Water Quality Monitoring Plan

Kaipapaʻu Stream Bridge Replacement
Koʻolauloa District, Oahu, Hawaii

March 2014

1. INTRODUCTION

This Water Quality Monitoring Plan (WQMP) has been written to accompany the Section 401 Water Quality Certification (WQC) application for the proposed Kaipapaʻu Stream Bridge Replacement project, Project No. BR-083-1(48). This submittal follows requirements of Hawaii Administrative Rules (HAR) §11-54, relating to Water Quality Certification for construction activities which may result in discharges into waters of the State of Hawaiʻi. This certification is required by Section 401 of the Clean Water Act of 1977, in conjunction with Department of the Army Permit requirements.

Section 1.1 Project Overview

The Kaipapaʻu Stream Bridge is a two-lane section of Kamehameha Highway, State Route 83, located in Hauʻula, Oʻahu. The bridge crosses Kaipapaʻu Stream approximately 300 feet upstream from coastal marine waters. The Kaipapaʻu Stream Bridge Replacement project will include bridge widening through phased construction and demolition of the existing bridge. The stream will be diverted around the work area. There will be no interruption of stream flow. In-stream work will only occur during fair weather conditions and not during spawning season (August to October).

Section 1.2 Surface Water Resources Affected

Kaipapaʻu Stream is assigned the code number 3-1-10 in the Hawaiʻi Stream Assessment. It is generally described as a perennial stream. At the project site, Kaipapaʻu Stream is characterized as perennial. The amount of water flow depends on seasonal rainfall conditions.

Coastal marine waters, located approximately 300 feet downstream of the project site, are designated as “Class A” by the DOH-Clean Water Branch. Waters designated as “Class A” are to be protected for recreational uses, aesthetic enjoyment, and protection and propagation of marine life.

Section 1.3 Description of Proposed “In-stream” Construction Activities

In-stream work is defined as work affecting the stream bank, stream bed, stream water quality and/or aquatic animal movement and habitat. During in-stream work, temporary diversion of the Kaipapaʻu Stream will be required to facilitate construction activities, including:

- Maintenance dredging upstream;
- Temporary diversion of Kaipapaʻu Stream;
- Excavation and dewatering of drilled shafts;
- Construction of new bridge/demolition of old bridge;
- Abutment demolition and reconstruction;
- Stream bank stabilization; and
- Restoration of disturbed areas

The new bridge will meet other requirements of AASHTO, FHWA, and DOT (i.e. bridge railings, guardrails and end treatments).

2. PARAMETERS MEASURED

The primary pollutants associated with construction activities at the project site are expected to be sediments (suspended solids) and construction debris. **Table 1** shows the parameters to be monitored prior, during and after construction:

Table 1. Analytical Methods and Instruments

Analysis List	Method	Reference	Instrument
Stream Flow	Rational (Q)	DPW, Honolulu (1988)	Stream Flow Meter
pH	EPA 150.1	EPA (1979)	Orion SA 250 pH meter
Temperature	thermister calibrated to NBS cert. thermometer (EPA 170.1)	EPA (1979)	YSI Model 57 DO meter
Dissolved Oxygen	EPA 360.1	EPA (1979)	YSI Model 57 DO meter
Turbidity	Method 2130B (EPA 180.1)	Standard Methods 18th Edition (1992)	Hach 2100P Turbidimeter
Suspended Solids	Method 2450D (EPA 160.2)	Standard Methods 18th Edition (1992)	Mettler H31 balance
Salinity	Refractive index	HRS 11-54	Vital Sine SR6 Salinity Refractometer

All water quality testing will be done by a trained water quality specialist (analytical laboratory) required for this project. A water quality consultant will be retained by the contractor throughout the entire construction period to monitor the water quality of the stream upstream, at the project site and downstream to ensure that all BMPs and water pollution control measures are adequate to prevent construction activities from causing discharges of potential pollutants into the stream.

All water quality parameters will be measured from grab samples collected by the analytical laboratory's field technician. The field technician will also note weather conditions, any unusual site conditions, and the condition of nearby discharge pollution control measures at the time of sample collection, and record the time and place of sampling. Photo documentation of stream conditions will also be taken and included in water quality monitoring reports.

3. WATER QUALITY SAMPLING

Section 3.1 Sampling Locations

Water quality samples will be taken at four locations: one site upstream, two at the impact area (upstream and downstream) and one site downstream of the project area.

Sampling Station #1 Coordinates:
Latitude: 21° 37' 02" N
Longitude: 157° 54' 52" W

Sampling Station #2 Coordinates:
Latitude: 21° 37' 01" N
Longitude: 157° 54' 50" W

Sampling Station #3 Coordinates:
Latitude: 21° 37' 01" N
Longitude: 157° 54' 49" W

Sampling Station #4 Coordinates:
Latitude: 21° 37' 02" N
Longitude: 157° 54' 48" W

Projection used is North American Datum 1983 (NAD83) UTM Zone 4N.

Section 3.2 Sampling Frequency

Water quality sampling will take place in three phases: Pre-construction, during construction, and post-construction.

Section 3.2.1 Pre-construction water quality sampling

Prior to construction, a total of 10 sets of samples will be collected over a 2-week period to establish the pre-construction baseline. If time permits, a less frequent schedule may be implemented (i.e., once per week for ten weeks or twice per week for five weeks). Preconstruction samples will be collected at the Upstream and Downstream Control Sampling Stations (Stations #1 and #4) in triplicate, as described below in **Section 4**. Impact Station samples will not be collected during the pre-construction phase. All pre-construction data and action levels (as defined in the Project Data Quality Objectives detailed below in **Section 6**) calculated on the basis of that data will be submitted to HDOH CWB prior to commencement of in-stream construction work for the Project.

Section 3.2.2 During construction water quality sampling
Each of the four sample stations will be sampled during construction work hours (i.e., between 7:00 am and 4:00 pm). Sampling activities will be performed when construction activities are underway. Water quality sampling frequency will occur as follows:

> Monthly - Active construction activities inside stream channel (i.e. shaft drilling, abutment demolition and reconstruction)
>
> Quarterly - Construction activities occurring only outside the stream channel

Monthly sampling will be performed throughout the duration of in-stream work, or until all in-stream BMPs are removed. Temperature, pH, dissolved oxygen, turbidity and TSS data will be submitted promptly to HDOH CWB as described below in **Section 5**. The relative standard deviation of the results from the triplicate samples collected at the Impact Station during each sampling event will be calculated and reported with each data submittal.

Section 3.2.3 Post-construction water quality sampling
Post-construction water quality sampling will be conducted once per week for three weeks following the removal of all in-stream BMPs. Three samples at each impact area will be collected. Control station samples will not be collected during the post-construction phase. Temperature, pH, dissolved oxygen, turbidity and TSS data will be submitted promptly to HDOH CWB as described below in **Section 5**.

4. SAMPLING AND ANALYTICAL PROCEDURES/QUALITY ASSURANCE

All water quality monitoring samples collected for this Project will be collected using MULTI INCREMENT® sampling techniques[1]. For water quality parameters measured in the field (i.e., temperature, pH and dissolved oxygen), field measurements will be taken immediately following sample collection from representative MULTI INCREMENT® samples as described below. Analysis of turbidity and TSS will be conducted by the designated laboratory from representative MULTI INCREMENT® samples.

While limited access to sampling points and dynamic field conditions preclude the description of specific sampling procedures, A MULTI INCREMENT® sampling approach will be used for the collection of all water quality samples. An Aloha Sampler® attached to an extendable pole will be used to fill individual 1 liter bottles, with a total of 3 liters to be collected for each sample, including two 1-liter bottles for TSS and turbidity analysis, respectively, and a third 1-liter bottle for field measurement of temperature, pH and dissolved oxygen. Field measurements for temperature, pH and dissolved oxygen will be conducted in the field immediately upon the collection of each sample. TSS samples will be stored on ice pending shipping to the laboratory for analysis, and turbidity samples will be analyzed by the designated water quality consultant, and will

[1] "*MULTI INCREMENT®*" is a registered trademark of EnviroStat, Inc. As a condition of use, all *MULTI INCREMENT®* samples must be collected in accordance with trademark requirements.

only be chilled if the samples cannot be analyzed within a reasonable timeframe (e.g., 4-8 hours).

At each designated sample location, “decision unit” area will be defined as the full accessible cross-section of the flowing stream to a depth that can be sampled without disturbing sediments. As each bottle is filled, the sampler bottles will be moved left-to-right and up-and-down at random within the cross-sectional decision unit area as the required sample volume is collected.

All relevant sample collection information will be recorded in a field log book in accordance with SM 1060B (SM, 2012). At the time of sample collection, field sampling personnel will record their name(s), the date, the time of sample collection, as well as sample location (including GPS coordinates), sample ID, and other field data including weather conditions, construction activities, unusual site conditions, and condition of any BMPs in the stream at the time of sample collection. Any construction-related (or non-construction-related) conditions or activities noted at or near the project site that might impact water quality at the time of sample collection will also be recorded.

In addition to the collection of water samples for the analysis of water quality parameters, and the recording of relevant information in a field log book as described above, photographs will be taken by the sampler during each sampling event including pictures of all in-stream project BMPs (including the stream flow diversion and any other temporarily constructed structures) as well as any unusual conditions at the work site, including unusual conditions at or near sampling stations and work site BMPs that may be having an impact on water quality. Photographs will be transcribed as .pdf files to include the date, time, and description of the item(s) photographed. These records will be collected and maintained in addition to the daily records of site conditions and BMPs to be collected and maintained by the construction contractor as required for compliance with NPDES permit requirements.

Monitoring will be conducted within three (3) feet of the discharge pollution prevention structures at the site (Station 2 & 3). Upstream monitoring will be conducted in an area (Station 1) that will not be impacted by construction activities. The downstream sampling location (Station 4) will be located “below” all anticipated project activities. To the extent possible, each sample will be collected within the main stream flow.
It is further recommended that a competent water quality analytical laboratory such as AECOS, Inc., undertake the water quality sampling and monitoring required by this WQMP.

5. REPORTS

Results of sample testing will be available from the laboratory upon completion of the analyses, usually within 24 to 48 hours for turbidity and pH measurements because of the short hold times for these samples. The in-situ testing results will be submitted to DOH-CWB within 48 hours of the water quality testing activity.

Written reports will be prepared for submittal to DOH within a week after testing. The report will include, in addition to the analytical results, the time and date of sampling, the person who took the sample(s), the date each analysis was conducted, as well as identification of the laboratory and the analyst that conducted each analysis. The laboratory will retain, in its records, the analytical procedures used and any relevant QA/QC and instrument calibration information pertaining to the specific run.

Prior to the start of construction, water quality testing will be performed to establish a baseline of the parameters to be tested. The results of the water quality testing will be submitted to DOH at least 30 days prior to the start of construction activities.

6. DATA QUALITY OBJECTIVES

This Quality Assurance Project Plan (QAPP) has been developed based on recommendations included in guidance documents produced by the U.S. Environmental Protection Agency (USEPA) including: USEPA Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4 (*USEPA, 2006*).

Elements of this QAPP include: a discussion of the Data Quality Objectives process (**Section 6.1**); detailed consideration of Data Quality Objectives for this specific project (**Section 6.2**); a discussion of required qualifications for field samplers, analytical personnel and qualified analytical laboratories (**Section 6.3**); a discussion of sample collection, transport and storage procedures (**Section 6.4**); a discussion of sample collection quality control procedures (**Section 6.5**) and a discussion of analytical quality control procedures (**Section 6.6**).

Section 6.1 The Data Quality Objectives Process

The Data Quality Objectives (DQO) process is a data acquisition and planning process recommended by the U.S. Environmental Protection Agency (USEPA) and HDOH for use when environmental data are used to select between two alternatives or derive an estimate of contamination. The DQO process is used to develop performance and acceptance criteria (or data quality objectives) that clarify study objectives, define the appropriate types of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Section 6.2 Data Quality Objectives for this Program

Step 1: State the Problem

The Kaipapaʻu Stream Bridge will require construction of a new bridge and demolition of the existing bridge where State Route 83 crosses Kaipapaʻu Stream. Planned construction activities have the potential to contribute sediments to the Kaipapaʻu Stream, potentially affecting turbidity and TSS levels, as well as pH and dissolved oxygen levels in stream waters in the immediate vicinity of the project site. A stream diversion system will be implemented during the full duration of in-stream construction activities to minimize these potential effects.

The primary problem is how best to minimize and/or prevent the discharge of potential pollutants into Kaipapaʻu Stream during construction.

Planning Team

Persons involved in the process include the following:
Michael U. Kuong, Rural Construction Engineer – HDOT (or his designee)
Li Nah Okita, Project Manager – HDOT
Pratt Kinimaka, District Engineer – Emergency Contact
Walter Chong, Project Engineer – R. M. Towill Corporation
Chester Koga, Project Coordinator – R. M. Towill Corporation
Project Contractor – To be Determined
Water Quality Consultant – To be Determined
Water Quality Analytical Laboratory – To be Determined

During the demolition and reconstruction of the Kaipapaʻu Stream Bridge, the potential for pollutants to be discharged into the stream is possible. Pollutants include soil, suspended sediments, dewatering effluent, hydrotesting effluent, construction/demolition debris, and petroleum-related products from construction equipment and machinery.

Handling of construction storm water, dewatering and hydrotesting effluent discharges will be done in accordance with NPDES NOI - Forms C, G and F, respectively and their associated permit conditions and procedures and BMPs Plans submitted for the project. The NPDES NOI - Forms C, F, and G (HIR10D570) applications for the proposed project were submitted to DOH-CWB and approved in February 2010.

The project contractor will be required to implement the DOH-approved site-specific BMPs plan to prevent or minimize the discharge of pollutants into the stream.

A water quality consultant will be retained by the contractor throughout the entire construction period to monitor the water quality of the stream upstream, at the project site and downstream to ensure that all BMPs and water pollution control measures are adequate to prevent construction activities from causing discharges of potential pollutants into the stream.

At the project site, Kaipapaʻu Stream is characterized as perennial. The amount of water flow depends on seasonal rainfall conditions. The topography in the vicinity of the existing bridge is relatively flat. Ground elevations along the deck and rails of the existing bridge and roadway range from approximately 10 to 14 feet Mean Sea Level (msl). The stream bed beneath the bridge ranges in elevation from approximately -3 to +4 feet msl. The bridge is located approximately 300 feet away from the shoreline. Due to the existing elevation, the water under the bridge may be tidally influenced.

In June 2012 sampling was performed prior to and during demolition of the Christensen house. Sampling data during the demolition is included in **Table 2,** below.

Table 2: Water Quality of Kaipapa‘u Stream During-Construction (Demolition) Monitoring Performed by AECOS, Inc. from 6/25/12 to 6/26/12

Monitoring Station	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH (ppt)	Salinity
Station #1	No water	-	-	-	-
Station #2	22.7	5.25	61	7.02	<1
Station #3	22.6	5.00	58	7.02	<1
Station #4	23.4	7.34	86	6.84	<1

Monitoring Station	Turbidity (NTU)	Total Susp. Solids (mg/L)	Nitrate+Nitrite (ug/L)	Total Nitrogen (ug/L)
Station #1	No water	-	-	-
Station #2	1.41	1.1	802	1110
Station #3	1.49	1.5	825	1130
Station #4	2.10	2.2	745	1170

Step 2: Identify the Decision

The goal of the water quality monitoring and assessment activity is to prevent construction activities from causing discharges of potential pollutants into the stream.

Questions: Is the monitoring program designed such that the results provide the necessary and accurate information to effectively guide the continued implementation and adjustment of the construction activity’s BMPs and erosion and sediment control measures thereby preventing potential pollutants from the proposed activity to enter State waters? Are the implemented BMPs and erosion and sediment control measures adequate to effectively prevent pollutants from entering the Stream?

Baseline data has been observed at the project site from 2006 to 2012 at different times of the year. Water quality monitoring has already been performed during the demolition of the Christensen house with no observed changes to the stream. Monitoring and BMPs were adequate to prevent potential pollutants from the demolition and site disturbance from entering into State waters. Monitoring during site activity was also sufficient. A list of BMPs and potential pollutants is included in the attached, **Section 7, Site-Specific Best Management Practices (BMPs) Plan**. A BMPs Plan has already been accepted by the DOH Clean Water Branch as part of the NPDES NOI permit. Water quality monitoring plans were also included in the NPDES accepted permits.

Should the result of the water quality monitoring indicate that pollutants are being discharged into the stream (through measurement of specified water quality parameters above the established baseline limits set in the initial water quality analysis), the water quality consultant will immediately notify the project contractor and the HDOT Construction Engineer. The project activity that is causing the discharge will be immediately halted and correction measures taken to address the source of discharge. The water quality consultant will work with the project contractor to resolve the discharge issue. The construction activity will only resume after correction measures have been taken and no further discharges occur or will occur once the activity resumes. Continued sampling will occur while post-discharge correction measures are taken. The water quality consultant will alert the project coordinator when, after correction measures are taken, the pollutant level of the sampling locations have returned to pre-disturbance levels.

Step 3: Information Inputs

Data gathered from the water testing and monitoring activities, including visual inspection of the surface waters, will be used to manage the project activity's impact on the steam environment.

Regular monitoring results, in addition to the daily and ongoing visual inspection of surface waters will be the informational inputs utilized for water quality management at the project site. Water quality monitoring will provide the detailed information on the parameters listed in **Table 2, Water Quality Parameters & Action Items**.

Results of sample testing will be available from the laboratory upon completion of the analyses, usually within 24 to 48 hours for turbidity and pH measurements. The results will be reported to HDOT and the project contractor. Should water testing reveal levels above the established baseline limits of the parameters tested, immediate action will be taken to resolve the issue. The HDOT, the water quality consultant and the contractor will work together to make the necessary corrections on site to rectify the situation. A written report of the initial sampling at the beginning of the project will be prepared for submittal to DOH within two weeks following sampling. Ongoing monitoring reports will be submitted to DOH on a weekly basis.

Samples taken prior to construction will be used to establish a baseline limit of the water quality parameters to be tested (see **Table 1**). A total of 10 sets of samples will be collected over a 2 week period to establish the pre-construction baseline.

During construction, "impact site" monitoring will be conducted within three (3) feet of the discharge pollution prevention structures at the site. Upstream monitoring will be conducted in an area that will not be impacted by construction activities. The downstream sampling location will be located downstream all anticipated project activities.

The ongoing visual surface water inspection will provide immediate results whether the project BMPs are effectively preventing pollutants from entering the stream. The visual inspections will also include photo-documentation of water quality and implemented BMPs. Should visual inspection reveal that pollutants (i.e. silt, sediment, oil sheen, etc.)

are entering the stream, work will cease immediately and corrective action will be taken to prevent further discharges into the stream.

Water quality sampling will be performed by a trained water quality specialist (Water Quality Consultant). Relevant quality assurance/quality control (QA/QC) results will be provided to DOH as part of the monitoring reports.

Step 4: Boundaries of the Study

The boundary of the study includes Kaipapaʻu Stream approximately 165 feet upstream and 115 feet downstream of the project site (defined by sampling Stations 1 and 4, respectively) and includes all of the stream water in the channel that pass through the project area throughout the entire duration of the project. See **Section 6, Construction Drawings, APE**.

Data collection will occur daily during active in-stream work (i.e. shaft drilling, abutment demolition and reconstruction). When construction activities are only taking place in areas outside the stream channel, testing will occur once every two weeks.

Step 5: Develop a Decision Rule

If either the visual inspection of the surface waters of the stream or instrument testing of water samples indicate pollutants levels resulting from the proposed activity above the established baseline limit (see **Table 1**), then offending activity will be immediately halted and corrective action taken to remedy the situation. The subject activity may resume only after corrective action has occurred.

Step 6: Specify Tolerable Limits on Decision Errors

To eliminate or minimize the potential for decision errors, the following measures will be implemented:

- All water quality analysis will be in compliance with all applicable State water quality standards (HRS 11-54-10).
- All water quality work will be done in accordance with this Water Quality Monitoring Plan.
- Water quality sampling will be performed by trained water quality personnel (water quality consultant) to be retained by the project contractor throughout the entire duration of the project.
- The HDOT Construction Engineer, the water quality consultant and the project contractor will work closely together to ensure that the project activities do not violate the water quality standards.
- Water quality testing will include laboratory and in-situ testing, in addition to visual monitoring of the stream. All data will be reviewed and reported to the DOH.

Any discrepancies in water quality data will be reviewed by the water quality consultant and the HDOT Construction Engineer to determine a possible cause. If necessary, re-sampling and water quality testing will be performed.

Should implemented BMPs and erosion and sediment control measures be insufficient to effectively prevent pollutants (soil, sediments, etc.) from discharging into the stream, the offending construction activity will cease and corrections made. Any changes to the site-specific BMPs will be reported to DOH-CWB.

Step 7: Optimize the Sampling Design

Monitoring of the stream will be carried out to provide baseline information and to evaluate the project's impact on water quality at the site. Sampling will occur at predetermined times throughout the entire construction period. A competent water quality analytical laboratory will be hired to undertake the water quality sampling and monitoring activities.

Samples for measurement of total suspended solids will be collected by filling a 1-liter plastic or glass at each of the sampling locations identified in **Section 3.1**, above. Sample locations and sampling frequency have been determined in accordance with regulations promulgated under HAR Chapter 11-54 (HDOH, 2012) and HDOH Guidance for Section 401 Water Quality Certification Projects (HDOH, 2000). Smaller containers may be used if shallow water prevents filling the larger container without disturbing the bottom. Two (2) sets of samples for nutrient analysis will be collected by filling 125-ml glass containers at the same sampling locations.

Monitoring will be conducted within three (3) feet of the discharge pollution prevention structures at the site (Station 2 & 3). Upstream monitoring will be conducted in an area (Station 1) that will not be impacted by construction activities. The downstream sampling location (Station 4) will be located "below" all anticipated project activities. To the extent possible, each sample will be collected within the main stream flow. Samples will be returned immediately to the laboratory to be analyzed for the parameters in ***Step 3***, above (aside from the parameters to be tested in-situ).

The sampling activities will be done during times when construction activities are underway.

Site conditions will be continually monitored and re-evaluated by the water quality consultant and the contractor. Should the stream condition change, the water quality consultant will assess the situation and contact the DOH-CWB to discuss an adjustment to the sampling design. The contractor will revise his erosion control measures as needed to accommodate changes at the site. Any changes in the erosion control plan will be transmitted to DOH.

The inspection and monitoring reports will be prepared and submitted to DOH within a week after each testing. The laboratory conducting analysis of samples under this program will participate in DOH/EPA sponsored quality assurance (QA) programs available for all analyses conducted as part of the monitoring program. This presently should include either or both the EPA Water Supply performance evaluation and/or EPA Water Pollution performance evaluation programs. Relevant QA/QC results are to be provided to DOH.

Section 6.3 Qualifications for Sampling

Responsibilities and qualifications of the various parties involved in the Water Quality Monitoring Program outlined in this AMAP are detailed in **Table 3**, below.

Table 3. Summary of WQMP Responsibilities and Qualifications

Organization	Responsibilities	Qualifications
Water Quality Consultant – TBD	• Collection of all samples. • Analysis of all samples for temperature, pH, dissolved oxygen and turbidity. • Daily reports of temperature, pH, dissolved oxygen and turbidity results (including QC data) to RMTC/Laboratory/DOT-H; • Monthly reports (including QC data) to RMTC/Laboratory/DOT-H; • Final WQ assessment report to RMTC/Laboratory/DOT-H.	Trained and experienced in project management, collection of water samples, analyzing TSS in aquatic and marine environments, collection of MULTI-INCREMENTAL® samples, use of water quality monitoring equipment to perform field measurements of water quality data, use of laboratory equipment to perform instrumental analysis, and report preparation.
Water Quality Analytical Laboratory – TBD	• Analysis of all samples for TSS. • Weekly reports of TSS results (including QC data) to Water Quality Consultant; • Monthly reports of TSS results (including QC data) to Water Quality Consultant; • Final WQ assessment report for TSS (including QC data) to Water Quality Consultant.	Knowledgeable of construction activities as they relate to 401 WQC requirements.
Construction Contractor – TBD	• Prime Contractor. • Daily Inspections of Job Site Conditions and BMPs, including photos, for NPDES compliance.	Knowledgeable of WQC monitoring requirements for this project.
R. M. Towill Corporation	• Planning and Design Consultant. • Submittal of 401 WQC Application Forms. • WQMP Project Manager. • Preparation of Final WQMP.	Knowledgeable of construction activities as they relate to 401 WQC requirements. Knowledgeable of WQC monitoring requirements for this project.
Dept. of Transportation-Highways (DOT-H)	• Owner. • Review, approval and submittal of all WQ monitoring reports to HDOH-CWB.	Knowledgeable of construction activities as they relate to 401 WQC requirements. Knowledgeable of WQC monitoring requirements for this project.

Section 6.4 Collection, Transport and Storage

Water quality samples will be collected as MULTI INCREMENT® samples as described above in **Section 4**. All samples will be tested in the field immediately following sample collections for parameters including pH, temperature and dissolved oxygen. Turbidity samples will be stored in a cooler pending analysis immediately following completion of field activities (within 24 hours). TSS samples will be stored on ice pending shipping to the designated water quality consultant for laboratory analysis. Allowable holding times and required conditions for sample preservation are detailed in **Table 4**.

Table 4. Allowable Holding Times and Preservation Requirements

Parameter / Analysis	Hold Time	Field Preservation
Temperature	Immediate	None
pH	Immediate	None
Dissolved Oxygen	Immediate	None
Turbidity	ASAP / 24 hours maximum	Chill on ice to 4° C if necessary
Total Suspended Solids	7 Days	Chill on ice to 4° C

Once field sampling activities have been completed (i.e., field conditions noted, BMP conditions inspected and documented, water samples collected, field analyses performed), TSS samples will be placed in a cooler on ice and stored at the analytical laboratory pending delivery to the shipper. All samples shipped to the water quality consultant will be transported with complete chain-of-custody documentation. A sample chain-of-custody form is included in **Attachment A**. Samples will be labeled with unique sample identification numbers specific to this project as determined according to the following system:

Upstream Control Station samples:	KSB-UCS	(MM/DD/YYYY)
Upstream Impact Station samples:	KSB-UIS	(MM/DD/YYYY)
Downstream Impact Station samples:	KSB-DIS	(MM/DD/YYYY)
Upstream Impact Station QC replicate 1 samples:	KSB-UIS R1	(MM/DD/YYYY)
Upstream Impact Station QC replicate 2 samples:	KSB-UIS R2	(MM/DD/YYYY)
Downstream Impact Station QC replicate 1 samples:	KSB-DIS R1	(MM/DD/YYYY)
Downstream Impact Station QC replicate 2 samples:	KSB-DIS R2	(MM/DD/YYYY)
Downstream Control Station samples:	KSB-DCS	(MM/DD/YYYY)

Section 6.5 Sample Collection Quality Control

To assess the potential for sampling error, the relative standard deviation (RSD) of the triplicate samples collected will be determined for each sampling point. If the RSD is greater than 20%, then a review of sampling conditions and protocol will be conducted to verify that sampling protocol is both precise and unbiased.

Section 6.6 Analytical Quality Control

This section details quality control procedures for all analyses to be performed by the water quality consultant (additional detail for laboratory quality control procedures during TSS analysis can be obtained directly from the Analytical Laboratory). Quality control procedures for field analyses (i.e., temperature, pH, and dissolved oxygen) are described in ***Section 6.6.1***. Quality control procedures for turbidity analyses are described in ***Section 6.6.2***. Quality control procedures for TSS analyses are described in ***Section 6.6.3***.

Section 6.6.1 Quality Control Procedures for Field Analyses

To assess the potential for error in the analysis of temperature, pH and dissolved oxygen in-stream samples, the following quality control procedures will be implemented: calibration of field instruments in accordance with appropriate analytical methods (SM, 2012) and manufacturer's instructions (YSI, 2009; YSI, 2010); and daily performance checks performed to verify instrumental precision and accuracy prior to and upon completion of field analyses.

Calibration of YSI Professional Plus Instrument

The YSI ProPlus instrument will be used to measure temperature, dissolved oxygen and pH in the field. Calibrating the instrument for measurement of temperature is not required, as the instrument is considered a primary measurement device. Calibrating the instrument for measurement of dissolved oxygen is accomplished using one point calibration in-stream-saturated air. Calibrating the instrument for measurement of pH is accomplished using a three-point calibration, based on buffered calibration standards with pH values of 4.0, 7.0 and 10.0.

Manufacturer instructions (YSI, 2009; YSI, 2010) recommend daily calibration of the YSI ProPlus instrument. However, based on recommendations from HDOH CWB (Terrence Teruya, pers. comm.), instruments used for this project will be calibrated on a monthly basis, with daily performance checks used to ensure that the calibration remains in control, as described below.

Performance Checks

Daily performance checks will be conducted prior to field measurements to ensure instrumental precision and lack of bias. Dissolved oxygen readings will be evaluated based on water saturated air. Acceptance criteria for dissolved oxygen readings will be +/- 5%. Initial readings of water saturated air as > 105% or < 95% will result in recalibration. For evaluation of pH readings, a mid-range standard (pH 7.0) will be used. Acceptance criteria for pH readings will be +/- 0.15 pH units. In the event that performance checks conducted prior to field sampling indicate deviation of greater than +/- 0.15 pH units, the instrument will be re-calibrated prior to use. All calibration results and performance checks will be logged.

Section 6.6.2 Quality Control Procedures for Turbidity Analyses

To assess the potential for error in the analysis of turbidity in-stream samples, the following quality control procedures will be implemented: calibration of instruments in accordance with appropriate analytical methods (*USEPA, 1993; SM, 2012*) and manufacturer's instructions (*HF Scientific, 2010*); daily performance checks performed to verify instrumental precision and bias prior to and upon completion of field analyses.

Calibration of HF-Micro 100 Laboratory Turbidimeter

The HF-Micro 100 Laboratory Turbidimeter will be used to measure turbidity in-stream samples collected for this project. Calibrating the instrument for measurement of turbidity is accomplished using a three-point calibration, using styrene divinylbenzene Primary Calibration Standards with values of 0.02, 10.0 and 1000 NTUs.

Manufacturer instructions (*HF Scientific, 2010*) recommend calibration of the HF-Micro 100 Laboratory Turbidimeter at least once every three months. Instruments used for this project will be calibrated on a monthly basis, with daily performance checks used to ensure that the calibration remains in control, as described below.

Performance Checks

Daily performance checks will be conducted prior to sample analysis to ensure instrumental precision and lack of bias. A mid-range standard (10.0 NTU) will be used. Acceptance criteria for turbidity results will be +/- 5%. In the event that performance checks conducted prior to field sampling indicate deviation of greater than 5%, the instrument will be re-calibrated prior to use.

Replicate Analysis

In accordance with EPA Method 180.1 (USEPA, 1993), replicate analysis will be performed for at least one sample collected on each day. During pre-construction phase, triplicate samples will be collected from the Downstream Control Station; during the construction phase, triplicate samples will be collected from the Impact Station. This will result in replicate analysis at a rate of at least 20% for all samples collected. Acceptable relative percent difference (RPD) for replicate analysis will be 20% or less.

Section 6.6.3 Quality Control Procedures for TSS Analyses

To assess the potential for error in the analysis of TSS in-stream samples, quality control procedures will be implemented including: calibration of balance in accordance with appropriate analytical methods (SM, 2012); daily temperature readings of ovens; analysis of blanks and known standards in conjunction with the analysis of each batch of samples analyzed for TSS, in accordance with analytical method SM 2540-D (SM, 2012). Replicate analysis will be conducted on at least five percent of the samples analyzed for TSS during analysis. Laboratory control limits for replicate analysis have been established at +/- 10% (SM, 2012).