a good location to settle and make a good attachment. With significant soil deposition, sediments can physically interfere with the recruitment of coral larvae (Richmond, 1993; Dashbach, 1996).

Coral communities are an important component of the overall ecology of the nearshore waters that adjoin the Ofu Saute watershed. They provide shelter to fish, invertebrates, and other marine organisms. Some of these resources represent a supplemental food source for residents of the watershed and other areas in West Tutuila.

In Olosega, discharges of turbid waters and sediments are not expected to impact future nearshore water quality and the marine environment. The lack of streams and the availability of Olosega's wetland area enables the detention of stormwater runoff.

Long-Term Monitoring

Surveys of coral communities have been performed along the reef fronts in the vicinity of Sili and Olosega. Continued monitoring of the Sili sites is not believed to be necessary since there is little potential for the discharge of turbid stormwater, sediments, and nutrients into the nearshore waters along the northwest coast.

Similarly, Olosega Village is not influenced by turbid stormwater runoff from local streams or sheet runoff. There are no streams in the Village. The Olosega wetland and other depressions detain most of the sheet flow from upland slopes.

At the same time, nutrient inputs from cesspools, septic tanks, and piggeries may be generating significant nutrient inputs into the nearshore waters that front Olosega Village. Consequently, the marine survey site used by Green should be monitored approximately once every three years.

Groundwater and Surface Water Supplies

Conservation of Groundwater Supplies

As stated earlier, Ofu Village is already connected to the ASPA water system. However, Olosega presently uses spring water for its drinking water supply.

To facilitate the long-term conservation of these resources, it is recommended that a 100-foot buffer or setback should be established around each groundwater and surface supply, i.e., groundwater well or spring catchment, in the watershed. In essence, the establishment of piggeries, new structural development, or other land uses would not be permitted within the 100-foot radius to prevent potential contamination of the surface supplies.

Nutrient Inputs

Some nutrient contribution is also occurring through the continued use of septic tanks, cesspools, or other soil-based, wastewater treatment systems in the watershed. In addition, some of the piggeries in Olosega may also discharge nutrient-enriched wastewater into the Olosega wetland or other natural depressions. These sources of nutrients are also accompanied by some bacterial contamination.

While the total volume of wastewater generation from the watershed is limited, the discharges are concentrated in the inhabited village area where housing densities are between two and four housing units per acre. Local soils are generally inadequate to provide effective treatment. For this reason, the nearshore waters in front of Olosega Village should be monitored for nutrient and bacterial contamination on a quarterly basis.

The long-term input of turbid and nutrient-enriched waters into the wetland and other depressions in Olosega represents an important concern. These inputs are potentially detrimental to groundwater quality if they cannot be effectively treated by the wetland and the underlying substrata. In addition, nutrient inputs may also adversely change the composition of the nearshore marine environment.

As the population of the watershed grows, nutrient and bacterial inputs will only increase. Village areas in the Olosega Sisifo watershed that are unsuitable for soil-based, wastewater treatment should be more specifically identified. As recommended in the ASPA Utilities Master Plan, this identification process should be based upon a more detailed sanitation survey of more densely inhabited areas of Olosega Village. This survey would evaluate existing wastewater treatment practices, soil characteristics, the location and density of land uses, the distance to surface water supplies and the nearshore waters, topography, and other related factors. Using the conclusions and recommendations associated with this evaluation, ASPA and other participating Project Notification and Review System (PNRS) agencies will be better able to:

- require the use of septic tanks and leachfields that provide a sufficient amount of additional soil-based treatment; and,
- provide greater technical assistance to building permit applicants.

MANAGEMENT NEEDS AND RECOMMENDATIONS

The primary focus of future resource management in the Olosega Sisifo watershed will be to:

- conserve the wetland in Olosega;
- perform a detailed sanitation survey of the inhabited Ofu Village area;
- monitor nearshore water quality;
- conserve and monitor coral communities; and
- detain urban runoff through the use of drywells in conjunction with the development of any new future residential development upslope of Olosega Village.

Representatives of participating public agencies should make periodic visits to the watershed to observe, document, and monitor selected resource conditions, determine potential methods of correcting a potential hazard or undesirable conditions, share potential solutions with designated residents of Olosega Village and Lalomoana, and encourage the participation of traditional leaders and village residents in the implementation of resource management solutions.

The scope of issues that should be addressed by each agency in the field is summarized in Table 38-3. The general focus of recommended technical assistance is also identified. The experience and insights of agency representatives will determine the specific methodology to be used in the field.

**TABLE 38-3
RECOMMENDED FOCUS OF FUTURE TECHNICAL ASSISTANCE
OLOSEGA SISIFO WATERSHED**

Participating Public Agency	Resource Management Issue	Focus of Technical Assistance
ASEPA	Facilitate a coordinated resource management effort within the watershed.	<ol style="list-style-type: none"> 1. Coordinate overall watershed management activities. 2. Hold periodic meetings with participating ASG and federal agencies to discuss, prioritize, and schedule resource management activities. 3. Coordinate program efforts with local traditional leaders and/or designated resident of the watershed. 4. Make annual assessment of resource management program.
ASPA/ASEPA	Perform a detailed evaluation of community sanitation problems associated with the use of soil-based treatment systems.	<ol style="list-style-type: none"> 1. Survey inhabited village areas in Olosega Village. 2. Evaluate existing treatment practices, soil characteristics, location and density of land uses, the distance to water supplies and nearshore waters, topography, and other factors. 3. Require use of septic tanks and leachfields that provide sufficient amounts of additional soil-based treatment; or, deny building applications in areas unsuitable for soil-based treatment.
ASEPA	Monitor water quality of nearshore waters.	Measure changes in and total/fecal bacteria and nutrients on a quarterly basis.
ASEPA	Conserve surface water supplies	<ol style="list-style-type: none"> 1. Revise American Samoa GIS to delineate 100-foot buffers around each groundwater and surface supply in Olosega Village. 2. Restrict land uses within designated buffers.
ASCZM/DOC	Detain stormwater runoff in future residential and commercial areas.	In the event that residential development takes place upslope of Olosega, require the use of onsite drywells for all new residential structures, or the development of a community stormwater detention facility.
ASDOC	Monitor changes in population and land use	Annually map type and location of land uses in village and estimate resident population.
ASG Dept. of Marine/Wildlife Resources	Sustain healthy marine communities in nearshore waters	Monitor changes in coral coverage, fish habitat, diversity and other characteristics (used by Green) along the reef front of Olosega approximately every three years.

Source: Pedersen Planning Consultants, 1998

OLOSEGA SASAE

Watershed 39

GEOGRAPHY

The Olosega Sasae watershed is located on the west side of the Island of Olosega. The watershed, which comprises about 1.2 square miles of land area (Figure 39-1), is uninhabited.

The east and west sides of Olosega are divided by Piumafua Mountain, near the center of the Island, which rises approximately 2,095 feet above mean sea level. Alei Ridge extends north of the Piumafua Mountain peak to Leumasili Point. Mataala Ridge extends southeast to Maga Point, which represents the southern tip of Olosega.

Along the east shoreline of Olosega, the Olosega Sasae watershed is located between Leumasili Point and Maga Point. No embayments are situated along the east shoreline of the watershed.

There are six drainages in the watershed.

RESOURCES OF THE WATERSHED

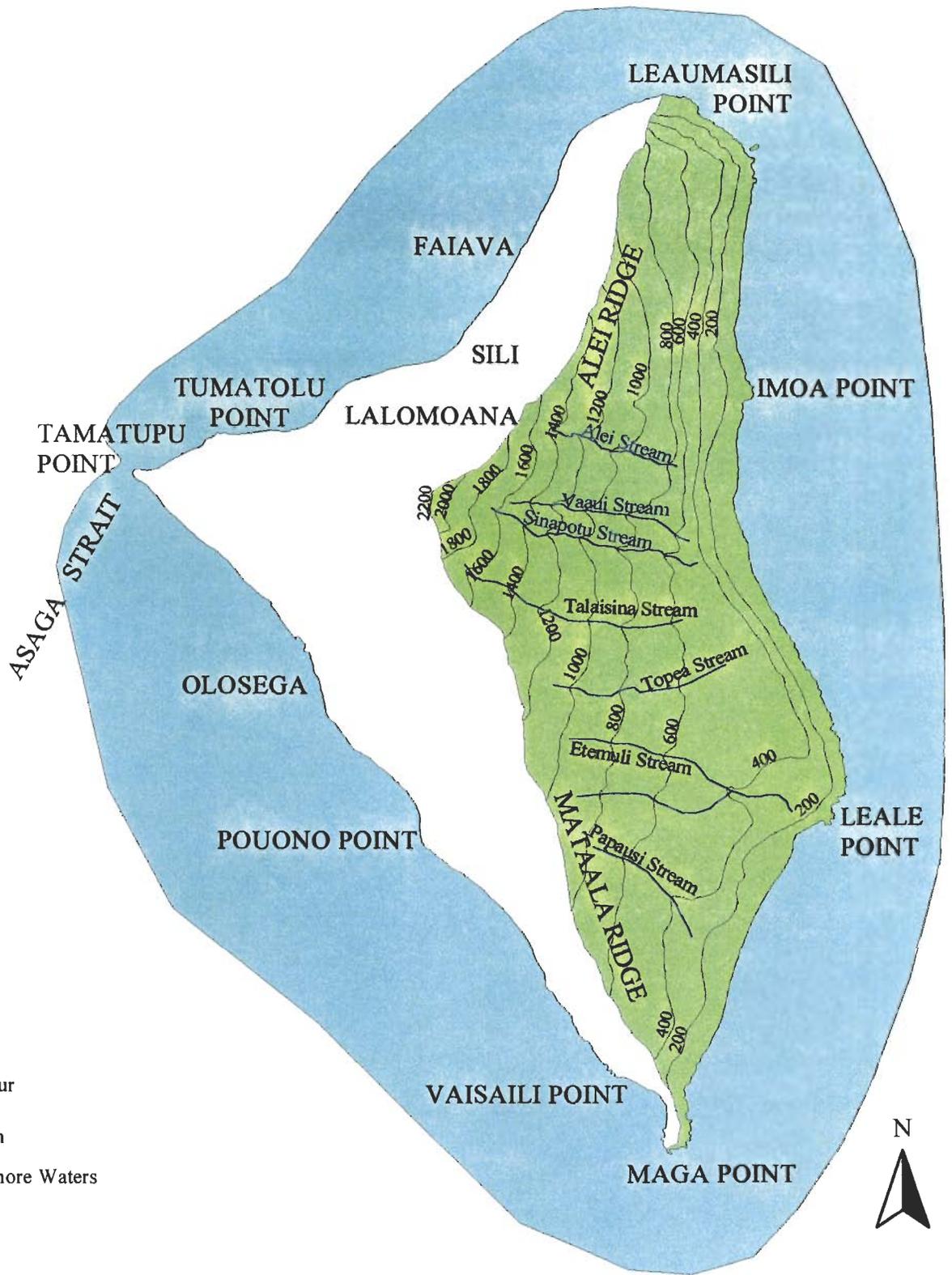
Soils

The U.S. Soil Conservation Service (National Resource Conservation Service) published a Soil Survey of American Samoa in 1984. Selected information derived from this survey provides some useful information for future watershed planning and management (Figure 39-2). Four soil classifications were identified by the U.S. Soil Conservation Service for lands within the Olosega Sasae watershed (Table 39-1).

TABLE 39-1
SELECTED SOIL CHARACTERISTICS
OLOSEGA SASAE WATERSHED

SCS Soil Unit	Name	Typical Slope (Percent)	Flood	Runoff	Erosion	Soil Depth To:		Land Use Suitability	
						High Water (Feet)	Bed Rock (Inches)	Soil Based WW Treatment	Subsistence Ag Potential
4	Fagasa family-Lithic Hapludolls-Rock outcrop assoc	70-130	None	Very Rapid	Very Severe	>6	20-40	Severe Slope Depth	Limited
12	Ngedebus Variant extremely cobbly sand	0-5	Occ	Very Slow	Slight	>6.0	>60	Severe Flood Poor Filter Large Stones	Poor
14	Ofu silty clay	15-40	None	Med	Mod	>6.0	>60	Severe Slope	Good
15	Ofu silty clay	40-70	None	Med	Mod	>6.0	>60	Severe Slope	Poor

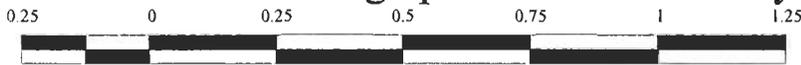
Source: U.S. Soil Conservation Service, 1984



American Samoa Geographical Information System

Olosega Sasae Watershed
Existing Conditions

39



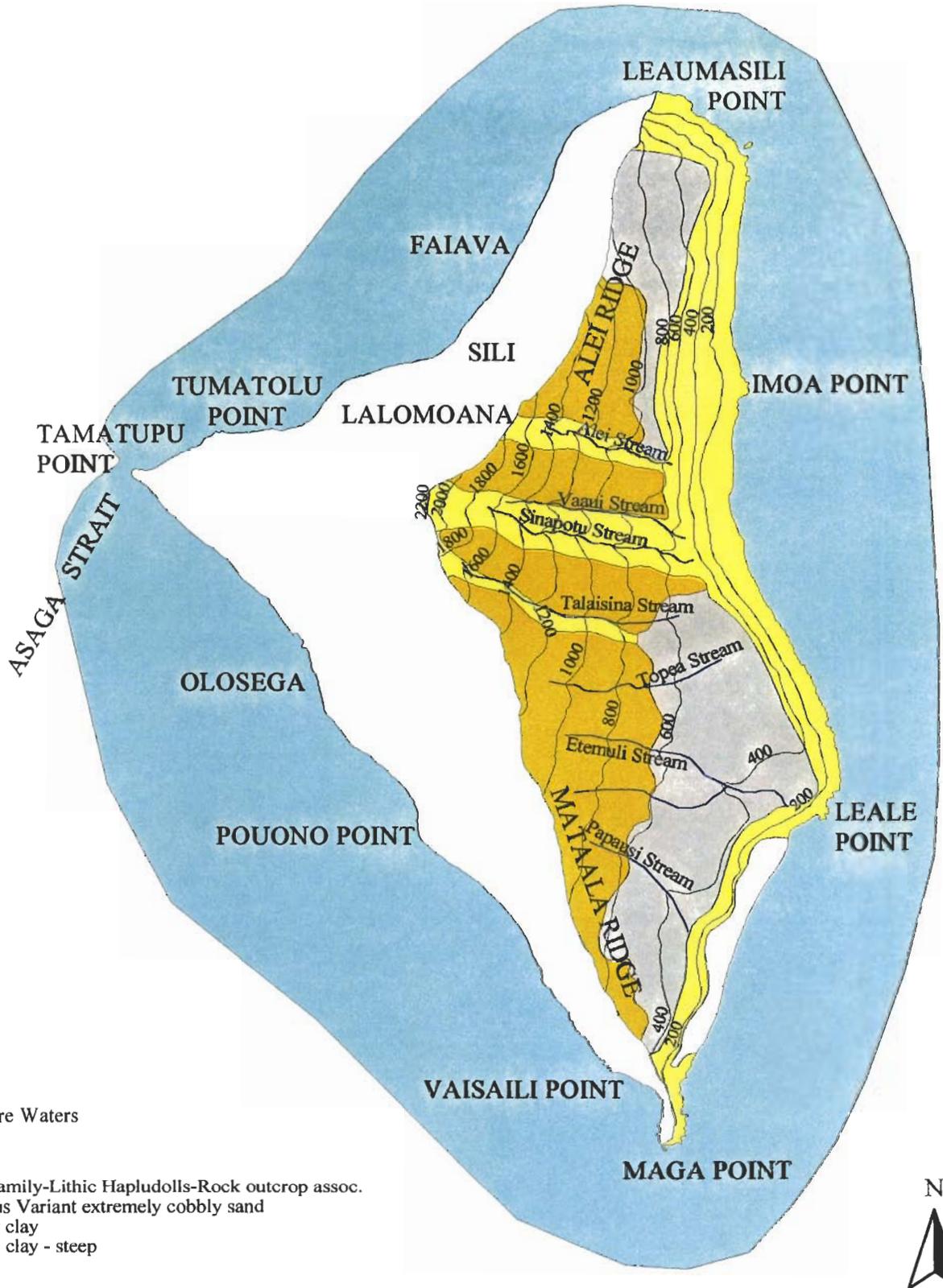
Miles

Scale: 1:24,000

Prepared by: Pedersen Planning Consultants

Tel: 307-327-5434

Figure 39-1

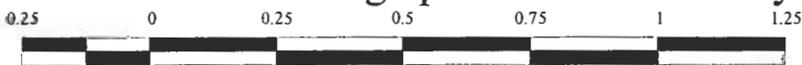


LEGEND

- Contour
- Reef
- Stream
- Nearshore Waters

Soils

- Fagasa family-Lithic Hapludolls-Rock outcrop assoc.
- Ngedebus Variant extremely cobbly sand
- Ofu silty clay
- Ofu silty clay - steep



Ngedebus Variant Extremely Cobbly Sand

Ngedebus variant extremely cobbly sand soils (SCS mapping unit 12) extends along a small portion of the southeast coast that is known as Oge. This soil is found along the shoreline up to about the 50-foot contour.

Ngedebus variant extremely cobbly sand soils is a deep, excessively drained soil that is derived from coral and seashells. These soils commonly comprise narrow sandy beaches less than 50-feet wide.

A representative surface layer is usually black extremely cobbly sand that is about 15 inches thick. The surface layer has a high content of organic matter; however, in some areas, the surface layer comprises extremely stony sand. Pale brown extremely cobbly sand defines the substratum to a depth of 60 inches or more (U.S. Soil Conservation Service, 1984).

The permeability of this soil ranges between six and 20 inches per hour. The potential hazard of water erosion is slight; potential soil runoff is very slow. This soil is occasionally subjected to brief periods of flooding.

Ngedebus Variant extremely cobbly sand soils has a poor potential for subsistence agricultural production. Coconut production can only be supported in scattered areas. Subsistence production is hampered by a higher content of coral fragments throughout the soil.

Rapid permeability characteristics of this soil make this soil unsuitable for septic tank and effluent drainfield applications. Rapid permeability of the soil does not afford effective soil-based treatment of wastewater.

Fagasa Family-Lithic Hapludolls-Rock Outcrop Association

The steeper upland slopes of the Vaau Stream drainage, as well as the steeper lower slopes of the entire watershed, contain well-drained soils known as the Fagasa family-Lithic Hapludolls-Rock outcrop association (SCS mapping unit 4).

The Fagasa Family soils contain a surface layer of dark, brown silty clay that is about 12 inches thick. A dark brown subsoil is approximately five inches thick. The substratum, which is characterized by a dark-brown, sandy clay loam, extends to a depth of 31 inches. The depth to bedrock ranges between 20 to 60 inches or more.

The Lithic Hapludolls are shallow, well-drained soils that are derived from igneous rock. The surface layer is highly variable, but U.S. Soil Conservation Service soil scientists have observed the surface layer to contain about five inches of dark brown, cobbly silty clay. The subsurface layer, which is about four inches thick, is a dark brown, very cobbly, silty clay. The substratum represents a clay loam, approximately six inches thick, over weathered bedrock.

The soil permeability of the Fagasa Family and Lithic Hapludolls soils are both between two and six inches per hour. Since the Fagasa Family-Lithic Hapludolls soil typically occurs on very steep slopes, potential runoff can be very rapid. The potential for water erosion is very severe (U.S. Soil Conservation Service, 1984).

The cultivation of subsistence crops on these soils is not considered desirable because of the stoniness of the soil and high erosion potential. When cultivation in these soils is necessary, care should be exercised to minimize the amount of exposed soil in cultivated areas. The U.S. Soil Conservation Service estimates that this soil can annually sustain up to 5 tons per acre of erosion without impacting crop productivity (U.S. Soil Conservation Service, 1984). While the erosive characteristics of this soil generally may not significantly impact subsistence crop productivity, the erosive quality of the soil can be a significant contributor to sedimentation in downslope streams and the nearshore waters.

When heavier rainfall events occur, significant erosion of these soils can be expected from undeveloped upslope areas of the watershed. Natural runoff from steeper slopes in the watershed carries water, sediments, and organic debris to downslope drainage courses and streams. Such erosion can readily influence downstream water quality.

Fagasa Family and Lithic Hapludolls soils are unsuitable for septic tank and effluent drainfield applications. Steeper slopes and the limited depth to bedrock do not afford effective soil-based treatment of wastewater.

Ofu Silty Clay (15 to 40 percent slopes)

The upper northeast slopes of Alei Ridge and a significant portion of the slopes of Mataala Ridge are characterized by Ofu silty clay on 15 to 40 percent slopes (SCS mapping unit 14). This Ofu silty clay soil is a deep, well-drained soil that is formed in volcanic ash and residuum derived from basic igneous rock.

The surface layer is typically a reddish-brown silty clay that is approximately 16 inches thick. A dark brown, silty clay loam characterizes the upper 29 inches of the subsoil; the lower 15 inches of the subsoil contains a dark brown silty clay. A substratum of dark brown silty clay, or silty clay loam, is found in some areas at depths of 30 to 60 inches or more.

The permeability of Ofu silty clay ranges between two and six inches per hour. The potential hazard of water erosion is moderate; potential runoff is considered to be medium (U.S. Soil Conservation Service, 1984).

Ofu silty clay is well suited for subsistence crop production. Typical crops produced from these soils include coconuts, breadfruit, bananas and taro.

These soils are poorly suited for septic tanks and related effluent drainfields. Steeper slopes do not enable effective soil-based treatment of wastewater.

Ofu Silty Clay (40 to 70 percent slopes)

The upper, northeast slopes of Puimafua Mountain and the upper slopes of Mataala Ridge are characterized by Ofu silty clay (SCS mapping unit 15). These soils are deep, well drained soils formed in volcanic ash and residuum that is derived from basic igneous rock.

The surface layer, which is about 10 inches thick, is typically dark reddish-brown, silty clay. In some locations, the surface layer represents a stony silty clay. The subsoil contains about nine inches of dark reddish brown silty clay loam; reddish brown silty clay loam extends another 18 inches. The substratum of reddish-brown, silty clay loam extends to a depth of 60 inches or more. The depth to weathered bedrock ranges from 40 to 60 inches or more.

Ofu silty clay soils have a soil permeability that ranges between two and six inches per hour. The potential hazard of water erosion is severe; the potential occurrence of runoff is medium to rapid.

These soils generally support woodlands, but not commercial timber harvests. Steeper slopes, as well as potential water erosion and runoff hazards, make these soils unsuitable for subsistence agricultural production.

The use of these soils for septic tank and effluent drainfield applications is also unsuitable. Steeper slopes where these soils occur do not promote effective soil-based treatment of wastewater effluent.

Streams

Stream Locations

There are seven drainages in the Olosega Sasae watershed. Each of the stream courses typically discharge to a point several hundred feet above mean sea level. At this point, stream flows cascade over steeper lower slopes during higher stream flow conditions and discharge into the nearshore waters. Lower stream flows continue over the steeper lower slopes of the watershed before their shoreline discharge.

Alei Stream originates on the northeast slopes of Piumafua Mountain and Alei Ridge at about the 1,375-foot elevation. A defined stream course continues downslope to approximately 750 feet above mean sea level.

Vaau Stream begins just below the 1,550-foot contour. The defined stream course cuts into the basaltic northeast slopes of Piumafua Mountain until approximately the 500-foot elevation.

The headwaters of Sinapoto Stream are located near the 1,650-foot elevation. This stream proceeds down the east slopes of Piumafua Mountain until approximately 500-feet above mean sea level. The U.S. Geological Survey map for Olosega incorrectly depicts Sinapoto Stream as a tributary to Vaau Stream. Each of the streams has a separate upslope discharge.

Talaisina Stream begins along the southeast slopes of Piumafua Mountain about the 1,650-foot contour. The defined stream course, which is not reflected in available 1989 topographic maps (1:200 scale), terminates near the 575-foot elevation.

Topea Stream also originates at approximately 1,150 feet above mean sea level. This stream course descends the east slopes of Mataala Ridge to approximately the 525-foot contour.

Etemuli Stream and one tributary begin near the 950-foot elevation. The main stem and the tributary merge near the 400-foot contour. The main stem continues to about the 225-foot elevation.

The headwaters of Papausi Stream are situated at approximately 725 feet above mean sea level. The defined stream course ends near the 300-foot contour.

Stream Flows Within the Watershed

There are no stream flow records available for the streams in the Olosega Sasae watershed.

Wetlands

There are no significant wetlands in the Olosega Sasae watershed.

Marine Resources

No historical observations of coral communities are known to have been made of the fringing reef in the nearshore waters that adjoin the watershed.

Wildlife Resources

Forest Birds

A 1986 Survey of the Forest Birds of American Samoa also documented about 12 forest birds in various areas of Olosega (Engbring and Ramsey, 1989). This survey, which was made on the Islands of Tutuila, Ofu, Olosega, and Tau, recorded the number of birds observed during 8-minute counts in July 1986 (Table 39-2).

TABLE 39-2
FOREST BIRD SURVEY RESULTS
NATIVE FOREST AND NON-FOREST BIRDS
JULY, 1986

Species	Tutuila	Ofu	Olosega	Tau	Total
Tahiti Petrel	0	-	-	1	1
White-tailed Tropicbird	154	11	27	234	426
Red-footed Booby	22	-	-	-	22
Great Frigatebird	1	-	-	-	1
Reef Heron	1	0	0	0	1
Red Junglefowl	527	17	0	26	570
Banded Rail	163	22	16	75	276
Spotless Crake	-	-	-	1	1
Purple Swamphen	10	4	0	15	29
Blue-gray Noddy	1	0	0	0	1
Brown Noddy	65	1	0	359	425
Black Noddy	0	11	0	5	16
White Tern	331	88	17	60	496
Many-colored Fruit Dove	10	0	0	2	12
Purple-capped Fruit Dove	3,107	104	33	1,176	4,420
Pacific Pigeon	207	15	8	282	512
Blue-crowned Lory	-	65	79	533	677
Common Barn Owl	2	0	0	0	2
White-rumped Swiftlet	441	348	13	284	1,086
Collared Kingfisher	136	43	14	95	288
Red-vented Bulbul	95	-	-	-	95
Fiji Shrikebill	-	1	9	93	103
Wattled Honeyeater	3,748	875	457	2,779	7,859
Cardinal Honeyeater	621	-	-	-	621
Polynesian Starling	296	41	3	146	486
Samoan Starling	1,647	253	91	929	2,920
Total Birds Recorded	11,585	1,899	767	7,095	21,346

Notes: A dash (-) indicates the species is not resident on the island surveyed.

Source: Engbring and Ramsey, 1989

Seabirds

Nesting and roosting seabirds, including the brown booby, the brown noddy, and the blue-gray noddy, use the rocky peninsula at Maga Point and the adjacent coastal cliffs. Red-footed boobies and masked boobies have also been observed in this area.

“Maga Point is steep and inaccessible, and seabirds have found a refuge here because of its isolation. The area should be designated as a seabird sanctuary” (Engbring and Ramsey, 1989). It is believed that this recommendation remains appropriate. There is no demand for land uses on the east side of Olosega or access to the nearshore waters. Consequently, the establishment of a seabird sanctuary could be made without significantly impacting village activities on the Island of Olosega, or in the vicinity of Maga Point. The ASG Department of Marine and Wildlife Resources should prepare legislation for review and adoption by the *Fono*.

Shoreline Protection

The fringing reef and rugged basaltic shoreline provide natural protection to the east coast of Olosega. There are no man-made shoreline protective structures in the watershed.

Groundwater and Surface Water Supplies

No groundwater wells or surface water systems are known to be developed in the Olosega Sasae watershed.

USE OF THE WATERSHED

Resident Population

The Olosega Sasae watershed is uninhabited.

Land Uses

There are no known land uses that occur in the Olosega Sasae watershed.

Use of the Nearshore Waters

No use of the nearshore waters for fishing and general water recreation is known to occur.

RESOURCE MANAGEMENT ISSUES

Future Land Uses to the Year 2015

No residential, commercial, industrial, and public facility land uses are expected to occur in this watershed during the 1996-2015 period. Steeper slopes and the lack of vehicular access will discourage future land uses in the watershed.

One potential exception may be the increased production of some subsistence crops, e.g., bananas, that could be grown commercially on Ofu silty clay (15 to 40 percent slopes). Areas containing these soils have been mapped by the U.S. Soil Conservation Service as SCS mapping unit 14. The location of these soils can also be reviewed via use of the computerized GIS for American Samoa.

Flood Potential

A flood insurance study of American Samoa and related flood insurance rate maps were published by the U.S. Federal Emergency Management Agency (FEMA) in 1991. The study evaluated selected geographical locations throughout the Territory. Hydrologic and hydraulic analyses that were presented in the study were made by the U.S. Army Corps of Engineers, Pacific Ocean Division. No study was made of the nearshore waters and adjoining shoreline.

The flood insurance rate map for the shoreline of the Olosega Sasae watershed indicates that there is a coastal flood hazard through much of the nearshore waters and adjoining shoreline. Potential baseline flood elevations were not indicated.

The entire Olosega Sasae watershed has been designated by the Federal Emergency Management Agency as "zone x." This designation indicates that the areas are outside of the 100-year floodplain (Federal Emergency Management Agency, 1991). In essence, FEMA is suggesting that the flood hazard potential in these areas is limited.

Stormwater Runoff/Sedimentation and the Relationship to Surface Water Quality

The seven streams in the Olosega Sasae watershed likely transport a considerable amount of turbid water and sediments to the nearshore waters that adjoin the watershed. These discharges are derived exclusively from the natural erosion of more erosive soils on steeper slopes of the watershed.

The detention of a portion of future stormwater flows would be desirable. However, this is not feasible because of the remote nature of the watershed.

While no uses are presently made of lands in the watershed, it is recommended that future land uses in the watershed be limited to agricultural production and watershed conservation. Future agricultural production should be limited to upland areas where Ofu silty clay on 15 to 40 percent slopes (SCS mapping unit 14) is present. These soils have good potential for subsistence crop production. At the same time, the soils pose a moderate potential for water erosion and soil runoff. Consequently, the ASG Land Grant representatives should provide technical assistance to any future plantation operators to ensure that appropriate land conservation practices are applied to future agricultural production.

Nearshore Water Quality and the Marine Environment

Turbidity and Sedimentation

The concern for continued turbidity and sedimentation in the nearshore waters of the watershed is important. Coral communities are significantly dependent upon the availability of light and related photosynthesis, and occasional periods of significant turbidity and sedimentation do not promote long-term coral nutrition, growth, reproduction, and depth distribution (Richmond, 1993).

When corals fertilize, they are free-swimming. Consequently, they need a good location to settle and make a good attachment. With significant soil deposition, sediments can physically interfere with the recruitment of coral larvae (Richmond, 1993; Dashbach, 1996).

Coral communities are an important component of the overall ecology of the nearshore waters that adjoin the Olosega Sasae watershed. They provide shelter to fish, invertebrates, and other marine organisms.

Long-Term Monitoring

The long-term monitoring of the reef front between Maga Point and Imoa Point is recommended. The monitoring of this remote site will enable the ASG to better understand the ecological impacts associated with turbid water and sediment discharges from an undisturbed watershed.

Groundwater and Surface Water Supplies

There are no groundwater and surface water supplies located in the Olosega Sasae watershed. Consequently, there are no significant management issues associated with these resources.

MANAGEMENT NEEDS AND RECOMMENDATIONS

The primary focus of future resource management in the watershed will be to:

- encourage appropriate agricultural practices in upland faatoaga areas;
- limit agricultural production to selected areas with soils more conducive to agricultural production and less prone to erosion;
- restrict land uses other than agriculture that would significantly increase the discharge of turbid waters and sediments into local streams;
- monitor future changes in land use; and,
- monitor the condition of coral reefs in the nearshore waters between Maga Point and Imoa Point.

Representatives of participating public agencies should make periodic visits to the watershed to observe, document, and monitor selected resource conditions, determine potential methods of correcting a potential hazard or undesirable conditions, share potential solutions with a designated resident of Olosega, and encourage the village's implementation of resource management solutions.

The scope of issues that should be addressed by each agency in the field is summarized in Table 39-3. The general focus of recommended technical assistance is also identified. The experience and insights of agency representatives will determine the specific methodology to be used in the field.

**TABLE 39-3
RECOMMENDED FOCUS OF FUTURE TECHNICAL ASSISTANCE
OLOSEGA SASAE WATERSHED**

Participating Public Agency	Resource Management Issue	Focus of Technical Assistance
ASEPA	Facilitate a coordinated resource management effort within the watershed.	<ol style="list-style-type: none"> 1. Coordinate overall watershed management activities. 2. Hold periodic meetings with participating ASG and federal agencies to discuss, prioritize, and schedule resource management activities. 3. Coordinate program efforts with local traditional leaders and/or designated resident of the watershed. 4. Make annual assessment of resource management program.
ASDOC	Restrict land uses other than agriculture that would generate significant discharges of turbid water and sediment into local streams.	<ol style="list-style-type: none"> 1. Require a PNRS review for any structural development in the watershed. 2. Limit future structural development to those supporting agricultural production. 3. Provide specific design and construction criteria in conjunction with the approval of any future structures.
ASDOC	Monitor changes in population and land use	Annually map type and location of land uses in village and estimate resident population.
ASCC Land Grant Program	Reduce erosion and sedimentation from upslope agricultural production	<ol style="list-style-type: none"> 1. Encourage soil conservation methods with any future growers of subsistence and commercial agricultural crops. 2. Encourage upslope agricultural production only on Ofu silty clay soils on 15 to 40 percent slopes (SCS unit 14).
ASG Dept. of Marine/Wildlife Resources	Sustain healthy marine communities in nearshore waters	Monitor changes in coral coverage, fish habitat, diversity and other characteristics (used by Green) between Maga Point and Imoa Point approximately every three years.

Source: Pedersen Planning Consultants, 1998

TAU MATU

Watershed 40

GEOGRAPHY

The Tau Matu watershed comprises the northern two-thirds of Tau Island. The watershed comprises about 14.2 square miles of land area (Figure 40-1).

The interior boundaries of this watershed include Mataalaosagamai Ridge, Olotania Crater, and Lata Mountain. Other prominent inland features include Judd's Crater, upslope of Fitiuta Village, as well as Lepue, Olomatimu, and Olomanu Crater in the northwest part of Tau. Faleselau Ridge and Tavalagi Ridge lie upslope of Faleasao Village.

Along the shoreline, the Tau Matu watershed extends between Siufaalele Point, the southeast tip of the watershed. Tufu Point represents the southeast boundary of the watershed.

There are several coves along the shoreline of the watershed. The largest is situated in the nearshore waters that front Faleasao Village.

RESOURCES OF THE WATERSHED

Soils

The U.S. Soil Conservation Service (National Resource Conservation Service) published a Soil Survey of American Samoa in 1984. Selected information derived from this survey provides some useful information for future watershed planning and management (Figure 40-2). Fifteen soil classifications were identified by the U.S. Soil Conservation Service for lands within the Tau Matu watershed (Table 40-1).

Urban Land-Ngedebus Complex

Urban land-Ngedebus complex soils (SCS mapping unit 35) is situated along the northwest coast of Tau. This soil generally extends along the shoreline village areas of Tau, Siufaga, and the adjoining Fusi area.

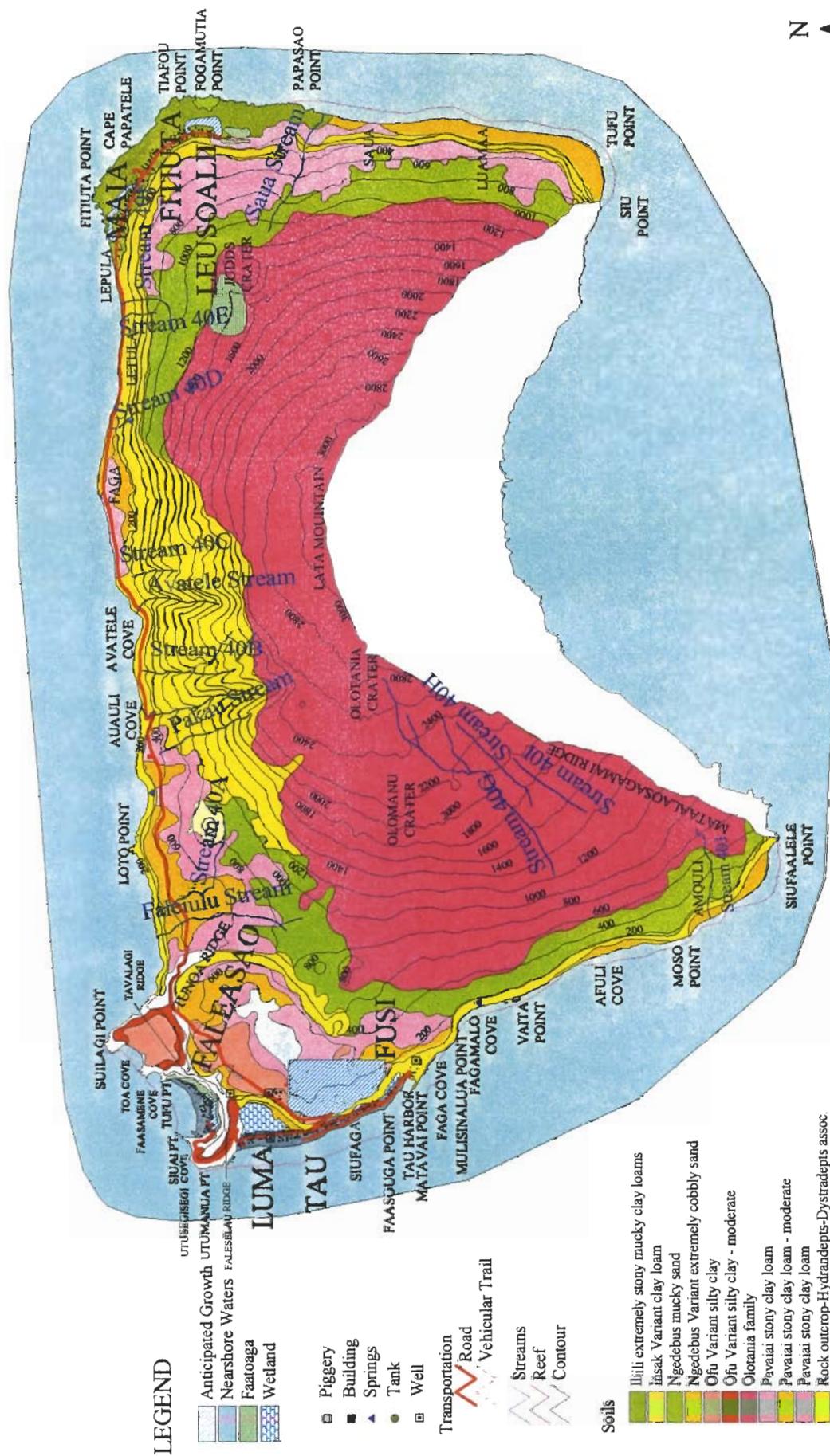
These soils generally comprise coral fragments, sand, cinders and other material that have been graded or filled to support residential, commercial and public facilities in the village areas.

The Ngedebus soil extends to a depth of 60 inches or more. The surface layer, which extends about 4 inches below ground elevation, typically contains light, brownish-gray and brown sand. The underlying material is characterized by pale brown and light yellow, brown sand. The permeability of Ngedebus soil ranges between six and 20 inches per hour.

Surface drainage on this soil is generally slow, and the hazard of potential soil erosion is slight. In some places, the soil is subject to occasional, brief periods of flooding during prolonged, heavy rainfall or during high tide (U.S. Soil Conservation Service, 1984).

These soils are generally suitable to support residential and commercial development in areas that are protected from flooding. However, this soil is poorly suited in unprotected areas.

Where moderate to higher housing densities occur, the U. S. Natural Resources Conservation Service recommends the use of community sewage systems prevent the potential contamination of groundwater and surface water supplies. Housing densities in Tau, Siufaga, and Fusi are typically four to five units per acre. In Faleasao, housing densities range between two and seven units per acre.



Tau Matu Watershed Management Issues

Figure 40-2

American Samoa Geographical Information System



Miles
Scale: 1:60,000

**TABLE 40-1
SELECTED SOIL CHARACTERISTICS
TAU MATU WATERSHED**

SCS Soil Unit	Name	Typical Slope (percent)	Flood	Runoff	Erosion	Soil Depth To:		Land Use Suitability	
						High Water (feet)	Bed Rock (inches)	Soil Based WW Treatment	Subsistence Ag. Potential
5	Iliili extremely stony mucky clay loam	3-15	None	Slow	Slight	>6	8-20	Severe Depth to rock Large stones	Poor
7	Insak Variant clay loam	0-2	Occasional	Slow	Slight	0.5-20	>60	Severe flood Wetness	Moderate for wet crops
11	Ngedebus mucky sand	0-2	Occ	Very slow	Slight	>3.5	>60	Severe flood Wetness Poor Filter	Moderate
12	Ngedebus Variant extremely cobbly sand	0-5	Occ	Very slow	Slight	>6.0	>60	Severe Flood Wetness Poor filter Large stones	Poor
16	Ofu Variant silty clay	6-20	None	Slow to Med	Slight to Mod	>6.0	>60	Moderate Slope	Moderate
17	Ofu Variant silty clay	20-40	None	Med to Rapid	Mod to Severe	>6.0	>60	Severe Slope	Moderate
18	Ofu Variant-Rock outcrop complex	40-70	None	Rapid	Severe	>6.0	>60	Severe Slope	Poor
22	Olotania family	15-10	None	Med to Rapid	Mod to Severe	>6.0	>20	Severe Depth to rock Poor filter Slope	Poor
23	Pavaiai stony clay loam	6-12	None	Slow to Med	Slight to Mod	>6	38	Severe Depth To Rock	Moderate
24	Pavaiai stony clay loam	12-25	None	Medium	Mod-erate	>6.0	38	Severe Depth To Rock Slope	Moderate
25	Pavaiai stony clay loam	25-40	None	Med to Rapid	Mod to Severe	>6.0	20-40	Severe Depth to Rock Slope	Moderate
27	Rock outcrop-Hydrandepts-Dystrandepts assoc	70-130	N/A	N/A	N/A	N/A	N/A	Poor Potential	Poor
31	Sogi Variant-Pavaiaia association	15-50	None	Med to Rapid	Mod to Severe	>6.0	20-40	Severe Depth to Rock Slope	Moderate
35	Urban land-Ngedebus complex	0-5	Occ.	Slow	Slight	>3.5	>60	SevereFlood Wet Poor Filter	Poor

Source: U.S. Soil Conservation Service, 1984

Ofu Variant-Rock Outcrop Complex, 40 to 70 Percent Slopes

The steep slopes immediately upslope and northeast of Faleasao Village contain Ofu variant-rock outcrop complex (SCS mapping unit 18). These soils are also found in Lepue Crater, which is situated about 1.6 miles east of Faleasao. Ofu variant-rock outcrop complex comprises about 65 percent Ofu variant silty clay and 25 percent rock outcrop.

Ofu variant is a deep, well-drained soil is that is formed in volcanic ash and other volcanic material. The rock outcrop represents exposed areas of volcanic tuff.

Approximately 8 inches of dark brown silty clay characterizes the surface layer of Ofu variant soil. Dark brown silty clay is found in the upper 6 inches of the subsoil; the lower 6 inches is dark, yellowish-brown clay loam. Highly weathered tuff that crushes easily to sandy loam defines the substratum to a depth of 60 inches or more.

The soil permeability associated with Ofu variant soil is moderately rapid. The potential hazard of water erosion is severe; potential runoff is rapid.

Ofu variant soils have poor potential for subsistence agriculture even though the soil supports woodland areas. Rock outcrop is exposed areas of tuff that supports little vegetation except for some trees and shrubs that grow in cracks and on ledges.

These soils are unsuitable for septic tank and drainfield applications. Rapid permeability, steep slopes and rock outcrop do not permit effective soil-based treatment for wastewater effluent.

Ofu Variant Silty Clay (20 to 40 percent slopes)

Ofu variant silty clay along 20 to 40 percent slopes (SCS mapping unit 17) is found along the top of Faleselau Ridge and the unnamed ridge east of Tavalagi Ridge. This is a deep, well-drained soil formed in volcanic ash and pyroclastic material.

The surface layer, which is approximately 8 inches thick, is typically dark brown silty clay. Dark brown silty clay comprises the upper 6 inches of the subsoil. The lower 14 inches of the subsoil is usually dark, yellowish-brown clay loam. Highly weathered tuff that crushes easily to sandy loam is characteristic of the substratum extends to a depth of 60 inches or more.

The soil permeability of Ofu variant silty clay ranges between 2 and 6 inches per hour. The potential hazard of water erosion is moderate to severe; potential runoff is medium to rapid.

This soil has moderate potential for the production of subsistence crops such as taro, bananas, breadfruit, and coconuts. However, the potential hazard of water erosion constrains these agricultural activities.

Steeper slopes make this soil generally unsuitable for septic tanks and effluent drainfields. This factor does not enable effective soil-based treatment for wastewater effluent.

Ofu Variant Silty Clay (6 to 20 percent slopes)

The steeper slopes northeast of Faleasao and upslope of Toa Cove are characterized by Ofu variant silty clay (SCS Unit #16). The same soil is evident along portions of the upper primary shoreline roadway from Tau Village to Tau High School, as well as the continuing vehicular trail northeast of Tau High School. Ofu variant silty clay is a deep, well-drained soil formed in volcanic ash and other volcanic material.

The surface layer typically represents dark brown, silty clay about 8 inches thick. In the subsoil, dark brown silty clay characterizes the upper 6 inches; dark, yellowish-brown clay loam typifies the lower 14 inches of the subsoil. Highly weathered tuff that crushes easily to sandy loam comprises the substratum to a depth of 60 inches or more.

The permeability of Ofu variant silty clay ranges between two and six inches per hour. The potential hazard for water erosion is slight to moderate; potential runoff is slow to medium.

This soil is well-suited for the production of a variety of subsistence and commercial agricultural crops. Coconuts, breadfruit, bananas and taro are the primary subsistence crops. Potential vegetable crops include head cabbage, Chinese cabbage, cucumbers, beans, radishes, and peppers. One limitation is the potential hazard associated with water erosion.

Ofu variant silty clay is somewhat suitable for septic tank and drainfield applications.

Insak Variant Clay Loam

The wetland in Tau Village that is downslope of Manua High School is characterized by Insak variant clay loam soils (SCS mapping unit 7). This deep, very poorly drained soil is formed in fine textured alluvium deposited over coral sand.

The surface layer typically contains approximately five inches of very dark grayish brown clay loam. A second layer is characterized by a very dark, grayish-brown silty clay loam that is about eight inches thick. In some areas, the surface layer contains loam or silty clay loam (U.S. Soil Conservation Service, 1984).

Very dark, grayish-brown silty clay, about 31 inches thick, comprises the subsoil. The subsoil is light gray coral sand that extends to a depth of 60 inches or more.

Insak variant clay loam has permeability that ranges between two and six inches per hour. The potential hazard of water erosion is slight; potential runoff is slow (U.S. Soil Conservation Service, 1984).

The water table typically within six to 20 inches below ground elevation. Insak variant clay loam is also subject to occasional, brief periods of flooding.

Insak Variant soil has moderate potential for subsistence agriculture. However, these soils can only support crops that require or tolerate continued wetness.

Saturated soils and susceptibility to occasional flooding make this soil unsuitable for septic tank and effluent drainfields. These characteristics do not afford adequate soil-based treatment for wastewater.

Rock Outcrop-Hydrandepts-Dystrandepts Association, Very Steep

Soils known as rock outcrop-hydrandepts-dystrandepts association (SCS mapping unit 27) is located in various parts of the watershed (Figure 40-2). As the name implies, this soil represents a combination of rock outcrop, Hydrandepts, and Dystrandepts.

Along the northwest coast of Tau, rock outcrop-hydrandepts-dystrandepts association soils are found along steeper slopes immediately upslope of the inhabited villages of Tau, Siufaga, and Fusi. These soils continue along the steeper slopes along the shoreline to Afuli Cove. In these areas, the soil generally is below the 200 foot contour.

A significant area of Rock outcrop-hydrandepts-dystrandepts association is also situated along the north shoreline and north central part of the watershed. This area is primarily located north of Olomoana Crater and upslope of Auauli Cove and Avatele Cove. In this area, these soils extend up to the 2,600-foot elevation (Figure 40-2).

Rock outcrop-hydrandepts-dystrandepts association also extends along the steeper slopes inland of the east shoreline of Tau. These soils are generally located between the 200 and 400-foot contour in this area.

Exposed areas of bedrock represent Rock outcrop. The rock outcrop is on very steep and nearly vertical side slopes. This soil type contains little or no soil material. Where present, the soil is usually gravelly and ranges from sandy loam to silty clay loam.

Hydrandepts are located at higher elevations on very steep side slopes. Hydrandepts formed in volcanic ash under heavy rainfall. This soil is well drained and frequently represents a silty clay loam. Hydrandepts is typically shallow, or sometimes moderately deep to bedrock.

Dystrandepts are found at lower elevations on very steep side slopes. Dystrandepts, which is formed in volcanic ash, is well drained and are usually shallow or moderately deep to bedrock. The soil contains a stony surface layer and typically represents a clay loam or silty clay loam.

These soils are unsuitable for both subsistence agriculture and septic tank applications because of steep slopes and the lack of an adequate soil layer for soil-based wastewater treatment.

Pavaiai stony clay loam (6 to 12 percent slopes)

In the northwest part of Tau Matu watershed, there are scattered areas of Pavaiai stony clay loam soils (SCS soil mapping unit 23) on the northwest plateau upslope of Faleasao and Tau (Figure 40-2).

This soil is formed in volcanic ash and underlain by lava. The surface layer typically contains a very dark, grayish-brown, stony clay loam that is about 7 inches thick. In some cases, the surface layer contains a silty clay loam. The subsurface layer, approximately 5 inches thick, and is a very dark, grayish-brown, clay loam. The subsoil is characterized by a dark brown, very cobbly, sandy loam that is roughly 26 inches thick. A lava bedrock is encountered between 20 and 40 inches below ground elevation (U.S. Soil Conservation Service, 1984).

The permeability of this Pavaiai soil is moderately rapid. The potential for erosion is slight to moderate; the rate of stormwater runoff is generally slow to medium (U.S. Soil Conservation Service, 1984).

Pavaiai stony clay loam soils are moderately suitable for subsistence agriculture. The production of subsistence crops is constrained somewhat by the presence of stones, the limited depth to rock, and the hazard of water erosion. However, the content of stones in the surface layer is usually not significant enough to impact planting and other agricultural. The use of mulch, crop residue, and cross-slope farming can reduce the potential of erosion.

Pavaiai stony clay loam soils are moderately suitable for residential development and septic tank installations. The presence of stones, the limited depth to bedrock, and slope represent constraints to residential land uses and soil-based wastewater treatment. The design of access roads should incorporate measures to control of surface runoff and stabilize cut slopes.

Pavaiai Stony Clay Loam (12 to 25 percent slopes)

This soil (SCS soil mapping unit 24) is found in portions of the northwest plateau upslope of Faleasao and Tau.

This moderately deep, well drained soil was formed in volcanic ash and is underlain by lava. The surface layer, which is about seven inches thick, is typically a very dark, grayish-brown, stony clay loam. In some areas, the surface layer is a stony silty clay loam. The subsurface layer is only about five inches thick and contains a very dark, grayish-brown, clay loam. A dark brown, very cobbly sand loam represents the subsoil that is about 26 inches thick. A lava bedrock occurs at a depth of about 20 to 40 inches.

Rock outcrops also occur in some small areas. Where they occur, the depth to bedrock is less than 20 inches.

The permeability is moderately rapid for this Pavaiai soil. The available water capacity is moderate, and effective rooting depth is 20 to 40 inches. The hazard of water erosion is moderate, since runoff is medium.

These Pavaiai soils are moderately suited to the production of subsistence crops. The primary constraints are slope, the potential for water erosion, the limited depth to bedrock, and the presence of stones. The presence of stones in the surface layer is not significant enough to affect the planting of subsistence crops. The control of erosion can be accomplished by the use of crop residues and mulch, as well as cross-slope farming.

Residential uses and related septic tank installations have moderate suitability on these soils. The design of access roads should incorporate measures to control of surface runoff and stabilize cut slopes.

Pavaiai Stony Clay Loam, 25 to 40 Percent Slopes

Pavaiai stony clay loam soils (SCS mapping unit 25) is found upslope of the northwest plateau upslope of Faleasao and Tau, as well as inland slopes above Siufaga, Fitiuta, and the southeast coast of Tau. This soil is formed in volcanic ash and underlain by basaltic lava.

The surface layer, which is about 10 inches thick, comprises a very dark, grayish-brown, stony clay loam. The surface layer is also stony in scattered areas.

The first six inches of the subsoil are represented by a very dark, grayish-brown sandy loam that contains a considerable amount of gravel. The lower 14 inches of the subsoil is a very fine sandy loam that also contains a significant amount of gravel (U.S. Soil Conservation Service, 1984).

Soil permeability ranges between two and six inches per hour. Potential hazards associated with water erosion are moderate to severe. Potential runoff is medium to rapid (U.S. Soil Conservation Service, 1984).

Pavaiai stony clay loam soils have moderate potential for subsistence crop production. Potential agricultural opportunities include the production of taro, bananas, breadfruit, and coconuts. However, agricultural production is constrained by the potential hazards associated with water erosion, the presence of stones, and the limited depth to rock (U.S. Soil Conservation Service, 1984).

The limited depth to bedrock and steeper slopes do not promote adequate soil-based treatment for wastewater. Consequently, this soil is unsuitable for septic tank and effluent drainfield applications.

Sogi Variant-Pavaiai Association, 15 to 50 Percent Slopes

Upland slopes in the northwest and east part of the Tau Matu watershed include soils known as Sogi variant-Pavaiai association (SCS mapping unit 31). As the name implies, this soil represents a combination of Sogi variant and Pavaiai stony clay loam.

Sogi variant is a well-drained soil that is formed in volcanic ash. The surface layer is a dark brown silty clay that is approximately eight inches thick. The subsoil, which is about 22 inches thick, is characterized by a dark brown silty clay over *pahoehoe* lava.

The Pavaiai stony clay loam is also well-drained and formed in volcanic ash. The surface layer, which extends about 10 inches in depth, is usually a very dark, grayish-brown sandy loam that contains a considerable amount of gravel. The 20-inch subsoil is a very fine sandy loam that also contains a considerable amount of gravel. Underlying lava is found at about 30 inches. The depth to bedrock ranges between 20 and 40 inches.

The permeability of Sogi variant-Pavaiai association ranges between two and six inches per hour. Potential water erosion is moderate to severe; potential runoff is medium to rapid.

These soils are moderately suited to the production of subsistence crops. Such crops include banana, breadfruit, taro, and coconuts.

Sogi variant-Pavaiai association is not suited for the septic tank and effluent drainfield applications because of its limited depth to bedrock and high gravel content. These characteristics do not afford adequate soil-based treatment.

Iliili Extremely Stony Mucky Clay Loam, 3 to 15 Percent Slopes

Iliili extremely stony mucky clay loam (SCS mapping unit 5) comprises most of the soils in the inhabited village areas of Fitiuta, Maia, and Leusoalii.

Iliili extremely stony mucky clay loam is underlain by lava and formed by volcanic ash. The surface layer represents a very dark, grayish-brown, clay loam that is about five inches thick. The subsoil includes about four inches of very dark, grayish-brown, clay loam that is extremely stony.

The permeability of the soil is rapid. This Iliili soil has a slight potential to generate water erosion; its runoff is slow.

The stony surface layer and limited depth to bedrock constrain cultivation, as well as residential development. Iliili extremely stony mucky clay loam provides a stable building foundation; however, the soil is difficult to excavate. The treatment of sewage effluent from soil-based treatment systems is not recommended since the soil does not adequately treat wastewater. The use of community sewage systems is required to prevent groundwater contamination.

Ngedebus Mucky Sand

Two small areas on the northwest end of Maia Village and southeast side of Fitiuta Airport contain Ngedebus mucky sand (SCS mapping unit 11).

Ngedebus mucky sand is a deep, somewhat excessively drained soil. This soil is derived from coral and sea shells.

The surface layer is typically black mucky sand that is approximately 12 inches thick. In some areas, the surface layer comprises loamy sand. The substratum is gray to very pale brown sand that extends to a depth of 60 inches or more.

The permeability of Ngedebus mucky sand is rapid. The potential hazard of water erosion is slight; potential runoff is very slow. Very brief periods of flooding can occur on these soils.

Ngedebus mucky sand is moderately suited to the production of subsistence crops such as taro, bananas, breadfruit and coconuts. However, agricultural uses are constrained by the retention of adequate moisture and low soil fertility.

Its suitability for septic tank installations and effluent drainfields is poor. Rapid permeability and the limited depth to the water table do not enable effective soil-based treatment.

Ngedebus Variant Extremely Cobbly Sand

Ngedebus variant extremely cobbly sand soils (SCS mapping unit 12) extends along various remote coastal areas of the watershed (Figure 40-2). In general, these areas are located along the north, southeast, and southwest coasts of Tau. These soils are typically situated below the 200-foot contour.

Ngedebus variant extremely cobbly sand soils is a deep, excessively drained soil that is derived from coral and sea shells. These soils commonly comprise narrow sandy beaches less than 50-feet wide.

A representative surface layer is usually black extremely cobbly sand that is about 15 inches thick. The surface layer has a high content of organic matter; however, in some areas, the surface layer comprises extremely stony sand. Pale brown extremely cobbly sand defines the substratum to a depth of 60 inches or more (U.S. Soil Conservation Service, 1984).

The permeability of this soil ranges between six and 20 inches per hour. The potential hazard of water erosion is slight; potential soil runoff is very slow. This soil is occasionally subjected to brief periods of flooding.

Ngedebus Variant extremely cobbly sand soils has a poor potential for subsistence agricultural production. Coconut production can only be supported in scattered areas. Subsistence production is hampered by a higher content of coral fragments throughout the soil.

Rapid permeability characteristics of this soil make this soil unsuitable for septic tank and effluent drainfield applications. Rapid permeability of the soil does not afford effective soil-based treatment of wastewater.

Olotania Family, 15 to 40 Percent Slopes

Olotania family soils (SCS mapping unit 22) dominate the upland slopes of the Tau Matu watershed. These soils are well-drained and formed in volcanic ash and cinders.

The surface layer is typically a dark yellowish-brown, silty clay loam that is about 8 inches thick. About 17 inches of dark yellowish-brown silty clay loam characterizes the subsoil. Weathered volcanic cinders that represent the substratum extend to a depth of 60 inches or more.

The Olotania family soils have a soil permeability that ranges between two and six inches per hour. The potential hazard of water erosion is moderate to severe; potential runoff is medium to rapid.

Olotania family soils support woodlands, but are not suited for subsistence crop production. Potential water erosion hazards constrain these agricultural uses.

The limited depth to bedrock is the primary deterrent to septic tank and effluent drainfield applications. This factor does not permit effective soil-based treatment of wastewater.

Streams

Stream Locations

There are 15 streams in the Tau Matu watershed. These streams are primarily located along the north coast of Tau. However, other streams are found in the east and southwest parts of the Tau Matu watershed.

North Coast

There are 10 streams along the north coast that drain the north slopes of Lata Mountain. The peak of Lata Mountain lies near the center of the watershed.

Faleiulu Stream originates just below the 820 -foot elevation. This stream drains surface flows from the east side of Tunoa Ridge and the northwest slopes of Lata Mountain. This stream discharges along the generally uninhabited north coast of Tau.

An unnamed stream (Stream 40A) begins at approximately the 900-foot contour on the south side of Lepue Crater. This stream, which transports surface runoff from Lepue Crater and the northwest slopes of Lata Mountain, terminates at about 150 feet above mean sea level. During higher stream flows, stream flows likely cascade directly to the nearshore waters. Lower flows likely drain slowly over the steeper slopes of the drainage before entering the nearshore waters west of Loto Point.

The headwaters of Pakau Stream are situated at approximately 2,025 feet above mean sea level. This drainage carries runoff from the northwest slopes of Lata Mountain. The stream discharges along the shoreline east of Loto Point.

An unnamed stream (Stream 40B) begins near the 1,250-foot contour. This stream drains surface runoff from the north slopes of Olotania Crater, as well as the northwest slopes of Lata Mountain. Stream flows are ultimately carried to the nearshore waters of Auauli Cove.

Mataufuau Stream and one tributary drain a portion of the northwest slopes of Lata Mountain. This stream originates near the 1,175-foot elevation. The defined stream course ends near the 50-foot contour just seaward of the shoreline vehicular trail. However, stream flows continue to drain over steeper coastal slopes before discharging into the nearshore waters.

Avatele Stream begins at about 1,255 feet above mean sea level. This stream course proceeds down steeper mountain slopes and passes underneath the shoreline vehicular trail before its discharge into Avatele Cove.

The headwaters of an unnamed stream (Stream 40C) that drains the north slopes of Lata Mountain originate near the 1,125-foot contour. The defined stream course terminates at about 250 feet above mean sea level. Stream flows likely continue to drain down steeper slopes upslope of the vehicular trail during lower and higher flows. It is uncertain whether these stream flows ultimately discharge into the nearshore waters.

On the east side of Faga, a short stream segment (Stream 40D) begins near the 300-foot contour. The U.S. Geological survey map for the Island of Tau indicates the presence of a fresh-water spring at the headwaters of Stream 40D that likely feeds this stream course. However, this stream may also carry a small portion of runoff from the northeast slopes of Lata Mountain. The point of discharge occurs along the nearshore waters between Faga and Letula.

Between Letula and Lepula, Stream 40E originates near the 825-foot elevation. This stream course drains a portion of the runoff from the northeast slopes of Lata Mountain. The defined stream course terminates just upslope of the main vehicular trail along the north coast of Tau. Lower flows probably drain across the vehicular trail during lower flow periods. Higher stream flows likely generate some strong stream discharges over the road surface.

Stream 40F also drains a portion of the surface runoff from the northeast slopes of Lata Mountain. The headwaters of the stream are located near the 1,025-foot contour. This stream also terminates upslope of the vehicular trail along the north coast of Tau.

East Coast

There is only one stream along the east coast of Tau.

Saua Stream originates on the southeast slopes of Judd's Crater at about 915-feet above mean sea level. This stream drains a portion of the east slopes of Lata Mountain. The stream discharges near Papasao Point along the northeast coast of Tau.

Southwest Coast

There are four unnamed streams (40G through 40J) along the southwest coast of Tau. These streams drain the southwest slopes of Lata Mountain, as well as the northwest side of Mataalaosagamai Ridge.

The headwaters of Stream 40G are located southwest of Olotania Crater near the 2,700-foot contour. After receiving additional runoff from two tributaries, the stream course of the main stem continues downslope to about 1,800 feet above mean sea level. Stormwater runoff drains along steeper slopes of the lower watershed that are not contained within a defined drainage course. Ultimately, stream flows discharge into Afuli Cove.

Stream 40H originates near the 2,400-foot elevation and continues to about the 1,680-foot contour. Stormwater runoff and stream flows continue to drain to the nearshore waters along the steeper slopes of the watershed. Stream flows eventually discharge into Afuli Cove.

Stream 40I begins at about the 1,950-foot contour to approximately 1,440 feet above mean sea level. Surface runoff carried within the defined stream course continues to drain along the steeper slopes northwest of Mataalaosagamai Ridge. Stream flows eventually discharge into Afuli Cove.

Stream 40J begins about 840 feet above mean sea level. This stream course transports a limited amount of surface runoff from the northwest side of Mataalaosagamai Ridge. The stream discharges along the shoreline near Amouli.

Stream Flows Within the Watershed

No streamflow records were discovered for the streams in the Tau Matu watershed.

Wetlands

There are two wetland areas on the west side of Tau.

Luma

Inland of Luma, there is a disturbed coastal marsh. Available topographic maps from 1989 aerial photography suggest that this depression is located at an elevation between four and five feet above mean sea level.

When surveyed by Whistler in 1976, extensive cultivation was documented. However, some red mangrove, willow primrose, and water chestnut were present (Whistler, 1976). In May, 1996, taro cultivation was observed in a portion of the marsh.

Road drainage from the paved roadway upslope of Luma is directed to the marsh below via appropriately designed road inlets. As a result, Luma and Tau do not experience any significant flooding from stormwater runoff from upper slopes and the primary shoreline roadway.

In May, 1996, a drainage outlet from the wetland to the nearshore waters was located. A closed culvert was situated between the northwest corner of the wetland and the nearshore waters. A manhole associated with the line was located between the ASG dispensary and Tau Motel. Upon inspection, it was determined that sand inside the discharge line prevented the discharge of overflows from the wetland.

Fusi

A small wetland, comprising about two acres of land, is located northeast of Tau Harbor. Available topographic maps from 1989 aerial photography suggest that this depression is located at an elevation of approximately four feet above mean sea level.

Whistler concluded in 1976 that the marsh was probably once heavily cultivated, but was not at the time of his observations. Predominant vegetation in 1976 included the willow primrose, red mangrove, and water chestnut (Whistler, 1976).

In May 1996, a local resident who lives in the Fusi area indicated that he was concerned with the solid waste material and junk that has been dumped into the wetland. He was concerned for the safety of his children who play near the area. He recalls that the ASG Department of Public Works, Maintenance and Operations Division, began dumping a variety of solid waste material into this wetland in the aftermath of Hurricane Tusi in January, 1987 (Saiaana, 1996). Some of the junk in the wetland was removed in 1995.

Wetland Conservation

Both wetlands in the west part of Tau should be conserved to enable wetland functions for stormwater detention, subsistence agriculture, and groundwater recharge. The upcoming Wetlands Restoration and Enhancement Plan should survey the wetland in greater detail to determine if other potential wetland functions can be derived from other resource management efforts.

The functionality of the former coastal marsh at Fusi cannot begin to be realized until solid waste material is completely removed from the wetland. This task should be completed by the ASG Department of Public Works.

Marine Resources

Coral Communities

A fringing reef encircles most of the Island of Tau. Along the east coast of Tau, the width of the fringing reef ranges between 250 and 500 feet. The northwest coast of Tau contains reef widths from 550 to 650 feet wide. South of Tau Harbor, the fringing reef is typically less than 300 feet wide.

Various private consultants have made field investigations of the fringing reefs of Tau since the late 1970's. In a cumulative sense, the available survey information suggests:

- Coral communities are generally in better condition than those surrounding Tutuila.
- Although damaged extensively by Hurricane Tusi in 1987, coral communities escaped major damage from more recent storms.

1978-1979

About five percent coral cover was observed along inshore areas that flanked the east margin of Faleasao Bay. Coral covered increased to about 20 percent along the outer reef platform (Aecos and Aquatic Farms, 1980).

Along the west end of Faleasao Bay, live coral covered about 30 percent of the bottom with an equal proportion of dead coral heads present (Aecos and Aquatic Farms, 1980).

In the vicinity of Tau Village, coral cover was approximately five percent on the inner reef flat and *ava* that provided boat access to offshore waters. On the middle reef flat, which was located between 100 and 200 feet offshore, coral coverage was near 10 percent. Coral

coverage increased to 20 percent some 200 to 300 feet from the shoreline (Aecos and Aquatic Farms, 1980).

Northwest of Faasouga Point, live coral coral coverage characterizes about five percent of the sandy inshore areas. The middle reef flat, however, increased significantly up to 85 percent. The outer reef flat contained a coverage of only 10 percent.

1995

A recent 1996 study of various coral reefs throughout the Samoan Archipelago included marine surveys of the reef fronts seaward of Tau Village, Fagamalo Cove, and Afuli Cove along the west coast of Tau, as well as Faga and Lepula on the northeast coast. The study focused primarily upon the quantification of coral communities, the abundance and diversity of reef fish, and selected habitat characteristics (Table 40-2).

**TABLE 40-2
FISH COMMUNITIES AND HABITAT CHARACTERISTICS
ISLAND OF TAU
1996**

Location	Coral Cover (percent)	Fish Species Richness (number of species)	Fish Density (individuals per ha)	Fish Biomass (kg per ha)
Tau Village	20-39	<100	<5,000	<500
Fagamalo Cove	<20	<150	5,000-9,999	>10,000
Afuli Cove	<20	100-149	5,000-9,999	500-999
Faga	<20	100-149	5,000-9,999	500-999
Lepula	20-39	100-149	>10,000	<500

Source: Department of Marine and Wildlife Services, 1996

Green also noted that the coral reefs of the Manua Islands were severely damaged by Hurricane Tusi in 1987, but escaped significant damage from Hurricane Ofa in February, 1990 and Hurricane Val in December, 1991. In addition, the reefs in Manua were also influenced by infestations by the crown-of-thorns starfish and a recent coral bleaching event. From her review of past studies, Green concluded that the reef fronts of the Manua Islands tended to be in better condition than those on Tutuila.

Green also mentioned that the reef fronts at Lepua and Afuli were among the best surveyed in the Samoan archipelago.

Wildlife Resources

Forest Birds

A 1986 Survey of the Forest Birds of American Samoa documented about 18 forest birds in various areas of Tau (Engbring and Ramsey, 1989). This survey, which was made on the Islands of Tutuila, Ofu, Olosega, and Tau, recorded the number of birds observed during 8-minute counts in July, 1986 (Table 40-3).

Other Birds

A cave located in the rock cliff near Faleasao Village on the northwest tip of Tau Island may be used by the white-rumped swiftlet and by sheath-tailed bats as a roosting and nesting site (Aecos and Aquatic Farms, 1980).

**TABLE 40-3
FOREST BIRD SURVEY RESULTS
NATIVE FOREST AND NON-FOREST BIRDS
JULY, 1986**

Species	Tutuila	Ofu	Olosega	Tau	Total
Tahiti Petrel	0	-	-	1	1
White-tailed Tropicbird	154	11	27	234	426
Red-footed Booby	22	-	-	-	22
Great Frigatebird	1	-	-	-	1
Reef Heron	1	0	0	0	1
Red Junglefowl	527	17	0	26	570
Banded Rail	163	22	16	75	276
Spotless Crake	-	-	-	1	1
Purple Swamphen	10	4	0	15	29
Blue-gray Noddy	1	0	0	0	1
Brown Noddy	65	1	0	359	425
Black Noddy	0	11	0	5	16
White Tern	331	88	17	60	496
Many-colored Fruit Dove	10	0	0	2	12
Purple-capped Fruit Dove	3,107	104	33	1,176	4,420
Pacific Pigeon	207	15	8	282	512
Blue-crowned Lory	-	65	79	533	677
Common Barn Owl	2	0	0	0	2
White-rumped Swiftlet	441	348	13	284	1,086
Collared Kingfisher	136	43	14	95	288
Red-vented Bulbul	95	-	-	-	95
Fiji Shrikebill	-	1	9	93	103
Wattled Honeyeater	3,748	875	457	2,779	7,859
Cardinal Honeyeater	621	-	-	-	621
Polynesian Starling	296	41	3	146	486
Samoan Starling	1,647	253	91	929	2,920
Total Birds Recorded	11,585	1,899	767	7,095	21,346

Notes: A dash (-) indicates the species is not resident on the island surveyed.

Source: Engbring and Ramsey, 1989

Shoreline Protection

The shoreline of the Tau Matu watershed is afforded some natural protection from the fringing reef that is located in the nearshore waters seaward of the watershed. Exposed basaltic sea cliffs, which generally remain undeveloped, also characterize a significant amount of the coastline.

Some man-made shoreline protective structures have been constructed in selected shoreline locations. An engineered revetment protects Tau Harbor which was completed by the U.S. Army Corps of Engineers in December, 1980. Similarly, revetment was constructed seaward of the Faleasao Relief Harbor which was completed in the early 1990's. In addition, some basalt walls have been constructed along portions of the shoreline to protect the vehicular trail that connects the east and west sides of Tau.

In March, 1994, Sea Engineering, Inc. and Belt Collins Hawaii published a shoreline inventory report that outlined, in part, ongoing shoreline erosion conditions and related shore protection needs for

American Samoa. Sea Engineering, Inc. and Belt Collins Hawaii noted the following conditions in the Tau Matu watershed that were determined to be “critical”, or “potentially critical” conditions.

Tau Village

The shoreline that fronts Tau and Luma experienced significant erosion from Hurricane Val in 1991. A scarp has been eroded 20 to 40 feet landward during the recent hurricanes. Sea Engineering noted that the erosion was not a problem. With the exception of a church and one house, all homes were set back and built on or behind the elevated dune ridge.

Faga

On the northeast side of Tau, the shoreline vehicular trail in the Faga area is susceptible to storm damage. The narrow shoreline vehicular trail in this area is located on the backshore between steep rock cliffs and the shoreline. Basalt boulders have been placed along the road shoulder to provide some protection. The maintenance of the vehicular is important since the trail is the only vehicular access that connect the east and west sides of Tau.

Lepula

Between Faga and Lepula, there was evidence of past shoreline erosion. The concrete bases of several utility poles on the seaward side of the road were undermined. Some of these poles were 10 to 15 feet seaward of the road shoulder.

The shoreline reach that fronts Lepula is potentially critical where the vehicular trail is located at lower elevations.

Groundwater and Surface Water Supplies

Groundwater and Surface Water Supplies

The villages of Faleasao and Tau are served by one satellite water system that is operated and maintained by the American Samoa Power Authority (ASPA). This system is supplied by two groundwater wells (ASPA wells 209 and 212). ASPA well 209 is located near Tau Harbor; well 212 is situated on the north side of Tau High School. Both wells are chlorinated.

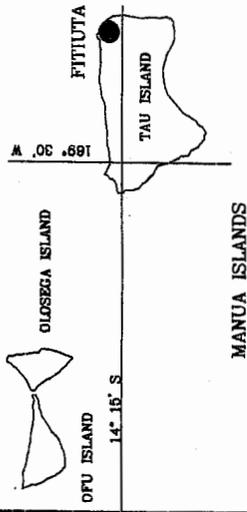
In terms of groundwater quality, an ASG Department of Public Works representative reported in May 1996 that a number of people in Tau are experiencing kidney problems. There is a question whether local public health is being diminished by higher chloride levels that are ranging between 400 and 500 parts per million, or other water quality characteristics (Tavaseu, 1996).

The village council of Tau believes that the *taufusi* in Tau is contaminating the ASPA water supply (Mailoi and Moliga, 1996). In Faleasao, one long-term resident reported that the ASPA groundwater supply that is transported to the village tastes salty (Tali, 1996).

Along the northeast coast of Tau, the villages of Fitiuta (including Maia) and Leusoalii are also served by one satellite water system that is operated and maintained by the American Samoa Power Authority (ASPA). This system is supplied by two groundwater wells (ASPA wells 207 and 208) in Faga. Well 208 was not operational in May 1998 because of past damages to the transmission main and electrical power supply that were incurred from Hurricane Val in 1991. Water supplies at both wells are chlorinated (Figure 40-3).

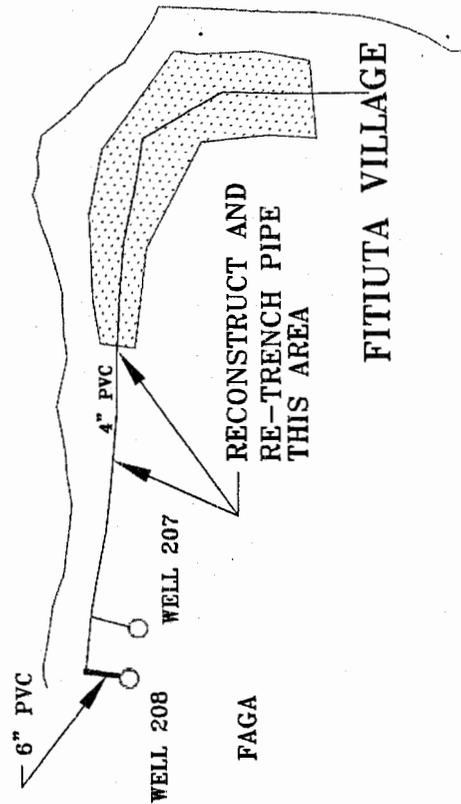
Available groundwater quality data for ASPA well 207 indicate that chloride levels in the groundwater supply are low.

SOUTH PACIFIC OCEAN

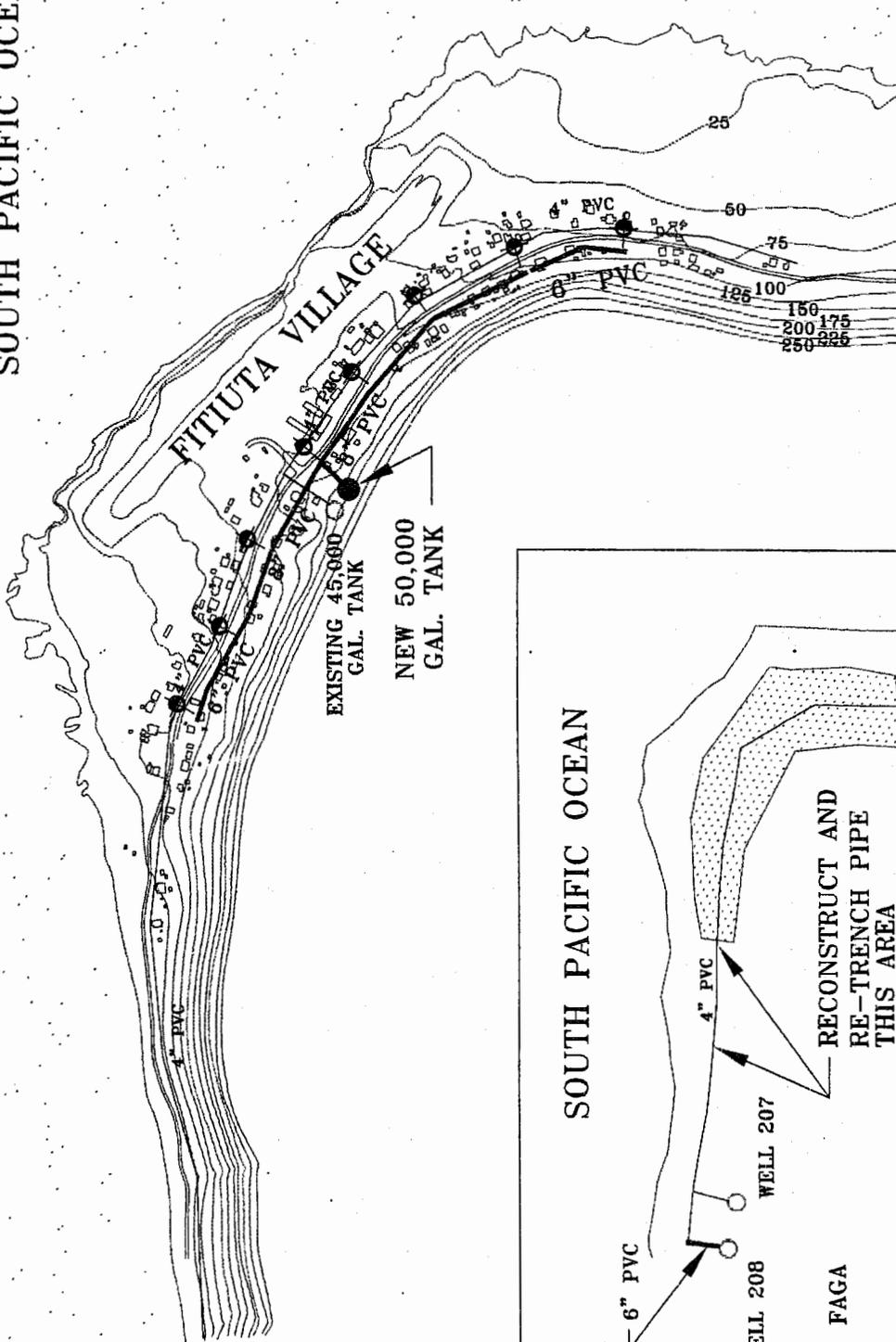


SCALE = 1 INCH = 800 FT.
0 800 1600

SOUTH PACIFIC OCEAN



NOT TO SCALE



LEGEND

- EXISTING**
- 4" PVC
 - ROADS
 - CONTOURS
 - STREAMS
- PLANNED**
- 6" PVC
 - WATER MAIN, SIZE & TYPE
 - 6" FIRE HYDRANT

PLANNING CRITERIA

1995 POPULATION (ESTIMATED):	468	2015 POPULATION (FORECASTED):	617
1995 AVERAGE DAY DEMAND:	48,351 GAL	2015 AVERAGE DAY DEMAND:	62,817 GAL
CONSTRUCTION COST (1995 USD):		\$275,000	

AMERICAN SAMOA
POWER AUTHORITY



P.O. BOX PFB, PAGO PAGO, AMERICAN SAMOA

FIGURE 40-3
FITIUTA VILLAGE
PLANNED WATER SYSTEM IMPROVEMENTS

Surface Water Supply and Quality

There are no village water systems in any of the inhabited village areas of Tau. However, individual roof catchment systems are used in Luma, Tau, and Siufaga are used as the primary drinking water supply because of higher chloride levels and undesirable taste associated with the ASPA groundwater supply.

Along the northeast coast, individual roof catchment systems are primarily used as a supplemental water supply for non-potable purposes. However, some residents use water from their individual roof catchments when the ASPA system cannot provide adequate pressure (Paopao, 1996).

Proposed Water System Improvements

In its draft Utilities Master Plan, ASPA identifies proposed improvements for its Faleasao-Tau and Fitiuta satellite water systems.

Faleasao-Tau System

- In light of elevated chloride levels, ASPA proposes to drill new groundwater wells near the center of the old airport runway.
- Completion of a leak detection survey in Faleasao, Tau (including Luma), and Siufaga.
- Construction of PVC main from new groundwater wells to existing transmission main near Tau High School.
- Installation of new pressure reducing valve between existing tank and Faleasao Village water distribution network.
- Renovation of existing PVC transmission main from the existing storage tank to the Tau distribution system.
- Installation of nine fire hydrants.
- Construction of a 10,000-gallon storage tank.
- Construction of PVC transmission mains from new wells to new Tau tank, as well as from the new tank to the Tau village distribution system.

Fitiuta System

- Completion of a leak detection survey for Maia, Fitiuta, and Leusoalii.
- Renovation of the existing storage tank.
- Installation of tank telemetry for both well pumps.
- Reconstruction of transmission main on west side of village.
- Renovation of well 208 and restoration of operation.
- Installation of transmission main.
- Construction of a 50,000-gallon water storage tank in the vicinity of the existing tank.
- Installation of new PVC transmission main from new storage tank to system distribution.
- Construction of fire protection main along the main village road.
- Installation of 10 fire hydrants.

USE OF THE WATERSHED

Resident Population

Faleasao

Between 1980 and 1990, the resident population of Faleasao Village declined from 263 to 246 residents. This represents an average annual decline in population of about 6.5 percent. However development activity between 1990 and 1995 increased resident population to about 265 persons.

Population trends for Faleasao reflected in the 1990 Census statistics suggest that considerable in-migration has occurred in this community between 1980 and 1990, but changed radically by the end of the decade. The proportion of residents who were born outside of American Samoa during the 1980-1984 period was about 24 percent. Between 1985 and 1990, the proportion increased to 43 percent. In 1990, the proportion retreated to 17 percent. The dramatic swing of migration within Faleasao suggests one of three potential scenarios.

1. a significant return of American Samoans, who were born in the continental United States was made, during the 1985-1989 period.
2. a significant number of native residents of Faleasao departed for school, employment, or other reasons during the 1985-1989 period.
3. significant in-migration of new residents, who were not born in American Samoa and a considerable out-migration by native residents.

The low proportion of persons in Faleasao who were born outside of American Samoa suggests that some greater stability may be occurring within the community after a six percent decline in population during the past decade. In essence, those who remain are primarily native residents who are destined to remain in the community.

Luma

Between 1980 and 1990, the resident population of Luma Village increased from 236 to 293 residents. Such growth represented an average annual growth rate of about 24.2 percent. Development activity between 1990 and 1995 increased resident population to about 370 persons.

Siufaga

Between 1980 and 1990, the resident population of Siufaga Village declined from 232 to 143 residents. This represents an average annual decline in population of about 38.36 percent. However development activity between 1990 and 1995 increased resident population to about 183 persons.

Population trends for Siufaga reflected in the 1990 Census statistics suggest that considerable in-migration has occurred in this community between 1980 and 1990, but changed considerably by the end of the decade. The proportion of residents who were born outside of American Samoa during the 1980-1984 period was about 25 percent. Between 1985 and 1990, the proportion increased to 43 percent. In 1990, the proportion retreated to 20 percent. The dramatic swing of migration within Siufaga suggests one of three potential scenarios.

1. a significant return of American Samoans, who were born in the continental United States was made, during the 1985-1989 period.
2. a significant number of native residents of Faleasao departed for school, employment, or other reasons during the 1985-1989 period.
3. significant in-migration of new residents, who were not born in American Samoa and a considerable out-migration by native residents.

The low proportion of persons in Siufaga who were born outside of American Samoa suggests that some greater stability may be occurring within the community after a significant decline in population during the past decade. In essence, those who remain are primarily native residents who are destined to remain in the community.

Maia

Between 1980 and 1990, the resident population of Maia Village increased from 206 to 207 residents. Such growth represented an average annual growth rate of about 0.5 percent. Development activity between 1990 and 1995 increased resident population to about 214 persons.

Population trends for Maia reflected in the 1990 Census statistics suggest that considerable in-migration has occurred in this community between 1980 and 1990. The proportion of residents who were born outside of American Samoa during the 1980-1984 period was about 16 percent. Between 1985 and 1990, the proportion increased to 67 percent. In 1990, the proportion retreated to 24 percent.

The more recent downward swing of migration within Maia suggests that a significant return of American Samoans, who were born outside of American Samoa, occurred during the 1985-1989 period. However, discussions with Manua's District Governor and Manua High School representatives suggest that a significant number of native residents of Maia departed for school, employment, or other reasons in the late 1980s. Out-migration continues and is occurring particularly among the 18-45 age group and persons over 50 years of age. Consequently, the 1990 Census statistics reflected a decline in persons born outside of American Samoa.

Leusoalii

Between 1980 and 1990, the resident population of Leusoalii Village increased from 201 to 247 residents. Such growth represented an average annual growth rate of about 22.9 percent. Development activity between 1990 and 1995 increased resident population to about 254 persons.

Population trends reflected in the 1990 Census statistics suggest that considerable in-migration has occurred in this community between 1980 and 1990. The proportion of residents who were born outside of American Samoa during the 1980-1984 period was about four percent. Between 1985 and 1990, the proportion increased to 66 percent. In 1990, the proportion declined dramatically to 22 percent.

The more recent downward swing of migration within Leusoalii suggests that a significant return of American Samoans, who were born outside of American Samoa, occurred during the 1985-1989 period. However, discussions with Manua's District Governor, Tufele Lia, as well as Manua High School administrators, suggest that a significant number of native residents of Leusoalii departed for school, employment, or better medical care in the late 1980s. Out-migration continues and is occurring particularly among the 18-45 age group and persons over 50 years of age (Laapuli, 1994). Consequently, the 1990 Census statistics reflected a decline in persons born outside of American Samoa.

Land Uses

Residential

Faleasao

The 1990 Census recorded 39 housing units in Faleasao. About 92 percent of the housing stock was owner occupied; three percent were rental units. Approximately five percent of the housing units were vacant or used by owners as vacation homes. ASG Building Division records indicate that two building permits were issued for two residential structures from 1990

through 1994. Consequently, the 1995 housing stock includes approximately 41 housing units.

Luma

Luma village contained about 63 housing units in 1990. About 73 percent of the housing was owner-occupied; six percent were rental units. The remainder of the housing stock was believed to represent vacant homes. Two new residential building permits were issued between 1990 and 1995 which suggests that the present housing stock includes approximately 65 housing units.

Siufaga

The 1990 Census documented 33 housing units in Siufaga. About 67 percent of these homes were owner-occupied. Nine percent were rental units. The remaining 24 percent were vacant or vacation homes for absentee owners. ASG Building Division records indicate that no building permits were issued for new residential structures from 1990 through 1994. Onsite observations of the village also suggested that few, if any, homes have been built in the community since 1990. Consequently, the 1995 housing stock includes 33 homes.

Maia

The 1990 Census documented 32 homes in Maia. Approximately 69 percent of these homes were owner-occupied. Roughly 25 percent were rental units. The remaining six percent were vacant or vacation homes that are occasionally used by off-island homeowners. ASG Building Division records indicate that no building permits were issued for new residential buildings from 1990 through 1994. Consequently, the 1995 housing stock includes 32 homes.

Leusoalii

The 1990 Census documented 38 housing units in Leusoalii. Approximately 79 percent of all housing units were owner-occupied. Rental units included about 13 percent of the housing stock. The remaining eight percent were vacant or vacation homes that are used by absentee owners. ASG Building Division records indicate that no building permits were issued for new residential buildings from 1990 through 1994. Consequently, the 1995 housing stock includes 38 homes.

Agriculture

Piggeries

Four to five piggeries are located in Faleasao. Each piggery contains one to four pigs (Tali, 1996). Piggeries of similar size are located in Luma and Tau; however, local residents were unsure how many piggeries were located in the village.

Only a few families in Fitiuta have piggeries. Historically, a very large piggery was located south of the present Fitiuta Airport to just north of Saua Stream.

Faatoaga

Plantations that produced both subsistence and commercial crops were located primarily in the vicinity of the inhabited village areas of Maia, Fitiuta, and Leusoalii. In May, 1996, High Chief Paopao reported that agricultural production primarily consisted of banana and breadfruit, as well as some *tamu*, pineapple, and tapioca. In the aftermath of Hurricane Tusi in 1987, only limited coconut production had occurred.

Along the northeast coast of the Island of Tau, *faatoaga* were also located south of Leusoalii in May, 1996. In this area, plantations were observed adjacent to the main vehicular trail along portions of the north coast.

In May, 1996, agricultural production in Tau Village was primarily evident in the *taufusi* in the village, as well as the upland slopes of the northwest plateau near Tau High School.

Commercial

In 1995, six commercial enterprises were established in Faleasao. These enterprises included two grocery stores, three retail stores, and one video store.

There were about 13 commercial enterprises that operated in Tau and Luma. These enterprises included two video stores, one commercial agricultural produce distributor, an inter-island shipping agent, general construction contractor, a laundromat, four grocery stores, one retail store, one bakery, and one gas station. Tau Motel also provides visitor accommodations in Luma.

One commercial enterprise was based in Siufaga. This business was a small gas station. Otherwise, local residents patronized stores in Luma which has a variety of grocery and retail stores.

No commercial enterprises operated in Maia.

There were eight commercial enterprises that were operating in Leusoalii. These enterprises included the Amerika Samoa Bank, two grocery stores, two retail stores, a distributor of kerosene and gasoline, and two eating establishments.

Industrial

There were no industrial operations within the Tau Matu watershed in 1995.

Public Facilities

Faleasao

The ASG Department of Education offers an early childhood education program in Faleasao. In September, 1994, this program was attended by 11 younger children.

Elementary school-aged children attend Faleasao Elementary in Faleasao. The September, 1994 enrollment was 167 students. High school students attend nearby Manua High School in the Luma village Census area. This facility was attended by 98 students in September, 1994.

Luma

Luma Village includes a public dispensary and Manua High School. The dispensary is located on the north end of the village and contains about four beds.

The ASG Department of Education does not provide any early childhood education program in Luma or Tau. Elementary school students attend Faleasao Elementary School in nearby Faleasao.

Manua High School in Luma had about 99 students enrolled in September, 1994. This enrollment, which includes students from other Manua villages, represents a decline from several years ago when the student enrollment was about 160 students (Wilson, 1994). The school is administered by a faculty and staff of 14 persons.

Siufaga

The ASG Department of Education does not offer an early childhood education program in Siufaga. Elementary school-aged children attend Faleasao Elementary in Faleasao. High school students attend nearby Manua High School in the Luma village Census area.

Tau Harbor and the ASG Public Works Center are located near the south end of the village.

Maia

The only public facility in Maia Village is the Airport which is partly located in Fitiuta Village. An increase in chartered air traffic is expected at this Airport. However, increased aircraft operations will not warrant any expansion of this facility. The ASG Department of Education does not offer an early childhood education program in Maia. Elementary school-aged children attend Fitiuta Elementary in the Leusoalii village Census area. The September, 1994 enrollment at this school facility was 108 students. High school students attend nearby Manua High School in the Luma village Census area.

Leusoalii

An important public facility in the Leusoalii village Census area is the Fitiuta Airport.

The ASG Department of Education offers two early childhood education programs in Fitiuta. In September, 1994, this program had a combined student enrollment of 18.

Elementary school-aged children attend Fitiuta Elementary in the Leusoalii village Census area. The September, 1994 enrollment was 108 students.

High school students attend nearby Manua High School in the Luma village Census area.

Use of the Nearshore Waters

Faleasao

In Faleasao, Chief Tali said that some 30 persons use the nearshore waters seaward of the village for fishing. Local fishermen usually fish with the use of fishing poles, nets, and spears (Tali, 1996).

Some 50 to 100 persons in the village use the nearshore waters seaward of Faleasao for general water recreation (Tali, 1996).

The traditional village council does not permit use of the nearshore waters on Sundays in recognition of the Lord's day.

Luma and Tau

About 10 persons use the nearshore water seaward of Luma and Tau during the weekend. During the week, only about five persons per day fish in this area.

Swimming and general water recreation are not permitted in the nearshore waters because two children have been lost in the nearshore waters (Polataivao, 1996).

Maia and Fitiuta

Approximately 10-20 fishermen use the shoreline for fishing each day. No residents use the nearshore waters for general water recreation because of the rough, sea conditions along this coast.

RESOURCE MANAGEMENT ISSUES

Future Land Uses to the Year 2015

Residential

Faleasao

Potential area that could be used for residential expansion in Faleasao includes the existing *faatoaga* behind the village which could support about 18 single family homes. About 10 additional housesites are located on adjoining moderate slopes *mauga* of the Village between the 250 and 400-foot elevation.

During the next 20 years, ASPA believes that only six new homes will be constructed within the existing *faatoaga* behind Faleasao. An additional six homes will be built on steeper adjoining slopes that are *mauga* of the existing village *faatoaga*.

This limited growth of Faleasao will be generated primarily by a small number of returning American Samoans who will seek an early retirement and/or more relaxed lifestyle. Secondly, a potential commitment by the American Samoa Government to promote an expansion of commercial agricultural activities will also encourage a few younger families to stay and, possibly, establish one or more agricultural export businesses. Consequently, a slight increase in resident population and related residential settlement is expected to occur.

The presence of the elementary school will continue to encourage families with younger children in Faleasao. However, most elementary children will not remain through high school. Many families will continue to send high school-aged children to Samoana High School on the island of Tutuila since Manua Island students are not required to obtain any district exemption for enrollment. As a result, Faleasao will continue to experience an out-migration of young adults who will seek educational opportunities outside of Manua. Most of the young adults that will leave for educational opportunities will likely not return to Faleasao since no significant employment opportunities are envisioned during the 1996-2015 period.

During the next 20 years, ASPA believes that these potential development opportunities and constraints will generate the following sequence and volume of residential construction within Faleasao.

1996-2000	Three new single family homes within the <i>faatoaga</i> behind the existing shoreline residential area.
2001-2005	Three new single family homes on moderate slopes above shoreline residential area between 250 and 400-foot elevation.
2006-2010	Three new single family homes within the <i>faatoaga</i> behind the existing shoreline residential area.
2011-2015	Three new single family homes on moderate slopes above shoreline residential area between 250 and 400-foot elevation.

The cumulative effect on Faleasao of this prospective residential growth is that the village housing stock will increase to roughly 53 housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 5.51 persons per household. The future village population in the year 2015 is expected to include about 292 persons.

Luma

Future residential expansion is hampered by a relatively large *taufusi* behind the northern end of Luma Village. The presence of saturated soils in this area will probably discourage development in this area.

This development constraint in Luma is offset, however, by a larger expanse of undeveloped land between the 125 and 290-foot elevation. Some residential expansion has already occurred in this area (Laapuli, 1994). Between Manua High School and an existing dirt trail in this area, these vacant lands could provide about 108 new single family units at a low density of two units per acre. This estimate assumes a considerable setback and potential expansion of Manua High School complex which is north of these lands.

ASPA believes that the availability of these developable lands will encourage greater residential settlement of the *mauga* slopes between the 125-290 foot elevation during the next 20 years for Luma. However, this growth will be gradual and will present the construction of about 35 new single family homes during the 1996-2020 period. This anticipated growth could easily be accommodated between the 125 and the 225-foot elevations.

An additional five homes will be constructed on vacant lands in both Luma and Tau. It is believed that the existing village area could accommodate up to eight new single family homes.

Future residential growth in Luma Village will be fueled primarily by a small number of returning American Samoans who will seek an early retirement and/or more relaxed lifestyle. Secondly, a potential commitment by the American Samoa Government to promote an expansion of commercial agricultural activities will also encourage a few younger families to stay and, possibly, establish one or more agricultural export businesses.

The out-migration of young adults from Luma will continue during this period despite efforts by ASG to promote commercial agriculture. More young adults will leave rather than stay and pursue new agricultural opportunities. However, the overall out-migration of this age group from the community will diminish with the availability of greater employment opportunities in agriculture and transportation. The presence of the high school in this community will also encourage a greater number of young adults to remain on-island.

During the next 20 years, ASPA believes that such development will more specifically generate the following volume of residential construction within Luma:

1996-2000	10 single family homes on the vacant lands <i>mauga</i> of the existing residential area between the 125 and 290-foot elevation
	5 additional homes on vacant lands within existing residential areas in Luma and Tau
2001-2005	10 single family homes on the vacant lands <i>mauga</i> of the existing residential area between the 125 and 290-foot elevation
2006-2010	10 single family homes on the vacant lands <i>mauga</i> of the existing residential area between the 125 and 290-foot elevation
2011-2015	10 single family homes on the vacant lands <i>mauga</i> of the existing residential area between the 125 and 290-foot elevation

The cumulative effect of this prospective residential growth on Luma is that the housing stock will increase to roughly 110 housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 4.86 persons per household. Consequently, the anticipated village population in the year 2015 will include about 534 persons.

Siufaga

Siufaga has limited residential expansion area within the existing village area. It is believed that two additional housesites are developable near the center of the village on the east side of the shoreline at about 12 feet above mean sea level. Small wetlands and saturated soils inland of Tau Harbor and the shoreline roadway constrain development near the south end of the inhabited village area.

Moderate slopes that are upslope of the steep ridge *mauga* of Siufaga offer considerable room for future residential expansion. Between the 125 and 270-foot elevation, there is ample land area for the construction of, at least, 78 single family homes. This assumes a residential density of about two homes per acre.

While significant area is available for future residential growth, the predominant growth of Tau's west coast is expected to occur in neighboring Luma. Some growth will also occur on the moderate slopes above the village because of good shoreline views and adjacent residential growth to the north. However, this growth in Siufaga will be considerably less than Luma and generally occur after the initial development of lands upslope of Luma.

During the next 20 years, ASPA believes that these potential development opportunities and constraints will generate the following sequence and volume of residential construction within Siufaga.

1996-2000	No new residential construction except for home replacements, extensions, and renovations.
2001-2005	Two new single family homes near the center of the village on the east side of the shoreline at about 12 feet above mean sea level.
2006-2010	Five new single family homes on moderate slopes <i>mauga</i> of the village between the 125 and 270-foot elevation.
2011-2015	Seven new single family homes on moderate slopes <i>mauga</i> of the village between the 125 and 270-foot elevation.

The cumulative effect on Siufaga of this prospective residential growth is that the village housing stock will increase to roughly 47 housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 4.74 persons per household. The anticipated village population in the year 2015 will include about 223 persons.

Maia

Potential residential expansion of Maia is limited by steeper slopes on the northwest side of the village. However, vacant lands are available on the north side of the existing residential area between the 25 and 100 foot elevation. Pedersen Planning Consultants estimates that this area, which is situated between the shoreline roadway and the shoreline, could easily accommodate an additional 38 single family homes. Such development could be developed without encroaching upon the Airport's runway safety zone which extends 350 southwest of the runway centerline.

The amount of developable land in this area could more than double the existing housing stock. However, residential growth in Maia will primarily be driven by the extent of potential in-migration of returning American Samoans who will seek an early retirement, a more relaxed lifestyle, and/or the opportunity to care for older extended family members. The potential arrival of this population is expected to be gradual and will, during the next 20 years, generate the development of 15 new single family homes.

Secondarily, a potential commitment by the American Samoa Government to promote an expansion of commercial agricultural activities of Maia will also encourage a few younger families to stay and, possibly, establish one or more agricultural export businesses (Lia, 1994). A few additional cash jobs will be generated by the anticipated development and operation of a small lodge in Fitiuta. It is believed that the retention of some young adults and their eventual families may offset the ongoing out-migration of young adults from this community.

During the next 20 years, ASPA believes that these potential development opportunities and constraints will generate the following sequence and volume of residential construction within Maia.

- | | |
|-----------|--|
| 1996-2000 | No new residential construction except for home replacements, extensions, and renovations. |
| 2001-2005 | Five new single family homes available on the north side of the existing residential area between the 25 and 100 foot elevation. |
| 2006-2010 | Five new single family homes available on the north side of the existing residential area between the 25 and 100 foot elevation. |
| 2011-2015 | Five new single family homes available on the north side of the existing residential area between the 25 and 100 foot elevation. |

The cumulative effect on Maia of this prospective residential growth is that the village housing stock will increase to roughly 47 housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 5.72 persons per household. By the year 2015, the future village population is expected to include about 269 persons.

Leusoalii

Steeper slopes northwest of the shoreline roadway clearly obstruct further residential development *mauga* of the village. On the south end of the village, however, there is a sizable expansion area, between the primary shoreline roadway and the 25-foot elevation, which could accommodate about 23 single family homes.

During the next 20 years, Pedersen Planning Consultants believes that these potential development opportunities and constraints will generate the following sequence and volume of residential construction.

- | | |
|-----------|---|
| 1996-2000 | Five new homes on the south side of Leusoalii between shoreline roadway and 25-foot elevation. |
| 2001-2005 | Eight new homes on the south side of Leusoalii between shoreline roadway and 25-foot elevation. |
| 2006-2010 | Five new homes on the south side of Leusoalii between shoreline roadway and 25-foot elevation. |

2011-2015 Five new homes on the south side of Leusoalii between shoreline roadway and 25-foot elevation.

The driving force of future residential development will be a modest increase in resident population. Principal in-migration will be by returning American Samoans who will seek and early retirement, a more relaxed lifestyle, and/or the opportunity to care for older extended family members.

Secondarily, a potential commitment by the American Samoa Government to promote an expansion of commercial agricultural activities will also encourage a few younger families to stay and, possibly, establish one or more agricultural export businesses (Lia, 1994). A few additional cash jobs will be generated by the anticipated development and operation of a small lodge in Fitiuta. It is believed that the retention of some young adults and their eventual families may offset the ongoing out-migration of young adults from this community.

The cumulative effect of this prospective residential growth is that the housing stock will increase to roughly 61 housing units in the year 2015. During the same period, it is believed that the average household size will have gradually decreased to approximately 5.71 persons per household. It is expected that the 2015 village population will include about 348 persons.

Commercial

Faleasao

An increased dependence upon household amenities in Faleasao will prompt the development of two additional retail stores between 2006 and 2010.

Luma

The gradual growth in residential population of Luma and anticipated growth in agricultural production will increase the demand for some household amenities, convenience items, small tools, and other supplies. These consumer demands will lead to the construction of two new retail stores between 2001 and 2005, as well as two additional retail operations between 2006 and 2010. The development of new commercial facilities will likely take place in the existing community adjacent to the existing shoreline roadway.

Siufaga

No new commercial facilities are anticipated during the planning period. It is believed that Siufaga residents will continue to patronize commercial stores in Luma.

Maia

It is anticipated that one new retail store and one grocery store will be built during the 2006-2010 period in Maia. Additional demand for household amenities, convenience items, and more imported foods will prompt this anticipated growth. These new commercial stores will probably be located along the existing shoreline roadway.

One auto repair will likely become established during the 1996-2016 period. This service will be a home-based service that will probably operate on a part-time basis.

Leusoalii

Pedersen Planning Consultants believes that two additional retail stores will be constructed on lands adjacent to the shoreline roadway during the 2006-2010 period. Such development will be made in response to increasing consumer demands for household amenities, convenience items, and imported foods.

Hotel and Visitor Accommodations

The anticipated establishment of National Park area will increase the number of incoming visitors to the Island of Tau. Future visitors will tend to include more experienced and affluent travelers who are accustomed to visiting remote locations and staying for longer periods. With the establishment of the National Park, the impact of travel information by the U.S. Department of Interior will generate increased visitor travel by the year 2000. Increased visitor travel to Tau will generate an estimated overnight accommodations demand for about four additional rooms in Luma Village between 2001 and 2005.

Industrial

Faleasao

Despite modest increases in future resident population of Faleasao, no additional light industrial operations or facilities are anticipated to the year 2015. The lack of developable land that would be suitable for industrial activities, as well as the lack of nearby consumer market, represent the primary constraints to future industrial development in this community.

Luma

The establishment of about two light industrial services in Luma can be expected during the 2001-2005 period. These services will be home-based enterprises, e.g., welding service, that may operate on a part-time basis when consumer needs arise. Both businesses will employ two persons. Consequently, no new industrial facilities are expected during the planning period.

Siufaga

One new light industrial service, e.g., sheet metal operation, is anticipated during the 2011-2015 period in Siufaga. This operation will result from the limited increase in residential population. However, this service would be a home-based enterprise that would probably operate on a part-time basis. Consequently, the development of new industrial facilities for these services is not expected.

The development of a private warehouse facility may be constructed in the vicinity of Tau Harbor. This facility would be constructed to support the temporary storage of agricultural products prior to their shipment to the Island of Tutuila by boat. It is assumed that this facility will be built between 2001 and 2005.

Maia

No new industrial facilities are expected to be constructed in Maia during the 1996-2015 period.

Leusoalii

One new light industrial service, e.g., steel fabricator, is anticipated during the 2011-2015 period in Leusoalii. This operation will result from the limited increase in residential population. However, this service would be a home-based enterprise that would probably operate on a part-time basis. Consequently, the development of new industrial facilities for these services is not expected.

Public Facilities

Through the application of 1990 age characteristics to anticipated village populations in the year 2015, the general demand for future early childhood programs, elementary education, and high school education was quantified (Table 40-4). In some cases, these demands may generate the future development of expanded public school facilities within or outside the Tau Matu watershed.

**TABLE 40-4
POTENTIAL DEMAND FOR PUBLIC SCHOOL FACILITIES
YEAR 2015
TAU MATU WATERSHED
(NUMBER OF STUDENTS)**

Village	Early Childhood	Elementary	Secondary
Faleasao	20	79	35
Luma	16	123	59
Siufaga	13	54	18
Maia	16	56	22
Leusoalii	17	70	42

Source: Pedersen Planning Consultants, 1995

Impact of Future Population Growth Upon Water Consumption and Waste Generation

Future population growth and changes in land use in the Tau Matu watershed will increase the volume of future wastewater and solid wastes that are generated by local residents. The consumption of potable water will also increase with a growing population (Tables 40-5 and 40-6).

**TABLE 40-5
ANTICIPATED AVERAGE DAY DEMAND
DRINKING AND OTHER POTABLE WATER (IN GALLONS PER DAY)
TAU MATU WATERSHED AREA**

Village	1995	2015
Faleasao	19,126	29,894
Luma	53,026	65,554
Siufaga	33,556	89,254
Maia	14,150	24,252
Leusoalii	34,201	38,565

Source: Pedersen Planning Consultants, 1995

**TABLE 40-6
ANTICIPATED AVERAGE DAILY WASTEWATER GENERATION
TAU MATU WATERSHED AREA
(IN GALLONS PER DAY)**

Village	1995	2015
Faleasao	13,388	20,926
Luma	37,118	45,888
Siufaga	11,261	21,450
Maia	9,905	16,976
Leusoalii	23,941	26,996

Source: Pedersen Planning Consultants, 1995

Flood Potential

A flood insurance study of American Samoa and related flood insurance rate maps were published by the U.S. Federal Emergency Management Agency (FEMA) in 1991. The study evaluated selected geographical locations throughout the Territory. Hydrologic and hydraulic analyses that were presented in the study were made by the U.S. Army Corps of Engineers, Pacific Ocean Division. No detailed study was made of local streams, nearshore waters and the adjoining shoreline of the Island of Tau.

The flood insurance rate map for the shoreline of the Tau Matu watershed indicates that there is a coastal flood hazard through much of the nearshore waters and adjoining shoreline. However, no baseline flood elevations were determined by FEMA.

All inland areas of the Tau Matu watershed have been designated by the Federal Emergency Management Agency as “zone x”. This designation indicates that these areas are outside of the 100-year floodplain (Federal Emergency Management Agency, 1991). In essence, FEMA is suggesting that the flood hazard potential in these areas is limited.

Stormwater Runoff/Sedimentation and the Relationship to Surface Water Quality

Inhabited Village Areas

Stormwater runoff and the related discharge of turbid waters and sediments into the nearshore waters is not a significant issues in the inhabited areas of Faleasao, Tau (including Luma), Siufaga, Maia, Fitiuta, and Leusoalii.

After heavier rainfall periods, some turbid runoff drains into Faleasao Village. Turbid drainage may remain in the interior of the village for about two days (Tali, 1996).

Stormwater runoff from upland slopes above Tau are detained by the taufusi at Tau Village. The village does not experience any significant flooding.

In Maia, there is occasional stormwater overflow on the primary roadway after a heavy rainfall period. However, no flooding occurs in the village.

At the airport at Fitiuta, a drainageway that passes along the south side of the airport access road continues to the ocean. Consequently, some discharge of stormwater runoff occurs seaward of the airport access road.

North Coast of Tau

More significantly, the north coast of Tau includes approximately 10 streams that likely are the primary carriers of turbid waters and sediments to the nearshore waters of Tau. These streams transport turbid stormwater and sediments to the nearshore waters along the north coast even though many of the stream courses terminate somewhat upslope of the shoreline. Olotania family soils and Sogi variant-Pavaiai association soils, for example, have a moderate to severe potential for water erosion. These soils lie upslope of several streams along the north coast of Tau.

The presence of more erosive soils in upland areas, combined with steeper slopes in the lower portions of the stream drainages, do not permit any feasible opportunities for stormwater detention. Consequently, the continued transport of turbid water and some sediments via the erosion of more erosive soils can be expected along these undeveloped slopes.

Any potential efforts aimed at reducing the input of turbid water and sediments into the nearshore waters along the north coast of Tau should focus upon providing technical assistance to any residents that may be operating plantations east of Tanoa Ridge (upslope of Faleasao). Pavaiai stony clay loam on 25 to 40 percent slopes (SCS mapping unit 25) also has moderate potential for the production of

coconuts, bananas, and breadfruit. However, this soil is also characterized by a moderate to severe water erosion hazard, as well as a medium to rapid runoff potential. The use of Pavaiai stony clay loam (SCS mapping unit 25) is not recommended in this area because of its capability to generate downslope erosion and sedimentation into Faleiulu Stream, Stream 40A, and Pakau Stream.

Nearshore Water Quality and the Marine Environment

Turbidity and Sedimentation

The concern for continued turbidity and sedimentation in the nearshore waters of the Tau Matu watershed is important. Coral communities are significantly dependent upon the availability of light and related photosynthesis, and occasional periods of significant turbidity and sedimentation do not promote long-term coral nutrition, growth, reproduction, and depth distribution (Richmond, 1993).

When corals fertilize, they are free-swimming. Consequently, they need a good location to settle and make a good attachment. With significant soil deposition, sediments can physically interfere with the recruitment of coral larvae (Richmond, 1993; Dashbach, 1996).

Coral communities are an important component of the overall ecology of the nearshore waters that adjoin the Ofu Saute watershed. They provide shelter to fish, invertebrates, and other marine organisms. Some of these resources represent a supplemental food source for residents of Tau.

Discharges of turbid waters and sediments in the watershed are not expected to significantly impact future nearshore water quality and the marine environment. The lack of streams in the inhabited areas of northeast and northwest Tau, as well as the availability of the wetland area in Tau Village, greatly reduces the long-term potential for significant stormwater discharges along the northeast and northwest coasts.

Nutrient Inputs

Some nutrient contribution is also occurring through the continued use of septic tanks, cesspools, or other soil-based, wastewater treatment systems in the inhabited areas of the watershed. In addition, some of the piggeries in Faleasao and Tau may also discharge nutrient-enriched wastewater into the wetland in Tau. These sources of nutrients are also accompanied by some bacterial contamination.

As the population of the watershed grows, nutrient and bacterial inputs will only increase. Village areas in Faleasao and Tau that are unsuitable for soil-based, wastewater treatment should be more specifically identified. As recommended in the ASPA Utilities Master Plan, this identification process should be based upon a more detailed sanitation survey of more densely inhabited areas of Faleasao and Tau. This survey would evaluate existing wastewater treatment practices, soil characteristics, the location and density of land uses, the distance to surface water supplies and the nearshore waters, topography, and other related factors. Using the conclusions and recommendations associated with this evaluation, ASPA and other participating Project Notification and Review System (PNRS) agencies will be better able to:

- require the use of septic tanks and leachfields that provide a sufficient amount of additional soil-based treatment; and,
- provide greater technical assistance to building permit applicants.

Long-Term Monitoring

Surveys of coral communities have been performed along the reef fronts in the vicinity of Faleasao, Tau Village, Fagamalo Cove, Afuli Cove, Faga and Lepula. With the exception of Faga, Lepula, and Afuli Cove, continued monitoring of these sites along the west coast is not believed to be necessary

since there is limited potential for the discharge of turbid stormwater, sediments, and nutrients into the nearshore waters along the northwest coast. Consequently, the marine survey site used by Green at Faga, Lepula, and Afuli Cove should be monitored approximately once every three years.

While the total volume of wastewater generation from the watershed is limited, the wastewater effluent discharges are concentrated in the inhabited village area where housing densities are between two and four housing units per acre. Local soils are generally inadequate to provide effective soil-based treatment. For this reason, the nearshore waters in front of Faleasao Village and Tau Village should be monitored for nutrient and bacterial contamination on a quarterly basis.

Groundwater and Surface Water Supplies

Conservation of Groundwater Supplies

To facilitate the long-term conservation of groundwater resources, it is recommended that a 100-foot buffer or setback should be established around each groundwater supply, i.e., groundwater well, in the watershed. In essence, the establishment of piggeries, new structural development, or other land uses would not be permitted within the 100-foot radius to prevent potential contamination of the surface supplies.

MANAGEMENT NEEDS AND RECOMMENDATIONS

The primary focus of future resource management in the Tau Matu watershed will be to:

- conserve the wetland in Tau Village;
- perform a detailed sanitation survey of Faleasao and Tau;
- monitor nearshore water quality;
- provide technical assistance to plantation operators east of Tunoa Ridge (east of Faleasao);
- discourage use of agricultural production on Pavaiai stony clay loam (SCS mapping unit 25); and,
- conserve and monitor coral communities.

Representatives of participating public agencies should make periodic visits to the watershed to observe, document, and monitor selected resource conditions, determine potential methods of correcting a potential hazard or undesirable conditions, share potential solutions with designated residents of Faleasao, Tau, Siufaga, Fitiuta, and Leusoalii, and encourage the participation of traditional leaders and village residents in the implementation of resource management solutions.

The scope of issues that should be addressed by each agency in the field is summarized in Table 40-7. The general focus of recommended technical assistance is also identified. The experience and insights of agency representatives will determine the specific methodology to be used in the field.

**TABLE 40-7
RECOMMENDED FOCUS OF FUTURE TECHNICAL ASSISTANCE
TAU MATU WATERSHED**

Participating Public Agency	Resource Management Issue	Focus of Technical Assistance
ASEPA	Facilitate a coordinated resource management effort within the watershed.	<ol style="list-style-type: none"> 1. Coordinate overall watershed management activities. 2. Hold periodic meetings with participating ASG and federal agencies to discuss, prioritize, and schedule resource management activities. 3. Coordinate program efforts with local traditional leaders and/or designated resident of the watershed. 4. Make annual assessment of resource management program.
ASPA/ASEPA	Perform a detailed evaluation of community sanitation problems associated with the use of soil-based treatment systems.	<ol style="list-style-type: none"> 1. Survey inhabited village areas in Faleasao and Tau (including Luma). 2. Evaluate existing treatment practices, soil characteristics, location and density of land uses, the distance to water supplies and nearshore waters, topography, and other factors. 3. Require use of septic tanks and leachfields that provide sufficient amounts of additional soil-based treatment; or, deny building applications in areas unsuitable for soil-based treatment.
ASEPA	Monitor water quality of nearshore waters that front Faleasao and Tau Villages	Measure changes in and total/fecal bacteria and nutrients on a quarterly basis.
ASEPA	Conserve surface water supplies	<ol style="list-style-type: none"> 1. Revise American Samoa GIS to delineate 100-foot buffers around each groundwater and surface supply in Faga, Tau, and Fusi. 2. Restrict land uses within designated buffers.
ASDOC	Monitor changes in population and land use	Annually map type and location of land uses in village and estimate resident population.
ASG Dept. of Marine/Wildlife Resources	Sustain healthy marine communities in nearshore waters	Monitor changes in coral coverage, fish habitat, diversity and other characteristics (used by Green) along the reef front of Faga and Lepula approximately every three years.

Source: Pedersen Planning Consultants, 1998

TAU SAUTE Watershed 41

GEOGRAPHY

The Tau Matu watershed comprises the southern one-third of the Island of Tau. The watershed comprises about 3.3 square miles of land area (Figure 41-1).

The interior boundaries of this watershed include Mataalaosagamai Ridge, Olotania Crater, and Lata Mountain. The prominent inland feature on the south side of Tau is a spectacular 1,400-foot high escarpment and two sloping plateaus (Aecos and Aquatic Farms, 1980). The lower plateau between the 1,200 and 1,400-foot contour is known as Liu Bench.

Along the shoreline, the Tau Matu watershed extends between Siufaalele Point, the southwest tip of the watershed. Tufu Point represents the southeast boundary of the watershed.

There are no embayments that adjoin the shoreline of the watershed. However, there are several shoreline coves that include:

- Vailoloaititi Cove, Vailoloatele Cove, and Lavania Cove along the southwest shoreline.
- Maefu Cove and Aufotu Cove along the southeast shoreline of the watershed.

RESOURCES OF THE WATERSHED

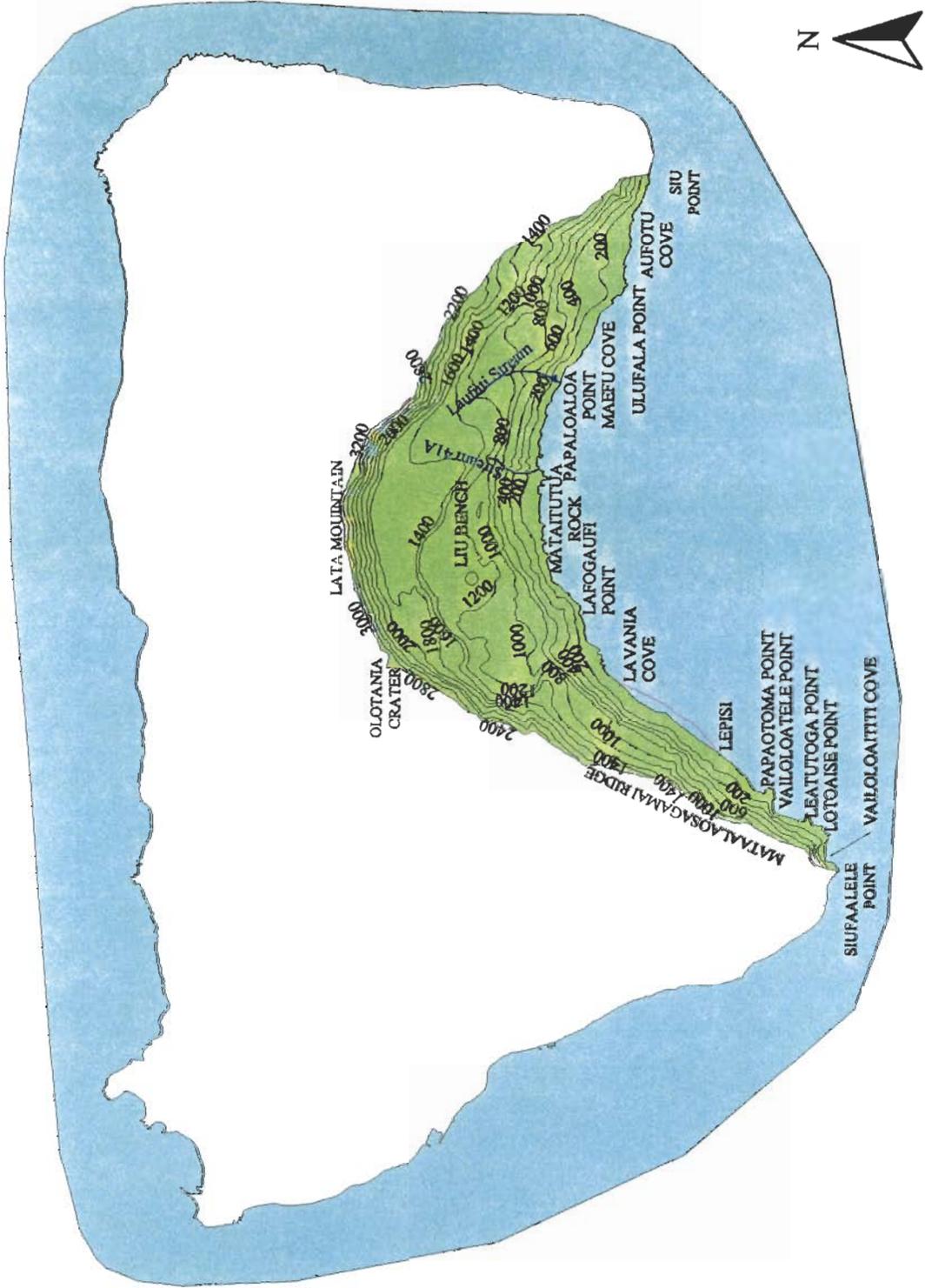
Soils

The U.S. Soil Conservation Service (National Resource Conservation Service) published a Soil Survey of American Samoa in 1984. Selected information derived from this survey provides some useful information for future watershed planning and management (Figure 41-2). Four soil classifications were identified by the U.S. Soil Conservation Service for lands within the Tau Saute watershed (Table 41-1).

**TABLE 41-1
SELECTED SOIL CHARACTERISTICS
TAU SAUTE WATERSHED**

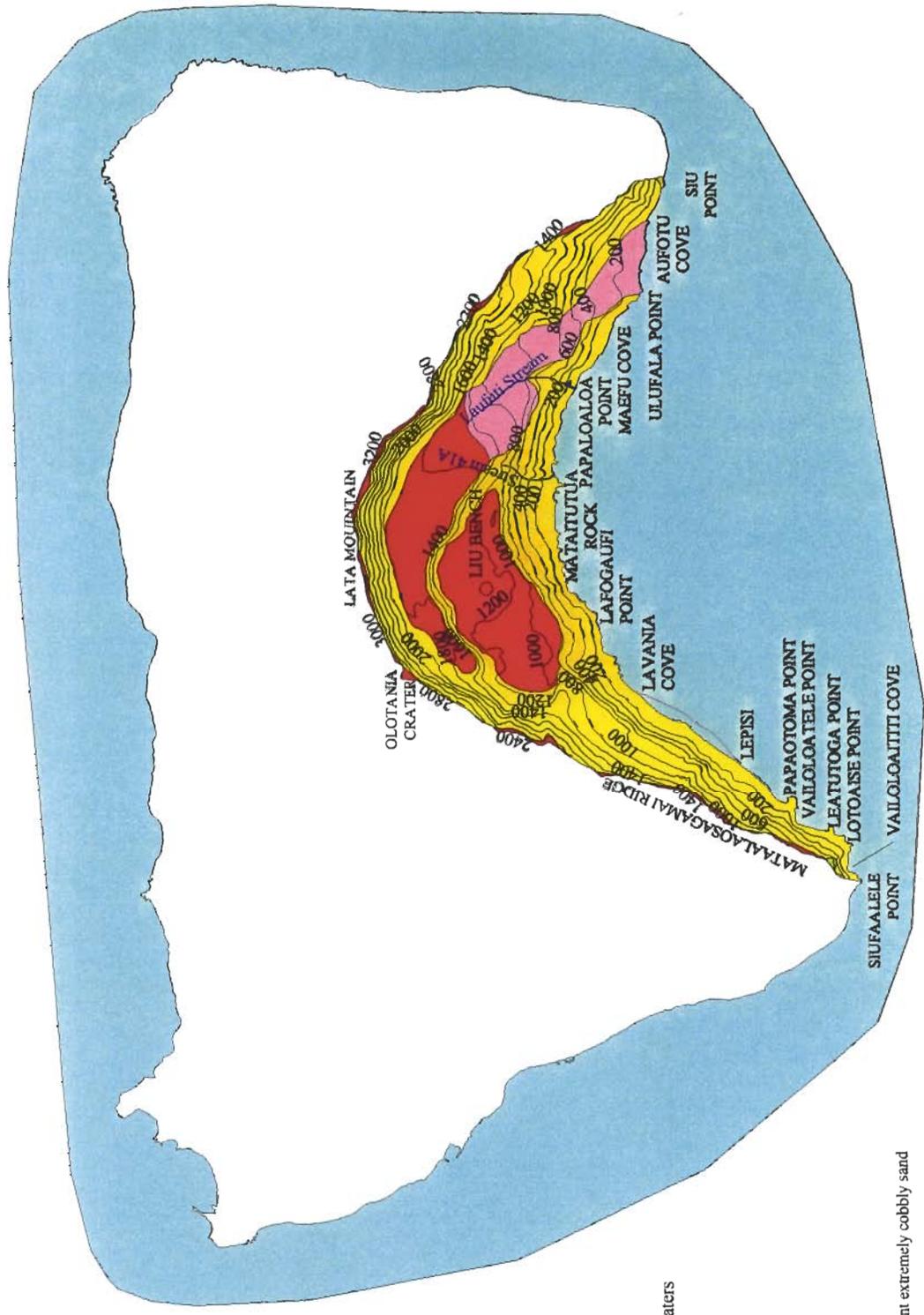
SCS Soil Unit	Name	Typical Slope (percent)	Flood	Runoff	Erosion	Soil Depth To:		Land Use Suitability	
						High Water (feet)	Bed Rock (inches)	Soil Based WW Treatment	Subsistence Ag. Potential
12	Ngedebus Variant extremely cobbly sand	0-5	Occ	Very slow	Slight	>6.0	>60	Severe Flood Wetness Poor filter Large stones	Poor
22	Olotania family	15-10	None	Med to Rapid	Mod to Severe	>6.0	>20	Severe Depth to rock Poor filter Slope	N/A
25	Pavaiai stony clay loam	25-40	None	Med to Rapid	Mod to Severe	>6.0	20-40	Severe Depth to Rock Slope	Moderate
27	Rock outcrop-Hydrandepts-Dystrandeps assoc	70-130	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: U.S. Soil Conservation Service, 1984



Tau Saute Watershed
Existing Conditions

Figure 41-1



Tau Saute Watershed Management Issues

Figure 41-2

American Samoa Geographical Information System



Rock Outcrop-Hydrandepts-Dystrandepts Association, Very Steep

Soils known as rock outcrop-hydrandepts-dystrandepts association (SCS mapping unit 27) characterize the upper ridges of Mataalaosagamai Ridge and Lata Mountain, the ridge that defines the two sloping plateaus, as well as the steeper slopes downslope of Liu Bench (Figure 40-2). As the name implies, this soil represents a combination of rock outcrop, Hydrandepts, and Dystrandepts.

Exposed areas of bedrock represent Rock outcrop. The rock outcrop is on very steep and nearly vertical side slopes. This soil type contains little or no soil material. Where present, the soil is usually gravelly and ranges from sandy loam to silty clay loam.

Hydrandepts are located at higher elevations on very steep side slopes. Hydrandepts formed in volcanic ash under heavy rainfall. This soil is well drained and frequently represents a silty clay loam. Hydrandepts is typically shallow, or sometimes moderately deep to bedrock.

Dystrandepts are found at lower elevations on very steep side slopes. Dystrandepts, which is formed in volcanic ash, is well drained and are usually shallow or moderately deep to bedrock. The soil contains a stony surface layer and typically represents a clay loam or silty clay loam.

These soils are unsuitable for both subsistence agriculture and septic tank applications because of steep slopes and the lack of an adequate soil layer for soil-based wastewater treatment.

Olotania Family (15 to 40 percent slopes)

The two sloping plateaus on the south side of Lata Mountain are characterized by Olotania family soils (SCS mapping unit 22). These soils are well-drained and formed in volcanic ash and cinders.

The surface layer is typically a dark yellowish-brown, silty clay loam that is about 8 inches thick. About 17 inches of dark yellowish-brown silty clay loam characterizes the subsoil. Weathered volcanic cinders that represent the substratum extend to a depth of 60 inches or more.

The Olotania family soils have a soil permeability that ranges between two and six inches per hour. The potential hazard of water erosion is moderate to severe; potential runoff is medium to rapid.

Olotania family soils support woodlands, but are not suited for subsistence crop production. Potential water erosion hazards constrain these agricultural uses.

The limited depth to bedrock is the primary deterrent to septic tank and effluent drainfield applications. This factor does not permit effective soil-based treatment of wastewater.

Pavaiai Stony Clay Loam (25 to 40 percent slopes)

The Laufuti Stream drainage on the southeast side of the watershed contains Pavaiai stony clay loam soils (SCS mapping unit 25).

The surface layer, which is about 10 inches thick, comprises a very dark, grayish-brown, stony clay loam. The surface layer is also stony in scattered areas.

The first six inches of the subsoil are represented by a very dark, grayish-brown sandy loam that is contains a considerable amount of gravel. The lower 14 inches of the subsoil is a very fine sandy loam that also contains a significant amount of gravel (U.S. Soil Conservation Service, 1984).

Soil permeability ranges between two and six inches per hour. Potential hazards associated with water erosion are moderate to severe. Potential runoff is medium to rapid (U.S. Soil Conservation Service, 1984).

Pavaiai stony clay loam soils have moderate potential for subsistence crop production. Potential agricultural opportunities include the production of taro, bananas, breadfruit, and coconuts. However, agricultural production is constrained by the potential hazards associated with water erosion, the presence of stones, and the limited depth to rock (U.S. Soil Conservation Service, 1984).

The limited depth to bedrock and steeper slopes do not promote adequate soil-based treatment for wastewater. Consequently, this soil is unsuitable for septic tank and effluent drainfield applications.

Ngedebus Variant Extremely Cobbly Sand

Ngedebus variant extremely cobbly sand soils (SCS mapping unit 12) is found along the southeast tip of Tau near Tufu Point (SCS mapping unit 12). These soils extend from the shoreline up to about the 200-foot contour.

Ngedebus variant extremely cobbly sand soils is a deep, excessively drained soil that is derived from coral and seashells. These soils commonly comprise narrow sandy beaches less than 50-feet wide.

A representative surface layer is usually black extremely cobbly sand that is about 15 inches thick. The surface layer has a high content of organic matter; however, in some areas, the surface layer comprises extremely stony sand. Pale brown extremely cobbly sand defines the substratum to a depth of 60 inches or more (U.S. Soil Conservation Service, 1984).

The permeability of this soil ranges between six and 20 inches per hour. The potential hazard of water erosion is slight; potential soil runoff is very slow. This soil is occasionally subjected to brief periods of flooding.

Ngedebus Variant extremely cobbly sand soils has a poor potential for subsistence agricultural production. Coconut production can only be supported in scattered areas. Subsistence production is hampered by a higher content of coral fragments throughout the soil.

Rapid permeability characteristics of this soil make this soil unsuitable for septic tank and effluent drainfield applications. Rapid permeability of the soil does not afford effective soil-based treatment of wastewater.

Streams

Stream Locations

Two streams are located in the Tau Saute watershed.

Downslope of the upper sloping bench, Laufuti Stream originates near the 1,200-foot contour. This stream transports surface runoff from the southeast slopes of Lata Mountain and the upper sloping bench. The point of discharge for this stream course is along the shoreline northwest of Maefu Cove. The U.S. Geological Survey map for the Island of Tau indicates the presence of a fresh-water spring along the lower end of the drainage at about 100-feet above mean sea level.

An unnamed stream (Stream 41A) is located along the steep slopes below the southeast side of Liu Bench. The stream begins at about the 1,000-foot elevation and continues to its point of shoreline discharge near the east side of Papaloaloa Point.

Stream Flows Within the Watershed

No streamflow records were discovered for the streams in the Tau Saute watershed.

Wetlands

There are no wetland on the south side of Tau.

Marine Resources

No historical observations of coral communities are known to have been made of the fringing reef in the nearshore waters that adjoin the watershed.

Wildlife Resources

Forest Birds

A 1986 Survey of the Forest Birds of American Samoa also documented about 18 forest birds in various areas of Tau (Engbring and Ramsey, 1989). This survey, which was made on the Islands of Tutuila, Ofu, Olosega, and Tau, recorded the number of birds observed during 8-minute counts in July, 1986 (Table 41-2).

TABLE 41-2
FOREST BIRD SURVEY RESULTS
NATIVE FOREST AND NON-FOREST BIRDS
JULY, 1986

Species	Tutuila	Ofu	Olosega	Tau	Total
Tahiti Petrel	0	-	-	1	1
White-tailed Tropicbird	154	11	27	234	426
Red-footed Booby	22	-	-	-	22
Great Frigatebird	1	-	-	-	1
Reef Heron	1	0	0	0	1
Red Junglefowl	527	17	0	26	570
Banded Rail	163	22	16	75	276
Spotless Crake	-	-	-	1	1
Purple Swampphen	10	4	0	15	29
Blue-gray Noddy	1	0	0	0	1
Brown Noddy	65	1	0	359	425
Black Noddy	0	11	0	5	16
White Tern	331	88	17	60	496
Many-colored Fruit Dove	10	0	0	2	12
Purple-capped Fruit Dove	3,107	104	33	1,176	4,420
Pacific Pigeon	207	15	8	282	512
Blue-crowned Lory	-	65	79	533	677
Common Barn Owl	2	0	0	0	2
White-rumped Swiftlet	441	348	13	284	1,086
Collared Kingfisher	136	43	14	95	288
Red-vented Bulbul	95	-	-	-	95
Fiji Shrikebill	-	1	9	93	103
Wattled Honeyeater	3,748	875	457	2,779	7,859
Cardinal Honeyeater	621	-	-	-	621
Polynesian Starling	296	41	3	146	486
Samoan Starling	1,647	253	91	929	2,920
Total Birds Recorded	11,585	1,899	767	7,095	21,346

Notes: A dash (-) indicates the species is not resident on the island surveyed.

Source: Engbring and Ramsey, 1989

The highest densities for several forest birds, include the Fiji Shrikebill, were observed along the south coast of Tau.

The largest colony of black noddies also nests in larger Barringtonia trees along the south coast. *White Terns, Brown Noddies, and White-Tailed Tropicbirds also use this area for nesting and roosting. Tahiti Petrels and Audubon's Shearwaters use the upper cliff ridge around Lata Mountain* (Engbring and Ramsey, 1989).

Fruit Bats

Historical observations of the south coast of Tau indicate that the fruit bat roosts in the lowland rain forest upslope of Papaotoma Point (Aecos and Aquatic Farms, 1980).

Proposed Wildlife Sanctuary

Engbring and Ramsey recommended that the south coast of Tau, between Lavania Cove to Ulufala Point, should be established as a wildlife reserve (Engbring and Ramsey, 1989). In light of the valuable wildlife habitat in this remote area, this recommendation is believed to be appropriate. There is no significant demand for land uses on the south coast of Tau. Some recreational use is made of the area in the vicinity of Vailoloaititi Cove. However, this area is situated considerably west of the proposed reserve area. Consequently, the establishment of a seabird sanctuary could probably be made without significantly impacting recreational activities of Tau residents.

It is recommended that the ASG Department of Marine and Wildlife Resources should discuss the proposed reserve with selected traditional leaders from all villages on the Island of Tau. If traditional leaders believe that the designation of a wildlife reserve would not conflict with other land uses and recreational activities along the south coast of Tau, the ASG Department of Marine and Wildlife Resources should prepare legislation for review and adoption by the *Fono*.

Shoreline Protection

The fringing reef and rugged basaltic shoreline provide natural protection to the south coast of Tau. There are no man-made shoreline protective structures in the watershed.

Groundwater and Surface Water Supplies

No groundwater wells or surface water systems are known to be developed in the Tau Saute watershed. However, a fresh-water spring is apparently located along the lower Laufuti Stream drainage.

USE OF THE WATERSHED

Resident Population

The entire Tau Saute watershed is uninhabited.

Land Uses

Evidence of some recreational use was observed at Vailoloatele Cove in May, 1996. It appears that a few residents from the west side of Tau use this area for occasional drinking parties. However, trash along the beach area was limited.

Use of the Nearshore Waters

It is believed that limited use is made of the nearshore waters for fishing and general water recreation. Vehicular access to the south coast of Tau requires a 4-wheel drive vehicle, considerable time, and patience. Further field surveys and discussions with traditional leaders are needed to gain a better sense of the importance of this shoreline area for public recreational use.

RESOURCE MANAGEMENT ISSUES

Future Land Uses to the Year 2015

No residential, commercial, industrial, and public facility land uses are expected to occur in this watershed during the 1996-2015 period. Steeper slopes and the lack of vehicular access will discourage future land uses in the watershed.

One potential exception may be the production of some subsistence crops, e.g., bananas, that could be grown on Pavaiai stony clay loam (25 to 40 percent slopes). The Laufuti Stream drainage contains these soils (SCS mapping unit 25). The location of these soils can also be reviewed via use of the computerized GIS for American Samoa.

Flood Potential

A flood insurance study of American Samoa and related flood insurance rate maps were published by the U.S. Federal Emergency Management Agency (FEMA) in 1991. The study evaluated selected geographical locations throughout the Territory. Hydrologic and hydraulic analyses that were presented in the study were made by the U.S. Army Corps of Engineers, Pacific Ocean Division. No detailed study was made of local streams, nearshore waters and the adjoining shoreline of the Island of Tau.

The flood insurance rate map for the shoreline of the Tau Saute watershed indicates that there is a coastal flood hazard through much of the nearshore waters and adjoining shoreline. However, no baseline flood elevations were determined by FEMA.

All inland areas of the Tau Saute watershed have been designated by the Federal Emergency Management Agency as "zone x". This designation indicates that these areas are outside of the 100-year floodplain (Federal Emergency Management Agency, 1991). In essence, FEMA is suggesting that the flood hazard potential in these areas is limited.

Stormwater Runoff/Sedimentation and the Relationship to Surface Water Quality

The two streams in the Tau Saute watershed likely transport a considerable amount of turbid water and sediments to the nearshore waters that adjoin the south coast of Tau. These discharges are derived exclusively from the natural erosion of more erosive soils, i.e., Pavaiai stony clay loam (SCS mapping unit 25) and Olotania family (SCS mapping unit 22), along on the steeper slopes of the watershed.

The detention of a portion of future stormwater flows is desirable. However, detention of future stormwater flows is not feasible because of the geology, topography, and remote nature of the Tau Saute watershed.

While no uses are presently made lands in the watershed, it is recommended that future land uses in the watershed be limited to watershed conservation and shoreline recreation. Upland areas along the Laufuti Stream drainage have moderate potential for subsistence agricultural production. However,

these soils have a moderate to severe potential for water erosion, as well as a medium to rapid potential for soil runoff.

Nearshore Water Quality and the Marine Environment

Turbidity and Sedimentation

The concern for continued turbidity and sedimentation in the nearshore waters of the watershed is important. Coral communities are significantly dependent upon the availability of light and related photosynthesis, and occasional periods of significant turbidity and sedimentation do not promote long-term coral nutrition, growth, reproduction, and depth distribution (Richmond, 1993).

When corals fertilize, they are free-swimming. Consequently, they need a good location to settle and make a good attachment. With significant soil deposition, sediments can physically interfere with the recruitment of coral larvae (Richmond, 1993; Dashbach, 1996).

Where present, coral communities are an important component of the overall ecology of the nearshore waters that adjoin the Tau Saute watershed. They provide shelter to fish, invertebrates, and other marine organisms.

Groundwater and Surface Water Supplies

There are no significant management issues associated with these resources. The fresh-water spring along Laufuti Stream is not expected to be significantly impacted as long as upland slopes are not significantly developed for agriculture.

MANAGEMENT NEEDS AND RECOMMENDATIONS

The primary focus of future resource management in the Tau Saute watershed will be to:

- limit future land uses in the watershed to shoreline recreation, watershed conservation, and a wildlife sanctuary.
- monitor future changes in land use;
- establish a wildlife sanctuary between Lavania Cove to Ulufala Point if this designation does not significantly impact shoreline recreation and other potential land uses along the south coast of Tau; and,
- monitor the condition of coral reefs in the nearshore waters between Papaloaloa Point and Maefu Cove.

Representatives of participating public agencies should make periodic visits to the watershed to observe, document, and monitor selected resource conditions, determine potential methods of correcting a potential hazard or undesirable conditions, share potential solutions with a designated resident of Tau, and encourage the implementation of resource management solutions by local villages.

The scope of issues that should be addressed by each agency in the field is summarized in Table 41-2. The general focus of recommended technical assistance is also identified. The experience and insights of agency representatives will determine the specific methodology to be used in the field.

**TABLE 41-2
RECOMMENDED FOCUS OF FUTURE TECHNICAL ASSISTANCE
TAU SAUTE WATERSHED**

Participating Public Agency	Resource Management Issue	Focus of Technical Assistance
ASEPA	Facilitate a coordinated resource management effort within the watershed.	<ol style="list-style-type: none"> 1. Coordinate overall watershed management activities. 2. Hold periodic meetings with participating ASG and federal agencies to discuss, prioritize, and schedule resource management activities. 3. Coordinate program efforts with local traditional leaders and/or designated resident of the watershed. 4. Make annual assessment of resource management program.
ASDOC	Restrict land uses other than shoreline recreation, watershed conservation, and a wildlife sanctuary.	<ol style="list-style-type: none"> 1. Require a PNRS review for any land uses or structural development in the watershed. 2. Restrict future structural development between Lavania Cove and Ulufala Point. 3. Provide specific design and construction criteria in conjunction with the approval of any future structures.
ASDOC	Monitor changes in population and land use	Annually map type and location of land uses in village and estimate resident population.
ASDMWR	Establish a wildlife sanctuary between Lavania Cove and Ulufala Point.	<ol style="list-style-type: none"> 1. Hold discussions with traditional leaders of Tau to discuss potential wildlife conservation designation and existing land uses. 2. Determine if a potential sanctuary designation will significantly impact shoreline recreation and other potential land uses along south coast of Tau. 3. If no significant impact is determined, prepare draft legislation for the Fono that would establish the wildlife sanctuary.
ASG Dept. of Marine/Wildlife Resources	Sustain healthy marine communities in nearshore waters	Monitor changes in coral coverage, fish habitat, diversity and other characteristics (used by Green) between Papaloaloa Point and Maefu Cove approximately every three years.

Source: Pedersen Planning Consultants, 1998

AGENCY ACRONYMS

<u>Acronym</u>	<u>Full Agency Name</u>
ASCC	American Samoa Community College
ASCZM	American Samoa Coastal Zone Management
ASCZMP/FBNMS	American Samoa Coastal Zone Management Program/ Fagatele Bay National Marine Sanctuary
ASDMWR	American Samoa Department of Marine and Wildlife Resources
ASDOA	American Samoa Department of Agriculture
ASDOC	American Samoa Department of Commerce
ASDPO or DPO	American Samoa Department of Planning Office (renamed ASDOC or American Samoa Department of Commerce)
ASDPW	American Samoa Department of Public Works
ASEPA	American Samoa Environmental Protection Agency
ASG	American Samoa Government
ASPA	American Samoa Power Authority
CCCAS	Congregational Christian Church of American Samoa
FEMA	U. S. Federal Emergency Management Agency
NRCS	Natural Resource Conservation Service (formerly U.S. Soil Conservation Service)
SCS	U. S. Soil Conservation Service

SAMOAN GLOSSARY

<u>Samoan Word</u>	<u>English Translation</u>
aiga	family, extended family
aumaga	young or untitled men of a Samoan village
ava	channel, passage, gap
faaSamoa	Samoa custom, Samoa way of life
faatoaga	plantation, farm
faifeau	minister, pastor
faisua	mollusc, giant clam
fale	house
Fono	the Legislative branch of the American Samoa Government (ASG)
malae	open space; village green, place used for social and traditional gatherings, as well as for recreation
matai	titled head of a Samoan extended family, high ranking title holder
palagi	foreigner
puleaoga	school principal
pulenuu	village mayor representing ASG in villages of American Samoa
sami	ocean
sao	senior title-holder in Samoan village who, in part, makes decisions concerning the use of communal lands
taufusi	swamp, marshland
vaipuna	spring

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