# APPENDIX B
# Applicable Water Quality Monitoring and Assessment Program

# Applicable Water Quality Monitoring and Assessment Program for Castle Hills Access Road Drainage Improvements and Kapunahala Stream Bank Stabilization, Kāneʻohe, Oʻahu, Hawaiʻi.

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## Introduction

This water quality monitoring and assessment program accompanies the Section 401 Water Quality Certification (WQC) application for the proposed Castle Hills Access Road drainage improvements project hereinafter referred to as "the Project". This program has been prepared in accordance with water quality regulations promulgated in Hawaii Administrative Rules (HAR) Chapter 11-54 (HDOH, 2004) and the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH, 2000).

The State of Hawaiʻi Department of Transportation proposes to construct drainage improvements and stabilize the banks of Kapunahala Stream in the vicinity of Poʻokela Street (Castle Hills Access Road) (Fig. 1) in order to minimize erosion. The construction will be bid in two separate phases due to HDOT budgetary constraints.

During the first phase, in-water work will take approximately six weeks and includes construction of a new gabion wall along a portion of the south bank of Kapunahala Stream located downstream of Poʻokela Street and adjacent to the existing cement rubble masonry (CRM) outlet structure (Fig. 2). The purpose of the new gabion wall is to provide stream bank stabilization. Temporary sheet pile shoring will be installed adjacent to and within Kapunahala Stream.

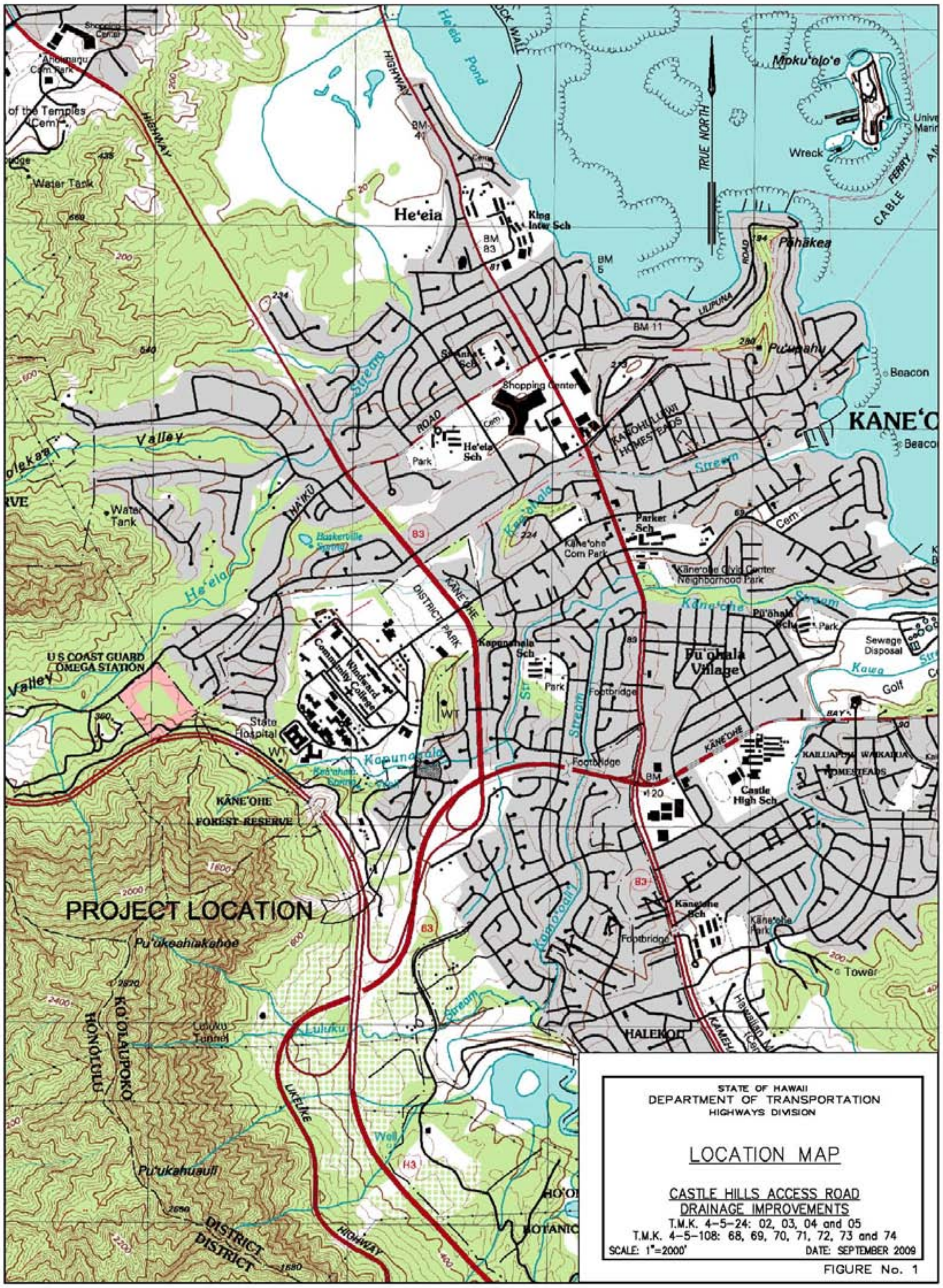


Figure 1. Project Location (Park Engineering, 2009)

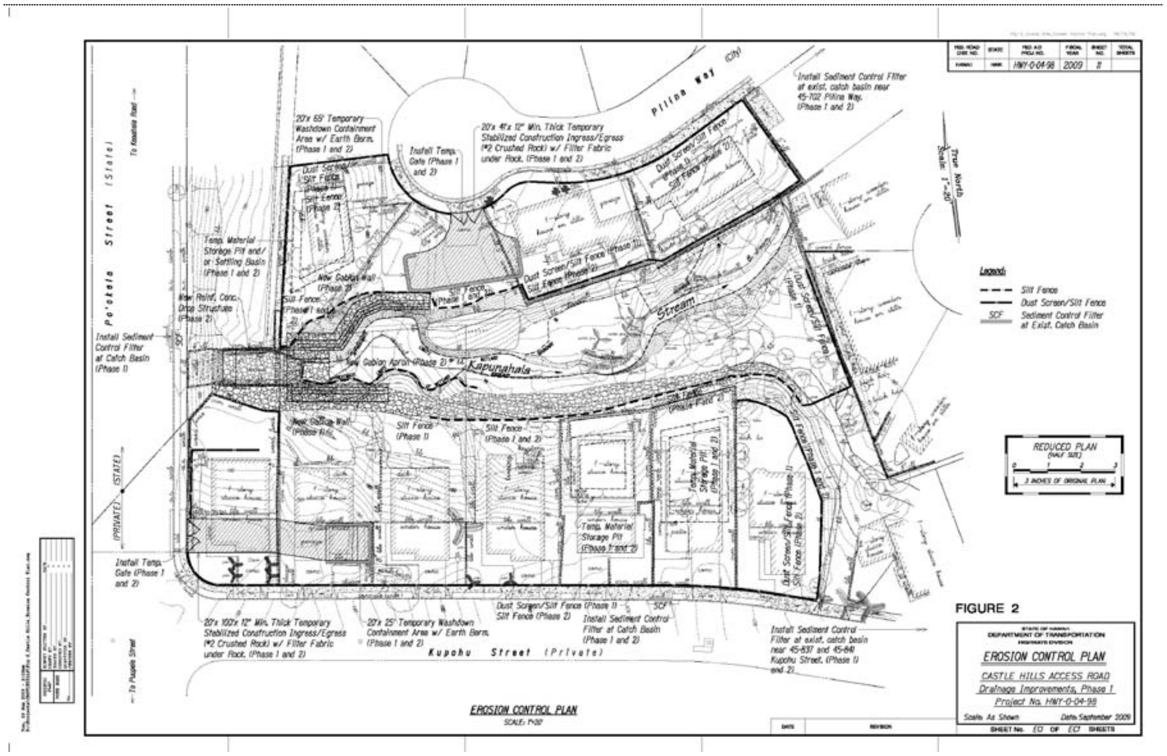


Figure 2. Phased erosion control measures to be constructed on Kapunahala Stream (Park Engineering, 2009)

The second phase of the project (Fig. 2) includes construction of a temporary stream diversion system consisting of a pipe culvert and temporary gabion wall along a portion of the north stream bank of Kapunahala Stream downstream of Poʻokela Street. After construction of the temporary stream diversion, the existing CRM outlet structure located downstream of the existing 20-feet x 10-feet concrete box culvert under Poʻokela Street will be demolished and construction of a new reinforced concrete drop structure outlet will occur. Temporary sheet pile shoring will be installed around the new drop structure outlet to isolate the work area thereby preventing potential pollutants from entering into Kapunahala Stream, minimizing groundwater intrusion into the work area, and providing temporary structural support for the excavated area.

A new gabion apron downstream of the new drop structure outlet will be constructed to stabilize the stream banks and minimize erosion. The gabion apron will be constructed after the construction of the new concrete drop structure. The stream diversion system will remain in place and bypass stream flow around the work area of the gabion apron. Upon completion the diversion will be taken out.

A new gabion wall along a portion of the north stream bank of Kapunahala Stream located downstream of the new drop structure outlet will be constructed. Temporary sheet pile shoring will be installed adjacent to and within Kapunahala Stream.

This monitoring program is designed to monitor potential impacts from construction occurring in the stream. The in-water work on this project is expected to be completed within six weeks for Phase 1 and 32 weeks for Phase 2. The total construction duration (in-stream and non-stream work) is expected to be completed in 39 weeks for Phase 1 and 52 weeks for Phase 2.

## Parameters to be Measured

Receiving water quality parameters to be measured follow the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH 2000). The parameters to be measured are pH, turbidity, and total suspended solids (TSS).

An individual designated by the contractor will perform daily visual inspections of the construction site to ensure that the construction activities do not result in adverse impacts. Information provided will include, but will not be limited to: the description of the construction activity, date, time, and other ongoing activities which are not related to the construction activities but may affect water quality.

## Sampling Locations

Three stations (Figs. 3 to 5) will be monitored preconstruction, during each construction phase and post construction. There will be one upstream control station located 15 meters (~50 ft) upstream from the upstream edge of the project (mauka side of Poʻokela Street); an impact station located 1 meter (~3 ft) downstream from the furthest downstream work and a downstream control station located 15 meters (~50 ft) downstream from the furthest downstream impact station. The impact station will move when the work areas change within the different phases of the project. The three monitoring phases to be used during construction are Phase 1, Phase 2a (temporary stream diversion system start) through 2d (temporary stream diversion system end) and Phase 2e/2f (construction of new gabion wall).

A fourth station, labeled Ditch (Figs. 3 to 5) is located in a concrete lined ditch that enters the project site in the construction area. Throughout all construction phases of the project this ditch may contribute pollutants to Kapunahala Stream. This location will act as a third control station and will be monitored only when water is flowing.

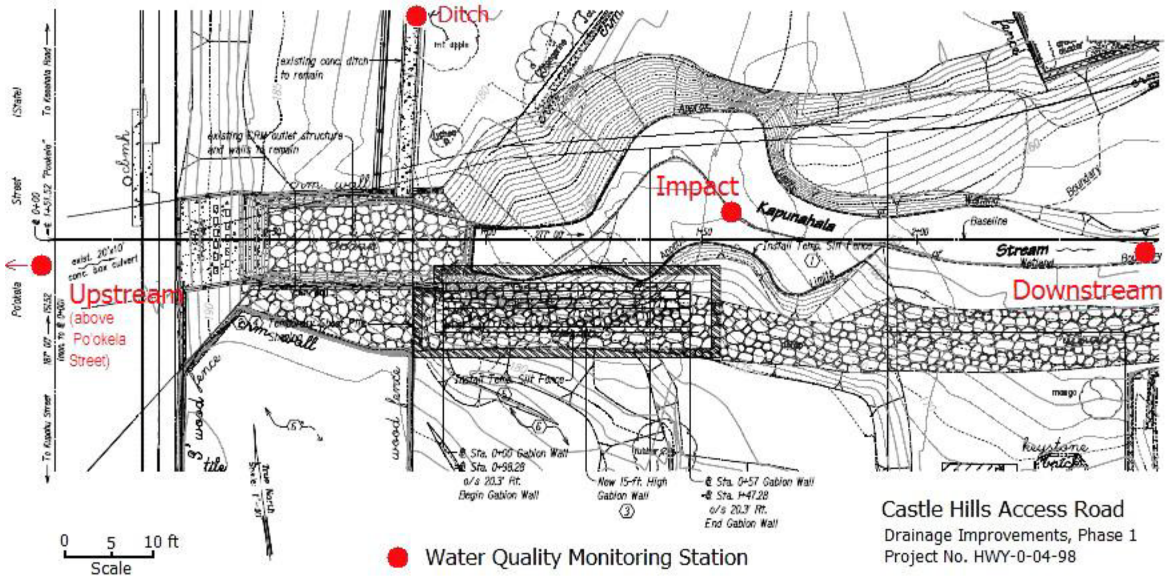


Figure 3. Monitoring locations for Phase 1

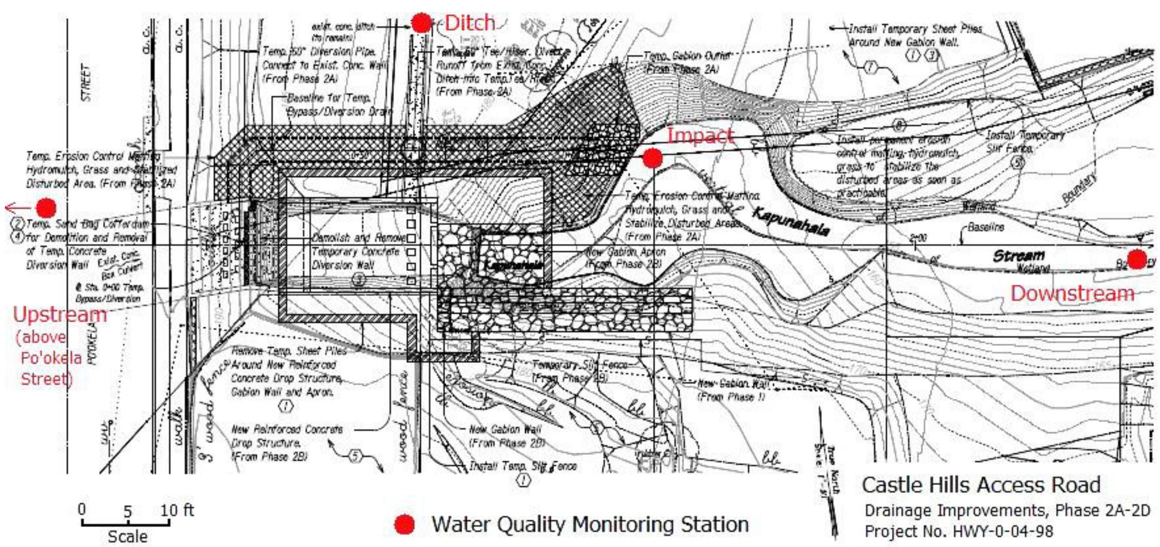


Figure 4. Monitoring locations for Phase 2a through 2d.

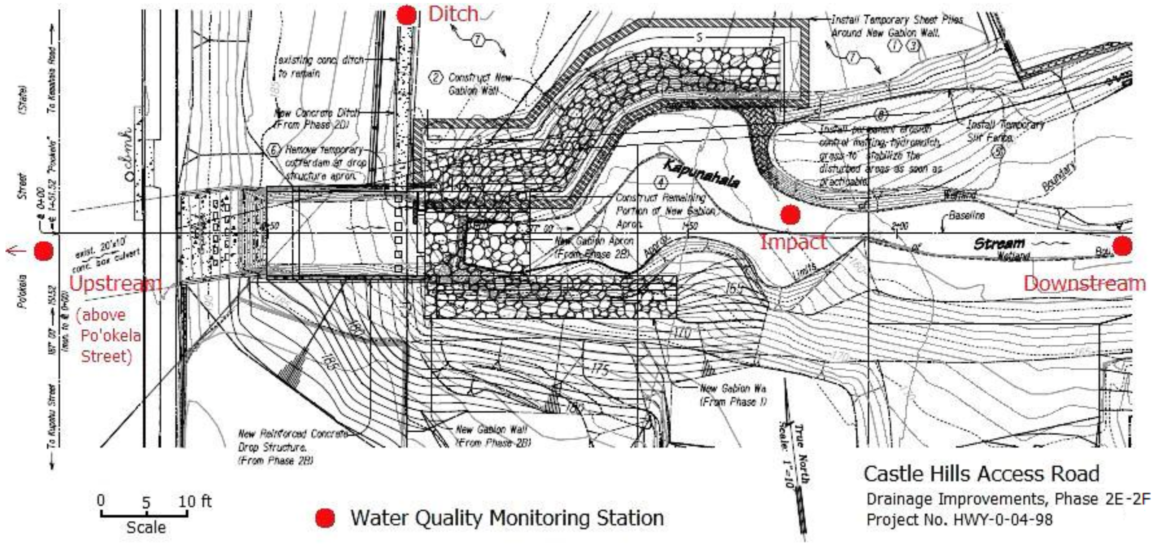


Figure 5. Monitoring locations for Phase 2e and 2f.

The impact stations, located within one meter (~3 ft) of the downstream end of each work phase moves laterally and up and down in the stream. The coordinates for each monitoring station are found in Table 1.

Table 1. Monitoring station coordinates

| **Station Name** | **Lattitude (N)** | **Longitude (W)** |
|---|---|---|
| Upstream Control | 21°24.210 | 157°48.622 |
| Ditch | 21°24.224 | 157°48.598 |
| Impact Phase 1 | 21°24.215 | 157°48.573 |
| Impact Phase 2a through 2d | 21°24.218 | 157°48.588 |
| Impact Phase 2e and 2f | 21°24.215 | 157°48.583 |
| Downstream Control | 21°24.211 | 157°48.571 |

## Sampling Frequency

**Preconstruction Sampling**

Prior to construction, ten sampling events will be conducted by *AECOS* field personnel over a minimum five week period. Three stations will be sampled during preconstruction, the upstream control station, Phase 1 (furthest up) impact station and the downstream control station. The ditch control station will be sampled if there is flow.

**During Construction Sampling**

Three stations (Fig. 3) will be sampled by *AECOS* field personnel three times a week during in-water work for Phase 1 which is expected to be completed within six weeks. Three stations (Fig. 4) will be sampled for Phase 2a through 2d (start to end of temporary stream diverions system) once a week. Phase 2a through 2d is expected to be completed within 21 weeks. Three stations (Fig. 5) will be sampled during Phase 2e/2f three times a week. Phase 2e/2f is expected to be completed within 10 weeks. The ditch control station will be sampled if there is flow.

**Post-Construction Sampling**

Post-construction sampling will occur at the same locations sampled for preconstruction monitoring. Sampling will be performed by *AECOS* field personnel and will occur once a week for five weeks after the project is completed and all BMPs are removed. The ditch control station will be sampled if there is flow.

## Sampling and Analytical Methods

The contractor's representative will be responsible for a daily log of weather conditions and relevant observations. This individual will make visual inspections of water quality at a minimum once daily as long as in-water work is occurring. This will ensure that any physical change in the character of the receiving water due to construction will be corrected. If any change is noted, modification to existing Best Management Practices (BMPs) will be implemented in a timely manner. Results of the visual inspections will also be noted in a field notebook.

All water quality parameters will be measured from grab samples collected by experienced *AECOS* field technicians. Field measurements will be made at the time of collection. The samplers will record all field measurements in a field book. They will note any unusual site conditions and the condition of any treatment device at the time of collection, and will record the date, time and location of each sample. They will also note construction activity, weather conditions, and whether activity not related to construction may be impacting the stream water quality.

Measurement of pH will be taken *in situ.* If the pH cannot be accurately measured *in situ*, a plastic bottle or beaker will be used to collect samples for pH. Samples collected for pH must be analyzed within 15 minutes of collection.

A one-liter plastic bottle will be used at each monitoring station to collect samples for turbidity and TSS. Prior to collecting a sample, each plastic bottle will be pre-rinsed with the water to be sampled. The samples will be collected right below the surface by facing the plastic bottle upstream to fill. The samples will be placed in a cooler, chilled and returned to the laboratory for analysis. Table 2 lists the analytical methods and instrumentation to be used in this monitoring program. Table 3 lists the analytical hold times and field preservation for each method.

Table 2. Analytical methods and instruments to be used for the Project's water quality monitoring program.

| **Analysis** | **Method** | **Reference** | **Instrument*** |
|---|---|---|---|
| pH | $4500H^{+}$ | SM, 1998 | Hanna pocket pH meter |
| Turbidity | 180.1, Rev. 2.0 | EPA, 1993 | 2100N Hach Turbidimeter |
| Total Suspended Solids | 2540 D | SM, 1998 | Toledo balance |

* Typical instruments are listed; other manufacturers or models may be substituted.

Table 3. Analytical hold times and preservation for the Project's water quality monitoring program.

| **Analysis** | **Hold time** | **Field Preservation** |
|---|---|---|
| pH | 15 minutes | none |
| Turbidity | 48 hrs | chill on ice to 4ºC |
| Total Suspended Solids | 7 days | chill on ice to 4ºC |

## Quality Assurance

The water sampling and field testing will be performed by *AECOS* personnel trained to perform these tasks.

Once samples have been obtained and site conditions and field measurements have been properly documented in the field notebook, a written record of the chain of custody of the samples must be made for the laboratory analyses. A chain-of-custody (COC) form serves the purpose of accompanying the samples to the laboratory and directing the laboratory analysts on the analyses to be performed. The form also identifies the samples, so the laboratory can report the analytical results by sample ID. When transferring possession of samples, the sampler should sign and record the date and time on the chain-of-custody record. Each person who takes custody should fill in the appropriate section of the chain-of-custody record. The chain of custody will be filed with the laboratory data and become a part of the permanent record.

All instrument calibration procedures will be undertaken prior to field measurements. The pH meter will be maintained and calibrated according to manufacturer instructions and SOPs. Operation and calibration will only be performed by personnel who have been properly trained in these procedures. Documentation of calibration and any maintenance information will be maintained in appropriate field or log books. All calibrations will be made prior to analyzing the samples. Analysis for pH must be undertaken within 15 minutes of sample collection. pH measurements should be made *in situ* if conditions allow.

Any item of field equipment that has shown by calibration or otherwise to be defective is to be taken out of service until it has been repaired. The equipment is placed back in service only after verifying by calibration that the equipment performs satisfactorily. If at any time calibration and maintenance is beyond the capability of the trained personnel, the *AECOS* Project Manager will be notified. An attempt will be made to solve the problem. If the equipment or instrument still cannot be repaired, the equipment will be taken out of service and sent for repair and replacement equipment will be obtained at the laboratory.

*AECOS* participates in Environmental Protection Agency (EPA) certified provider's quality assurance (QA) programs available for all analyses conducted as part of this monitoring program. This includes EPA Water Supply performance evaluations and EPA Water Pollution performance evaluation programs. Relevant quality assurance/quality control (QA/QC) results will be provided to HDOH upon request.

The laboratory will retain in its records, the analytical procedures used, any relevant QA/QC information, and instrument calibration information pertaining to the specific analysis. All analytical results and field notes will be entered into a notebook or file established for this purpose, and provided in a final report prepared for the monitoring program. This file will be available for inspection by HDOH-authorized personnel during normal business hours.

## Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements developed through a seven-step process based on EPA guidance for developing DQOs (USEPA, 2000). The project-specific DQOs below describe each step and how it pertains to the water quality monitoring and assessment plan (WQMAP).

### *Step 1: State the Problem*

Stream banks on the upper reach of Kapunahala Stream near Poʻokela Street (Fig. 1) are severely eroded. Approximately 12-feet of vertical degradation occurred within a period of 13-years. Most of the stream degradation occurred during one storm event in 1996. The area immediately downstream of the existing CRM outlet structure has eroded by approximately 10-feet in height. The erosion is undermining the existing CRM outlet structure. The unsupported CRM outlet structure then fails and falls into the eroded area of the stream. Erosion and undermining is expected to continue until drainage improvements and stream bank stabilization are installed (Park Engineering, 2009).

The proposed Project intends to improve drainage and stabilize the stream banks to minimize erosion. Improvements will reduce flow velocity, dissipate stream flow energy, minimize erosion and provide stream bank stability.

Construction work includes demolition of an existing outlet, excavation of soil, installation and removal of temporary gabion wall, installation of permanent gabion walls, construction of a new outlet structure, construction and removal of a temporary stream diversion system to divert the stream around the work area, installation and removal of temporary sheet pile shoring, and installation of landscaping. These work tasks have the potential to release soil, concrete, rubble and debris into Kapunahala Stream increasing sediment loads and pH.

### *Step 2: Identify the Decision*

The intent of this monitoring and assessment program is to 1) ascertain that the Best Management Practices (BMPs) for the project are adequate to ensure that the stream water quality outside of the work area is unaffected by the construction, 2) promptly determine if BMPs prove inadequate so that modification of the BMPs can be implemented immediately upon discovery or as soon as possible to bring the activity into compliance, 3) serve as a basis for self compliance, so that activities associated with the proposed action can proceed within the parameters required by State Water Quality Standards, and 4) assess any short-term or long-term impacts in-water construction may have had on Kapunahala Stream water quality.

***Step 3: Identify the Inputs to the Decision***

Turbidity, TSS and pH will be analyzed. These parameters were chosen as the best available methods to measure increase in sediment load or pH due to construction. The data collected as a part of this monitoring program will be used to determine whether the objectives listed above are being met. Preconstruction monitoring will provide data to assess baseline conditions. During construction results will be used to determine whether BMPs are effective. Post construction data will be used to assess whether the project impacted water quality on a short-term or long-term basis.

Data collected during construction will be sent to the permittee, HDOT, by facsimile, as they become available (.i.e., field measurements within 24 hrs of sampling, turbidity and TSS within 24 hrs of completion of analyses). Within two weeks of completing analysis, a typed report of results will be sent to the HDOT via facsimile or email. These reports will have a running statistical summary for each phase of the project and will include field notes.

A final construction monitoring and assessment report will be submitted to the HDOT within 60 days of completion of post construction monitoring and analysis. The monitoring report will include a summary of the water quality monitoring results (preconstruction, during construction, and post-construction). All the data will be suitable for assessment of construction impacts upon Kapunahala Stream.

***Step 4: Define the Study Boundaries***

Data collection will be limited to four stations during each phase of construction. The study boundaries start at the upstream control station approximately 50 ft (15m) upstream of the project limits and ends at the downstream control station approximately 50 ft (15m) downstream of the project limits. Sampling will occur ten times during preconstruction sampling, three times a week during Phase 1 and Phase 2e/2f construction, once a week during Phase 2a through 2d and once a week for 5 weeks for post construction monitoring. The location of each station is found in Figures 3 to 5 and GPS coordinates are found in Table 1.

***Step 5: Develop a Decision Rule***

The results of this study will be evaluated against the decisions outlined during Step 2 of the DQO process. If the measured parameters at the impact station exceed Hawaii Water Quality Standards or baseline conditions and the exceedance is not related to ambient conditions, it may be necessary to modify the BMPs.

During field sampling, samplers must take required field notes. If at any time it is noted that there is a turbidity plume extending beyond the BMPs and the plume is associated with construction, all work should stop until the cause is determined and corrected.

If the turbidity at the downstream control station at any time exceeds any of these three numerical references:

- the turbidity at the upstream control station,
- the turbidity geometric mean of the preconstruction results (applicable to "dry" or "wet" season if preconstruction data collection allows), or
- 2.0 NTU in the "dry" season (May 1 through October 31) and 5.0 NTU during the "wet" season (November 1 through April 30);

or if pH results at the downstream control station

- fall outside of the range of 5.5 to 8.0,
- deviate more than 0.5 units from the control stations, or
- deviate more than 0.5 units from the preconstruction mean;

or if the total suspended solids (TSS) at the downstream control station at any time exceeds any of these three numerical references:

- the TSS at the upstream control station,
- the TSS geometric mean of the preconstruction results (applicable to "dry" or "wet" season if preconstruction data collection allows), or
- 10.0 mg/L in the "dry" season (May 1 through October 31) and 20.0 mg/L during the "wet" season (November 1 through April 30),

then a determination must be made whether the cause is attributable to construction. Samples collected at the Ditch control station will be used to assess whether the increase in pollutants are being contributed by the concrete lined ditch.

Upon obtaining results that exceed the limits set for turbidity and TSS, the laboratory analyst will notify the *AECOS* project manager. The project manager will notify the contractor's representative. If the field samplers notice a problem in the field (i.e. pH out of range or a turbidity plume) they will notify the contractor's representative, or if he is not available, the on-site manager immediately. The contractor's representative or on-site manager will attempt to track the cause of the exceedance. If it is determined that construction is causing the problem, then the activity responsible should cease until the problem is corrected.

***Step 6: Specify Tolerable Limits on Decision Errors***
Environmental decisions are variable. Some uncertainty will be the result of sample design errors and some uncertainty will be the result of measurement errors. When examining the data against the decision rules (Step 5), a decision must be made whether the data show the water quality is within the range of ambient conditions (null hypothesis) or if the water quality is affected by construction activities. Two potential decision errors exist, Type I—false rejection of the null hypothesis (conclude a water quality impact has occurred where one has not) or Type II—false acceptance of the null hypothesis (conclude no water quality impact has occurred where one has). The tolerable limit on decision errors is set at >80%. It is assumed that differences in the percent change can be negative or positive (two-sided t-test), and the $\alpha$ significance level is set at 0.05.

To address decision errors that are the result of measurement errors, quality controls will be conducted on approximately ten percent of the samples to be collected and analyzed. Acceptable relative percent differences for field duplicates are 75% or less. Laboratory control limits for quality control samples is established between 90 and 110%. Replicate analysis will be performed in 10% of the samples.

All field meters will be calibrated prior to use and calibration procedures will be recorded in the field book or a special notebook used only for recording meter calibrations and maintenance procedures. Field measurements will be measured and recorded in duplicate.

***Step 7: Optimize the Design***
Directed sampling will be employed in the study area. The sampling locations and sampling frequency were developed in accordance with water quality regulations promulgated in Hawaii Administrative Rules (HAR) Chapter 11-54 (HDOH, 2004) and the General Monitoring Guideline for Section 401 Water Quality Certification Projects (HDOH, 2000). BMPs or station locations may be modified dependent on site conditions and results of analyses.

## Reports/Assessment

Draft results of sample testing will be sent via facsimile or email to HDOT from the laboratory upon completion of the analyses, usually within 48 hours for all measurements except TSS. A brief report for submittal to HDOT will be prepared within two weeks of completion of analysis. In addition to analytical results, the report will include time and date of sampling, name of the person who collected the samples, date each analysis was conducted, and identification of the laboratory and analyst(s) that conducted the work. The reports will have a running statistical summary for each phase of the project.

A preconstruction monitoring report will assess water quality and compare baseline data to applicable State Water Quality Standards. This report will be prepared within 45 days of completion of preconstruction monitoring and analysis.

A final report and water quality assessment will be prepared upon completion of the monitoring program. This report will be submitted to HDOH within 60 days following completion of post-construction monitoring and analysis. If post-construction monitoring is not required, the report will be submitted 60 days following completion of construction monitoring and analysis. The final report will identify the methods and procedures for analytical measurements and include all data collected as well as statistical summaries of results by station and activity phase (preconstruction, construction, and post-construction). This report will also assess whether water quality was affected by the construction activity. Upon completion of the monitoring program, the contract laboratory will retain the original data and field notebook for a minimum of five years.

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