Summary of Coastal State and Territory Information Related to Ocean Acidification and the Clean Water Act 303(d) Program
November 15, 2010

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1. State and Territory Marine pH Water Quality Criteria by US EPA Region

US EPA 1976 Recommended Marine pH Criteria

"pH range of 6.5 to 8.5 for marine aquatic life (but not varying more than 0.2 units outside of the normally occurring range)." These marine criteria apply to open-ocean waters within 3 miles of a State or Territory's shoreline where the depth is substantially greater than the euphotic zone (depth of water that receives sufficient light for photosynthesis and growth of green plants).

US EPA Region 1

Connecticut: 6.5-8.5 for class SA and class SB coastal waters.

Maine: In Maine's legislation, regulation of marine pH is discussed in context regarding surface water discharges stating, "Notwithstanding section 414-A, the department may not issue a water discharge license for any of the following discharges…(5) Discharge of pollutants to any water of the State that violates sections 465, 465-A and 465-B, except as provided in section 451…causes the 'pH' of estuarine and marine waters to fall outside of the 7.0 to 8.5 range."

Massachusetts: pH range of 6.5-8.5 standard units (s.u.), and not more than 0.2 s.u. outside of the natural background range for water classes SA or SB and 6.5-9.0 s.u. and not more than 0.5 s.u. outside of the natural background range for water class SC. Also states that there shall be no change from natural background conditions that would impair any use assigned to these classes.

New Hampshire: For Class A waters, pH is "as naturally occurs"; for Class B waters, 6.5-8.0 unless due to natural causes; and for waters identified in RSA 485-A:8 III , 6.0-9.0 unless due to natural causes. Note: the pH standards apply to all waters, without distinction between freshwater and marine.

Rhode Island: "6.5-8.5 but not more than 0.2 units outside of the normally occurring range" for all seawater classifications.

US EPA Region 2

New Jersey: "For SE1, SE2, SE3 waters, pH range is 6.5-8.5 units. For SC waters, natural pH conditions shall prevail."

New York: "The normal range shall not be extended by more than one-tenth (0.1) of a pH unit (§703.3)."

Puerto Rico: For Class SB and SC waters, in no case the pH will lie outside the range of 7.3-8.5 standard pH units, except when caused by natural phenomena. Class SA waters are coastal and estuarine waters of high quality and/or exceptional ecological or recreational value, whose existing characteristics shall not be altered, except by natural causes, in order to preserve the existing natural phenomena. For these waters, no parameter shall be altered in concentration, except by natural causes.

Virgin Islands:

Criterion	Class A	Class B	Class C
pH	Existing natural conditions	<8.3 Tolerable limit>7.0	<8.5 Tolerable limit>6.7

US EPA Region 3

Delaware: pH water quality criteria (WQC) is applicable to all waters (fresh and marine) stating, "[pH] shall be between 6.5 and 8.5 unless outside this range due solely to natural conditions. Where within this range, maximum human-induced change from background shall be 0.5 Standard Units; pH which results from human-induced change must remain within this range. Where pH is below 6.5 or above 8.5 due solely to natural conditions, it shall not be lowered (where below 6.5) or raised (where above 8.5) more than 0.3 Standard Units due to human-induced changes."

For the Delaware River Basin, the WQC for pH in "tidal zones" is between 6.5 and 8.5 units. This WQC applies for all water quality monitoring (WQM) zones (2, 3, 4, 5, and 6).

Maryland: "Normal pH values may not be less than 6.5 nor greater than 8.5" for Use II (Estuarine and Marine Aquatic Life and Shellfish Harvesting) waters.

Virginia: pH range is 6.0-9.0 for Open Ocean and Estuarine waters (Class I and II).

US EPA Region 4

Alabama: For the Outstanding Alabama Water, Swimming and Other Whole Body Water Contact, Fish and Wildlife, and Agricultural and Industrial Water Supply designated uses, the pH standard states, "For salt waters and estuarine waters to which this classification is assigned, wastes as herein described shall not cause the pH to deviate more than one unit from the normal or natural pH, nor be less than 6.5, nor be greater than 8.5."

For the Public Water Supply and Shellfish Harvesting designated uses, the standard states, "sewage, industrial wastes or other wastes shall not cause the pH to deviate more than one unit from the normal or natural pH, nor be less than 6.5, nor greater than 8.5."

Florida: For Class II and III (marine) waters, pH shall not vary more than one unit above or below natural background of coastal waters, provided that the pH is not lowered to less than 6.5 units or raised above 8.5 units. If natural background is less than 6.5 units in marine waters, the pH shall not vary below natural background or vary more than one unit above natural background levels. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background.

Georgia: The pH standard for recreation classified uses is within the range of 6.0-8.5. The pH standard for fishing classified uses is within the range of 6.0-8.5.

Mississippi: Applicable to all waters, "The normal pH…shall be 6.0 to 9.0 and shall not be caused to vary more than 1.0 unit within this range. Variations may be allowed on a case-by-case basis if the Commission determines that there will be no detrimental effect on the water body's designated uses as a result of the greater pH change. In black water streams and in those watersheds with highly acidic soils, the pH may be lower than 6.0 due to natural conditions."

North Carolina: "Saltwater pH: shall be normal for the waters in the area, which generally shall range between 6.8 and 8.5 except that swamp waters may have a pH as low as 4.3 if it is the result of natural conditions."

South Carolina: pH standards are specific to water body classification. pH criteria for "Shellfish Harvesting Waters" should not vary more than 0.3 units above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature, but not lower than 6.5 or above 8.5. For Class SA and Class SB tidal salt waters, pH should not vary more than 0.5 pH units above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature, but not lower than 6.5 or above 8.5.

The South Carolina Estuarine and Coastal Assessment Program (SCECAP) established its own marine pH standards based on collected water quality data from 2001-2002. Values below 7.4 represented marginal or fair pH conditions and values below 7.1 poor conditions.

US EPA Region 6

Louisiana: "The pH shall fall within the range of 6.0 to 9.0 unless natural conditions exceed this range or where otherwise specified in the table (LAC 33:IX.1123). No discharge of wastes shall cause the pH of a water body to vary by more than one pH unit within the specified pH range for the subsegment where the discharge occurs."

Texas: Marine waters including all bays and estuaries, the Gulf of Mexico, and water segments denoted as "Tidal" and "Above Tidal" has a pH criteria range of 6.5-9.0.

US EPA Region 9

American Samoa: "pH range is 6.5-8.6 (+/- 0.2 pH units of that which could naturally occur)."

California: Their Ocean Plan states, "The pH shall not be changed at any time more than 0.2 units from that which occurs naturally."

The North Coast Basin Plan specifies pH standards for inland surface water, enclosed bays and estuaries in Chapter 3 stating, "For waters not listed in Table 3-1 and where pH objectives are not prescribed, the pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.2 units in waters with designated marine or saline beneficial uses nor 0.5 units within the range specified above in fresh waters with designated COLD or WARM beneficial uses."

Commonwealth of Northern Mariana Islands (CNMI): For both Class AA and Class A marine waters, the pH criterion range is 7.5 to 8.6.

Guam: "For open ocean waters where the depth is substantially greater than the euphotic zone, the pH should not be changed more than 0.2 units from the naturally occurring variation, or in any case outside the range of 6.5 to 8.5."

Hawaii: For embayments and marine coastal waters, pH shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, storm drain or groundwater discharge may depress the pH to a minimum level of 7.0. For marine oceanic waters, pH shall not deviate more than 0.5 units from a value of 8.1.

US EPA Region 10

Alaska: For aquaculture water supply and for the growth and propagation of fish, shellfish, other aquatic life, and wildlife, pH "may not be less than 6.5 or greater than 8.5, and may not vary more than 0.2 pH unit outside of the naturally occurring range." For seafood processing supply and harvesting for consumption of raw mollusks or other raw aquatic life, pH "may not be less than 6.0 or greater than 8.5." For contact water recreation, pH "may not be less than 6.0 or greater than 8.5. If the natural pH condition is outside this range, substances may not be added that cause any increase in buffering capacity of the water." For industrial water supply and secondary contact recreation, pH "may not be less than 5.0 or greater than 9.0."

Oregon: Unless otherwise specified in Oregon Administrative Rules (OAR) 340-041-0101 through 340-041-0350 (0101-0350), pH values may not fall outside the following ranges:
(a) Marine waters: 7.0-8.5
(b) Estuarine waters: 6.5-8.5

Washington: Aquatic life pH criteria in marine water are listed below:

Use Category	pH Units
Extraordinary quality	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.2 units.
Excellent quality	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.5 units.
Good quality	Same as above.
Fair quality	pH must be within the range of 6.5 to 9.0 with a human-caused variation within the above range of less than 0.5 units.

2. State and Territory Assessment Information by US EPA Region

2.1 Use of Modeling for Clean Water Act 303(d) Listing

US EPA Region 1

New Hampshire: Models are used for listing purposes. If modeling is used and demonstrates predicted violations, the waterbody is listed as "threatened" instead of as "impaired".

US EPA Region 2

New Jersey: Results obtained through a model to list or delist a waterbody can be used if the Department determines that the model adequately predicts water quality in the specific waterbody.

US EPA Region 6
Texas: A "Category 5b" water is determined when "modeling shows that the dissolved oxygen criteria cannot be met under natural conditions."

US EPA Region 9
Commonwealth of the Northern Mariana Islands: Modeled data can be used to list a waterbody as Category 5 or Category 4 when "Water quality models predict impaired use under current loading for a standard, and where quantitative or qualitative data/information from professional sources indicates that the cause of impaired use is from a pollutant(s)."

US EPA Region 10
Oregon: Multivariate models can be used to evaluate biological data and ultimately for listing purposes. Models have also been identified to be used in assessing dissolved oxygen (DO) data and attainment.

Washington: "Modeled data that meet quality assurance procedures will be allowed when the status of water quality is being determined in relation to natural conditions."

2.2 Natural Condition

US EPA Region 1
Massachusetts: Natural background condition is defined as "water quality which exists or would exist in the absence of pollutants requiring and other controllable cultural factors that are subject to regulation under M.G.L.c.21, sections 26 through 53" and "excursions from criteria due to solely natural conditions shall not be interpreted as violations of standards and shall not affect the water use classifications adopted by the Department."

A baseline assessment of Massachusetts' ocean waters is currently being conducted by the Office of Energy and Environmental Affairs. A draft report, which references pH data from Massachusetts Bay when discussing ocean acidification, is available at http://www.env.state.ma.us/eea/mop/draft-v2/draft-v2-ba.pdf.

US EPA Region 2
New Jersey: Has narrative criteria for toxics, nutrients, and natural conditions:

> *Natural Conditions**:** The SWQS* [Surface Water Quality Standard] *at N.J.A.C 7:9B-1.5(c) state, "Natural water quality shall be used in place of the promulgated water quality criteria of N.J.A.C. 7:9B-1.14 for all water quality characteristics that do not meet the promulgated water quality criteria as a result of natural causes." The concept of "natural causes" is applied when the Department can document that there are no anthropogenic sources or causes of a given characteristic or that the characteristic is clearly attributable to the natural conditions of the waterbody. Data that do not meet applicable SWQS criteria potentially due to natural conditions will be carefully evaluated.*

US EPA Region 3
Maryland: Baseline data, including marine pH, are collected by the Department of Natural Resources and the National Park Service at Assateague Island.

The Chesapeake Bay Interpretive Buoy System (CBIBS) contains long-term weather and water data from sampling stations in Chesapeake Bay. Gooses Reef Buoy also records pH data. Data available at: http://www.buoybay.org/site/public/.

US EPA Region 4

Florida: "'Natural background' shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department. The establishment of natural background for an altered waterbody may be based upon a similar unaltered waterbody or on historical pre-alteration data."

A preliminary assessment is done for pollutants that have a natural condition provision in their Water Quality Standards (WQS), such as marine pH. For instance, if a waterbody exceeds the WQS for a pollutant that has a natural condition provision and the natural background for that pollutant is unknown, then it is placed in category 3c with the intent to use strategic monitoring during the next cycle to establish the natural condition (refer to http://www.dep.state.fl.us/water/watersheds/assessment/draft-assess_gp4.htm).

Category 3c is defined as "enough data and information present to determine that one or more designated uses may not be attained according to the Planning List methodology…[and] these waters will be prioritized for future monitoring to verify use attainment or impaired status."

US EPA Region 9

American Samoa: The biological integrity of benthic communities shall be assessed by comparison to reference condition(s) with similar abiotic and biotic environmental settings:

> *Such reference conditions shall be those observed to support the greatest community evenness, diversity, and abundance of aquatic life as is expected to be or has been historically found in natural settings essentially undisturbed or minimally disturbed by human impacts, development, or discharges. This condition shall be determined by consistent sampling and reliable measures of selected indicator communities of flora and/or fauna and may be used in conjunction with other measures of water quality. Waters shall be of a sufficient quality to support a resident biological community as defined by metrics derived based upon reference conditions. These narrative biological criteria shall apply to fresh water, wetlands, estuaries, and coral reefs and other marine conditions based upon their respective reference conditions and metrics.*

California: Background conditions are determined from monitoring data to set water quality objectives.

Guam: "The assessment for Aquatic Life Use Support is based on physical/chemical data collected for fresh and marine water samples. Both conventional and toxicant data are analyzed by Guam EPA. Guam EPA has collected extensive physical and chemical data at sites established during the early 1980s and utilizes this collected data as ambient characteristics."

US EPA Region 10

Oregon: Has general methodologies to determine natural condition, including the use of reference streams, pollutant transport models, DNA testing, historical data (where available) and/or other sampling methods and studies.

Washington: Chapter 1 §6(e) of the "Water Quality Program Policy" has a detailed assessment methodology regarding natural condition determination:

> *Waterbody segments with data indicating impairment will be placed in Category 5 unless Ecology determines that the exceedance of water quality criteria is due to natural conditions or processes. Segments will be placed in Category 5 when human activities cause, or have a strong potential to cause, significant impacts in addition to natural conditions.*

Washington continued:
A determination regarding natural conditions will require information and data to validate the condition, with no presumption either way. A decision to place a waterbody segment in Category 1 because the impairment is from natural conditions will require, at a minimum, identification of a likely natural source or process sufficient to produce the impairment and information to support that there are no human impacts or none in excess of the allowable limits. The assessment may include well-reasoned best professional judgment, but this must be accompanied by information that supports the determination. Wilderness areas or other areas with no significant human impact will be assumed to represent natural conditions. Decisions about impairment are made with the data that are readily available and are not deferred or delayed because of data gaps.

If data or information is available to determine that the human increment is below the threshold, the exceedance will not be considered a violation, and a case will be made that it is due to natural conditions, qualifying the waterbody segment for Category 1. The presence of common large-scale physical processes in marine waters, such as upwelling, circulation, and thermal heating effects, presents naturally occurring situations that would override the ability of sufficient human influences to produce exceedances. In these cases, Ecology staff will use historic data and best professional judgment to determine that the human influences are significant or not. For marine waterbodies that are clearly due to natural conditions, the waterbody segment will be placed in Category 1. For waterbodies that appear to have natural conditions sufficient to override human influences, but the information is not conclusive, the waterbody segment will be placed in Category 2. In the absence of any data to determine whether the exceedance is above or below the threshold allowance, the waterbody segment will be placed in Category 5. The subsequent TMDL or other analysis will further determine the extent of human influences.

2.3 Coastal Monitoring Programs

US EPA Region 1
Maine: Casco Bay Estuary Partnership, Department of Marine Resources.

Massachusetts: Massachusetts Water Resources Authority (MWRA) measures pH in some of its surveys in Massachusetts Bay.

US EPA Region 2
New Jersey: New Jersey Coastal Water Quality Monitoring Network.

New York: Long Island Sound Study (LISS, a collaborative program with state and local involvement, does not cover all marine waters of NY).

Puerto Rico: Coastal Monitoring Network.

US EPA Region 3
Delaware: Delaware Boat Run Monitoring Program (limited, estuarine focus).

Virginia: Estuarine Probabilistic Monitoring Program.

US EPA Region 4
Florida: Inshore Marine Monitoring and Assessment Program, Florida Coral Reef Monitoring Project, South Florida Coastal Water Quality Monitoring Network, Coastal Marine and Resources Assessment.

Mississippi: Mississippi Coastal Assessment Program.

South Carolina: South Carolina Estuarine and Coastal Assessment Program.

US EPA Region 9
American Samoa: American Samoa Environmental Protection Agency Coral Reef Monitoring Program.

California: Southern California Coastal Water Research Program, North Coast Surface Water Ambient Monitoring Program, Hydrography and Phytoplankton Study in San Francisco Bay, Central Coast Ambient Monitoring Program, Southern California Coastal Ocean Observing System.

Commonwealth of Northern Mariana Islands: CNMI Marine Monitoring Team (performs biological monitoring).

Guam: Guam Coastal Assessment, Guam Coral Reef Monitoring Group.

US EPA Region 10
Alaska: Alaska Monitoring and Assessment Program is conducting five coastal projects.

Oregon: Coastal Environmental Monitoring and Assessment Program.

Washington: Marine Flight Program conducted by the Puget Sound Assessment and Monitoring Program (PSAMP).

2.4 Water Quality Criteria Related to Other Ocean Acidification Parameters

US EPA Region 3
Delaware: Alkalinity is assessed for all waters of the state. One standard is set for both fresh and marine waters. According to §4.5.4 of the Delaware SWQS,

> *Alkalinity, measured as mg/L as CaCO3, in all waters of the State shall not be less than 20 mg/L unless due solely to natural conditions. If less than 20 mg/L due solely to natural conditions, no reduction due to human induced changes is allowed.*

For the Delaware River Basin, the WQC for alkalinity in "tidal zones" is summarized in Table 3-7 of the 2008 Delaware River Basin IR:

> *For WQM zone 2, alkalinity must be maintained between 20-100 mg/L.*
> *For WQM zone 3, 4, 5, and 6, alkalinity must be maintained between 20-120 mg/L.*

Specific total alkalinity (TA) data could not be found.

US EPA Region 10
Alaska: WQS contain a standard for dissolved gas which states:

> *The concentration of total dissolved gas may not exceed 110% of saturation at any point of sample collection for aquaculture water supply; contact and secondary contract recreation; growth and propagation of fish, shellfish, other aquatic life, and wildlife; and harvesting for consumption of raw mollusks or other raw aquatic life designated uses. See 18 AAC* [Alaska Administrative Code] *70. 020(b)(15)(A).*

A specific assessment methodology or data could not be found for partial pressure of carbon dioxide (pCO_2).

The "Alaska Department of Environmental Conservation (ADEC) Division of Water, Water Quality Monitoring and Assessment Strategy" indicates that alkalinity is monitored in the Alaska's Clean Water

Alaska continued:
Actions (ACWA) Initiative monitoring program and the ADEC Cruise Ship program; however a WQS, assessment methodology, or data for TA could not be found.

Oregon: The Oregon standard for dissolved gases (OAR 340-041-0031) states:

> *(1) Waters will be free from dissolved gases, such as carbon dioxide, hydrogen sulfide, or other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such water.*
> *(2) Except when stream flow exceeds the ten-year, seven-day average flood, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 110 percent of saturation. However, in hatchery-receiving waters and other waters of less than two feet in depth, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection shall not exceed 105 percent of saturation.*

Water quality limited determination is made when more than 10 percent of samples exceed standard and a minimum of at least two exceedances of the standard, or a survey that identifies beneficial use impairment due to total dissolved gas such as assessment of fish conditions.
Specific data for pCO_2 could not be found.

2.5 Data Found for Other Ocean Acidification Parameters with No Associated Water Quality Criteria and/or Assessment Methodology

US EPA Region 1
Massachusetts: EPA STORET has TA results for ocean and estuarine waters.

US EPA Region 3
Maryland: EPA STORET has dissolved inorganic carbon (DIC) and alkalinity results for ocean and estuarine waters.

US EPA Region 4
Florida: EPA STORET has total inorganic carbon data for all Florida waters.

Georgia: EPA STORET has DIC results for ocean and estuarine waters.

South Carolina: South Carolina Estuarine and Coastal Assessment Program (SCECAP) collects TA and DIC in marine waters.

2.6 Other Useful Assessment Methods

US EPA Region 2
New Jersey: Includes a continuous monitoring assessment protocol for pH:

> *Continuous Monitoring: More and more frequently, instruments such as Datasondes are being deployed to continuously monitor the water. The parameters most commonly measured in this fashion are water temperature, dissolved oxygen (DO), pH, salinity and conductivity. The protocol for comparing continuous monitoring data, collected over a minimum of three days, to the SWQS criteria is as follows:*
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> > *pH: When evaluating continuously recorded pH data, as with DO, an exceedance occurs when the pH criterion is not met for the equivalent of one hour or more during a 24-hour period.*

3. State and Territory Coral Reef Bioassessment Information by US EPA Region

US EPA Region 2

Virgin Islands: In 2006, the Water Quality Management (WQM) program began collaborating with the US EPA's Office of Research and Development to develop biocriteria centered on the tropical coral reef community. The bioassessment protocol will include three simple, no-contact observations of stony coral (colony identity, size, and percent live tissue) that are combined to generate assessment endpoints that reflect reef value and sustainability. Refer to the Multi-Year Water Quality Monitoring Strategy (MYWQMS) report available at http://www.dpnr.gov.vi/dep/pubs/index.htm for more information.

US EPA Region 4

Florida: The Florida Keys Coral Reef Monitoring Project is a large-scale, multiple-investigator project funded by the EPA and designed to assess the status and trend of Florida's offshore reefs, patch reefs, and hard-bottom communities over a 5-year period. A total of 42 reefs are sampled using a total of 168 video units to provide a total coverage of 5,040 m^2. More information is available at http://spinner.cofc.edu/~coral/epacrmp/epawork.htm?referrer=webcluster&.

US EPA Region 9

American Samoa (AS): The AS-EPA Coral Reef Monitoring Program monitors ocean water quality and coral reef health. The Coral Reef Monitoring Plan was designed by the Coral Reef Monitoring Coordinator and the Coral Reef Advisory Group (CRAG). More information is available at http://www.crag.as/?nav=Projects-Coral_Reef_Monitoring&cont=Monitoring.

According to the 2010 Integrated Report (IR), AS-EPA, in a cooperative effort with the Pacific Territories of CNMI and Guam, will undertake a Reef Flat Environmental Monitoring and Assessment Program (EMAP) effort in 2010.

A modified aquatic life-use support (ALUS) determination assessment methodology for coral reefs was developed by Peter Houk and Craig Musburger of Pacific Marine Resources Institute, Inc., which is described in Part III of the 2010 IR §iii.A(3.2)(ii). The full methodology can be found in the document titled, "Assessing the Effects of Non-Point Sources Pollution on American Samoa's Coral Reef Communities".

California: The Multi-Agency Rocky Intertidal Network (MARINe), a non-state program, monitors the health of coral reefs along the California coastline, as well as the entire west coast from Alaska to Mexico. More information on MARINe is available at http://www.marine.gov/About.html.

Commonwealth of the Northern Mariana Islands: Has separate but similar biocriteria assessment methodology for coral reefs and seagrass communities.
Narrative language about biological criteria is discussed in §C1.2 of the Draft 2010 IR:

> *The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.*

The CNMI Department of Environmental Quality (DEQ) standards further protect successful annual coral reproduction events by requiring certain permitted dredge and fill activities to stop work during a "period not to exceed 3 weeks centered around the largest, annual coral spawning month (typically June or July)."

CNMI Interagency Marine Monitoring Team (MMT) monitors coral reef assemblages and seagrass communities. CNMI MMT uses data from two monitoring efforts; 1) Saipan Lagoon seagrass

CNMI continued:
monitoring, and 2) nearshore coral reef monitoring. Data is available at http://www.cnmicoralreef.net/rp/pubs.htm.

Biological surveys of the Northern Islands were performed by NOAA Coral Reef Ecosystem Division (NOAA-CRED) on three occasions during the past 2000-2010 decade. The data compiled summarizes fish populations and a detailed analysis of the coral reef assemblages.
According to §C1.2 of the Draft 2010 IR, coral reef assemblages are evaluated by calculating a ratio of coral/crustose coralline algae (favorable attributes for sustainable coral assemblages) to turf/macroalgae (unfavorable attributes). A second metric-coral species richness per unit area is simultaneously considered. These two coral reef metrics are used in conjunction with recent analyses of the 10 years monitoring dataset for the southern islands to make ALUS assessments.

Biocriteria attainment pertains only to the aquatic life designated use. This designated use is attained when the biocriteria score is "fair" or "good" for all sites within the water body segment. Coral assemblages surveyed from 2008 to 2009 were evaluated as indicators of ALUS as follows:

- *"Good" – Minimal or significant impacts reported from disturbance events. If natural disturbances impacted coral assemblage metrics then statistically significant recovery is currently underway. If no significant impacts from natural disturbances then metrics were evaluated relative to those expected from 2008 reporting and found to be higher than the mean average.*
- *"Fair" – Minimal or significant impacts reported from disturbance events. If natural disturbances impacted coral assemblage metrics then non-significant recovery trends are currently apparent. If no significant impacts from natural disturbances then metrics were evaluated relatively to those expected from 2008 reporting and found to be similar to the mean average.*
- *"Poor" – Minimal or significant impacts reported from disturbance events. If natural disturbances impacted coral assemblage metrics then no recovery trends are currently apparent. If no significant impacts from natural disturbances then metrics were evaluated relatively to those expected from 2008 reporting and found to be lower than the mean average.* (§C1.2)

Guam: Included in the Executive Summary §1.1 of the 2008 IR, but not the WQS, is a narrative description of the biological quality of marine waters stating:

> *Water in this category must be of sufficient quality to allow for the propagation and survival of marine organisms, particularly shellfish and other similarly harvested aquatic organisms, corals and other reef-related resources, and whole body contact recreation.*

Criteria used to identify waters as impaired is discussed in Part III of the 2008 IR (§3.0). This section includes language on coral reefs:

> *Coral reef assessment results found that the health of individual reef and lagoon areas were impaired due to pollutant discharges, such as sediment runoff from the land and groundwater discharge high in nutrients;*

According to the 2008 IR §6.1.2, Guam EPA is looking to improve coordination between the highly overlapping areas of coral reef protection activities, coastal zone and watershed programs, and water quality regulatory actions. Guam's Coral Reef Management priorities for 2010-2015 are available at http://coralreef.noaa.gov/aboutcrcp/strategy/reprioritization/managementpriorities/resources/guam_mngmnt.pdf.

Guam continued:
The Water Monitoring Strategy for the Territory of Guam (WMSTG) consisted of three major water categories, river, marine and reef complexes, that are sampled based on the Rotating Basin Design, as outlined by US EPA's Environmental Monitoring and Assessment Program. Within the Rotating Basin Design, there are a total of 65 River Stations, 17 Reef Stations and 38 Marine Stations. The sampling frequencies for these stations are scheduled so four sub-complexes are sampled for two, six week periods every other year. Over a two year period, all Guam EPA sampling complexes should be monitored. This schedule allows the monitoring staff to evaluate the data from sub-complexes for possible contamination trends over a given amount of time.

The Guam Coastal Assessment (GCA) program assesses the benthic habitat and performs a community assessment for macroinvertebrates, marine algae and benthic fauna. An additional parameter under consideration for future monitoring is coral disease identification.

Guam Coral Reef Monitoring Group is a network of agencies that monitor coral reefs in the coastal waters of Guam.

Hawaii: Hawaii has a unique narrative biocriteria that pertain specifically to coral reefs. For reef flats and reef communities, the standard states:

> *Specific criteria to be applied to all reef flats and reef communities: No action shall be undertaken which would substantially risk damage, impairment, or alteration of the biological characteristics of the areas named herein. When a determination of substantial risk is made by the director, the action shall be declared to be contrary to the public interest and no other permits shall be issued pursuant to chapter 342, HRS.*
>
> *The director shall determine parameters, measures, and criteria for bottom biological communities which may be affected by proposed actions. The location and boundaries of each bottom-type class shall be clarified when situations require their identification. For example, the location and boundaries shall be clarified when a discharge permit is applied for or a waiver pursuant to Section 301(h) of the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251 et seq.) is required. Permanent benchmark stations may be required where necessary for monitoring purposes. The water quality standards for this subsection shall be deemed to be met if the time series surveys of benchmark stations indicate no relative changes in the relevant biological communities, as noted by biological community indicators or by indicator organisms which may be applicable to the specific site.*

4. Source of Information

Information presented in this document is based on a preliminary online search of documents and websites, including State Water Quality Criteria and Standards and Clean Water Act 303(d) Integrated Reports, for the 23 States and five Territories that have marine waters. This document is for information only, and is not to be used for regulatory purposes.