AMAP GUIDELINES (DQO format)
August 14, 2015 Version 1

A. A Clean Water Act (CWA), Section 401 Water Quality Certification (WQC) does not exempt a discharger from compliance with applicable CWA or State Water Quality Standards (WQS) requirements. A WQC only provides the framework within which work may be performed, and must include the best degree of treatment or controls. The controls are generally referred to as the best management practices (BMPs). Samples are taken to verify that the BMPs are adequate to prevent any pollution of the surrounding receiving State waters.

> Example: The WQC application identifies the discharge of Water Pollutant A. After the WQC is issued, it is discovered that Water Pollutant B is also being discharged. Water Pollutant B is not covered by the WQC. The WQC is now invalid, and the discharger faces enforcement action.

An Applicable Monitoring and Assessment Plan (AMAP) is a document that addresses the sampling component of a given project. The AMAP explains in detail what you are doing and why you are doing it. The AMAP shall follow the standard approach utilized in the Scientific Method. The AMAP shall include some basic information that would allow someone unfamiliar with the project to understand what was done.

A well written and properly executed AMAP will produce representative data that is legally defensible. It is the sole responsibility of the discharger to obtain and provide representative data and demonstrate their compliance with their WQC conditions and/or environmental laws. The Department of Health (DOH), Clean Water Branch (CWB) is not responsible for checking or double checking your AMAP. Poorly written AMAPs, poor sample design or unrepresentative sampling cannot produce data of sufficient quality to demonstrate compliance with applicable WQS and environmental laws. If you have poor sample design, data that is not representative, and/or cannot demonstrate your compliance with your WQC conditions, State WQS or environmental laws, your WQC may be revoked and you may be subject to the appropriate corrective/compliance/enforcement actions authorized by the Hawaii Revised Statutes (HRS). Therefore, it is in your best interests to produce an AMAP of the highest quality.

B. The objective of taking samples is to obtain the most accurate information in order to make the correct decision. On a macro scale, the Data Quality Objectives (DQO) are utilized to ensure that representative data is collected using a systematic approach. On a micro scale, proper Quality Control (QC) is applied to ensure that accurate data is collected. Following these guidelines

will help to ensure that representative data is collected resulting in the best decision(s) being made.

C. Utilize the DQO to develop your AMAP. (Download and Read the DQO Guidelines: http://www.epa.gov/quality/qs-docs/g4-final.pdf. Also see www.QE3C.com.)

The DQO is a seven (7) step planning process that addresses the problem(s) (or issues) that will be encountered during the project.

TITLE PAGE – provide preparer's name, company, qualification and contact information of the author of the AMAP and date and version of the AMAP.

INTRODUCTION – a brief description of the project. Provide the following:

a. Project name, scope, location, existing environmental conditions, receiving State water information, and purposes of preparing this AMAP.
b. Specific statutory and legal requirements, rules, regulations that are applicable to this project and guidelines, matrix, rationale/justifications used as the basis of preparing this AMAP.

1. **STATE THE PROBLEM** - The first, and most critical step, is to define the problem(s). This is a description of each of the potential problems in one (1) or two (2) sentences that will be the focus of the AMAP. Everything else in the AMAP will seek to resolve this/these problem(s).

   a. The problem statement describes the problem as it is currently understood and predicted/anticipated, and the conditions that are causing, or may have the potential of causing the problem.
   b. The general format of a problem statement: **In order to** [support/understand/establish/determine/confirm/reduce/prevent] (some issue) **data regarding** [pollutant/contaminant] [in/on/above/below] (the medium) **are needed.**
   c. Example: In order to confirm that BMPs are preventing sediment in the work area from impacting marine waters, data regarding turbidity in the ocean are needed.
   d. There can be more than one problem statement that must be addressed.

2. **IDENTIFY THE GOAL OF THE STUDY** - Principal Study Questions (PSQs): Identify the issue(s) or condition(s) that will allow you to reveal the solution to the problem. State the alternative actions for each PSQ. For each PSQ, formulate a Decision Statement.

a. The general format of a decision statement: **Determine whether** [PSQ] **and requires** [Alternate Action A] **or** [Alternate Action B].
b. Example: Determine whether BMPs are ineffective and requires modification or no further action is necessary.
c. State how data will be used.
    1. Pre-construction (pre-con) data will be used to establish the baseline (existing) levels for each parameter in State waters. A minimum of 10 sets of data shall be collected at the Control and Impact station Decision Units (DUs). If 10 sets cannot be collected (e.g., dry stream bed) and there is insufficient data to establish action levels, then the DUs shall be photo-documented, and corrective actions shall be taken whenever water is present. MULTI INCREMENT samples or the acceptable equivalent shall be collected over a reasonable period of time before commencing the proposed construction activity to collect seasonal (dry or wet for the class of the impacted State waters, as appropriate) representative samples at the project site. As appropriate, samples may also be collected over a minimum of a two (2) week period immediately before commencing any proposed construction activity. Impact station DUs shall be sampled in triplicate with the highest pre-con means serving as the action levels (turbidity and Total Suspended Solids (TSS)). The highest and lowest pH means shall serve as the pH action levels. Dissolved Oxygen (DO), Temperature and Salinity means may also serve as action levels where these parameters are impacted by the project. The percent Relative Standard Deviation (%RSD) shall be calculated for all triplicate samples. The %RSD should be maintained as low as possible, and in no case should exceed 20%. (An exceedance of 20% indicates that the sampling procedure is not capturing the variability adequately.) Standard distance of the Control DUs from the Impact DU is within 50 feet. (See Figure 3 for an example.)
    2. Submit pre-con data to the CWB prior to the start of any construction activities, preferable to be submitted with the Section 401 WQC Application or the e-Permitting NWP Blanket WQC Notification Form.
    3. Pre-con data (turbidity and TSS highest triplicate means) will be compared to during-construction data to demonstrate whether there are no impacts to water quality during the project construction.
    4. Pre-con data will be compared to post construction data to demonstrate that there are no long term adverse impacts to water quality from construction activities.

5. For streams, during construction, the upstream control station data will be compared to the impact and downstream control stations to demonstrate that there are no impacts to water quality.
6. For open coastal and oceanic waters, during construction, the up-current control station data will be compared to the impact and down-current control stations to demonstrate that there are no impacts to water quality.
7. If a plume emanates from the work area, the plume should also be sampled as a separate DU.

3. **IDENTIFY INFORMATION INPUTS** - Specify the parameters that will be measured/analyzed. State detection limits, action levels, instruments/measuring devices, references, calibration procedures, precision, accuracy, etc.

   a. General Information

      1. State who will take the samples.
      2. Photos shall be taken by the samplers of the sampling sites, BMPs and general work area that will be impacted, either directly or indirectly, by the proposed construction activities. Photos shall be date/time stamped with a narrative description of what is being documented. The standard date format is MM/DD/YY and the standard time format is the 24 hour clock. Include a photo orientation map that shows the location and orientation of photos taken.
      3. Station locations (i.e., DUs) shall be identified with GPS coordinates (latitude/longitude with datum (WGS84)).
      4. Include a scaled plan view map that shows the project location, a delineation of all BMPs and DUs, the location of all inputs that may impact the DUs, and GPS coordinates (WGS84) of all DU boundaries.
      5. All sampling activities shall be documented in a field notebook/logbook (Standard Methods 20th Ed. 1060B).
      6. Contractor/duly authorized representative's responsibilities:
         a. Knowledgeable of their responsibilities as specified in the AMAP.
         b. Inspect and properly maintain BMPs, document in a logbook and include photos (follow procedure in step 2 above).

   b. Sampling

      1. Clearly indicate the sampling locations for Pre-, During- and Post-construction monitoring. (Inside of BMP containments, outside of BMP containments, impact DU, upstream/up-current, and

downstream/down-current control DUs, etc.)

2. Specify the number of DUs (by phase if it changes).
3. Note the importance of the pre-construction sample results for establishing baseline conditions, in establishing action levels, and for comparison to post-construction values to determine long term project impacts. Take at least 10 sets of MULTI INCREMENT pre-con samples (or the acceptable equivalent) in triplicate and calculate the percent relative standard deviation (%RSD). %RSD should be maintained as low as possible, and not exceed 20%.
4. State the sampling frequency(ies) (by phase if it changes).
5. State the Parameters that will be measured, Units, Methods, Instruments, Minimum Detectable, Minimum Sensitivity, Hold Times, and Field Preservation (present this information in a table). See Appendix 1 for the Matrix for minimum standard parameters and frequencies.
6. State that parameters are measured from MULTI INCREMENT samples or the acceptable equivalent.
7. Describe the sampling procedure (or include a Sampling Standard Operating Procedure (SOP)).
8. Samplers shall include a narrative of site conditions that may impact sample results.
9. Include an example of the Chain of Custody form, Data Sheet form, and Report form.
10. Specify calibration standards and ranges for instruments including any expiration dates for supplies.
11. State that samples must be taken during work operations (i.e., at the time when the potential for pollution is greatest).
12. Address specific QA/QC issues associated with the sampling. Lab QC should be described. Improper field sampling is usually the largest source of error. Field measurement QC must be as rigorous as lab QC.
13. Calibrate all field instruments/probes, as applicable.
14. Perform Secondary (QC) checks prior to, and after, each day's sampling. These procedures should be documented in specific SOPs, along with the acceptable ranges for each check. Submit QC data with field measurements.
15. Streams: For projects in streams, the standard requirement is to conduct post-con erosion assessment of the downstream banks and beds quarterly, for two (2) years, to verify no long term adverse impacts as a result of the project.
16. Beach nourishment: For beach nourishment projects, the standard requirement is to conduct post-con beach profile measurements of the nourished beach quarterly, for two (2) years, to verify that nourished beach performs effectively as proposed and there will be no long term adverse impacts as a result of the project.

c. Personnel

1. Specify Name, Title, Organization, Responsibilities and Qualifications of ALL personnel involved with this document (in a table). Samples should be collected by a Qualified Sampler. ("Qualified Sampler", as used in this document, means a person who actively practices environmental science, or has formal training in sampling theory, practices and techniques. Qualified Samplers must be experienced in, and thoroughly knowledgeable of, all aspects of the sampling including all equipment, instruments, SOPs, calibrations, secondary checks, limits, and reporting requirements. Samplers must be able to recognize unobvious or potential problems and have the ability to address those issues, and notify the appropriate person of the problem(s) for timely proper corrective/remedial action. The concern here is that problems are best addressed if they are immediately recognized when the samples are taken. The chances of correcting problems are reduced with delay and the further the data gets passed on.)

2. Reports and Assessments

    a. Field data (raw) shall be submitted to DOH-CWB within 24 hours (or by the end of the next business day) of when the field samples were taken, via e-mail in excel and pdf format to cleanwaterbranch@doh.hawaii.gov. Include photos and site conditions/comments in the field data report. Sample results for TSS shall be submitted by the end of the next business day after TSS results become available.
    b. The project owner (Certifying person of the Section 401 WQC Application) or their duly authorized representative (the representative must meet 40 CFR § 122.22 requirements) is responsible for sending the reports to CWB.
    c. Email reports to CleanWaterBranch@DOH.hawaii.gov. Specify when and how all reports and assessments will be submitted to the DOH-CWB to comply with your WQC requirements. Refer to your WQC for details.

4. **DEFINE THE BOUNDARIES OF THE STUDY** - Specify the boundaries: Define the population of interest, spatial boundaries, temporal boundaries, and scale of decision making. (The scale of decision making means the DU.)

    a. Example: The DU consists of all of the water along the length of the installed BMP measures (i.e., turbidity barrier) out to one meter, from the surface to the bottom. The temporal boundaries are from the beginning of the project (e.g., March 1, 2011) to the end of the project (e.g., April 30, 2011).

b. Include a scaled map or construction drawing of the project site with the BMPs and indicate where the DUs are located. Note that because of the nature of water sampling, samplers may have to choose between addressing the spatial or temporal components.

5. **DEVELOP THE ANALYTIC APPROACH** - State the Decision Rule(s) as "if...then...else..." statements that incorporate the parameter of interest (or pollutants of concern (POC)), the unit of decision making, the action level and the alternative actions.

   a. The general format of a Decision Rule: **If the** [parameter of interest] **within** [DU] **is >** [the action level] **then** [alternate action A] **else** [alternate action B].
   b. Example: If the mean turbidity value of the Impact DU is greater than the value at the upstream control DU, or the highest mean pre-con value, then stop work and inspect/repair BMPs, else no further action required.
   c. Since you may have multiple parameters of interest and multiple DUs, you will probably have multiple Decision Rules.

6. **SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA** - Specify Error Tolerances. (Depending on the project, this section can be quite involved. The more critical the consequences of an incorrect decision, the greater the importance of this section.)

   a. MULTI INCREMENT samples are cheaper alternative means of obtaining representative and more accurate sample values than traditional (grab or composite) samples. MULTI INCREMENT samples cannot determine statistical values such as the range or standard deviation; however MULTI INCREMENT samples do provide values at, or very close to the mean which are the most important values for determining impacts. Decision errors are far less likely with this method.
   b. To verify that MULTI INCREMENT samples are providing accurate values, they should be taken in triplicate and the percent Relative Standard Deviation (%RSD) should be calculated. %RSD should be maintained as low as possible, and in no case should exceed 20%.
   c. If MULTI INCREMENT samples are not taken, appropriate statistical performance or acceptance criteria shall be provided. For example:
      1. Take 90+ samples per day (e.g., every 15 minutes 24/7). Explain how the data will be evaluated and what levels will trigger corrective actions. These levels should be recorded on the data sheets so that the samplers will know when an exceedance has occurred and that they need to take corrective actions.

2. Determine the variability of the environmental variables.
    a. An estimate of the population Standard Deviation is needed.
3. Identify the decision errors.
    a. Discuss the consequences of making each decision error.
    b. Example: There are 2 possible errors that could be made. A parameter is measured as above a limit when it is actually below, or it is measured below the limit when it is actually above.
4. Choose the Null Hypothesis.
    a. The Null Hypothesis should state the opposite of what the project hopes to accomplish.
    b. Example: The sampling is attempting to show that erosion control measures are reducing the amount of sediment runoff; therefore the null hypothesis should state that the erosion control measures did not reduce the amount of sediment runoff. You must then collect sufficient data to allow you to reject the null hypothesis. If you fail to do this, you must accept the null hypothesis (i.e., your BMP's did not reduce runoff).
5. Specify the boundaries of the gray region (width of the gray region = Δ).
    a. The gray region is the range of values within which the consequences of making a decision error are relatively minor. One end of the range is the action level, and the other end is the point at which the consequences of making a decision error become significant.
    b. Example: Lower Bound of the Gray Region (LBGR) = Action Level - (Analytical error + Sampling error)
6. Assign probability limits on either side of the gray region.
    a. In this step you specify the error rates that the decision makers are willing to accept, and provide a rationale for the rates.
    b. Example: Alpha (α) error - (5%) that the project succeeded when it actually failed. Beta (β) error - (20%) that the project failed when it actually succeeded.

d. The action levels should be established and recorded on the data recording sheet so that the samplers will know when an exceedance has occurred and the project owner and/or general contractor needs to take appropriate corrective actions. (Example: Typical action levels could be "the highest mean pre-con turbidity value".)

7. **DEVELOP THE PLAN FOR OBTAINING DATA** - Optimize the Sample Design. Identify the most resource effective data collection and analysis

design that satisfies the DQOs specified in the last six (6) steps.

a. Collect MULTI INCREMENT samples.
    1. Usually, MULTI INCREMENT samples are more accurate and a cheaper alternative to traditional sampling methods.

b. Non-MULTI INCREMENT samples.
    1. Review DQO outputs from steps 1 to 6 to ensure they are internally consistent.
        a. The outputs provide information on the context of, requirements for and constraints on data collection design.
    2. Develop alternate sample designs.
        a. For each decision rule, develop one or more sample designs for consideration and evaluation in Step 7. Keep in mind the Step 5 outputs defining the population you are trying to represent with the data.
    3. For each design option, select needed mathematical expressions.
        a. Define suggested method(s) for testing the statistical hypothesis and define sample size formula(e) that corresponds to the method(s).
        b. Example:
            1. Generate frequency distribution histogram(s) for each population.
            2. Select one or more statistical methods that will address the PSQ's.
            3. List the assumptions for choosing these statistical methods.
            4. List the appropriate formula for calculating the number of samples, n.
    4. Select the optimal sample size that satisfies the DQO's for each data collection design option.
        a. Using the appropriate formula, calculate the number of samples needed, by varying α and β for each Δ. Select the sample sizes that have acceptable levels of α, β and Δ.

D. Attachments

1. List all technical documents used in preparation of this document.
2. List all technical documents associated with equipment and instruments in the AMAP.
3. List all procedural documents that will be used in the AMAP.
4. Include copies of applicable SOPs, as referenced in the AMAP. See http://www.epa.gov/quality/qs-docs/g6-final pdf.

5. Include example copies of the Chain of Custody form, Datasheet form and Report form.

Additional AMAPs may be required to assess impacts upon biota or for erosion (e.g. beaches and streams).

Appendix 1 – Matrix

General Monitoring Guideline for Section 401 Water Quality Certification Projects

Period of Construction Project	<1 to 4 Months					≥5 Months to ≤4 Year					Construction Project Monitoring Frequency*		
Parameter to Monitor for "X" Months of "In-Water" Work	≤1	>1	2	3	4	≥5	1	2	3	≤4	Pre-	During	Post
Photo Documentation	✔										✔	✔	✔
pH	✓	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✓
Turbidity	✓	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✓
Total Suspended Solids (TSS)	✓	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✓
Dissolved Oxygen (DO)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✔	✔	✓
Salinity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✔	✔	✓
Temperature	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✔	✔	✓
Secchi Disc or Light Extinction	⛒	⛒	⛒	⛒	⛒	⛒	⛒	⛒	⛒	⛒	⛒	⛒	⛒
Biological Monitoring	✗	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘
Nitrate + Nitrite Nitrogen (NO_3NO_2)	○	○	○	○	○	●	●	●	●	●	●	●	●
Total Kjeldahl Nitrogen (TKN)	○	○	○	○	○	●	●	●	●	●	●	●	●
Ammonia Nitrogen (NH_4)	○	○	○	○	○	●	●	●	●	●	●	●	●
Total Nitrogen (TN)	○	○	○	○	○	●	●	●	●	●	●	●	●
Ortho-Phosphate (PO_4)	○	○	○	○	○	●	●	●	●	●	●	●	●
Total Phosphorus (TP)	○	○	○	○	○	●	●	●	●	●	●	●	●
Chlorophyll ∝	○	○	○	○	○	●	●	●	●	●	●	●	●
Silicate	○	○	○	○	○	●	●	●	●	●	●	●	●
Pesticides, PAHs, metals, etc.	●	●	●	●	●	●	●	●	●	●	●	●	●
Other													
Monitoring Frequency	D	D	D	3W	3W	3W	2M	M	Q	Q	*	**	***

Symbol Legend	
✔	Basic water quality monitoring parameters
✓	Included with dredging projects, if no habitat loss or modification
✓	Optional per data evaluation suggesting no significant impact
⛒	Optional per dredging projects
✗	Photo documentation on dredging project with some habitat loss or modification
✘	Bio-monitoring on dredging projects with habitat loss or modification
●	To be determined on individual case
○	Optional per individual cases for dredging projects

Notes:

* Pre-construction sampling for TSS and Turbidity of TEN samples over TWO weeks for projects that impact bottom sediment.

** During construction monitoring is limited to length of "in-water" work period.

*** Post-construction monitoring is limited to once per construction period.

Shaded blocks represent basic or minimum requirement for most projects.

D = Daily
W = Weekly
M = Monthly
Q = Quarterly
(i.e., 3W = three times per week)

Note that the monitoring frequency is based on the length of in-water work where the BMPs are not modified (e.g., due to multiple phases). If the BMPs are modified for different phases, the length of in-water work will be based on the length of each phase. Thus, each phase may have a different monitoring frequency.