Project Planning Document and Work Plan

State of Florida DEP

Agreement Number OEP02

(Previously S0769 and SO933)

Project Background

The Indian River Lagoon (IRL) is a diverse, shallow-water estuary stretching 156 miles along 40% of Florida's east coast. The lagoon is an important economic resource to the state, providing a total estimated annual economic value of $3.7 billion, supporting 15,000 full and part-time jobs and providing recreational opportunities for 11 million people annually. In spring 2011, an algal "super bloom" occurred throughout most of the Brevard County and Indian River portion of the lagoon. Approximately 47,000 acres of seagrasses were lost, a reduction of about 60%, valued at $235 million to $470 million in commercial and recreational fisheries losses. Seagrasses provide food, shelter and nursery areas for marine life in the lagoon; but seagrasses need sunlight to grow. In the southern portion of the IRL freshwater discharges from Lake Okeechobee and surrounding basins resulted in a 100% loss of oyster restoration areas in the St. Lucie Estuary. Throughout the lagoon the discharges prohibited light from reaching seagrass beds resulting in loss, added nutrients to an already nutrient saturated system fueling large algae blooms and carried a variety of other foreign materials of aquatic and human health concern. Many critical water quality parameters effecting pollution measurements change during daily cycles, reducing the usefulness of sporadic sampling. Kilroy Monitoring Stations can be installed to measure flow speed, flow direction, water temperature, wave conditions, water depth and can accommodate additional instruments to monitor other water quality parameters almost constantly. Kilroys communicate in near real time to a land-based database with data available to the public via Internet access. Stationing Kilroys at key discharge points into the IRL will allow us to identify discharge sites that are contributing the most pollution and prioritize those for mitigation.

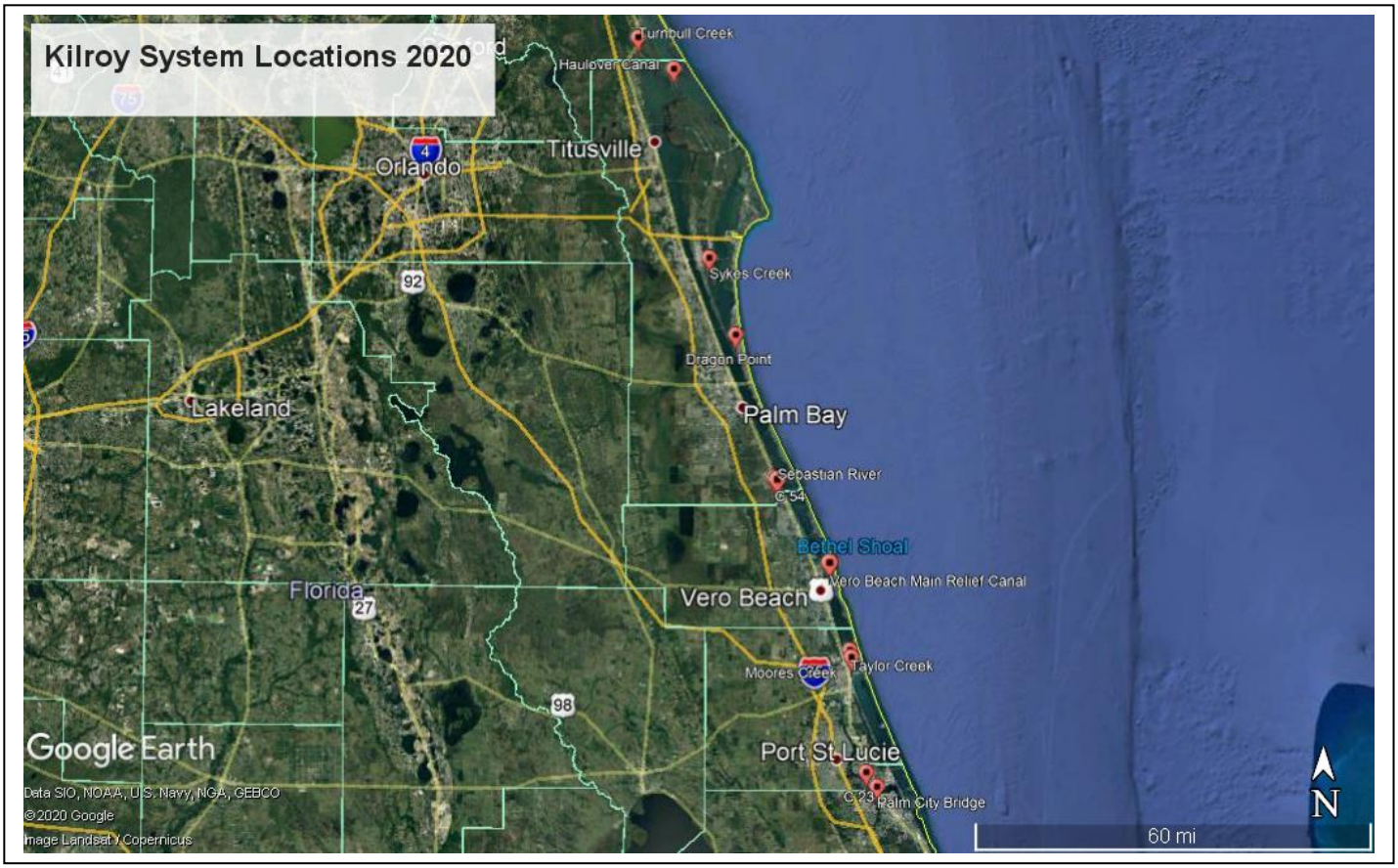
Project Description

Monitoring instruments will be placed at sites along the Indian River Lagoon to monitor water parameters and nutrient content from discharge sites into the IRL. The Grantee will install Kilroy monitoring systems to monitor for flow speed, flow direction, water temperature, water depth, salinity, turbidity, pH, dissolved oxygen, chlorophyll a, blue green algae and oxygen reduction potential. Monitoring will also be conducted for nitrates and phosphates. Data from these sondes will be compared with independent sonde and laboratory data to show comparability to results obtained from more typical methods. Comparable data from this project will allow counties, cities and agencies to assess compliance with established TMDLs and make informed decisions for meeting compliance and other matters that affect the waters of the IRL. For the duration of the project the Grantee's engineers will check calibration and clean each system at monthly intervals. At each monthly interval, reagents for the NuLab nutrient monitoring system will be checked and replenished as necessary and the waste container emptied and water disposed of as required.

Site Plan

Site #	Site Description	Latitude	Longitude	Mounting Structure in place	Piling Needed	Permit Required
1	Palm City Bridge	27.171312	-80.259958	Yes	No	No
2	C 23	27.204825	-80.284285	Yes	No	No
3	Moore's Creek	27.451736	-80.322274	Yes	No	No
4	Taylor Creek	27.466811	-80.326105	Yes	No	No
5	Haulover Canal	28.729502	-80.761268	Yes	No	No
6	Dragon Point	28.139997	-80.603378	Yes	No	No
7	Sykes Creek	28.316768	-80.672030	Yes	No	No
8	Turnbull Creek	28.798334	-80.850268	Yes	Yes	No
9	C54	27.835718	-80.517104	Yes	No	No
10	Sebastian River	27.810387	-80.505386	Yes	No	No
11	IRC Main Relief Canal	27.650900	-80.375078	Yes	No	No

Map of Installation Sites



OVERVIEW

The Kilroy Monitoring System is comprised of an ORCA designed and constructed monitoring instrument that measures flow speed, flow direction, water depth and water temperature. The Kilroy Monitoring system is integrated with a YSI EXO2 sonde with probes measuring ph/ORP, Conductivity/Temperature, Optical DO, Turbidity, total algae that includes chlorophyll and blue green algae sensors and fDOM. Additionally, the Kilroy is integrated with a NuLab nutrient monitoring system that monitors nitrate, nitrite and ortho-phosphate by utilizing wet chemistry which is not affected by bromides, water color changes and other contaminants that affect optical nutrient sensors.

The integrated package is coupled to an ORCA designed and constructed communications system that reports to the ORCA designed database at 4 to 6-hour intervals. The complete system is solar powered and utilizes a battery backup for times when sunlight is not available.

Detection Limits and accuracy for each of the sensors used in the Kilroy Monitoring system are as follows:

Kilroy

Sensor	Detection Limit	Accuracy
Temperature	-55° to 150° C	NA
Depth	0 – 30 psi	NA
Flow Speed	NA	NA
Flow Direction	NA	NA

YSI

Probe	Detection Limit	Accuracy
Temperature	-5° to +50° C	-5 to 35° C: +/- 1% 35 - 50° C: +/- 5%
DO	0 – 50 mg/L	0 – 200%: +/- 1% of reading or 0.1 mg/L, whichever is greater; 200 to 500%: +/- 5% of reading
pH	0 – 14 units	+/- 0.2 pH
Turbidity	0 – 4000 FNU	0-999 FNU: 0.3 FNU or +/- 2% of reading, whichever is greater; 1000 – 4000 FNU: +/- 5% of reading
Chlorophyll	0 – 400 ug/L	R^2 >.999
Blue Green Algae PE	0 – 280 ug/L or 0 to 100 RFU	R^2 >.999
Conductivity	0 – 200 mS/cm	+/- 5% of reading
ORP	-999 - +999 mV	+/- 20 mV
fDOM	0 - 300 ppb	R^2 >.999
Salinity	0 - 70 ppt	+/- 1 % of reading

Nu Lab

Sensor	Detection Limit	Sensitivity
NO3 / N	0 – 5 mg/L	.003
PO4 / P	0 – 8 mg/L	.003

Data Quality Checks

Each deployment site will be visited no less than once per month at which time YSI measurements will be verified using a YSI handheld sonde identical to the deployed instrument measuring salinity/conductivity/temperature, dissolved oxygen, pH/ORP, fDOM, total algae, and turbidity. The handheld sonde will be calibrated and verified prior to the site visit, and then verified after the monthly site visits. If post-sampling verifications do not meet acceptance criteria listed, associated sample data will be qualified with "J" (estimated). Any deployed instrument found out of calibration will be returned to the lab for calibration and check before redeployment. Calibration checks will be recorded in the ORCA database prior to and after recalibration. At each monthly site visit grab samples will be obtained by ORCA team members. Grab samples will be sent overnight to PACE Analytical Services, Inc. for comparability assessment of Nitrate/Nitrite, Orthophosphate and Chlorophyll a. At each monthly maintenance check, reagents for the NuLab nutrient monitoring device will be replenished and a grab sample will be obtained for verification.

For this project PACE Analytical Services, Inc., 8 East Tower Circle, Ormond Beach, FL has been selected. State of Florida certification E83079 and PACE Quality Assurance Manual attached. PACE method and detection limits for this project as follows:

Test Description	Method	MDL	PQL	Unit
Nitrogen, Nitrate	300.0/353.2	0.025	0.05	mg/L
Nitrogen, Nitrite	300.0/353.2	0.025	0.05	mg/L
Nitrogen, Nitrate/Nitrite (calculation)	300.0/353.2	0.025	0.05	mg/L
Ortho-Phosphate (field filtration required)	365.1	0.00344	0.004	mg/L
Chlorophyll a	SM10200H	1	1	mg/m3

Grab sampling will be performed in accordance with DEP SOP 001/01 and PACE Analytical Services requirements and in compliance with Table FS 1000-4 of DEP SOP FS 1000, the following sample preservation will be conducted within 15 minutes of collection: filtration for ortho-phosphate, acidification for nitrate and nitrite (unless analysis will occur within 48 hours of collection), thermal preservation (immerse samples in ice) for ortho-phosphate, nitrogen, and chlorophyll a. In accordance with FQ1230, field blanks will be collected at a frequency of 5%, or one blank for every 20 samples. One to two of the required 15 field blanks with be obtained during each monthly maintenance cycle for the duration of the project.

Lab results will be compared to instrument readings by ORCA engineers. Values from lab results will be added to the ORCA database for reference.

Readings from each instrument will occur every 4 to 6 hours. In the event the average difference of 12 consecutive readings from a sensor exhibits a 25% drift from the previous 12 consecutive readings, that cannot be explained by know environmental changes, it will be rechecked for proper calibration in situ by comparison with a calibrated instrument. If found to be out of calibration the instrument will be removed from the field and recalibrated before being redeployed or will be replaced by a calibrated instrument provided an instrument is available. In the event a grab sample differs from the in-situ instrument reading by greater than 25% an additional grab sample will be obtained for verification of the results. If 2 consecutive grab samples differ from the instrument measurement by more than 25%, the instrument will be checked for malfunction and removed from the field for repairs, if confirmed.

At no less than 6-month intervals instruments will be removed from the field for laboratory controlled calibration checks. These checks will be conducted per applicable portions of DEP SOPs FT 1000, FT 1100 (pH), FT 1300 (salinity), FT 1500 (DO), and FT1900 (continuous monitoring) using acceptance criteria in Table FT 1000-1 (see below). Calibrations will be checked for instruments removed from the field for laboratory controlled calibration prior to re-calibration and readings will be recorded in the ORCA database before and after laboratory calibration. Due to the harsh conditions instruments may from time to time fail and require repair or replacement. All efforts will be made to repair instruments in a timely manner and when possible, a replacement instrument will be deployed until repairs can be completed.

Table FT 1000-1: Field Testing Acceptance Criteria

Parameter	Acceptance Criteria
pH (FT 1100)	± 0.2 Standard pH Units of buffer or more stringent program criteria
Specific Conductance (FT 1200)	± 5% of standard value
Temperature (FT 1400)	± 0.5°C of NIST-traceable value (with correction factors) Verification over range of applicable values
Dissolved Oxygen (FT 1500)	± 0.3 mg/L of theoretical value (see Table FT 1500-1)
Turbidity (FT 1600)	0.1-10 NTU: ± 10% of standard value 11-40 NTU: ± 8% of standard value 41-100 NTU: ± 6.5% of standard value > 100 NTU: ± 5% of standard value

Data Access

Data from the Kilroy Monitoring Systems will be reviewed for accuracy and quality of data on a daily basis by ORCA engineers. During monthly maintenance cycles ORCA's database management will review the data stream with field data to ensure accurate data is transmitted from deployed sensors.

Real time data from the most recent measurement and a historical graph can be accessed through ORCA's home page at www.teamorca.org . Historical data ranging from installation to current date can be viewed by requesting access to ORCA's database. Access is granted through log in to ORCA's internal website with user name and password. Viewing of data tables or exporting of .csv files is accessible through this site. Suspect data will be marked as questionable until confirmed valid. Data determined to be not viable will be removed from the dataset.

Kilroy System Calibration

Calibration of instruments will be performed in laboratory conditions employing methods outlined by the manufacturer and in accordance with applicable portions of DEP FT guidelines as listed in Data Quality Checks on page 5 of this planning document. Calibrations will be recorded on calibration worksheets and calibrations logged into the ORCA database. Instrument removed from the field will be checked for calibrations prior to recalibration and values from pre-calibration and post-calibration checks will be recorded and logged into the ORCA database.

Handheld calibration checks will be performed using a YSI EXO handheld display attached to a YSI EXO2 sonde. The YSI EXO2 sonde used for handheld calibration checks will be calibrated prior to monthly site visits and checked for calibration after site visits are completed. Values will be checked at each monthly site visit for conductivity/ temperature, dissolved oxygen, pH/ORP, fDOM, total algae, and turbidity. Values from pre- and post-calibration checks for the handheld device will be recorded in the ORCA database.

1.0 Kilroy System Database

1.1 ORCA maintains a relational database for storing both field measurements and the Kilroy System control and configuration. The database will allow for an automated system of checks and balances to help ensure proper operation of the Kilroy System.

1.2 Calibration Constants

1.2.1 Calibration constants developed for the instruments will be imported into the database. This will produce a history of what has been done and when it was done. Secondly it will be used to check for unusual trends in calibration for instruments on a calibration to calibration cycle.

1.3 Chemical Reagents

1.3.1 A system of tracking each received reagent is employed to ensure proper tracking of chemicals used throughout the system.

1.4 Calibration Timelines

1.4.1 The ORCA database holds the calibration timestamps and constant to identify timeframes when an instrument must be returned to the laboratory for maintenance/calibration.

1.5 Maintenance/Instrument Reports

1.5.1 Each field maintenance trip report will be recorded in the database to create an easily accessible record of operations involving specific moorings and instruments.

2.0 Kilroy

2.1 Board Inspection

2.1.1 The mother board and sensors are striped from the housing which can then be cleaned and refurbished. A testing communications cable is connected to the board and a PC and communications are verified. The pressure and temperature sensors are reconnected to the board and the device is polled for the Analog to Digital Converter values coming from the sensors, these values are compared to expected values and recorded to verify that the sensors are operational before moving onto more thorough testing.

2.2 Housing Inspection

2.2.1 The aluminum housing is cleaned of any bio fouling and inspected for any signs of corrosion. Zinc anodes are removed and either discarded or set aside for reuse depending on condition. Acoustic legs are replaced along with pressure and temperature sensors. The unit is then sealed and an internal positive pressure is applied to it before being submerged for leak testing. After confirming no leaks then circuit board is reinstalled and reconnected to the sensors.

2.3 Pressure Calibration

2.3.1 Once the Kilroy is reassembled a recalibration of the pressure sensor is done. The Kilroy is secured to the test equipment and the ambient pressure is logged. Measurements of the pressure sensor's output are polled and recorded at known levels of head pressure. These are then plotted and compared to what the head pressure and the atmospheric pressure are exerting and a linear relationship is plotted. From this linear plot an offset and gain value are recorded to be written to the Kilroy software package. Once the Kilroy is reassembled a recalibration of the pressure sensor is done. The Kilroy is secured to the test equipment and the ambient pressure is logged. A test cylinder is filled with water and the control board polls both Kilroy's pressure gauge output and the NIST pressure gauge. The two values are recorded and the cylinder is gradually drained of water while the two gauges continue to record measurements. The two data sets are then plotted and a linear relationship is found between them. This provides gain and offset coefficients for pressure which are recorded and then written to the Kilroy.

2.4 Temperature Calibration

2.4.1 A temperature bath is prepared at a specified range. Using a CTD to monitor the temperature the Kilroy is allowed to soak while the heater/chiller is allowed to run. The computer polls both the CTD and Kilroy for the values of their onboard thermometers, these values are then stored for processing. After running the desired temperature range the data is plotted and a linear relationship between the two data sets is found. The resultant gain and offset values are then used as coefficients for Kilroy's temperature sensor.

2.5 Acoustic Verification Test

2.5.1 During construction and at 6-month intervals a representative number of Kilroy device acoustics will be verified by comparison to a calibrated acoustic monitoring device.

3.0 **YSI EXO2 Multi-parameter Sonde**

3.1 Basic Calibration Procedures – EXO Sonde 2 sensors require periodic calibration to ensure peak performance. For calibration all basic steps are the same with some specific variations for individual instruments and standards. All EXO Sonde 2 instruments are calibrated after 6 months of continuous deployment or when data is deemed questionable through hand sampling comparisons or erratic/unrealistic data samples, whichever comes first. All EXO2 calibrations produce a Calibration Worksheet. This worksheet will be catalogued and maintained by ORCA's engineering department in each instrument's history file and will be readily available upon request.

3.2 Set Up - The EXO calibration cup should always be rinsed thoroughly with de-ionized water (DIW). A minimum of three rinses will suffice. To avoid diluting calibration standards, perform three rinses with the standard to be used after the DIW rinse. When using a full sensor load, fill the calibration cup to the first line. If not using an entire sensor load, fill to the second (higher) line. Actual volumes of standard will vary depending on how many and what instruments are being calibrated; ensure the sensor head is completely submerged in standard prior to beginning calibration. If different types of sensors are being calibrated, be sure to do a complete rinse of the cup and sensors to avoid cross contamination of different types of standards. Also, a dedicated calibration cup and sensor guard is maintained on hand in the lab to ensure a greater degree of cleanliness and accuracy. This guard and cup will never be used in the field.

3.3 Basic Calibration in KOR Software: Once connected to the YSI host software, the user has the option to select what type of instrument is being calibrated. Individual instrument calibration procedures are described below. Some instruments have one parameter to calibrate, while others have more than one. Users can also choose to perform 1, 2, or 3-point calibrations. Again, these options are described below for individual sensors. Always ensure the inputs for the calibration standards are correct and matching (e.g., microSiemens vs milliSiemens). There's also the option to input the type of standard, manufacturer of the standard, and lot number for tracking purposes. As a standard procedure, always fill in all available information for each standard used. When ready, click the Start Calibration button. The probes begin to sample, and data will be displayed on the screen. Clicking the "Graph Data" button will show current samples as they are taken. Initially for all instruments, the data will appear unstable and will slowly move to stable. Users can also compare the pre-cal and post-cal values in graph form. After confirming that the values are within the acceptable margin of error as listed in chart below, click "Apply" to accept the updated calibration. This procedure needs to be repeated for each calibration point and each parameter. Click "Complete" when all points have been calibrated. A calibration summary appears with a QC score. A green check mark indicates a

successful calibration, while a red X indicates an improper calibration. In the case of an unsuccessful calibration, repeat the calibration procedure. ***At the end of every calibration description in this document, a sample Calibration Worksheet is provided.***

Sensor	Acceptable margin of error
Conductivity	0 to 100: +/- 55 of reading or 0.0001 mS/ch, w.i.g. 100 to 200: +/- 1% of reading
Temperature	-5 to 35° = +/- 0.01° C^2 35 to 50° C = +/- 0.05 C^2
Dissolved Oxygen	0 to 20 mg/L: +/- 0.1 mg/L 20 to 50 mg/L: +/- 5% of reading
fDOM	R2 > 0.999 for serial dilution of 300 ppb QS solution
ORP	+/- 20 mV in Redox standard solution
pH	+/- 0.1 pH units within +/- 10° C of calibration temp. +/- 2% pH units for entire temp. range
Blue Green Algae, Phycoerythrin	Linearity: R^2 > 0.999 for serial dilution of Rhodamine WT solution from 0 to 280 ug/mL BGA-PE equivalents
Chlorophyll	Linearity: R^2 > 0.999 for serial dilution of Rhodamine WT solution from 0 to 400 ug/mL Chl a equivalents
Turbidity	0 to 999 FNU: 0.3 FNU or +/- 2% of reading 1000 to 4000 FNU: +/- 5% of reading
Salinity (calculated from conductivity and temperature)	+/- 1.0 % of reading or 0.1 ppt

3.4 **Conductivity**

3.4.1 This procedure calibrates conductivity, non-linear function (nLF) conductivity, specific conductance, salinity, and total dissolved solids.

3.4.2 Clean with soft brush.

3.4.3 Place the correct amount of conductivity standard into a clean and dry or pre-rinsed calibration cup. ORCA's in house NIST traceable Conductivity, Temperature, and Depth sensor (Smart Conductivity, Temperature and Pressure V1.15 SN:4893-CTD 1998, Applied Microsystems Ltd.) serves as a baseline for measuring calibration standard.

3.4.4 Carefully immerse the probe end of the sonde into the solution, making sure the standard is above the vent holes on the conductivity sensor.

3.4.5 Gently rotate and/or move the sonde up and down to remove any bubbles from the conductivity cell.

3.4.6 Allow at least one minute for temperature equilibration before proceeding.

3.4.7 In the Calibrate menu, select Conductivity and then a second menu will offer the options of calibrating conductivity, nLF conductivity, specific conductance, or salinity. Calibrating any one option automatically calibrates the other parameters.

3.4.8 After selecting the option of choice (specific conductance is recommended), enter the value of the standard used during calibration. Be certain that the units are correct and match the units displayed in the second window at the top of the menu.

3.4.9 Click Start Calibration. Observe the readings under Current and Pending data points and when they are stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.4.10 If the data do not stabilize after 40 seconds, gently rotate the sonde or remove/reinstall the cal cup to make sure there are no air bubbles in the conductivity cell.

3.4.11 Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

3.4.12 Rinse the sonde and sensor(s) in tap or purified water and dry.

3.5 **Dissolved Oxygen Sensor**

3.5.1 These directions are for a 1-point calibration. For a 2-point calibration, refer to user manual.
3.5.2 Fill calibration cup with water and saturate with a running air stone for a minimum of 1 hour.
3.5.3 Place DO sensor and thermistor in saturated water. Wait approximately 5 minutes before proceeding to allow the temperature and oxygen pressure to equilibrate.
3.5.4 Calibrate -> ODO -> ODO % sat
3.5.5 Enter current barometric pressure in mm of Hg NIST Traceable barometer (Inches of Hg x 25.4 = 25.4 mm of Hg)
3.5.6 Click "1 Point Calibration", and enter the standard value.
3.5.7 "Start Calibration". Once data are stable for ~ 1 min, click Apply to accept this calibration point.
3.5.8 For further information, refer to Section 5.3 Page 73 of EXO Sonde 2 User Manual.

3.6 Depth and Level Sensor

3.6.1 Remove depth sensor from solution (in air)
3.6.2 "Calibrate" -> "Port D-Depth" -> "Depth or Level"
3.6.3 Click "1 Point Calibration". Enter 0.
3.6.4 "Start Calibration". After ~1 min of stable data, click "Apply" to accept calibration point. This process zeros the sensor with regard to current barometric pressure.
3.6.5 Click "Exit" to return to the sensor calibration menu.
3.6.6 Ensure the orientation of the sonde remains constant while taking reading.

3.7 **pH Sensor**

3.7.1 Select the 3-point option to calibrate the pH probe using three calibration standards. In this procedure, the pH sensor is calibrated with a pH 7 buffer and two additional buffers (ideally pH buffers of ~4 and ~10).
3.7.2 Pour the correct amount of pH buffer in a clean and dry or pre-rinsed calibration cup, making sure the sensor's glass bulb is in solution by at least 1cm. Allow at least 1 minute for temperature equilibration before proceeding.
3.7.3 "Calibrate"-> " pH or pH/ORP" -> "pH".
3.7.4 Select the number of points desired for the calibration. Enter the value(s) of the pH buffer(s) that will be used for the calibration.
3.7.5 Observe the temperature reading above the standard value. The actual pH value of all buffers varies with temperature. Enter the correct value from the bottle label for your calibration temperature for maximum accuracy. For example, the pH of one manufacturer's pH 7 Buffer is 6.994 at 25˚C, but 7.012 at 20˚C.
3.7.6 Click Start Calibration.
3.7.7 Observe the readings under Current and Pending data points and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.
3.7.8 Confirm that the Pending data value is close to the Set Point value.
3.7.9 Click Proceed and wait for the software to prompt you to move the sensor to the next standard solution.
3.7.10 Rinse the sensor in deionized water. If possible, rinse sensor with extra pH buffer solution to avoid dilution of the next buffer solution. Pour the correct amount of an additional pH buffer standard into a clean, dry or pre-rinsed calibration cup, and carefully immerse the probe end of the sonde into the solution. Allow at least 1 minute for temperature equilibration before proceeding.
3.7.11 Repeat the calibration procedure and click Apply when the data are stable. Rinse the sensor and pour additional pH buffer, if necessary. Repeat calibration procedure for the third point and click Apply when data are stable.
3.7.12 Click Complete. View the Calibration Summary screen and QC score. A green check indicates a successful calibration.
3.7.13 Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.
3.7.14 Rinse the sonde and sensors in tap or purified water and dry.

3.8 **Oxidation Reduction Potential (ORP) Sensor**

3.8.1 ORP calibration standard is made by mixing 125ml of DIW with YSI's 3682 Zobell ORP Calibration Solution. This NIST traceable ORP standard is created specifically by YSI to calibrate the EXO's ORP sensor.

3.8.2 Pour the correct amount of standard with a known oxidation reduction potential value in a clean, dry or calibration cup.

3.8.3 "Calibrate" -> "pH/ORP" -> "ORP mV"

3.8.4 "Start Calibration". Observe the readings under Current and Pending data points. When stable for ~ 1 min, click Apply to accept calibration point. *Do not leave sensors in Zobell solution for a long time. A chemical reaction occurs with the copper on the sonde that will degrade the sonde materials over time.

3.8.5 Discard the used standard.

3.8.6 Click Complete. View the Calibration Summary screen and QC score.

3.8.7 Click Exit to return to the sensor calibration menu.

3.8.8 Rinse the sonde in tap or purified water and dry the sonde.

Effect of temperature on ORP

The oxidation reduction potential value shows an inverse relationship with temperature. This effect must be accounted for when calibrating the EXO ORP sensor with Zobell solution. Enter the mV value from the table below that corresponds to the temperature of the standard.

Temp (°C)	mV	Temp (°C)	mV
-5	270.0	25	231.0
0	263.5	30	224.5
5	257.0	35	218.0
10	250.5	40	211.5
15	244.0	45	205.0
20	237.5	50	198.5

3.9 **EXO2 Turbidity Sensor**

3.9.1 Before calibrating, be certain that the probe is clean and free of debris. Use a clean, spare sonde guard.

3.9.2 For proper calibration, you must use a NIST Traceable standard. YSI offers different standards designed to specifically calibration the turbidity standard:

608000	0 NTU (all turbidity sensors); 1 gallon
607200	12.4 FNU (EXO); 12.7 NTU (YSI 6-Series); 1 gallon
607300	124 FNU (EXO); 126 NTU (YSI 6-Series); 1 gallon
607400	1010 FNU (EXO); 1000 NTU (YSI 6-Series); 1 gallon

3.9.3 In addition to the standards available through YSI, there is a 100 NTU standard by AMCO-AEPA (Item No 8021) and a 1,000 NTU standard by Ricca Chemical (Cat. NO 8825-16). Due to the non-linear function of the sensor, calibration ranges may be limited:

1-point	2-point	3-point
0-1 FNU (or NTU)	5-199 FNU (or NTU)	200-4200 FNU (or NTU)

3.9.4 For a 3-point calibration: Pour the correct amount of 0 NTU standard (clear deionized or distilled water) into the calibration cup. Immerse the probe end of the sonde into the water.

3.9.5 "Calibrate" -> "Turbidity" -> "Turbidity FNU"

3.9.6 Click 3 Point for the Calibration Points. Enter 0 FNU for first standard value, 124 FNU for second standard value, and 1010 for the third value. (0 must be calibrated first.)

3.9.7 "Start Calibration". Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.9.8 If the temperature of your field site is substantially different from the lab temperature, allow the sensor to sample for 3-5 minutes at each calibration point before accepting it. This step ensures the best possible temperature compensation when deployed.

3.9.9 Next place the sensors in the second calibration standard. Click Proceed on the pop-up window. Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles.

3.9.10 When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.9.11 Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor. Click Complete. View the Calibration Summary screen and QC score.

3.9.12 Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

3.9.13 Rinse the sonde in tap or purified water and dry the sonde.

3.10 EXO2 Chl + BGA-PC Total Algae Sensor:

There are two different parameters that must be calibrated independently; Chlorophyll and BGA-PC Total Algae.

3.10.1 This procedure calibrates Chlorophyll Relative Fluorescent Unit (RFU) or Chlorophyll µg/L. If the user has both units selected, then this procedure must be performed twice, once for each unit, to completely calibrate the parameter.

3.10.2 For 2-point calibrations, one standard must be clear water (0 µg/L), and this standard must be calibrated first. The other standard is a 625 µg/L Rhodamine WT dye solution. Detailed instructions on preparation come directly from the EXO2 User Manual:

3.10.3 The solution is used in the calibration steps below.

3.10.4 µg/L – 1- or 2-point: This procedure will zero your fluorescence sensor and use the default sensitivity for calculation of chlorophyll concentration in µg/L.

3.10.5 Pour enough deionized water into the calibration cup to immerse the probe end of the sonde in the water.

3.10.6 "Calibrate" -> "BGA-PC/Chlor" -> "Chl µg/L" -> "2-point calibration"

3.10.7 Enter 0 for first standard value and 66 for second standard value.

3.10.8 "Start Calibration". Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles.

3.10.9 When data are Stable (or data shows no significant change for approximately 40 seconds), click "Apply" to accept this calibration point.

3.10.10 Next place the sensors in the Rhodamine WT standard. Click Proceed on the pop-up window. Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.10.11 Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.
3.10.12 Rinse the sonde in tap or purified water and dry the sonde.
3.10.13 RFU – 1- or 2-point: RFU is a percent full scale output; it outputs relative fluorescence from 0-100%.
3.10.14 Pour the correct amount of clear deionized or distilled water into the calibration cup. Immerse the probe end of the sonde in the water.
3.10.15 In the Calibrate menu, select BGA-PC/Chlor, then select Chl RFU. Select either a 1- or 2-point calibration.
3.10.16 Enter 0 for first standard value and 16.4 for second standard value.
3.10.17 Click Start Calibration. Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.
3.10.18 Next place the sensors in the Rhodamine WT standard. Click Proceed on the pop-up window. Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles.
3.10.19 When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.
3.10.20 Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.
3.10.21 Rinse the sonde in tap or purified water and dry the sonde.
3.10.22 Blue-green Algae Phycocyanin This procedure calibrates BGA RFU *or* BGA µg/L.
3.10.23 If the user has both units selected, then this procedure must be performed twice, once for each unit, to completely calibrate the parameter.
3.10.24 For the 2-point calibration, one of the standards must be clear water (0 µg/L), and this standard must be calibrated first. The other standard should be in the range of the suspected BGA-PC content at the environmental site. We will use a 625 µg/L Rhodamine WT dye solution (for detailed instructions, see section on calibrating for chlorophyll), and the solution is used in the calibration steps below.
3.10.25 *µg/L – 1- or 2-point*: This procedure will zero your fluorescence sensor and use the default sensitivity for calculation of phycocyanin-containing BGA in µg/L, allowing quick and easy fluorescence measurements that are only semi-quantitative with regard to BGA-PC. However, the readings will reflect changes in BGA-PC from site to site, or over time at a single site.
3.10.26 Pour the correct amount of clear deionized or distilled water into the calibration cup. Immerse the probe end of the sonde in the water.
3.10.27 "Calibrate" -> "BGA-PC/Chlor" - > "BGA µg/L" -> 1- or 2-point calibration.
3.10.28 Enter 0 for first standard value and 16 for second standard value.
3.10.29 "Start Calibration". Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.
3.10.30 Next place the sensors in the Rhodamine WT standard. Click Proceed on the pop-up window. Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.
3.10.31 Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.
3.10.32 Rinse the sonde in tap or purified water and dry the sonde.

3.10.33 *RFU – 1- or 2-point:* RFU is a percent full scale output; it outputs relative fluorescence from 0-100%. This calibration procedure is recommended if you are also using grab samples to post-calibrate in vivo algae readings.

3.10.34 Pour the correct amount of clear deionized or distilled water into the calibration cup. Immerse the probe end of the sonde in the water.

3.10.35 "Calibrate" -> "BGA-PC/Chlor" -> "BGA RFU" -> 1- or 2-point calibration.

3.10.36 Enter 0 for first standard value and 16 for second standard value.

3.10.37 "Start Calibration". Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.10.38 Next place the sensors in the Rhodamine WT standard. Click Proceed on the pop-up window. Observe the readings under Current and Pending data points. While stabilizing, click the Wipe Sensors button to activate the wiper to remove any bubbles. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.10.39 Click Complete. View the Calibration Summary screen and QC score.

3.10.40 Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

3.10.41 Rinse the sonde in tap or purified water and dry the sonde.

3.11 EXO2 fluorescent dissolved organic matter (fDOM) Sensor

3.11.1 Before calibrating, be certain that the sensing window is clean (cleaning instructions, section 6.10 of EXO User Manual). This procedure calibrates fDOM Relative Fluorescence Units (RFU) or fDOM Quinine Sulfate Units (QSU)/ppb. If the user has both units selected, then this procedure must be performed twice, once for each unit, to completely calibrate the parameter.

3.11.2 For 2-point calibrations, the first standard must be clear water (0 µg/L). The second standard should be a 300 µg/L quinine sulfate solution. Detailed mixing instructions:

3.11.3 *** This reagent is particularly dangerous. Remember that only trained personnel should handle chemicals ***

3.11.4 Preparation: Use the following procedure to prepare a 300 µg/L solution of quinine sulfate (300 QSU) that can be used to calibrate the EXO fDOM sensor for field use:

3.11.5 Purchase solid quinine sulfate dihydrate with a high purity (>99%). (Recommended supplier: Fisher Scientific item #6119-70-6.) Purchase 0.1 N (0.05 M) sulfuric acid, to avoid the hazards of diluting concentrated sulfuric acid to make this reagent. (Recommended supplier: Fisher Scientific item # AA35651K7.)

3.11.6 Weigh 0.100 g of solid quinine sulfate dihydrate and quantitatively transfer the solid to a 100-mL volumetric flask. Dissolve the solid in about 50 mL of 0.05 M (0.1 N) sulfuric acid (H), dilute the solution to the mark of the volumetric flask with additional 0.05 M sulfuric acid, and mix well by repeated inversion. This solution is 1000 ppm in quinine sulfate (0.1%).

3.11.7 Transfer 0.3 mL of the 1000 ppm solution to a 1000 mL volumetric and then fill the flask to the top graduation with 0.05 M sulfuric acid. Mix well to obtain a solution of 300 µg/L (300 QSU or 100 RFU).

3.11.8 Store the concentrated standard solution in a darkened glass bottle in a refrigerator to retard decomposition. The dilute standard prepared in the previous step should be used within 5 days of preparation and should be discarded immediately after exposure to EXO's metal components. Degradation of quinine fluorescence by copper and chloride. Exposure of the quinine sulfate solution to any copper-based component of the EXO sonde and sensors (primarily the wiper assembly) will begin to degrade the solution significantly within minutes. Quinine fluorescence is also degraded by the presence of chloride or halide ions, found in estuarine or seawater, conductivity standards, and Zobell solution. Thus, clean your sensors thoroughly and perform your calibration as quickly as

possible on immersion of the sensors into the quinine sulfate solution. Discard the used standard. When quinine sulfate standards are required in the future, perform another dilution of the concentrated solution.

3.11.9 :::Effect of temperature on fluorescence :::

3.11.10 The intensity of the fluorescence of many dyes shows an inverse relationship with temperature. This effect must be accounted for when calibrating the EXO fDOM sensor with Quinine Sulfate Solution. Enter the QSU or RFU value from the table below that corresponds to the temperature of the standard.

Temp (˚C)	RFU	QSU	Temp (˚C)	RFU	QSU
30	96.4	289.2	18	101.8	305.4
28	97.3	291.9	16	102.7	308.1
26	98.2	294.6	14	103.6	310.8
24	99.1	297.3	12	104.6	313.8
22	100	300	10	105.5	316.5
20	100.9	302.7	8	106.4	319.2

3.11.11 Do not leave sensors in quinine sulfate solution for a long time. A chemical reaction occurs with the copper on the sonde (wiper assembly, sonde bulkhead, copper tape) that degrades the solution and causes it to drift. Also, start with very clean sensors, as the presence of chloride and halide ions (from estuarine or seawater, conductivity standards, and Zobell solution) can compromise QS fluorescence.

3.11.12 QSU – 1- or 2-point

3.11.13 Pour the correct amount of clear deionized or distilled water into the calibration cup. Immerse the probe end of the sonde in the water.

3.11.14 "Calibrate" - > "fDOM" -> "QSU/ppb" -> 1- or 2-point calibration.

3.11.15 Enter 0 for first standard value and 300 µg/L for second standard value. Click Start Calibration. Observe the readings under Current and Pending data points, and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.11.16 Remove the central wiper from the EXO2 sonde before proceeding to the next step.

3.11.17 Next place the sensors in the correct amount of 300 µg/L quinine sulfate standard in the calibration cup. Click Proceed on the pop-up window. Observe the readings under Current and Pending data points. While stabilizing, verify that no air bubbles reside on the sensing face of the sensor. If there are bubbles, gently shake or move the sensor to dislodge. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.11.18 Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

3.11.19 RFU – 1- or 2-point

3.11.20 Pour the correct amount of clear deionized or distilled water into the calibration cup. Immerse the probe end of the sonde in the water.

3.11.21 "Calibrate" -> "fDOM" -> "RFU" -> 1- or 2-point calibration.

3.11.22 Enter 0 for first standard value and 100 RFU for second standard value.

3.11.23 Click Start Calibration. Observe the readings under Current and Pending data points, and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.11.24 Remove the central wiper from the EXO2 sonde before proceeding to the next step.

3.11.25 Next place the sensors in the correct amount of 300 µg/L quinine sulfate standard in the calibration cup. Click Proceed on the pop-up window. Observe the readings under Current and Pending data points. While stabilizing, verify that no air bubbles reside on the sensing face of the sensor. If there are bubbles, gently shake or move the sensor to

dislodge. When data are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

3.11.26 Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

3.11.27 Rinse the sonde in tap or purified water and dry the sonde. Discard the used standard.

4.0 NuLAB

4.1 NuLab Nitrogen Procedure

Instrument Identification:

NuLAB Specific	
Serial Number	
Wavelength (nm)	
Master Macro Revision	
ORCA Specific	
NuLAB N+N Device ID (database ref.)	
KION S/N	
KION F/W	

Baseline Reagent Configuration:

Reagent	Database Reference ID
NEDA	
Sulphanilamide	
Imidazole	
OBS (N+N) Standard	
OBS Concentration (mg/l)	

Notes:

1) **DO NOT** use reagents that have EOL (end-of-life) dates that are beyond date of first maintenance cycle.
2) Register reagents being used in database before deployment (via engineering web interface)
3) Allow at least 1 hour for reagents to equilibrate before testing
4) **DO NOT** leave the system running without physically monitoring the first measurement cycle (in case of a leak or pinched line).

Procedure #1: Initial Reagent Blank

As with any reagent change a reagent blank needs to be re-calculated to compensate for any nutrients potentially present within the system. The inlet line must be placed in D.I. (de-ionized water) for a proper blank to be obtained. A standard (70 micron) filter needs to be installed as well (in the event a contaminant gets into the sample as well as loading the mechanics with equivalent resistance to be seen in the field)

- Once configured run a 5-measurement reagent blank.
- Run both 'Prime' and 'Inlet Flush' macros to ensure no air is trapped in the lines.
- Enter values in the table below (after completion the 'dd' KION command will display the results).
- If the OBS is out of range then re-activate the cadmium column and repeat the test.

Initials _____

Date _____

Sample	OBS (0.03-0.04)	Absorption (< 0.008)
1		

2		
3		
4		
5		
	Average Abs.	
	Deviation	
	D.I. Creation Date	

Note:

1) **DO NOT** wipe the records on the KION resulting from the testing as these will be uploaded to the database for recording.

Procedure #2: Known Test Standard

Once a reagent blank is correctly completed the instrument is to be run overnight in order to stress both the mechanics and to monitor measurement stability.

- Replace the D.I. with a premixed standard.
- Connect sample chamber and pump system to allow the chamber to be operational for this test. The sample chambers inlet/outlet lines need to be placed in a bucket with some clean water (does not have to be D.I.)
- Disable all replicates and use the 'alt' sample table (hourly sampling)

Initials _____

Date _____

Test Standard Concentration (mg/l) _____

Test Standard Database ID _____

Sample	OBS (0.03-0.04)	Conc. (mg/l)
1		
2		
3		
4		
5		
6		
7		
8		
	Average Pump Current	
	Dropped OBS (bad count/good count)	

Post Operation:

If the unit is to be stored prior to deployment drop all the lines into D.I. and prime the system several times to wash all reagent from both lines and valve. If storage is longer than 3 days, remove the Cadmium column and store in a solution D.I. plus and Imidazole to avoid damage and the necessity of an additional reactivation.

4.1.1 NuLab PO4 Procedure

Instrument Identification:

NuLAB Specific	
Serial Number	
Wavelength (nm)	
Master Macro Revision	
ORCA Specific	
NuLAB PO4 Device ID (database ref.)	
KION S/N	

KION F/W	

Baseline Reagent Configuration:

Reagent	Database Reference ID
Ascorbic Acid	
Ammonium Molybdate	
Wash (35% isopropyl)	
OBS (PO4) Standard	
OBS Concentration (mg/l)	

Notes:

5) **DO NOT** use reagents that have EOL (end-of-life) dates that are beyond date of first maintenance cycle.
6) Register reagents being used in database before deployment (via engineering web interface)
7) Allow at least 1 hour for reagents to equilibrate before testing
8) **DO NOT** leave the system running without physically monitoring the first measurement cycle (in case of a leak or pinched line).

Procedure #1: Initial Reagent Blank

As with any reagent change a reagent blank needs to be re-calculated to compensate for any nutrients potentially present within the system. The inlet line must be placed in D.I. (de-ionized water) for a proper blank to be obtained. A standard (70 micron) filter needs to be installed as well (in the event a contaminant gets into the sample as well as loading the mechanics with equivalent resistance to be seen in the field)

- Once configured run a 5-measurement reagent blank.
- Run both 'Prime' and 'Inlet Flush' macros to ensure no air is trapped in the lines.
- Enter values in the table below (after completion the 'dd' KION command will display the results).
- If the OBS is out of range then re-activate the cadmium column and repeat the test.

Initials _____

Date _____

Sample	OBS (0.03-0.04)	Absorption (< 0.008)
1		
2		
3		
4		
5		
	Average Abs.	
	Deviation	
	D.I. Creation Date	

Note:

2) **DO NOT** wipe the records on the KION resulting from the testing as these will be uploaded to the database for recording.

Procedure #2: Known Test Standard

Once a reagent blank is correctly completed the instrument is to be run overnight in order to stress both the mechanics and to monitor measurement stability.

- Replace the D.I. with a premixed standard.

- Connect sample chamber and pump system to allow the chamber to be operational for this test. The sample chambers inlet/outlet lines need to be placed in a bucket with some clean water (does not have to be D.I.)
- Disable all replicates and use the 'alt' sample table (hourly sampling)

Initials _____
Date _____
Test Standard Concentration (mg/l) _____
Test Standard Database ID _____

Sample	OBS (0.03-0.04)	Conc. (mg/l)
1		
2		
3		
4		
5		
6		
7		
8		
	Average Pump Current	
	Dropped OBS (bad count/good count)	

Post Operation:
If the unit is to be stored prior to deployment drop all the lines into D.I. and prime the system several times to wash all reagent from both lines and valve.

5.0 Field Maintenance and Operation

5.1 General Procedures

5.1.1 Each mooring is to be visited every 4 weeks. Each station is equipped with a 'call button' which allows the field crew to register the visit with the database. This allows for consistent record keeping and assists in locating invalid data resulting from any maintenance operations. Each visit will require device specific operations listed below. A standardized checklist will be provided as a reminder to the field crews of necessary operations. Record keeping will be handled via a web interface into the database. This will allow us to correlate mooring and device operations with the measurements being taken. Hand sampling will be entered as well as a secondary measurement reference.

5.2 Post Mooring visit

5.2.1 Field maintenance notes will be transferred to the database shortly after the visit to the mooring. These notes will be correlated with the 'call button' times to maintain temporal coordination. Both mooring and device specific notes will be kept and entered into the database.

5.3 Device Specific operations

5.3.1 **Kilroy:**

The Kilroy needs to be visually inspected every 4 weeks.

- Inspection/Replacement of anti-fouling mechanism for depth sensor
- Re-application of anti-fouling compound on the acoustic sensor pods as needed

Every 6 months the instrument will be returned to ORCAs manufacturing facility for recalibration of depth/temperature and acoustics.

5.3.2 **YSI EXO2 Multi-parameter Sonde**

Visual inspection every 4 weeks. Laboratory calibration every 6 months. Return YSI for recalibration should the laboratory calibration indicate further attention warranted.

5.3.3 **Green Eyes NuLAB**

Chemical reagent change every 4-6 weeks. Each change will result in a reagent blank being created as well as an on-board standard being updated.
Installation of new sample chamber filters as necessary.

6.0 **Data Quality**

6.1 Device Operation

The Kilroy Monitoring System is comprised of an ORCA designed and constructed monitoring instrument that measures flow speed, flow direction, water depth and water temperature. The Kilroy Monitoring system is integrated with a YSI EXO2 sonde with probes measuring ph/ORP, Conductivity/Temperature, Optical DO, Turbidity, total algae that includes chlorophyll and blue green algae sensors and fDOM. Additionally, the Kilroy is integrated with a NuLab nutrient monitoring system that monitors nitrate, nitrite and ortho-phosphate by utilizing wet chemistry which is not affected by bromides, water color changes and other contaminants that affect optical nutrient sensors.

The integrated package is coupled to an ORCA designed and constructed communications system that reports to the ORCA designed database at 4-hour intervals. The complete system is solar powered and utilizes a battery backup for times when sunlight is not available.

Each deployment site will be visited no less than once per month at which time YSI measurements will be verified using a YSI handheld sonde identical to the deployed instrument measuring salinity/conductivity/temperature, dissolved oxygen, pH/ORP, fDOM, total algae, and turbidity. The handheld sonde will be calibrated and verified with applicable portions of DEP SOPs FT 1000 (field testing general), FT 1100 (pH), FT 1300 (salinity), FT 1500 (DO) and FT 1900 (field continuous monitoring) prior to the site visit, and then verified after the monthly site visits. Verifications for pH and salinity will be conducted with standards that bracket the sample readings from the field. If post-sampling verifications do not meet acceptance criteria listed, associated sample data will be qualified with "J" (estimated). Any deployed instrument found out of calibration will be returned to the lab for calibration and check before redeployment. Calibration checks will be recorded in the ORCA database prior to and after recalibration. At each monthly site visit grab samples will be obtained by ORCA team members Billy Wells and Morgan Marmitt. Grab samples will be sent overnight to PACE Analytical Services, Inc. for comparability assessment of Nitrate/Nitrite, Orthophosphate and Chlorophyll a. At each monthly maintenance check, reagents for the NuLab nutrient monitoring device will be replenished and a grab sample will be obtained for verification.

6.2 Measurement Checks

Data from deployed Kilroy Monitoring systems will be reviewed on a daily basis by ORCA engineers for data accuracy. In addition, the database will monitor for missing devices and moorings and generate automated alerts (via email) as necessary. Data will also be reviewed to recognize any trends or drift of the instrument data.