TERRITORY OF AMERICAN SAMOA INTEGRATED WATER QUALITY MONITORING AND ASSESSMENT REPORT 2010

Prepared by: LT Elena Vaouli, Christianera Tuitele, Edna L. Buchan, Josephine Regis, Phil Wiles, and Nate Ilaoa

American Samoa Environmental Protection Agency
American Samoa Government
Pago Pago, American Samoa 96799

Table of Contents

I Overview

The American Samoa Environmental Protection Agency (AS-EPA) has a responsibility to monitor, assess, and protect water quality for the Territory of American Samoa. U.S. federal and American Samoa local environmental legislation and regulations all apply in American Samoa.

This report has been prepared to satisfy the listing requirements of Section 303(d) and the reporting requirements of Section 305(b) and 314 of the Clean Water Act. The report is the principal means by which AS-EPA, Congress, and the public evaluate whether territorial waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of remaining problems. The report was prepared in accordance with Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act (USEPA 2005) and 2006 Integrated Report Guidance (IRG). Water quality and associated data from fiscal year 2008 (FY08) and fiscal year 2009 (FY09) as well as cumulative assessments from FY03 to FY09, were used to complete the report.

i Geographical Summary

The Territory of American Samoa lies roughly 14 degrees south of the equator between longitudes 169 and 173 west and about 2,500 miles southwest of Hawaii. The principal islands are Tutuila, Aunu'u, and the Manu'a islands (a cluster of three islands, Ta'u, Ofu and Olosega, located about 65 miles east of Tutuila). Swains Island, a small island with a population of less than 25 and Rose Atoll, an uninhabited atoll about 120 miles east of Tutuila, make up the remainder of the territory. The population of the territory was 57,291 people in the year 2000, of which approximately 97% live on the island of Tutuila.

The islands of American Samoa are volcanic in origin and exhibit the rugged topographic relief common to the Pacific volcanic islands. The climate of the territory is tropical, with uniform high temperatures and high humidity throughout the year. Mean daily temperature during the year varies from about 78 to 82 degrees Fahrenheit. The maximum altitude is about 3,180 ft. above mean sea level at the summit of Lata Mountain on Ta'u Island. Tutuila, with an area of 53 square miles, is the largest island in the territory. It is approximately 20 miles long and ranges in width from less than one mile, to a maximum of 5 miles at the Tafuna-Leone plain. A sharp-crested ridge 1,000 to 2,000 feet high with steeply eroded slopes dominates the entire length of the island.

The steep, variable topography of Tutuila effects localized rainfall amounts. The airport at Tafuna receives about 125 in. (3,180 mm) but Pago Pago receives nearly 200 in (4,090 mm). The crest of the range at Mt. Alava, altitude 1,600 ft. (914 m), receives considerably more than 250 in (6,350 mm). The driest months are June through September and the wettest are December through March, but heavy showers can occur in any month.

ii Territorial Water Quality Review

Fresh Surface Waters

The small, steep watersheds and periodic intense rainfall cause highly variable flows in the nearly 260 miles of American Samoa's perennial streams. Despite these highly variable flows, the streams of American Samoa support a variety of aquatic species, several of which may be harvested for consumption. Designated uses include potable water supplies, support of indigenous wildlife, and aesthetic and recreational enjoyment. Stream water quality is most affected by development along a stream that changes the hydrology and shade along a stream, by development within a watershed that causes erosion and increased turbidity, and by nutrient and bacterial pollution from poorly constructed human and pig waste disposal systems. In some areas, improved service by sewage lines and subsequent decrease in the number of poorly constructed septic systems, as well as improved pig waste management, has improved stream water quality.

Ground Waters

The Tafuna-Leone plain is the site of the majority of American Samoa's residential and business development. The plain is also the site of the majority of the wells that pump ground water for distribution. Because volcanic stratum of Tutuila is highly permeable and does not have a great capacity to filter, there is a constant risk of groundwater contamination as pollution migrates from the surface with rainwater. The greatest threats to groundwater quality in American Samoa are pesticide residues, pollutants associated with automobiles, and pathogen and nutrient pollution from poorly constructed human and pig waste disposal systems. As in many small tropical islands with highly permeable soils, the fresh water aquifer floats on a layer of salt water beneath the ground. Rare dry periods of two- to three-months duration can result in critical drinking water shortages as salt water intrudes on the depleted fresh water lens. The territory suffered its worst drought of historical record in 1974. In 1998 the Territory experienced a drought, but not as severe as the 1974 drought, and there was not a noticeable increase in chlorides in the drinking water.

Wetlands

American Samoa possesses a number of small but very important wetland habitats. The wetlands include coastal mangrove swamps, inland freshwater marshes and some cultivated *taro* fields. Designated uses include support of indigenous aquatic and terrestrial life, fishing, food cultivation and gathering, recreation, flood control and groundwater recharge. Wetlands in the territory are being lost or degraded by urban growth and development as a result of population increase.

Ocean Shoreline

American Samoa has nearly 150 miles of coastline. Fringing coral reefs that surround all of the islands in the territory characterize the embayments and open coastal waters of American Samoa.

Designated uses include fishing and food gathering, recreation, support of marine life, mariculture, and scientific investigations. The reefs also provide a buffer for the islands against the impact of waves. The greatest threats to near-shore water quality and to the health of the reefs in American Samoa are from runoff from the land, especially pathogen and nutrient pollution from poorly constructed human and pig waste disposal systems as well as increased turbidity and nutrients from erosion. Solid waste, i.e. improperly disposed of trash, is another source of pollution in open coastal waters and embayments.

Pago Pago harbor is the most industrialized embayment in the Territory, with over a century of development subsequent to the creation of the Territory under the United States. As well as the sources of water quality impairments mentioned above for embayments in general, Pago Pago Harbor is affected by pollution from marina and port traffic, a small shipyard, and in the outer harbor effluent from the tuna canneries and sewage treatment plant. All point sources have National Pollutant Discharge Elimination System (NPDES) permits. Due to the segregation and transportation of cannery waste beyond the inner harbor, better treatment of sewage, and more effective monitoring and prosecution by the Coast Guard of commercial vessels that pollute the harbor, the water quality in the inner harbor has greatly improved in the last decade.

Open Coastal Waters

There are special management areas within the Territory's open coastal waters including Fagatele Bay National Marine Sanctuary, the Territorial Marine Park on Ofu and the American Samoa National Park, Ofu segment.

Designated uses of open ocean waters include fishing, scientific investigations, boating, support of marine life, and recreation. While there is a small offshore fishery, it is unknown whether offshore waters are affected by pollution. High strength wastes (high solids, high nitrogen, high phosphorus) from the tuna canneries are dumped in a designated zone approximately five miles offshore. Monitoring shows that the waste has no more than a localized effect, and is in compliance with the canneries Ocean Dumpling permit.

II Background

i Total Waters

Table 1. Atlas Description of American Samoa

Topic	Value
Territorial Population	57,291*
Territory Surface Area (square miles)	76.1
Total Miles of Streams (miles)	258
Square Miles of Coral Reef	184
Miles of Ocean Coast	149
Acres of Fresh Water and Tidal Wetlands	396

*From 2000 Census

ii Maps

The Territory of American Samoa is divided into 41 watershed units to simplify management of aquatic and terrestrial resources. Maps with watershed delineations are presented in Appendix B, Figures 1 and 2.

iii Water Pollution Control Program

A. Watershed Approach

The total surface area of American Samoa is very small, only 76.1 sq. miles. This small surface area is divided into 41 watersheds, each with an average size of 1.8 sq. miles (Appendix B, Table 1, Figures 1 and 2). Water quality monitoring, along with coral / fish / benthic monitoring covers 33 out of the 41 watersheds, and also covers >95% of the population of American Samoa. Accordingly, tracking water quality on a watershed scale is fully adequate to meet our monitoring objectives and goals.

B. Point Source Program

There are only seven identified point sources in the Territory. These sources include: Starkist, Samoa Packing COS, Utulei Waste Water Treatment Facility, Tafuna Waste Water Treatment Facility, British Petroleum, Satala Power Plant, and Southwest Marine. Analysis of NPDES monitoring data confirms that overall, these facilities meet the requirements established by individual NPDES permits, and these point sources have negligible impact on water quality.

C. Nonpoint Source Control Program

American Samoa has determined that all threatened or impaired designated uses in the Territory are due to nonpoint sources (NPS). Therefore, watersheds identified as threatened or impaired are considered areas where NPS management measures have not yet improved water quality in the coastal zone. Threatened and impaired watersheds are targeted for enhanced management measures and water quality monitoring.

Full approval of the American Samoa Coastal Nonpoint Pollution Control Program (ASCNPCP) was received July 24, 2003. In FY08 and FY09 program effort was directed towards full implementation of the program plan.

iv Cost / Benefit Assessment

Following are the approximate economic and social costs and benefits of actions necessary to achieve the objective of the Clean Water Act.

Costs:

- Capital investments in municipal facilities in the past 5 years: 16 million dollars
- Capital investments in municipal facilities in the past 10 years: 21 million dollars
- Capital investments in municipal facilities since 1972: 43 million dollars

- Capital investments in industrial facilities in the past 5 years: 1.5 million dollars
- Capital investments in industrial facilities in the past 10 years: 3.5 million dollars
- Capital investments in industrial facilities since 1972: 10 million dollars
- Investments in nonpoint source measures in the past 5 years: 3.5 million dollars
- Investments in nonpoint source measures in the past 10 years: 5.0 million dollars
- Investments in nonpoint source measures since 1972: 7.0 million dollars
- Annual operation and maintenance costs of municipal facilities: 1.5 million dollars
- Annual operation and maintenance costs of industrial facilities: 8.5 million dollars
- Total annual costs of municipal and industrial facilities: 10.0 million dollars
- Annual costs to government to administer water pollution control activities: 2.0 million dollars.

Benefits Information

Benefits to the territory include the protection of the groundwater that supplies the majority of the drinking water for the Territory, the improved quality of Pago Pago Harbor, which has improved recreational and aesthetic enjoyment as well as habitat and coral reef recovery, and the protection of fringing coral reefs from pollution. The coral reefs around American Samoa are used recreationally and supply much of the fresh fish and seafood for the territory. The reefs also provide a buffer for the islands against the impact of waves.

v Special Territorial Concerns and Recommendations

Most special concerns in American Samoa are related to geographical aspects of the islands and cultural aspects of the Samoan people. The main concern is the pressure that the growing population in American Samoa is exerting on natural resources and the local environment. During the past ten years the population of the territory has increased considerably. The population will likely reach 100,000 people within the next 20 years. There is a very limited land base to accommodate this growth. Only one third of Tutuila contains land that is suited for human development (i.e., only 19 square miles have a slope of less than 30%). Development factors such as poor land use permitting, overfishing, and increased production of solid waste and sewage will impact groundwater, streams, and coastal waters.

While local environmental education has made great strides in the last decade, there is still a widespread lack of understanding, acknowledgment, and acceptance of environmental issues that affect the Territory. The need to control litter and pig waste is now somewhat understood. However, the effect of pollution from soil erosion, automobiles and untreated sewage is not recognized as a public health and environmental threat. There is a lack of political and public will to enforce most environmental regulations. The regulations themselves are quite comprehensive, but are not seen as a priority for enforcement.

The Malaeimi valley in central Tutuila has been determined to be a major recharge area for the Tafuna-Leone aquifer, which supplies the majority of the drinking water for the Territory. This valley has been proposed as a Special Management Area, and it is critical that the development in the area is carefully controlled to protect groundwater resources. Unfortunately, the Governor has not yet adopted the proposal.

Lastly, the unique coral reef habitat that characterizes the fringing reefs of American Samoa merits special concern. Modern development, leading to road construction, increased solid waste and sewage, and sedimentation, has caused much indirect stress to the coral reefs, while overfishing has directly impacted the reef environment. The concern worldwide for the health and protection of coral reefs is mirrored here in American Samoa. This has led to directed management and research efforts on how to best protect reef habitats.

III Surface Water Assessment

i. Current Surface Water Monitoring Program

A. Monitoring Program Description

American Samoa has identified the following monitoring objectives to insure our monitoring program is efficient and effective in generating data that serve all management needs:

1. To help establish water quality standards for all types of Territorial waters
2. To determine water quality status and trends for all types of Territorial waters
3. To make designated use support determinations and identify impaired waters for all types of Territorial waters
4. To identify causes and sources of water quality problems for all types of Territorial waters
5. To evaluate the effectiveness of Non Point Source Best Management Practices for restoring impaired designated uses for all types of Territorial waters
6. To evaluate the effectiveness of NPDES permits

AS-EPA has developed a Territorial Monitoring and Assessment Program that includes all elements recommended by USEPA. The program incorporates an efficient combination of monitoring plans and strategies to meet all monitoring objectives. The plans/strategies include fixed station, intensive and screening level monitoring, judgmental, and probability designs. Monitoring plans and strategies include:

1. AS-EPA Nearshore Marine Water Quality (BEACH) Monitoring Plan
2. AS-EPA Stream Water Quality Monitoring Plan
3. American Samoa EMAP
4. AS-EPA Coral Reef Monitoring Plan
5. Water Quality Monitoring Strategy for Pago Pago Harbor, American Samoa
6. AS_EPA Tier II Fish Toxicity Study
7. Sediment Toxicity Study for Pago Pago Harbor, American Samoa
8. American Samoa Coastal Nonpoint Source Monitoring Strategy
9. ASPA Drinking Water /Groundwater Systems Water Quality Monitoring Plan
10. National Park of American Samoa Water Quality Monitoring Plan

B. Monitoring Schedule

Waters that will be monitored and assessed during the next 2-year integrated report cycle include:

Streams New stream systems will be assessed according to the plan outlined in the AS-EPA Stream Water Quality Monitoring Plan.
Ocean Shoreline Swimming resources will continue to be monitored according to the AS-EPA Nearshore Marine Water Quality Monitoring Plan. Coral reefs will be monitored according to the AS-EPA Coral Reef Monitoring Plan (to assess the effects of NPS pollution on AS Coral Reef Communities). Reef flats will be monitored by an EMAP effort.
Wetlands No new wetland assessments will be conducted in the period leading up the next integrated report.

ii. Status of Plan to Achieve Comprehensive Assessments

The expanded AS-EPA Territorial Water Quality Monitoring and Assessment Program was designed to be statistically rigorous and to satisfy USEPA guidelines for water quality monitoring programs. All categories of water bodies directly monitored by agency efforts were depicted and inventoried in the program. Sampling locations were georeferenced with GPS as a collaborative effort with the American Samoa Coastal Management Program (ASCMP). ASCMP is leading an effort to create a Territorial GIS and has the technical staff and equipment to incorporate georeferenced data into that GIS.

The Recreational Beach Monitoring Program and the Stream Monitoring Program were created to develop and implement comprehensive monitoring in these aquatic habitats. 49 recreational beach locations in American Samoa are monitored, 43 weekly, and 6 monthly. This monitoring effort provides excellent coverage for local beach recreational areas. The stream monitoring program is based on a probabilistic model, where a small population of streams are selected at random from the overall population and monitored for 1 year. After that period, a new population of streams is selected at random for monitoring. The first 4 years of stream monitoring data were analyzed in FY09, and provided a robust assessment of stream water quality in American Samoa. Other programs, including the American Samoa EMAP and the AS-EPA Coral Reef Monitoring Program, monitor ocean water quality and coral reef health, and will allow the Territory to achieve comprehensive assessments with the limited resources available.

iii. Assessment Methodology

A. Assessment Methodology

1. The 2010 Integrated Report

AS-EPA assembled and evaluated all existing and readily available data and information from sampling and analyses completed in FY08 and FY09, as well as cumulative assessments from FY03 to FY09, relating to the categories of waters specified in 40 CFR§130.7(b)(5).

Sources for data and information evaluated for this report include:
1. AS-EPA Stream Monitoring Program
2. AS-EPA Beach Monitoring Program
3. ASPA/AS-EPA Groundwater Monitoring Program
4. AS-EPA Tier II Fish Toxicity Study

5. AS-EPA EMAP
6. AS-EPA Coral Reef Monitoring Program
7. National Park of American Samoa
8. Center for Biological Diversity (non site-specific information regarding ocean acidification)

For this report, multiple uses based on current water quality standards have been assessed. The primary uses for water bodies in the territory are:
1. Potable water supplies
2. Support and propagation of indigenous aquatic and terrestrial life
3. Compatible recreation and aesthetic enjoyment
4. Fish and Shellfish consumption

Specific criteria for determining attainment of these individual uses have been incorporated in accordance with Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates (USEPA 1997) and are described below in detail.

2. Assessment Information

The primary unit of assessment used by AS-EPA for this report is the watershed. As indicated previously, the total surface area of American Samoa is very small, only 76.1 sq. miles. This small surface area is divided into 41 watersheds, each with an average size of 1.8 sq. miles (Appendix B, Table 1, Figures 1 and 2). Water quality monitoring, along with coral / fish / benthic monitoring, covers 31 of the 41 watersheds and also covers >95% of the population of American Samoa. Accordingly, tracking water quality on a watershed scale is fully adequate to meet our monitoring and assessment objectives and goals.

Because the watershed is the primary assessment unit, AS-EPA recognizes that data from several locations within a watershed need to be reconciled before assessing the overall use support of waters within that watershed. In this regard, when multiple sources of data within one watershed indicated different levels of use support, AS-EPA chose a conservative approach by selecting the least supporting level for the entire watershed.

Two types of assessment information were utilized: "Evaluated" and "Monitored". "Evaluated waters" are those for which the use support decision is based on information other than site-specific ambient data. This includes data on land use, location of sources, and best professional judgment of qualified biologists. "Monitored waters" are those for which the use support decision is principally based on current, site-specific, ambient monitoring data believed to accurately portray water quality conditions. The majority of the assessments in this report utilize monitored data.

Each source of Aquatic Life Use Support (ALUS) data, whether "evaluated" or "monitored" is assigned a Data Quality Level in accordance with Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates (USEPA 1997). Data types are grouped into four categories: biological, habitat, toxicological, and physical/chemical. The rigor of a method within each data type is dictated by its technical components, spatial/temporal coverage, and data quality (precision and sensitivity). Level 4 data

are of the highest quality for a data type and provide relatively high level of certainty. Level 1 data represent less rigorous approaches and thus provide a level of information with a greater degree of uncertainty.

3. Guidelines for Determining Levels of Use Support for Primary Uses.

3.1 Potable Water Supplies

The 2005 American Samoa Water Quality Standards added definitions for Class 1 and 2 streams. Class 1 has drinking water as a designated use. Class 2 does not have drinking water as a designated use. The assessment framework used for use support decisions for Class 1 waters is shown in Table 3 below.

Table 3. Assessment Framework for Determining Drinking Water Use Support

Classification	Monitoring Data		Use Support Restrictions
Full Support	Contaminants do not exceed water quality criteria	and/or	Drinking water use restrictions are not in effect.
Full Support but Threatened	Contaminants are detected but do not exceed water quality criteria	and/or	Some drinking water use restrictions have occurred and/or the potential for adverse impacts to source water quality exists.
Partial Support	Contaminants exceed water quality criteria intermittently	and/or	Drinking water use restrictions resulted in the need for more than conventional treatment with associated increases in cost.
Nonsupport	Contaminants exceed water quality criteria constantly	and/or	Drinking water use restrictions resulted in closures.
Unassessed	Source water quality has not been assessed for contaminants used or potentially present.		

3.2 Support and Propagation of Indigenous Aquatic and Terrestrial Life

Of the four data type categories (biological, habitat, toxicological and physical/chemical), two categories, physical/chemical and biological, were used during this reporting period for Aquatic Life Use Support (ALUS) determination. These data are of varying data quality levels as per the hierarchy of data levels for evaluation of aquatic life use attainment of the 1997 305(b) EPA

guidance. The guideline for determining ALUS using more than one type of data is shown in Table 4 below.

Table 4. Determination of ALUS Using More Than One Data Type

ALUS Attainment	
Fully Supporting:	No impairment indicated by all data types.
Fully Supporting but Threatened:	No impairment indicated by all data types; one or more categories indicate an apparent decline in ecological quality over time or potential water quality problems requiring additional data or verification or other information suggest a threatened determination.
ALUS Non-Attainment	
*Partially Supporting:	Impairment indicated by one or more data types and no impairment indicated by others.
*Not Supporting:	Impairment indicated by all data types.
*A determination of *Partially Supporting* or *Not Supporting* could be made based on the nature and rigor of the data and site-specific conditions in the results of the data types. If bioassessment (usually Level 3 or 4) indicates impairment, then a determination of *Not Supporting* should be made.	

i. Physical/Chemical Methods

USEPA guidance (1997) states the importance of incorporating the established criteria for conventionals and toxicants in ALUS determinations and to use the "worst case" approach where multiple parameters are available (USEPA, 1997). Tables 5 and 6 below, describe the decision guidelines used for determining ALUS using Physical/Chemical Methods for conventional data (and additional parameters) and toxicant data.

Conventional pollutants are defined by the Clean Water Act of 1977 as BOD, TSS, fecal coliform, oil and grease, and pH. Additional parameters analyzed by AS-EPA include Temperature, Dissolved Oxygen, Turbidity, Total Nitrogen, Total Phosphorus, and Enterococcus. These parameters were assessed by the criteria developed by the USEPA for the "Conventional Category". Priority pollutants include all pollutants listed as Priority Pollutants by the Clean Water Act and subsequent amendments to the act. No priority pollutant monitoring was conducted in FY08 or FY09.

Much of AS-EPA's Physical/Chemical data is considered Low/Moderate quality, based on technical components and spatial/temporal coverage, as defined by Table 3-4 in the 1997 EPA guidance document Hierarchy of Physical/chemical Data Levels for Evaluation of Aquatic Life Use Attainment. The ASWQS provides standards for these parameters presented in Table A1 (Appendix A)**.**

Table 5. Decision Guidelines for Conventionals (and additional parameters) Used to Assess ALUS in Freshwater Rivers and in Marine Waters

Degree of Aquatic Life Use Support	**Criteria for Conventionals***
Fully Supporting	For any one pollutant, ASWQS exceeded in ≤10 percent of measurements.
Partially Supporting	For any one pollutant, ASWQS exceeded in 11 to 25 percent of measurements.
Not Supporting	For any one pollutant, ASWQS exceeded in >25 percent of measurements.

* ASWQS state that compliance with numeric standards shall be determined utilizing at least four consecutive measurements over a period of not less than 3 months or greater than 12 months, unless otherwise specified by the Environmental Quality Commission.

Table 6. Decision Guidelines for Toxicants (priority pollutants, metals, chlorine and ammonia) Used to Assess ALUS in Freshwater Rivers and in Marine Waters

Degree of Aquatic Life Use Support	**Criteria for Toxicants***
Fully Supporting	For any one pollutant, no more than 1 exceedance of acute criteria within a 3-year period based on grab or composite samples and no more than 1 exceedance of chronic criteria within a 3-year period based on grab or composite samples
Partially Supporting	For any one pollutant, acute or chronic criteria exceeded more than once within a 3-year period, but in ≤10 percent of samples.
Not Supporting	For any one pollutant, acute or chronic criteria exceeded in >10 percent of samples.

* ASWQS state that for toxic substances, compliance shall be determined by any single sample, unless otherwise specified by the Environmental Quality Commission.

ii. Habitat Assessment and Bioassessment

In FY08 and FY09, the AS-EPA stream monitoring program did not include a habitat assessment. No stream bioassessment data were collected during this period. Guidelines from the USEPA guidance (1997) for ALUS determination using habitat assessment data are provided in Table 7 below.

In FY08 and FY09, the AS-EPA Coral Reef Monitoring Program included bioassessments. Guidelines from the USEPA guidance (1997) for ALUS determination using bioassessment data are provided in Table 8 below. These guidelines were not developed for coral reef

bioassessments. Therefore, a modified assessment methodology was developed by Peter Houk and Craig Musburger of Pacific Marine Resources Institute, Inc.

Seventeen locations around Tutuila Island have been surveyed over the past 5 years. Coral and benthos abundances, as well as taxonomic checklists, were used to create Bray-Curtis similarity matrices. These matrices quantify the relative similarities among sites based upon species presence and/or abundance. Similarity matrices were graphically interpreted using non-metric, multi-dimensional scaling (MDS) (Clarke and Warwick, 2001). ANOSIM testing was employed to evaluate the relationship between reef types and ecological data. These tests are based upon ranked, species similarity measures between sites attributed to varying reef types, and yield an R statistic which serves as a measure of class separation. R values can range between -1 and 1; R values near zero suggest that the null hypothesis is true (there is no difference among reef types), R values higher than 0.5 suggest a false null hypothesis (e.g. reef types support different assemblages). P values are calculated for each R statistic using a permutated test of random rearrangement, and comparing the true R value with the generated distribution. Species-centered, principal components analyses (PCA's) were created to graphically interpret coral species affinities with each other and their affinities with reef types (ter Braak, 1983). These ordinations rotate the multidimensional species similarity datasets to extract as much variance as possible (i.e., show the greatest gradients) in two dimensions. Finally, standard correlation testing was conducted to explore linear relationships between fish and coral diversity measures and watershed characteristics.

To examine temporal trends at each site further ANOSIM tests were conducted between survey years using coral abundance data. These tests of significant community-level changes were depicted using site-based PCA plots that display the most influential gradients between sites and survey years, and directional changes. For the benthic assemblages paired t-tests were employed to compare the benthic substrate ratio between survey years, defined by:

$$= \frac{\%\ \text{cover of (coral + soft coral + all other coralline algae)}}{\%\ \text{cover of (macroalgae + turf algae + inhibitive coralline algae)}}$$

Site-based ANOSIM and t-tests were subsequently used to establish United States Environmental Protection Agency (USEPA) aquatic life use support (ALUS) determinations (EPA, 1997, 2002). In accordance with reference material three categories were used for the rankings: fully, partially, and not supportive for aquatic life use support. Houk and Musburger (2007) reported initial assessments for each site. Given the emergence of temporal data, assessments for this report are now based upon directional trends following: 1) if benthic and coral data show statistically significant changes that are attributed to an improved community state then a 'fully supportive' ranking is made, 2) if benthic and coral data show now significant changes then rankings remain the same as reported by Houk and Musburger (2007), and 3) if benthic and coral data show statistically significant changes that are attributed to a declining community state then a 'non-supportive' ranking is made. (see Assessing the Effects of Non-Point Sources Pollution on American Samoa's Coral Reef Communities, 2008, by Peter Houk and Craig Musburger).

Table 7. ALUS Determination Based on Habitat Assessment Data

Degree of Aquatic Life Use Support	Criteria
Fully Supporting	Reliable data indicate natural channel morphology, substrate composition, bank/riparian structure, and flow regime of region. Riparian vegetation of natural types and of relatively full standing crop biomass (i.e., minimal grazing or destructive pressure).
Partially Supporting	Modification of habitat slight to moderate usually due to road crossings, limited riparian zones because of encroaching land-use patterns, and some watershed erosion. Channel modification slight to moderate.
Not Supporting	Moderate to severe habitat alteration by channelization and dredging activities, removal of riparian vegetation, bank failure, heavy watershed erosion or alteration of flow regime.

Table 8. ALUS Determination Based on Bioassessment Data

Degree of Aquatic Life Use Support	Criteria
Fully Supporting	Reliable data indicate functioning, sustainable biological assemblages (e.g. fish, macroinvertebrates, or algae) none of which has been modified significantly beyond the natural range of the reference condition.
Partially Supporting	At least one assemblage (e.g. fish, macroinvertebrates, or algae) indicates moderate modification of the biological community compared to the reference condition.
Not Supporting	At least one assemblage indicates nonsupport. Data clearly indicate severe modification of the biological community compared to the reference condition.

Data levels for the four data type categories were ranked according to the hierarchy provided in the USEPA guidance (1997).

3.3 Recreation and Aesthetic Enjoyment

The current ASWQS lists *Enterococci* and *E.coli* as the microbiological indicators for fresh surface waters and *Enterococci* as the indicator for microbiological quality in marine waters.

Microbiological criteria used to determine use support for waters designated for whole body contact recreation are depicted in Table 9 below. The assessment methodology for determining whole body recreational contact in the 2008 report was based on the percentage of single sample exceedances. At the request of USEPA, the percentage of rolling geomean exceedances is included in the assessment methodology for this report.

Table 9. Whole Body Contact Recreation (all surface and marine water designations)

Level of Recreation Use Support	**Criteria**			
	Fresh Surface Water	Ocean Waters	Embayments: Pago Pago Harbor, Fagatele Bay, Pala Lagoon	All Other Embayments, Open Coastal Waters
Fully Supporting	*E. coli*: The single sample density of 576 and the geometric mean of 126 *E. coli* per 100 mL is exceeded in ≤10 percent of measurements. *Enterococci*: The single sample density of 151 and the geometric mean of 33 *enterococci* per 100 mL is exceeded in ≤10 percent of measurements.	*Enterococci*: The single sample density of 276 and the geometric mean of 35 *enterococci* per 100 mL is exceeded in ≤10 percent of measurements.	*Enterococci*: The single sample density of 104 and the geometric mean of 35 *enterococci* per 100 mL is exceeded in ≤10 percent of measurements.	*Enterococci*: The single sample density of 124 and the geometric mean of 35 *enterococci* per 100 mL is exceeded in ≤10 percent of measurements.
Partially Supporting	*E. coli*: The single sample density of 576 or the geometric mean of 126 *E. coli* per 100 mL is exceeded in 11 to 25 percent of measurements. *Enterococci*: The single sample density of 151 or the geometric mean of 33 *enterococci* per 100 mL is exceeded in 11 to 25 percent of measurements.	*Enterococci*: The single sample density of 276 or the geometric mean of 35 *enterococci* per 100 mL is exceeded in 11 to 25 percent of measurements.	*Enterococci*: The single sample density of 104 or the geometric mean of 35 *enterococci* per 100 mL is exceeded in 11 to 25 percent of measurements	*Enterococci*: The single sample density of 124 or the geometric mean of 35 *enterococci* per 100 mL is exceeded in 11 to 25 percent of measurements
Not Supporting	*E. coli*: The single sample density of 576 or the geometric mean of 126 *E. coli* per 100 mL is exceeded in >25 percent of measurements. *Enterococci*: The single sample density of 151 or the geometric mean of 33 *enterococci* per 100 mL is exceeded in >25 percent of measurements.	*Enterococci*: The single sample density of 276 or the geometric mean of 35 *enterococci* per 100 mL is exceeded in >25 percent of measurements.	*Enterococci*: The single sample density of 104 or the geometric mean of 35 *enterococci* per 100 mL is exceeded in >25 percent of measurements.	*Enterococci*: The single sample density of 124 or the geometric mean of 35 *enterococci* per 100 mL is exceeded in >25 percent of measurements.

3.4 Fish and Shellfish Consumption

Based on the results of the AS-EPA Tier II Fish Toxicity study, the fish consumption advisory continues to exist for fish and shellfish in the inner Pago Pago harbor. The USEPA guidance document (1997) provided classification hierarchy for use support status based on fish/shellfish consumption advisory data as depicted in Table 10 below.

Table 10. Fish/Shellfish Consumption Use Support Determination Based on Advisory Data

Degree of Aquatic Life Use Support	**Criteria***
Fully Supporting	No fish/shellfish restrictions or bans are in effect.
Partially Supporting	"Restricted consumption" of fish in effect. Restricted consumption is defined as limits on the number of meals or size of meals consumed per unit of time for one or more fish/shellfish species. Or, a fish or shellfish ban in effect for a subpopulation that could be at potentially greater risk, for one or more fish/shellfish species.
Not Supporting	"No consumption" of fish or shellfish ban in effect for general population for one or more fish/shellfish species, or commercial fishing/shellfishing ban in effect.

* Fish/Shellfish consumption restrictions shall be determined based on Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Risk Assessment and Fish Consumption Limits. Third Edition (USEPA 2000). For target species, collect 3-10 individuals for each of 3-5 composites. Ranges are given due to highly variable abundance among coral reef fish species. Size-class composite analysis is not practicable for coral reef fish, since reef fish do not follow typical age-size relationships found for pelagic and temperate fishes (see Tier 2 fish toxicity study. Chemical contaminants in fish and shellfish and recommended consumption limits for Territory of American Samoa, 2005, by Peshut and Brooks).

4. Guidelines for Determining Consolidated Assessment and Listing Methodology (CALM) Categories

The Consolidated Assessment and Listing Methodology (CALM) categories for the 2010 report were determined from the Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act (USEPA 2005). Each water body type was assigned a CALM category, based on the following descriptions.

- Category 1 Water body meets all designated uses. No use is impaired.
- Category 2 Water body meets some of the designated uses. There is insufficient data to evaluate any remaining designated uses.
- Category 3 There are insufficient data to evaluate any designated uses.

- Category 4a Water body is impaired for one or more designated uses, but a TMDL has already been prepared and completed.
- Category 4b Water body is impaired for one or more designated uses, but a TMDL is not necessary because other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.
- Category 4c Water body is impaired for one or more designated uses, but a TMDL is not necessary because a pollutant does not cause the impairment.
- Category 5 Water body is impaired, and a TMDL is required [303(d) list].

In this report, waters that were assessed as Fully Supporting but Threatened (Fully Supporting/Threatened) were not considered impaired. Instead, AS-EPA regards threatened waters to be "waters for which monitoring or evaluative data indicate potential water quality problems requiring additional data or verification" (Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates, USEPA 1997). For instance, waters that had fewer excursions above the standard than specified in the listing criteria, or for which data were considered of low quality, or situations where too few samples precluded examining data with respect to the water quality standards, were considered Threatened. Waters assessed as Threatened are not expected to exceed WQS by the next listing cycle.

iv. Streams Water Quality Assessment

Using the guidelines presented above, American Samoa's stream waters were assessed according to levels of use support. This information is presented in Tables A2 through A4 in Appendix A and summarized in Appendix C.

AS-EPA gathered water quality data from streams in the Territory. All data were Monitored Data, no Evaluated Data was used for this report. The assessment of these data covers 142.4 miles out of 257.5 total stream miles (Table C2). The Assessed Goals were to Protect and Enhance Public Health and Protect and Enhance Ecosystems. All other categories were either "Not Applicable" or "Applicable but no data was available" for this reporting period (Table A2). The Major Causes/Stresses identified for this reporting period were Nutrients, Low DO, Pathogen Indicators, and Turbidity (Table A3). The Major assessed sources of impairment were Collection System Failure and Intensive Animal Feeding Operations (Table A4). Trend analyses will be developed as stream monitoring continues and data accrues.

For the goal Protect and Enhance Ecosystems (Aquatic Life), 142.4 stream miles were assessed. Of those miles, 11.1 were found to be "Fully Supporting", 30.4 were found to be "Fully Supporting but Threatened", 0.0 miles were found to be "Partially Supporting", and 100.9 miles were found to be "Not Supporting". For the goal to Protect and Enhance Public Health, 142.4 stream miles were assessed for Swimming and all found to be "Not Supporting" (Table A2).

The following CALM categories were assigned based on the assessments for Aquatic Life Use Support and Swimming (Tables C2 and C2). Seventeen of 31 watersheds were placed in Category 3 (115.1 miles). Fourteen watersheds were placed in Category 5 (142.4 miles). Fourteen watersheds were classified as "Not Supporting" based on the Swimming, Eleven watersheds were "Not Supporting" based on ALUS.

v. Ocean Shoreline Assessment

Using the guidelines presented above, American Samoa's ocean shoreline waters were assessed according to levels of use support. This information is presented in Tables A5 through A7 in Appendix A and summarized in Appendix C.

For this reporting period, the total size assessed in shoreline miles was 123.1 out of 149.5 total shoreline miles (Table C2). The Assessed Goals were 1) Protection and Enhancement of Ecosystems (Aquatic Life) and 2) Protection and Enhancement of Public Health (Fish Consumption and Whole Body Contact Recreation/Swimming). All other categories were either "Not Applicable" or "Applicable but no data was available" for this reporting period (Table A5). The Major Causes/Stresses identified for this reporting period were PCBs, Metals (Mercury), Pathogen Indicators and Undetermined NPS Stressors, (Table A6). The Major sources of impairment were Collection System Failure, Intensive Animal Feeding Operations, and Multiple Nonpoint Sources (Table A7). Trend analyses will be developed as the territorial coral reef and marine monitoring program continues and data accrues.

For the goal Protect and Enhance Ecosystems (Aquatic Life) 49.8 miles were assessed. Of those miles, 18.8 miles were found to be "Fully Supporting", 13.5 miles were found to be "Partially Supporting", and 17.5 miles were found to be "Not Supporting". For the goal to Protect and Enhance Public Health, 102.6 shoreline miles were assessed for swimming. Of this total, 44.7 miles were "Fully Supporting," 9.1 miles were "Partially Supporting," and 48.8 miles were "Not Supporting". For the goal to Protect and Enhance Public Health, 7.9 shoreline miles were assessed for fish consumption, and 7.9 miles were found to be "Not Supporting" (Table A5).

The following CALM categories were assigned based on the assessments for Aquatic Life Use Support and Swimming (Tables C1 and C2). Ten of the 41 watersheds in American Samoa were given a CALM Category 2 (52.1 miles). Nine watersheds received a Category 3 rating (26.4 miles), while twenty two watersheds received a Category 5 rating (71.0 miles). NOTE: Watershed 24 would have received a Category 4A rating based on the assessment for Fish Consumption (TMDL completed 11 April 2007); however, the watershed received a Category 5 rating based on the Swimming Assessment.

vi. Wetlands Assessment

No wetlands assessments were conducted during this reporting period. All watersheds that contained wetlands (14 out of 41) were placed in CALM category 3 (396.0 acres). Wetland assessment information is presented in Tables A8 through A10.

vii. Schedule for Establishing TMDLs / 303 (d) List

A TMDL priority list (303(d) list) for Category 5 waters is given in Appendix C.

Most pollutants on the 303 (d) TMDL list are land based pollutants that move down streams to the ocean shoreline. The AS-EPA Watershed Management and Protection Program is persistently working to reduce pollutant loads to streams, with the ultimate goal of elimination of the pollutant loads. Therefore, all streams have been placed on the high priority list and ocean shorelines on the medium priority list.

viii. Evaluating Pollutants/Surface Waters for Removal from the 303(d) List

AS-EPA shall remove a pollutant of a surface water from the 303(d) list based on one or more of the following criteria:

- USEPA approved a TMDL for the pollutant;
- The data used for previous listing is superseded by more recent credible and scientifically defensible data showing that the surface water meets the applicable numeric or narrative surface water quality standard. All historical data is considered, with a greater weight placed on more recent (last 3 – 5 years) data, except for Ocean Shoreline (beaches for swimming), with a greater weight placed on the last 2 years because of the large number of samples collected;
- The surface water no longer meets the criteria for impairment based on a change in the applicable water quality standard or a designated use approved by USEPA;
- The surface water no longer meets the criteria for impairment for the specific narrative water quality standard based on a change in narrative water quality standard implementation procedures;
- A re-evaluation of the data indicate that the surface water does not meet the criteria for impairment because of a deficiency in the original analysis; or
- Pollutant loadings from naturally occurring conditions alone are sufficient to cause a violation of applicable water quality standards.

AS-EPA shall remove a surface water from the 303(d) List if all pollutants for the surface water or segment are removed from the list.

ix. Pollutant/Surface Water Combinations Removed from the 303(d) List

AS-EPA removed the pollutant Enterococcus for Watersheds 14, 18, 19, 28, and 34 (Waterbody Type Ocean Shoreline) from the 2008 303(d) list because the data used for previous listing is superseded by more recent credible and scientifically defensible data showing that the surface waters now meet the applicable numeric water quality standard. Sa'ilele Beach (Watershed 14), Aloa Beach (Watershed 18), Auasi Wharf (Watershed 19), Maliu Mai Beach and Maliu Mai Swimming Hole (Watershed 28) were sampled weekly (approximately 100 samples) and Aunu'u Wharf (Watershed 34) was sampled monthly (24 samples) over FY08 and FY09, and all met both the single sample and geometric mean criteria for fully supporting recreational use.

AS-EPA removed Watersheds 14, 18, 19, and 34 (Waterbody Type Ocean Shoreline) from the 2008 303(d) list and placed them in CALM Category 2 for the 2010 Integrated Report because all pollutants for the waterbodies were removed from the list.

It is shown that there is a significant relationship between rainfall and enterococci counts on American Samoa's beaches (see *Localized beach contamination in American Samoa: Results from two years of weekly monitoring*, DiDonato and Paselio, Marine Pollution Bulletin 52, 2006). The correlation of beach contamination and rainfall can serve as a useful indicator of the efficacy of AS-EPA Watershed Management and Protection efforts. The decrease in enterococci levels as reported above occurred over the past 2 years, in spite of above average rainfall for American Samoa; rainfall for FY08 was 113% of normal, and was 105% of normal for FY09 (see Pacific ENSO Application Climate Center, NOAA, 2010).

Removal of the pollutant Enterococci from the 303(d) list for the beaches of these watersheds is a success story for the AS-EPA Watershed Management and Protection Program, especially the Piggery Compliance Program. The Program received an Environmental Award for Outstanding Achievement from USEPA in 2008. Over the past 3 years AS-EPA has reduced the number of pigs kept in illegal piggeries by 20% (from 8,373 to 6,674) resulting in a significant reduction of pig waste washed down streams onto the beaches of American Samoa.

x. Results of Probabilistic-based Surveys

The Ocean EMAP Monitoring Plan was developed in 2004 to address the need to evaluate and assess water quality of American Samoa's coastal waters (0.25 mi. from the mean high water mark). Parameters were chosen to measure concentrations of the priority pollutants causing impairment, as well as related ecological indicators. This

plan was developed as a collaborative effort between AS-EPA and the National Park of American Samoa (NPSA). Technical assistance was provided by the USEPA, Gulf Ecology Division.

The method selected for this assessment was the USEPA's Environmental Monitoring and Assessment Program (EMAP). This method employs a probabilistic (random) approach to site selection and leads to a statistically rigorous comprehensive assessment. Fifty (50) coastal sampling locations were selected from around American Samoa's main islands (Rose Atoll and Swain's Island were excluded for logistical reasons). Of these fifty (50), thirty (30) were within the marine boundaries of the National Park; the remaining twenty (20) were randomly selected from the entire Territorial region (0.25 mi. from the mean high water mark). Thus, there was a bias to sample sites reflecting the Park's needs. However, the site selection method insures that a Territorial comprehensive assessment will result. As currently designed, this assessment was for one time only. Therefore there was not enough data to make 305(b) determinations regarding Ocean EMAP monitoring locations. AS-EPA, in a cooperative effort with the Pacific Territories of CNMI and Guam, will undertake a Reef Flat EMAP effort in 2010.

Monitoring parameters for the Ocean EMAP included:

Water Quality Indicators

Hydrographic Profile

- Dissolved oxygen
- Salinity
- pH
- temperature
- depth
- light attenuation (PAR, transmittance)
- secchi depth

Water Quality Samples

- dissolved nutrients (ortho-phosphates, nitrites, nitrates, ammonia)
- chlorophyll *a*
- total suspended solids (TSS)
- *Enterococcus*

Sediment Quality

- sediment contaminants (organics and metals)
- sediment TOC
- percent silt/clay

Biota

Fish/Shellfish

- tissue contaminants (organics and metals)
- external pathology (fish)

Benthos

- community structure (standard grab – 0.04 m^2)

Habitat

- SAV (presence/absence)
- Basic habitat type
- Marine debris (presence/absence)

Results are presented in Table 11 below.

Table 11. Attainment Results Calculated Using Probabilistic Monitoring Designs

Project Name	American Samoa EMAP
Target Population	All Territorial estuaries, plus waters extending up to 0.25 miles from shore
Type of Waterbody	Pago Pago Harbor and Open Coastal Waters
Size of Target Population	85
Units of Measurement	km^2
Designated_Use	Aquatic Life Use Support
Percent_attaining	77%
Percent_not attaining	23%
Percent nonresponsive	n/a
Indicator	Physical-chemical-bacteriological
Assessment date	20080115
Precision	90%

xi. Cumulative Use Support Summary

Table C1 in Appendix C summarizes use support for data collected only between FY08 and FY 09. To account for historical data not reflected in Table C1, a second assessment for use support was completed using use support determinations made from data collected between FY03 and FY09. This cumulative assessment is summarized in Appendix D. 305b Use Support / CALM Assessment Category Summary. For this summary, the lowest level of use support was used for watersheds where use support determination differed from year to year, except where a pollutant or watershed has been removed from the Section 303(d) list. In addition, since wetland data was low precision evaluated data, all wetlands were assigned to CALM Category 3.

IV Groundwater Assessment

Tables 12 to 14 report on the quality of the Tutuila, Ofu/Olosega and Ta'u aquifers that provide the majority of American Samoa's ground water resources. Table 12 provides an overview of the most important sources of ground water contamination.

Best professional judgment provided the methodology and justification for prioritization of the sources indicated. In the same table, letters in the third column correspond with the following concerns for each contaminant source.

A. Human health and/or environmental risk (toxicity)
B. Size of population at risk
C. Location of sources relative to drinking water sources
D. Number and/or size of contaminant sources
E. Hydrogeologic sensitivity
F. Territorial findings, other findings
H. Geographic distribution/occurrence

As well, letters in the fourth column correspond with the contaminants/classes of contaminants considered to be associated with each of the sources that was checked.

A. Inorganic pesticides
B. Organic pesticides
C. Halogenated solvents
D. Petroleum compounds
E. Nitrate
G. Salinity/brine
H. Metals
I. Radionuclides
J. Bacteria
K. Protozoa
L. Viruses

Table 13 provides a summary of American Samoa's ground water protection efforts. AS-EPA and other cooperating government agencies have increased efforts to monitor and protect groundwater resources. Table 14 provides and ground water contaminant summary for the Tutuila aquifer. Tables 15-22 provide the occurrence of particular groups of contaminants for each hydrogeologic setting in American Samoa.

Table 12: Major Sources of Ground Water Contamination

Contaminant Source	Ten Highest Priority Sources	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots	x	A,B,C,D,E,G	E,J,K,L
Drainage wells			
Fertilizer applications	x	A,B,C,D,E,G	E,J,K,L
Irrigation practices			
Pesticide applications	x	A,B,C,D,E,G	A,B
On-farm agricultural mixing and loading procedures			
Land application of manure (unregulated)			
Storage and Treatment Activities			
Land application (regulated or permitted)			
Material stockpiles			
Storage tanks (above ground)			
Storage tanks (underground)	x	A,B,C,D,E,G	D
Surface impoundments			
Waste piles			
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills	x	A,E	A,B,C,D,E,H,I,J,K,L
Septic systems	x	A,B,C,D,E,G	E,J,K,L
Shallow injection wells			
Other			
Hazardous waste generators			
Hazardous waste sites			
Large industrial facilities			
Material transfer operations			
Mining and mine drainage			
Pipelines and sewer lines	x	A,B,C,D,E,G	E,J,K,L
Salt storage and road salting			
Salt water intrusion	x	A,B,C,D,E,F,G	G
Spills			
Transportation of materials			
Urban runoff	x	A,B,C,D,E,G	C,D
Small-scale manufacturing and repair shops	x	A,C,E,G	C,D,H
Other sources (please specify)			

Table 13: Summary of American Samoa's Ground Water Protection Programs.

Programs or Activities	Program Exists or is Under Development	Implementation Status	Responsible State Agency
Active SARA Title III Program	x	under development	AS-EPA/TEMCO
Ambient ground water monitoring system	x	fully established	ASPA/AS-EPA
Aquifer vulnerability assessment	x	fully established	AS-EPA/ASPA
Aquifer mapping	x	under development	AS-EPA/ASPA
Aquifer characterization	x	under development	AS-EPA/ASPA
Comprehensive data management system	x	fully established	AS-EPA/ASPA
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)	x	under development	AS-EPA/ASPA
Ground water discharge permits			
Ground water Best Management Practices	x	under development	AS-EPA/ASPA
Ground water legislation	x	fully established	AS-EPA/ASPA
Ground water classification	x	under development	AS-EPA/ASPA
Ground water quality standards	x	fully established	AS-EPA
Interagency coordination for ground water protection initiatives	x	fully established	AS-EPA/ASPA
Non point source controls	x	fully established	AS-EPA/ASPA/DOC
Pesticide State Management Plan	x	fully established	AS-EPA
Pollution Prevention Program	x	fully established	AS-EPA
Resource Conservation and Recovery Act (RCRA) Primacy			
Source Water Assessment Program			
State Superfund			
State RCRA Program incorporating more stringent requirements than RCRA Primacy			
State septic system regulations	x	fully established	ASPA/Public Health
Underground storage tank installation requirements	x	fully established	AS-EPA
Underground storage tank remediation fund			
Underground storage tank permit program	x	fully established	AS-EPA
Underground injection control program			
Vulnerability assessment for drinking water/wellhead protection	x	fully established	AS-EPA/ASPA
Well abandonment regulations	x	fully established	AS-EPA/ASPA
Wellhead Protection Program (EPA approved)	x	under development	AS-EPA/ASPA
Well installation regulations	x	fully established	AS-EPA/ASPA
Brownfields 128(a) Program	x	fully established	AS-EPA

Table 14: Ground Water Contamination Summary

Source Type	Number of Sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL	0								
CERCLIS (non-NPL)	0								
DOD/DOE	2	2	0	Petroleum	2	1	2	1	1
LUST	1	1	0	Petroleum	1	0	0	0	0
RCRA Corrective Action	0								
Undergroun d Injection	0								
State Sites	3	3	0	PCB, Petroleum	3	2	3	1	2
Non-Point Sources	0								
Other (specify)	0								

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks

Table 15. Aquifer Monitoring Data
Hydrogeologic Setting: Tutuila
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	38	**VOC**	0	0	23	23	0	0	0	0	0
		SOC	-	-	-	-	-	-	-	-	-
		NO_3	0	0	23	23	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only

Table 16. Aquifer Monitoring Data
Hydrogeologic Setting: Aoa
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	1	**VOC**	0	0	1	1	0	0	0	0	0
		SOC	0	0	1	1	0	0	0	0	0
		NO_3	0	0	1	1	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only.

Table 17. Aquifer Monitoring Data
Hydrogeologic Setting: Fagasa
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	2	**VOC**	0	0	2	2	0	0	0	0	0
		SOC	0	0	2	2	0	0	0	0	0
		NO_3	0	0	2	2	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only.

Table 18. Aquifer Monitoring Data
Hydrogeologic Setting: Masefau
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	2	**VOC**	-	-	-	-	-	-	-	-	-
		SOC	-	-	-	-	-	-	-	-	-
		NO_3	0	0	2	2	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only.

Table 19. Aquifer Monitoring Data
Hydrogeologic Setting: Vatia
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	1	**VOC**	-	-	-	-	-	-	-	-	-
		SOC	-	-	-	-	-	-	-	-	-
		NO_3	0	0	1	1	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only.

Table 20. Aquifer Monitoring Data
Hydrogeologic Setting: Aunu'u
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	2	**VOC**	-	-	-	-	-	-	-	-	-
		SOC	0	0	2	2	0	0	0	0	0
		NO_3	0	0	2	2	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only.

Table 21. Aquifer Monitoring Data
Hydrogeologic Setting: Ofu/Olosega
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	2	**VOC**	-	-	-	-	-	-	-	-	-
		SOC	-	-	-	-	-	-	-	-	-
		NO_3	0	0	2	2	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only.

Table 22. Aquifer Monitoring Data
Hydrogeologic Setting: Ta'u-Faleasao/Fitiuta
Data Reporting Period: FY08 and FY09

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l **AND** No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l **OR** Other parameters are detected at concentrations exceeding the MDLs but less than or equal to the MCLs	One or more parameters are detected at concentrations exceeding the MCLs	Number of Wells Removed from service	Number of wells Requiring Special Treatment1	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5mg/l AND VOC, SOC, and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Untreated Water Quality Data from Public Water Supply Wells		**VOC**									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data from Public Water Supply Wells	2	**VOC**	0	0	2	2	0	0	0	0	0
		SOC	0	0	2	2	0	0	0	0	0
		NO_3	0	0	2	2	0	0	0	0	0
		Other2	-	-	-	-	-	-	-	-	-

1 All groundwater wells required chlorination treatment.
2 Includes inorganic chemical contaminants only

V Public Participation Process

As part of the integrated report process, AS-EPA announced the completion of the Integrated Water Quality Monitoring and Assessment Report and solicited public comments over a 30-day period. The public announcements were advertised in a local newspaper and on the ASEPA website, and the document was made available to any interested member of the public to review and provide comments. One comment was received (see Appendix E)

VI Appendix A

Table A1: Summary of American Samoa Water Quality Standards

Parameters	Fresh Surface Waters	Embayments	Pago Harbor Embayment	Embayments (Fagatele Bay and Pala Lagoon)	Open Coastal Waters	Ocean Waters
Temperature	-not to deviate more than 1.5 ^{o}F from ambient and not to fluctuate more than 1 ^{o}F on an hourly basis or to exceed 85 ^{o}F (except when due to natural causes)					
Light Penetration Depth	not < 65.0 ft (to exceed given value 50% of the time)	not < 120.0 ft (to exceed given value 50% of the time)	not < 65.0 ft (to exceed given value 50% of the time)	not < 130.0 ft (to exceed given value 50% of the time)	not < 130.0 ft (to exceed given value 50% of the time)	not < 150.0 ft (to exceed given value 50% of the time)
PH	6.5-8.6 range (+/- 0.2 pH units of that which would naturally occur)	6.5-8.6 range (+/- 0.2 pH units of that which would naturally occur)	6.5-8.6 range (+/- 0.2 pH units of that which would naturally occur)	6.5-8.6 range (+/- 0.2 pH units of that which would naturally occur)	6.5-8.6 range (+/- 0.2 pH units of that which would naturally occur)	6.5-8.6 range (+/- 0.2 pH units of that which would naturally occur)
Dissolved Oxygen	not < 75% saturation or not <6.0 mg/L	not < 70% saturation or not <5.0 mg/L	not < 70% saturation or not <5.0 mg/L	not < 80% saturation or not <5.5 mg/L	not < 80% saturation or not <5.5 mg/L	not < 80% saturation or not <5.5 mg/L
Turbidity	not > 5.0 NTU	not > 0.35 NTU	not > 0.75 NTU	Fagatele Bay not >0.25 NTU; Pala Lagoon not >0.75 NTU	not > 0.25 NTU	Not > 0.20 NTU
Chlorophyll-a	N/A	not >0.5 ug/L	not >1.0 ug/L	not >0.35 ug/L	not >0.25 ug/L	not >0.18 ug/L
Total Nitrogen	not > 300.0 ug/L	not > 150.0 ug/L	not > 200.0 ug/L	not > 135.0 ug/L	not > 130.0 ug/L	not > 115.0 ug/L
Total Phosphorus	not > 150.0 ug/L	not > 20.0 ug/L	not > 30.0 ug/L	not > 15.0 ug/L	not > 15.0 ug/L	not >11.0 ug/L
E. coli / Enterococcus	*E. coli*: Single sample density not > 576 *E. coli* per 100 mL. *Enterococci*: Single sample density not > 151 *enterococci* per 100 mL. Geometric mean not > 33 *enterococci* per 100 mL.	*Enterococci*: Single sample density not > 124 *enterococci* per 100 mL. Geometric mean not > 35 *enterococci* per 100 mL.	*Enterococci*: Single sample density not > 104 *enterococci* per 100 mL. Geometric mean not > 35 *enterococci* per 100 mL.	*Enterococci*: Single sample density not > 104 *enterococci* per 100 mL. Geometric mean not > 35 *enterococci* per 100 mL.	*Enterococci*: Single sample density not > 124 *enterococci* per 100 mL. Geometric mean not > 35 *enterococci* per 100 mL.	*Enterococci*: Single sample density not > 276 *enterococci* per 100 mL. Geometric mean not > 35 *enterococci* per 100 mL.

Table A2: Individual Use Support Summary for Streams (miles) Total Miles of Streams = 258

Goals	Use	Size Assessed (miles)	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Insufficient Data
Protect & Enhance Ecosystems	**Aquatic Life**	142.4	11.1	30.4	0.0	100.9	115.1
Protect & Enhance Public Health	**Fish Consumption**	-	-	-	-	-	-
	Shellfishing	-	-	-	-	-	-
	Swimming	142.4	0	0	0	142.4	115.1
	Drinking Water	*	*	*	*	*	*
Social & Economic	**Agricultural**	*	*	*	*	*	*
	Cultural/Ceremonial	*	*	*	*	*	*

Notes:
zero (0) = Category applicable, but size of water in category is zero
dash (-) = Category applicable no data available
Asterisk (*****) = category not applicable

Table A3: Total Sizes of Waters Impaired by Various Cause/Stressor Categories
Type of Waterbody: Streams

Cause/Stressor Category	Size of Waters Impaired (miles)
Cause/Stressor Unknown	-
Unknown Toxicity	-
Pesticides	-
Priority Organics	-
Non-point Organics	-
PCBs	-
Dioxins	-
Metals	-
Ammonia	-
Cyanide	-
Sulfates	-
Chloride	-
Other Inorganics	-
Nutrients	116.9
pH	-
Siltation	-
Organic Enrichment/low DO	89.6
Salinity/TDS/Chlorides	-
Thermal Modifications	*
Flow Alterations	-
Other Habitat Alterations	-
Pathogen Indicators	142.4
Radiation	*
Oil and Grease	-
Taste and Odor	-
Suspended Solids	-
Noxious Aquatic Plants (Macrophytes)	*
Excessive Algal Growth	-
Total Toxics	-
Turbidity	100.9
Exotic Species	-
Other (specify)	*

Notes: zero (0) = Category applicable, but size of water in category is zero
dash (-) = Category applicable no data available
asterisk (*) = category not applicable

Table A4. Total Sizes of Waters Impaired by Various Source Categories
Type of Waterbody: Streams

Source Category	Size of Waters Impaired (miles)
Industrial Point Sources	-
Municipal Point Sources	-
Combined Sewer Overflows	-
Collection System Failure	142.4
Domestic Wastewater Lagoon	*
Agriculture	-
Crop-related sources	*
Grazing-related sources	*
Intensive Animal Feeding Operations	142.4
Silviculture	*
Construction	-
Urban Runoff/Storm Sewers	-
Resource Extraction	*
Land Disposal	-
Hydromodification	-
Habitat modification (non-hydromod)	-
Marinas and recreational Boating	*
Erosion from Derelict Land	-
Atmospheric Deposition	-
Waste Storage/Storage Tank Leaks	-
Leaking Underground Storage Tanks	-
Highway maintenance and Runoff	-
Spills (Accidental)	-
Contaminated Sediments	-
Debris and Bottom Deposits	-
Internal Nutrient Cycling (Primary lakes)	*
Sediment Resuspension	*
Natural Sources	-
Recreational And Tourism Activities	*
Salt Storage Sites	*
Groundwater Loadings	*
Groundwater Withdrawal	*
Other Specify	-
Unknown Source	-
Sources Outside State Jurisdiction	*

Notes: asterisk (*) = category not applicable

dash (-) = Category applicable no data available

zero (0) = Category applicable, but size of water in category is zero

Table A5: Individual Use Support Summary for Ocean Shoreline (shore miles) Total Miles of Ocean Shoreline = 149.5

Goals	Use	Size Assessed (miles)	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Insufficient Data
Protect & Enhance Ecosystems	**Aquatic Life**	49.8	18.8	*	13.5	17.5	99.7
Protect & Enhance Public Health	**Fish Consumption**	7.9	-	-	-	7.9	141.6
	Shellfishing	-	-	-	-	-	-
	Swimming	102.6	44.7	*	9.1	48.8	46.9
	Drinking Water	*	*	*	*	*	*
Social & Economic	**Agricultural**	*	*	*	*	*	*
	Cultural/Ceremonial	*	*	*	*	*	*

Notes:
zero (**0**) = Category applicable, but size of water in category is zero
dash (**-**) = Category applicable no data available
Asterisk (*****) = category not applicable

Table A6: Total Sizes of Waters Impaired by Various Cause/Stressor Categories
Type of Waterbody: Ocean Shoreline

Cause/Stressor Category	Size of Waters Impaired (miles)
Cause/Stressor Unknown	--
Unknown Toxicity	-
Pesticides	-
Priority Organics	-
Non-point Organics	-
PCBs	7.9
Dioxins	-
Metals (Mercury)	7.9
Ammonia	-
Cyanide	-
Sulfates	-
Chloride	-
Other Inorganics	-
Nutrients	-
PH	-
Siltation	-
Organic Enrichment/low DO	-
Salinity/TDS/Chlorides	-
Thermal Modifications	*
Flow Alterations	-
Other Habitat Alterations	-
Pathogen Indicators	57.9
Radiation	*
Oil and Grease	-
Taste and Odor	-
Suspended Solids	-
Noxious Aquatic Plants (Macrophytes)	*
Excessive Algal Growth	-
Total Toxics	-
Turbidity	-
Exotic Species	-
Other (Undetermined NPS stressor)	31.0

Notes: zero (**0**) = Category applicable, but size of water in category is zero
dash (**-**) = Category applicable no data available
asterisk (*****) = category not applicable

PCBs and Metals Categories: TMDL was completed in 2007 for Watershed 24, Pago Pago Harbor (7.9 miles)

Undetermined NPS Stressor Category: This category is used for all watersheds determined to be impaired for ALUS by Coral Reef Bioassessments

Table A7. Total Sizes of Waters Impaired by Various Source Categories
Type of Waterbody: Ocean Shoreline

Source Category	Size of Waters Impaired (miles)
Industrial Point Sources	-
Municipal Point Sources	-
Combined Sewer Overflows	-
Collection System Failure	57.9
Domestic Wastewater Lagoon	-
Agriculture	-
Crop-related sources	*
Grazing-related sources	*
Intensive Animal Feeding Operations	57.9
Silviculture	*
Construction	-
Urban Runoff/Storm Sewers	-
Resource Extraction	*
Land Disposal	-
Hydromodification	-
Habitat modification (non-hydromod)	-
Marinas and recreational Boating	*
Erosion from Derelict Land	-
Atmospheric Deposition	-
Waste Storage/Storage Tank Leaks	-
Leaking Underground Storage Tanks	-
Highway maintenance and Runoff	-
Spills (Accidental)	-
Contaminated Sediments	-
Debris and Bottom Deposits	-
Internal Nutrient Cycling (Primary lakes)	*
Sediment Resuspension	*
Natural Sources	-
Recreational And Tourism Activities	*
Salt Storage Sites	*
Groundwater Loadings	*
Groundwater Withdrawal	*
Other Specify (Multiple Nonpoint Sources)	31.0
Unknown Source	-
Sources Outside State Jurisdiction	*

Notes: asterisk (*) = category not applicable
dash (-) = Category applicable no data available
zero (0) = Category applicable, but size of water in category is zero

Table A8: Individual Use Support Summary for Wetlands (acres) Total Acres of Wetlands = 396

Goals	Use	Size Assessed (acres)	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Insufficient Data
Protect & Enhance Ecosystems	**Aquatic Life**	-	-	-	-	-	396
Protect & Enhance Public Health	**Fish Consumption**	*	*	*	*	*	*
	Shellfishing	*	*	*	*	*	*
	Swimming	*	*	*	*	*	*
	Drinking Water	*	*	*	*	*	*
Social & Economic	**Agricultural**	-	-	-	-	-	396
	Cultural/Ceremonial	-	-	-	-	-	396
	Recreational	-	-	-	-	-	396

Notes:
zero (**0**) = Category applicable, but size of water in category is zero
dash (**-**) = Category applicable no data available
Asterisk (*****) = category not applicable

Table A9: Total Sizes of Waters Impaired by Various Cause/Stressor Categories
Type of Waterbody: Wetlands

Cause/Stressor Category	Size of Waters Impaired (acres)
Cause/Stressor Unknown	-
Unknown Toxicity	-
Pesticides	-
Priority Organics	-
Non-point Organics	-
PCBs	-
Dioxins	-
Metals	-
Ammonia	-
Cyanide	-
Sulfates	-
Chloride	-
Other Inorganics	-
Nutrients	-
PH	-
Siltation	-
Organic Enrichment/low DO	-
Salinity/TDS/Chlorides	-
Thermal Modifications	*
Flow Alterations	-
Other Habitat Alterations	-
Pathogen Indicators	-
Radiation	*
Oil and Grease	-
Taste and Odor	-
Suspended Solids	-
Noxious Aquatic Plants (Macrophytes)	*
Excessive Algal Growth	-
Total Toxics	-
Turbidity	-
Exotic Species	-
Other (habitat loss)	-

Notes: zero (**0**) = Category applicable, but size of water in category is zero
dash (**-**) = Category applicable no data available
asterisk (*****) = category not applicable

Table A10. Total Sizes of Waters Impaired by Various Source Categories
Type of Waterbody: Wetlands

Source Category	Size of Waters Impaired (acres)
Industrial Point Sources	-
Municipal Point Sources	-
Combined Sewer Overflows	-
Collection System Failure	-
Domestic Wastewater Lagoon	-
Agriculture	-
Crop-related sources	*
Grazing-related sources	*
Intensive Animal Feeding Operations	-
Silviculture	*
Construction	-
Urban Runoff/Storm Sewers	-
Resource Extraction	*
Land Disposal	-
Hydromodification	-
Habitat modification (non-hydromod), i.e., filling	-
Marinas and recreational Boating	*
Erosion from Derelict Land	-
Atmospheric Deposition	-
Waste Storage/Storage Tank Leaks	-
Leaking Underground Storage Tanks	-
Highway maintenance and Runoff	-
Spills (Accidental)	-
Contaminated Sediments	-
Debris and Bottom Deposits	-
Internal Nutrient Cycling (Primary lakes)	*
Sediment Resuspension	*
Natural Sources	-
Recreational And Tourism Activities	*
Salt Storage Sites	*
Groundwater Loadings	*
Groundwater Withdrawal	*
Other Specify	-
Unknown Source	-
Sources Outside State Jurisdiction	*

Notes: asterisk (*) = category not applicable

Dash (-) = Category applicable no data available

Zero (0) = Category applicable, but size of water in category is zero

VII Appendix B

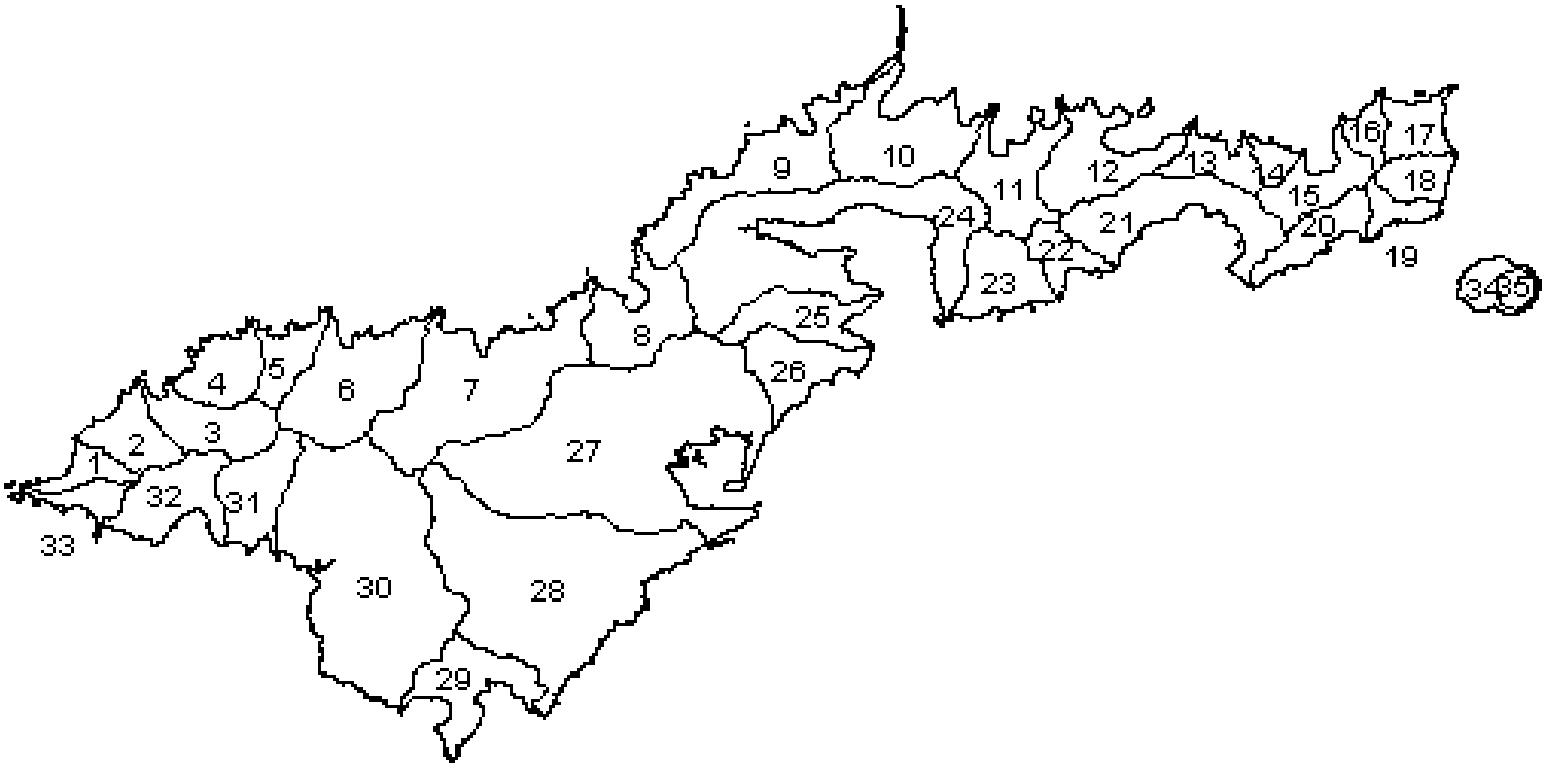
Table B1. Area and aquatic resources information for watersheds of American Samoa.

Watershed	Number	Watershed Area (mi^2)	Perennial Stream Miles	Ocean Shoreline Miles	Wetland Acres	Latitude	Longitude
Poloa	1	0.42	1.6	1.4	0	170° 50' 05.21" W	14° 19' 02.57" S
Fagalii	2	0.80	6.6	1.8	0	170° 49' 34.48" W	14° 18' 24.30" S
Maloata	3	1.08	7.7	0.9	0	170° 48' 59.11" W	14° 18' 14.45" S
Fagamalo	4	1.30	7.3	3.2	0	170° 48' 26.06" W	14° 17' 36.76" S
Aoloau Sisifo	5	0.62	5.1	3.3	0	170° 47' 27.50" W	14° 17' 25.16" S
Aoloau Sasae	6	2.05	15.9	2.6	0	170° 46' 26.61" W	14° 17' 35.02" S
Aasu	7	3.27	16.0	4.5	0	170° 45' 10.66" W	14° 17' 46.61" S
Fagasa	8	1.35	6.0	2.3	0	170° 43' 18.75" W	14° 17' 13.56" S
Fagatuitui	9	2.00	14.4	8.6	0	170° 42' 06.27" W	14° 15' 15.27" S
Vatia	10	1.89	14.4	4.0	34.1	170° 39' 54.64" W	14° 14' 50.92" S
Afono	11	1.29	7.2	3.4	0	170° 38' 53.76" W	14° 15' 22.23" S
Masefau	12	1.42	7.7	4.5	43.1	170° 37' 52.29" W	14° 15' 23.39" S
Masausi	13	0.60	4.5	1.7	0	170° 36' 28.22" W	14° 15' 21.65" S
Sailele	14	0.26	0	1.5	0	170° 35' 48.79" W	14° 15' 23.39" S
Aoa	15	0.85	3.3	1.5	23.5	170° 35' 14.58" W	14° 15' 41.95" S
Onenoa	16	0.30	2.9	0.9	0	170° 34' 48.48" W	14° 14' 58.46" S
Tula	17	0.60	3.6	2.5	8.0	170° 33' 41.80" W	14° 14' 44.54" S
Alao	18	0.52	4.2	0.7	15.5	170° 33' 48.76" W	14° 15' 47.17" S
Auasi	19	0.40	1.8	1.7	0	170° 34' 22.97" W	14° 16' 17.32" S
Amouli	20	0.80	4.3	2.4	0	170° 35' 16.32" W	14° 16' 38.19" S
Fagaitua	21	1.88	14.4	3.7	2.0	170° 36' 47.93" W	14° 16' 05.14" S
Alega	22	0.51	2.8	1.3	0	170° 38' 14.33" W	14° 16' 48.05" S
Laulii-Aumi	23	0.70	6.0	2.0	0	170° 39' 01.88" W	14° 17' 18.20" S
Pago Pago	24	4.00	21.1	7.9	0.6	170° 41' 58.11" W	14° 16' 20.29" S
Fagaalu	25	0.96	6.5	1.3	0	170° 40' 58.92" W	14° 17' 28.92" S
Matuu	26	1.00	7.5	2.2	0	170° 41' 20.33" W	14° 18' 07.33" S
Nuuuli Pala	27	6.70	24.0	8.8	122.9	170° 42' 38.40" W	14° 18' 58.97" S
Tafuna Plain	28	5.50	0	6.9	0	170° 43' 26.26" W	14° 20' 51.99" S
Fagatele-Larson	29	1.23	0	5.7	0	170° 45' 34.39" W	14° 22' 25.49" S
Leone	30	5.67	26.2	4.9	96.8	170° 47' 11.99" W	14° 20' 56.08" S
Afao-Asili	31	1.07	3.2	1.2	0	170° 47' 57.98" W	14° 20' 02.84" S
Nua-Seetaga	32	1.20	7.5	2.6	0	170° 48' 58.35" W	14° 19' 53.87" S
Amanave	33	0.40	3.2	1.8	0	170° 50' 03.81" W	14° 19' 30.26" S
Aunuu Sisifo	34	0.38	0	3.4	111.9[a]	170° 33' 38.94" W	14° 16' 58.98" S
Aunuu Sasae	35	0.22	0	0.1		170° 32' 47.75" W	14° 17' 04.82" S
Ofu Saute	36	1.78	0	5.2	5.9	169° 40' 09.18" W	14° 11' 08.81" S
Ofu Matu	37	1.06	0	4.2	0	169° 39' 28.09" W	14° 09' 56.41" S
Olosega Sisifo	38	1.00	0	4.1	7.4	169° 37' 54.65" W	14° 10' 08.65" S
Olosega Sasae	39	1.20	0	3.4	0	169° 36' 33.94" W	14° 10' 21.85" S
Tau Matu	40	14.20	ND	18.7	36.0	169° 28' 18.79" W	14° 12' 55.30" S
Tau Saute	41	3.30	0.6	6.4	0	169° 27' 35.81" W	14° 14' 57.18" S
Totals		75.78	257.5	149.4	396.0		

[a]represents total wetlands in both watersheds 34 and 35 (Aunuu Sisifo and Aunuu Sasae)

[nd]no data

Figure 1. Map of Tutuila and Aunu'u, American Samoa, and the 35 watersheds that comprise the islands.



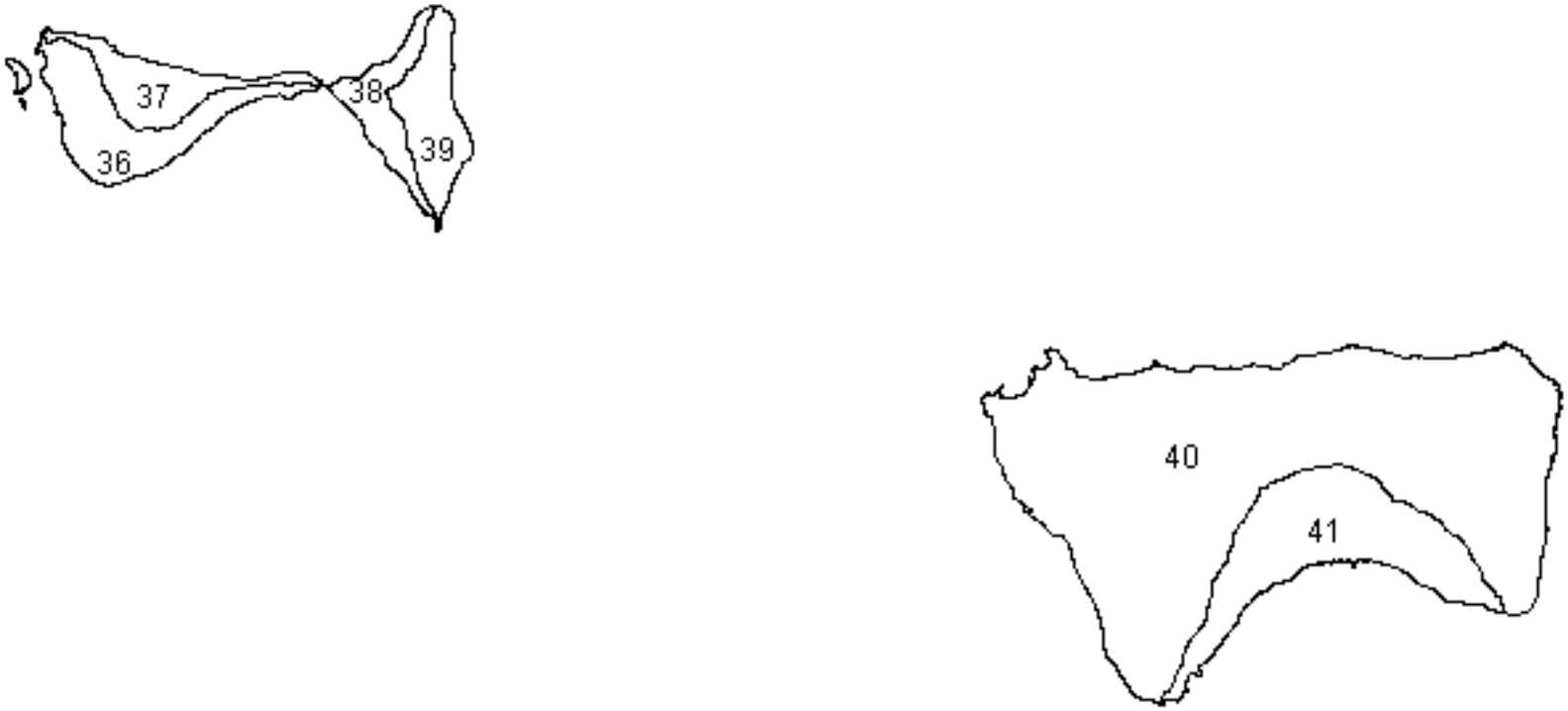


Figure 2. Map of the Manu'a Islands (Ofu, Olosega, and Ta'u), American Samoa, and the 6 watersheds that comprise the islands.

VIII Appendix C. Table C1. 305b Use Support / CALM Assessment Category Summary (FY08 and FY09 data)

WATERSHED	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Development Category	mi	mi	pr	pr	pr	pr	mi	in	pr	mi	mi	mi	mi	mi	in	in	in	ex	mi	in	in	mi	ex	ex	ex	in	ex	ex	pr	ex	mi	in	in	ex	pr	mi	pr	mi	pr	pr	pr
Waterbody Type **Designated Use**																																									
Streams																																									
Aquatic Life					F		F*	F	F*	N		N	N					N				N	N	N	N	N				N											
Swimming					N		N	N	N	N		N	N					N				N	N	N	N	N				N											
Drinking Water **																																									
CALM Assessment Category	3	3	3	3	5	3	5	5	5	5	3	5	5		3	3	3	5	3	3	3	5	5	5	5	5	3			5	3	3	3								3
Ocean Shoreline																																									
Aquatic Life							N	N	F			F	P		N						N		N		N	N		P	F	P											
Swimming			N					N		N	N	N		F	N	N	F	F	F	P	N	N	N	N	N	P	N	F		N	N	P	P	F		F		F		F	
Fish Consumption																								N																	
CALM Assessment Category	3	3	5	3	3	3	5	5	2	5	5	5	5	2	5	5	2	2	2	5	5	5	5	5	5	5	5	5	2	5	5	5	5	2	3	2	3	2	3	2	3
Wetlands																																									
Aquatic Life																																									
Agriculture																																									
Cult./Ceremonial																																									
Recreation																																									
CALM Assessment Category										3		3			3		3	3			3			3			3			3				3	3	3		3		3	

Note: In watersheds where samples were taken at more than one site, the lowest level of use support was used for the summary.

Legend

Shaded areas indicate watersheds that do not have the waterbody type for evaluating designated use, or, the designated use does not apply for the waterbody in that watershed.

Designated Use Support Level
F - Fully Supporting (good)
F*- Fully Supporting/Threatened (good)
P - Partially Supporting (fair)
N - Not Supporting (poor)

Development Category
pr - pristine
mi - minimal
in - intermediate
ex - extensive

CALM Assessment Category
1 - All Designated Uses (DUs) met
2 - Some DUs met; insufficient data to evaluate remaining DUs
3 - Insufficient data to evaluate any DUs
4 - Water is impaired; TMDL not needed
5 - Water is impaired; TMDL needed

Note: Watershed 24 (Pago Pago) placed in Category 4a for Fish Consumption (TMDL completed in 2007) but remains in Category 5 for Swimming

Note: All Waterbodies (Streams) have only ASWQS Class 2 designated uses

Table C2. Size of Surface Waters Assigned to Reporting Categories for 2010

Waterbody Type	Category							Total in Territory	Total Assessed
	1	2	3	4a	4b	4c	5		
Stream, Miles	0.0	0.0	115.1	0.0	0.0	0.0	142.4	257.5 miles	142.4
Ocean Shoreline, Miles	0.0	52.1	26.4	7.9*	0.0	0.0	71.0	149.5 miles	123.1
Wetlands, Acres	0.0	0.0	396.0	0.0	0.0	0.0	0.0	396.0	0.0

CALM Assessment Category

1-- All Designated Uses (DUs) met.

2-- Some DUs met; insufficient data to evaluate remaining Dus.

3-- Insufficient data to evaluate any DUs.

4-- Water is impaired; TMDL not needed.

4a- Impaired or threatened for one or more designated uses but does not require the development of a TMDL because TMDL had been completed.

4b- Impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.

4c- Impaired or threatened for one or more designated uses but does not require the development of a TMDL because impairement is not caused by a pollutant.

5-- Water is impaired; TMDL needed.

* Watershed 24 (Pago Pago) placed in Category 4a for Fish Consumption (TMDL completed in 2007) but remains in Category 5 for Swimming

Table C3. 303 (d) and TMDL Priority List 2010

Category 5 Waters (303(d)) High Priority List

Waterbody Type	Watershed Number	Pollutant	Year Listed	Projected TMDL Submittal Date
Streams	2	TN, TP, Turbidity, DO / Enterococcus	2004 / 2008	2012
Streams	20	TN, TP, Turbidity, DO	2004	2012
Streams	21	TN, TP, Turbidity, DO / Enterococcus	2004 / 2008	2012
Streams	24	TN, TP, Turbidity, DO / Enterococcus	2004 / 2010	2012
Streams	25	TN, TP, Turbidity / Enterococcus	2004 / 2010	2012
Streams	26	TN, TP, Turbidity, DO / Enterococcus	2004 / 2010	2012
Streams	27	TN, TP, Turbidity, DO / Enterococcus	2004 / 2008	2012
Streams	7	TN, TP / Enterococcus	2006 / 2010	2012
Streams	1	Enterococcus	2008	2012
Streams	3	Enterococcus	2008	2012
Streams	4	Enterococcus	2008	2012
Streams	8	Enterococcus	2008	2012
Streams	10	Enterococcus / TN, Turbidity, DO	2008 / 2010	2012
Streams	19	Enterococcus	2008	2012
Streams	23	Enterococcus / TN, TP, Turbidity	2008 / 2010	2012
Streams	30	Enterococcus / TN, TP, Turbidity, DO	2008 / 2010	2012
Streams	5	Enterococcus	2010	2012
Streams	9	Enterococcus	2010	2012
Streams	12	TN, TP, Turbidity, DO, Enterococcus	2010	2012
Streams	13	TN, TP, Turbidity, Enterococcus	2010	2012
Streams	18	TN, TP, Turbidity, DO, Enterococcus	2010	2012
Streams	22	TN, TP, Turbidity, Enterococcus	2010	2012

Table C3. 303 (d) and TMDL Priority List 2010

Category 5 Waters (303(d)) Medium Priority List

Waterbody Type	Watershed Number	Pollutant	Year Listed	Projected TMDL Submittal Date
Ocean Shoreline	23	Enterococcus / Undetermined NPS Stressor	2004 / 2008	2015
Ocean Shoreline	24	Enterococcus	2004	2015
Ocean Shoreline	25	Enterococcus / Undetermined NPS Stressor	2004 / 2008	2015
Ocean Shoreline	26	Enterococcus / Undetermined NPS Stressor	2004 / 2008	2015
Ocean Shoreline	27	Enterococcus	2004	2015
Ocean Shoreline	3	Enterococcus	2006	2015
Ocean Shoreline	8	Enterococcus / Undetermined NPS Stressor	2006 / 2008	2015
Ocean Shoreline	10	Enterococcus	2006	2015
Ocean Shoreline	12	Enterococcus / Undetermined NPS Stressor	2006 / 2008	2015
Ocean Shoreline	15	Enterococcus/ Undetermined NPS Stressor	2006 / 2008	2015
Ocean Shoreline	21	Enterococcus / Undetermined NPS Stressor	2006 / 2008	2015
Ocean Shoreline	30	Enterococcus/ Undetermined NPS Stressor	2006 / 2008	2015
Ocean Shoreline	32	Enterococcus	2006	2015
Ocean Shoreline	33	Enterococcus	2006	2015
Ocean Shoreline	7	Undetermined NPS Stressor	2008	2015
Ocean Shoreline	11	Enterococcus	2008	2015
Ocean Shoreline	13	Undetermined NPS Stressor	2008	2015
Ocean Shoreline	16	Enterococcus	2008	2015
Ocean Shoreline	20	Enterococcus	2008	2015
Ocean Shoreline	22	Enterococcus	2008	2015
Ocean Shoreline	28	Undetermined NPS Stressor	2008	2015
Ocean Shoreline	31	Enterococcus	2008	2015

VIV Appendix D. 305b Use Support / CALM Assessment Category Summary (Cumulative: Includes all FY03 to FY09 data)

WATERSHED	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Development Category	mi	mi	pr	pr	pr	pr	mi	in	pr	mi	mi	mi	mi	mi	in	in	in	ex	mi	in	in	mi	ex	ex	ex	in	ex	ex	pr	ex	mi	in	in	ex	pr	mi	pr	mi	pr	mi	pr	pr
Waterbody Type Designated Use																																									
Streams																																									
Aquatic Life	F*	N	F*	F*	F		N	F*	F*	N		N	N		F*	F*	F*	N	F*	N	N	N	N	N	N	N	N			N	F*	F*									
Swimming	N	N	N	N	N		N	N	N	N		N	N					N	N		N	N	N	N	N	N	N			N											
Drinking Water																																									
CALM Assessment Category	5	5	5	5	5	3	5	5	5	5	3	5	5		2	2	2	5	5	5	5	5	5	5	5	5	5			5	2	2	3								3
Ocean Shoreline																																									
Aquatic Life			F				N	N	F	F*		P	P		N						N		N	F*	N	N		P	F	P				F							
Swimming			N					N		N	N	N		F	N	N	F	F	F	N	N	N	N	N	N	P	N	F		N	N	P	P	F		F		F		F	
Fish Consumption	F																				F		F	N	F	F				F						F					
CALM Assessment Category	2	3	5	3	3	3	5	5	2	5	5	5	5	2	5	5	2	2	2	5	5	5	5	5*	5	5	5	5	2	5	5	5	5	2	3	1	3	2	3	2	3
Wetlands																																									
Aquatic Life																																									
Agriculture																																									
Cult./Ceremonial																																									
Recreation																																									
CALM Assessment Category										3		3			3		3	3			3			3			3			3				3	3	3		3		3	

Note: In watersheds where samples were taken at more than one site, the lowest level of use support was used for the summary.

Legend

Shaded areas indicate watersheds that do not have the waterbody type for evaluating designated use, or, the designated use does not apply for the waterbody in that watershed.

Designated Use Support Level
F - Fully Supporting (good)
F* - Fully Supporting/Threatened (good)
P - Partially Supporting (fair)
N - Not Supporting (poor)

Development Category
pr - pristine
mi - minimal
in - intermediate
ex - extensive

CALM Assessment Category
1 - All Designated Uses (DUs) met
2 - Some DUs met; insufficient data to evaluate remaining DUs
3 - Insufficient data to evaluate any DUs
4 - Water is impaired; TMDL not needed
5 - Water is impaired; TMDL needed

Note: Watershed 24 (Pago Pago) placed in Category 4a for Fish Consumption (TMDL completed in 2007) but remains in Category 5 for Swimming

Note: All Waterbodies (Streams) have only ASWQS Class 2 designated uses

Note: In watersheds where use support determination differed from year to year the lowest level of use support was used for this summary, except where a pollutant or watershed has been removed from the 303(d) list.

Table D2. Size of Surface Waters Assigned to Reporting Categories Summary (Cumulative: Includes all FY03 to FY09 data)

Waterbody Type	Category							Total in Territory	Total Assessed
	1	2	3	4a	4b	4c	5		
Stream, Miles	0.0	20.5	26.9	0.0	0.0	0.0	210.1	257.5 miles	230.6
Ocean Shoreline, Miles	5.2	48.3	25.0	7.9*	0.0	0.0	71.0	149.5 miles	124.5
Wetlands, Acres	0.0	0.0	396.0	0.0	0.0	0.0	0.0	396.0	0.0

CALM Assessment Category

1-- All Designated Uses (DUs) met.

2-- Some DUs met; insufficient data to evaluate remaining Dus.

3-- Insufficient data to evaluate any DUs.

4-- Water is impaired; TMDL not needed.

4a- Impaired or threatened for one or more designated uses but does not require the development of a TMDL because TMDL had been completed.

4b- Impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.

4c- Impaired or threatened for one or more designated uses but does not require the development of a TMDL because impairement is not caused by a pollutant.

5-- Water is impaired; TMDL needed.

* Watershed 24 (Pago Pago) placed in Category 4a for Fish Consumption (TMDL completed in 2007) but remains in Category 5 for Swimming

X Appendix E

American Samoa Environmental Protection Agency

RESPONSE TO PUBLIC COMMENT: 2010 American Samoa Section 303(d) List of Impaired Waters

The draft 2010 American Samoa Section 303(d) List of Impaired Waters was made available for a 30-day public comment period ending 25 April 2010. The American Samoa Environmental Protection Agency (AS-EPA) received one comment. This comment and the response from AS-EPA are provided below.

COMMENT # 1: Miyoko Sakashita, Oceans Director, Staff Attorney, Center for Biological Diversity.

Based on the scientific evidence provided by the Center for Biological Diversity (CBD), "American Samoa should place coastal water segments subject to its jurisdiction on the 303(d) list and develop a total maximum daily load for carbon dioxide pollution that is impairing its seawater quality."

"American Samoa must list ocean waters as impaired for ocean acidification because designated used of the commercial, subsistence, and recreational fishing; the support and propagation of marine life are not attained or threatened due to ocean acidification."

American Samoa's marine pH standard included in Am. Samoa Admin. Code § 24.0210(d)(7), (e)(8), (f)(7), (g)(7) may be inadequate to protect aquatic life.

(See full text of this comment, attached)

AS-EPA RESPONSE # 1:

NO CHANGES MADE: While the American Samoa Environmental Protection Agency agrees that ocean acidification is potentially a global, long-term issue that warrants continued monitoring and evaluation, and that American Samoa's reefs may be vulnerable to impacts of ocean acidification, AS-EPA does not consider it appropriate at this time to list coastal water segments within American Samoa's jurisdiction as either impaired or threatened due to ocean acidification per Section 303(d) of the Clean Water Act, for the reasons discussed below:

For the 2010 303(d) list, AS-EPA evaluated all existing and readily available water quality-related data and information regarding specific coastal water segments within American Samoa's jurisdiction. Based on AS-EPA's review of available information, including that submitted by the CBD, AS-EPA is not aware of any site specific data or calibrated predictive models which indicate the American Samoa's jurisdictional coastal water segments violate American Samoa's marine pH standard, or, that will violate the standard by the next listing cycle (2012). Consequently, AS-EPA does not believe it is appropriate to list American

Samoa's jurisdictional coastal water segments as impaired or threatened due to ocean acidification at this time.

American Samoa's marine pH standard is approved by the US Environmental Protection Agency (EPA). EPA is currently reviewing its aquatic life criterion for marine pH to determine if revisions to the standard are warranted. EPA's review is based on scientific information and data related to ocean acidification received in response to the Notice of data availability (NODA) included in the Federal Register Notice of 15 April 2009 (Vol. 74, No. 71, page 17484). AS-EPA will review EPA's final decision, and if deemed appropriate, will then recommend changes to American Samoa's marine pH water quality standard in the future.

In the 22 March 2010 Federal Register (Vol. 75, No. 54, page 13537) EPA issued a call for public comment on Ocean Acidification as it relates to 303(d) listings including whether EPA should issue guidance regarding the listing of impaired waters as threatened or impaired for ocean acidification, and what that potential guidance should entail. EPA expects to make a decision by 15 November 2010. AS-EPA will review EPA's final decision as well as guidance EPA decides to issue prior to making a decision on how to address ocean acidification on future 303(d) listings.

Sent via U.S. and electronic mail

April 22, 2010

LT Elena Vaouli & Christianera Tuitele
Water Program Manager
PO Box PPA
Utulei Office Building
Pago Pago, American Samoa 96799
elena.vaouli@asepa.gov
christianeratuitele3@gmail.com

Re: Comments on American Samoa's Draft 2010 Section 303(d) List of Impaired Waters

On behalf of the Center for Biological Diversity, these comments are submitted in response to American Samoa's draft list of impaired water bodies pursuant to the Clean Water Act section 303(d). American Samoa's draft 303(d) list failed to include any ocean waters that are threatened or impaired by ocean acidification or even discuss the threat of ocean acidification. American Samoa is especially vulnerable to the impacts of ocean acidification because of the fragile coral reefs that occupy its coastal areas and because the community is highly dependent on ocean and coastal resources. This comment letter supports the inclusion of American Samoa's ocean waters on the list.

The ocean absorbs carbon dioxide causing seawater to become more acidic. Among various adverse impacts to marine life, this process—termed ocean acidification—impairs the ability of calcifying organisms to build their protective structures. Already ocean pH has changed significantly due to human sources of carbon dioxide. On the current trajectory, ocean ecosystems are likely to become severely degraded due to ocean acidification.

On August 6, 2009, the Center for Biological Diversity submitted scientific information supporting the inclusion of ocean waters on American Samoa's 303(d) list. Since then, it has only become more apparent that ocean acidification poses a serious threat to seawater quality with adverse effects on marine life. Nonetheless, American Samoa's draft 303(d) list failed to include any ocean segments threatened or impaired by ocean acidification. The overwhelming scientific evidence supports the inclusion of ocean waters on the 303(d) list because ocean acidification is causing degradation of seawater quality in violation of American Samoa's water quality standards and threatens to become worse. This letter and its source documents should be taken under consideration in support of listing ocean waters, and the Center's previous letter and documents are incorporated by reference.

American Samoa is urged to take ocean acidification seriously and to take prompt steps to halt this threat to our ocean ecosystems. American Samoa should place coastal water segments subject to its jurisdiction on the 303(d) list and develop a total maximum daily load for carbon dioxide pollution that is impairing our seawater quality.

The Clean Water Act Requires American Samoa to Include Ocean Waters Threatened or Impaired by Ocean Acidification on Its 303(d) List

Under the Clean Water Act, "[e]ach state shall identify those waters within its boundaries for which the effluent limitations … are not stringent enough to implement any water quality standard applicable to such waters." 33 U.S.C. § 1313(d)(1)(a). A water body failing to meet any numeric criteria, narrative criteria, waterbody uses, or antidegradation requirements shall be included as a water-quality limited segment on the 303(d) list, as well as water bodies that are threatened with such impairment. 40 C.F.R. § 130.7(b)(3).

EPA has acknowledged the reach of the Clean Water Act to address ocean acidification (EPA 2009). Moreover, the EPA is taking steps that affirm states' duties and authorities to address ocean acidification under the Clean Water Act (EPA 2010). While EPA's action is important, American Samoa has an independent duty to evaluate ocean acidification during the preparation of its 303(d) list. Additionally, the Clean Water Act's section 303(d) is an effective mechanism to address atmospheric deposition of carbon dioxide (CO_2) and has been used to address parallel pollution problems such as mercury and acid rain. EPA's *Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions* acknowledges that atmospheric deposition must be a factor considered by states during their water quality assessments (available at http://www.epa.gov/owow/tmdl/2008_ir_memorandum.html).

American Samoa must list ocean waters as impaired for ocean acidification because designated uses for the commercial, subsistence, and recreational fishing; the support and propagation of marine life are not attained or threatened due to ocean acidification. Am. Samoa Admin Code § 24.0205(e)(1)(A), (F), (f)(1)(A), (D). Further, it is the policy of American Samoa's Environmental Quality Commission (EQC) that existing water uses and the level of water quality necessary to protect existing uses shall be maintained, and any water quality degradation which would interfere with or become injurious to these existing uses is prohibited. Existing uses are those uses identified in these standards. Am. Samoa Admin Code § 24.0202(a). As described in these comments, our previous submission, and the accompanying studies, ocean acidification adversely affects these uses on a long-term basis therefore violating American Samoa's designated uses and water quality standards.

Additionally, the water quality standards require that embayments, Fagatele Bay and Pala Lagoon, near-shore open coast, and oceanic water shall maintain a pH between the ranges of 6.5 to 8.6 and be within 0.2 pH units of that which would occur naturally. Am. Samoa Admin. Code § 24.0210(d)(7), (e)(8), (f)(7), (g)(7). Since this standard may be inadequate to protect aquatic

life (Zeebe et al. 2008), American Samoa should gauge the need to list waters due to ocean acidification on the 303(d) list by the impacts on water quality and marine life.

For these reasons, which are supported by the Center for Biological Diversity's previous submission and information contained herein, American Samoa must list its ocean waters on its 303d list.

Additional Information Illustrating Impairment of Ocean Waters by Ocean Acidification and Corresponding Adverse Impacts to Marine Life

Ocean acidification is already affecting a variety of marine organisms. New scientific information continues to affirm that ocean acidification is degrading water quality and impairing aquatic life beneficial uses of the ocean. Some of this new information is described here, and additional information is referenced in the bibliography and enclosed on a CD.

The National Academy of Sciences reports in, *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean* that "[l]ike climate change, ocean acidification is a growing global problem that will intensify with continued CO_2 emissions and has the potential to change marine ecosystems and affect benefits to society" (NRC 2010). The committee found that unless carbon dioxide emissions are "substantially" curbed, pH will continue to decline with "risk of ecosystem changes that threaten coral reefs, fisheries, protected species, and other natural resources of value to society" (Id.).

Ocean acidification's effects will become increasingly severe due to continuing emissions and the relatively long atmospheric residence time of carbon dioxide.

> Increasing ocean acidification follows directly (albeit with a time lag) the accelerating trend in world CO_2 emissions, and the magnitude of ocean acidification can be predicted with a high level of certainty.

(Secretariat of the Convention on Biological Diversity 2009: 21). This trend of accelerating acidification is of particular concern because current rates of increase in atmospheric CO_2 content are 100 times faster than any recorded in the last million years, and ocean pH is now predicted to reach lows not seen in hundreds of millions of years (Talmage & Gobler 2009). Many calcifying species have never experienced a change in pH of this magnitude so rapidly, and may be unable to adapt (Talmage & Gobler 2009). Recently, a survey in the Pacific revealed that ocean acidification from anthropogenic sources is already significantly affecting surface waters (Bryne et al. 2009). The Byrne study calculated that surface ocean waters in the North Pacific Ocean have experienced an annual decline of 0.0017 pH units between 1991 and 2006, and that this rate of change is accelerating (Byrne et al. 2009).

The predicted drop in ocean pH will affect a wide array of calcifying marine organisms, perhaps most notably corals. The importance of coral reefs to both natural ocean ecosystems and human society is becoming ever more apparent. Coral reefs are "the most biodiverse ecosystems

of the ocean, estimated to harbour around one third of all described marine species" (Veron et al. 2009: 1428) and the loss of reefs would also result in the loss of the large proportion of the planet's biodiversity that is in some way dependant upon them. Furthermore, tens of millions of people worldwide depend on reefs as a source of food and other services, the value of which has been estimated to be between $172 billion and $375 billion annually (Veron et al. 2009).

Scientists warn that at current levels of CO_2 (387 ppm), the world's coral reefs are committed to an irreversible decline due to warming and acidifying waters, and that due to ocean acidification at 450 ppm coralline algae will cease to calcify and coral calcification will decline by about 50 percent (Veron et al. 2009). There is growing evidence that ocean acidification has already impacted saturation rates in areas with corals causing adverse effects, and if CO_2 levels are allowed to reach 560 ppm only a few areas of the Pacific will have conditions suitable for coral growth (*Id.*).

In order to form the protective aragonite structures of which coral reefs are composed, coral polyps require ocean water that is sufficiently saturated with carbonate ions. As the pH of ocean water drops, so does the amount of carbonate ions. Carbonate coral reefs do not form in water with carbonate ion concentrations below 200 μmol kg-1 (Secretariat of the Convention on Biological Diversity 2009). A recent study concluded that "even at future atmospheric CO_2 concentrations of 450–500 ppm (a conservative estimate), carbonate-ion concentrations will drop below 200 μmol per kg-1, beyond which CaCO3-building reefs are no longer viable, and reef erosion will exceed calcification" (Secretariat of the Convention on Biological Diversity 2009: 29). Dore et al. reported the results of nearly 20 years of time-series measurements of seawater pH and associated parameters at Station ALOHA in the central North Pacific Ocean near Hawaii (Dore et al. 2009). They documented a significant long-term decreasing trend in surface pH, which is indistinguishable from the rate of acidification expected from equilibration with the atmosphere (Dore et al. 2009). Similarly, American Samoa's waters are also being affected by ocean acidification and its impacts threaten the designated uses of those waters.

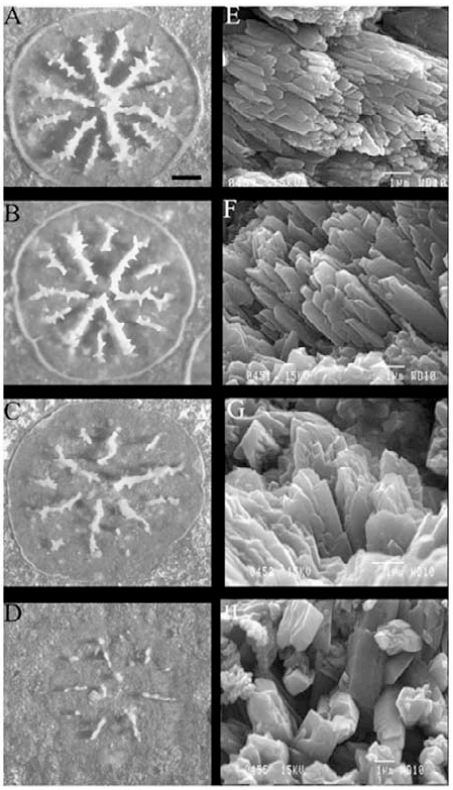


Figure 2(a–d) Progressive changes in the mesoscale skeletal development, including distortion of basal plate and retardation of septal development, of 8-day-old corallites of Favia fragum with decreasing seawater saturation state. Visible changes in the amount of aragonite produced by the corals are quantified by cross-sectional area analysis and weighing of individual corallites. (e–h) Progressive changes in the morphology and orientation of crystals within the corallites are documented by scanning electron microscopy imaging of broken faces of primary septa. In Figures 2a and 2e, W = 3.71 (control); in Figures 2b and 2f, W = 2.40; in Figures 2c and 2g, W = 1.03; and in Figures 2d and 2h, W = 0.22. In Figure 2a, scale bar is 200 mm. (Cohen et al. 2009).

American Samoa's corals are threatened by ocean acidification. For example, a recent study of Atlantic golf ball coral (*Favia fragum*) recruits were tested under undersaturated aragonite states and were found to have significant delays and impairment of skeletal growth (Cohen et al. 2009). See figure 2. Most corals studied have exhibited adverse reactions to ocean acidification at levels to be reached in the near future. Research shows that coral calcification will decline by 10-50 percent by mid-century, and consequently reefs are at risk as well as the services they provide for biodiversity and shoreline protection (Kleypas et al. 2009).

Most marine animals studied thus far have demonstrated adverse effects to ocean acidification, and new studies continue to confirm this unfortunate news. For example, exposure of brittlestar (*Ophiothrix fragilis*) to low levels of pH cause reduced larval size, abnormal development, and skeletogenesis (Secretariat of the Convention on Biological Diversity 2009). Even more poignantly, a 0.2 unit drop in pH resulted in 100% larval mortality within eight days, whereas the control group showed only a 30% mortality rate within the same period (Secretariat of the Convention on Biological Diversity 2009).

Additionally, for American Samoa's consideration, shellfish are vulnerable to adverse consequences due to ocean acidification. Another study of clams, scallops, and oysters showed that levels of CO_2 expected to be absorbed this century by oceans worldwide "are capable of significantly decreasing the size, rates of metamorphosis, and survivorship of larvae from three species of commercially and ecologically valuable shellfish (*M. mercenaria, A. irradians, and C. virginica*)" (Talmage & Gobler 2009: 2076). Under CO_2 conditions expected later this century,

the shellfish experienced dramatic declines in survivorship and impaired growth (*Id.*). Already, ocean acidification may have contributed to global declines in shellfish (*Id.*). The impacts of ocean acidification from loss of calcifying organisms or alterations in marine food webs are estimated at about $160 billion annually (Cooley et al. 2009). Annual harvests of the three species in the Talmage study in states on the east coast of United States alone are estimated to be worth hundreds of millions of dollars (Talmage & Gobler 2009). Ecosystem services provided by these species have been valued even more highly than their harvest (*Id.*). Consequently, American Samoa's coastal resources are at risk due to acidification.

Additionally, a decline of 0.3 pH united causes a 40 percent decrease in the sound absorption of surface seawater and sound may travel 70 percent farther, thus noise from vessels, military, and other human sources may adversely affect sensitive marine mammals (Brewer et al. 2009).

The scientific information about ocean acidification is compelling, and it shows that ocean acidification is among the top water quality problems facing our marine waters. The overwhelming scientific information about ocean acidification confirms that it is from anthropogenic pollution, that it is already affecting ocean waters, that the majority of marine organisms are adversely affected by it, and that it is poised to continue to become more severe in the years to come.

American Samoa Is Required to Consider Scientific Evidence of Ocean Acidification Submitted by the Center for Biological Diversity.

In preparing its 2010 303(d) list, American Samoa has a duty to consider the information submitted by the Center for Biological Diversity. The regulations governing implementation of the Clean Water Act's section 303(d) *require* that a state "evaluate all existing and readily available water quality-related data and information to develop the list." 40 C.F.R. § 130.7(b)(5); *see also Sierra Club v. Leavitt*, 488 F.3d 904 (11th Cir. 2007). The data and information provided by the Center for Biological Diversity on ocean acidification is from highly credible scientific journals and reports. Not only is the scientific understanding of ocean acidification well established, but also the magnitude of the problem and likely effects are predictable with a high degree of certainty (Secretariat of the Convention on Biological Diversity 2009).

Conclusion

The materials submitted with the previous letter and here support a finding that American Samoa's oceans are threatened or impaired. The purpose of water quality standards is to protect the biological diversity of American Samoa's waters as well as recreational and commercial uses. Ocean acidification will have significant negative impacts on the survival of calcareous organisms as well as fish and other marine species. Commercial and recreational uses will be harmed as a result, which will particularly affect the tourism and fishing industries that are so important to American Samoa's residents. Swift action on ocean acidification is needed because these changes in ocean chemistry are irreversible on any practical timescale.

We urge American Samoa to add ocean water segments to its list of threatened and impaired waters under section 303(d) of the Clean Water Act. American Samoa has the authority and the duty to address this serious water quality problem—ocean acidification.

Respectfully submitted,

Miyoko Sakashita
Oceans Director
Staff Attorney
miyoko@biologicaldiversity.org
enclosure

References

The following articles are enclosed on a compact disc to support listing waters as threatened or impaired under section 303(d) of the Clean Water Act.

Balch, W.M. and P.E. Utgoff. 2009. Potential Interactions Among Ocean Acidification, Coccolithophores, and the Optical Properties of Seawater. Oceanography 22:146-159.

Brewer, P.G. 2009. A Changing Ocean Seen with Clarity. Proceedings of the National Academy of Sciences 106: 12213.

Brewer, P.G. and K. Hester. 2009. Ocean Acidification and the Increasing Transparency of the Ocean to Low-Frequency Sound. Oceanography 22:86-93.

Burns, W.C.G. 2008. Anthropogenic Carbon Dioxide Emissions and Ocean Acidification: The Potential Impacts on Ocean Biodiversity. In R.A. Askins et al. (eds.), Saving Biological Diversity 187-202.

Byrne, R.H. Sabine Mecking, Richard A. Feely, and Xuewu Liu. 2009. Direct observations of basin-wide acidification of the North Pacific Ocean. Geophysical Research Letters 37: L02601.

Cohen, A.L. and M. Holcomb. 2009. Why Corals Care About Ocean Acidification: Uncovering the Mechanism. Oceanography 22:118-127.

Cohen, A. L., D. C. McCorkle, S. de Putron, G. A. Gaetani, and K. A. Rose. 2009. Morphological and compositional changes in the skeletons of new coral recruits reared in acidified seawater: Insights into the biomineralization response to ocean acidification, Geochem. Geophys. Geosyst., 10, Q07005.

Convention on Biological Diversity. 2009. Scientific Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity. CBD Technical Series 46.

Cooley, S.R., H.L. Kite-Powell, and S.C. Doney. 2009. Ocean Acidification's Potential to Alter Global Marine Ecosystem Services. Oceanography 22: 172-181.

Doney, S.C., W.M. Balch, V.J. Fabry, and R.A. Feely. 2009. Ocean Acidification: A Critical Emerging Problem for the Ocean Sciences. Oceanography 22: 16-25.

Doney S. C., Fabry V. J., Feely R. A., & Kleypas J. A. 2009. Ocean Acidification: The Other CO_2 Problem. Annual Review of Marine Science 1:169–92.

Dore, John. E., Roger Lukasb, Daniel W. Sadlerb, Matthew J. Churchb, and David M. Karlb. 2009. Physical and biogeochemical modulation of ocean acidification in the central North Pacific. Proceedings of the National Academy of Sciences, 106: 12235–12240.

Environmental Protection Agency. 2009. Ocean Acidification and Marine pH Water Quality Criteria. Federal Register 74: 17484.

Environmental Protection Agency. 2010. Clean Water Act Section 303(d): Notice of Call for Public Comment on 303(d) Program and Ocean Acidification. Federal Register 75: 13537.

Fabry, V.J., J.B. McClintock, J.T. Mathis, and J.M. Grebmeier. 2009. Ocean Acidification at High Latitudes: The Bellweather. Oceanography 22: 160-171.

Feely, R.A., S.C. Doney, and S.R. Cooley. 2009. Ocean Acidification: Present Conditions and Future Changes in a High- CO_2 World. Oceanography 22:

Fore, L. 2009. Heeding a call to action for US coral reefs: The untapped potential of the Clean Water Act (editorial). Marine Pollution Bulletin 58 (2009) 1421–1423.

Gattuso, J.-P., L. Hansson, and the EPOCA Consortium. 2009. European Project on Ocean Acidification (EPOCA): Objectives, Products, and Scientific Highlights. Oceanography 22:190-201.

Gledhill, D.K., R. Wanninkhof, and C.M. Eakin. 2009. Observing Ocean Acidification from Space. Oceanography 22:48-59.

Hauri, C., N. Gruber, G.-K. Plattner, S. Alin, R.A. Feely, B. Hales, and P.A. Wheeler. 2009. Ocean Acidification in the California Current System. Oceanography 22:60-71.

Hutchins, D.A., M.R. Mulholland, and F. Fu. 2009. Nutrient Cycles and Marine Microbes in a CO_2-Enriched Ocean. Oceanography 22:128-145.

Juranek, L. W. , R. A. Feely, W. T. Peterson, S. R. Alin, B. Hales, K. Lee, Sabine, C. L. and J. Peterson. 2009. A novel method for determination of aragonite saturation state on the continental shelf of central Oregon using multi-parameter relationships with hydrographic data. Geophysical Research Letters 36, L24601.

Kleypas, J.A. and K.K. Yates. 2009. Coral Reefs and Ocean Acidification. Oceanography 22:

Maier, C., J. Hegeman, M. G.Weinbauer, and J.-P. Gattuso. 2009. Calcification of the cold-water coral Lophelia pertusa under ambient and reduced pH. Biogeosciences, 6: 1671–1680.

Millero, F.J., R. Woosley, B. DiTrolio, and J. Waters. 2009. Effect of Ocean Acidification on the Speciation of Metals in Seawater. Oceanography 22:72-85.

National Research Council. 2010. Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean. 175 pp.

Ocean Acidification Reference User Group. 2009. Ocean Acidification: The Facts. A special introductory guide for policy advisers and decision makers. Laffoley, D. d'A., and Baxter, J.M. (eds). European Project on Ocean Acidification (EPOCA).

Orr, J.C., K. Caldeira, V. Fabry, J.-P. Gattuso, P. Haugan, P. Lehodey, S. Pantoja, H.-O. Pörtner, U. Riebesell, T. Trull, E. Urban, M. Hood, and W. Broadgate. 2009. Research Priorities for Understanding Ocean Acidification: Summary From the Second Symposium on the Ocean in a High- CO_2 World. Oceanography 22:182-189.

Parks. N. 2009. Is regulation on ocean acidification on the horizon? Environmental Science and Technology 6118.

Talmage, Stephanie C. and Gobler, Christopher J. 2009. The Effects of Elevated Carbon Dioxide Concentrations on the Metamorphosis, Size, and Survival of Larval Hard Clams (Mercenaria Mercenaria), Bay Scallops (Argopecten Irradians), and Eastern Oysters (Crassostrea Virginica). Stony Brook University, School of Marine and Atmospheric Sciences.

Tans. P. 2009. An Accounting of the Observed Increase in Oceanic and Atmospheric CO_2 and an Outlook for the Future. Oceanography 22:26-35.

Veron, J.E.N. et al. 2009. The coral reef crisis: The critical importance of <350 ppm CO_2. Marine Pollution Bulletin 58: 1428–1436.