WATER QUALITY MONITORING OF CHANNEL ISLANDS HARBOR, CITY OF OXNARD, VENTURA COUNTY

COMBINED MONITORING & QUALITY ASSURANCE PROJECT PLAN

OXN_CIH_QAPP_2023

Prepared by:

Aquatic Bioassay & Consulting Laboratories

29 N. Olive Street, Ventura CA 93001

For

The City of Oxnard

Department of Public Works

October 2023

A1. Title and Approval Sheets

Quality Assurance Project Plan

Project: Water Quality Monitoring of Channel Islands Harbor, City of Oxnard & Ventura County

Revision Date: October 2023

Organization(s): City of Oxnard

Approval Signatures

_____ _____

Michael L. Wolfe, P.E Date
Public Works Director, City of Oxnard

_____ _____

Karin Wisenbaker Date
Project QA Officer, Project Data Manager
Aquatic Bioassay & Consulting Laboratories

_____ _____

Amanda Rosenblum Date
Environmental Scientist
Los Angeles Regional Water Quality Control Board

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Erick Burres Date
Citizen Monitoring Coordinator
State Water Board

_____ _____

Julia Sudds Date
Laboratory QA Officer
Babcock Laboratories, Inc.

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TABLE 1. PROJECT DISTRIBUTION LIST

Organization	Title/Project Role	Contact Information
City of Oxnard	Assistant Public Works Director	(805) 385-7578
City of Oxnard	Special Districts Manager	SpecialDistricts@oxnard.org (805) 385-7578
City of Oxnard	Project Manager	CIHarbor@oxnard.org (805) 385-7578
Aquatic Bioassay & Consulting Labs	Project QA Officer, Project Data Manager	karin@aquaticbioassay.com (805) 643-5621 x17
LA Regional Water Quality Control Board	Environmental Scientist	Amanda.Rosenblum@waterboards.ca.gov (213) 576-6619
State Water Board	Citizen Monitoring Coordinator	Erick.Burres@waterboards.ca.gov (213) 576-6788
County of Ventura	Harbor Director	Michael.Tripp@ventura.org (805) 973-5950
Channel Islands Neighborhood Council	Volunteer Coordinator	Chuckcarter8@yahoo.com (949) 677-7284
Babcock Laboratories, Inc.	QA Officer	jsudds@babcocklabs.com (951) 653-3351 x238
Aquatic Eco-Technologies	Algal Population Analyst	dave@aquaticecotechnologies.com (213) 740-0230

A4. Project/Task Organization

Involved Parties and Roles

The City of Oxnard is the lead agency and responsible for all project management, oversight and coordination (Figure 1). The City of Oxnard's (City) **Public Works Director** or their designee, will be responsible for communications with the Los Angeles Regional Water Quality Control Board (LARWQCB), the State of California's Citizen Monitoring Program, and the Oxnard City Council. The City's **Project Manager** will oversee each phase of the project including project oversight and coordination, contract administration, and facilitate communications between Channel Islands Neighborhood Council (CINC), contract laboratories, and LARWQCB. The City's Project Manager will work in close relationship with CINC .

Karin Wisenbaker, from Aquatic Bioassay & Consulting Laboratories (Aquatic Bioassay), will be acting as both the Project QA Officer and Data Manager. She will review water quality monitoring results submitted to the California Environmental Exchange Network (CEDEN) by contract laboratories to ensure they meet project Data Quality Objectives (DQOs). Aquatic Bioassay will be responsible for the deployment, maintenance, and weekly data downloads for the remote sensors, and collection of water samples for chlorophyll-a and phytoplankton analysis. Additionally, they will process bacteria and toxicity samples.

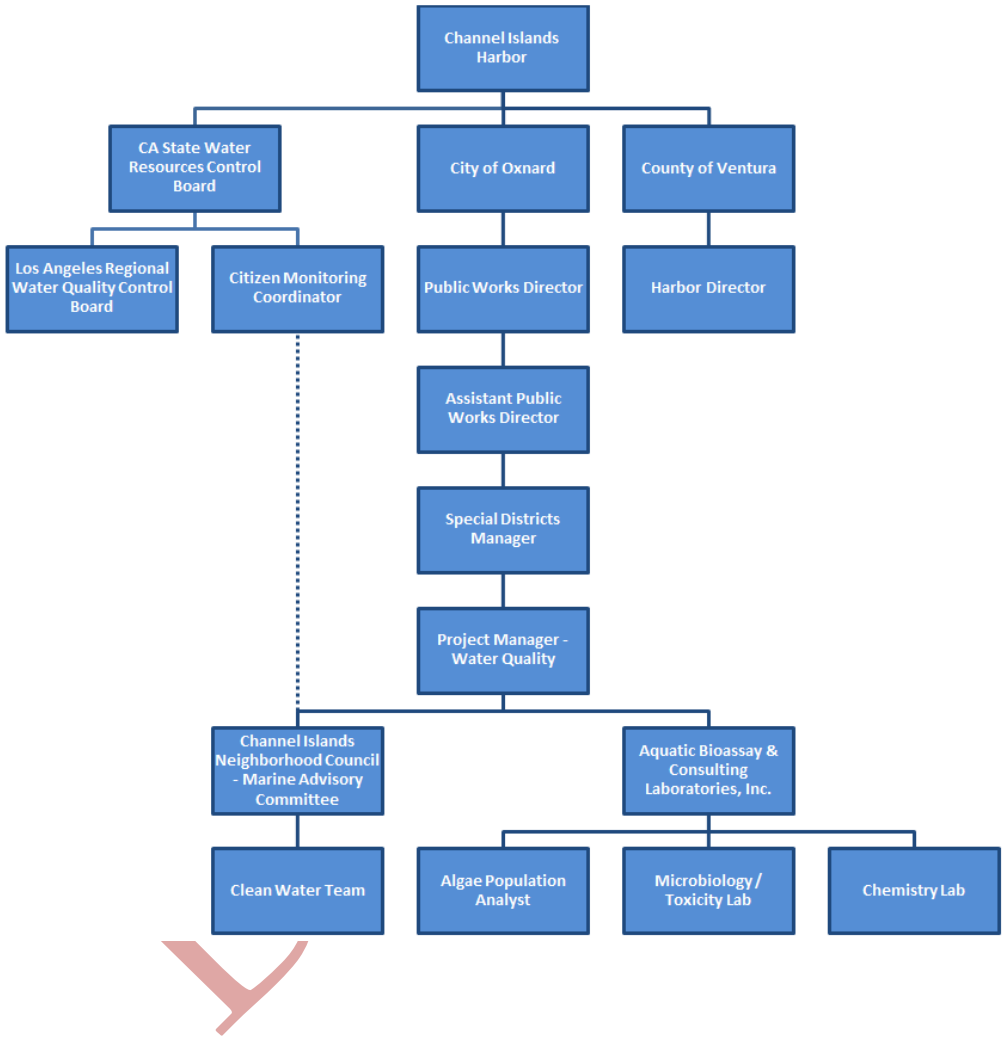
The Citizen Monitoring Coordinator, **Erick Burres**, will provide training to the CINC Volunteers for water sampling and collection of field measurements and observations. He will ensure that the volunteer team is aware of and adhering to specifications set forth in the sampling plan/QAPP.

The CINC Volunteer Coordinator is tasked with working with the City's Project Manager for scheduling sampling efforts, including volunteer field team mobilization and field training sessions.

Babcock Laboratories, Inc. (Babcock Labs) or their sub-contract laboratory, will perform water quality analysis on samples collected for this project, including nutrients, general chemistry, metals, chronic toxicity and pesticides. The Project Manager is **Alexandria Guerra** and the QA Officer is **Julia Sudds.** Aquatic EcoTechnologies (AET) will provide chlorophyll-a identification and algae (phytoplankton) population analyses. The City of Oxnard, or consultant, will calibrate the handheld water quality sensors . Aquatic Bioassay will perform the bacteria and toxicity analysis. All laboratories will adhere to the DQOs outlined in this document and notify the Project QA Officer when data does not meet these objectives. They will ensure the data generated for this project is sent to the Project QA Officer in a format in compliance with the CEDEN data submission guidelines.

Changes and updates to this QAPP may be made after review by the Project Manager, the Project QA Officer, and the Public Works Director or designee. The City's Public Works Director or designee will be responsible for making changes, submitting drafts for review, preparing a final copy, and submitting the final QAPP for signature.

FIGURE 1. ORGANIZATIONAL CHART



A5. Problem Definition/Background

Decisions, Actions and Outcomes

The erosion of water quality conditions in Channel Islands Harbor since the decommissioning of the Mandalay Power Generating Station has prompted the City and CINC to seek funding for mitigation projects. To secure funding for these projects, more water quality data is needed to help establish the key contaminants and their sources to the Edison Canal. This data will be provided to the regulatory agencies to determine if the Edison Canal, Mandalay Bay, the Channel Islands Harbor are impaired waterbodies that should be included on the State's list of impaired and threatened waterbodies (303(d) list).

Background

An algal bloom occurred in Channel Islands Harbor (CIH) in June 2018. The bloom was followed by widespread low dissolved oxygen in the water, presumably related to bacterial decomposition of the algae. The bloom and subsequent low oxygen event may have been related to changes in circulation in CIH that occurred after the cooling water pumps of the Mandalay Power Generating Station were decommissioned on March 29, 2018.

A hydrological study was conducted in response, using the Environmental Fluid Dynamic Code model. It concluded that the residence time of water in CIH has dramatically increased since the pumps were decommissioned. This could result in excessive algal growth and subsequent depletion of dissolved oxygen in the water when the bloom dies and is decomposed. Given the present long residence times of water in CIH, from 15 to 70 days, the possibility of additional algal blooms and low dissolved oxygen is concerning.

Nutrient sampling was conducted following two rain events and during two dry weather periods in fall 2018 and winter 2019 at stations located throughout the CIH back basins and the Canal. Nitrogen and phosphorus concentrations were elevated in the Edison Canal following wet weather and were much lower during dry weather. This indicated that there is a net influx of nutrients to the Canal, especially during wet weather. Combined with long retention times in the Canal (> 50 days), these elevated nutrient concentrations create an ideal habitat for algal blooms.

The City, in conjunction with Aquatic Bioassay and AET, initiated a multi-faceted long-term program to monitor and plan a strategy to address the situation. An automated sensor package was deployed in August 2018 to measure dissolved oxygen and chlorophyll fluorescence, a proxy for algal biomass. Four new instruments were deployed in March 2019 throughout the northern part of the CIH. Continuous monitoring of the data generated by these sensors has been instrumental in identifying emerging water quality events.

Faced with the prospect of continuous, long term degradation of water quality conditions in CIH, Harbor residents and the City began to explore mitigation pathways. It became clear that there was no short term, low cost solution. It is possible that capital projects including reductions in runoff from the surrounding agricultural fields, mechanical filtration or treatment of the water in the Canal will be necessary.

Regulatory Framework

The Los Angeles Region Basin Plan for Coastal Watersheds of Los Angeles and Ventura Counties (Basin Plan) designates key aquatic life beneficial uses for the Edison Canal, Mandalay Bay and Channel Islands Harbor. Among these beneficial uses is the preservation or enhancement of habitats, vegetation, fish, shellfish, or wildlife that live in marine or terrestrial environments, and the preservation or enhancement of water and food sources for wildlife.

As discussed in detail below, this project is designed to assess the aquatic life uses in the Harbor by monitoring water quality for a full suite of nutrients, chlorophyll-a and algal toxins, and phytoplankton identification. Monitoring will be conducted in several ways: using remote sensors that collect data on a continuous basis, weekly in-situ water quality measurements, and monthly in-situ water collection. The monthly monitoring will be scheduled for nine dry weather and three wet weather events for a total of 12 events per year. In addition, metals, organic pesticides, and toxicity will be measured during two dry weather and three wet weather events per year.

A6. Project/Task Description

Work Summary

The CIH Water Quality Monitoring Program is intended to build the dataset necessary to determine if sites in the Channel Islands Harbor, Mandalay Bay, and Edison Canal are meeting water quality objectives pertaining to aquatic life beneficial uses specified in the Basin Plan. The program is designed to answer three key questions that are important to the public, regulators and the City:

1. Do concentrations of nutrients, metals, and organic contaminants in the water column of Channel Islands Harbor, Mandalay Bay and Edison Canal support beneficial uses for aquatic life and meet other applicable regional or statewide water quality standards?
2. Are algae present in numbers that result in nuisance, harm to aquatic life, or eutrophic conditions?
3. Are harmful species of phytoplankton present, and is there evidence of algal toxins in the water column?

The sampling plan is based on sampling frequencies that include continuous collection and weekly, monthly, and wet and dry weather in-situ sampling (Table 2). These sampling frequencies will adhere to the following rules:

- Monthly sampling will occur concurrently with weekly sampling events.
- Wet weather sampling will occur concurrent with weekly and monthly sampling following storms during the rainy season (October 15th to May 15th). Dry weather sampling will occur concurrently with weekly and monthly sampling during the dry season (May 16th to October 14th).

- More than one wet weather sampling event may occur in the same month depending on the frequency of sample-able storms; therefore, monthly and wet event analytes might be collected during two storm events in the same month.
- Wet and dry weather event analytes should be sampled no more than five times per year.
- Wet weather samples may be collected in the same month, but the measurements should not be taken within seven days of each other.

Parameters to be measured and the sampling schedule are described below.

1. Continuous sampling:
    a. Collected at 15-minute intervals by remote sensors in two locations in the northern part of the CIH. The sensors will collect data on temperature, conductivity, salinity, dissolved oxygen and chlorophyll-a. Each sensor will be visited weekly by Aquatic Bioassay staff who will upload the newest dataset, and clean and maintain the sensors before placing them back in the water.

2. Weekly sampling:
    a. Water samples will be collected by Aquatic Bioassay staff at the two remote sensor locations for algae population, extracted chlorophyll-a, and domoic acid, which is an algal toxin. Algae population samples will be preserved in Lugol's solution and chlorophyll a and domoic acid samples will be frozen. Algae population and chlorophyll a samples will be analyzed by AET. If an algae species is identified in the population sample that could potentially produce domoic acid, the associated domoic acid sample will be analyzed by Babcock Labs or their sub-contract laboratory.

3. Monthly sampling will occur during nine dry weather periods and following three wet weather events:
    a. Using handheld sensors, water quality measurements will be collected by CINC volunteers in the field at 10 stations for temperature, pH, salinity, dissolved oxygen, and turbidity.
    b. CINC volunteers will monitor at 10 stations for nutrients including ammonia, nitrate-nitrite, total nitrogen, total phosphorus, and orthophosphate (soluble reactive phosphorus).
    c. CINC volunteers will monitor at 10 stations for boron, hardness as $CaCO_3$, sulfate, total dissolved solids, and total suspended solids.
    d. CINC volunteers will collect water samples for bacterial analysis at 10 stations. The samples will be analyzed for enterococcus bacteria by Aquatic Bioassay.

4. Weather dependent sampling:
    a. CINC volunteers will collect samples during three wet-weather sampling and two dry-weather events at 9 stations to monitor for metals, organic contaminants, and chronic toxicity.

TABLE 2. SAMPLING FREQUENCIES FOR GROUPS OF PARAMETERS BY STATIONS.

Station	Weekly (52/year)	Monthly (12/year)					3 Wet /2 Dry		
	Remote Sensor[1]	Field Measurements	Algae	Toxins	Bacteria	Nutrients/ General Chem	Metals	Organics	Toxicity
Oxn_CI-04		✓			✓	✓	✓	✓	✓
Oxn_CI-05		✓			✓	✓	✓	✓	✓
Oxn_CI-06	✓	✓	✓	✓		✓	✓	✓	✓
Oxn_CI-07	✓	✓	✓	✓		✓	✓	✓	✓
Oxn_CI-08		✓			✓	✓			
Oxn_CI-13		✓			✓	✓			
Oxn_CI-20		✓				✓	✓	✓	✓
Oxn_CI-28		✓			✓	✓	✓	✓	✓
Oxn_CI-30		✓			✓	✓	✓	✓	✓

1. Sensors will be cleaned and data will be downloaded on a weekly basis while sensors are deployed.

Project Schedule

This program is scheduled to begin in the Winter of 2023 and to continue until spring 2026 , after which time the LARWQCB begins reviewing data for the 2030 303(d) listing process (Table 3). The CINC volunteer monitoring team was trained for sampling by the Citizen Monitoring Coordinator immediately following the completion of the RB4_CIH_QAPP_2020 QAPP in the fall of 2020. Once sampling has begun, it will continue through the end of spring 2026. The monitoring may continue if additional funding is available. Data QC and validation will occur immediately as data results are returned to the Project Manager and QA Officer from the laboratories and data are loaded to the project database from the field data sheets and electronic data delivery. These data sets will be put into the correct formats and uploaded to CEDEN by the QA Officer. This ongoing data QC, management, and CEDEN upload effort will ensure the data are provided to the LARWQCB beginning in 2026 for the 2030 303(d) listing process.

TABLE 3. PROJECT SCHEDULE

Task	Winter 2023	Spring 2023	Summer 2023	Fall 2023	Winter 2024	Spring 2024	Summer 2024	Fall 2024	Winter 2025	Spring 2025	Summer 2025	Fall 2025	Spring 2026	2026
Quality Assurance Project Plan	✓													
Project mobilization & Training*	✓													
Sampling and analysis	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Data QC and validation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CEDEN data submittals		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2030 impaired waterbody listing process begins														✓

Geographic Locations

A total of 10 sampling locations have been identified that will be sampled for the constituents and frequencies described above (Table 4, Figure 4). .

TABLE 4. STATION LOCATIONS AND COORDINATES.

Site	Latitude	Longitude
Oxn_CI-04	34.186739	-119.232246
Oxn_CI-05	34.197614	-119.235964
Oxn_CI-06	34.188082	-119.223384
Oxn_CI-07	34.188907	-119.229818
Oxn_CI-08	34.179458	-119.222370
Oxn_CI-13	34.175949	-119.223778
Oxn_CI-20	34.182590	-119.233721
Oxn_CI-28	34.193819	-119.235190
Oxn_CI-29	34.202961	-119.238601
Oxn_CI-30	34.206672	-119.247453

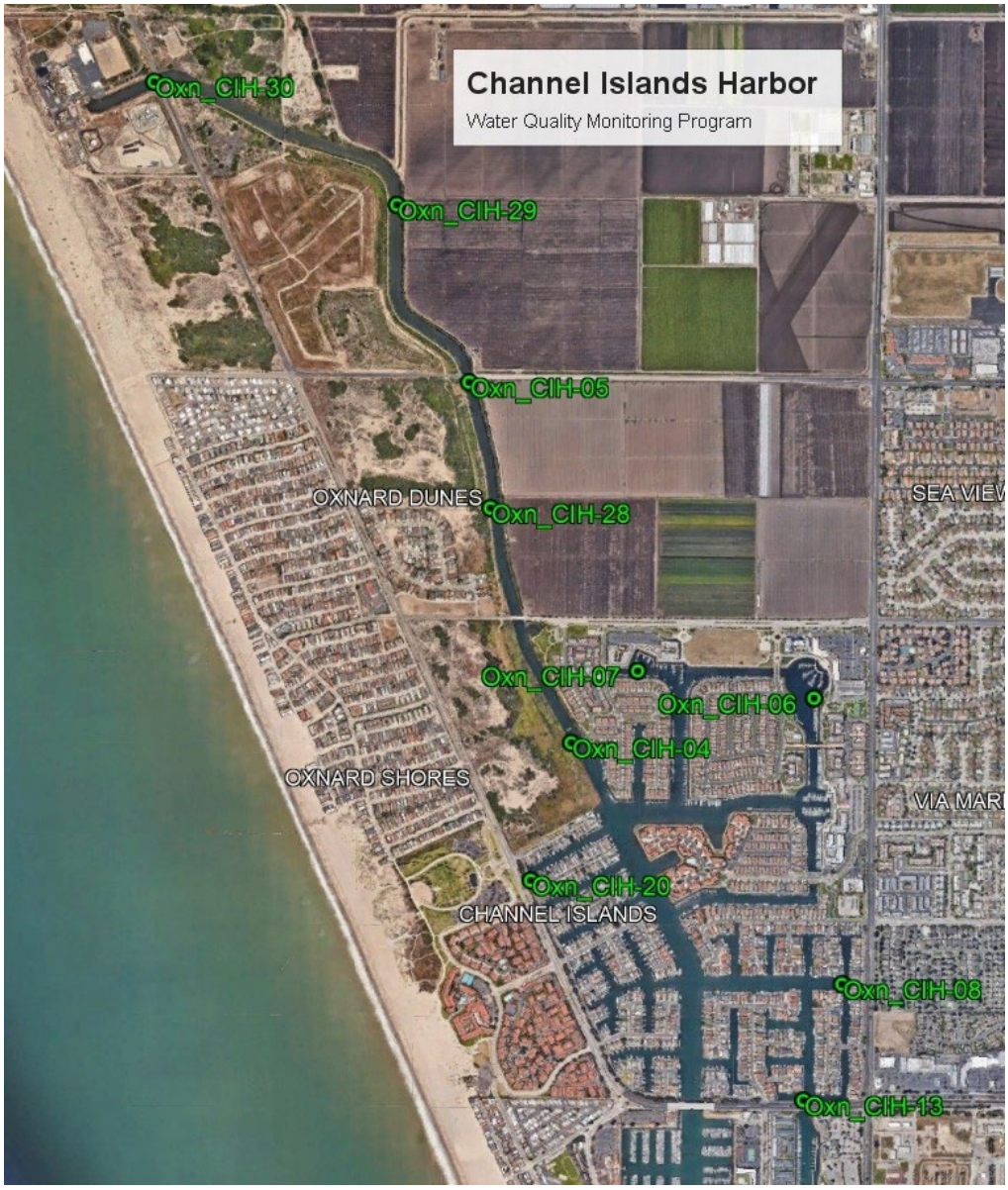


FIGURE 2. MAP OF STATION LOCATIONS.

Resource and Time Constraints

The key time constraint for this project is providing the required data to the Los Angeles Regional Water Quality Board by October 2024 to have CIH and Edison Canal included on the 2026 list of impaired water bodies. Resource constraints include the availability of the Babcock Laboratories for most of the sample analyses, budget resources, and availability of CINC volunteers to conduct sampling.

A7. Quality Objectives and Criteria

Table 5 and Table 6 summarize the DQOs for each field and laboratory measured constituent. Whenever possible, the methods with the greatest sensitivity and lowest detection limit will be employed as the primary methods. Table 5 shows the applicable DQOs for each type of measurement or analysis. A description of the quantitative DQOs to be considered is provided below.

TABLE 5. PROGRAM MEASUREMENT AND ANALYSES TYPES WITH ASSOCIATED DQOS.

Measurement or Analyses	Data Quality Objective
Continuous Monitoring	Accuracy, Completeness
Field Measurements	Accuracy, Completeness
Bacterial Analyses	Precision, Accuracy, Completeness
Water Organics Analyses	Accuracy, Precision, Recovery, Completeness
Trace Metals Analyses	Accuracy, Precision, Recovery, Completeness
Nutrient/General Analyses	Accuracy, Precision, Recovery, Completeness
Algae and Toxins	Accuracy, Completeness

Quantitative Objectives

Accuracy

Accuracy describes how close the measurement is to its true value. Accuracy is determined by measuring a sample of known concentration and comparing the known value against the measured value. The accuracy of measurements and laboratory analyses are listed in Table 6.

Continuous monitoring: The accuracy of the continuous monitoring logger is described by the manufacturer of the instrument. To maintain accuracy, the logger is sent to the manufacturer annually to be calibrated.

Field measurements: The accuracy of in-situ field measurements (e.g. temperature, pH, DO, conductivity, turbidity) is described by the manufacturer(s) of the instruments. To ensure accuracy for in-situ field measurements during this program, the field probes will be calibrated by the City of Oxnard, or consultant, before every sampling event and these calibration records will be maintained by the City of Oxnard.

Laboratory measurements (chemistry): The accuracy of laboratory measurements will be checked by performing tests on Quality Control Standards (QCs) prior to and/or during sample analysis at the

contract laboratories. Quality Control Samples (QCs) containing a known concentration of each parameter are purchased from a certified outside/reputable source or may also be prepared by a professional partner, e.g. a commercial or research laboratory. The concentration of the standards will be unknown to the analyst until after measurements are determined.

Bacteria: Accuracy criteria for bacterial testing will be based on positive and negative control testing rather than numerical limits owing to the difficulty in preparing solutions of known bacterial concentration.

Toxicity Testing: The reliability of toxicity testing results depends on the quality of test organisms, testing conditions and the expertise of laboratory personnel. For each test organism there are numerous test conditions and reference toxicant criteria that must be met before the result can be accepted.

Precision

Precision describes how well repeated measurements agree. The precision objectives apply to duplicate and split samples taken during field sampling and laboratory analysis. In accordance with protocols described by SWAMP, these field and laboratory splits are two grab samples collected in rapid succession or two aliquots from the same composite sample, respectively. The accuracy of measurements and laboratory analyses are listed in Table 6. Field measurements: During field sampling, duplicate samples will be collected at five percent of the sampling sites to evaluate the precision of the sampling technique and to assess short-term environmental variability at the sample site.

Laboratory measurements (chemistry): For each laboratory analysis, one sample is analyzed in duplicate at the rate of one per sample batch, or 1 in 20 samples, whichever is more frequent, to demonstrate the precision of the analytical measurement. The relative percent difference (RPD) between the measured sample and split/ duplicate sample is used to qualify the precision of the measurement (Equation 1).

$$RPD = \left| \frac{(X_1 - X_2)}{(X_1 + X_2)/2} \right| * 100$$

Where:

X_1: is the concentration of the original sample

X_2: is the concentration of the duplicate sample

For most chemical constituents listed in Table 6, the RPD between duplicate samples should not exceed 25%.

Toxicity Testing: The precision objectives for toxicity testing apply to laboratory reference toxicant tests and USEPA DMR studies. Reference toxicant results for each species should fall within ± 2 standard deviations (SD) of the mean of the preceding 20 tests. A reference toxicant test is run with each batch of test samples. The laboratory must participate in the USEPA DMR testing annually and meet the precision standards of this program.

Recovery

Recovery is the accuracy of an analytical measurement compared to a known parameter addition to a sample. The recovery of a sample can vary widely depending on the matrix (e.g. freshwater vs brackish water), therefore matrix spike and matrix spike duplicates are used to demonstrate the performance of the method in a medium. The matrix spike sample is prepared by adding a spike, a known concentration

of a parameter, to a replicate sample at a concentration at least ten times the method detection limit (MDL). If there is limited sample volume, the laboratory may substitute laboratory control spikes (LCS) in place of matrix spikes.

$$\% \text{ Recovery} = \left| \frac{(X_1 - X_2)}{X_3} \right| * 100$$

Where:

X_1: is the concentration of the spiked sample

X_2: is the concentration of the original (un-spiked) sample

X_3: is the concentration of the spike added

Matrix spikes and matrix spike duplicates (LCS and LCS dups) will be analyzed at a frequency of one pair per sample batch, or one in 20 samples, whichever is more frequent. The DQO for recovery outside of this acceptable range indicates an analytical process that is not being performed adequately for that parameter (Table 6). In this case, an attempt to correct the problem (prepare batch again, by dilution, change spike concentration, etc.) will be made and the samples and the matrix spikes will be reanalyzed. If the matrix spike problem cannot be corrected, the results should be flagged with a QA code.

Laboratory Blanks

Laboratory blanks are performed to demonstrate that the analytical procedures do not result in sample contamination. Laboratory blanks will be prepared and analyzed by the contract laboratory at a rate of at least one for each analytical batch. Method blanks will consist of laboratory-prepared blank water processed along with the batch of environmental samples. The laboratory blank should be prepared and analyzed before analysis of the associated environmental samples. If the result for a single method blank is greater than the RL the source(s) of contamination should be corrected, and the associated samples should be reanalyzed. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of contamination.

Sensitivity and Method Detection Limits

The MDL is the lowest detectable concentration for the instrument, chemical procedure, or equipment. This is important because it can never be shown that a pollutant was not present, only that it was not detected. Sensitivity refers to the detectable differences in concentration for test instruments and is therefore represented by the number of decimal places. The desired method detection limits and sensitivity of field and laboratory measurements are described by SWAMP for some parameters. For other parameters, the target reporting limits are provided by the analytical laboratory. These represent the lowest amount of a parameter in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (i.e. the lower limit of quantitation). The reporting level for chronic toxicity tests is dependent on the sample dilutions tested. In this study, we will be using 100% sample compared to a laboratory control. Therefore, results could be reported from 0 to 100% survival.

Qualitative Objectives

Completeness

Completeness is the fraction of the planned data that must be collected in order to fulfill the statistical criteria of the project. It is expected that 90% of all measurements can be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems. Completeness will be determined by comparing the number of measurements that were planned to those collected that were also deemed valid. An invalid measurement would be one that does not meet the sampling methods requirements and the data quality objectives. Completeness of results will be checked monthly. This will allow for identification and correction of problems.

Comparability

Comparability of the data can be defined as the similarity of the data generated by different monitoring programs and is important for the utility of the data in the state database. To ensure the comparability of data collected in this monitoring program to other regional and statewide datasets, all sampling and analysis procedures follow standard protocols such as those described by SWAMP. Additionally, comparability of analytical data is addressed by analysis of certified reference materials.

Representativeness

Representativeness, which describes the degree to which the environmental data generated by the monitoring program accurately and precisely represents the actual environmental conditions. Specifically, representativeness of the data is addressed by selecting appropriate locations (e.g., generally not less than 200 meters apart), methods, times, and frequencies of sampling for each environmental parameter, and by maintaining the integrity of the sample after collection.

Bias

Sampling and analytical bias occurs when there is a systematic misrepresentation of a measurement process. This may occur from improper data collection, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods or techniques. Bias can be minimized by ensuring field crew members have completed field training on proper sampling techniques, field probe calibration, and collecting field duplicates, and that chemistry/toxicity laboratories follow DQOs.

TABLE 6. DATA QUALITY OBJECTIVES FOR FIELD AND LABORATORY MEASUREMENTS.

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Continuous Water Quality Measurements								
Dissolved Oxygen	None	± 0.5 mg/L or 10%	N/A	Manufacturer Factory Calibration	90%	ABCL	N/A	mg/L
Temperature	None	± 0.5 °C	N/A			ABCL	N/A	°C
Specific Conductivity	None	± 10%	N/A			ABCL	N/A	µS/cm
Salinity	None	N/A	N/A			ABCL	N/A	ppt
Chlorophyll a	None	± 10%	N/A			ABCL	N/A	µg/L
Field Water Quality Measurements								
Dissolved Oxygen	None	± 0.5 mg/L or 10%	N/A	1 point calibration	90%	City of Oxnard	N/A	mg/L
Temperature	None	± 0.5 °C	N/A	2 point calibration (Annually)		City of Oxnard	N/A	°C
Salinity	None	N/A	N/A	N/A		City of Oxnard	N/A	ppt
pH	None	± 0.2	N/A	2 point calibration		City of Oxnard	N/A	pH units
Turbidity	None	± 0.2 or 10%	N/A	2 point calibration		City of Oxnard	N/A	NTU
Turbidity (Secchi)	None	NA	N/A	NA		City of Oxnard	N/A	m
Bacterial Analysis: Freshwater								
Enterococcus	None	Laboratory positive and negative cultures	80 - 120%	Laboratory Duplicate - RPD < 25%	90%	ABCL	10	MPN/100 mL
Algae								
Chlorophyll a	Particulate	NA	NA	NA	90%	AET	0.025	ug/L
Phytoplankton	N/A					AET	N/A	Identification
Toxins[1]		Reference Material (CRM, SRM or LCS)	80 - 150%	Reference Material Duplicate - RPD < 25%	90%			
Domoic Acid	Particulate					Babcock[2]	0.625	ug/L
Nutrients								
Ammonia as N	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	Babcock	0.01	mg/L
Nitrate+Nitrite as N	Total					Babcock	0.2	mg/L
Total Kjeldahl Nitrogen	Total					Babcock	0.2	mg/L
OrthoPhosphate (SRP)	Total					Babcock	0.05	mg/L
Total Phosphorus as P	Total					Babcock	0.05	mg/L
Total Nitrogen	Total					Babcock	N/A (Caluculated)	mg/L
Genral Chemistry						Babcock		
Boron	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	Babcock	0.1	mg/L
Hardness as CaCO3	Total					Babcock	3	mg/L
Sulfate	Total					Babcock	1	mg/L
Total Dissolved Solids	Total					Babcock	10	mg/L
Total Suspended Solids	Total					Babcock	2	mg/L
Chronic Toxicity								
Americamysis bahia	N/A	Meets EPA control response standards; DMR intralab results w/in criteria	N/A	Ref Tox ± 2 SD of preceding 20 tests	90%	ABCL	N/A	Survival (%)
Metals								
Copper	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	75 -125% (70 - 130 % for Hg)	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	Babcock	10	µg/L
Mercury	Total					Babcock	0.2	µg/L
Nickel	Total					Babcock	20	µg/L
Selenium	Total					Babcock	5	µg/L
Organochlorine Pesticides								
DDD(o,p')	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	Babcock	0.5	µg/L
DDD(p,p')	Total					Babcock	0.5	µg/L
DDE(o,p')	Total					Babcock	0.5	µg/L
DDE(p,p')	Total					Babcock	0.5	µg/L
DDE(p,p')	Total					Babcock	0.5	µg/L
DDT(o,p')	Total					Babcock	0.5	µg/L
DDT(p,p')	Total					Babcock	0.5	µg/L
Aldrin	Total					Babcock	0.5	µg/L

1. Domoic Acid will only be analyzed when plankton samples showpotential algae that may produce domoic acid.
2. Babcock Laboratories will send samples to a sub-contracted laboratory.
3. Reporting limits may vary due to changes in preparation ratios and dilutions.

. TABLE 6. CONTINUED

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
b-BHC	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	Babcock	0.06	µg/L
Chlordane	Total					Babcock	0.1	µg/L
d-BHC	Total					Babcock	0.09	µg/L
Dieldrin	Total					Babcock	0.02	µg/L
Endosulfan I	Total					Babcock	0.14	µg/L
Endosulfan II	Total					Babcock	0.04	µg/L
Endosulfan Sulfate	Total					Babcock	0.66	µg/L
Endrin	Total					Babcock	0.06	µg/L
Endrin Aldehyde	Total					Babcock	0.23	µg/L
Heptachlor	Total					Babcock	0.01	µg/L
Heptachlor Epoxide	Total					Babcock	0.01	µg/L
Lindane	Total					Babcock	0.04	µg/L
Methoxychlor	Total					Babcock	1.8	µg/L
Toxaphene	Total					Babcock	1	µg/L
Decachlorobiphenyl	Total					Babcock	0.01	µg/L
Pyrethroid Pesticides								
Bifenthrin	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	Babcock[2]	2	µg/L
Cyfluthrin	Total					Babcock[2]	2	µg/L
Cypermethrin	Total					Babcock[2]	2	µg/L
Deltamethrin/TralomethrinDichloran	Total					Babcock[2]	2	µg/L
Fenpropathrin (Danitol)	Total					Babcock[2]	2	µg/L
Fenvalerate/EsfenvalerateL-Cyhaloth	Total					Babcock[2]	2	µg/L
Pendimethalin	Total					Babcock[2]	2	µg/L
Permethrin	Total					Babcock[2]	5	µg/L
Prallethrin	Total					Babcock[2]	2	µg/L
Sumithrin (Phenothrin)	Total					Babcock[2]	2	µg/L
Tefluthrin	Total					Babcock[2]	2	µg/L
Organophosphorus Pesticides								
Bolstar	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	Babcock	0.05	µg/L
Chlorpyrifos	Total					Babcock	0.05	µg/L
Demton	Total					Babcock	0.05	µg/L
Diazinon	Total					Babcock	0.05	µg/L
Dichlorvos	Total					Babcock	0.05	µg/L
Dimethoate	Total					Babcock	0.05	µg/L
Disulfoton	Total					Babcock	0.05	µg/L
Ethoprop	Total					Babcock	0.05	µg/L
Fenthion	Total					Babcock	0.05	µg/L
Malathion	Total					Babcock	0.05	µg/L
Merphos	Total					Babcock	0.05	µg/L
Methyl parathion	Total					Babcock	0.05	µg/L
Mevinphos	Total					Babcock	0.05	µg/L
Phorate	Total					Babcock	0.05	µg/L
Tokuthion	Total					Babcock	0.05	µg/L
Trichloronate	Total					Babcock	0.05	µg/L

1. Domoic Acid will only be analyzed when plankton samples show potential algae that may produce domoic acid.
2. Babcock Laboratories will send samples to a sub-contracted laboratory.
3. Reporting limits may vary due to changes in preparation ratios and dilutions.

A8. Special Training/Certifications

Sampling conducted for this project will be completed under the guidance of the City of Oxnard. The City of Oxnard will provide oversight and Aquatic Bioassay will aid with mobilization, training, data management and reporting as needed. Because this project is currently using citizen volunteers, the State Water Board Citizen Monitoring Coordinator has agreed to provide training on sample collection, handling and organization. The Coordinator will provide volunteers with technical assistance, training, and data management consultation. Training responsibilities will include:

1. Mobilization: sampling logistics, worksheets, communications (Citizen Monitoring Coordinator, Aquatic Bioassay)
2. Field probe calibration (City of Oxnard Wastewater Laboratory)
3. Water quality sampling: sampling technique, clean technique, sample handling, field observations, sample shipping (Citizen Monitoring Coordinator)

The CINC Volunteer Coordinator will ensure all members of the CINC volunteer field crew receive training prior to the first sampling event. Field training events will be documented with a sign-in sheet listing attendees, course time and date, instructor, and handouts. New field crew members must attend training before they are authorized to participate in sampling events. Training documentation will be maintained by the City of Oxnard. Training will be conducted as necessary.

Each participating laboratory is certified by the State of California's Environmental Laboratory Accreditation Program for the areas of testing for which they are responsible.

A9. Documentation and Records

The document hard copies generated by this project will be stored at each of the participating laboratories (Babcock Labs, Aquatic Bioassay, and AET) for the duration of the project (Table 7).

Field worksheets, chain of custody forms, laboratory bench sheets, QA/QC documentation and data results will be available for review by the Project QA Officer upon request.

Parties responsible for maintaining records for this project are as follows. The City of Oxnard will maintain all forms related to sample collection, sample transport, chain of custody, and field analyses, all records associated with the receipt and analysis of samples analyzed for all parameters, and all records submitted by the laboratories. Babcock Labs, City of Oxnard, Aquatic Bioassay and AET officers will maintain records for water quality chain of custody and bench sheets. All laboratories will make their records available to the Project Manager or QC Officer upon request. The Project Manager will oversee the actions of the responsible parties and will arbitrate any issues relative to records retention and any decisions to discard records.

All field results will be recorded at the time of completion using standardized field data sheets. Data sheets will be reviewed for outliers and omissions before leaving the sample site by the CINC Volunteer Coordinator. Chain of custody forms will be completed for all samples before leaving each sampling site. Data sheets and chain of custody forms will be stored by the City of Oxnard .

D ata from this project will be made publicly available after receipt by the Water Board from Babcock Labs and the City of Oxnard. The final electronic version of the database will be maintained by the City of Oxnard. Final datasets will be electronically submitted to CEDEN by the Project QA/Data Manager.

TABLE 7. DOCUMENT AND RECORD RETENTION, ARCHIVAL, AND DISPOSITION INFORMATION; DB = DATABASE

	Identify Type Needed	Retention	Archival	Disposition
Station occupation log	Notebook	Paper	Notebook; Db	5 years
	Field data sheet	Paper	Notebook; Db	5 years
Sample collection records	Chain of custody	Paper	Notebook	5 years
Analytical records	Lab notebooks	Paper	Notebook	3 years
	Lab results QA/QC	Paper and electronic	Notebook; Db	5 years
	Electronic data file	Electronic	Db	10 years
Data records	Data entry	Electronic	Db	Indefinite
Assessment records	QA/QC assessment	Paper and electronic	Document	Indefinite
	Final Report	Paper and electronic	Document	Indefinite

Db = database

B1. Sampling Process Design

A detailed monitoring plan, "Channel Islands Harbor Water Quality Monitoring Program" is posted on the City of Oxnard's website (https://www.oxnard.org/city-department/publicworks/channel-islands-harbor-water-quality/). This sampling plan includes information regarding design strategy, the type and total number of samples and matrices, and site identification. The sampling plan is based on sampling frequencies that include continuous, weekly, monthly and wet/dry weather sampling. The parameter list has been taken from the Ventura County Agricultural Irrigated Lands Group's Monitoring and Reporting Plan (February 2017). The intent of the sampling design is to determine if the concentrations of these contaminants exceed water quality standards in the Edison Canal, Mandalay Bay, and Channel Islands Harbor.

Sampling site locations are a subset of the locations used in the 2018 Channel Islands Harbor Nutrient Study (Table 4, Figure 2). Sites are in surface (receiving) waters near non-point source inputs, and where samples can be safely taken. Samples will be identified as follows: CIH01, CIH02, etc. To maintain spatial independence, all sites are located at least 200 meters away from one another.

Wet weather sampling will be conducted during the wet season (October 15 to May 15) following storm events that are forecasted to produce at least 0.25 inches of precipitation. This amount was chosen because it should generate significant runoff into the Edison Canal, Mandalay Bay and Channel Islands Harbor. Rainfall measurement will be determined using as a rain gauge at the City of Oxnard Civic Center (see Station H032 – Oxnard Civic Center (OXDC1) at:
https: //www.vcwatershed.net/fws/gmap.html).

Wet weather sampling shall occur within 24 hours after the start of rainfall to capture the first flush, if possible, and sampling events will be at least 96 hours apart. First flush is defined as the initial surface runoff of the rainstorm. During this phase, water pollution entering storm drains in areas with high proportions of impervious surfaces is typically more concentrated compared to the remainder of the storm. Actual rainfall will be tracked and recorded.

Dry weather samples will be collected during the dry season (May 16th to October 14th) following at least seven days of dry weather. If a storm event occurs during the dry season, sampling will be postponed for seven days.

Sampling frequencies and parameters to be measured include (Table 2 and Table 6):

1. Remote sensor data will be collected at 15-minute intervals at two locations in the CIH for temperature, conductivity, dissolved oxygen and chlorophyll-a.
2. Weekly sampling:
    a. Field water quality measurements will be collected weekly by CINC volunteers or consultant at 10 stations. They will use handheld sensors to monitor temperature, pH, salinity, dissolved oxygen, and turbidity.
    b. Extracted chlorophyll a, algae population, and domoic acid samples will be collected by Aquatic Bioassay weekly at the two remote sensor stations (stations 6 and 7). The chlorophyll-a and domoic acid samples will be filtered in the field by Aquatic Bioassay. AET will analyze the chlorophyll-a and algae population samples. If algae that may produce domoic acid, a harmful algal toxin, are present in the algae population sample, the domoic acid sample will be sent to Babcock Labs for analysis.

3. Monthly sampling:
    a. Field water quality measurements will be collected monthly by CINC volunteers or consultant at 10 stations. They will use handheld sensors to monitor temperature, pH, salinity, dissolved oxygen, and turbidity.
    b. Nutrients and general chemistry parameters including ammonia, nitrate, total nitrogen, orthophosphate, total phosphorus, boron, hardness, sulfate, total dissolved solids, and total suspended solids will be collected at all 10 stations by CINC volunteers. These constituents will be collected during **nine** dry weather and **three** wet weather events. Each of these samples will be analyzed by Babcock Labs.
    c. Metals (copper, mercury, nickel and selenium), chronic toxicity (*Americamysis bahia;* chosen for its sensitivity to metals and pesticides), and a suite of organic compounds (organochlorine pesticides, pyrethroid pesticides, and organophosphorus pesticides), will be collected by CINC volunteers at 9 stations. These constituents will be analyzed by Babcock Labs. These constituents will be collected during **two** dry weather and **three** wet weather events.
    d. Water samples will be collected for bacteria analysis at 6 stations. The samples will be analyzed for enterococcus bacteria by Aquatic Bioassay.

If during sampling, any site becomes inaccessible due to weather conditions, safety, or is otherwise inaccessible, the sampling team will immediately inform the Project Manager and the QA Officer. They will coordinate to restore site access, ensure the data for that event are properly QC flagged in the data set, and determine if the site should be dropped or if a new site should be established. They will also communicate any sampling design changes to the entire Project team.

All samples will be delivered to the laboratories before holding times expire (Table 8).

B2. Sampling Methods

All samples will be collected using the field collection procedures as described in the SWAMP Compendium guidelines: (https://www.waterboards.ca.gov/water_issues/programs/swamp/cwt_guidance.html). Sample types, preservations, analysis methods and holding times are presented in Table 8. Field sampling procedures are presented in Appendix B. If the field manual is updated or revised, the updated or revised chapter will be used for the subsequent sampling event(s). Any revisions/updates to chapters will be documented in an amendment to the QAPP.

The Project Manager should be contacted immediately if the sampling teams encounter problems while in the field. Any deviations from the QAPP will be noted on the datasheets and the Project Manager and QA Officer will be informed immediately. The Project Manager and QA Officer will decide if corrective actions and/or retraining is needed.

Mobilization

The Project Manager will schedule sampling events with the CINC team to ensure sampling frequencies for each parameter are met. The Project Manager will contact the chemistry laboratories at least two weeks before dry weather events to order the appropriate pre-cleaned sample bottles for each sample type. For the first wet weather event of the year, sample bottles will be ordered before September 15th to be ready for the beginning of the rainy season (October 15th). The lab will ship pre-cleaned

containers, including the correct preservative if required, as specified in Table 8. The Project Manager, consultant, or Volunteer Coordinator will ensure that the appropriate number of datasheets (Appendix A, Figure 3), bottle labels and chain of custody forms are printed for sampling at each station. The following equipment is required for each sampling event:

- Station maps and coordinates
- Waterproof labels
- Datasheets printed on waterproof paper
- Pens/pencils/sharpies
- GPS
- In situ probe - Hach HQ40d (or equal)
- Turbidity meter - Hach 2100Q
- Extra batteries
- Powder-free nitrile gloves
- Water grab sampling pole
- Sample containers
- Bubble wrap or bubble wrap bags (for glass containers)
- Ice chest(s)
- Wet (water) ice
- 100 mL graduated cylinder
- Chlorophyll a and toxins kit
    - Syringe
    - Syringe plunger
    - Swinnex filter
    - GF/F filter
    - Tweezers
    - Filter tube with cap

All field instruments will be calibrated according to the manufacturer's instructions at the beginning of each sampling day and checked at the end of each day. Field instrument calibration records will be maintained by the organization conducting the calibration. All sampling devices will be cleaned before use with a residue free detergent (e.g. Alconox). The number of coolers needed for each sampling event will vary based on the parameter list. The minimum number of coolers required is as follows:

- Weekly monitoring – 1 cooler
- Monthly monitoring – 3 coolers
- Monthly monitoring and dry/wet weather events – 8 coolers

TABLE 8. SAMPLE TYPES, PRESERVATIVES METHODS AND HOLD TIMES.

Parameter	Bottle Type	Preservative	Method	Maximum Holding Time
Bacteria				
Enterococcus	Sterile Plastic	≤ 6 °C, Sodium thiosulfate	SM 9230 D	8 hours
Nutrients				
Ammonia as N	HDPE Plastic	≤ 6 °C, acidify with H_2SO_4	SM 4500-NH3	48 hours; 28 days if acidified
Nitrate+Nitrite as N	HDPE Plastic	≤ 6 °C, acidify with H_2SO_4	EPA 353.2	48 hours; 28 days if acidified
Total Kjeldahl nitrogen	HDPE Plastic	≤ 6 °C, acidify with H_2SO_4	EPA 351.2	48 hours; 28 days if acidified
Total nitrogen	NA	NA	Calculated	NA
Orthophosphate (SRP)	HDPE Plastic	≤ 6 °C	SM 4500-PO4 E	48 hours
Total phosphorus	HDPE Plastic	≤ 6 °C, acidify with H_2SO_4	SM 4500-P B	28 days
Algae				
Chlorophyll-a	Filter	≤ 6 °C then freeze to ≤ -20°C	EPA 445	4 hours at ≤ 6 °C; 24 days at ≤ -20°C
Phytoplankton Identification	Amber Glass	≤ 6 °C, Lugol's Solution	Microscopy	6 months
General Chemistry				
Boron	HDPE Plastic	≤ 6 °C, acidify with HNO_3	EPA 200.7	6 months
Hardness as $CaCO_3$	HDPE Plastic	≤ 6 °C, acidify with HNO_3	SM 2340B	6 months
Sulfate	HDPE Plastic	≤ 6 °C	EPA 300	28 days
Total dissolved solids	HDPE Plastic	≤ 6 °C	SM 2540 C	7 days
Total suspended solids	HDPE Plastic	≤ 6 °C	SM 2540 C	7 days
Metals				
Copper, mercury,	HDPE plastic	≤ 6 °C, acidify with HNO_3	EPA 200.7	6 months after

nickel, selenium				filtration and acidification
Organics				
Organochlorine pesticides, Toxaphene	Glass	≤ 6 °C, Sodium thiosulfate	EPA 8081/8270	7 days until extraction, 40 days after extraction
Pyrethroid pesticides	Glass	≤ 6 °C	EPA 8270	7 days until extraction, 40 days after extraction
Organophosphorus pesticides	Glass	≤ 6 °C, Sodium thiosulfate	EPA 625	7 days until extraction; 40 days after extraction
Toxins				
Domoic acid[1]	Filter	Cool to 6°C for up to 6 hours, then freeze to ≤ 20°C	ELISA	28 days after freezing
Toxicity				
Americamysis bahia, 7 day chronic test	Plastic	4 °C	EPA-821-R-02-014a	36 hours (72 hours after storm event)

1. Domoic acid will only be analyzed when plankton samples are shown to contain algal species that may produce domoic acid.

In Situ and Water Sample Collection

The CINC volunteer field crews will confirm they have all necessary equipment and paperwork before sampling begins. Field crews, in teams of at least two, will be mobilized when sampling conditions are safe. In situ water quality measurements, observations and GPS coordinates will be recorded on the datasheets. All sampling locations are accessible from a boat, dock, or the shoreline. Water samples will either be collected directly, or sample bottles may be attached to a grab sampling pole. A surrogate bottle appropriate for the specific analysis or field measurement may be used for bottles with preservative. All bottles will be labeled with:

- Project name
- Station ID
- Sample date
- Sample time
- Bottle number (e.g. 1 of 1, 1 of 2)
- Field duplicate (if necessary)

Samples must be collected at the GPS coordinates specified in this plan. Deviations from these locations must be approved by the Project Manager and Project QA Officer.

Grab samples, except for phytoplankton, will be collected at or below the water's surface. At each sampling location, all sample bottles/containers designated for a suite of analytes (e.g. nutrients) will be filled sequentially before containers designated for another type of analyte (e.g. metals) are filled. If a field duplicate of a certain analyte is to be collected at a given location, all containers designated for both the sample and field duplicate will be filled sequentially before containers for another analyte are filled. A graduated cylinder will be used to measure 100 mL of sample water for phytoplankton samples.

Once sampling is complete, samples will be sent to the laboratories for analysis. Field chain of custody forms will be reviewed, and sample containers will be inventoried before signing chain of custody forms with a blue pen. Sample bottles will be placed in laboratory specific coolers and a laboratory specific chain of custody will accompany the samples from the City to the laboratories. The Project Manager will fill out, sign, and make a copy of the laboratory chain of custody form. The original form will be placed in a large plastic bag with locking top and taped to the inside of the cooler lid. The copies of the lab chain of custody form will be stored by the City. If samples are shipped via a commercial shipping company (e.g. UPS, FedEx, GSO, etc.), coolers will be lined with a large trash bag before adding wet ice and the sample containers. The bag will be tied off to prevent leakage during shipping.

Samples will be transferred to the analytical laboratories within the holding times specified in Table 8. Chemistry samples will be delivered to Babcock Labs. Samples for bacteria, toxicity, phytoplankton populations and chlorophyll a will be collected by the Aquatic Bioassay field team, brought to the Aquatic Bioassay lab and then shipped or delivered to AET for analysis. Sample delivery and shipping information is as follows:

City of Oxnard
Special Districts Division
1060 Pacific Ave., Building 1
Oxnard, CA 93030
(805) 385-7578

Babcock Laboratories, Inc.
Alexandria Guerra
6100 Quail Valley Court
Riverside, CA 92507
(951) 653-3351 x238

Aquatic Bioassay & Consulting Laboratories
Karin Wisenbaker
29 N. Olive Street
Ventura, CA 93001
(805) 643-5621 x17

Continuous Monitoring Sensors

Continuous monitoring sensors will be pulled from the water by Aquatic Bioassay staff and cleaned weekly to remove biological growth. Sensor data will be maintained for the durations included in Table 7.

B3. Sample Handling and Custody

Samples will be collected, stored at the proper temperature and transferred to the analytical laboratories within the holding times specified in Table 8. The Project Manager is responsible for ensuring that the field crew adhere to proper custody and documentation procedures. To provide for proper tracking and handling of the samples, chain of custody forms (Appendix A, Figure 4) will accompany the samples from the initial collection to the final identification and analysis are to be filled out and signed when there is a change of custody of the samples.

Whether shipping overnight or delivering via courier, all samples should be securely sealed and packaged to eliminate the chances for leakage or breakage. This can be done using ice chests with shipping material packed around the samples to protect and secure them. If refrigeration is required, wet ice or dry ice can be added around the packing material.

When samples are delivered to the appropriate laboratory, the chain of custody form must be signed by both the sample delivery person and the sample receiver at the lab. The sample is relinquished to the laboratory and sample temperature is measured upon receipt. The lab sample coordinator will log the samples into the logbooks or tracking system depending on the system used by the laboratory. All samples will be marked with a unique number to track their analysis. These identification labels will also be entered directly onto laboratory data sheets. Samples are stored based on whether they can be held at room temperature, refrigerated or frozen.

All hard copies of documents and electronic data generated by this project will be stored at the City of Oxnard (Table 7).

B4. Analytical Methods and Field Measurements

The standardized test methods, accuracy, target reporting limits and units used to measure the parameters of interest to CINC and the City of Oxnard are listed in Table 6. Field sampling procedures are presented in Appendix B.

The following equipment, or equal, will be used to collect in situ measurements:

- Hach HQ40D meter: dissolved oxygen, pH, temperature, salinity
- Hach 2100Q meter: turbidity

Remote sensors will be deployed to collect continuous monitoring data. Measurements include conductivity, temperature, chlorophyll-a, dissolved oxygen and salinity. Sensors will be cleaned, and data will be downloaded on a weekly basis. Remote sensors are wrapped in tape to reduce fouling. Sensors will be shipped to the manufacturer annually for a factory calibration. Data is collected every 15

minutes from late winter through early fall. Data is stored and maintained on each unit separately and is downloaded and backed up weekly .

It is the responsibility of each analyst to take corrective action upon instrument failure. Corrective action will be conducted according to manufacturer or method specifications.

B 5. Quality Control

Samples to be used for QA/QC will be collected in the field and created in the lab. Field QA/QC samples are used to evaluate precision considering sampling bias or field variability. Field QA/QC samples include field duplicates. Lab QA/QC samples are used to evaluate the analytical process for precision and accuracy. Internal laboratory QC checks will include:

- Toxicity: acceptable laboratory controls and reference toxicant test results
- Bacteriology: acceptable laboratory blank and positive controls
- Chemistry: method blanks, laboratory control materials, duplicates, matrix spikes, instrument calibrations and internal standards
- Field probes: instrument calibrations (before each sampling event)
- Remote sensors: instrument calibrations (annual factory calibration)

Field Sampling Quality Control

QA/QC activities for sampling processes include the collection of field duplicates for bacterial and water chemistry analysis, and field checks by sampling staff. In order to monitor the sampling process, the QA Manager or QA Officer will randomly observe sampling processes and compare the observed sampling methodology against the sampling standard operating procedure (SOP). Field briefings will be held prior to the initiation of work to ensure that field staff is aware of the day's sampling objectives and any issues they might face regarding sampling methods.

If a water sample is contaminated in the field, whether by equipment or a process, the contaminated sample will be discarded.

Field Duplicates

Field duplicates help quantify potential bias associated with sampling activities. Field duplicates are comprised of a duplicate sample taken at 5% of sampling sites. Stations where duplicate samples will be collected for each monthly event will be randomly identified using a random number generator. The duplicate station for each event will be identified on the field sheets and chain of custody and an additional set of sample bottles will be assigned. Each result will be recorded, as will the average of the two results, the difference between the largest and smallest result, and the percent difference between the largest and smallest result. The percent difference will be calculated as follows

Relative Percent Difference (RPD) = 100 * (Largest-Smallest) / Average

There are no specific criteria for field duplicate precision but results with an RPD of ± 25% are generally considered acceptable.

Toxicity

- The survival of test organisms in laboratory control water must be at least 90% for acute and 80% for chronic toxicity tests to be considered valid.
- Reference toxicant results must be within ± 2 standard deviations of the average of the previous 20 tests.
- All test acceptability conditions must be within specified limits.

Bacteriology

- Reagent blank samples must be below detection (<1 MPN/100 mL) for all samples for tests to be valid.
- Positive controls must be within specified ranges for the associated tests to be valid.

Chemistry

A batch is defined as a group of 20 or fewer samples of similar matrix, processed together under the same conditions and with the same reagents. QC samples are associated with each batch and are used to assess the validity of the sample analyses. Each batch must include the following QC checks:

- Method Blank: A method blank is a sample that contains no parameter of interest. For solid matrices, no matrix is used. The method blank serves to measure contamination associated with processing the sample within the laboratory.
- Laboratory Control Material (LCM) or Certified Reference Material (CRM): An LCM or CRM is a sample with a matrix similar to the client samples that contains parameters of interest at known or certified concentrations. It is used to determine the accuracy of the results based on the comparison of the measured concentration with the true value. For parameters that are greater than 10 times the MDL, the acceptable percent recovery is presented in Table 6.
- Duplicate Analyses: Duplicate analyses are samples that have been split and processed within a single batch. They are used to determine the precision of the results based on the percent relative difference (%RPD) between the two sets of results. Control limits for %RPD are presented in Table 6.
- Matrix Spike/Matrix Spike Duplicates (MS/MSD) or Laboratory Control Spike/Laboratory Control Spike Duplicates (LCS/LCS Dup): MS/MSD are samples of similar matrix to the client samples that are spiked with a known amount of parameters. Spike recovery measures the effect of interferences caused by the sample matrix and reflects the accuracy of the determination. The spike level should be at least ten times the MDL. The duplicate spike may be used to determine the precision of the analytical results.
- Initial Calibration: Initial calibration is performed by analyzing standards of known levels of concentration. The lowest level should be less than or equal to ten times the MDL and the remaining levels should represent the entire range of expected concentrations in the samples.
- Calibration Verification: When a calibration curve is not performed for each run, calibration verification is performed with a standard from, preferably a second source, is used to verify that the instrument is still operating within the original calibration curve.
- Internal Standard: An internal standard is a non-target parameter, which is added to samples and QC checks after the preparation of the sample, just prior to analysis. It is used to compensate for variations in the instrument response from one sample to the next.

- Recovery Surrogate: A recovery surrogate is a non-target parameter or parameters that are added to the sample prior to processing. It is used to indicate the extraction efficiency and instrument variation from sample to sample.

Corrective Action

Corrective action is taken when an analysis is deemed suspect for some reason, such as exceeding acceptable accuracy ranges for water chemistry. The corrective action will vary on a case-by-case basis, but at a minimum involves the following:

- A check of procedures.
- A review of documents and calculations to identify possible errors.
- Correction of errors based on discussions among analysts.
- A complete re-identification of the bioassessment sample.
- A re-analysis of the sample extract, if sufficient volume is available, to determine if results can be improved.
- A complete reprocessing and re-analysis of additional sample material, if sufficient volume is available and if the holding time has not been exceeded.
- Re-training of staff to ensure the action is not repeated.

The Laboratory QA Officer has systems in place to document problems and make corrective actions. All corrective actions will be documented and forwarded to the Project QA Officer and Project Manager.

B6. Instrument/Equipment Testing, Inspection and Maintenance Field Equipment Meters and Test Kit Maintenance

The meters and test kits used by all field teams should be maintained according to manufacturer instructions to assure that the meter and probes are properly functioning during each sampling event. This will include routine replacement of the batteries, carrying back-up batteries in the field, inspection of the probes, meter, and test kits for damage, and properly cleaning and storing equipment in between uses.

Continuous Monitoring Sensor Package Maintenance

The sensor package is maintained according to manufacturer instructions. The sensor package will be cleaned on a weekly basis by field teams and sent to the manufacturer for calibration annually.

Laboratory Instrument Maintenance

Laboratory instruments are maintained in accordance with the laboratory SOPs. Analysts are responsible for inspection and maintenance.

Analytical Instrument and Equipment Testing Procedures and Corrective Actions

Testing, inspection, and maintenance of analytical equipment used by the contract laboratory, as well as any corrective actions taken, are documented in the quality assurance manuals for each analyzing laboratory. Laboratory QA manuals are made available for review at the analyzing laboratory.

B7. Instrument/Equipment Calibration and Frequency

Laboratory and field instruments are calibrated, standardized, and maintained according to the analytical methods and manufacturer's specifications. Calibration records will be kept by the laboratory or agency maintaining the equipment. Analytical equipment that fails to meet performance requirements will be checked according to their respective Standard Operation Procedures (SOPs) and be recalibrated. If equipment continues to fail calibration, it will be repaired or replaced. Each piece of equipment will have its own maintenance log. The log will document any maintenance and service of the equipment. A log entry will include all the following information:

- Name of person maintaining the instrument/equipment
- Date and description of the maintenance procedure
- Date and description of any instrument/equipment problem(s)
- Date and description of action to correct problem(s)
- List of follow-up activities after maintenance (i.e., system checks)
- Date the next maintenance will be needed

Field water quality equipment will be calibrated before every field sampling event. Calibration acceptance criteria are presented in Table 6.

B8. Inspection/Acceptance for Supplies and Consumables

Glassware, sample bottles, and collection equipment will all be inspected prior to their use. Supplies will be examined for damage as they are received. All supplies will be stored appropriately and will be discarded after its expiration date. The Project Manager will be responsible for ensuring that project supplies and consumables records are up to date.

B9. Non-Direct Measurements

Non-direct measurements will not be used for this project.

B10. Data Management

The data collected for this project falls into three categories: data collected in the field by handheld sensors; data generated by the labs from a collected sample; and, data collected in the field by continuous sensors.

Field Data

The CINC volunteer team will collect water quality data in the field using handheld sensors and then copy these data from the field sheets into CEDEN compatible electronic formats provided by the QA Officer. Once the volunteers have entered the data, another team member will reconcile the electronic data to the corresponding field sheets. The CINC Volunteer Coordinator will forward the finalized electronic dataset to the City's Project Manager. The chain of custody and field datasheets will be forwarded to the Project Manager .

Chemistry Data

The analytical laboratories will conduct internal data QC checks on the water quality data, get the data approved by each laboratory's QC Officer, and then submit their CEDEN compatible datasets electronically to the Project QA Officer. The reports must also include copies of the chain of custody forms and analytical QC data.

After the Project QA Officer receives both the field and analytical datasets, they will review the laboratory data QC reports and conduct the following QC screen of the datasets:

- Check that laboratory hold times were met for all measurements
- Check that the chain of custody forms and laboratory reports are consistent
- Check for laboratory data report completeness
- Check for typographical errors on the laboratory reports
- Check for suspect values (outliers)
- Check for duplicates measurements

Following the initial screening, a more complete QA/QC review process will be performed by the Babcock QA Officer, or designated data reviewers. This will include an evaluation of analytical accuracy and precision. Accuracy will be evaluated by reviewing chemistry QC results, precision will be evaluated by reviewing laboratory and field duplicates, and sample completeness will be evaluated by comparing results to chain of custody forms.

Continuous Sensors

Continuous remote sensor data will be stored on each sensor package from deployment in the spring to retrieval in the fall. During that time, the data from each sensor package will be uploaded weekly to either a smartphone or laptop by Aquatic Bioassay field staff, and then uploaded to the Aquatic Bioassay data storage file system. These data will be backed up to the cloud nightly.

The finalized data sets will be submitted to the CEDEN database in a format compatible with CEDEN guidelines for data submission by the Project QA Officer. If during the submission process, the automated CEDEN data checkers automatically flag any data records, the Project QA Officer will identify and reconcile the problem.

The final project datasets will be stored in an Access database by Aquatic Bioassay and in CEDEN. The Access database will be backed up nightly to the cloud and to backup hard drives at Aquatic Bioassay. Hard copies of field sheets, chain of custody forms, and laboratory data will be stored for durations identified in Table 7.

Hardware and software will be updated at least as frequently as recommended by the manufacturer, or as needed. Testing of each component is not required on a regular basis, aside from day to day functionality.

C1. Assessments and Response Actions

The City's Project Manager is responsible for management and oversight of the project. The Project QA Officer will conduct periodic reviews of the data, field operations and training program and relay any problems to the Project Manager.

If an audit discovers any discrepancy, the QA Officer will document the discrepancy and discuss it with the appropriate person responsible for the activity (see organizational chart). The discussion will include whether the information collected is accurate, the cause(s) leading to the deviation, how the deviation might impact data quality, and what corrective actions might be considered. The QA Officer has the power to halt all sampling and analytical work by the CINC, Aquatic Bioassay, or State Laboratory if the deviation(s) noted are considered detrimental to data quality.

When procedures or project activities need to be modified to achieve project quality objectives, the QAPP must be amended (e.g. change of sampling locations, methods, matrices, QC samples). This amendment must be reviewed and approved by the City of Oxnard in the same manner as the original QAPP. The amendment should contain complete identifying information, as presented on the original QAPP title and approval page, with updated signatures and dates. Amendments should be approved before changes are implemented. Verbal approval of modifications may be obtained to expedite project work. Descriptions of modifications and verbal approvals must be documented in telephone logs or emails which are retained in the project file. Subsequently, this verbally approved modification must be documented in an amendment to the QAPP and submitted to the City of Oxnard days, or on a mutually agreed upon date, for formal signature approval. Note that when "minor" changes are made to a QAPP (e.g., extending the monitoring period, adding a sampling station), approved amendments are not required. Instead, the City of Oxnard should be notified by email of all changes and a letter documenting the changes or revised QAPP pages should be sent as a follow up.

Training Assessments

Training for field operations will be conducted by the Citizen Monitoring Coordinator and include water sampling techniques and collection of observational data. The City's Project Manager will ensure that there is hardcopy verification that volunteers have attended training and that new volunteers continue to be trained during the project. In addition, quarterly reviews of the field crews will be conducted to ensure personnel are fully trained.

Field Assessments

The Project Manager, QA Officer, Citizen Monitoring Coordinator or Citizen Monitoring Water Board staff will randomly conduct field audits to ensure that the field team's sample collection methodologies, field measurement procedures, and record keeping are being conducted as planned and as documented in this QA Project Plan. Any deviations that are noted will be corrected immediately to ensure all subsequent samples and field measurements collected are valid. Data that is not collected according to the procedures outlined in this QAPP will be rejected by the QA Officer and Project Manager and will not be included in the final dataset. If the deviations are associated with technical changes and/or improvements made to the procedures, the Project Manager or QA Officer will update the Field Logbook and amend this QA Project Plan. The Project Manager or QA Officer may stop any sampling activity that could potentially compromise data quality.

Laboratory Oversight

Each laboratory is responsible for their internal laboratory QC and is responsible for notifying the Project QA Officer when DQOs are not met and what the corrective action is. Each data delivery from the outside labs will be accompanied by all QC data generated as part of the analytical process. Following receipt of the off-site laboratory's data package for each sampling event, the Project Manager and

Project QA Officer will review the data package for completeness, as well as to ensure that all planned methodologies were followed and that QA/QC objectives were met.

It is each laboratory's responsibility to maintain their professional accreditation and data quality. Any lapse in these categories must be identified and reported by the Project Manager and QA Officer.

C2. Reports to Management

The Project QA Officer is responsible for ensuring a clean dataset is submitted to CEDEN. All data submitted to the CEDEN will have gone through the data review, verification and validation process outlined below in Section D1. Data will be submitted as it stands or assigned an appropriate QC flag to exclude the data from the project database. All rejected data will be retained in the project database and qualified as "rejected". The decision will be detailed in a report available upon request. The "rejected" data will be excluded from the CEDEN data submission provided to the Water Board.

Corrective actions are documented in the laboratory record. If a failure is not resolved, it is conveyed to the Laboratory QA Officer who determines if the failure compromised the associated results. Corrective actions are documented in the laboratory record. The nature and disposition of the problem will be documented in a data report sent to the Project QA Officer.

D1. Data Review, Verification, and Validation

Laboratory validation and verification of the data generated is the responsibility of the laboratory. The laboratory manager will maintain analytical reports in a database format as well as all QA/QC documentation for the laboratory.

The Data Manager/QA Officer will review all data packages received for adherence to the DQOs set forth in this QAPP. Chain of custody forms will be reviewed to ensure adherence to collection, transport, and receipt requirements, including test initiation within the required holding time. Chemistry and toxicity data will be evaluated for completeness, adherence to test methodology, passing acceptability criteria, choice of appropriate statistical methods, and proper reporting.

If results fail to meet any DQO the QA Officer will flag them for further review. Batch QA samples will be reviewed to determine the potential cause for failure to meet the DQO. If the cause cannot be readily ascertained, reserve samples will be reanalyzed (if within the designated holding times). If subsequent analyses meet the DQO, the samples will be deemed acceptable.

If samples fail to meet the DQOs a second time or the cause of the failure cannot be identified and rectified, the data will be excluded from the study results. All rejected data will be retained in the project database and qualified as "rejected". The ultimate decision of whether to accept or reject a data point will be made by the Project QA Officer.

If the analysis for more than 10% of any given parameter fails to meet the DQOs, the City's Project Manager and QA Officer shall meet to discuss the appropriateness of the DQO and any potential modifications. All proposed modifications of DQOs shall be reviewed by the QA Officer.

Laboratories will conduct a 20% raw data audit before delivering results to the final program database held by the City of Oxnard. If their error rate is greater than 5%, a 100% raw data audit will be triggered.

D2. Verification and Validation Methods

Data collected in the field will be validated and verified by the Project Manager. The field crews and Project Manager will have a thorough understanding of the QAPP and associated SOPs. After data collection, the Project Manager will review and verify field data and chain of custody forms based on their understanding of the SOPs. The analytical laboratory QA Officers are responsible for reviewing and verifying the data generated by their laboratories.

Reconciliation and correction of any data that fails to meet the project DQOs will be done by the Project Manager in consultation with the QA Officer. Any corrections require a unanimous agreement that the correction is appropriate.

D3. Reconciliation with User Requirements

Procedures to validate and verify the data collected for this project are outlined above.

Where data generated by this project do not meet the project DQOs, the Project QA Officer and Project Manager will assess if the data can be validated using the corrective action process. Based on the outcome of this exercise, they will assign a QC flag to the data prior to submission to CEDEN. In cases where no resolution can be found, a “rejected” flag will be assigned to the data in the project database. Any data with a “rejected” flag in the project database will be excluded from the dataset sent to the Water Board for submission to CEDEN.

QC flags in the CEDEN data set will inform end data users of issues or warnings associated with the data they are interested in. It will be up to the data user to decide if qualified data can be used. If qualified data are to be used, then it must be made clear in the final report that these deviations do not alter the conclusions of the study.

Appendix A – Field Data Sheets and Chain of Custody

CWT Field Data Sheet

GPS Reference GPS Reading

Waterbody Name: **Channel Islands Harbor**__WBD NO__18070103201 Latitude 34.18844

Project Name and/or ID: **CI Harbor**_____ Longitude -119.223076

Station ID: __CIH06_____ **Date** _____ Arrival time _____

Agency/Organization name and/or ID: **CINC CWT or ABC** Station Name: **Seabridge Marina- Remote Sensor**

Team Name: _____ Location ID: Dock B-14___ Station Visit ID _____

Leader (name & phone #):	Date of last rain
Members:	Oxnard - Civic Center
(list additional names on back)	vcwatershed.net/fws/Automedia

Observations: *Circle one underlined option:* Photos[1] **Yes/ No** **Observations Time:**

Cloud cover	no clouds; partly cloudy; cloudy sky (overcast);
Precipitation	none; misty; foggy; drizzle; rain; snow;
Wind	calm; breezy; windy;
Water Murkiness	clear water; cloudy water (>4" visibility), murky (<4" visibility). *[this pertains to the water itself, not to scum]*
Tide Level	Time of Last High Tide Level Time of Next Low Tide Level Current Tide Level
Estimated Flow Category	<0.1 cfs; 0.1 - 1 cfs; 1 - 5 cfs; 5 - 20 cfs; 20 - 50 cfs; 50 - 200 cfs; >200 cfs. If no flow at drains, record a field sheet with comment.
Sample color	none; amber; yellow; green; brown; gray; other: Note: Use Bacteria bottle to determine color.
Sample odor	none; fresh algae smell; chlorine; sulfide (rotten eggs); sewage; other
Other (presence:)	algae or water plants (percent coverage); oily sheen; foam or suds; leaf litter; trash; other

Wind Direction (From) ____

Wind Intensity (Beaufort) ____

Water Quality Measurements (Weekly) **Note: Must have 3 readings with increase/decrease less than 1%**

Instrument ID	Parameter (Characteristic)	Unit	Result	Repeated Measurement Result	Bracket/ Resolution	Measurement Time	Measurement Depth*	Comments
Hach HQ80D	Dissolved oxygen (DO)	mg/l (ppm)						
	pH	pH						
	Temperature, water	°C						
	Specific conductivity	µS/cm mS/cm						
	Salinity	mg/l (ppt)						
	Turbidity Secchi	meters						Record Extinction depth (Result) and bottom depth.
Hach 2020	Turbidity	NTU						Use 500 mL Nalgene bottle if meter is not available

***Measurement Depth**: *(Select)* surface; mid-column; near-bottom; (*or provide measured number and unit*)

water sampling device (circle) none; bucket; pole& beaker; LaMotte sampler

Sheet completeness review by _____

Departure Time _____

1. Take pictures when water is observed flowing from agriculture or storm drain.

Office use only
Season _____
Entered dBase by _____ Date _____
checked by Date

FIGURE 3. EXAMPLE OF FIELD DATASHEETS.

CWT Field Data Sheet Date _____ Page 2

Water Samples Station ID: CIH06____ Collection time _____

Sample ID	DateTime	Count	Type	Size	Analytes	W/M/Q	By	Ice	Comment

water sampling access (*circle*): walk-in (wading); bridge; bank; boat/ kayak.

water sampling device (circle) none; basket; pole&clamp; pump; bucket; pole& beaker; LaMotte Sampler; Kemmerer

Containers pre-cleaned by: vendor; laboratory; Project crews; other _____

Observations Fragment ID: _____ Collection time _____

Trash	
Encampments	
Wildlife	

Photo Log Picture number (use # generated by digital camera)

Looking Direction (upstream or downstream)

Forms and Files

Sonde or PDA File name(s)

Clean Remote Sensor and upload data to _____ application. **FileName:**_____

Chain of Custody Log updated by:

Office use only

Sheet completeness review by _____ Entered dBase by _____ Date _____

Departure Time _____ checked by _____ Date _____

FIGURE 3. EXAMPLE OF FIELD DATASHEETS (CONTINUED).

EventCode	WQ	Project Code	RWB4_CIH_2020	Agreement No. 19-049-270	
Fiscal Year		Parent Project Name	SWAMP RWB4 Monitoring	Results to	CEDEN Database http://ceden.org/CEDEN_checker/Checker/index.htm
Agency Code	RWQCB4___	**ProtocolCode**	**RB4_CIH_QAPP_2020**	Field Lead	Chuck Carter chuckcarter8@yahoo.com
OR ->	______				
		Agency	City of Oxnard (CINC)	Project Lead	Steve Howlett steve.howlett@oxnard.org
Note: Standard field preservation codes to choose ->			Field Acidified, Field Filtered, FieldFrozen		
To obtain appropriate "codes", consult the CEDEN Database Look-up-lists----->http://ceden.org/CEDEN_checker/Checker/LookUpLists.php					

Analysis Request: (Type/write in single analysis vertically (e.g.TOC) or analyte group with all analytes named (e.g. metals = Ni,Cu,Fe, Pb,Cr,Se)

SampleID	Station Code/ Station Name	Collection Date	Sample Time	Collection Method Code	Location Code	Sample Type Code	Collection Depth (m)	PrepPreservation Code & PrepPreservation Date	# of sample bottles	Nitrate as N, Total Nitrogen, Sulfate, Total Dissolved Solids, Total Suspended Solids	Orthophosphate (Field Filtered)	Ammonia as N, Total Phosphorous, (Acidified with H2SO4)	Metals: (Cu, Hg, Ni, Se, Boron), (Acidified with HNO3)	Organochlorine Pesticides, Toxaphene, Organophosphorus Pesticides	Pyrethroid Pesticides, Unpreserved

Request Details *:						
Turnaround Time (CIRCLE):	Rush	24 hours	48	72 hours	Regular (5 days +)	* Do not use this COC for tissue
Sample Types (i.e. matrix) on this form : (CIRCLE)	Ambient/ receiving water	Sediment	Oil	Effluent e.g. stormwater, groundwater		Other __**Brine**________

Samples Relinquished by:	Date & Time	Samples Received by:	Date & Time	**Distribution of COC form: Original accompanies shipment, Electronic copy emailed**		
Name (Print)		Name (Print)				
Signature		Signature		aguerra@babcocklabs.com; OIMA-helpdesk@waterboards.ca.gov		
Agency		Agency		**Cooler return**	30+ days w/ new bottles	ASAP

FIGURE 4. EXAMPLE OF CHAIN OF CUSTODY (BABCOCKENVLAB_WATERBOARDS_COC_V5.XLSX)

Comment [SR1]: Project Code, Project Name, Parent Project Code, QAPP Code, and Agency Code are in the process of being updated and approved by CEDEN. Final QAPP will be uploaded to the website upon CEDEN confirmation of changes.

Appendix B – Field Sampling Procedures

Monitoring Event Preparation

Prior to going into the field to collect either in-situ water quality measurements or water sampling, the following measures are performed:

- Order bottles from laboratories
  - Project Manager, consultant or Volunteer Coordinator inventories bottles once they arrive
- Project Manager or consultant ensures sampling probe is calibrated the morning before sampling begins
- Project Manager or consultant confirms monitoring date(s) with CINC Volunteer Coordinator and Project Manager and laboratories
- Project Manager, consultant, or Volunteer Coordinator prepares equipment
- Project Manager, consultant, or Volunteer Coordinator ensures sample bottles are labeled with the following information:
  - Project Name
  - Sample Date
  - Station ID
  - Sample Time
  - Parameters to be measured
  - Bottle numbers (e.g. 1 of 2)
  - Field Replicate
- Project Manager, consultant, or Volunteer Coordinator prepares field datasheets and chain of custody forms, make sure you have extra datasheets while you are in the field
- Project Manager, consultant, or Volunteer Coordinator checks field equipment to make sure it is working properly
- Project Manager, consultant, or Volunteer Coordinator has extra batteries available for field equipment and GPS

Field Monitoring Procedures:

In-Situ Water Quality Measurements

Prior to volunteers going into the field to sample, each sensor on the handheld water quality device will be calibrated by the City of Oxnard, or consultant. All calibration data sheets are required to be completed should be filled in with the date, field personnel, and calibration information for each sensor.

Hach HQ40D, or equal: Dissolved oxygen, water temperature and salinity

- Power on handheld monitor
- Submerge probe a minimum of 3” below surface
- Allow probe to adjust to water temperature 1 – 2 minutes

- Record on the field datasheets the results for dissolved oxygen, oxygen percent saturation, salinity, and water temperature

Hach 2100Q, or equal: Turbidity

- Taking turbidity measurements
  - Rinse sample cell with water three times before taking a reading
  - Fill the sample cell to the line (about 15 mL) and replace cap
  - With the cell with a soft, lint free cloth to remove water spots and fingerprints
  - Apply a thin film of silicone oil and wipe with a lint free soft cloth to obtain an even film over the entire surface
  - Push the power key to turn on the meter and place the meter on a flat surface. Do not hold the meter while making a measurement
  - Gently invert the sample cell to homogenize sample
  - Inset the sample cell into the instrument cell so the diamond mark aligns with the raised orientation mark in front of the cell compartment and close lid
  - Push Read and record results on field datasheets
- After sampling
  - It is very important to keep the meter and sample cells clean. The exterior surfaces of the meter may be cleaned as necessary. Always keep the cell compartment lid closed except when inserting the sample cell. The sample cells must be dirt and scratch free.
  - Wash the sample cells after field sampling, always rinse the cell with deionized water and dry with a lint free wipe (e.g. Kim Wipes).
  - Remove the batteries if meter is not going to be used for over a month.
- Calibration
  - Calibrate meter before going into the field
  - Push the power key to turn on the meter
  - Before measurement is taken, always make sure that the sample is homogeneous throughout by gently inverting the sample cell
  - Apply thin film of silicone oil and wipe with a lint free soft cloth to obtain an even film over the entire surface
  - Insert the 20 NTU standard into the instrument cell and close lid
  - Push Read button
  - Repeat with the 100 and 800 NTU standard
  - Push Done to review the calibration details
  - Push Save to save the results

Water Sample: Direct/ Grab Pole Sampling

- Gather all sample bottles
- Fill out waterproof label and place on bottle before sampling (labels will not stick to wet bottles)
  - Use clear packing tape to cover label
- Put on powder free nitrile gloves. Gloves must be replaced if they are contaminated
- Bacteria

- Water for bacteria analysis must be filled in a sterile bottle containing sodium thiosulfate. A surrogate bottle may NOT be used to collect water samples for bacteria analysis.
- Open container, do not touch the inside of the lid or bottle
- Fill bottle to the 100 mL line (leave airspace)
- Reseal cap
- Store in ice chest with wet ice

- Nutrients, general chemistry, turbidity, metals, organics and toxicity sampling
  - Attach sample bottle to grab sample pole (if used)
  - Open container, do not touch the inside of the lid or inside of the bottle
  - Submerge sample bottle into water
  - If sample bottles contain preservative, a clean surrogate bottle may be used to fill sample bottles with preservatives
    - Request surrogate bottle for each station from laboratory
    - Fill surrogate bottle with sample water
    - Use surrogate bottle water to fill primary bottle with preservative
    - DO NOT overfill bottle
  - Fill bottles to the top, but leave a headspace in the bottle

Chlorophyll-α and Toxin Sampling:

Chlorophyll-a and phytoplankton samples will be collected by Aquatic Bioassay staff and are collected weekly at the remote sensor locations. Toxin samples are collected simultaneously with chlorophyll-a. Two filters are collected for chlorophyll a and two for toxins. The toxin samples are archived until the phytoplankton samples are analyzed. If a harmful alga is identified, toxins will be analyzed by Babcock Labs from the associated sample.

Once on site:

- Rinse the syringe, syringe plunger, and Swinnex filter three times with sample water.
- Unscrew the Swinnex filter and place the O-ring in its slot on the intake end of the Swinnex.
- Place a new GF/F filter on right top of the O-ring so that the filter fits in the slot as well.
- Hold the intake end of the Swinnex with the O-ring and filter facing up so that they stay in place, fit the other end of the Swinnex to the intake end and screw the Swinnex shut tight.
- Submerge the tip of the syringe in the sample water and pull back the plunger and fill the syringe to the 50 ml line (make sure there are no air bubbles in the syringe).
- Attach the syringe and to the Swinnex filter.
- Use the syringe plunger to filter 50 mL of sample water through the Swinnex.
- Detach the syringe from the Swinnex and open the Swinnex.
- Use tweezers to fold the GF/F filter in half.
- Place the GF/F filter in a chlorophyll tube. Use a sharpie (industrial) to write the date and sample ID on the topmost part of the chlorophyll tube.
- Put a cap on the chlorophyll tube and place the tube in a rack. Cover the rack and tube with aluminum foil. Store the rack cold (e.g. in a cooler with ice/ice packs).
- Repeat steps to take a duplicate sample.

Phytoplankton Sampling

Phytoplankton samples are collected simultaneously with the chlorophyll-a samples.

- Fill out waterproof label and place on bottle before sampling (labels will not stick to wet bottles)
- Rinse the graduated cylinder with sample water
- Measure 100 ml of sample water and place that in a 125 ml amber glass bottle pre-charged with 3 ml of Lugol's preservative

RBR Remote Sensor Data Acquisition & Weekly Maintenance

Operating the RBR

The RBR remote sensor packages are deployed continuously from March through November each year by Aquatic Bioassay. During that time the sensors must be visited by a field crew to clean the sensors and download data. Once data is collected, they can be emailed to designated staff at Aquatic Bioassay or AET. The data will be graphed and sent to the City of Oxnard and posted to their website.

RBR software download

1. Before visiting the remote sensors, the Ruskin software for a laptop computer or cell phone need to be downloaded from: https://rbr-global.com/products/software
   Follow the installation instructions.

2. The remote sensor packages are deployed at Station CIH06, CIH07, CIH20 and CIH23. Carefully lift the RBR onto the dock using the ropes attached to the cleats. Don't untie them! Simply pull on the rope to bring them to the surface. Set them upright on the dock.

3. To establish a Bluetooth connection to the RBR via Wi-Fi:
   a. Open the Ruskin software on your phone/computer.
   b. Twist the end cap of the RBR sonde, so that the arrow is in the OFF position. You will feel the sonde vibrate slightly letting you know the unit is off.
   c. Turn on the Wi-Fi of your computer/phone.
   d. Turn the RBR end cap back to the ON position. You will feel the sonde vibrate again, letting you know it's on.
   e. You will see the software on your phone or computer searching for a connection and then connecting.
   f. If you failed to establish a successful connection, twist the end cap to the ON/OFF position to retrigger the Wi-Fi of the sondes and try connecting with the Wi-Fi again.
   g. Be patient, sometimes it takes a few moments.

4. Downloading data off the RBR

   You can download the RBR data to either your smart phone or computer as long as you have installed the software. However, using the phone app is the easiest way to download the data sets.

a. Via phone
    i. Once connected, the data will automatically download to your phone.
    ii. Each sensor package is identified using the last two numbers of the serial number. The specific number for each unit is on a laminated card, zip locked to the cage of the sensor package (e.g. 55, 56, etc.).
    iii. To check that the current dataset downloaded, go to the "Dataset" tab at the bottom of your application. Find the dataset using the identification number and click on it. Click on the "i" button on the top right-hand corner of the application. This will show the start date of the deployment, as well as the time for the last sample. If the time is around the time that you established a connection, then data has been downloaded to your phone.

b. Via computer
    i. Go to "Download" tap on the Ruskin software
    ii. Click on the Download button and choose an appropriate location on your computer to save the file
    iii. The download is complete when you see graphs of data appear at the bottom section of the software

c. Once data is downloaded to your phone, you can email the files to yourself and others to ensure you have backup copies. Once back at your desk, save the data files to the appropriate folders. Send the data to Aquatic Bioassay or AET for graphing and distribution to the City:
    i. Karin Wisenbaker – karin@aquaticbioassay.com
    ii. Dave Caron - dave@aquaticecotechnologies.com

5. Things to do/check before redeployment

a. Wiping down the sonde
    i. Use a wet sponge soaked in clean, freshwater and wipe down the sonde GENTLY, especially when wiping the chlorophyll and DO sensors. Ensure the automatic wipers are clean.
    ii. Wipe down the cage and body of the sensors to remove as much fouling material as possible. Sea squirts and other animals should be removed as best as possible. Calcareous tubes are difficult to remove and can be left.

b. Battery life
    i. If the sonde is connected to the computer, you can check on the internal voltage of the sonde by going to the "Information" tab. Change out the batteries if the internal voltage falls below 5 V. The RBR requires eight AA batteries.

c. Redeploying the RBR
    i. Be certain the RBR end cap is in the ON position. You will feel the unit vibrate to know it's on.
    ii. Make sure the deployment ropes are secured to the cleats.

iii. Lower the RBR back into the water using the ropes to gently lower it.

6. If you experience any problems with the RBR sensors or have questions, contact:
    a. Jim Mann – jim@aquaticbioassay.com
    b. Karin Wisenbaker – karin@aquaticbioassay.com
    c. Dave Caron - dave@aquaticecotechnologies.com

RBR Remote Sensor Deployment Protocol

Each year after the sensors have been deployed from the late winter through fall, they will be retrieved, cleaned and sent to Ruskin for annual factory maintenance, calibration and repair. After this is complete, the four units will be shipped back and redeployed. Once returned, the sensors need to be tested to ensure they are reading correctly and to determine if any of the sensors have readings that are not consistent with the other sensors. Below is a detailed description of how this calibration process is done.

1. Testing the sensors and calibrating between different loggers
   Materials
   - Bucket
   - Ice
   - Fresh water
   - Thermometer
   - Seawater
   - Air pump for bubbling water (optional)
   - Ground up spinach

2. Procedures:

   Test connection with phones and computer
   - Make sure that the connecting computer and phones have the latest version of the Ruskin software installed.
     - Note: Data may not download/transfer if you don't have the latest version of Ruskin
     - Turn on Wi-Fi for the computer/phone and open the Ruskin software on the device.
     - Twist the end cap of the logger to trigger Wi-Fi activation. You will feel the logger vibrate for a few seconds.
   - Find the logger on the list of available Wi-Fi connections on the computer/phone and connect to the logger.
   - If you fail to establish the connection, repeat the steps above.

   Check battery level before deployment
   - Establish connection to the logger via computer.
   - Select "Instruments" on the left-hand panel, and then the "Configuration" tab in the window.
   - Look at the internal voltage of the battery and note the value. Replace battery if the voltage is below 5 V.

   Test the temperature sensor
   - Prepare a bucket of ice water and place logger in the bucket.
   - Start a deployment event (15 second sampling interval) on the Ruskin software

- Twist the end cap of the logger to the "On" position to allow logging.
- Keep logger in the bucket for two minutes to obtain several readings.
- Take out logger and place it in a bucket of water at room temperature along with a thermometer.
- Keep logger in the bucket for two minutes to obtain several readings.
- Note the temperature reading on the thermometer.
- Stop logging by twisting the end cap of the logger to the "Off" position.
- Connect to phone/computer to download and review readings.
- Reading from the ice water should be about 0 ^{o} C, and the reading from the room temperature water should be comparable to the temperature indicated by the thermometer.

Test the conductivity sensor

- Prepare a bucket of fresh water and place logger in the bucket.
- Start a deployment event (15 second sampling interval) on the Ruskin software
- Twist the end cap of the logger to the "On" position to allow logging.
- Keep logger in the bucket for two minutes to obtain several readings.
- Take out logger and place it in a bucket of seawater.
- Keep logger in the bucket for two minutes to obtain several readings.
- Stop logging by twisting the end cap of the logger to the "Off" position.
- Connect to phone/computer to download and review readings.
- Reading from the fresh water should show a salinity of about 0, and those from the seawater should show a salinity of about 35.

Test the dissolved oxygen sensor

- If available, prepare a bucket of water with air pump for bubbling.
- Start a deployment event (15 second sampling interval) on the Ruskin software
- Twist the end cap of the logger to the "On" position to allow logging and place the logger in the bucket of bubbling water.
- Keep logger in the bucket for two minutes to obtain several readings.
- Stop logging by twisting the end cap of the logger to the 'Off' position.
- Connect to phone/computer to download and review readings.
- Reading should show about 100% oxygen saturation.
- If water with bubbling is unavailable, wet the surface of the sensor with water (e.g. by placing it in water) and keep the wet sensor in open air for two minutes. Again, readings should show about 100% oxygen saturation.

Test the chlorophyll sensor

- Prepare a bucket of fresh water and place logger in the bucket.
- Start a deployment event (15 second sampling interval) on the Ruskin software
- Twist the end cap of the logger to the "On" position to allow logging.
- Keep logger in the bucket for two minutes to obtain several readings.
- Prepare a solution of ground up spinach and place the chlorophyll sensor into the spinach solution.
- Keep the chlorophyll sensor in the spinach solution for two minutes.
- Stop logging by twisting the end cap of the logger to the "Off" position.
- Connect to phone/computer to download and review readings.
- Reading of the fresh water should show about 0 µg/L chlorophyll, while the spinach solution should show very high chlorophyll concentrations.

3. Calibration between different loggers
   - Perform tests on different loggers under the same condition. The readings from the loggers should give very similar, if not the same, results.
   - Note: Connecting multiple loggers to one computer/phone may lead to connectivity issues. If possible, connect different loggers to separate phones. Otherwise it is advisable to only have the Wi-Fi of 1 logger on at a time.

4. Preparing the logger and cage for deployment
   - Reduce biofouling on logger
   - The logger can be wrapped with PVC marking tape (Mcmaster Carr 6031T899) to prevent biofouling directly on the logger.
     - Make sure the sensory part of the sensors is not wrapped.
   - The cage needs to be connected with two nylon braided ropes so that it can be tied off on to the pier.
     - The ropes should be tied to the cage using bowline knots.
     - Zip ties should be used to secure the knot even further.
     - Cut ends of the rope should be melted with a flame to prevent them from falling apart.

5. Logger maintenance
   - While downloading data off the sensor, the body of the sensor can be wiped down with a wet microfiber cloth to reduce biofouling.
   - Lens paper should be used to wipe off the sensory part of the chlorophyll and DO sensor.
   - Loggers should be brought up for calibration every 3 – 7 months. Desiccants should also be replaced during such time.